LOHAN & DONNELLY
Consulting Engineers

13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Project Title: Amendment to the Residential Development at Prussia Street, Dublin 7

Report Title: Engineering & Services Report

Report Ref: 2572-LDE-ZZ-ZZ-RP-0001_ESR

Project Ref: 2572

Client: Randalswood Construction Ltd.

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1.0 Introduction:

Lohan & Donnelly Consulting Engineers (L&D) have been appointed by Randalswood Construction Ltd to prepare proposals for drainage and watermain arrangements for a proposed amendment to Large Residential Development at Prussia Street, Dublin 7.

The proposed scope of works is the inclusion of 2 additional floors, incorporating 10 additional residential units, to the previously granted planning permission. The additional floors will be incorporated into Block C which will increase from 7 storeys to 9 storeys.

1.1 Site Location:

The subject site is located on Prussia Street, opposite the junction of Prussia Street and St. Joseph's Road as shown on map below. The subject site contains an area of 0.3801 Hectares within the red line boundary.

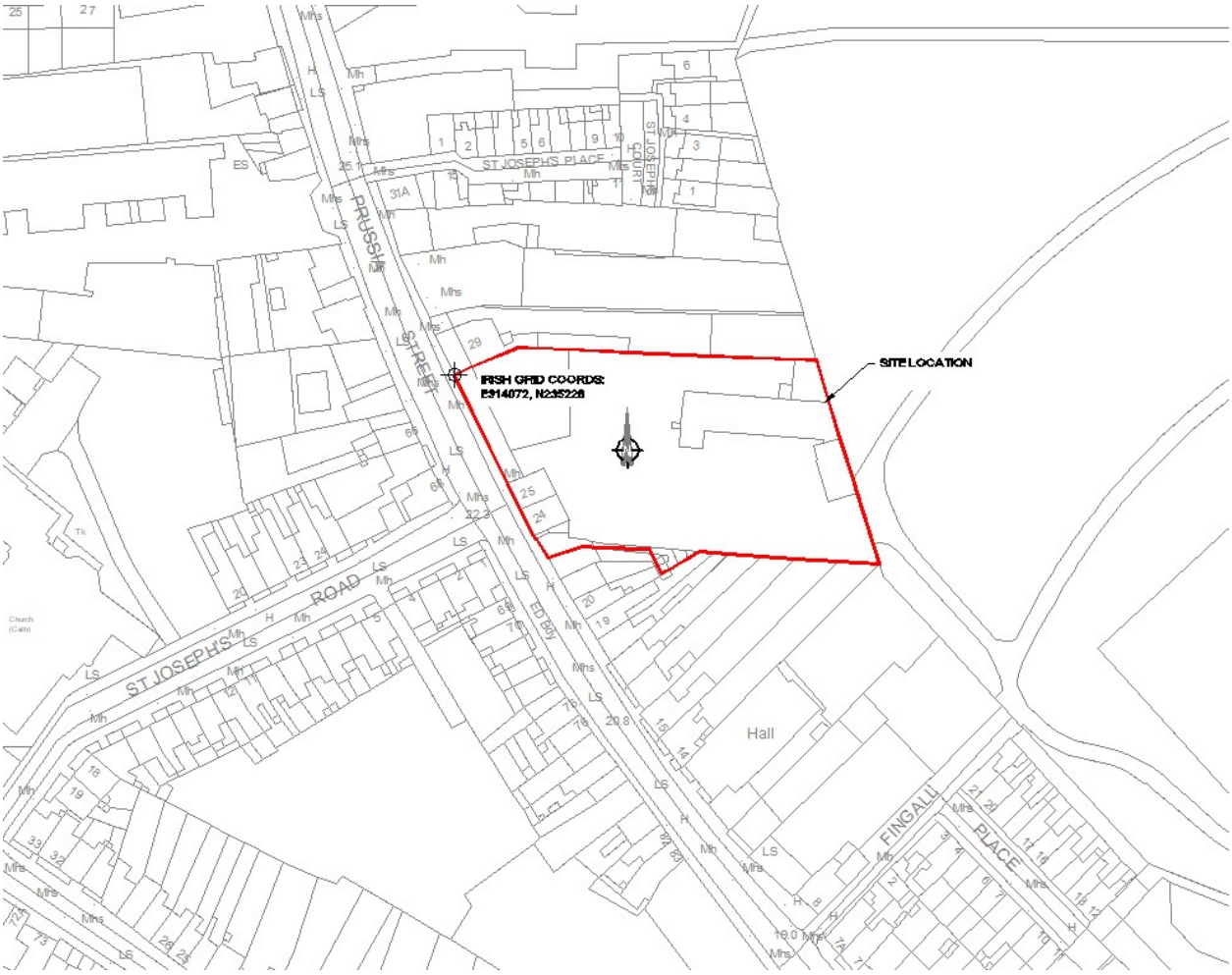


Figure 1-1.1: Site Location Map

1.2 Existing Granted Developement:

The existing permitted development is a residential development with retail units to the ground floor of block A.



Figure 1.2: Exiting site highlighted in red boundary

1.3 Proposed Redevelopment of Site:

The proposed amendment to the permitted planning application is the inclusion of two additional floors, comprising of 10 residential units.



Figure 1-3:Proposed Development

2.0 Surface Water Drainage & SUDS:

The proposed amendment to the planning results in an alteration to the blue roof areas provided on site. The ground level SUDs features have remained unchanged & the alteration in volumes has been calculated to ensure sufficient storage has been provided on site to accommodate the alteration.



Figure 2-1: Permitted Roof Level Suds Plan



Figure 2-2: Proposed Alteration to the Roof Level Suds Plan

2.1 Existing Surface Water Drainage Arrangements

Review of Irish Water records indicates that the site is served by a 990mm combined culvert sewer on Prussia Street as shown in Figure 3 below. There is not believed to be any form of surface water attenuation or sustainable urban drainage systems within the current site drainage arrangements. It is therefore considered that all existing paved areas within the site are positively drained to existing public sewers via gravity drainage.



Figure 2.1: Existing Combined Sewers, Irish Water Records

2.2 Site Characteristics & Design Parameters

2.2.1 Soil

L&D review of FSSR Soil maps indicates that the site location is indicated as being SOIL type 2, with an associated SPR of 0.3.

SOIL	WRAP	Runoff	SOIL Value	Soil Characteristics
1	Very high	Very low	0.15	Sandy, well drained
2	High	Low	0.30	Intermediate soils (sandy)
3	Moderate	Moderate	0.40	Intermediate soils (silty)
4	Low	High	0.45	Clayey, poorly drained
5	Very low	Very high	0.50	Steep, rocky areas

Table D1 Different Classes of Soil

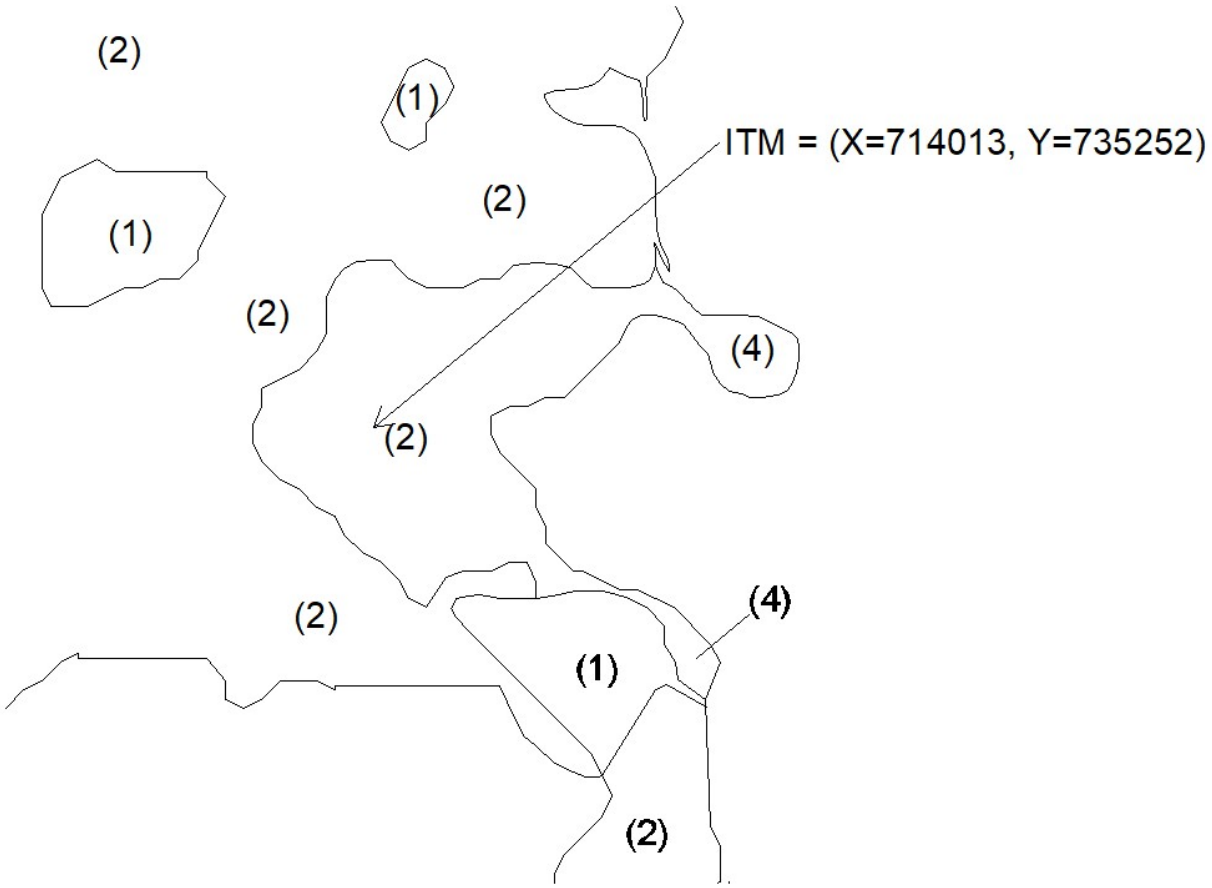


Figure 2.2.1: FSSR Soil Map

2.2.2 Rainfall

Site-specific rainfall data has been obtained by L&D from Met Eireann for the purposes of surface water sewer design, which indicates a M5-60 value of 16.3mm and ratio (R) of 0.278

