Waterman Moylan
Engineering Consultants

Engineering Assessment Report

SHD at Holybanks, Swords

March 2022

Waterman Moylan Consulting Engineers Limited
Block S, Eastpoint Business Park, Alfie Byrne Road, Dublin 3
www.watermangroup.com

Waterman Moylan
Engineering Consultants

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1	Mar '22	L.Ruiz	E.Caulwell	E.Caulwell

Comments

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1. Introduction

Waterman Moylan has been appointed by Cairn Homes Properties Ltd. to provide Engineering services on the development of their lands at Holybanks, Swords, Co. Dublin. This report has been prepared as part of a planning submission to An Bord Pleanála, for the proposed development which will consist of 621 no. units (145 no. 1-bed units, 278 no. 2-bed units, 187 no. 3-bed units and 11 no. 4-bed units) comprising 349 no. apartments, 118 no. houses and 154 no. duplex units. Building heights range from 1 no. to 7 no. storeys (over basement level). The scheme provides for public open space, communal open space areas, a crèche, residential amenities (including concierge, multi-purpose room, meeting room and gym), a new public park to the north of the site as an extension to Broadmeadow Riverside Park and services/bin store areas. The development provides for a total of 705 no. car park spaces (including houses), 856 no. secure bike parking spaces and 21 no. motorbike spaces at basement, under-croft, and surface level.

The proposed development also includes a Stormwater storage tank, located on the Celestica site to the east of Holybanks together with an outfall to the Broadmeadow River which will be laid along the Balheary Road. The Stormwater storage tank and outfall is required in order to alleviate known constraints in the foul water network that serves the Oldtown / Mooretown / Holybanks (Estuary West) lands catchments. The details for the stormwater storage tank and gravity outfall have been agreed with Irish Water.

As part of the proposed development, temporary permission (3 no. years) is sought for a single-storey Marketing Suite and associated signage (including hoarding) during the development construction stage.

In addition, provision has been made on the site for a future school that does not form part of the subject application.

Principal vehicular access to the site is from Glen Ellan Road, with an additional new secondary site entrance provided from Jugback Lane/Terrace. Pedestrian connections are provided to the site from Jugback Lane/Terrace, Glen Ellan Road and the proposed Broadmeadow Riverside Park extension. The development also includes infrastructure upgrade works to peripheral roads and junctions, all associated site development works above and below ground including hard and soft landscaping, boundary treatments, lighting, SuDs, pumping station, ESB substations and services to facilitate the development.

This report sets out the intended approach to deal with water/drainage services and road access/parking that would be required to facilitate a high-density residential development on the subject site. It details the options available for the disposal of stormwater, disposal of foul water, water supply and road access for the developed site.

2. Site Description

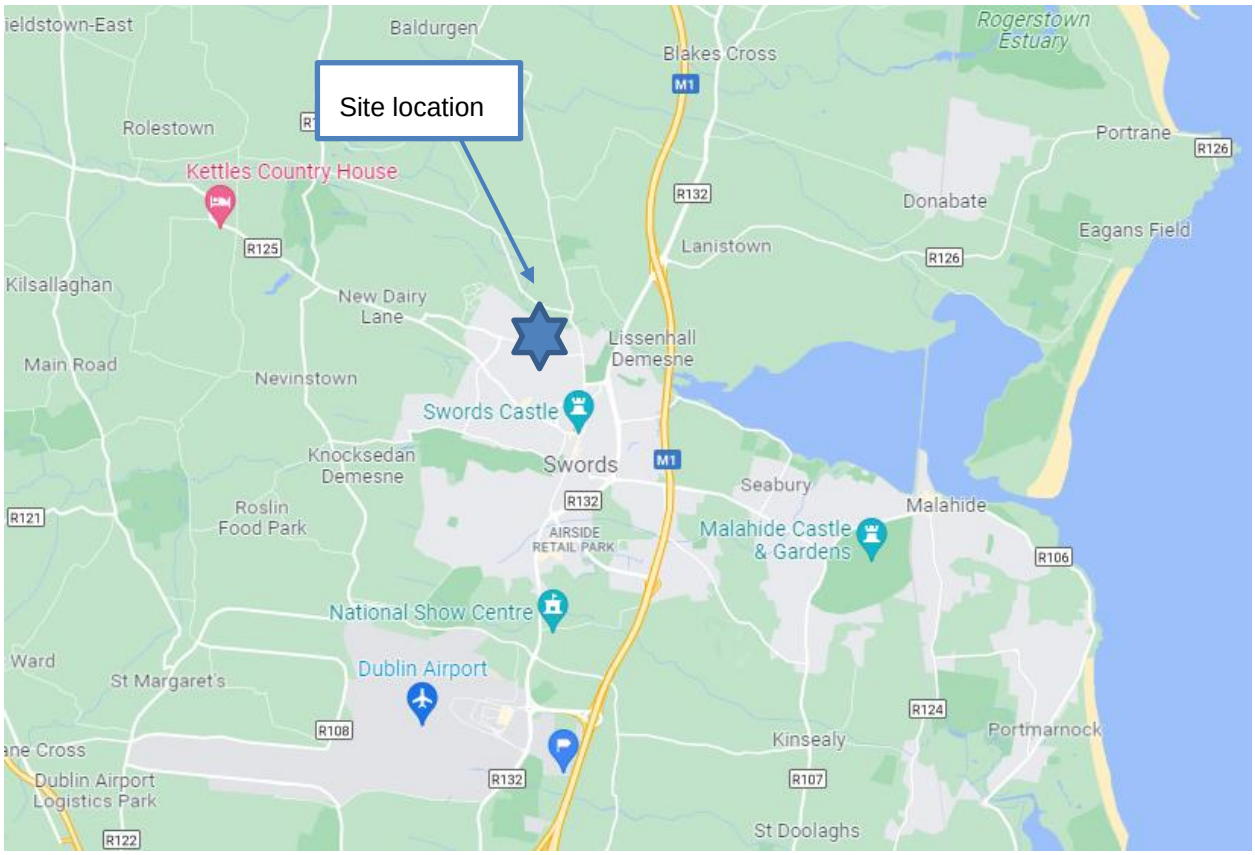
2.1 Site Location

The site is in Swords, Co. Dublin. The site is bound by Glen Ellan Road to the south, Jugback Lane/Terrace to the west, the former Celestica factory site to the east and the Broadmeadow River to the north.

In addition, as part of this application, a Stormwater Storage Tank is being proposed in the Celestica site which is directly adjacent east to the main subject site. The Celestica site is located on the junction of the Glen Ellan Road and the Balheary Road, Swords, Co. Dublin, as indicated in Figure 2 below.

Swords Celtic Football Club and its associated sports grounds are located to the north, on the opposite side of the Broadmeadow River. The Swords Business Campus is also located to the east of the site on the opposite side of Balheary Road. The site location is shown in Figure 1**Error! Reference source not found.** below.

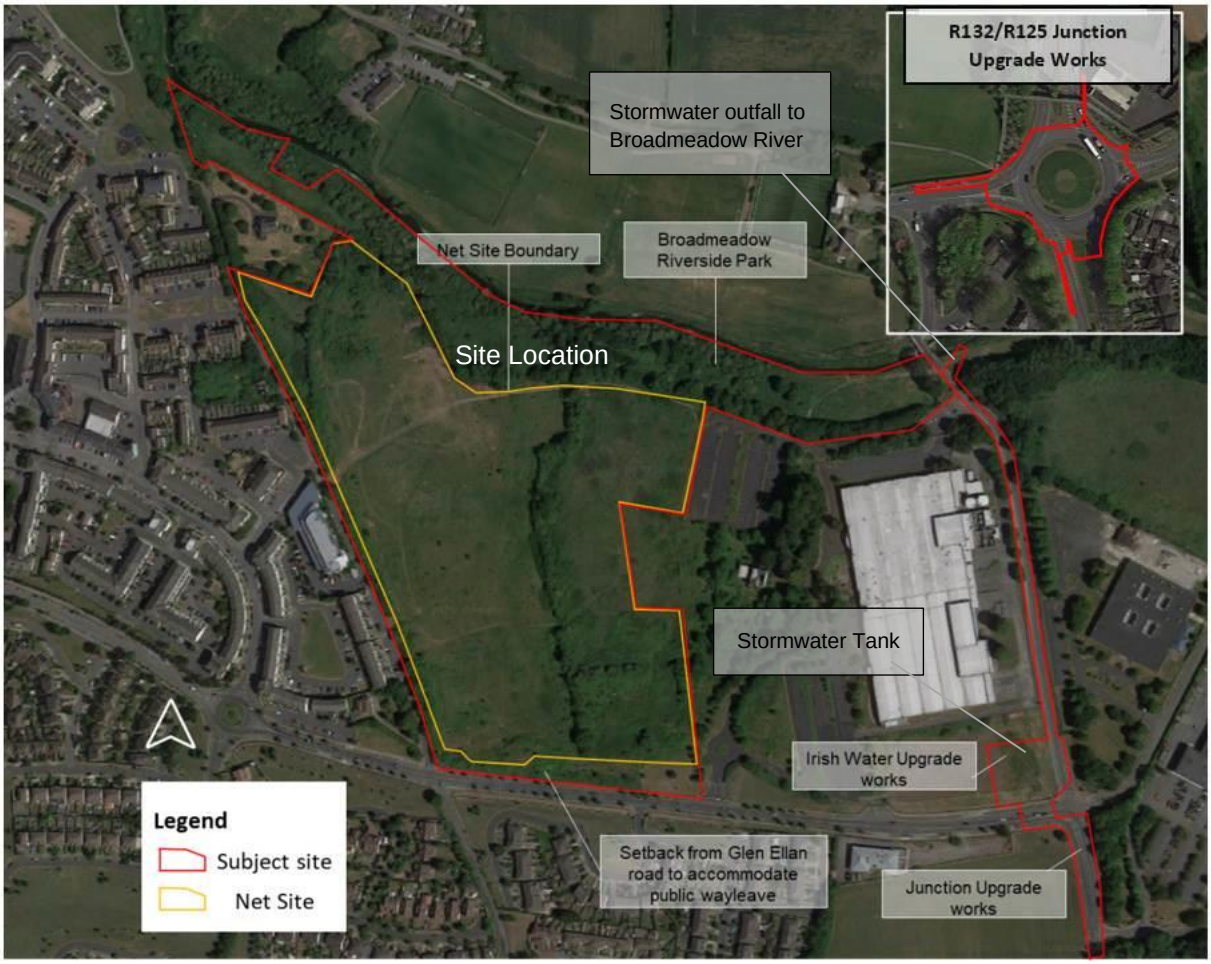
Figure 1 Site Location



2.2 Site Description

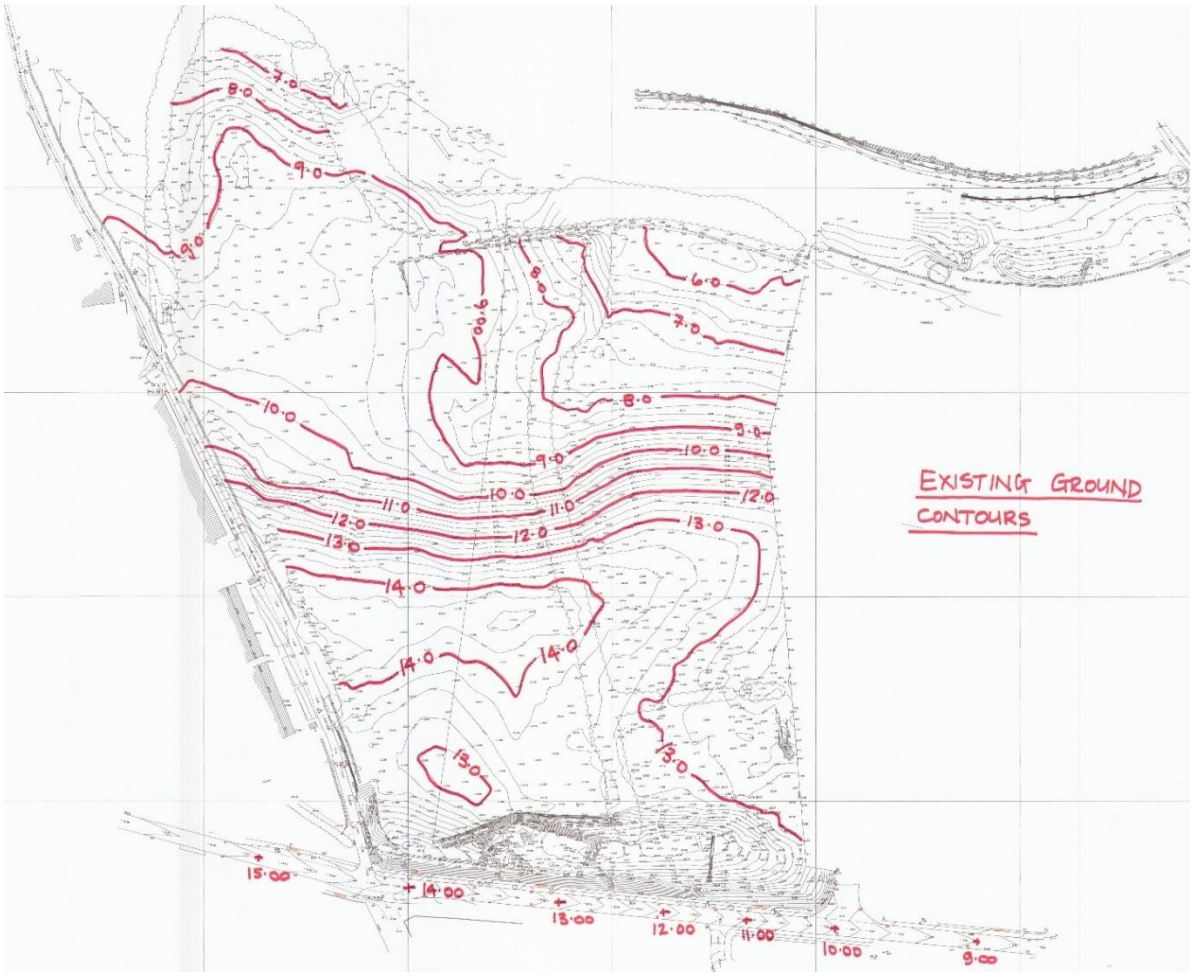
The overall site area is approximately 14.17ha. The site is currently greenfield as shown in Figure 2 below.

