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2023

Civil Engineering Planning Report

Civil Engineering Planning Report
Proposed Waste Processing Facility, Ballymount

Document Control Sheet

Client:	Starrus Eco Holdings Ltd
Document No:	221244-ORS-XX-XX-RP-C-13a-001

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P01	S2	KM	AK	MH	01/11/2023
P02	S2	KM	AK	MH	27/11/2023

ORS

Contents

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1. Introduction

This report outlines the Civil Engineering deliverables completed for the planning application for a proposed waste processing facility development and associated site works at Ballymount, Co. Dublin. The development will comprise of:

a) demolition of the existing processing sheds and offices;

b) relocation of the weighbridges;

c) construction of a single 4,710m^2 industrial building for all waste processing operations, complete with staff welfare facilities and a small site office;

d) sustainability features will include fire detection and extinguishing system, roof-mounted solar panels, LED lighting inside and outside, rainwater harvesting and permeable paving under the carpark.

A general outline of the proposed works is provided in Figure 1.1 below.

Figure 1.1 – Proposed Site Layout

2. Design Codes & Standards

The civil engineering works presented in this report and the accompanying drawings have been designed in accordance with the following codes of practice and standards:

- “Irish Building Regulations Technical Guidance Documents” Department of the Environment and Local Government
- “Greater Dublin Strategic Drainage Study” published under the National Development Plan
- CIRIA Report “C697 – Sustainable Drainage Systems”
- EPA - Wastewater Treatment Manuals – Treatment Systems for Small Communities, Business, Leisure Centres and Hotels
- EPA – Guidance on the Authorisation of Discharges to Groundwater (EPA, 2011)
- EPA – Groundwater Protection Responses for On-site Wastewater Systems for Single Houses
- European Communities Environmental Objectives (Surface Water) Regulations, 2009
- Irish Water Water Code of Practice
- Irish Water Wastewater Code of Practice
- Design Manual for Urban Roads and Streets

3. Site Location and Description

The site is currently an existing Materials Recovery Facility (MRF) in Ballymount with a total site area of circa 1.18ha. The site is located in Ballymount Little, to the east of M50 and to the south of Naas Road R110. Access is provided off the Ballymount Road Upper which bounds the site from the southwest. The site is bounded by existing industrial estates to the south and northwest. There is an agricultural land on which construction of a residential development is proposed, to the east of the site. The location of the site is shown in Figure 3.1 below.

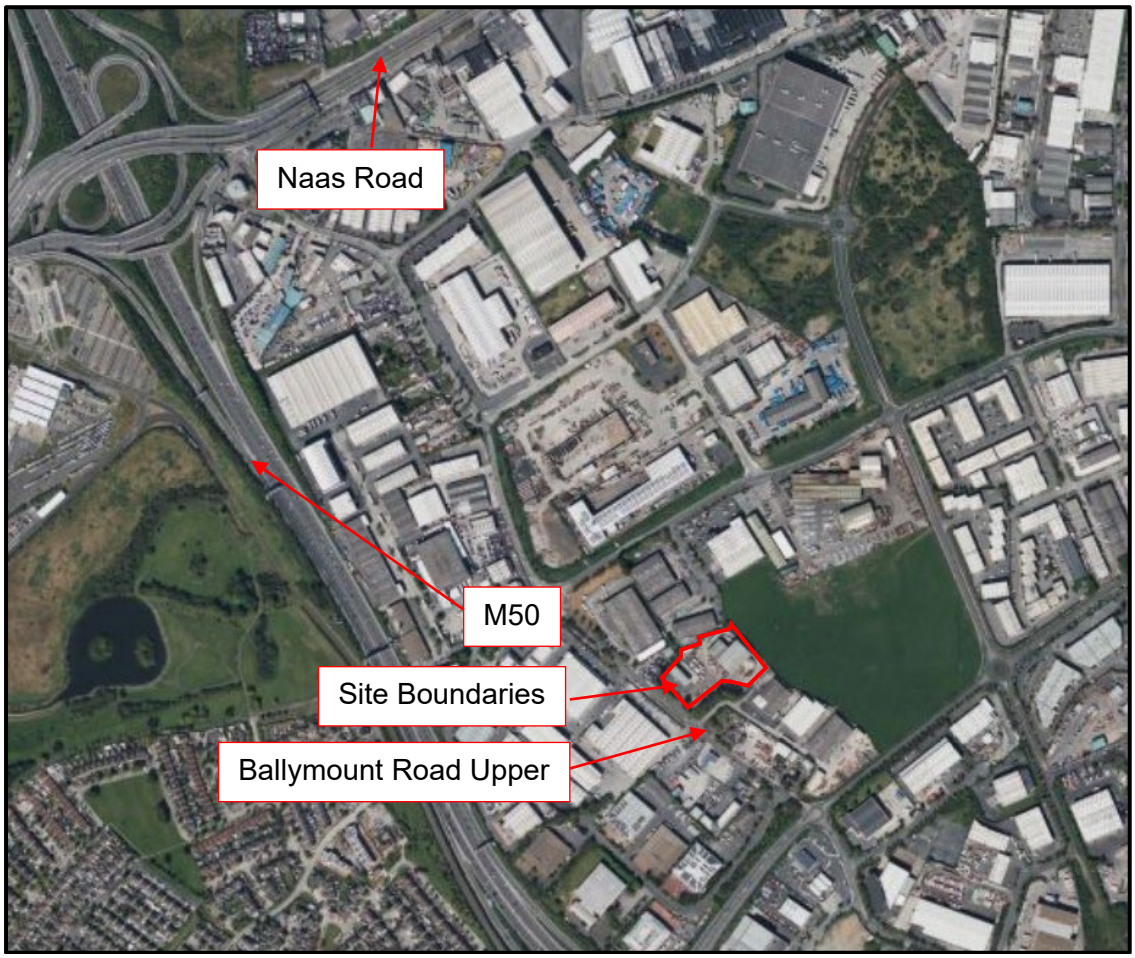

Figure 3.1 – Site Location and Extents (Source: Bing Maps)

There are two adjoining waste processing buildings in the north of the site, with an office block in the southwest. There are 2 weighbridges at the entrance, with car parking to the east and west, see Figure 3.2.