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 314072, Northing: 235228,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.5,	4.1,	5.0,	5.6,	6.1,	7.6,	9.4,	10.6,	12.3,	13.8,	15.0,	16.8,	18.3,	19.4,	N/A ,
10 mins	3.4,	4.9,	5.7,	7.0,	7.8,	8.5,	10.6,	13.1,	14.8,	17.1,	19.3,	20.9,	23.5,	25.4,	27.1,	N/A ,
15 mins	4.0,	5.8,	6.7,	8.2,	9.2,	10.0,	12.5,	15.4,	17.4,	20.2,	22.7,	24.6,	27.6,	29.9,	31.9,	N/A ,
30 mins	5.3,	7.5,	8.7,	10.5,	11.8,	12.7,	15.9,	19.4,	21.8,	25.1,	28.1,	30.4,	34.0,	36.7,	39.0,	N/A ,
1 hours	7.0,	9.8,	11.3,	13.6,	15.1,	16.3,	20.1,	24.4,	27.3,	31.3,	34.8,	37.6,	41.8,	45.1,	47.8,	N/A ,
2 hours	9.3,	12.8,	14.7,	17.5,	19.3,	20.8,	25.5,	30.7,	34.2,	39.0,	43.2,	46.5,	51.5,	55.3,	58.5,	N/A ,
3 hours	10.9,	15.0,	17.1,	20.3,	22.4,	24.0,	29.3,	35.1,	39.0,	44.3,	49.0,	52.6,	58.1,	62.4,	65.9,	N/A ,
4 hours	12.3,	16.7,	19.1,	22.5,	24.8,	26.6,	32.3,	38.6,	42.8,	48.5,	53.6,	57.4,	63.4,	67.9,	71.7,	N/A ,
6 hours	14.4,	19.5,	22.2,	26.1,	28.7,	30.7,	37.1,	44.2,	48.8,	55.2,	60.8,	65.0,	71.6,	76.6,	80.7,	N/A ,
9 hours	17.0,	22.8,	25.8,	30.2,	33.2,	35.4,	42.6,	50.5,	55.6,	62.7,	68.9,	73.6,	80.8,	86.3,	90.9,	N/A ,
12 hours	19.1,	25.5,	28.8,	33.6,	36.8,	39.2,	47.0,	55.6,	61.1,	68.7,	75.3,	80.4,	88.1,	94.0,	98.8,	N/A ,
18 hours	22.5,	29.7,	33.5,	38.9,	42.5,	45.3,	54.0,	63.6,	69.7,	78.1,	85.4,	91.0,	99.5,	106.0,	111.3,	N/A ,
24 hours	25.2,	33.2,	37.3,	43.2,	47.2,	50.1,	59.6,	69.9,	76.5,	85.6,	93.4,	99.4,	108.5,	115.4,	121.0,	140.4,
2 days	30.9,	40.0,	44.5,	51.1,	55.4,	58.7,	68.9,	79.9,	86.9,	96.5,	104.7,	111.0,	120.3,	127.5,	133.3,	153.0,
3 days	35.6,	45.4,	50.4,	57.5,	62.1,	65.6,	76.5,	88.2,	95.5,	105.6,	114.2,	120.7,	130.4,	137.8,	143.8,	164.1,
4 days	39.6,	50.2,	55.5,	63.0,	67.9,	71.6,	83.1,	95.4,	103.1,	113.5,	122.5,	129.2,	139.3,	146.9,	153.1,	174.0,
6 days	46.6,	58.5,	64.3,	72.6,	78.0,	82.0,	94.6,	107.8,	116.1,	127.3,	136.9,	144.0,	154.7,	162.8,	169.3,	191.3,
8 days	52.9,	65.7,	72.1,	81.1,	86.8,	91.2,	104.6,	118.7,	127.5,	139.3,	149.4,	156.9,	168.2,	176.6,	183.5,	206.4,
10 days	58.5,	72.4,	79.1,	88.7,	94.8,	99.4,	113.6,	128.5,	137.7,	150.2,	160.7,	168.6,	180.3,	189.1,	196.2,	220.0,
12 days	63.8,	78.5,	85.7,	95.8,	102.2,	107.1,	122.0,	137.5,	147.2,	160.2,	171.1,	179.3,	191.5,	200.6,	208.0,	232.6,
16 days	73.6,	89.8,	97.7,	108.8,	115.8,	121.1,	137.3,	154.1,	164.5,	178.4,	190.1,	198.9,	211.9,	221.6,	229.4,	255.4,
20 days	82.6,	100.2,	108.8,	120.7,	128.2,	133.9,	151.2,	169.1,	180.2,	194.9,	207.3,	216.6,	230.3,	240.5,	248.7,	276.0,
25 days	93.2,	112.3,	121.6,	134.4,	142.6,	148.7,	167.3,	186.4,	198.2,	213.9,	227.1,	236.9,	251.4,	262.2,	270.9,	299.6,

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

A site-specific Standard Average Annual Rainfall (SAAR) figure of 731mm from Met Eireann datasets has been adopted by L&D for detailed design with regard to determination of Greenfield runoff and stormwater storage volumes.

2.2.3 Sewer Design

All sewers are designed in accordance with IS 752:2008 and building regulations TGD Part H. All drainage works shall be in accordance with the requirements of Dublin City Council and Irish water. As the site is located in a city centre area, surface water sewers are designed using modified rational method for a 5 year return period

2.2.4 Climate Change

L&D designs have included for 20% increase in rainfall rates due climate change.

2.2.5 Greenfield Runoff Rate (Q_{BAR})

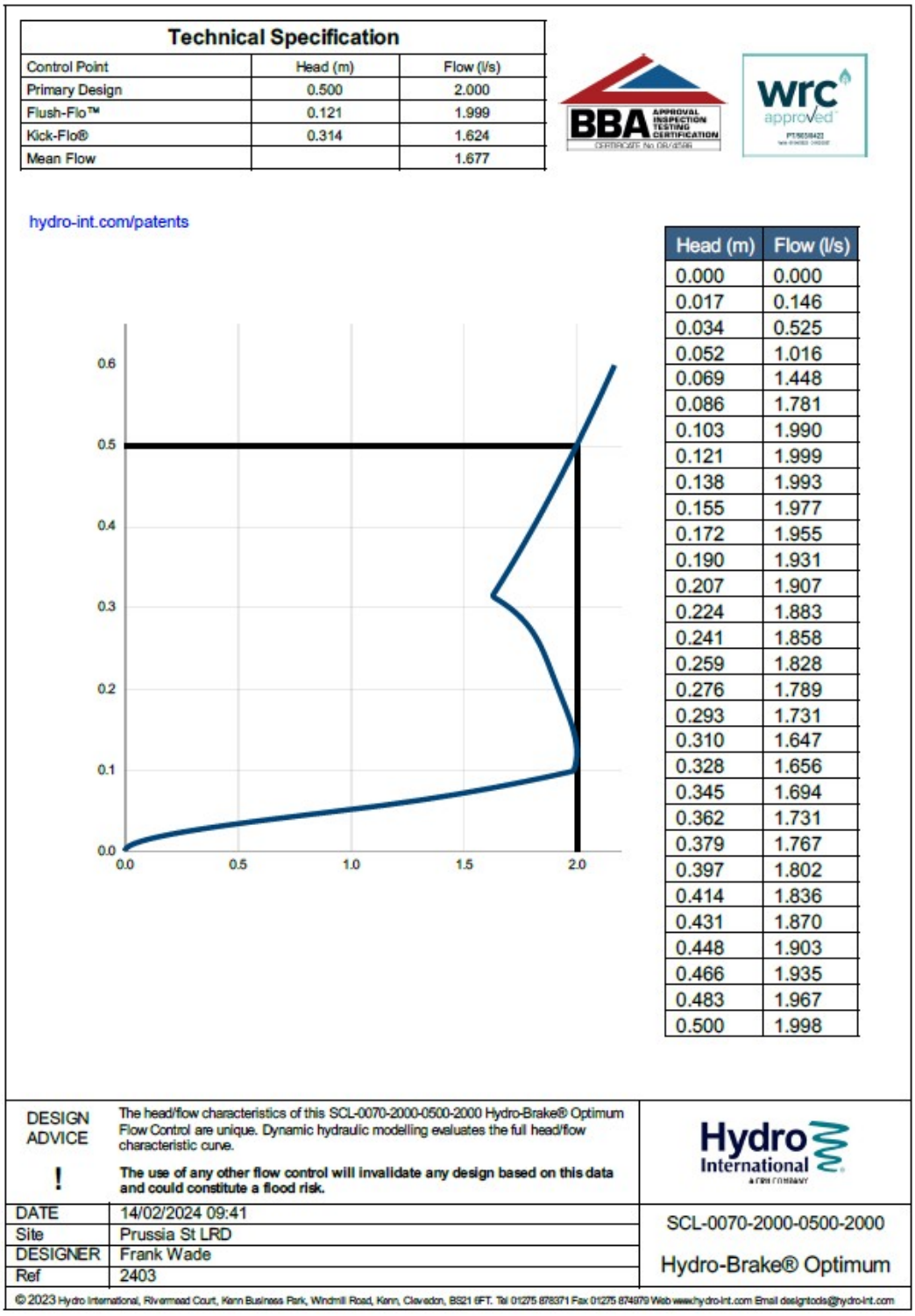
A Greenfield run-off rate for the site has been calculated in figure 5 based on a standard average annual rainfall value of 731mm, a soil index of 0.3 and a linear interpolation from a 50 Hectare catchment to the actual site area of 3,801m^2. The resulting QBAR calculated for the site is 0.728 litres/second. The calculated QBAR flow rate is lower than the minimum flow rate achievable using commercially available throttle systems without increased risk of blockage (generally accepted as 2.0 litres/second), therefore the lowest achievable flow rate of 2.0 litres/second is adopted for the purpose of attenuation volume calculations.