Figure 2 Site Location



The site generally falls from south to north towards the Broadmeadow River. The ground levels to the southwest are in the order of 14.0m falling to 5.6m at the northeast. See Figure 3 below illustrating the existing ground contours.

Figure 3 Existing Ground Contours



The existing ground topography of the proposed storage tank location ranges from 6.30m-6.90m, with gentle gradients falling from west to east and from north to south. The site for the proposed tank is brownfield, with some existing below ground infrastructure that will require removal and/or relocation.

2.3 Proposed Development

The proposed development will consist of a residential scheme of 621 no. units (145 no. 1-bed units, 278 no. 2-bed units, 187 no. 3-bed units and 11 no. 4-bed units) along with ancillary childcare facility (506.5 sq.m) and a range of residential amenity facilities (573 sq.m) including gym, concierge, meeting room and multi-purpose room.

The development will include the construction of:

- 118 no. houses comprising: 8 no. 1-storey, 1-bed maisonette units; 99 no. 2-storey, 3-bed units (18 no. mid-terrace and 81 no. semi-detached) and 11 no. 2-storey, 4-bed units (semi-detached).
- 349 no. apartment units (137 no. 1-bed units, 201 no. 2-bed units, and 11 no. 3-bed units) provided within 2 no. blocks ranging in height from 1 no. to 7 no. storeys (over basement level) to the south side of the site along Glen Ellan Road. A single level basement has been provided

for Block B and an under-croft area is provided within Block A incorporating parking areas, waste management areas, plant rooms and other ancillary services.

- 154 no. duplex units that are arranged within 14 no. 3-storey blocks comprising of 77 no. 2-bed units (ground floor) and 77 no. 3-bed units.
- Apartments and duplexes are provided with balconies/terraces along all elevations and dedicated services / bin store areas.
- The development will also provide for an ancillary childcare facility (506.5 sq.m), and residential amenity facilities (573 sq.m) including gym, concierge, meeting room and multi-purpose room within the ground floor of Block B.
- Provision of 705 no. car parking spaces, 856 no. bicycle parking spaces and 21 no. motorbike parking spaces (within basement, under-croft and at surface levels);
- The landscape proposal includes extensive public open space (10,008 sq.m.), in addition to a new public park measuring 29,400 sq.m as an extension of Broadmeadow Riverside Park to the north of the site.
- Principal vehicular access to the site is from Glen Ellan Road, with an additional new secondary site entrance provided from Jugback Lane/Terrace. New pedestrian connections are provided to the site from Jugback Lane/Terrace, Glen Ellan Road and the proposed Broadmeadow Riverside Park extension to the north of the site. Further, a segregated pedestrian/cycle path is proposed along a central green spine, connecting Glen Ellan Road in the south with Broadmeadow Riverside Park extension in the north.
- Junction and road improvement works are proposed to the Glen Ellan / Balheary Road junction and R132/R125 Seatown West Roundabout. This will include widening of Balheary Road (South), upgrade works to cycle/pedestrian facilities and for the partial signalisation of R132/R125 junction. The application also contains proposals to upgrade existing Irish Water infrastructure including the construction of a stormwater storage tank and overflow outfall gravity sewer to the Broadmeadow River.
- All associated site development works above and below ground including hard and soft landscaping, roads/footpaths/cycle paths, play areas, public art, boundary treatments, lighting, SuDs, pumping station, EV charging points, green roofs, ESB substations and services to facilitate the development.
- As part of the proposed development, temporary permission (3 no. years) is sought for a single-storey Marketing Suite and associated signage (including hoarding) during the development construction stage.

There is space for a future school allocated on-site and as such the sitewide infrastructure will make an allowance for this school where appropriate.

3. Foul Water Drainage

3.1 Introduction

There is an existing 600mm diameter foul sewer along Glen Ellan Road to the south of the subject site. This sewer is approximately 9m deep at the site boundary and drains eastwards ultimately outfalling to the Swords Waste Water Treatment Plant (WWTP). See appendix A for Irish Water Record Maps.

A Pre-Connection Enquiry form was submitted to Irish Water and a response has been received. Please refer to Appendix B for the Irish Water response in February 2022. In summary, Irish Water stated that to accommodate the proposed connection to the Irish Water network at the premises, a storage tank will be required in the future to manage the impacts of excessive rainfall in the sewer network downstream of the development. In this regard, following consultation with Irish Water, it is proposed to include as part of this application a Stormwater Storage Tank. The proposed tank will be located on the junction of the Glen Ellan Road and Balheary Road, Swords, Co. Dublin, approximately 280m east of the development. The proposed tank will alleviate constraints within the Irish Water foul water system, that occur during times of heavy or prolonged rainfall, resulting from surface water and foul water infiltration. Waterman Moylan has prepared a separate report to detail the proposed Stormwater Storage tank design and this forms part of the subject application. Please refer to the Stormwater Storage Tank report which is submitted under a different cover.

A Statement of Design Acceptance for the proposed drainage design has been received from Irish Water in March 2022 and is included in Appendix C.

3.2 Receiving Environment

Despite the depth of the existing foul sewer on Glen Ellan Road it is not possible to drain the entire site by gravity to the existing foul sewer network. In this regard, a portion of the site will have to be pumped to facilitate an outfall to the existing foul sewer network. It is proposed to locate a pumping station on the open space to the north of the site and to pump to the onsite drainage network before out falling by gravity via the onsite drainage network to the 600mm diameter public sewer on Glen Ellan Road. See Figure 4 below which shows the area of site to be pumped and the area which can drain by gravity. Please refer to Waterman Moylan Drawing No's 17-088-P200, P201 and P202 for details of the proposed drainage network for the site.

3.3 Stormwater Storage Tank on Foul Sewer Network

As part of the assessment by Irish Water of the suitability of the subject site for development, Irish Water undertook a model review of the constraints within the network and determined that a tank of 2,250m³ volume is required to store excess rainfall that enters the foul drainage network for rainfall ever by of up to 1 in 5 year return periods. In addition, it is proposed to also provide a new outfall sewer from the stormwater storage tank to the Broadmeadow River, to be laid along the Balheary Road for overflow of the excess stormwater during the more rainfall events that exceced the 1 in 5 year return period.

The proposed offline 2,250m³ stormwater storage tank, and high-level overflow gravity sewer to the Broadmeadow is detailed on accompanying planning drawings 17-088-P202 and P203 & 17-088-P210. The proposed gravity overflow pipe will be laid from the proposed stormwater storage tank and discharges northwards to the Broadmeadow River, just east of the Balheary Road. Further information is provided in the Stormwater Storage Tank report enclosed with this pack.

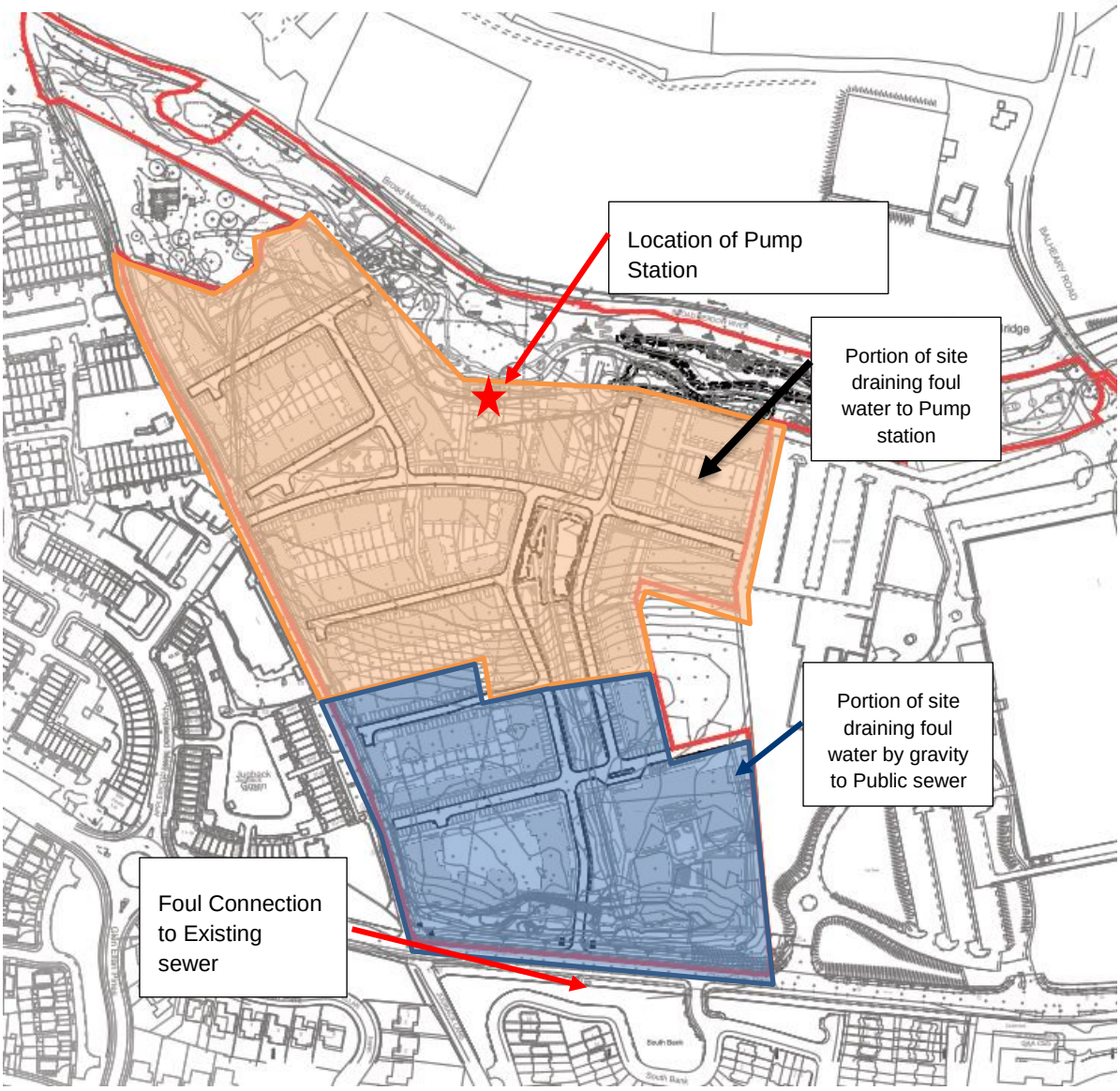
3.4 Network Design

Drains generally will consist of uPVC pipes (to IS 123) or concrete socket and spigot pipes (to IS 6). Pipes will be laid to comply with the requirement of the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H. Foul water sewers will consist of concrete pipes (to IS 6) or uPVC capable of resisting jetting pressure of 2,600psi and laid strictly in accordance with Irish Water requirements for taking in charge.

Internal Slung drains will generally consist of Ductile Iron pipework fixed to the underside of the basement floor slab.

In accordance with the Irish Water *"Code of Practice for Wastewater Supply*", 150mm nominal internal diameter sewers have been proposed for carrying wastewater from 20 properties or less; whilst 225mm nominal internal diameter carrying Wastewater from more than 20 properties. Furthermore, where there are at least ten dwelling units connected, the 150mm diameter pipes are laid at a minimum gradient of 1:150 and they will be laid at 1:60 for up to nine connected dwelling units.

Figure 4 Foul Water Scheme



3.5 Foul Water Calculations

The design of the foul water drainage has been based on the "*Code of Practice for Wastewater Infrastructure*", (July 2020) published by Irish Water. The peak foul flow is based on Irish Water recommended peak demand/ flow factors. Pipe capacities and velocities have been calculated using Colebrook-White formula with a roughness coefficient (Ks) of 1.5 mm.

3.6 Proposed Foul Water Strategy

The proposed development will consist of 621 No residential units and a Créche. The foul network has also been designed to accommodate a future School. Based on the Irish Waters Code of Practice, the peak foul flow from the proposed development will be as follows:

Table 1: Calculation of proposed Foul Water Flow

Description	No. of Units	Flow l/h/day	Population per Unit	Infiltration Factor	Total Discharge (l/d)
Residential Units	621	150	2.7	1.1	276,655.5
Crèche	1	50	143	1.1	7,865
Future School	1	50	795	1.1	43,725
				Totals	***328,245.5 l/d***

Calculation of Proposed Peak Foul Flow		
Total Daily Discharge *(from Table 1.)*	328,245.5	l/d
Residential Dry Weather Flow (RDWF)	3.202	l/s
Commercial Dry Weather Flow (CDWF)	0.597	l/s
Residential Foul Flow (=3 x RDWF)	***9.606***	***l/s***
Peak Foul Flow (=4.5 x CDWF)	***2.687***	***l/s***
Total Peak Foul Flow	***12.293***	***l/s***

The PE for the development, including the future school is 2615 people. The proposed foul water outfall from the site is a 225 mm-diameter pipe laid at a minimum gradient of 1:200, giving a minimum capacity of 30l/s. Therefore, the proposed outfall has adequate capacity to cater for the flows from the development.

3.7 Foul Water Pumping Station

It is calculated that foul water from 229 No units will need to be pumped to the on-site foul drainage network. Therefore, the total flow into the proposed pumping station will be as follows:

Table 2: Calculation of Pumped Foul Water Flow

Description	No. of Units/People	Flow l/h/day	Population per Unit	Infiltration Factor	Total Discharge (l/d)
Residential Units	229	150	2.7	1.1	102,019.5
				Totals	***102,019.5 l/d***

The foul water pumping station with storage capacity for 102 m3 of foul drainage and rising main will comply with the standards set out in the Irish Water Code of Practice for Wastewater Infrastructure. The foul pumping station allows for a buffer zone of 15m to the closest occupied buildings, in accordance with Section 5.5. of the Irish Water 'Code of Practice for Wastewater Supply', which establishes a minimum buffer zone of 15m for Type 3 pumping stations. From a technical perspective, the ground levels and location at a central position within the scheme are favourable.