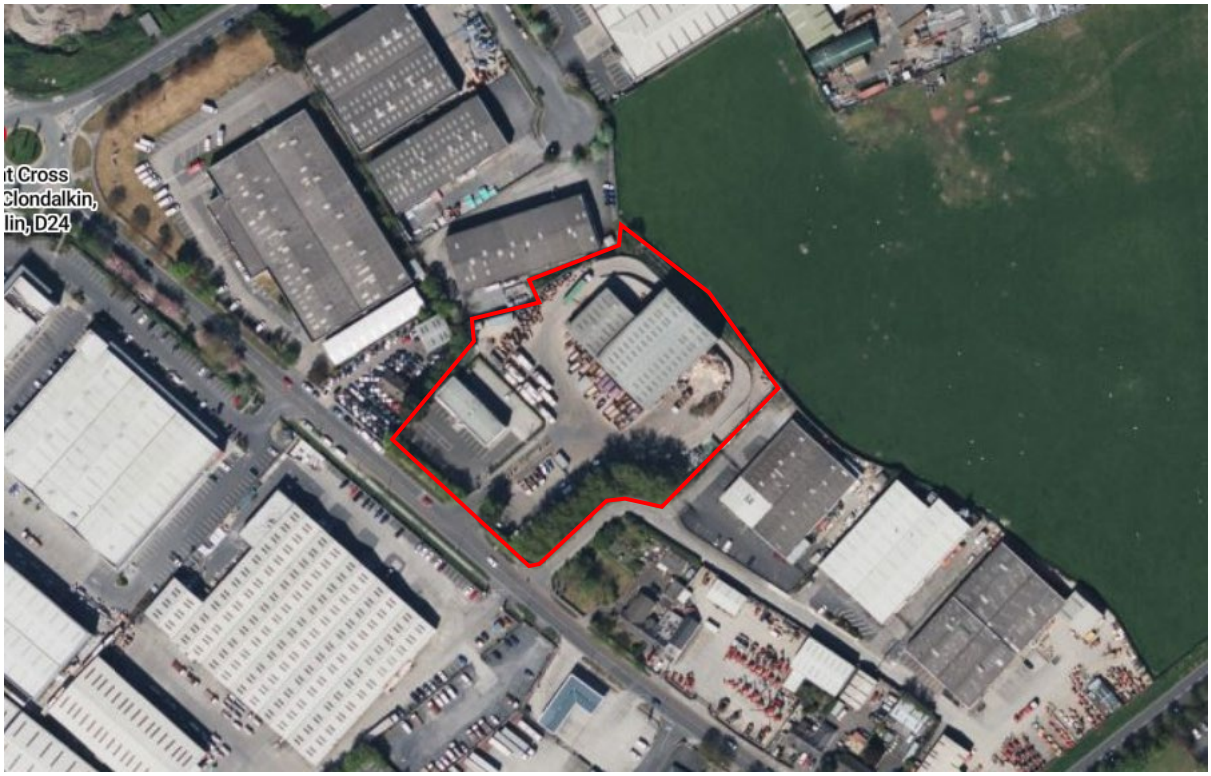

Figure 3.2 – Existing Site Layout (Source: Bing Maps)

The development will include the demolition of the existing processing sheds and offices and the expansion of waste processing operations on the site into a single building. A single 4,710m^2 industrial building will be built on the site, complete with staff welfare facilities and a small site office and weighbridge. All waste processing will be carried out inside the building which will be equipped with negative air extraction, dust and odour control units, modern fire detection and extinguishing system, 500kW of roof mounted solar panels, rainwater harvesting, and LED lighting inside and outside. It is proposed to use permeable paving under the carpark.

3.1 Site Topography

The subject site is generally flat. It slopes gradually from southeast to northwest from approximately 64.95m OD in the southeast to 63.495m OD in the northwest.

4. Water and Wastewater Services

4.1 Irish Water Correspondence

A pre-connection enquiry was lodged with Irish Water in November 2023 for both water and wastewater. The email containing the Pre-Connection Enquiry Ref Number CDS23008187 is attached in Appendix A.
A confirmation of feasibility (COF) is still to be received from Irish Water.

Existing water, wastewater and surface water infrastructure maps in the locality of the site have been sourced from the public infrastructure maps available in QGIS software and from South Dublin County Council, and are attached in **Appendix B**.

4.2 Water Supply

The proposed development will connect to the existing watermain located to the southeast on Ballymount Road Upper.

The anticipated water demand for the development has been calculated in accordance with Irish Water – Code of Practice for Water Infrastructure. Given that the proposal is for an industrial development without canteen, the water usage per person has been taken as 50 litres per day for staff, 2No. shifts per day with 10No. operatives in each. It is expected to have approx. 150 visitors (delivery drivers) a day, using 10 l/day/ person (conservative). As calculated in **Appendix C** for the industrial units.

The watermain shall have a minimum cover of 900mm and shall be overlain with tape containing a tracer wire. The watermain shall also be located a minimum of 3m away from any structure as per Irish Water Code of Practice requirements. Air valves to BS5159 and sluice valves to BS5163 where required shall be installed on site. Where a main is terminating in a cul-de-sac, it will be terminated in loops in accordance with the requirements of Irish Water Code of Practice for Water Infrastructure. The proposed watermain network incorporates sufficient fire hydrants to ensure that all buildings are within 46m of same as per BS750.

All watermain infrastructure shall be designed and constructed in accordance with Irish Water documents “Code of Practice for Water Infrastructure” and “Water Infrastructure Standard Details”.

Please refer to ORS drawing no. 221244-ORS-ZZ-00-DR-CE-401 for details of the proposed water supply infrastructure.

4.3 Wastewater Network

A COF letter is still to be received from Irish Water to ensure there is sufficient capacity to cater for this development.

The proposal for the wastewater for this development is for 1No. connection to the existing wastewater network. The wastewater from the entire development will fall by gravity and connect into an existing 225mm diameter wastewater sewer located on Ballymount Road Upper.

The anticipated wastewater volume generated from the entire development has been calculated in accordance with Irish Water – Code of Practice for Wastewater Infrastructure. The water usage per person has been taken as 50 litres per day for staff and 10 litres per day for visitors. Therefore, as calculated in **Appendix D**, the anticipated total daily flow for the development will be approximately 3.5 m^3/day. This translates to a Dry Weather Flow of 0.04l/s or Peak Dry Weather Flow (4.5DWF) of 0.18l/s.

150mm diameter pipes will be provided between access junctions falling at a grade of 1 in 100. All internal wastewater drainage will be separate to surface water drainage infrastructure in accordance with Irish Water standards. Proposed wastewater sewer loading calculations are attached in **Appendix D**.

All wastewater infrastructure shall be designed and constructed in accordance with Irish Water documents “Code of Practice for Wastewater Infrastructure” and “Wastewater Infrastructure Standard Details”.

Please refer to ORS drawing no. 221244-ORS-Z2-00-DR-C-400 for details of the proposed wastewater drainage infrastructure.

5. Surface Water Drainage

5.1 Drainage Strategy

The proposed site will be served via below ground gravity pipework which will run below the yard and below the road alongside the development. The surface water network will be fed via an ACO channel in the yard, on-road gullies, and rainwater from the building roof via guttering and downpipes.

It is proposed to collect run-off generated from impermeable areas of the site and attenuate the runoff in SuDS measures. In developing the surface water design for the site, a range of SuDS measures were reviewed. Measures which were deemed suitable in controlling the quality and quantity of water discharged from the development include:

- Rainwater harvesting;
- Collection of excess roof rainwater and run-off from impermeable surfaces and attenuating this run-off prior to discharge to outfall locations;
- The use of trapped gullies throughout the development;
- Permeable paving;
- Soakaways;
- Swale behind the building;
- The use of an oil interceptor.

The excess surface water runoff will be attenuated prior to discharging to the existing 300mm diameter surface water pipe located to the southwest of the site. It is proposed to provide attenuation within a 1450m^3 attenuation tank in the south-eastern side of the site. This tank has been sized to store both surface water and fire water, in the event of a fire.

The rainwater from the roof of the building will be collected and will fall by gravity. On the northwestern side of the building, it will discharge into the soakaway behind the building. The soakaway will allow runoff to infiltrate into the subsoil. On the southern side of the building, the rainwater from the roof will flow by gravity through the system of 225mm to 375mm pipes at a gradient 1:150 - 1:200 on the southeast and southwest of the building, and then to the 10,000l precast concrete rainwater harvesting tank located at the entrance to the site.

The discharge from the impermeable paving will be collected via the system of ACO channels in the yard area and gullies on the road.

Prior to the surface water discharging into the existing public drainage system, it will be flow-controlled to greenfield runoff rates and will pass through a full retention oil interceptor.

The following design criteria has been incorporated into the design:

- Pipes are designed for small catchment areas as defined in GDSDS, based on the Modified Rational Method and a rainfall intensity of 50mm/hour onto impermeable surfaces.
- All surface water pipes have been designed to achieve a minimum self-cleansing velocity of 0.75m/s.
- Surface water pipework will be laid to a gradient no flatter than 1:500.
- The GDSDS requirements with respect to interception volume, long-term storage

volume and treatment volume have been considered.
- Minimum surface water pipe size of 225mm
- Minimum depth of cover to pipework of 1.2m below roads without appropriate protection
- Maximum depth of pipework 5m
- Roughness value for surface water pipework, k_s 0.6mm

5.2 Rainfall & Soil Characteristics

Rainfall and soil characteristics are summarised below in table 1 for the area of the site. Soil characteristics are taken from the HR Wallingford database for the site location.