QBAR Calc for 50ha			*QBAR Calc interpolated for*	*3801*	m^2
AREA in sq km	0.5		AREA in sq km	0.003801	
SAAR in mm	731				
SOIL	0.3				
QBARrural	95.86134389	l/s	QBARrural	0.728737936	l/s

Figure 2.2.5: QBAR Calculation

2.2.6 Flow Control

The proposed flow control device is designed to the adopted QBAR 2.0 litres/second based on the lowest achievable flow rate. A provisional design is presented below in figure 2.2.6 based on a design head of 0.5m.



Technical Specification		
Control Point	Head (m)	Flow (l/s)
Primary Design	0.500	2.000
Flush-Flo™	0.121	1.999
Kick-Flo®	0.314	1.624
Mean Flow		1.677

hydro-int.com/patents

Head (m)	Flow (l/s)
0.000	0.000
0.017	0.146
0.034	0.525
0.052	1.016
0.069	1.448
0.086	1.781
0.103	1.990
0.121	1.999
0.138	1.993
0.155	1.977
0.172	1.955
0.190	1.931
0.207	1.907
0.224	1.883
0.241	1.858
0.259	1.828
0.276	1.789
0.293	1.731
0.310	1.647
0.328	1.656
0.345	1.694
0.362	1.731
0.379	1.767
0.397	1.802
0.414	1.836
0.431	1.870
0.448	1.903
0.466	1.935
0.483	1.967
0.500	1.998

DESIGN ADVICE

The head/flow characteristics of this SCL-0070-2000-0500-2000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International

DATE	14/02/2024 09:41
Site	Prussia St LRD
DESIGNER	Frank Wade
Ref	2403

SCL-0070-2000-0500-2000

Hydro-Brake® Optimum

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Figure 2.2.6: Flow Control Device Hydraulic Characteristics

2.2.7 Surface Water Outfall

The final outfall manhole shall receive outflow from a flow control device limiting surface water flows to 2.0 litres/second as outlined above. Outflow from the outfall manhole shall pass through a 150mm interceptor trap before combining with wastewater in the final foul outfall manhole. Combined runoff shall exit the site via a second 150mm interceptor trap and shall discharge to the public 990mm combined culvert sewer on Prussia Street at existing manhole SO14350201. The outfall surface water manhole shall contain a redundant surface water pipe extended to the site boundary to facilitate a future connection to a separate surface water system.

2.2.8 SuDS Measures Considered

Consideration has been given to what SuDS measures are feasible for incorporation into the proposed development, presented in tabular form below:

SuDS Measure	Incorporated within Design?	Comments
Extensive Blue/Green Roof	Y	The roofs of the majority of apartment buildings are formed as extensive blue/green roofs
Intensive Blue/Green Roof	N	The building design intent is to avoid high parapets due to overshadowing of adjacent developments, preventing the use of extensive roof substrates due to the increased depth of soil required.
Swales, Filter Drains, Infiltration trenches, Rain Gardens	Y	Rain gardens are incorporated into the landscaped zones at surface level
Permeable Paving	Y	Permeable paving is proposed for the surface level paved areas of the development
Petrol Interceptor	Y	The surface water outfall includes two interceptors upstream of the final flow control device
Surface Water Attenuation	Y	Attenuation storage is achieved through use of a blue roof attenuation system, tree pits, rain gardens and permeable paving sub-base voids
Site Run-off Rates	Y	L&D Design follows approach 2 outlined in Section 3.3.1 *Ciria SuDS Manual 2015*, which indicates that where controlling runoff to greenfield volumes is considered unachievable then calculations should utilise a set discharge rate of 2 litres/second/hectare or $Q_{bar(rural)}$, whichever is greater, is adopted for determination of attenuation storage. As Q_{BAR} is slightly greater than 2.0 litres/second/hectare, this is adopted for use in L&D Design.
Rainwater Harvesting	N	No rainwater harvesting proposed within development
Detention Basins, Retention Ponds, Stormwater Wetlands	N	Not suitable due to space constraints and lack of infiltration
Bio-retention Systems	Y	Bio-retention systems incorporated into surface level landscaped zones
Tree pits	Y	Tree pits incorporated into surface level landscaped zones

2.2.9 SuDS Measures Applied

As can been seen above, the proposed SuDS measures for this development place strong emphasis on nature-based SuDS and avoid the use of below-ground chambers or tank systems.

It is proposed to incorporate extensive blue/green roof systems into the construction of the building with the aim of delaying and reducing runoff from the site in times of precipitation. The intention is to provide an additional natural and sustainable form of attenuation within the site that will reduce the total runoff from the site by temporarily retaining the runoff within the extensive green roof layer and promoting evaporation. The extensive green roofs shall be composed of a mix of sedum, moss and chive to promote biodiversity and shall include an 80mm growth medium and 20mm drainage sheet.

All blue/green roof systems shall incorporate a 100mm void former below this to increase the interception storage capacity of the green roof system and allow the system to function as a blue roof attenuation system. An approximate green roof area of 1284m^2 shall be provided equivalent to approximately 85% of the total overall roof areas in the development including parapets and upstands.

It is proposed to install permeable paving systems in the pedestrian paved areas and the trafficked shared surface with the aim of reducing impermeable area, reducing runoff from the site in time of precipitation and improving quality of runoff generally. For non-trafficked private open space permeable pavements, a minimum of 250mm depth of clause 505B sub-base granular stone fill with approximately 30% voids is to be used. For non-trafficked common area permeable pavements, a minimum of 350mm depth of clause 505B sub-base granular stone fill with approximately 30% voids is to be used For trafficked permeable pavements, a minimum of 350mm depth of clause 505B sub-base granular stone fill with approximately 30% voids is to be used. All sub-bases shall be used to provide sub-ground storage volume for rainfall events.

It is proposed to utilise tree pits with stormwater storage capacity for all proposed trees as shown in landscape architectural plans. Tree pits shall incorporate a minimum of 300mm depth of clause 505B sub-base granular stone fill with approximately 30% voids below the rootball and soil base of the tree in order to provide long term storage for rainfall events.

It is proposed to utilise raingardens and bio-retention areas as part of the landscaping scheme. Rainwater runoff from paved areas shall be directed into low-level rain gardens via lateral inlet kerbs and surface rills in order to provide long term storage.