The rising main will be HDPE and shall comply with the requirements of IS EN 12201, in accordance with Irish Water specification requirements.

Emergency storage, with a capacity of 24-hour Dry Weather Flow, will be provided above the highest pump cut-in level to ensure surcharging of the collection system does not occur.

3.7.1 Pumping Chamber Design Criteria

The size of the proposed rising main for the development will be 110mmOD/90mmID.

The capacity of the pumps to be provided have been based on the following design criteria:

Table 3: Pumping Station Design Criteria

Static Head	6.9	m
Rising Main diameter	90	mm Ø
Length of Rising Main	225	m
Dry Weather Flow	1.18	l/sec

The pump station is designed to deliver a minimum peak flow of 3 times DWF, therefore the design flow rate is 12.74 m^3/hr.

Velocities have been calculated for the 90 mm rising main to achieve the minimum pump rate required to achieve self-cleansing velocity.

Irish Water "*Code of Practice for Wastewater Supply*", (July 2020) recommends that velocities of discharge should be in the range of between 0.75 m/s to 1.8 m/s, therefore the pump flow rate discharge flow should be as follows to reach minimum self-cleaning velocity on the rising main:

Table 4 DWF Factor

V (m/s)	Required flow rate (l/s)	DWF Factor
0.75 (90 mm)	5.20	4.68

3.7.2 Septicity

The retention time in the rising main has been determined.

Table 5 Septicity Retention time

Flow rate (m^3/day)	Volume Rising Main (m^3)	Retention time (h)
102.0	1.43 (90 mm)	0.11

Based on the above there will be no septicity in the rising main.

4. Surface Water Drainage

4.1 Introduction

The proposed surface water drainage network complies with the GDSDS Regional Drainage Policies Volume 2, for New Developments. The Masterplan for Estuary West has also been considered in preparing the surface water drainage strategy for the development.

There is an existing 300mm diameter surface water sewer in Glen Ellan Road to the south of the site and the Broadmeadow River bounds the site to the north. The site currently drains to the Broadmeadow River.

4.2 Site Characteristics

The following parameters have been used in greenfield run-off rate and attenuation calculations.

Table 6 Surface Water Catchment Details

	Catchment
Site Area (Catchment) – Ha [(1)]	10.83 ha
Impermeable Area - Ha	4.8
% Hardstanding	44%
SAAR – mm	744
SOIL Index	0.3
Climate Change	20%

[(1)] The total gross area of this application is 14.17 Ha. The catchment area for surface water is 10.83 and does not include the green corridor along the Broadmeadow River or the wayleave to the south of the site.

4.3 Greenfield run-off rates

The Estuary West Masterplan stipulates that the post-development run-off rates are limited to 2l/s/ha for the site. Therefore, the proposed design is based on an outflow of 21.6 l/s.

4.4 SUDS Assessment

As per Fingal County Council guidelines surface water should be managed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Volume 2, for New Developments and CIRIA documents. These documents specify that surface water run-off should be managed as close to its source as possible, with the re-use of rainwater within the buildings prioritised.

Sustainable Urban Drainage Systems (SUDS) have been developed and are in use to alleviate the detrimental effects of traditional urban stormwater drainage practices that typically consisted of piping run-off of rainfall from developments to the nearest receiving watercourse. Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as SUDS. They are typically made up of one or more structures, built to manage surface water run-off. The use of SUDS to

control run-off also provides the additional benefit of reducing pollutants in the surface water by settling out suspended solids, and in some cases providing biological treatment.

A stormwater management or treatment train approach assures that run-off quantity and quality is improved. The following objectives of the treatment train provide an integrated and balanced approach to help mitigate the changes in stormwater run-off flows that occur as land is urbanised and to help mitigate the impacts of stormwater quality on receiving systems:

1) **Source control:** conveyance and infiltration of run-off; and
2) **Site Control:** reduction in volume and rate of surface run-off, with some additional treatment provided.

In addition, the specific guidelines from "The Fingal Masterplan for Estuary West" were considered for the SUDS design and the following SUDS strategy is proposed:

- Run-off within the curtilage of the property boundary shall pass through at least one SUDS component before discharging to downstream SUDS components within the public realm.
- Run-off from public areas (such as roads, parking bays, hard and soft landscaped areas and footpaths) shall pass through at least two SUDS components before discharging to the final downstream detention/retention/polishing SUDS components within the public realm.
- The Final SUDS Components located in the public realm shall comprise basins/ponds/wetlands (as appropriate), before discharge to the River Broadmeadow or local surface water sewer. The location of such basins, ponds and wetlands shall be outside the high-end future scenario fluvial flood extents.
- Storage for the 100-year event (as a minimum) including a 20% increase in rainfall intensity for climate change shall be provided for run-off from the public realm, with a maximum discharge rate of 2l/s/ha.

The applicant has considered the use of all appropriate SUDS measures as part of the site SUDS strategy, details are outlined in Table 7 below. Refer to drawing 17-088-P204/P205 showing the proposed SUDS Measures on site.

Table 7 SUDS Measures

SUDS Stage	SUDS Measure	Measure Outline	Use on-site
Source Control	Green Roofs	Green Roofs are roofs with a vegetated surface that can provide attenuation and treatment of rainwater. They also provide evapotranspiration from the roof's plants and substrate, reducing run-off volumes and the burden on the drainage network.	It is proposed to use green roofs on the roofs of the proposed apartment blocks for both treatment and interception storage in line with the Fingal County Council Masterplan for Estuary West.
	Permeable Pavements	Permeable pavements are alternative paving surfaces to standard finishes that allow stormwater run-off to filter through voids in the pavement surface into an underlying stone reservoir,	Permeable paving will be utilised for the surface carparking area to provide treatment and storage to rainwater falling on these areas.

		where it is temporarily stored and/or infiltrated.	
	Bioretention Systems/ Swales	Bioretention systems are shallow, landscaped depressions designed to store and/or convey run-off and remove pollutants. They may be used as conveyance structures to pass the run-off to the next stage of the treatment train and can be designed to promote infiltration where soil and groundwater conditions allow.	Bioretention systems in the form of Swales will be considered for access road surface water treatment to treat water at the source before conveying it to a downstream Detention Basin with a maximum slope of 1 in 4.

SUDS Stage	SUDS Measure	Measure Outline	Use on-site
Site Control	Detention Basin and Hydrobreak	A detention basin is a landscaped depression that is normally dry, except during and following rainfall events. They are designed to provide storage and treat run-off. Hydrobreaks are used to restrict the outfall from the detention basin to the equivalent of the existing agricultural run-off. This ensures the development will not give rise to any impact downstream of the site.	It is proposed to use a central detention basin as a primary form of treatment and storage of surface water on-site before discharging to the surface water network, via a hydrobreak with a maximum slope of 1 in 4. In addition, there will be a detention basin located within the public realm to the north of the site. This detention basin will act as a final form of treatment and storage of surface water before discharging to the Broadmeadow River via a hydrobreak with a maximum slope of 1 in 4.
	Petrol Interceptor	A petrol interceptor is a trap used to filter out hydrocarbon pollutants from rainwater run-off. It is typically used in road construction to prevent fuel contamination of watercourses carrying away the run-off. Petrol interceptors work on the premise that some hydrocarbons such as petroleum and diesel float on top of the water. The contaminated water enters the interceptor typically after flowing off roads and entering a drain before being deposited into the	A Petrol Interceptor will be installed, upstream of the proposed detention basins for any areas that could not benefit from source control treatment. Additionally, a petrol interceptor will be installed upstream of the attenuation area to the south of the site.

		first tank inside the interceptor. The first tank builds up a layer of the hydrocarbon as well as other scum preventing it from entering the watercourse.	
	Attenuation area	Attenuation area are excavations filled with a void-forming material that allows the temporary storage of water before discharging it at a controlled rate to a drainage network. They can be grouped and linked together to drain large areas. Attenuation area provide stormwater attenuation and stormwater treatment.	It is proposed to use an stone filled attenuation area to the south of the site before discharging via a hydrobreak to the public surface water sewer located on Glen Ellan Road.

In accordance with the SUDS Manual CIRIA C753, the pollution prevention guidelines have been followed to ensure appropriate levels of treatment are provided before attenuated run-off from the site is discharged into the ordinary watercourse. Fingal County Council pro forma for SUDS has also been completed and is included in Appendix D.

4.5 Mitigation Measures

The Pollution Hazard Indices, shown in Table 8 below, for the different proposed land uses have been derived from Table 26.2 of CIRIA C753.

Table 8 Pollution Hazard Indices for different land uses

	TSS	Metals	Hydro-carbons
Apartment / Residential roof	0.2	0.2	0.05
Residential road/car park	0.5	0.4	0.4
Main access road	0.7	0.6	0.7

To ensure the proposed SUDS strategy will appropriately mitigate against the potential pollution derived from these areas the Pollution Mitigation Indices (PMI) in Table 26.3 and 26.15 of CIRIA C753 have been reviewed and laid out in Table 9 below;

Table 9 Indicative SUDS mitigation indices for discharge to surface waters

	TSS (PMI)	Metals (PMI)	Hydro-carbons
Permeable paving	0.7	0.6	0.7
Swale	0.5	0.6	0.6

Detention Basin	0.5	0.5	0.6
Green Roof	0.8	0.7	0.9
Attenuation Area	0.3	0.5	0.6

For each land use, different mitigations have been applied. Below are shown the calculations for the total pollution prevention for each type of hard standing on site. The calculation has been made in line with CIRIA C753 as follows:

- The following formula has been used to calculate the total mitigation in line with CIRIA C753.

  Total SUDS Mitigation index = Mitigation Index $_1$ + 0.5(Mitigation Index $_2$) +0.5(Mitigation Index $_3$) *[1]*

- The total Mitigation index is then taken away from the pollution Hazard indices for the land use to determine if sufficient treatment has been provided. A negative number indicates that enough treatment has been provided and a positive number indicated additional forms of treatment are required.

  Total SUDS mitigation = Pollution Harzard $_{Table\ 7}$ – Total SUDS Mitigation Index $_{[1]}$ *[2]*

Table 10 Pollution Hazard Indices for different land uses

	Mitigation Method 1			Mitigation Method 2			Total SUDS Mitigation		
	TSS	Metals	H-C	TSS	Metals	H-C	TSS	Metals	H-C
Residential roof	Permeable Paving			Not required and treatment level has already been met.			**-0.5**	**-0.4**	**-0.65**
(Pollution Hazard $_{Table\ 7}$ – Mitigation Index $_{Table\ 8}$)	-0.5	-0.4	-0.65						
Main access road	Swale			Detention Basin $_{(x0.5)}$			**-0.05**	**-0.25**	**-0.2**
(Pollution Hazard $_{Table\ 7}$ – Mitigation Index $_{Table\ 8}$)	+0.2	0	+0.1	-0.05	-0.25	-0.2			
Main access road (South)	Swale			Attenuation Area			**Petrol interceptor**		
(Pollution Hazard $_{Table\ 6}$ – Mitigation Index $_{Table\ 7}$)	+0.2	0	+0.1	0.05	-0.25	-0.2	Appropriate treatment is provided using a Class I Petrol Interceptor		
Surface car park	Permeable Paving			Swale $_{(x0.5)}$			**-0.15**	**-0.3**	**-0.3**
(Pollution Hazard $_{Table\ 7}$ – Mitigation Index $_{Table\ 8}$)	+0.1	0	-0.1	-0.15	-0.3	-0.3			
Apartment roofs	Green Roof			Not required and treatment level has already been met.			**-0.6**	**-0.5**	**-0.85**
(Pollution Hazard $_{Table\ 7}$ – Mitigation Index $_{Table\ 8}$)	-0.6	-0.5	-0.85						

As described in Table 10 above all the hardstanding on-site passes through adequate levels of treatment to remove the Total Suspended Solids, Metals and Hydrocarbons present before discharge to the watercourse. In conclusion, the water quality from this catchment should be high.