Table 1 - Rainfall & Soil Characteristics (Adopted from GDSDS)

Characteristic	**Value**
Mean Annual Rainfall SAAR mm	849
Ratio 'r'	0.28
M5-60 mm	17.5
Soil SPR Value % Runoff	0.30 (SOIL Type 1)
Max rainfall intensity depth for stormwater network design mm/hr	50

5.3 Catchment and SuDS Systems

The proposed site layout has been designed to have its own storage via permeable paving, attenuation and rainwater harvesting tanks and soakaway. Each catchment will have a gravity surface water drainage network which will outfall into a dedicated SuDS area. The permeable paving, tanks and soakaway will be sized to store the runoff from a 1:100-year storm of critical duration plus a 20% climate change allowance. From the modelling carried out of the stormwater network, a minimum storage of 410m^3 is required in the offline attenuation tank. A tank of size 1450m^3 has been provided; this tank has been sized to store surface water and also fire water in the event of a fire. In addition to this, storage is provided in the permeable paving, soakaway, rainwater harvesting tank and swale. The attenuation storage provided is greater than the attenuation required and is therefore determined to be sufficient.

Refer to **Appendix F** for the storm water network calculations for the development.

A breakdown of the different land uses across the site is included below in Table 5.1 below.

Table 5.1 – Catchment Land Uses/Area

Catchment Area (%Runoff Coefficient)	Areas (Hectares)
Yard Areas (90%)	0.347
Footpath Areas (90%)	0.064
Roof Areas (95%)	0.469
Permeable Parking Spaces (50%)	0.111
Landscaped Green Space (10%)	0.189
Catchment: Total Area	**1.180**

Refer to ORS drawing nos. 221244-ORS-ZZ-XX-DR-CE-421 for the attenuation tank and typical SuDS details.

Summary of SUDS measures reviewed and incorporated is included in Appendix G.

5.4 Flow Controls

The surface water collected within the site will flow into the SuDs measures and where possible will infiltrate into the subsoil or discharge to the proposed 225mm surface water network. The final manhole before the discharge shall include a flow control device to limit flows to greenfield run-off rates.

5.4 Oil Interceptors

A full retention oil Interceptor will be installed prior to discharge into the existing surface water system on Ballymount Road Upper. All surface water shall be drained from impermeable areas through precast lockable gully traps.

Please refer to ORS drawing nos. 221244-ORS-ZZ-00-DR-CE-400, 221244-ORS-ZZ-00-DR-CE-401, 221244-ORS-ZZ-00-DR-CE-420 and 221244-ORS-ZZ-00-DR-CE-421 for details of the proposed surface water drainage for the development.

6. Flood Risk Identification

The Floodinfo.ie website was consulted for high level information on any potential flood risk on the site. The site is not in an area of defined flood risk under the OPW mapping and there is no indication of any likely past or future flood incidences in the vicinity of the site. Refer to figure 6.1 below.

The development will present no significant increase in risk of flooding either within the site or downstream of the site. Surface water runoff will be limited to greenfield runoff rates via flow control measures.

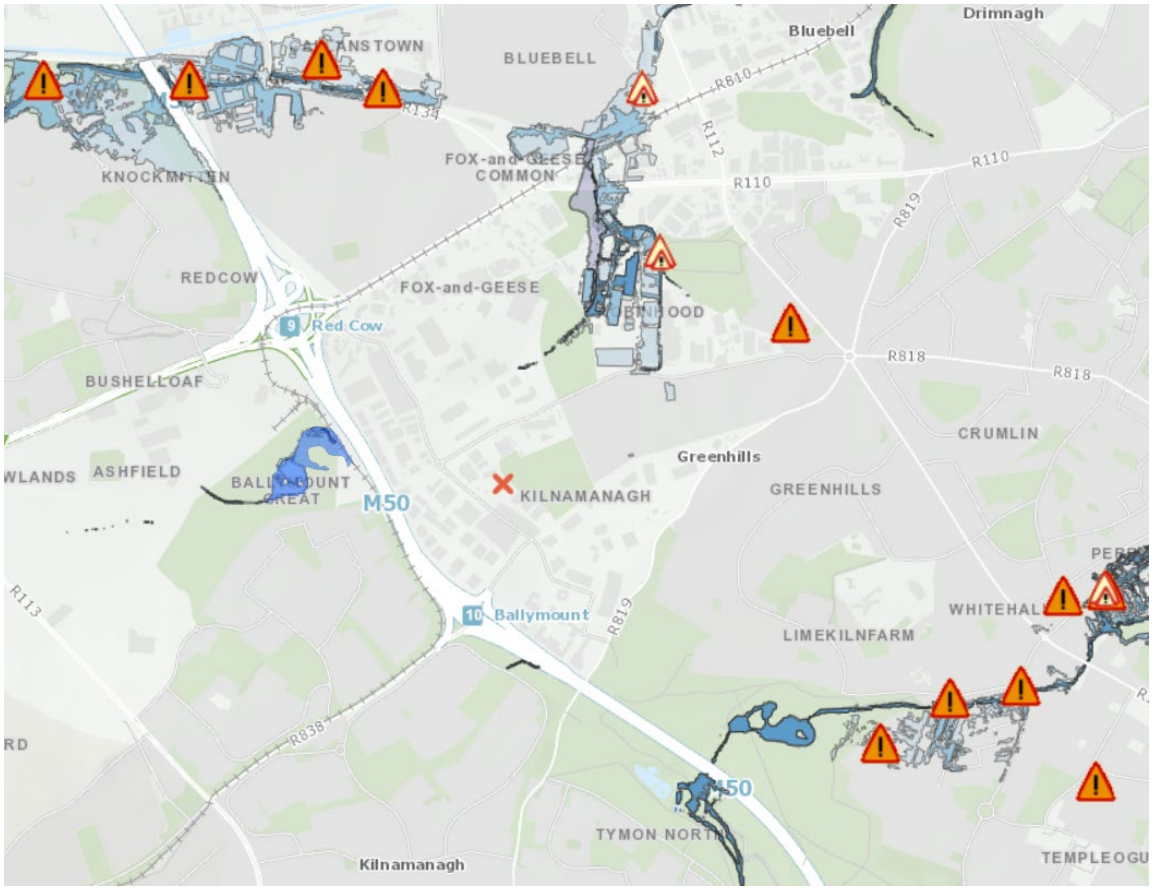

Figure 6.1 – Floodinfo Map – approximate site location marked with red X.

7. Site Access and Traffic

Guidance has been taken from DMURS for the engineering design of streets and footpaths in the development, the following criteria are addressed as follows.

Sightlines of 49m will be achieved at the site entrance in accordance with DMURS given the 50kph speed limit and use of the road by public buses.

Internal road markings are proposed to be limited to the approach to internal junctions and STOP lines. A STOP sign will be provided at each internal junction where a STOP line is proposed.

Appropriate dropped kerbs and linemarking will be used at the site entrance to allow for pedestrian desire lines across the entrance. Proposed internal pedestrian pathways will be linked via dropped kerbs and tactile paving. A number of raised uncontrolled, pedestrian crossings are proposed throughout the site also.

All turning areas have been checked by swept path analysis (Autotrack) to ensure sufficient space to allow for emergency vehicles.

Please refer to ORS drawing no. 221244-ORS-ZZ-00-DR-TR-730 for Autotracks of a fire tender and private car.

8. Health and Safety

ORS understand their health and safety responsibilities as set out in the Health and Safety at Work (Construction) Regulations 2013.