2.2.10 Volume Storage

The required attenuation volume has been calculated for the 100 year event, including for a 20% increase for the effects of climate change and urban expansion. The full suite of calculations for all areas is included within Appendix A. The summary tables below indicates a required attenuation volume of 158.63m^3 for the total site area and for the selected runoff coefficients in compliance with GDSDS requirements.

	total area	blue/green roof area excluding upstands	blue/green roof percentage	Attenuate?	Site Area for Attenuation Calculation	Run-off Coefficient
	sqm	sq.	%			
Roof area A1	385	327	84.93506494	Y	385	0.8
Roof area B1	213	181	84.97652582	Y	213	0.8
Roof area B2	217	0	0	Y	217	0.8
Roof area C1	73	0	0	Y	73	0.8
Roof area C3	280	250	89.28571429	Y	280	0.8
Roof area D1	25	0	0	Y	25	0.8
Terraces & Impermeable Zones	362	0	0	Y	362	0.8
Trafficked permeable paving	665	0	0	Y	665	0.8
Non-trafficked permeable paving	805	0	0	Y	805	0.8
Landscaped/Grassed areas	565	0	0	Y	565	0.3
Raingardens	120	0	0	Y	120	0.3
Roof area C2	91	0	0	Y	91	0.8

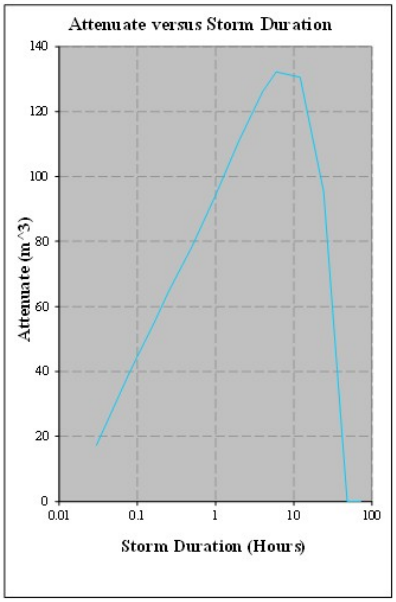
Figure 2.2.10a: Area summary

LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Project:	Prussia Street LRD Surface Water Attenuation	Job No:	2403
		Page No:	1
Date:	20/01/2024 Calc'd by: FW	Checked by:	FM

Roof Area: 1284 m^2 I. Factor: 0.80 Paved Area: 1832 m^2 I. Factor: 0.80 Other: 685 m^2 I. Factor: 0.3 Equivalent Impermeable Area: 2698.3 m^2 Attenuated Flow Rate: 2 l/s

Storm Duration (Hours)	Rainfall (mm)	Total Surface Water (m^3)	Allowable Discharge (m^3)	Attenuate (m^3)
0.03	6.50	17.54	0.216	17.32
0.08	15.00	40.47	0.576	39.90
0.166	20.90	56.39	1.1952	55.20
0.25	24.60	66.38	1.8	64.58
0.50	30.40	82.03	3.6	78.43
1.00	37.60	101.46	7.2	94.26
2.00	46.50	125.47	14.4	111.07
4.00	57.40	154.88	28.8	126.08
6.00	65.00	175.39	43.2	132.19
12.00	80.40	216.94	86.4	130.54
24.00	99.40	268.21	172.8	95.41
48.00	111.00	299.51	345.6	0
72.00	120.70	325.68	518.4	0



Maximum Volume of Attenuate: 132.19 m^3 Climate Change = 1.2 Required Attenuation Volume = 158.63 m^3

Note: This spreadsheet calculates the Volume of Attenuate based on a Return Period of: 100 years.

Figure 2.2.10b: Stormwater Attenuation Summary Table

2.2.11 Volume Runoff

L&D assessment indicates that post-development runoff volumes exceed pre-development runoff volumes. Therefore, approach 2 outlined in Section 3.3.1 Ciria SuDS Manual 2015, which indicates that where controlling runoff to greenfield volumes is considered unachievable then calculations should utilise a set discharge rate of 2 litres/second/hectare or $Q_{bar(rural)}$, whichever is greater, is adopted for determination of attenuation storage.

2.2.12 Treatment Volume, Water Quality Improvement & Treatment Train

For interception storage criterion 1.1 to GDSDS Appendix E, the interception of the first 5mm of rainfall is required, utilising 80% runoff for all paved areas and 0% runoff for pervious surfaces. For the total paved area of site considered as an impermeable area of 3801m^2, a maximum interception volume is calculated as:

⇨ 3,801 x 0.005 = 19.005m^3

2.2.13 Long Term Storage

GDSDS Appendix E provides a calculation method for long term storage using the formula:

$$Vol_{xs} = RD.A.10\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

Where:

- VolXS is the extra runoff volume (m^3) of development runoff over Greenfield runoff
- RD is the rainfall depth for the 100 year, 6-hour event (mm)
- PIMP is the impermeable area as a percentage of the total area (values from 0 to100)
- A is the area of the site (ha)
- SOIL is the "SPR" index from FSR
- α0.8 is the proportion of paved area draining to the network or directly to the river (values from 0 to1) with 80 percent runoff
- β is the proportion of pervious area draining to the network or directly to the river (values from 0 to1)

Calculating this volume for the subject site determines a long term storage requirement of **24.7065m^3.**

2.2.14 Surface Water Storage Volume Proposals

Summarising the various storage requirements outlined above, the total surface water storage volumes determined for the subject site are as follows:

Type	Storage Volume Required
Attenuation Storage	158.63m^3
Interception Storage	19.005m^3
Long Term Storage	24.7065m^3
SUM	**201.71m^3**

Carrying out a validation exercise using the uksuds online tool results in a similar total storage volume requirement of 187m^3 as per figure below.

hrwallingford

Calculated by:	Francis Wade
Site name:	Prussia St LRD
Site location:	Prussia Street

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics

Total site area (ha):	0.3801
Significant public open space (ha):	0.0565
Area positively drained (ha):	0.3236
Impermeable area (ha):	0.3236
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.32
Net impermable area for storage volume design (ha):	0.32
Pervious area contribution to runoff (%):	0

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Specify Qbar manually
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	2
SPR:	0.47	0.3

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	65
Rainfall 100 yrs 12 hrs:	--	80.4
FEH / FSR conversion factor:	1	1.1
SAAR (mm):	947	731
M5-60 Rainfall Depth (mm):	17	17
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.72	1.7
Growth curve factor 30 year:	2.13	2.1
Growth curve factor 100 years:	2.61	2.6
Q_{BAR} for total site area (l/s):	2.61	2
Q_{BAR} for net site area (l/s):	2.22	1.7

Design criteria

Climate change allowance factor:	1.2
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	4.7	3.6
1 in 100 year (l/s):	5.8	4.4

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	107	134
Long term storage 1/100 years (m^3):	55	53
Total storage 1/100 years (m^3):	162	187

Blue Roof.

It is proposed to incorporate 100mm void formers with a 90% voids ratio below the extensive green roof substrates for the majority of roof areas, which shall enable the roof to act as a "blue roof" by proving attenuation storage at roof level. Each roof area shall have a specific outlet design, with the flow rate for each roof area calculated on the basis of that roof area as a percentage of the overall contributory area to ensure that the total flow rate from all roof areas does not exceed the maximum flow rate of 2.0 litres/second. Each roof outlet shall incorporate an emergency overflow system so that in the event of a local blockage of the flow restrictor element of the outlet, attenuated rainwater may overtop the outlet system and escape via downpipes before it can overtop roof waterproofing and cause water damage. However, as this increase in flow rate would lead to excess water reaching the outfall manhole where a flow control device limits outflow to 2.0 litres/second and which would therefore lead to flooding of the outfall manhole, each roof area shall also incorporate a separate tell-tale overflow set just below the control level for the roof outlets which will discharge rainwater out from the building onto podium areas. Thus, if there is a blockage of a roof outlet it will be apparent upon activation of the tell-tale overflow that such a blockage is present and must be actioned to prevent continuation of overflowing rainwater into public spaces.

Assessment of the various roof areas and potential for blue roof storage results in the following:

Building/Zone	Extensive Green Roof	100mm Blue roof & 90% void module	Available area for blue roof modules	Storage Volume Provided
Block A, Roof A1	Yes	Yes	385 m^2	26.370m^3
Block B, Roof B1	Yes	Yes	213 m^2	11.256 m^3
Block B, Roof B2	Yes	No	0	0
Block C, Roof C1	Yes	No	0	0
Block C, Roof C2	Yes	No	0	0
Block C, Roof C3	Yes	Yes	280 m^2	16.428 m^3
Substation, Roof D	Yes	No	0	0
SUM				**54.054 m^3**

Permeable Paving.

It is proposed to utilise Clause 505B granular stone for the sub-base of both trafficked and non-trafficked permeable pavements. This grading of stone provides a 40% voids ratio in which stormwater can be stored. A series of perforated pipes route excess runoff to surface water sewers while the adoption of an unlined sub-base facilitates additional dispersion of surface water through plane infiltration.

Assessment of the various permeable pavements proposed and the associated storage volumes achieved by each results in the following:

Zone	Trafficked or Pedestrian	Clause 505B sub-base depth, 30% voids	Total area	Storage Volume Provided
Private Open Spaces, patios	Pedestrian, load category 1	250mm	320 m^2	24.0 m^3
Central courtyard footways	Pedestrian, load category 2	350mm	583 m^2	61.215 m^3
Shared surface	Trafficked, load category 4	350mm	572 m^2	60.060 m^3
SUM				**145.275 m^3**

Tree Pits.

It is proposed that sunken Tree pits shall incorporate a minimum of 300mm depth of clause 505B sub-base granular stone fill with approximately 30% voids below the rootball and soil base of the tree in order to provide long term storage for rainfall events.

Assessment of the various tree pits available in the landscape design and the associated storage volumes achieved by each results in the following:

Tree Pit Ref & Type	Quantity	Plan Area of each pit	Depth of 40% sub-base below pit	Storage Volume Provided
STP1 – sunken type	10	1.5m x 1.5m	300mm	0.27 m^3 x 17
STP2 – sunken type	32	1.2m x 1.2m	300mm	0 m^3
SUM				**4.59 m^3**

Rain Gardens.