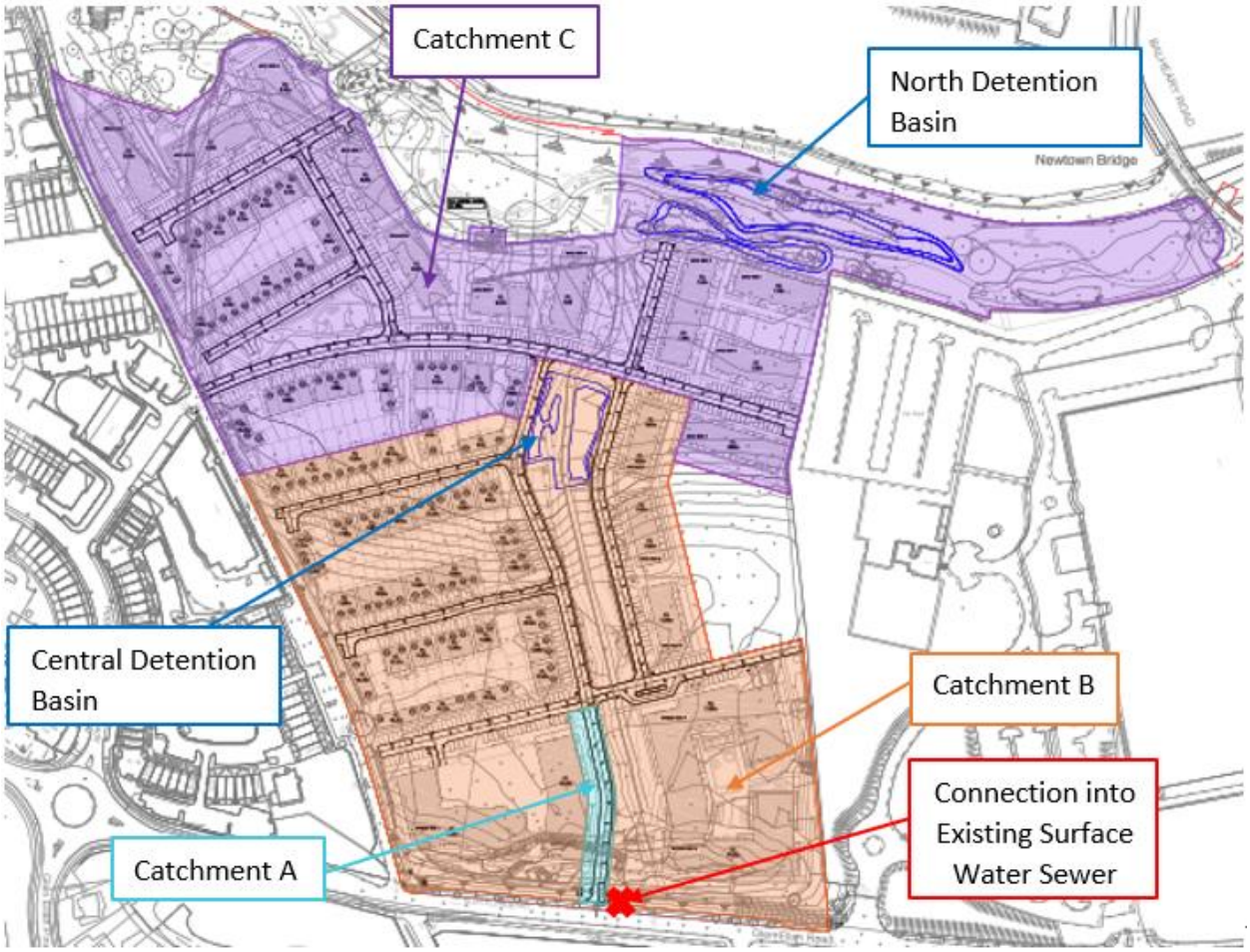
4.6 Storm Water Calculations

The total impermeable area of the catchment including roads, car-parking and roofs, is approximately 48,760 m^2, and peak outflow will be limited to 21.6 l/s for the 1 in 100-year event. It is proposed that the 1 in 100-year critical design storm plus an additional 20% for climate change will be used for stormwater attenuation calculations. The proposed surface water drainage network can be seen on Waterman Moylan drawings 17-088 P200 and P201.

The subject site will be split into 3 No. catchments for the purpose of surface water attenuation. These catchments are indicated on Surface Water Catchment Drawing No. 17-088-P207 and in Figure 5 below.

The calculations for the surface water design are included in Appendix E of this report. In addition, a Stage 1 Surface Water Audit has been carried out by JBA Consulting and it is included with this application.

Figure 5 Surface Water Catchme



Catchment A

This catchment comprises the southern area of the access road to the site off Glen Ellan Road as shown on Surface Water Catchment Drawing No. 17-088-P200/201. The overall catchment area is 0.13ha, with approximately 0.11 ha of impermeable area. This part of the road drains into a swale located along the edge of the road which then drains into an stone filled attenuation area that will store surface water for high-intensity rain events before discharging via a hydrobreak into the existing public sewer located on Glen Ellan Road. The max outflow from this catchment is 2l/s. Storage design calculations indicate that for a return period of 100years, 240-minutes winter storm event is critical and requires storage of 25 m^3, including a 20% additional storage allowance to facilitate climate change. It is proposed to provide an attenuation area at the end of the road swale of 0.9m depth with a 72m^2 area and 40% voids with a storage volume of 25m^3.

The attenuation area will be the final SUDS feature before discharging surface water to the adjacent network on Glen Ellan Road. It will normally be dry and will only fill up during storm events. The stormwater

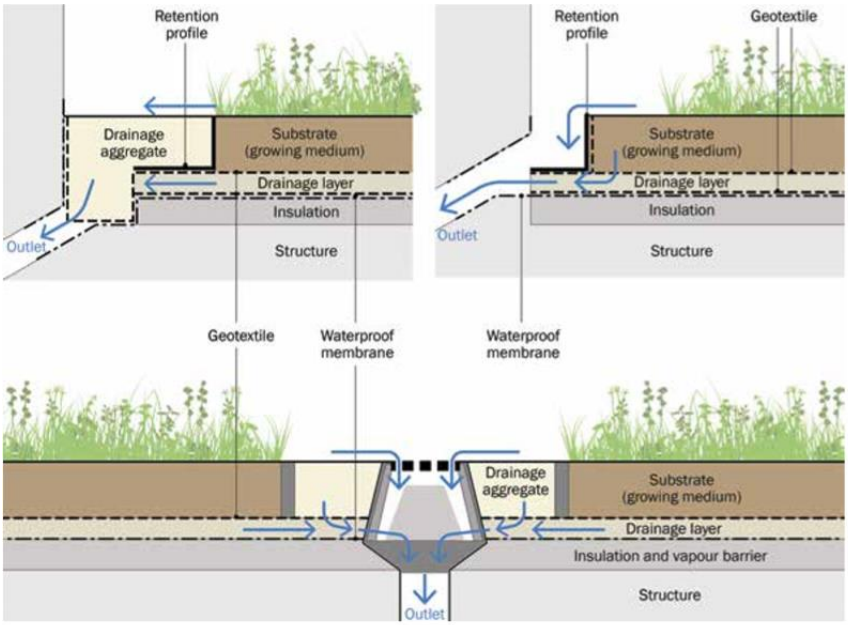
will then be released via a Hydrobreak to the surface water network to the south, as indicated on the drainage drawing. The flow control device will be fitted to a 225mm outlet pipe and will be fitted with a pull cord bypass. A penstock valve will be installed within the flow control chamber, on the upstream end of the manhole, to isolate and carry out maintenance of the flow control device.

Catchment B – Southern Catchment

This catchment comprises the southern area of the subject site as shown on Surface Water Catchment Drawing No. 17-088-P207. The overall catchment area is 4.8 ha, with approximately 2.5ha of impermeable area. An allowance of 2 l/s from the future school has also been made.

Green Roofs have been considered and incorporated into the development proposals. The locations of the green roofs are illustrated on the accompanying Waterman Moylan SUDS Drawing No. 17-088-P203/P204. Green Roof account for 60% of the total area of the roof for Apartment Block A1/A2 and B. All water falling on the hardstanding area formed by the apartment roofs will drain through a green roof before discharging to the local surface water network. The Green roof will attenuate water through storage in the growing medium and evapotranspiration during small storm events whilst during higher storm events, they will discharge excess water to the building's drainage system.

Figure 6 Example Details of outlets from a green roof (CIRIA C697)



Moreover, storage will be provided in a series of swales along the main access road and a central detention basin. A hydrobreak located at the end of the basin will allow some of the water to store in the detention basin before discharging into the site surface water network. The central detention basin can store approximately 600 m^3. Storage design calculations indicate that for a return period of 100years, 60-minutes winter storm event is critical and requires storage of 452 m^3, including 20% additional storage to facilitate climate change.

The detention basin will normally be dry and will only fill up during storm events. The stormwater will then be released via a Hydrobreak to Catchment C (North Catchment) to the north, as indicated on the drainage drawing with a maximum flow rate of 85 l/s. The flow control device will be fitted to a 225mm outlet pipe and will be fitted with a pull cord bypass. A penstock valve will be installed within the flow control chamber, on the upstream end of the manhole, to isolate and carry out maintenance of the flow control device.

Catchment C – Northern Catchment

This catchment comprises the northern area of the subject site as shown on Surface Water Catchment Drawing No. 17-088-P207. The overall catchment area is 5.9ha, with approximately 2.2 ha of impermeable area. This catchment receives surface water via a hydrobreak located at the end of the central detention basin as described above. The max outflow from this catchment is 19.6 l/s. Storage will be provided in a series of swales along the length of the residential road and a detention basin in the green space to the north of the site. The detention basin is the final suds feature before the outfall to the Broadmeadow River.

The north detention basin utilises an existing low-lying area, thus, minimum excavation is required having a low impact on the ecology of the surrounding area. The detention basin will have maximum side slopes of 1 in 4 and will provide a storage volume of approximately 3,000 m^3. This volume will be provided above ground, within the detention basin and will be utilised during high storm events meaning the detention basin will generally be dry. Storage design calculations indicate that for a return period of 100years, 1,440-minutes winter storm event is the critical storm and requires storage of 2,706 m^3, including a 20% allowance to facilitate climate change. The excess storage in the north detention basin will accommodate water in the case of a surcharged outfall from the Broadmeadow River.

Appendix E shows the surface water network calculations for the 1 in 30 and 1 in 100 year storm event plus 20% for climate change. It is important to note that for the 100 year storm manholes SWMH45 and SWMH52 have a FLOOD warning status which indicates that the manhole may surcharge in the 1 in 100 year storm event. Results show that SWMH would flood 1.71 m^3 during the 1 in 100 year storm. SWMH52 is not contained on a road area but in landsacape, the surcharged volume can drain to landsacped areas from where it will drain naturally to ground or back into netwrok when the storm has passed. SWMH45 would flood 20.9 m^3 during the 1 in 100 year storm. This manhole is also not contained within the road area but in landscape, the surcharged volume can drain to landscape areas which is quite large surrounding the proposed manhole where it will drain naturally to ground or back to the network once the storm has passed. The area availible for overflow is over 1000m2, the landscape areas in this area has been further reviewed to ensure FFL's are 150mm above these manholes cover levels.In addition, there is a direct route across the landscaping to the Broadmeadow river from these chambers. Therefore the minor flooding during the 1 in 100 year storm does not present a flood risk to the adjacent properties.

Please refer to Waterman Moylan Drainage Drawing No's 17-088-P200 and P201 for details of the drainage layout. The details of the swales, attenuation area and detention basins can be seen on Waterman Moylan Drawing 17-088-P211/P212.

Calculations for pipe sizes and gradients are based on stormwater run-off from the roofs and surfaced areas using the Rational Method for surface water design (Bilhams Formula).

Pipe capacities and velocities have been calculated using Colebrook-White formula with a roughness coefficient (Ks) of 0.6mm.

4.7 Network Design

As described above, the proposed surface water drainage system for this development has been designed as a SUDS system and uses permeable paving, swales, green roofs, stone filled attenuation area and detention basins together with flow control devices and petrol interceptors to treat run-off and remove pollutants to improve quality, restrict outflow and control quantity.

Strict separation of surface water and wastewater will be implemented within the development. Surface water local drains will be a minimum of 225mm dia. and generally will consist of PVC (to IS123) or concrete socket and spigot pipes (to IS 6). These drains will be laid to comply with the requirement of the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H and will be laid strictly in accordance with the requirements of Fingal County Council.

5. SUDS Maintenance

For the SUDS strategy to work as designed, the entire drainage system must be well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained. Maintenance and cleaning of gullies, manholes (including catch pits) and attenuation tanks will ensure adequate performance. The recommended program is outlined in the tables below.

Table 11 Permeable Paving Maintenance Schedule

SUDS Element	Maintenance		
	Maintenance period	Maintenance Task	Frequency
Permeable Paving	Regular	Brushing and vacuuming (standard cosmetic sweep over the whole surface)	Once a year, after autumn leaf fall, or as required, based on site-specific observations of clogging or manufacturer's recommendations.
	Occasional	Removal of weeds	As required
	Remedial work	Remediation work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users	As required
	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually

Table 12 Swale Maintenance Schedule

	Maintenance period	Maintenance Task	Frequency
Swale	Regular	Remove the litter and debris	Monthly, or as required
		Cut grass – to retain height within specified design range.	Monthly (during the growing season), or as required
		Manage other vegetation and remove nuisance plants.	Monthly at the start, then as required
		Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
		Inspect infiltration coverage	Monthly for 6 months, quarterly for 2 years, then half-yearly
		Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half-yearly
	Occasional	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if the soil is exposed over 10% or more of the swale treatment area

	Remedial actions	Repair erosion or other damage by re-turfing or re-seeding	As required
		Re-level uneven surfaces and reinstate design levels	As required
		Remove build-up of sediment on upstream gravel trench, flow spreader or at top of the filter strip	As required
		Remove and dispose of oils or petrol residues using safe standards practices	As required

Table 13 Green Roof Maintenance Schedule

	Maintenance		
Green Roof *	Maintenance Issues	Vegetation becoming either overgrown or dying	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment source	Annually and after severe storms
		Inspect drain inlets to ensure unrestricted run-off from the drainage layer to conveyance or roof drain system.	Annually and after severe storms
		Inspect the underside of the roof for evidence of leakage.	Annually and after severe storms
		Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly and annually or as required
		During establishment (i.e. year one), replace dead plants as required.	Monthly
		Post-establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
		Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
		Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
		Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate.	Six monthly or as required
	Remedial Work	If erosion channels are evident, these should be established with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
		If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

*Note: Please refer to architects plans/documents for access strategy for green roofs.

Table 14 Detention Basin Maintenance Schedule

	Maintenance period	Maintenance Task	Frequency
Detention Basin	Regular	Remove the litter and debris	Monthly, or as required
		Cut grass – to retain height within specified design range.	Monthly (during the growing season), or as required
		Manage other vegetation and remove nuisance plants.	Monthly at the start, then as required
		Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
		Inspect infiltration coverage	Monthly for 6 months, quarterly for 2 years, then half-yearly
		Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half-yearly
	Occasional	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if the soil is exposed over 10% or more of the swale treatment area
	Remedial actions	Repair erosion or other damage by re-turfing or re-seeding	As required
		Re-level uneven surfaces and reinstate design levels	As required
		Remove build-up of sediment on upstream gravel trench, flow spreader or at top of the filter strip	As required
		Remove and dispose of oils or petrol residues using safe standards practices	As required

6. Water Supply

6.1 Water Supply – General

There is an existing 150mm along Balheary road that connects into a 300mm diameter watermain to the northeast of the subject site. In addition, there is a 250mm diameter watermain on Glen Ellan Road to the south of the subject site.

A Pre-Connection Enquiry form was submitted to Irish Water and a response has been received. A copy of the response is attached in Appendix B. In addition, a statement of design acceptance has been received and can be found in Appendix C.