ORS

Appendix A – Pre-connection Enquiry Email from Irish Water

From: newconnections
To: Karine Mamikonjana
Subject: CDS23008187 Uisce Éireann Pre-Connection Enquiry EMAIL:0624392
Date: 02 November 2023 16:33:36
Attachments: image.png
image.png

Uisce Éireann Pre Connection Enquiry Ref Number: CDS23008187

Dear Customer,

Thank you for submitting your Pre-connection Enquiry Form for Panda Waste Management, Ballymount Industrial Estate, Ballymount, Dublin . Your Uisce Éireann reference number for your application is CDS23008187, which you can keep for your records.

Next steps in your enquiry:

Assessment of Enquiry: Your enquiry is currently being assessed to confirm it is

technically feasible; we will be in touch once this assessment has been completed. A significant level of analysis is required before we can provide a response. Two of a number of considerations are:

- A review of the available capacity in Uisce Éireann infrastructure versus your requirements.
- The location for connection versus the distance to/from our network.

Where your requirements are of a significant nature for example, multiple properties or commercial/industrial developments, this work may take a period of time to complete.

Getting a Confirmation of Feasibility: If your application is technically feasible, we will issue you with a letter of "Confirmation of Feasibility". This will outline what capital works if any, may be required to upgrade the public infrastructure to cater for your development.
From receipt of your Pre-connection Enquiry, it takes on average 16 weeks to issue a Confirmation of Feasibility.

Design Layout Approval: Where you are proposing to apply for a housing development (two or more properties), a **Statement of Design Acceptance** to your proposal will be required from Uisce Éireann before applying for Planning Permission. Please therefore submit your designs for assessment to Uisce Éireann to ensure they comply with our requirements, in advance of applying for Planning Permission.

Connection Application: Your Confirmation of Feasibility; which is a specific requirement to apply for Planning Permission through the Strategic Housing Development process, will assist you in obtaining your Planning Permission following which you may apply for your connection immediately.

If you have any further queries please contact us on **1800 278 278** or **+353 1 707 2828;** alternatively, you can visit www.water.ie/connections for more information. **Please note that the rates charged for 1850 numbers may vary across different service providers. Calls from mobiles may be more expensive.**

Please do not amend this subject line as it will help us deal with your response.

Yours sincerely,

Customer Service Advisor

Callsave 1800 278 278 | +353 1 707 2828
www.water.ie/connections

Is don duine amháin nó don eintiteas amháin ainmnithe ar an seoladh an fhaisnéis agus d'fhéadfadh ábhar faoi rún, faoi phribhléid nó ábhar atá íogair ó thaobh na tráchtála de a bheith mar chuid den fhaisnéis. Tá toirmeasc ar aon daoine nó aon eititis; nach dóibh siúd an fhaisnéis- aon athbhreithniú a dhéanamh, aon atarchur a dhéanamh nó aon athdháileadh a dhéanamh, nó aon úsáid eile a bhaint as an bhfaisnéis, nó aon ghníomh a bhraithfeadh ar an bhfaisnéis seo a dhéanamh agus d'fhéadfaí an dlí a shárú dá ndéanfaí sin. Séanann Uisce Éireann dliteanas as aon ghníomh agus as aon iarmhairt bunaithe ar úsáid neamhúdaraithe na faisnéise seo. Séanann Uisce Éireann dliteanas maidir le seachadadh iomlán agus ceart na faisnéise sa chumarsáid seo agus séanann Uisce Éireann dliteanas maidir le haon mhoill a bhaineann leis an bhfaisnéis a fháil. Má tá an ríomh-phost seo faighte agat trí dhearmad, déan teagmháil leis an seoltóir más é do thoil é agus scrios an t-ábhar ó gach aon ríomhaire. D'fhéadfadh ríomhphost a bheith so-ghabhálach i leith truaillithe, idircheaptha agus i leith leasuithe neamhúdaraithe. Séanann Uisce Éireann aon fhreagracht as athruithe nó as idircheapadh a rinneadh ar an ríomhphost seo nó as aon dochar do chórais na bhfaighteoirí déanta ag an teachtaireacht seo nó ag a ceangaltáin tar éis a sheolta. Tabhair faoi deara go bhféadfadh monatóireacht a bheith á dhéanamh ar theachtaireachtaí chuig Uisce Éireann agus ó Uisce Éireann d'fhonn ár ngnó a chosaint agus chun a chinntiú go bhfuiltear ag teacht le beartais agus le caighdeáin Uisce Éireann. Is cuideachta gníomhaíochta ainmnithe é Uisce Éireann atá faoi theorainn scaireanna, a bunaíodh de bhun fhorálacha na n-Achtanna um Sheirbhísí Uisce 2007-2022, a bhfuil a bpríomh-ionad gnó ag Teach Colvill, 24-26 Sráid na Talbóide, BÁC 1.

Go raibh maith agat as d'aird a thabhairt.

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Thank you for your attention.