It is proposed to form shallow rain gardens adjacent to the shared surface. Lateral inlet kerbs shall be incorporated into the border of the shared surface to allow excessive runoff to collect in rain garden, facilitating evapotranspiration and infiltration, in addition to achieving additional stormwater storage volume.

The rain gardens are intended to have gently sloped side gradients to facilitate maintenance and shall incorporate planting to landscape architect details.

Assessment of the various rain gardens available in the landscape design and the associated storage volumes achieved by each results in the following:

Raingarden Ref	Plan Area	Average depth	Storage Volume Provided
Raingarden 1	21m^2	75mm	1.575m^3
Raingarden 2	36m^2	75mm	2.7m^3
Raingarden 3	48m^2	90mm	4.32m^3
Raingarden 4	8m^2	50mm	0.4m^3
SUM			**8.995 m^3**

The plan area of the proposed extensive blue/green roof areas is 1,284m^2. It is proposed to include a 20mm dimpled drainage sheet below the green roof substrate with a 90% voids ratio, which shall be positioned below the level of the drainage outlets on the roof in order to retain the water and facilitate evapotranspiration. The volume of interception storage provided by the roof drainage sheet would be equivalent to:

- ⇨ 1284 x 0.02 x 0.9 = 23.112m^3

Incorporation of green roofs into the surface water design shall improve water quality through the process of rainwater filtering through the extensive green roof substrate into the void former system below.

The quality of run-off from the permeable paving areas of the site shall also be improved due to the filtering process of the paving, which retains silts and degrades hydrocarbons. A petrol interceptor is incorporated into the surface water drainage network to remove any hydrocarbons not filtered out via the various SuDS devices.

Site Control measures are achieved by the use of green roof areas for interception storage. Additional attenuation is achieved through provision of tree pits, raingardens and permeable paving. Permeable paving, tree pits and raingardens all provide an effective form of source control.

Summarising the total storage volumes provided by the various SuDS measures and storage systems utilised, the following table presents the sum of all storage volumes achieved:

Type	Storage Volume Provided
Permeable Paving Sub-Bases	145.275 m^3
Blue Roof Storage Modules	68.22 m^3
Tree Pit Bases	4.59 m^3
Rain Gardens	8.995 m^3
Green Roof Drainage Sheet	23.112m^3
SUM	**261.622m^3**

The total storage volume required = 201.71m^3

The total storage volume provided = 250.192m^3

Therefore the proposed design meets and exceeds the storage requirements under the GDSDS criteria.

2.2.15 Health & Safety and Maintenance Issues

It is recommended that maintenance of SuDS systems should be carried out at 6 month intervals. L&D recommend that a bi-annual maintenance regime be put in place for all elements of the stormwater drainage system, inclusive of all SuDS devices.

L&D notes that the proposed stormwater drainage system comprises green roof systems, permeable paving, below-ground attenuation system and flow control devices, underground manholes and underground pipes. These elements are generally considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction and operation.

For design of manholes and underground pipes, the recommendations of GDSDS and IS EN 752 are used to ensure safe means of access to all chambers.

Regular maintenance of the flow control devices is required to remove any blockages, particularly in the wake of heavy rainfall events or local floods. The vortex flow control chamber includes a penstock valve to prevent water ingress during maintenance and the manhole benching includes a local silt trap to facilitate removal of silt from the flow control chamber.

Permeable pavements require maintenance in the form of routine brushing and vacuuming of joints to maintain optimum performance and prevent growth within the bed joints. The frequency of maintenance varies by unit manufacturer but a bi-annual frequency is considered appropriate for this surface.

Green roofs require bi-annual inspection for removal of unwanted vegetation such as weeds. Blue roof outlets require similar bi-annual inspection to ensure the outlets are performing satisfactorily. All green roof areas shall incorporate fall-arrest systems for safe access by maintenance personnel.

2.2.16 Shared Surface Temporary Construction Access

A separate planning application has been submitted by the Grangegorman Development Agency to make temporary use of the shared surface link to Grangegorman as a haul road to facilitate future construction works within the Grangegorman campus. It is envisaged that this haul road and shared surface link shall be the first phase of development within the site and shall include formation of the sub-base to account for the servicing requirements of the proposed apartment development and sub-station. The second phase of development within the site shall be the construction of the apartment development and sub-station building. The shared surface link and haul road shall remain live during this phase and shall service both Grangegorman and the subject site concurrently. For the third phase of development, the temporary haul road shall eventually be redundant and the final permanent surface finishes and landscape features shall be installed at that time.

The surface water drainage system for the shared surface has therefore been designed to take cognisance of this phased development by providing two separate sewer networks, one which serves the apartment buildings and central courtyards, and a second which serves only the shared surface. Each network has its own petrol interceptor and the shared surface area is served by a second flow control device which then discharges into the final flow control manhole so that the total outflow from both the apartment development and the shared link to Grangegorman shall never exceed 2 litres/second as outlined above.

3.0 Foul Water Drainage

The existing permitted drainage on site requires no alteration & has the capacity to accommodate the additional units & an application with Uisce Eireann is currently in progress to ensure there is sufficient capacity in the public network.

3.1 Existing Foul Water Drainage Arrangements

Review of Irish Water records indicates that the site is served by a 990mm combined culvert sewer on Prussia Street as shown in Figure 8 below.



Figure 3-1 : Existing Combined Sewers, Irish Water Records

3.2 Proposed Foul Water Drainage Arrangements

3.2.1 Foul Sewer Design

All sewers are designed in accordance with IS 752: 2008 and Building Regulations TGD Part H. All drainage works shall be in accordance with the requirements of Irish Water and Dublin City Council.

Wastewater generated within apartments at upper floors and within ground floor residential/commercial space shall enter a below-ground foul sewer system and exit the site via gravity flow.

We have received our Confirmation of Feasibility for the additional 10 units from Uisce Eireann, reference CDS26006496.

3.2.2 Daily Wastewater Discharge

For the original development a pre-connection enquiry application has been made to Irish Water detailing the proposed wastewater discharges. Reference number CDS24000639 has been allocated for the application and a Confirmation of Feasibility Letter from Irish Water has been received indicating that the proposed connection can be facilitated.

Subsequently a connection offer has been received for Phase 1 CDS2400063901, the connection offer for phase 2 is in progress with Uisce Eireann CDS2400063902 & the PCE for the proposed additional units is under review with Uisce Eireann CDS26006493

There is no required alteration to the existing proposed foul drainage network serving the site due to the additional floors. The uplift in the proposed discharge from the site is 0.3094l/s 6DWF.

3.2.3 Basement Foul Effluent & Outfall

A single storey basement composed of water storage and plant space is to be located below the ground floor level. Each space shall contain floor gullies to accommodate spillage or runoff from plant or water storage areas. All wastewater generated at basement level shall fall by gravity to a basement level pumping station. The pumping station shall contain dual pumps in duty/standby and associated monitoring telemetry with SMS dialer and control kiosk.

All effluent reaching the basement pumping station shall be pumped from the basement to a dedicated ground floor level foul sewer discharge manhole via an 80mm HDPE rising main. Wastewater from the discharge manhole shall exit via gravity flow to the final foul outfall manhole.

3.2.4 Foul Sewer Outfall

Wastewater entering the final outfall manhole shall combine with surface water runoff. Combined runoff shall exit the site via a 150mm interceptor trap and shall discharge to the public 990mm combined culvert sewer on Prussia Street via a connection to existing manhole SO14350201.

It is proposed to install a new 225mm diameter foul sewer at a maximum gradient of 1/150 to serve the new development, which would have a flow capacity of 39.1 litres/second, exceeding the 6DWF of 3.875litres/second combined with the maximum surface water contribution of 2.0 litres/second.

4.0 Water Supply

The existing permitted watermain on site requires no alteration & has the capacity to accommodate the additional units & an application with Uisce Eireann is currently in progress to ensure there is sufficient capacity in the public network.

4.1 Existing Water Usage and Watermain Arrangement

Review of Irish Water records indicates that the site is served by a 100mm uPVC watermain on Prussia Street as shown in Figure 9 below. It is not known what extent of existing water connections are present on the site currently.



Figure 4-1: Existing public watermains, Irish Water Records

4.2 Proposed Water Usage and Watermain Arrangement

4.2.1 Watermain Connection

The site will facilitate 120 apartment units, resulting in a pipe diameter of minimum 150mm in accordance with Irish water requirements for 100 to 300 dwellings. It is proposed to install a new 150mm diameter watermain across Prussia Street to serve the site.

For the previous development a pre-connection enquiry application has been made to Irish Water detailing the proposed water consumption Reference number CDS24000639 has been allocated for the application and a Confirmation of Feasibility Letter from Irish Water has been received indicating that the proposed connection can be facilitated.

Subsequently a connection offer has been received for Phase 1 CDS2400063901, the connection offer for phase 2 is in progress with Uisce Eireann CDS2400063902.

We have received our Confirmation of Feasibility for the additional 10 units from Uisce Eireann, reference CDS26006496.