In summary, Irish Water has confirmed that they can facilitate a main connection to serve the proposed development by providing a 20m of new 200 mm ID pipe main to be laid to connect the site development to the existing 300mm DI main to the northeast of the site. A secondary connection can be made providing 20 m of new 200mm ID pipe main to be laid to connect the proposed development to the existing 250mm uPVC watermain to the south of the site along Glen Ellan Road.

Table 15 Total Water Demand

Description	No. of Units/People	Flow l/h/day	Population per Unit	Total Discharge (l/d)
Residential Units	621	150	2.7	251,505
Crèche	1	50	143	7,865
Future School	1	50	795	43,725
Totals				***303,095 l/d***

The total water requirement from the public supply, for the development, is estimated at 303 m^3/day. The proposed watermain network can be seen on Waterman Moylan drawing 17-088 P040, P041 and P042.

7. Transport

7.1 General

The site will be accessed via a new access from Glen Ellan Road. Secondary access will be provided from/to Jugback Lane/Terrace. This secondary access will be primarily to provide connectivity to the adjacent Applewood Village and all its associated services/amenities.

A detailed traffic and transportation assessment has been undertaken for the proposed development and this is included under separate cover.

7.2 Car Parking

The proposed development comprises a mixture of traditional 1,2, 3 and 4 bed houses/maisonette which total 118, 154 duplex units together with 349 apartments and a Creche. The apartments are predominantly located within the south area of the site with two blocks, block A1/A2 and block B. All of the apartments are intended to be for rental and the houses will be sold individually. The future school site does not form part of this application.

Houses and duplexes will be provided with parking spaces at ground level. The main apartment complex to the southeast of the site will be provided with parking at the basement level beneath the apartments and the block to the southwest will have parking spaces at the undercroft of the apartment block A1/A2.

7.2.1 Fingal Development Plan 2017-2023 Car Parking Standards

Standards for car parking in new developments are set out in Table 12.8 of the Fingal Development Plan 2017 - 2023. Based on that, Table 16 below sets out the car parking requirements applicable to the subject proposed development.

Table 16 Fingal County Council Car Park Space Requirements

Land Use	Standard	Norm or Max
House – Urban / Suburban (1 or 2 bedrooms)	1-2 spaces within the curtilage	Norm
House – Urban / Suburban (3 or more bedrooms)	2 spaces within the curtilage	Norm
Apartment (1 bedroom)	1 space per unit plus 1 visitor space per 5 units	Norm
Apartment (2 bedrooms)	1.5 space per unit plus 1 visitor space per 5 units	Norm
Apartment (3 bedrooms)	2 spaces per unit plus 1 visitor space per 5 units	Norm
Crèche	0.5 space per classroom	Maximum

Disabled Spaces	1 space or more per every 100 spaces	Norm
Electric Vehicles (EV) Spaces	1 space or more per every 100 spaces	Norm

7.2.2 Car Parking Required

Based on the car parking standard set out in the Fingal Development Plan 2017 – 2023, the total car parking required to serve the proposed development is 1,061 spaces as calculated in Table 17 below.

There are no car parking standards set out for duplexes within Fingal Development Plan. Therefore, for the purpose of calculation, the car parking standards for apartment/townhouses have been applied for the duplex units.

Table 17 Fingal Development Plan 2017 – 2023 - Car Parking Requirements

Land Use	No. Units	Car Parking Spaces Required
Houses (Maisonettes) 1 bedroom	8 units	8 spaces for residents
Houses 3 or more bedrooms	110 units	220 spaces for residents
Apartments 1 bedroom	137 units	137 spaces for residents + 27 spaces for visitors
Apartments/Duplexes 2 bedrooms	278 units	417 spaces for residents + 55 spaces for visitors
Apartments/Duplexes 3 bedrooms	88 units	176 spaces for residents + 17 spaces for visitors
Crèche	506 sqm (8 classrooms)	4 spaces
Total	621 units 506 sqm (8 classrooms)	958 spaces for residents + 99 spaces for visitors + 4 spaces for the creche

7.2.3 Design Standards for New Apartments – December 2020

In December 2018, a revised version of the document "Sustainable Urban Housing: Design Standard for New Apartments" was released. The parking standards set out in this document are considerably lower than those contained in the Fingal Development Plan 2017 – 2023 in respect to apartment developments.

The following extracts from the "Design Standards for New Apartments – December 2020" summarise the guidelines for parking:

"*In suburban/urban locations served by public transport or close to town centres or employment areas and particularly for housing schemes with more than 45 dwellings per hectare net (18 per acre), planning*

authorities must consider a reduced overall car parking standards and apply an appropriate maximum car parking standard."

7.2.4 Car Parking proposed

The number of car parking spaces projected to serve the proposed development is presented in Table 18 below.

As shown in that table, the proposed development will be served by a total of 705 car parking spaces, with 220 spaces for the houses, 8 spaces for the maisonettes, 410 spaces for the apartment & duplex residents, 32 for the apartment & duplex visitors, 4 spaces for the creche, 5 car sharing spaces, 12 EV parking spaces and 14 Accessible parking spaces.

It is acknowledged that the number of parking spaces proposed for the apartments and duplexes, are below the FCC requirements set out above. The reduced provision for these units is in line with the *'Design Standard for New Apartments – December 2020'* and reflects the location of the proposed development in relation to public transport and within the ME – Metro Economic Corridor zoned land as is in the Fingal Development Plan and Estuary West Masterplan for the lands. For further details refer to the Car Parking Strategy report accompanying the documentation package

Table 18 Proposed Car parking strategy within the development

Land Use	No. Units	Standard	Car Parking Spaces Proposed
Maisonettes	8 units	1 space per unit	8 spaces
Houses (3 and 4 Bed)	110 units	2 spaces per unit	220 spaces
Apartments	349 units	0.76 spaces per unit	266 spaces
Duplexes	154 units	1.14 spaces per unit	176 spaces
Creche	506 sqm (8 classrooms)	0.5 space per classroom	4 spaces
Accessible Parking	-	-	14 spaces
EV Parking	-	-	12 spaces
Car Sharing Spaces	-	-	5 spaces
Total	621 units 506 sqm (8 classrooms)	-	705 spaces

7.3 Cycle Parking

7.3.1 Fingal Development Plan 2017 - 2023

Standards for bicycle parking in new developments are set out in Table 12.9 of the Fingal Development Plan 2017 - 2023. Based on that, Table 19 below sets out the cycle parking requirements applicable to the subject proposed development.

Table 19 Fingal Development Plan 2017-2023 - Cycle Parking Standards

Land Use	FDP Standard	Norm or Max
Apartment	1 per unit + 1 visitor space per 5 units	Norm
Crèche	0.5 space per classroom	Norm

7.3.2 Cycle Parking Required

Based on the cycle parking standard set out in the Fingal Development Plan 2017 – 2023, the total cycle parking required to serve the proposed development is 607 spaces as calculated in Table 20.

As for car parking, the cycle parking standard for apartment/townhouses has been applied for the duplex units.

Table 20 Fingal Development Plan 2017-2023 - Cycle Parking Spaces Required

Land Use	No. Units	Cycle Parking Spaces Required
Apartment	349 units	349 spaces for apartment residents + 70 spaces for apartment visitors
Duplexes	154 units	154 spaces for duplexes residents + 30 spaces for duplexes visitors
Crèche	506 sqm (8 classrooms)	4 spaces for the creche
Total	349 apartments 154 duplexes 506 sqm (8 classrooms)	503 spaces for residents + 100 spaces for visitors + 4 spaces for the creche

.

7.3.3 Design Standard for New Apartments – December 2020

The following extracts from the "Design Standards for New Apartments – December 2020" summarise the guidelines for cycle parking:

"*A general minimum standard of 1 cycle storage space per bedroom shall be applied. For studio units, at least 1 cycle storage space shall be provided. Visitor cycle parking shall also be provided at a standard of 1 space per 2 residential units. Any deviation from these standards shall be at the discretion of the planning authority and shall be justified with respect to factors such as location, quality of facilities proposed, flexibility for future enhancement/enlargement, etc.*"

Table 21 Total cycle parking spaces required (National Standards)

Land Use	No. Units	Cycle Parking Spaces Required	Parking Required (National Standards)
Residential – Long Stay	572 Apartment bedrooms	1 space per bedroom	572
Residential – Short Stay	349 apartments	1 space per 2 units	174
Total			746

7.3.4 Cycle Parking Proposed

The number of cycle parking spaces to be provided to serve the proposed development is presented in Table 22 below.

Long stay cycle parking will be provided within curtilage for the house units.

Short stay parking will be provided at surface level within the development as shown on the Architects layout.

Long and short stay cycle parking for both the duplex units and apartment blocks will be provided in close proximity to the apartment and duplex units as indicated on the architect's drawings.

Table 22 Proposed Cycle Parking

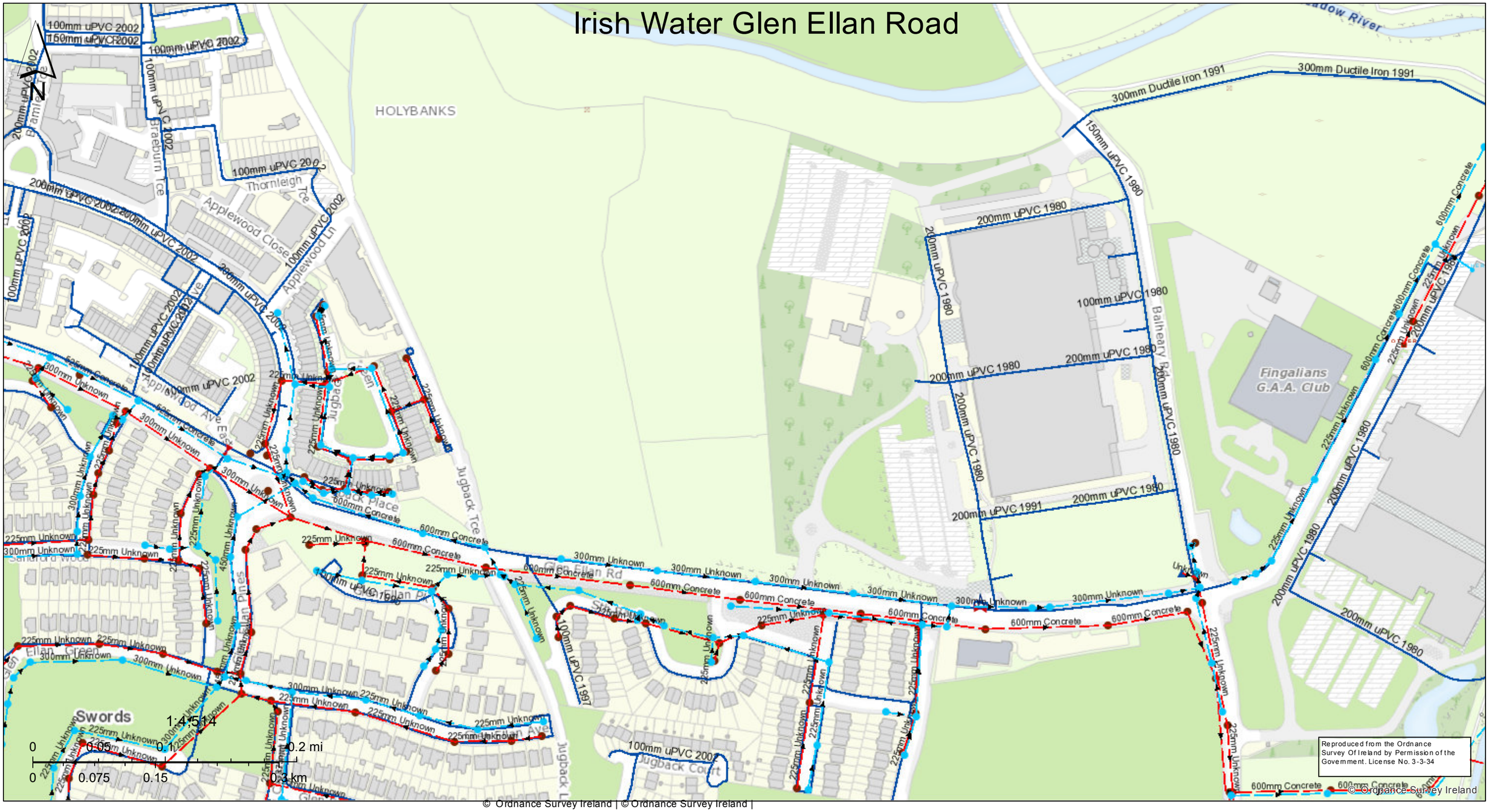
Land Use	No. Units	Proposed Standard	Proposed Bicycle Parking Spaces
Apartments	349 units	1.5 space per unit	528 spaces
Duplexes	154 units	1.56 space per unit	240 spaces
Creche	8 classrooms	1.0 space per classroom	8 spaces
Visitors	503 units	1 visitor space per 6.3 apartment/duplex units	80 spaces
Total	517 units 8 classrooms	-	856 spaces

In addition to the 856 bike parking spaces, 21 motorbike spaces will also be proposed.

APPENDICES

A. Irish Water Record Map

Irish Water Glen Ellan Road



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Legend

Stormwater Gravity Mains (Irish Water Owned)

- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)

- Surface

Storm Manholes

- Cascade
- Catchpit
- Hatchbox

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

UISCE ÉIREANN : IRISH WATER

"Gas Networks Ireland (GNI), their affiliates and assigns, accept no responsibility for any information contained in this document concerning location and technical designation of the gas distribution and transmission network ("the Information"). Any representations and warranties express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation, direct, indirect, special, incidental, punitive or consequential loss including loss of profits, arising out of or in connection with the use of the Information (including maps or mapping data). NOTE: DIAL BEFORE YOU DIG Phone 1850 427 747 or e-mail dig@gasnetworks.ie – The actual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of the gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 28 93 89) or can be downloaded free of charge at www.hsa.ie."