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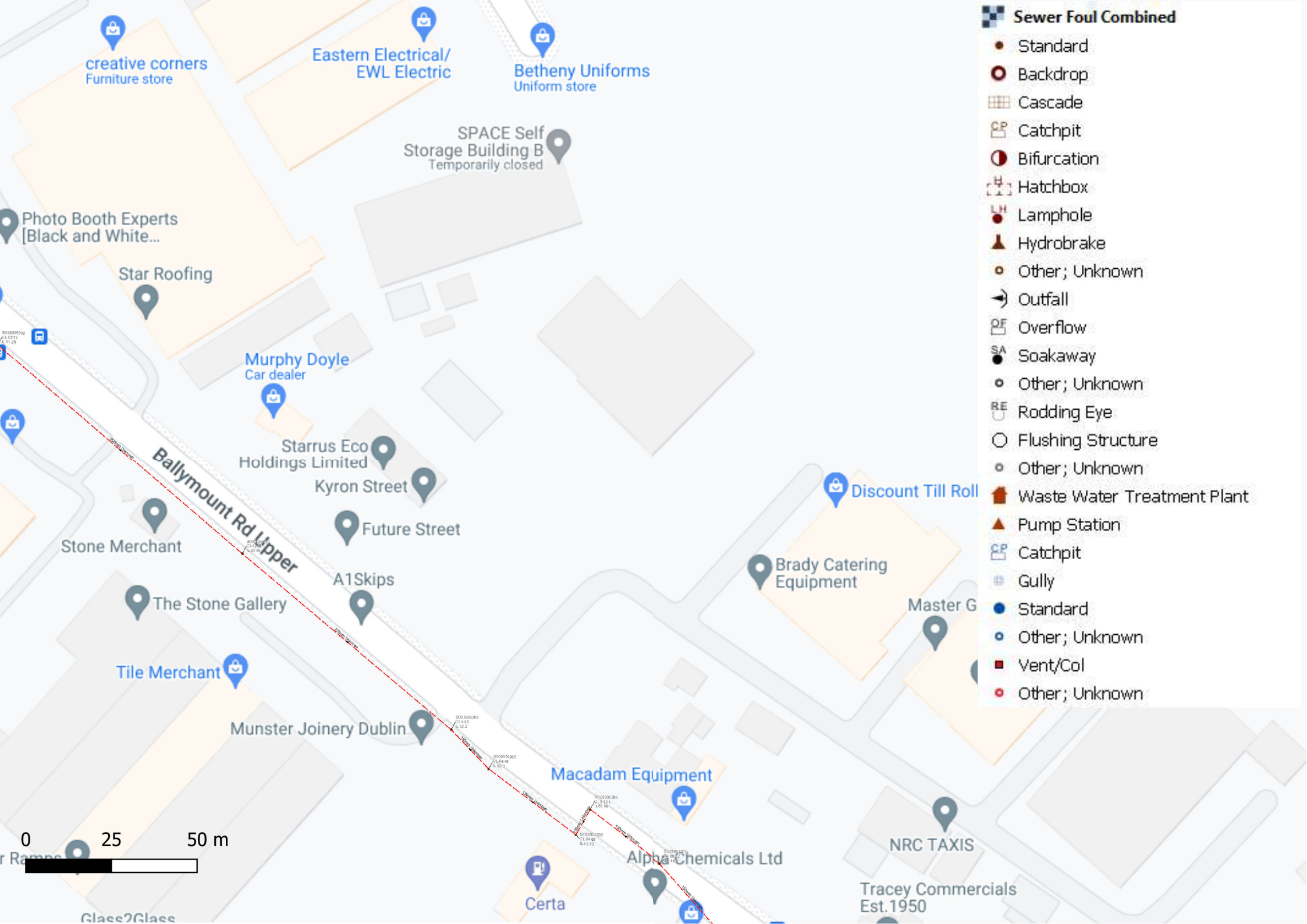
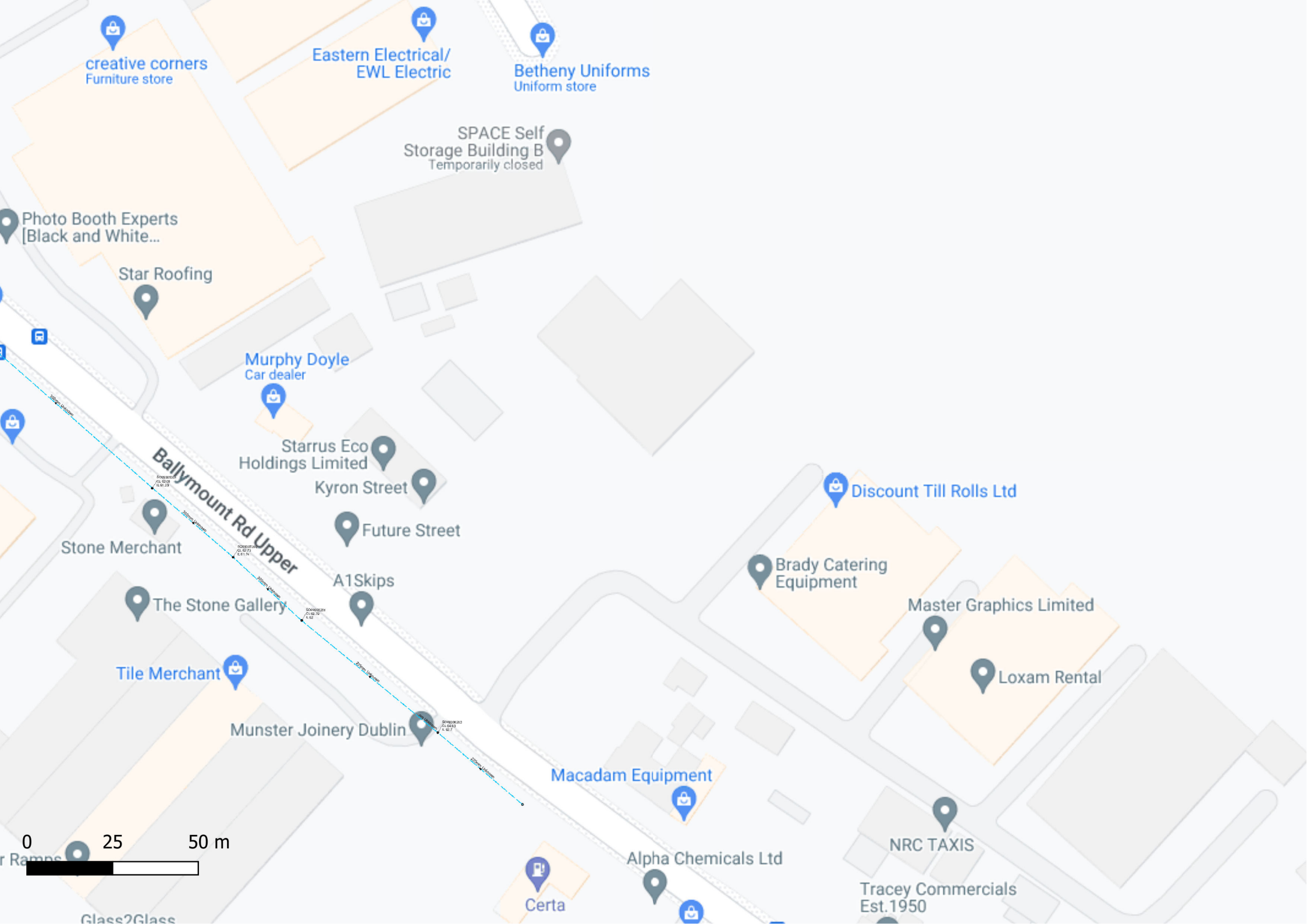
Appendix B – Existing Services Infrastructure Maps


creative corners
Furniture store
Eastern Electrical/
EWL Electric
Betheny Uniforms
Uniform store
SPACE Self
Storage Building B
Temporarily closed
Photo Booth Experts
[Black and White...
Star Roofing
Murphy Doyle
Car dealer
Starrus Eco
Holdings Limited
Kyron Street
Future Street
Ballymount Rd Upper
Stone Merchant
A1Skips
The Stone Gallery
Tile Merchant
Munster Joinery Dublin
Discount Till Roll
Brady Catering
Equipment
Master G
Macadam Equipment
NRC TAXIS
Alpha Chemicals Ltd
Certa
Tracey Commercials
Est.1950
Glass2Glass
0
25
50 m
Sewer Foul Combined
Standard
Backdrop
Cascade
Catchpit
Bifurcation
Hatchbox
Lamphole
Hydrobrake
Other; Unknown
Outfall
Overflow
Soakaway
Other; Unknown
Rodding Eye
Flushing Structure
Other; Unknown
Waste Water Treatment Plant
Pump Station
Catchpit
Gully
Standard
Other; Unknown
Vent/Col
Other; Unknown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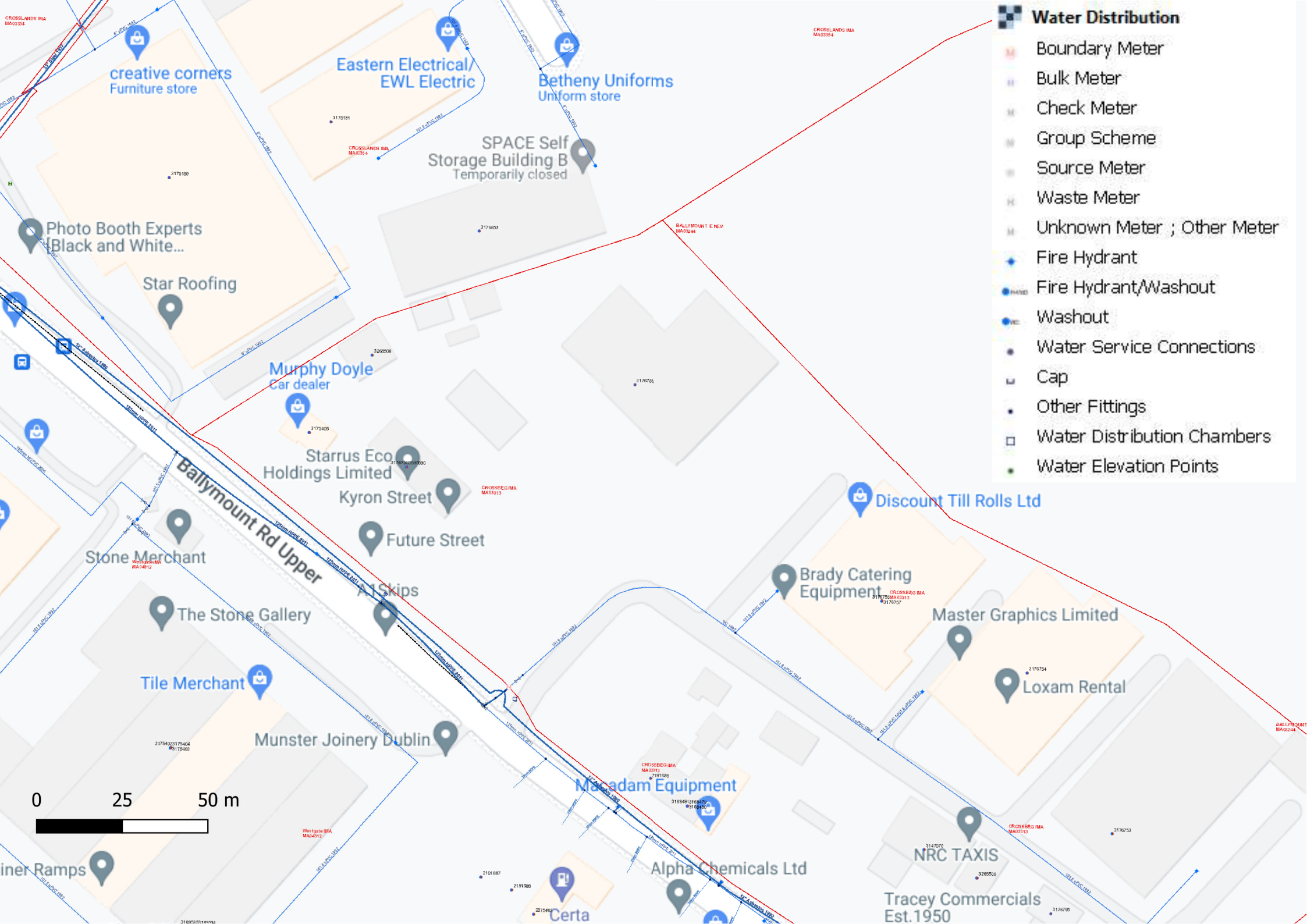
Water Distribution
Boundary Meter
Bulk Meter
Check Meter
Group Scheme
Source Meter
Waste Meter
Unknown Meter ; Other Meter
Fire Hydrant
Fire Hydrant/Washout
Washout
Water Service Connections
Cap
Other Fittings
Water Distribution Chambers
Water Elevation Points
creative corners
Furniture store
Eastern Electrical/
EWL Electric
Betheny Uniforms
Uniform store
SPACE Self
Storage Building B
Temporarily closed
Photo Booth Experts
Black and White...
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Loxam Rental
Macadam Equipment
NRC TAXIS
Alpha Chemicals Ltd
Certa
Tracey Commercials
Est.1950
0
25
50 m