4.2.2 Hydrants

Two hydrants are located along Prussia Street, one on each side of the road. Hydrant No.1 is located at the junction of Prussia Street and St. Joseph's Road, connected to an existing 225mm watermain. Hydrant No.2 is located at outside of No.22 Prussia Street, connected to an existing 100mm watermain. New hydrants are shown in provisional locations on the new shared surface linking Prussia Street and Grangegorman. Hydrant provisions shall be subject to the approval of the local Fire Officer.

4.2.3 Watermeters

A new bulk watermeter shall be installed for the development to meet the requirements of Irish Water, with associated control kiosk to be located to the approval of both Irish Water and Dublin City Council.

5.0 Servicing & Vehicular Access

Under the current application there is no alteration to the proposed servicing or vehicular access to the site. The situation presented during the previous granted application will remain unchanged.

5.1 Refuse Collection

The ground floor design includes a dedicated area for bin storage within block B. For collection of refuse from the proposed development, a dedicated servicing area has been formed within Block A which shall facilitate off-street refuse collections for all sizes of refuse collection lorry. A clear and level route is provided through the central courtyard for the fetching of bins to the servicing area for collection.

The dedicated servicing area location has been chosen to minimise interactions with pedestrians and cyclists using the shared surface link to Grangegorman to the south of the proposed location, and also to minimise impact on the adjacent protected structure to the north of the proposed location.

Vehicular access to the servicing area shall be from Prussia Street. Refuse vehicles shall approach the site from the north and shall reverse from Prussia Street into the servicing area. The footpath shall be dished locally at this location to facilitate vehicular access. The alterations to the footpath shall include tactile paving and contrasting paving and shall be in accordance with DMURS and with DCC Roadstreet Works Construction Standards. By agreement made with DCC Transportation Department, these works have been deemed minimal enough to not require a Letter of Consent. On completion of refuse collection, the refuse vehicle shall exit the servicing area in a forward gear.

The servicing area shall include gates at the rear of the servicing area to avoid conflict with residents of the development in the courtyard space. Gates shall also be provided at the street-side entrance to the servicing area, as would be common practice in similar schemes across the city. From an operational perspective, it is intended that management will have the gates open daily 8am-8pm (or earlier or later if required) to facilitate refuse collection days. The appointed

refuse collector shall also have fob/pin access to the gates, again similar to other schemes across the city.

Liaison with a number of waste collection service providers has informed the design of the servicing area. Collections for general waste (black bin collections) and recycling waste (green bin collections) can be arranged to be provided by medium-sized 12 tonne refuse lorries. However, collections for compost waste (brown bin collection) and glass waste (blue bin collections) can only be serviced by large refuse collection lorries and so the design of the servicing area has accounted for the highest commercial refuse collection vehicles in waste collection fleets and provides sufficient headroom for such vehicles. Detailed design of building structures has been carried out to the validate the depth of structural elements in this region and the design achieves a first floor structural slab depth of 225mm without downstand structural elements. The design of building services in the servicing area has been undertaken to route all waste pipes above the first floor structural slab, ensuring that no suspended services will be present in the servicing area which could restrict headroom. Detailed design of the building thermal envelope has validated the 200mm zone provision for insulation and finishes to the soffit of the 225mm first floor structural slab. Lighting to the servicing area shall be provided by side-mounted lighting fixtures, and no suspended electrical, plumbing or containment fixtures shall be affixed to the first floor soffit within the servicing area so as to maintain the maximum headroom provision at all points within the servicing area.

Further detail on the servicing area is presented in drawing 2403-LDE-ZZ-00-DR-SC-1007.

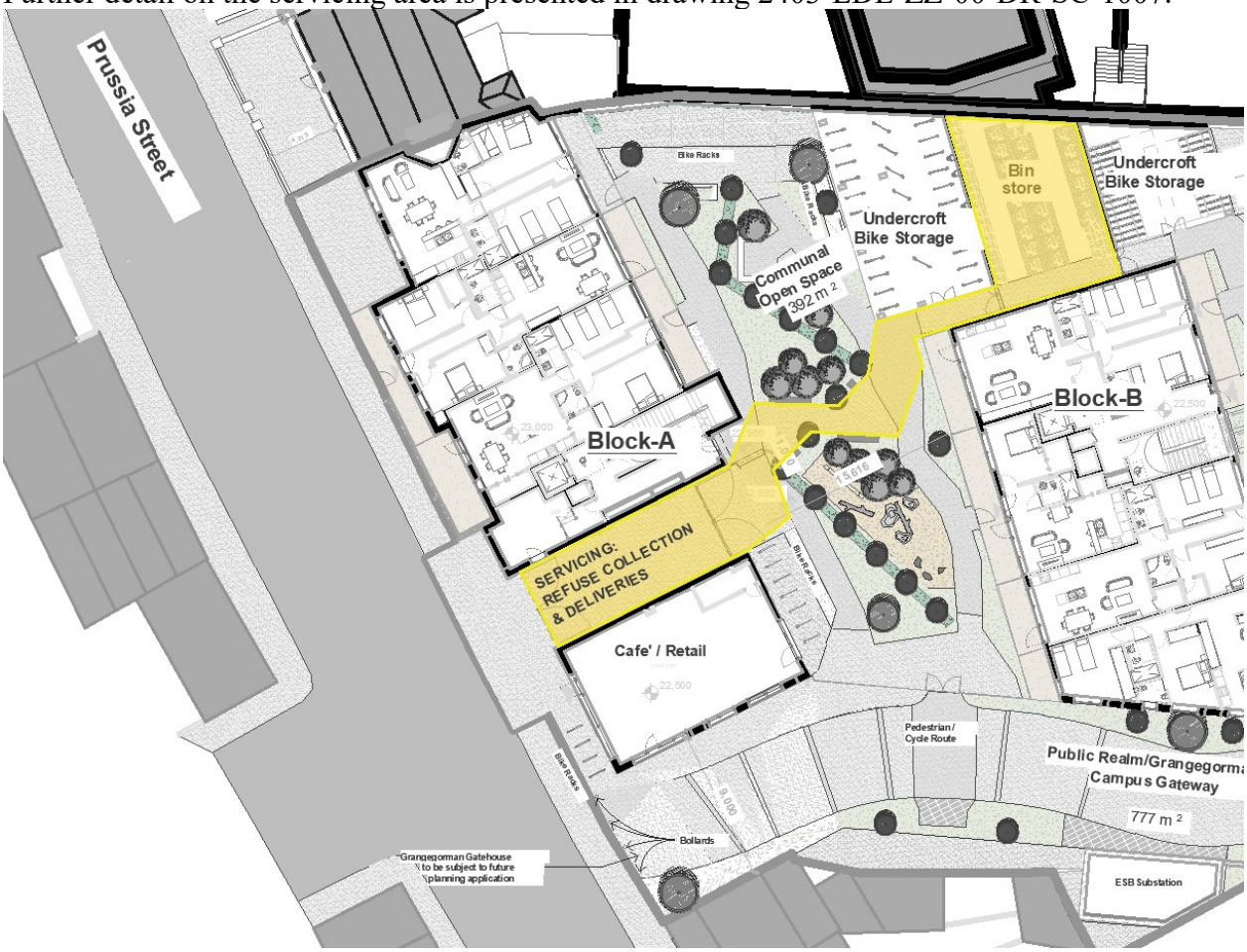


Figure 5.1: Bin store and route through central courtyard for bin collections in servicing area