B. Irish Water Response to Pre-Connection Enquiry

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

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

www.water.ie

Laura Ruiz

Eastpoint Business Park
Alfie Byrne Road
Dublin 3
D03H3F4

3 February 2022

Re: CDS21007318 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 625 units at Glen Ellan Road, Holybanks, Dublin

Dear Sir/Madam,

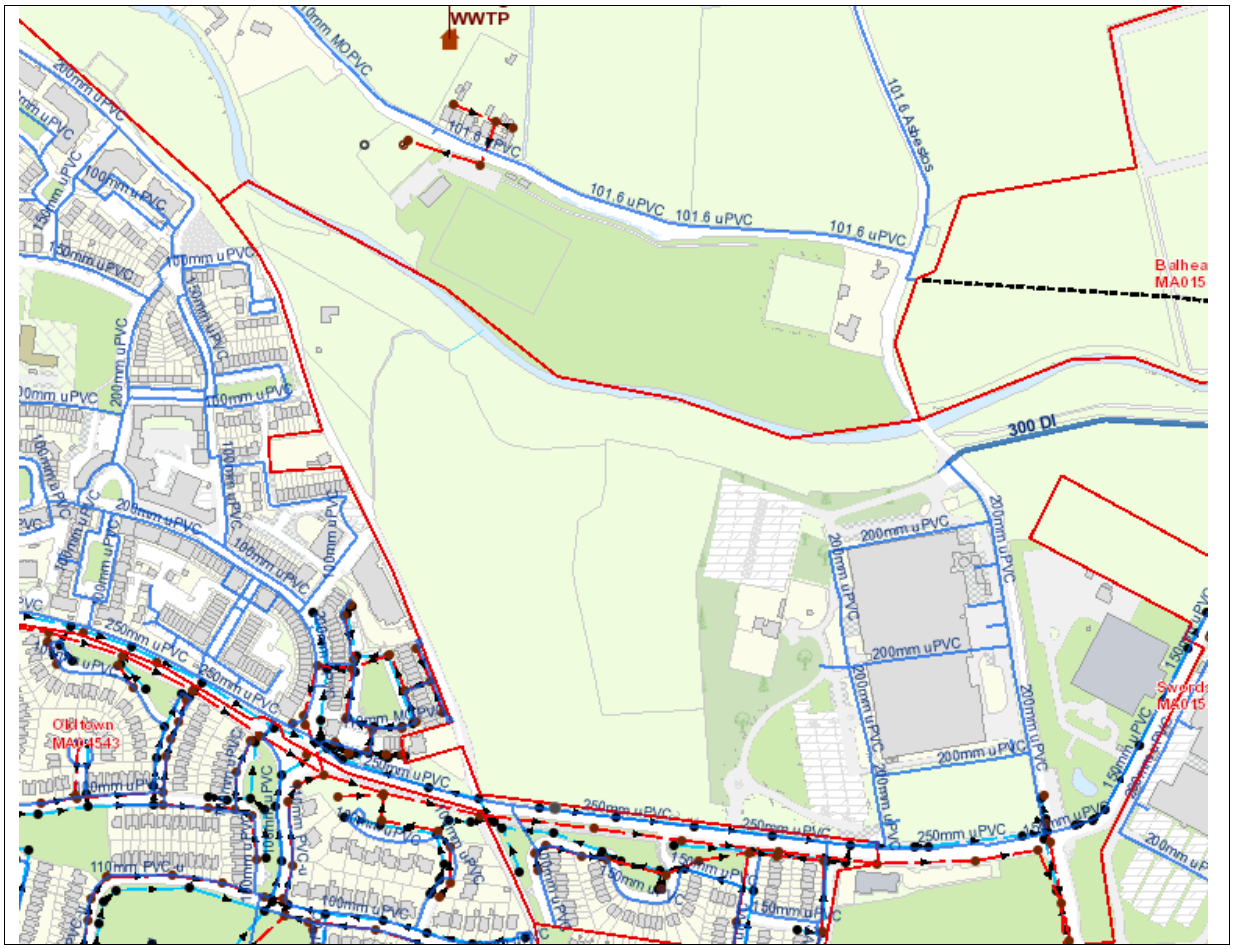
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Glen Ellan Road, Holybanks, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water networks as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water networks can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible Subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	Based on the network configuration as per IW GIS and the foreseen development demand and provided that no pressure issues have been flagged in the area the development is considered feasible with investments. • Connection main - (Approx.) 20m of new 200mm ID pipe (green line) main to be laid to connect the site development (yellow section) to the existing 300mm DI main, DMA meter and PRV to be installed on the connection main and linked with telemetry online. Green line in Figure 1 • Secondary connection main – (Approx.) 20m of new 200mm ID pipe (red line) main to be laid to connect site dev. to the existing 250mm uPVC main. Control valve to be installed on this main and set to closed during normal operations.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Dawn O'Driscoll, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1 D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

Wastewater Connection	In order to accommodate the proposed connection to the Irish Water network at the premises a storage tank will be required to manage the impacts of excessive rain fall in the sewer network downstream of the development. Irish Water does not currently have investment plans to carry out the works required to provide this storage as part of the upgrade. As part of a future connection agreement for this site, you will be requested to provide a contribution towards the costs for the required upgrade in conjunction with other developments in this contributing area. Alternatively, the Applicant has the option to wait for the results of the overall DAP in the area, currently at Stage 4. The DAP is scheduled for completion Q3 2022, subject to change.
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

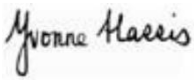
General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.

4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Tinus Walt from the design team at twalt@water.ie
For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

C. Irish Water Statement of Design Acceptance

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

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

www.water.ie

Laura Ruiz
Eastpoint Business Park Block S
Alfie Byrne Road
Dublin 3,
D03H3F4

7 March 2022

Re: Design Submission for Glen Ellan Road, Holybanks, Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS21007318

Dear Laura Ruiz,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Dario Alvarez
Email: dalvarez@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- [17-088-P040-Proposed Water Supply Layout-Sheet 1 of 4]
- [17-088-P040-Proposed Water Supply Layout-Sheet 1 of 4]
- [17-088-P040-Proposed Water Supply Layout-Sheet 1 of 4]
- [17-088-P040-Proposed Water Supply Layout-Sheet 1 of 4]
- [17-088-P200-Proposed Drainage Layout-Sheet 1 of 4]
- [17-088-P200-Proposed Drainage Layout-Sheet 1 of 4]
- [17-088-P200-Proposed Drainage Layout-Sheet 1 of 4]
- [17-088-P200-Proposed Drainage Layout-Sheet 1 of 4]
- [Foul longsections]

Standard Details/Code of Practice Exemption: N/A

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Dawn O'Driscoll, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1 D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

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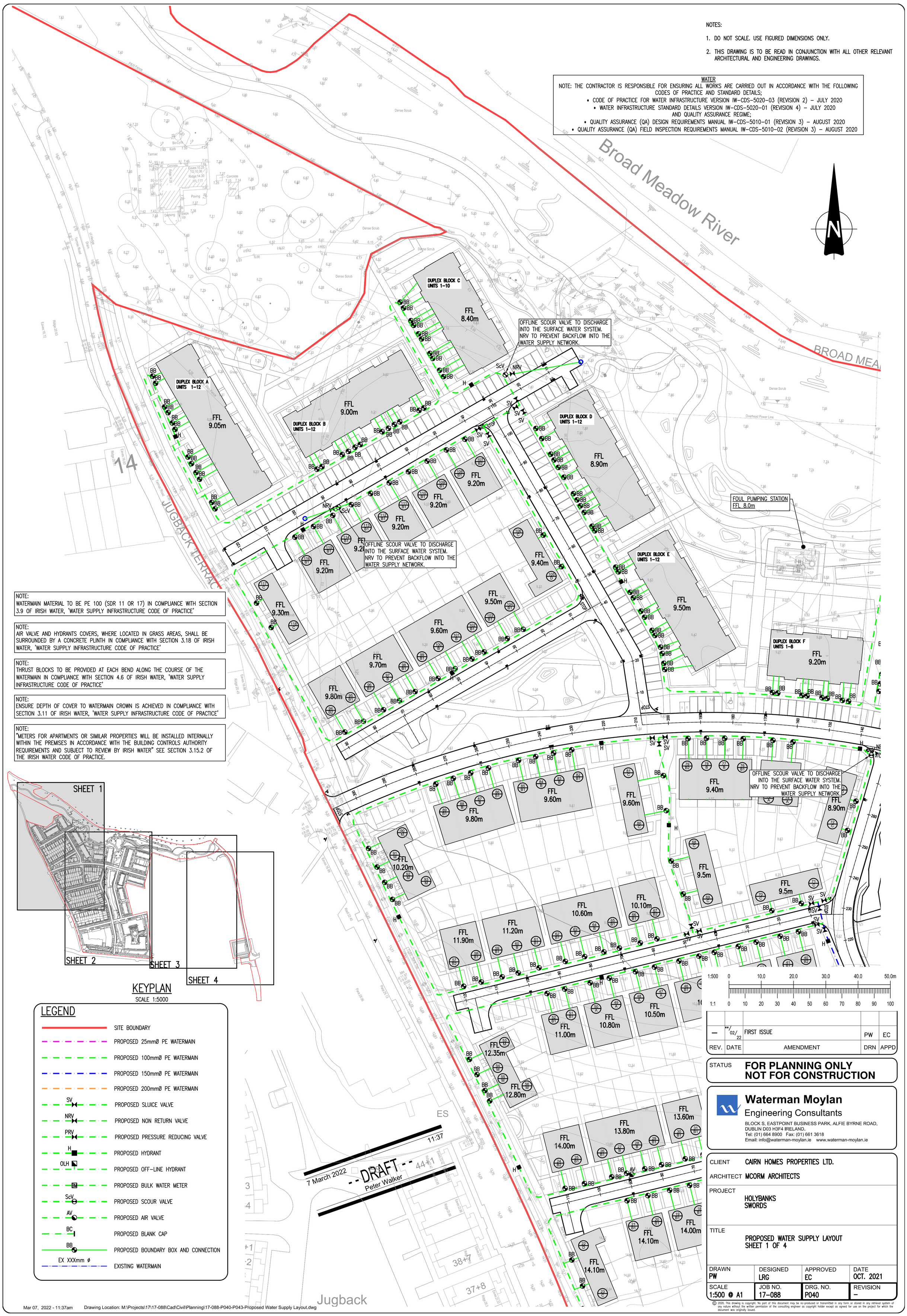

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KEYPLAN

SCALE 1:5000

LEGEND

	SITE BOUNDARY
	PROPOSED 25mmØ PE WATERMAIN
	PROPOSED 100mmØ PE WATERMAIN
	PROPOSED 150mmØ PE WATERMAIN
	PROPOSED 200mmØ PE WATERMAIN
SV	PROPOSED SLUICE VALVE
NRV	PROPOSED NON RETURN VALVE
PRV	PROPOSED PRESSURE REDUCING VALVE
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ScV	PROPOSED SCOUR VALVE
AV	PROPOSED AIR VALVE
BC	PROPOSED BLANK CAP
BB	PROPOSED BOUNDARY BOX AND CONNECTION
EX XXXmm ø	EXISTING WATERMAIN

1:500 0 10.0 20.0 30.0 40.0 50.0m

1:1 0 10 20 30 40 50 60 70 80 90 100

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Tel: (01) 664 8900 Fax: (01) 661 3618
Email: info@waterman-moylan.ie www.waterman-moylan.ie

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TITLE PROPOSED WATER SUPPLY LAYOUT SHEET 1 OF 4

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- - DRAFT - -

Peter Walker

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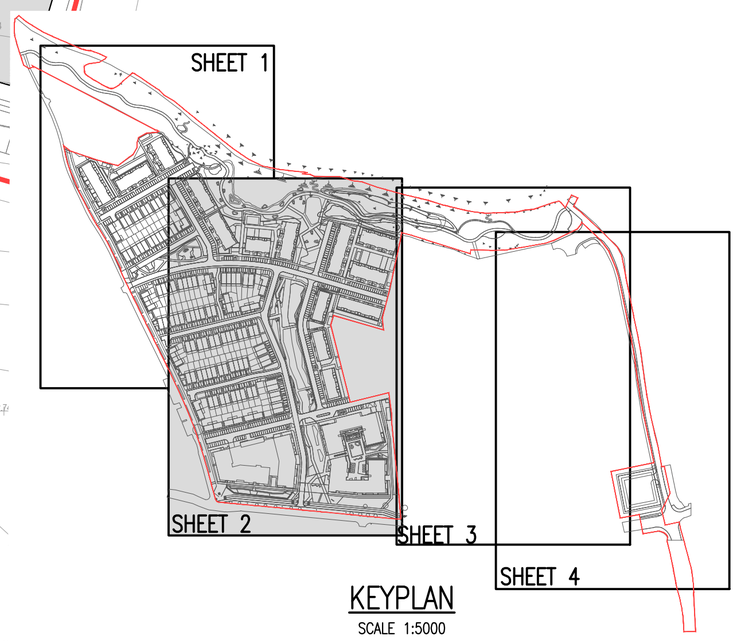

KEYPLAN
SCALE 1:5000

LEGEND

- SITE BOUNDARY
- PROPOSED 25mmØ PE WATERMAIN
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- BB — PROPOSED BOUNDARY BOX AND CONNECTION
- EX XXXmm Ø — EXISTING WATERMAIN