Irish Water Web Map

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

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

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

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

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

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

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

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

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

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

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

Inlet Type
- Gully
- Standard
- Other; Unknown

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

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

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

ESB Networks

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

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

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

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

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

UISCE ÉIREANN : IRISH WATER

Print Date: 17/10/2023

Printed by:Irish Water

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Appendix C – Water Demand Calculation

PROPOSED WATER DEMAND CALCULATIONS

ORS Ref: **221244**

CLIENT: **Starrus Eco Holdings Ltd**
PROJECT DESCRIPTION: **Proposed Waste Processing Facility, Ballymount**
DRAWING REFERENCE: 221244-ORS-Z0-00-DR-C-400

Unit Type:	*Number of shifts:*	*Flow (l/day/person):*	*Persons per development:*	*Total Flow (l/day)*
Industrial without canteen	2	50	20	2000
Delivery drivers*	1	10	150	1500

	Total Flow (l/day):	3500	*Total Flow (m^3/day):*	3.5

Average Hour Water Demand	**0.04**	*l/s*
Peak Hour Water Demand (Average Hour Water Demand x 5)	**0.20**	*l/s*

295 HTV 50%

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Appendix D – Wastewater Demand Calculation

PROPOSED FOUL SEWER DESIGN CALCULATIONS

ORS Ref: **221244**

CLIENT: Starrus Eco Holdings Ltd
PROJECT DESCRIPTION: Proposed Waste Processing Facility, Ballymount
DRAWING REFERENCE: 221244-ORS-Z0-00-DR-C-400

Unit Type:	*Number of shifts:*	*Flow (l/day/person):*	*BOD (g/day/person)*	*Persons*	*Total Flow (l/day)*	*BOD (g/day/person)*	*P.E.*
Industrial without canteen	2	50		20	2000		
Delivery drivers*	1	10		150	1500		
			Total		3500		

Total Flow per day	**3500.00**	*litres/day*
Dry Weather Flow (DWF)	**0.04**	*litres/second*
Peak Dry Weather Flow	**0.18**	*l/s @ 4.5 x DWF*

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Appendix E – Rainfall Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 309646, Northing: 230319,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.4,	3.6,	4.3,	5.3,	6.0,	6.5,	8.4,	10.5,	12.0,	14.1,	16.0,	17.5,	19.9,	21.7,	23.3,	N/A ,
10 mins	3.4,	5.0,	5.9,	7.3,	8.3,	9.1,	11.7,	14.7,	16.7,	19.7,	22.3,	24.4,	27.7,	30.3,	32.4,	N/A ,
15 mins	4.0,	5.9,	7.0,	8.6,	9.8,	10.7,	13.7,	17.3,	19.7,	23.1,	26.3,	28.7,	32.6,	35.6,	38.2,	N/A ,
30 mins	5.2,	7.7,	9.0,	11.1,	12.5,	13.7,	17.4,	21.7,	24.7,	28.8,	32.6,	35.5,	40.2,	43.8,	46.8,	N/A ,
1 hours	6.9,	10.0,	11.7,	14.3,	16.1,	17.5,	22.1,	27.4,	30.9,	35.9,	40.5,	44.0,	49.5,	53.8,	57.4,	N/A ,
2 hours	9.1,	13.1,	15.2,	18.4,	20.6,	22.3,	28.0,	34.4,	38.7,	44.8,	50.2,	54.5,	61.0,	66.1,	70.3,	N/A ,
3 hours	10.8,	15.3,	17.7,	21.4,	23.9,	25.8,	32.2,	39.4,	44.2,	51.0,	57.0,	61.7,	68.9,	74.6,	79.3,	N/A ,
4 hours	12.1,	17.0,	19.7,	23.7,	26.4,	28.6,	35.5,	43.3,	48.5,	55.8,	62.3,	67.4,	75.2,	81.2,	86.3,	N/A ,
6 hours	14.2,	19.9,	22.9,	27.5,	30.6,	33.0,	40.8,	49.6,	55.4,	63.5,	70.7,	76.3,	85.0,	91.6,	97.2,	N/A ,
9 hours	16.7,	23.2,	26.7,	31.9,	35.4,	38.1,	46.9,	56.7,	63.2,	72.3,	80.3,	86.5,	96.0,	103.4,	109.5,	N/A ,
12 hours	18.8,	26.0,	29.8,	35.4,	39.2,	42.2,	51.7,	62.4,	69.4,	79.2,	87.8,	94.5,	104.7,	112.6,	119.2,	N/A ,
18 hours	22.1,	30.3,	34.6,	41.1,	45.4,	48.7,	59.4,	71.4,	79.2,	90.1,	99.7,	107.0,	118.3,	127.1,	134.2,	N/A ,
24 hours	24.8,	33.8,	38.6,	45.6,	50.3,	53.9,	65.6,	78.5,	87.0,	98.7,	109.0,	116.9,	129.1,	138.4,	146.1,	172.8,
2 days	31.0,	41.3,	46.6,	54.3,	59.5,	63.4,	76.0,	89.7,	98.5,	110.7,	121.4,	129.5,	141.8,	151.3,	159.0,	185.6,
3 days	36.0,	47.2,	53.0,	61.4,	66.9,	71.1,	84.4,	98.8,	108.1,	120.7,	131.7,	140.1,	152.8,	162.4,	170.3,	197.3,
4 days	40.3,	52.4,	58.6,	67.5,	73.3,	77.7,	91.7,	106.8,	116.4,	129.5,	140.8,	149.4,	162.4,	172.3,	180.3,	207.8,
6 days	48.0,	61.5,	68.3,	78.1,	84.4,	89.2,	104.3,	120.5,	130.7,	144.6,	156.6,	165.6,	179.2,	189.5,	197.9,	226.3,
8 days	54.7,	69.4,	76.8,	87.3,	94.1,	99.3,	115.3,	132.4,	143.2,	157.8,	170.3,	179.7,	193.9,	204.5,	213.2,	242.4,
10 days	60.9,	76.7,	84.5,	95.7,	102.9,	108.3,	125.3,	143.2,	154.5,	169.7,	182.7,	192.4,	207.0,	218.0,	227.0,	257.0,
12 days	66.7,	83.4,	91.7,	103.5,	111.1,	116.8,	134.5,	153.1,	164.8,	180.6,	194.0,	204.1,	219.2,	230.5,	239.6,	270.5,
16 days	77.4,	95.8,	104.9,	117.7,	126.0,	132.1,	151.2,	171.2,	183.7,	200.4,	214.6,	225.3,	241.1,	253.0,	262.6,	294.8,
20 days	87.3,	107.3,	117.0,	130.8,	139.6,	146.2,	166.4,	187.6,	200.8,	218.4,	233.3,	244.4,	261.0,	273.4,	283.4,	316.7,
25 days	98.8,	120.5,	131.1,	145.9,	155.3,	162.4,	184.0,	206.5,	220.4,	238.9,	254.6,	266.3,	283.6,	296.6,	307.0,	341.8,