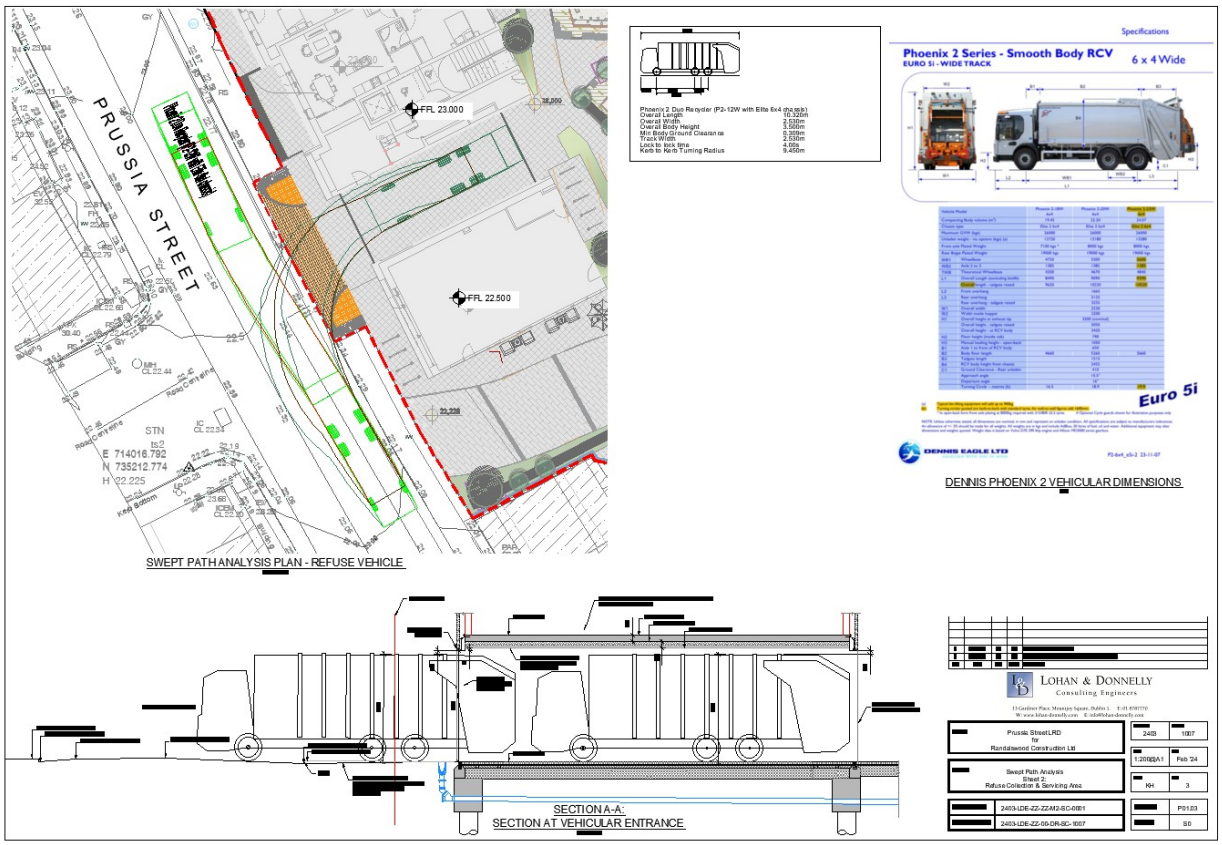


Figure 5.2: Drawing 2403-LDE-ZZ-00-DR-SC-1007

5.2 Deliveries

The proposed strategy to accommodate deliveries is that delivery vans shall enter the servicing area from Prussia Street in a reverse gear following the same swept path maneuver as the refuse lorries. Typical delivery vans are considerably smaller than the large refuse collection lorries and so the previous refuse lorry swept path analysis is deemed to validate the movement of delivery vans. On completion of delivery, vans shall exit the site in a forward gear.

Regular delivery drivers shall have fob/pin access to the gates to avoid dwell time on the street. There shall also be an intercom where unit/management can be contacted to take in deliveries. Management will strictly monitor this to ensure it is used for set down/loading only. The servicing zone has been designed to accommodate an area for parcel and letterbox storage so that the duration of delivery van stays can be minimised. This storage area is accessed both from the servicing area and from the central core so that delivery personnel may place parcels in the area quickly, while residents can collect deliveries without having to access the segregated servicing area. This minimises duration of deliveries while ensuring safety of residents.

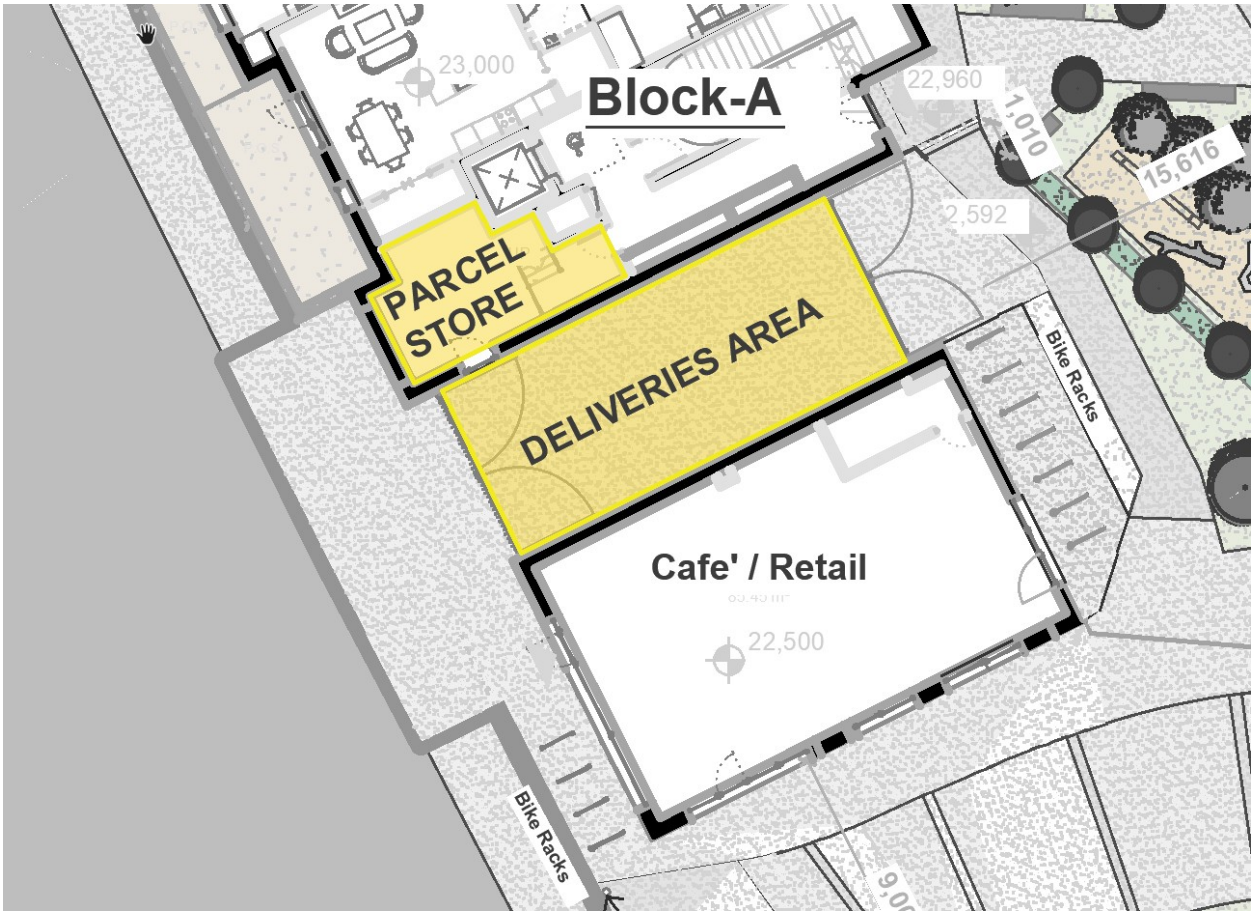


Figure 5.2.1 Delivery area and adjacent parcel store

5.3 Fire Tender Access

Swept path analysis drawings demonstrate that a fire tender can navigate the full length of the shared surface from Prussia Street to Grangegorman. Removeable bollards at the western and eastern ends of the roadway can be lowered to provide through-access to the Grangegorman site to the immediate east of the proposed development.



Figure 5.3: Fire tender accessing through Prussia Street Gateway to Grangegorman

5.4 High Top Conversion Vehicles

The proposed strategy to accommodate high top conversion vehicles (HTCVs) is that such vehicles shall enter the servicing area from Prussia Street in a reverse gear following the same swept path maneuver as the refuse lorries. These vehicles are substantially smaller than the large refuse collection lorries and so the previous refuse lorry swept path analysis is deemed to validate the movement of HTCVs. On completion of delivery, HTCVs shall exit the site in a forward gear.

Access to this area may be gained through an intercom where unit/management can be contacted for access. Management will strictly monitor this to ensure it is used for set down/loading only. No parking of HTCVs will be permitted in this space.