1:500 0 10.0 20.0 30.0 40.0 50.0m

1:1 0 10 20 30 40 50 60 70 80 90 100

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WATER

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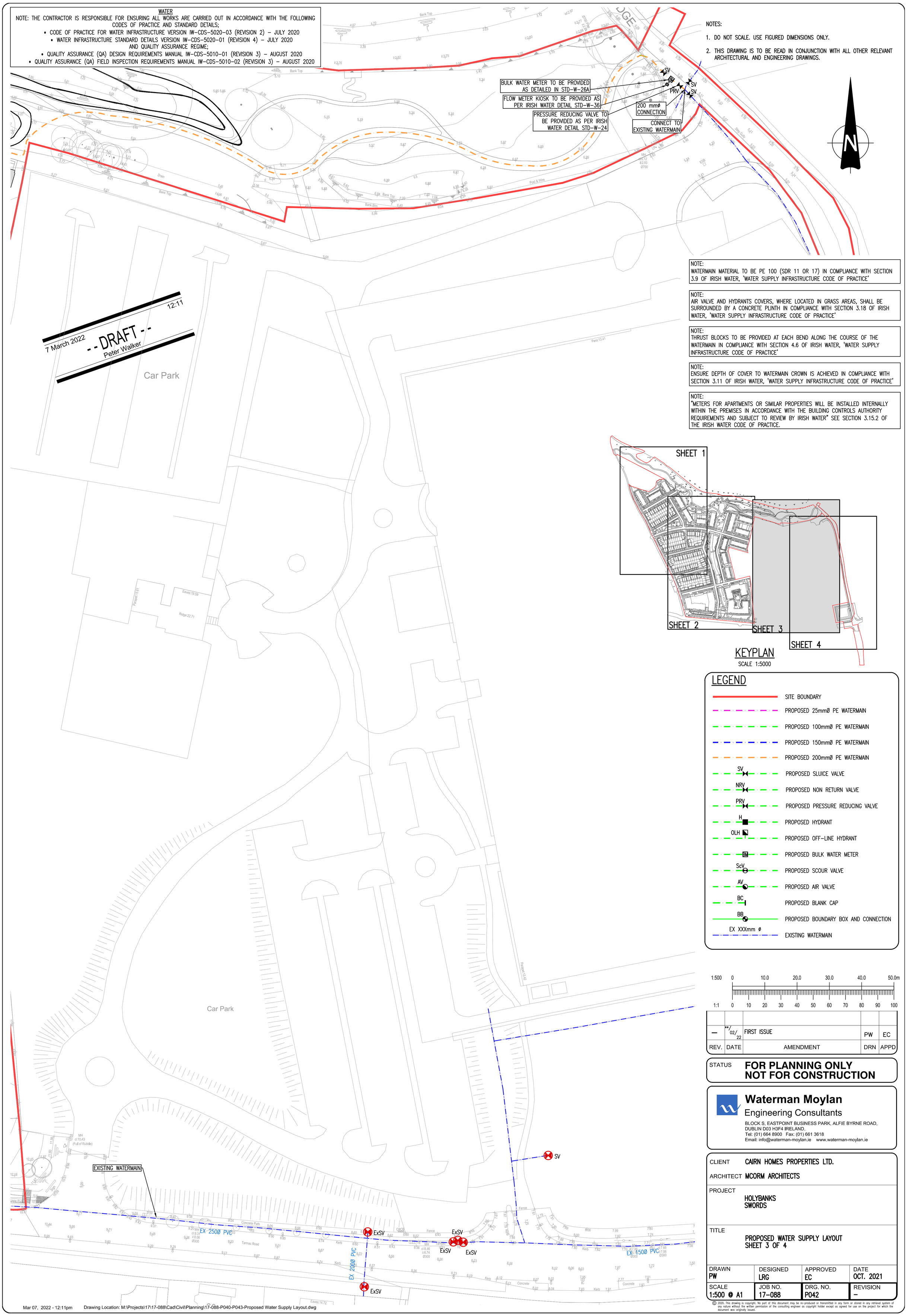

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KEYPLAN
SCALE 1:5000

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- BC — PROPOSED BLANK CAP
- BB — PROPOSED BOUNDARY BOX AND CONNECTION
- EX XXXmm Ø — EXISTING WATERMAIN

1:500 0 10.0 20.0 30.0 40.0 50.0m
1:1 0 10 20 30 40 50 60 70 80 90 100

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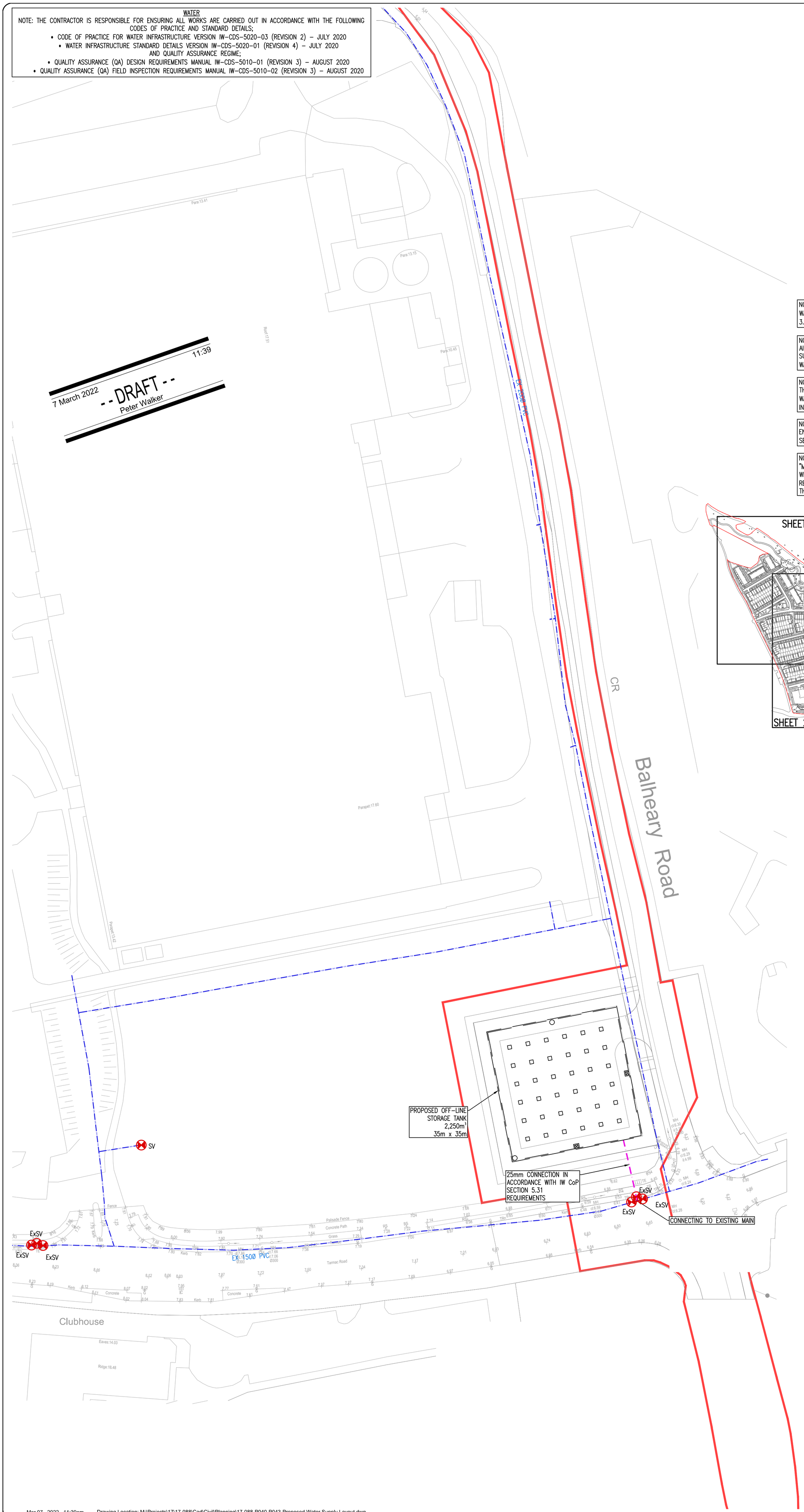
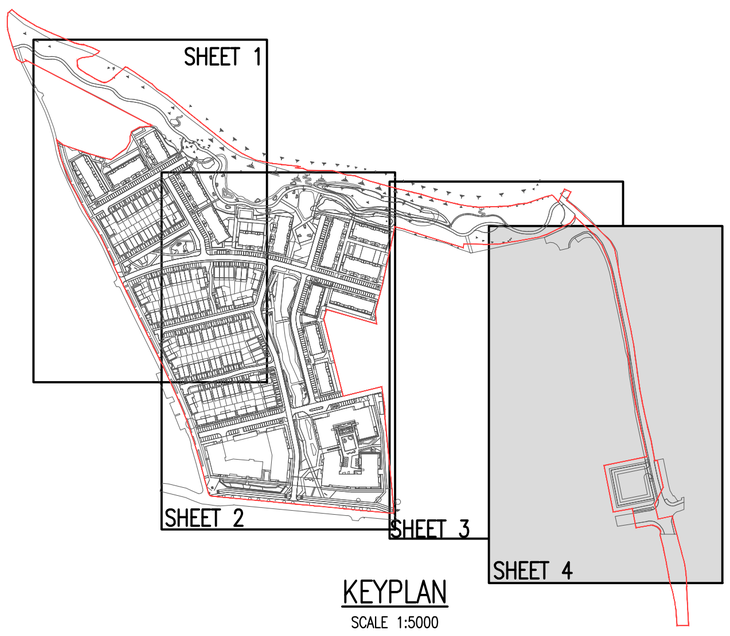
7 March 2022 11:39
- - DRAFT - -
Peter Walker





KEYPLAN
SCALE 1:5000

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- EX XXXmm Ø — EXISTING WATERMAIN

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1:1 0 10 20 30 40 50 60 70 80 90 100

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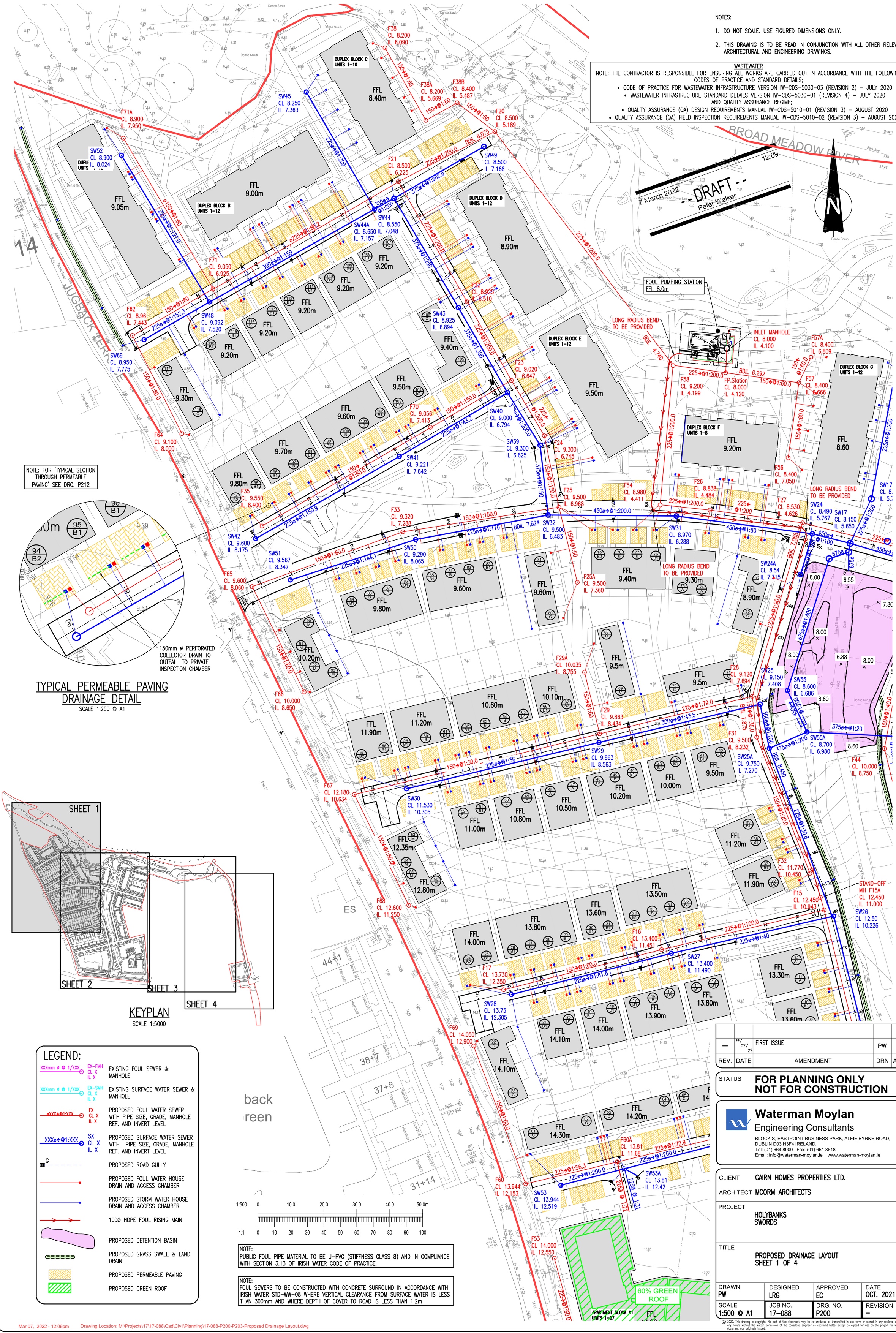

TYPICAL PERMEABLE PAVING DRAINAGE DETAIL

SCALE 1:250 @ A1

KEYPLAN

SCALE 1:5000

LEGEND:

XXXmm ø @ 1/XXX — EX-FMH CL X IL X	EXISTING FOUL SEWER & MANHOLE
XXXmm ø @ 1/XXX — EX-SMH CL X IL X	EXISTING SURFACE WATER SEWER & MANHOLE
øXXX←@1:XXX — FX CL X IL X	PROPOSED FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
XXXø←@1:XXX — SX CL X IL X	PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
G	PROPOSED ROAD GULLY
	PROPOSED FOUL WATER HOUSE DRAIN AND ACCESS CHAMBER
	PROPOSED STORM WATER HOUSE DRAIN AND ACCESS CHAMBER
	100Ø HDPE FOUL RISING MAIN
	PROPOSED DETENTION BASIN
	PROPOSED GRASS SWALE & LAND DRAIN
	PROPOSED PERMEABLE PAVING
	PROPOSED GREEN ROOF

1:500 0 10.0 20.0 30.0 40.0 50.0m

1:1 0 10 20 30 40 50 60 70 80 90 100

NOTE:
PUBLIC FOUL PIPE MATERIAL TO BE U-PVC (STIFFNESS CLASS 8) AND IN COMPLIANCE WITH SECTION 3.13 OF IRISH WATER CODE OF PRACTICE.