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

ORS

Appendix F – Storm Water Network Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.500	Minimum Backdrop Height (m)	0.200
Ratio-R	0.280	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1.01	0.113	5.00	64.500	1200	709646.445	730387.151	1.000
S1.02			64.500	1200	709598.686	730346.290	1.419
S1.03	0.136	5.00	64.500	1200	709608.314	730334.916	1.504
S1.04			64.300	1350	709570.041	730302.525	1.591
S1.05			64.350	1350	709535.229	730344.181	1.912
S2.01	0.210	5.00	64.500	1200	709660.505	730372.892	1.850
S2.02	0.142	5.00	64.500	1350	709620.302	730338.879	2.042
S2.03	0.051	5.00	64.300	1350	709570.783	730296.984	2.058
S1.06	0.029	5.00	64.350	1350	709526.141	730332.248	2.298
S1.07			64.350	1350	709523.110	730328.411	2.314
S1.08			63.700	1350	709508.486	730309.898	1.751
S3.01		5.00	64.500	1350	709629.585	730330.464	2.000

Links

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)
S1.07	S1.07	S1.08	23.592	0.600	62.036	61.949	0.087	271.2	375	8.36	50.0
S1.06	S1.06	S1.07	4.890	0.600	62.052	62.036	0.016	305.6	375	8.00	50.0
S1.05	S1.05	S1.06	15.000	0.600	62.438	62.280	0.158	94.9	375	7.74	50.0
S2.03	S2.03	S1.06	56.890	0.600	62.242	62.052	0.190	299.4	375	7.92	50.0
S2.02	S2.02	S2.03	64.864	0.600	62.458	62.242	0.216	300.3	375	7.01	50.0
S3.01	S3.01	S2.02	12.529	0.600	62.500	62.458	0.042	298.3	375	5.20	50.0
S2.01	S2.01	S2.02	52.661	0.600	62.650	62.474	0.176	299.2	300	5.97	50.0
S1.04	S1.04	S1.05	54.287	0.600	62.709	62.438	0.271	200.3	375	7.61	50.0
S1.03	S1.03	S1.04	50.140	0.600	62.996	62.709	0.287	174.7	300	6.90	50.0
S1.02	S1.02	S1.03	14.902	0.600	63.081	62.996	0.085	175.3	300	6.19	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1.07	1.095	121.0	101.3	1.939	1.376	0.680	0.0	264	1.221
S1.06	1.031	113.9	101.3	1.923	1.939	0.680	0.0	276	1.159
S1.05	1.860	205.4	37.0	1.537	1.695	0.248	0.0	107	1.423
S2.03	1.042	115.0	60.0	1.683	1.923	0.403	0.0	192	1.052
S2.02	1.040	114.9	52.5	1.667	1.683	0.352	0.0	178	1.017
S3.01	1.044	115.3	0.0	1.625	1.667	0.000	0.0	0	0.000
S2.01	0.904	63.9	31.3	1.550	1.726	0.210	0.0	148	0.898
S1.04	1.276	141.0	37.0	1.216	1.537	0.248	0.0	131	1.082
S1.03	1.186	83.8	37.0	1.204	1.291	0.248	0.0	140	1.151
S1.02	1.184	83.7	16.8	1.119	1.204	0.113	0.0	91	0.930

Links

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)
S1.01	S1.01	S1.02	62.853	0.600	63.500	63.081	0.419	150.0	225	5.98	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1.01	1.065	42.3	16.8	0.775	1.194	0.113	0.0	98	1.003

Pipeline Schedule

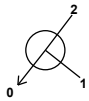
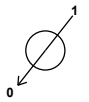
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.07	23.592	271.2	375	Circular	64.350	62.036	1.939	63.700	61.949	1.376
S1.06	4.890	305.6	375	Circular	64.350	62.052	1.923	64.350	62.036	1.939
S1.05	15.000	94.9	375	Circular	64.350	62.438	1.537	64.350	62.280	1.695
S2.03	56.890	299.4	375	Circular	64.300	62.242	1.683	64.350	62.052	1.923
S2.02	64.864	300.3	375	Circular	64.500	62.458	1.667	64.300	62.242	1.683
S3.01	12.529	298.3	375	Circular	64.500	62.500	1.625	64.500	62.458	1.667
S2.01	52.661	299.2	300	Circular	64.500	62.650	1.550	64.500	62.474	1.726
S1.04	54.287	200.3	375	Circular	64.300	62.709	1.216	64.350	62.438	1.537
S1.03	50.140	174.7	300	Circular	64.500	62.996	1.204	64.300	62.709	1.291
S1.02	14.902	175.3	300	Circular	64.500	63.081	1.119	64.500	62.996	1.204
S1.01	62.853	150.0	225	Circular	64.500	63.500	0.775	64.500	63.081	1.194

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.07	S1.07	1350	Manhole	Adoptable	S1.08	1350	Manhole	Adoptable
S1.06	S1.06	1350	Manhole	Adoptable	S1.07	1350	Manhole	Adoptable
S1.05	S1.05	1350	Manhole	Adoptable	S1.06	1350	Manhole	Adoptable
S2.03	S2.03	1350	Manhole	Adoptable	S1.06	1350	Manhole	Adoptable
S2.02	S2.02	1350	Manhole	Adoptable	S2.03	1350	Manhole	Adoptable
S3.01	S3.01	1350	Manhole	Adoptable	S2.02	1350	Manhole	Adoptable
S2.01	S2.01	1200	Manhole	Adoptable	S2.02	1350	Manhole	Adoptable
S1.04	S1.04	1350	Manhole	Adoptable	S1.05	1350	Manhole	Adoptable
S1.03	S1.03	1200	Manhole	Adoptable	S1.04	1350	Manhole	Adoptable
S1.02	S1.02	1200	Manhole	Adoptable	S1.03	1200	Manhole	Adoptable
S1.01	S1.01	1200	Manhole	Adoptable	S1.02	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1.01	709646.445	730387.151	64.500	1.000	1200	 0	S1.01	63.500	225
S1.02	709598.686	730346.290	64.500	1.419	1200	1  0	S1.01 S1.02	63.081 63.081	225 300
S1.03	709608.314	730334.916	64.500	1.504	1200	1  0	S1.02 S1.03	62.996 62.996	300 300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1.04	709570.041	730302.525	64.300	1.591	1350	 1	S1.03	62.709	300
						0	S1.04	62.709	375
S1.05	709535.229	730344.181	64.350	1.912	1350	1	S1.04	62.438	375
						 0	S1.05	62.438	375
S2.01	709660.505	730372.892	64.500	1.850	1200	 0	S2.01	62.650	300
S2.02	709620.302	730338.879	64.500	2.042	1350	1	S3.01	62.458	375
						 2	S2.01	62.474	300
						0	S2.02	62.458	375
S2.03	709570.783	730296.984	64.300	2.058	1350	 1	S2.02	62.242	375
						0	S2.03	62.242	375
S1.06	709526.141	730332.248	64.350	2.298	1350	1	S2.03	62.052	375
						 2	S1.05	62.280	375
						0	S1.06	62.052	375
S1.07	709523.110	730328.411	64.350	2.314	1350	 1	S1.06	62.036	375
						0	S1.07	62.036	375
S1.08	709508.486	730309.898	63.700	1.751	1350	 1	S1.07	61.949	375
S3.01	709629.585	730330.464	64.500	2.000	1350	 0	S3.01	62.500	375