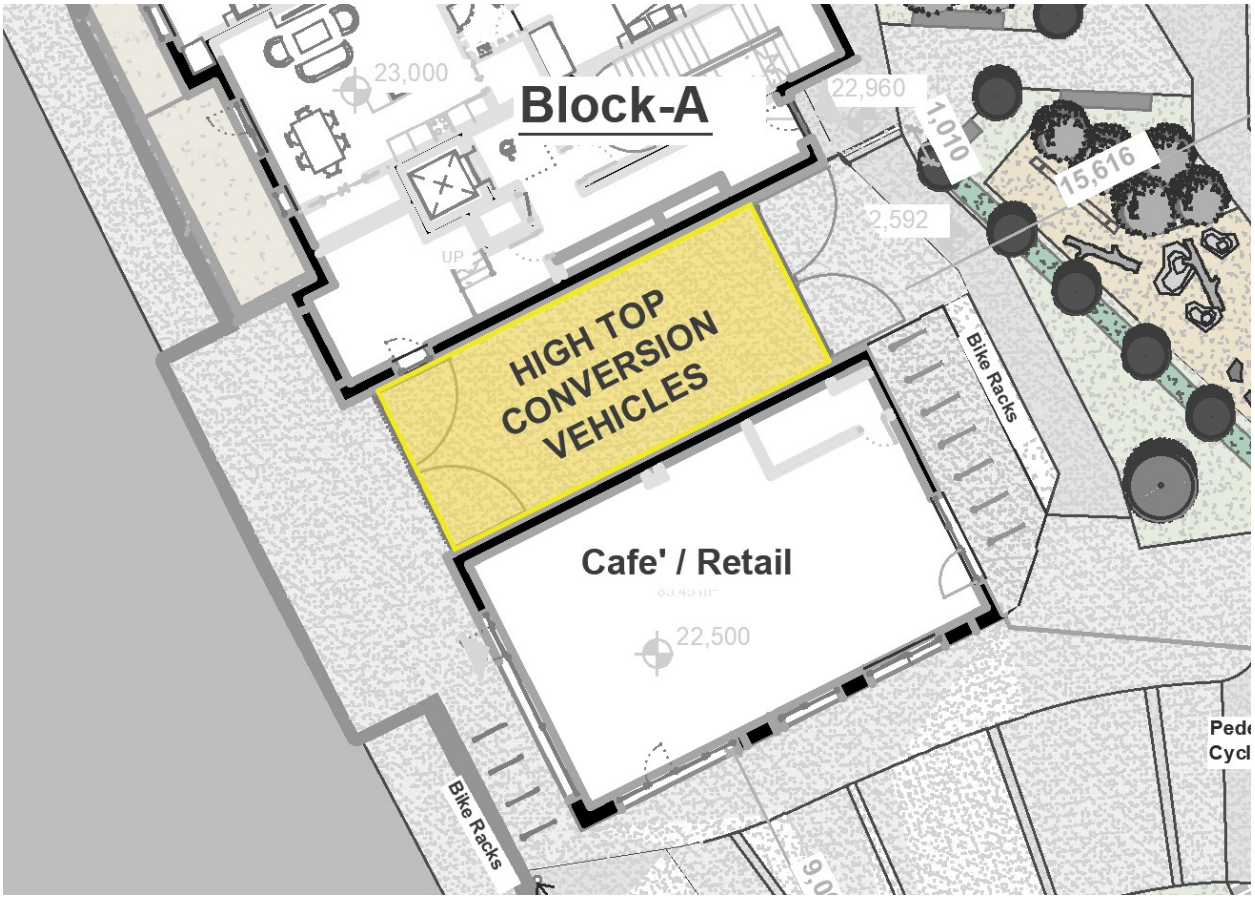


Figure 5.4: Servicing area location as set-down area for high top conversion vehicles

Signed: Alex Daly
Alex Daly

Date: 13th August 2026

For Lohan & Donnelly Civil & Structural Consulting Engineers

Enclosed:

Appendix A: Attenuation Calculations
Appendix B: Uisce Eireann COF

Appendix A:

LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

	Project:	**Development at Prussia Street Amendment**										
	Title:	**Schedule of Areas**										
	Ref:	**2572**		*QBAR Calc for 50ha*			*QBAR Calc interpolated for*		*3801*	m^2		
	By:	**KH**										
	Date:	**13/08/2026**		AREA in sq km	0.5		AREA in sq km		0.003801			
				SAAR in mm	731							
				SOIL	0.3							
Site area	3801	m^2		QBARrural	95.86134389	l/s	QBARrural		0.728737936	l/s		
Site area for attenuation	3801	m^2										
QBARrural	0.728738	l/s										
QBARmin	2	l/s										
Blue roof void former ratio	0.9											
Permeable paving sub-base voids ratio	0.3											

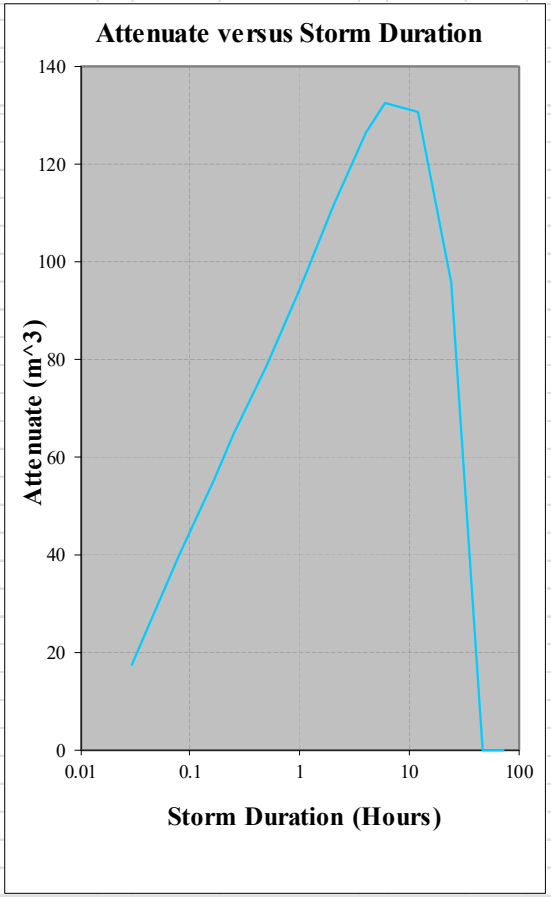
	total area	*blue/green roof area excluding upstands*	*blue/green roof percentage*	*Attenuate?*	*Site Area for Attenuation Calculation*	*Run-off Coefficient*	*blue roof discharge rate*	*Attenuation Volume*	*Attenuation Depth*	*Number of Outlets*	*Flow rate per outlet*
	sqm	sq,	%				l/s	m3	m	No.	
Roof area A1	385	327	84.93506494	Y	385	0.8	0.1	26.37024	0.089603262	2	0.05
Roof area B1	213	181	84.97652582	Y	213	0.8	0.1	11.256192	0.069098785	2	0.05
Roof area B2	217	0	0	Y	217	0.8					
Roof area C1	73	0	0	Y	73	0.8					
Roof area C3	280	250	89.28571429	Y	280	0.8	0.1	16.42752	0.073011200	2	0.05
Roof area D1	25	0	0	Y	25	0.8					
Terraces & Impermeable Zones	362	0	0	Y	362	0.8					
Trafficked permeable paving	665	0	0	Y	665	0.8					
Non-trafficked permeable paving	805	0	0	Y	805	0.8					
Landscaped/Grassed areas	565	0	0	Y	565	0.3					
Raingardens	120	0	0	Y	120	0.3					
Roof area C2	91	0	0	Y	91	0.8					
SUM	3801				3801		0.3	54.053952			
=	0.3801	Ha									

LOHAN & DONNELLY
Consulting Engineers
13 Gardiner Place, Mountjoy Square, Dublin 1. T: 01 8787770
W: www.lohan-donnelly.com E: info@lohan-donnelly.com

Project:	Prussia Street LRD Surface Water Attenuation Amendment			Job No:	2572
				Page No:	1
Date:	13/08/2026	Calc'd by:	FW	Checked by:	FM

Roof Area:	1284 m^2	Paved Area:	1832 m^2	Other:	685 m^2	Equivalent Impermeable Area:	2698.3 m^2	Attenuated Flow Rate:	2	l/s
I. Factor:	0.80	I. Factor:	0.80	I. Factor:	0.3					

Storm Duration (Hours)	Rainfall (mm)	Total Surface Water (m^3)	Allowable Discharge (m^3)	Attenuate (m^3)
0.03	6.50	17.54	0.216	17.32
0.08	15.00	40.47	0.576	39.90
0.166	20.90	56.39	1.1952	55.20
0.25	24.60	66.38	1.8	64.58
0.50	30.40	82.03	3.6	78.43
1.00	37.60	101.46	7.2	94.26
2.00	46.50	125.47	14.4	111.07
4.00	57.40	154.88	28.8	126.08
6.00	65.00	175.39	43.2	132.19
12.00	80.40	216.94	86.4	130.54
24.00	99.40	268.21	172.8	95.41
48.00	111.00	299.51	345.6	0
72.00	120.70	325.68	518.4	0



Maximum Volume of Attenuate: 132.19 m^3 Climate Change = 1.2 Required Attenuation Volume = 158.63 m^3

Appendix B:

CONFIRMATION OF FEASIBILITY

Alex Daly
Lohan & Donnelly
13 Gardiner Place
Mountjoy Square
Dublin
D01V0T8

21 August 2026

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Our Ref: CDS26006496 Pre-Connection Enquiry
25 Prussia Street, Arran Quay, Dublin 7, Dublin

Dear Applicant/Agent,

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

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 10 unit(s) at 25 Prussia Street, Arran Quay, Dublin 7, Dublin, (the **Development**).

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

• **Water Connection**	-	Feasible without infrastructure upgrade by Uisce Éireann
• **Wastewater Connection**	-	Feasible without infrastructure upgrade by Uisce Éireann The Development has to incorporate Sustainable Drainage Systems/ Attenuation in the management of storm water and to reduce surface water inflow into the receiving combined sewer. Full details of these have to be agreed with the LA Drainage Division.

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

Stiúrthóirí / Directors: Jerry Grant (Cathaoirleach / Chairperson), Niall Gleeson (POF / CEO), Douglas Millican, Michael Nolan, Patricia King, Eileen Maher, Cathy Mannion, Michael Walsh, Rena O'Sullivan and Orlagh Nevin.
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin, Ireland D01NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Uisce Éireann is a designated activity company, limited by shares.
Cláraithe in Éirinn Uimh.: 530363 / Registered in Ireland No.: 530363

UE / LH / 0P448 / 0725

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

Where can you find more information?

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

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

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

Yours sincerely,

Dermot Phelan

Dermot Phelan
Connections and Developer Services