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	17.500	Additional Storage (m³/ha)	20.0
Ratio-R	0.280	Check Discharge Rate(s)	✓
Summer CV	0.750	100 year (l/s)	4.5
Winter CV	0.840	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	240	360	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	2
Greenfield Method	IH124	Growth Factor 100 year	2.63
Positively Drained Area (ha)	0.750	Betterment (%)	0
SAAR (mm)	849	QBar	1.7
Soil Index	1	Q 100 year (l/s)	4.5
SPR	0.30		

Node S1.07 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	62.036	Product Number	CTL-SHE-0061-2000-1500-2000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S3.01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	62.550
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	350.0	0.0	1.200	350.0	0.0	1.201	0.0	0.0

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.500	Minimum Backdrop Height (m)	0.200
Ratio-R	0.280	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.182	64.500	709563.029	730390.835	2.500

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	17.500	Additional Storage (m³/ha)	20.0
Ratio-R	0.280	Check Discharge Rate(s)	✓
Summer CV	0.750	100 year (l/s)	4.5
Winter CV	0.840	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	240	360	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	20	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	2
Greenfield Method	IH124	Growth Factor 100 year	2.63
Positively Drained Area (ha)	0.750	Betterment (%)	0
SAAR (mm)	849	QBar	1.7
Soil Index	1	Q 100 year (l/s)	4.5
SPR	0.30		

Node Depth/Area 1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	62.000	Depth (m)	1.500
Side Inf Coefficient (m/hr)	0.18000	Time to half empty (mins)	1188	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	5.000	Number Required	1
Porosity	0.95	Pit Length (m)	15.000		

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m^3)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	114.002	32.259	30 year 240 minute winter	26.341	10.478
2 year 15 minute winter	80.001	32.259	30 year 360 minute summer	30.839	7.936
2 year 30 minute summer	77.960	22.060	30 year 360 minute winter	20.046	7.936
2 year 30 minute winter	54.709	22.060	30 year 720 minute summer	18.349	4.918
2 year 60 minute summer	55.294	14.612	30 year 720 minute winter	12.331	4.918
2 year 60 minute winter	36.736	14.612	30 year 1440 minute summer	11.347	3.041
2 year 120 minute summer	35.783	9.456	30 year 1440 minute winter	7.626	3.041
2 year 120 minute winter	23.773	9.456	30 year 2880 minute summer	7.001	1.876
2 year 240 minute summer	22.982	6.073	30 year 2880 minute winter	4.705	1.876
2 year 240 minute winter	15.268	6.073	100 year +20% CC 15 minute summer	327.534	92.681
2 year 360 minute summer	18.194	4.682	100 year +20% CC 15 minute winter	229.849	92.681
2 year 360 minute winter	11.826	4.682	100 year +20% CC 30 minute summer	225.151	63.710
2 year 720 minute summer	11.156	2.990	100 year +20% CC 30 minute winter	158.001	63.710
2 year 720 minute winter	7.497	2.990	100 year +20% CC 60 minute summer	155.463	41.084
2 year 1440 minute summer	7.116	1.907	100 year +20% CC 60 minute winter	103.286	41.084
2 year 1440 minute winter	4.782	1.907	100 year +20% CC 120 minute summer	97.758	25.835
2 year 2880 minute summer	4.514	1.210	100 year +20% CC 120 minute winter	64.948	25.835
2 year 2880 minute winter	3.034	1.210	100 year +20% CC 240 minute summer	60.509	15.991
30 year 15 minute summer	210.125	59.458	100 year +20% CC 240 minute winter	40.201	15.991
30 year 15 minute winter	147.456	59.458	100 year +20% CC 360 minute summer	46.738	12.027
30 year 30 minute summer	143.699	40.662	100 year +20% CC 360 minute winter	30.381	12.027
30 year 30 minute winter	100.841	40.662	100 year +20% CC 720 minute summer	27.459	7.359
30 year 60 minute summer	99.871	26.393	100 year +20% CC 720 minute winter	18.454	7.359
30 year 60 minute winter	66.352	26.393	100 year +20% CC 1440 minute summer	16.765	4.493
30 year 120 minute summer	63.357	16.744	100 year +20% CC 1440 minute winter	11.267	4.493
30 year 120 minute winter	42.093	16.744	100 year +20% CC 2880 minute summer	10.204	2.735
30 year 240 minute summer	39.647	10.478	100 year +20% CC 2880 minute winter	6.858	2.735

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Depth/Area 1	1980	62.628	0.628	1.3	45.6898	0.0000	OK

Link Event (Velocity)	US Node	Link	Outflow (l/s)
2880 minute winter	Depth/Area 1	Infiltration	0.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1050	62.994	0.994	3.2	72.2937	0.0000	OK

Link Event (Velocity)	US Node	Link	Outflow (l/s)
1440 minute winter	Depth/Area 1	Infiltration	1.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1050	63.469	1.469	4.8	106.7720	0.0000	OK

Link Event (Velocity)	US Node	Link	Outflow (l/s)
1440 minute winter	Depth/Area 1	Infiltration	1.5

ORS

Appendix G – SUDS measures

SUDS SELECTION HIERARCHY SHEET FOR LARGE-SCALE DEVELOPMENT				
SuDS Measures	Measures to be used on site	Rational for selecting/non-selecting measure	Area of feature (m^2)	Attenuation volume of feature (m^3)
Source Control - Providing storage at source				
Swales	Yes	There is an opportunity to add a swale on a green strip behind the building	120	25
Integrated constructed tree pits	No	N/A (no trees on site)	-	-
Rainwater Butts	No	N/A – rainwater harvesting tank installed more appropriate for this development	-	-
Downpipe Planters	No	Minimal landscaping proposed adjacent to building	-	-
Rainwater Harvesting	Yes	Selected to re-use rainwater in administration block	7.1	10
Soakaways	Yes	There is an opportunity to build a soakaway to the rear of the building	75	107
Infiltration trenches	No	Chosen for cars parking areas. Unsuited to areas subject to waste movement given EPA requirements for impermeable surfaces	-	-
Green Roofs	No	No opportunity for use of these measures	-	-
Green wall	No			
Filter strips	No			
Bio-retention systems/Raingardens	No			
Blue Roofs	No			
Filter Drain	No			
Site Control				
Detention Basins	No	No opportunity for use of these measures	-	-
Retention basins	No			
Regional Control				
Ponds	No	No opportunity for use of these measures	-	-
Wetlands	No			

Other				
Petrol/Oil interceptor/Grit Trap	Yes	Full retention interceptor to be used in line with EPA licence		
Attenuation tank - only as a last resort where other measures are not feasible	Yes	Requirement for below-ground tank given extent of hard-paved areas required. Over-sized to cater for firewater retention	1210	1450
Permeable pavement (Grasscrete, Block Paving, Porous Asphalt etc)	Yes	For passenger cars parking areas	830	60
Oversized pipes- - only as a last resort where other measures are not feasible	No	Not required	-	-