NOTE:
FOUL SEWERS TO BE CONSTRUCTED WITH CONCRETE SURROUND IN ACCORDANCE WITH IRISH WATER STD-WW-08 WHERE VERTICAL CLEARANCE FROM SURFACE WATER IS LESS THAN 300mm AND WHERE DEPTH OF COVER TO ROAD IS LESS THAN 1.2m

REV.	DATE	AMENDMENT	DRN	APPD
–	**/02/22	FIRST ISSUE	PW	EC

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Waterman Moylan
Engineering Consultants
BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND.
Tel: (01) 664 8900 Fax: (01) 661 3618
Email: info@waterman-moylan.ie www.waterman-moylan.ie

CLIENT CAIRN HOMES PROPERTIES LTD.

ARCHITECT MCORM ARCHITECTS

PROJECT HOLYBANKS SWORDS

TITLE PROPOSED DRAINAGE LAYOUT SHEET 1 OF 4

DRAWN	DESIGNED	APPROVED	DATE
PW	LRG	EC	OCT. 2021
SCALE	JOB NO.	DRG. NO.	REVISION
1:500 @ A1	17-088	P200	–

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NOTES:

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WASTEWATER

NOTE: THE CONTRACTOR IS RESPONSIBLE FOR ENSURING ALL WORKS ARE CARRIED OUT IN ACCORDANCE WITH THE FOLLOWING CODES OF PRACTICE AND STANDARD DETAILS;

- CODE OF PRACTICE FOR WASTEWATER INFRASTRUCTURE VERSION IW-CDS-5030-03 (REVISION 2) – JULY 2020
- WASTEWATER INFRASTRUCTURE STANDARD DETAILS VERSION IW-CDS-5030-01 (REVISION 4) – JULY 2020 AND QUALITY ASSURANCE REGIME;
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- QUALITY ASSURANCE (QA) FIELD INSPECTION REQUIREMENTS MANUAL IW-CDS-5010-02 (REVISION 3) – AUGUST 2020

KEYPLAN

SCALE 1:5000

TYPICAL PERMEABLE PAVING DRAINAGE DETAIL

SCALE 1:250 @ A1

LEGEND:

- EXISTING FOUL SEWER & MANHOLE
- EXISTING SURFACE WATER SEWER & MANHOLE
- PROPOSED FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
- PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
- PROPOSED ROAD GULLY
- PROPOSED FOUL WATER HOUSE DRAIN AND ACCESS CHAMBER
- PROPOSED STORM WATER HOUSE DRAIN AND ACCESS CHAMBER
- 100Ø HDPE FOUL RISING MAIN
- PROPOSED DETENTION BASIN
- PROPOSED GRASS SWALE & LAND DRAIN
- PROPOSED PERMEABLE PAVING
- PROPOSED GREEN ROOF

NOTE:
PUBLIC FOUL PIPE MATERIAL TO BE U-PVC (STIFFNESS CLASS 8) AND IN COMPLIANCE WITH SECTION 3.13 OF IRISH WATER CODE OF PRACTICE.

NOTE:
FOUL SEWERS TO BE CONSTRUCTED WITH CONCRETE SURROUND IN ACCORDANCE WITH IRISH WATER STD-WW-08 WHERE VERTICAL CLEARANCE FROM SURFACE WATER IS LESS THAN 300mm AND WHERE DEPTH OF COVER TO ROAD IS LESS THAN 1.2m

1:500 0 10.0 20.0 30.0 40.0 50.0m

1:1 0 10 20 30 40 50 60 70 80 90 100

REV.	DATE	AMENDMENT	DRN	APPD
–	**/02/22	FIRST ISSUE	PW	EC

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Email: info@waterman-moylan.ie www.waterman-moylan.ie

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PROJECT HOLYBANKS SWORDS

TITLE PROPOSED DRAINAGE LAYOUT SHEET 2 OF 4

DRAWN	DESIGNED	APPROVED	DATE
PW	LRG	EC	OCT. 2021
SCALE	JOB NO.	DRG. NO.	REVISION
1:500 @ A1	17-088	P201	–

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Mar 07, 2022 - 11:48am Drawing Location: M:\Projects\17\17-088\Cad\Civil\Planning\17-088-P200-P203-Proposed Drainage Layout.dwg

WASTEWATER

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NOTES:

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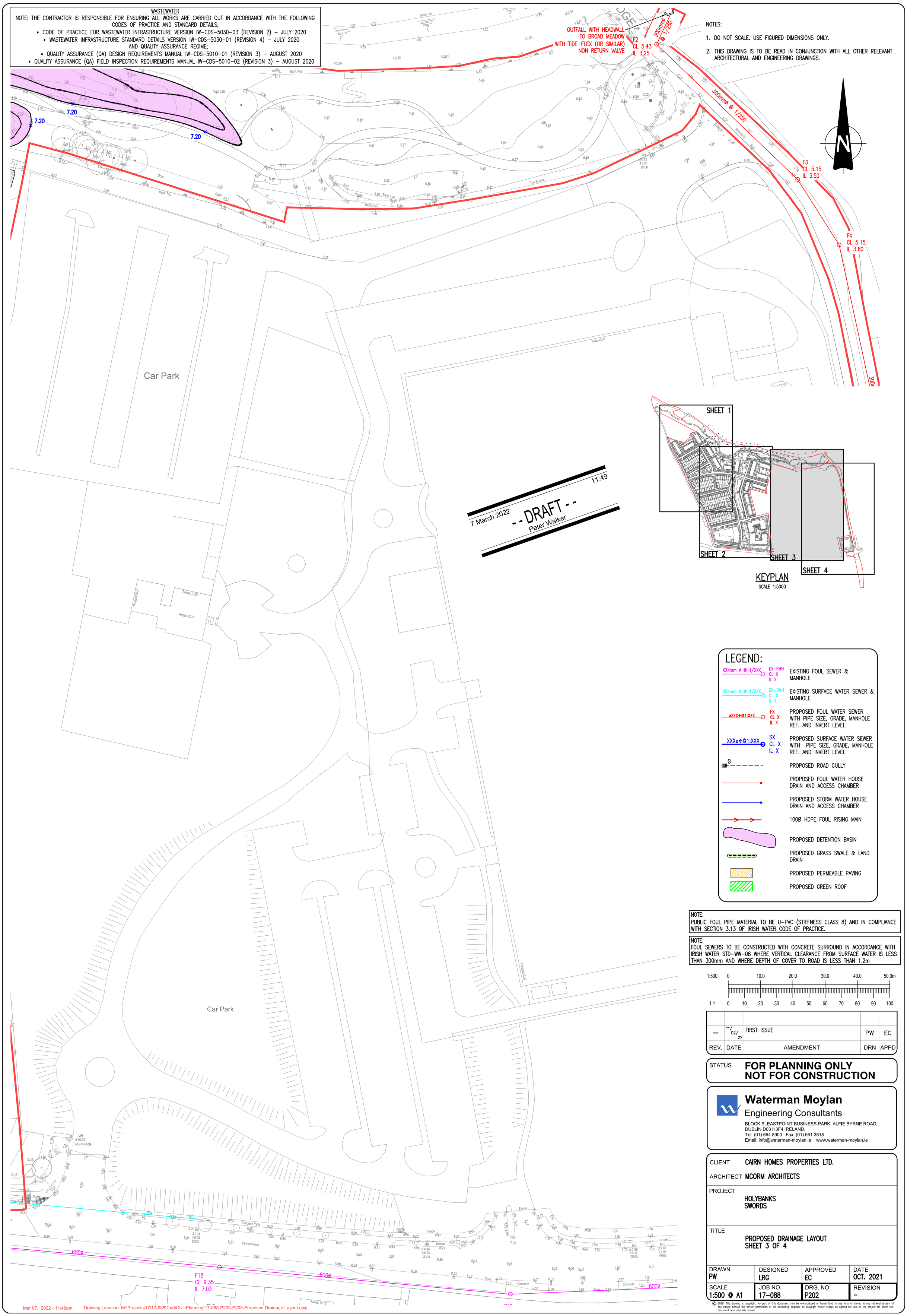

LEGEND:

XXXmm ø @ 1/XXX — EX-FMH CL X IL X	EXISTING FOUL SEWER & MANHOLE
XXXmm ø @ 1/XXX — EX-SMH CL X IL X	EXISTING SURFACE WATER SEWER & MANHOLE
øXXX←@1:XXX — FX CL X IL X	PROPOSED FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
XXXø←@1:XXX — SX CL X IL X	PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
G	PROPOSED ROAD GULLY
	PROPOSED FOUL WATER HOUSE DRAIN AND ACCESS CHAMBER
	PROPOSED STORM WATER HOUSE DRAIN AND ACCESS CHAMBER
	100Ø HDPE FOUL RISING MAIN
	PROPOSED DETENTION BASIN
	PROPOSED GRASS SWALE & LAND DRAIN
	PROPOSED PERMEABLE PAVING
	PROPOSED GREEN ROOF

NOTE:
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1:500 0 10.0 20.0 30.0 40.0 50.0m

1:1 0 10 20 30 40 50 60 70 80 90 100

REV.	DATE	AMENDMENT	DRN	APPD
–	**/02/22	FIRST ISSUE	PW	EC

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BLOCK S, EASTPOINT BUSINESS PARK, ALFIE BYRNE ROAD, DUBLIN D03 H3F4 IRELAND.
Tel: (01) 664 8900 Fax: (01) 661 3618
Email: info@waterman-moylan.ie www.waterman-moylan.ie

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ARCHITECT MCORM ARCHITECTS

PROJECT HOLYBANKS SWORDS

TITLE PROPOSED DRAINAGE LAYOUT SHEET 3 OF 4

DRAWN	DESIGNED	APPROVED	DATE
PW	LRG	EC	OCT. 2021
SCALE	JOB NO.	DRG. NO.	REVISION
1:500 @ A1	17-088	P202	–

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WASTEWATER

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AND QUALITY ASSURANCE REGIME;

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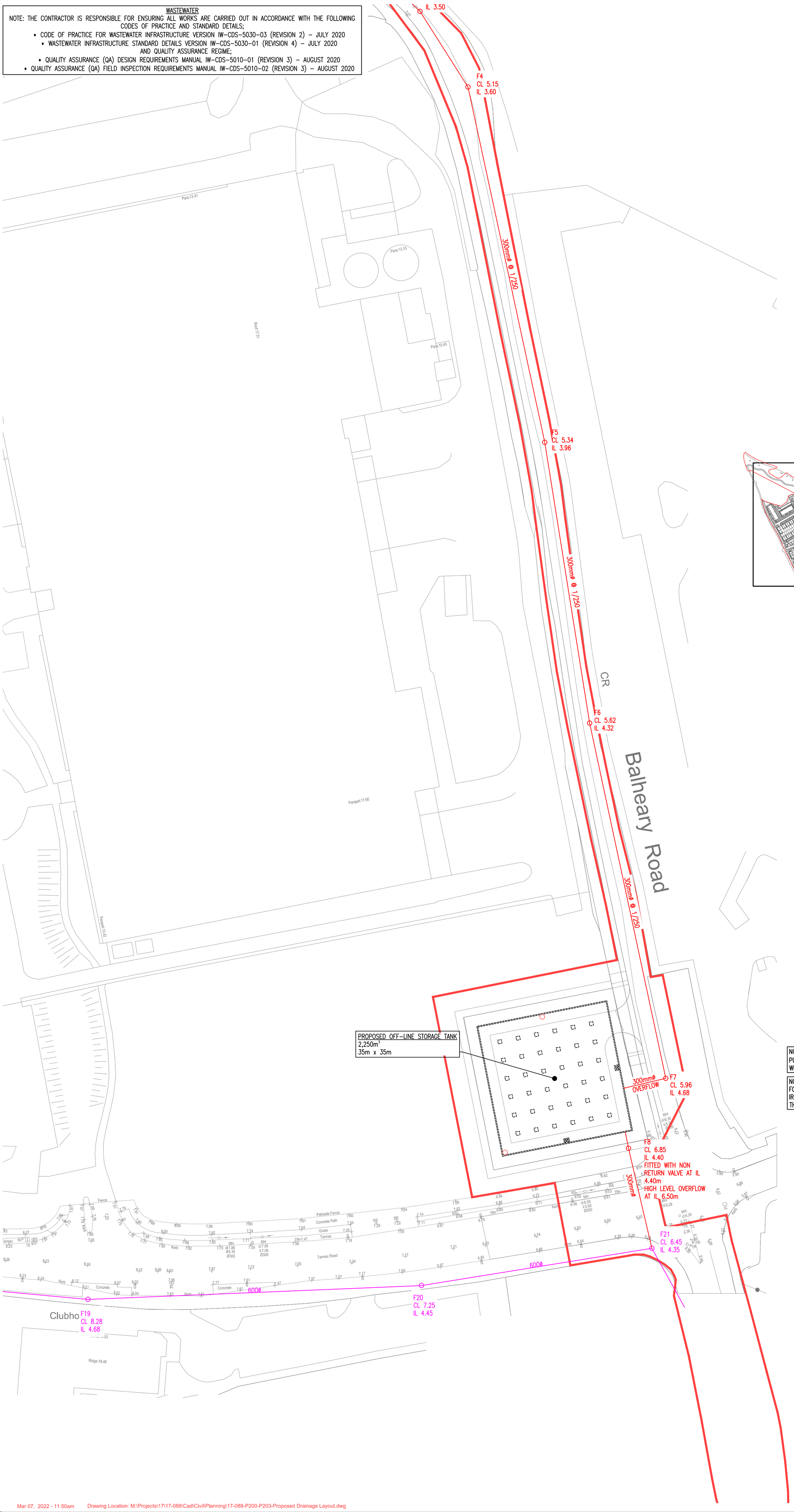

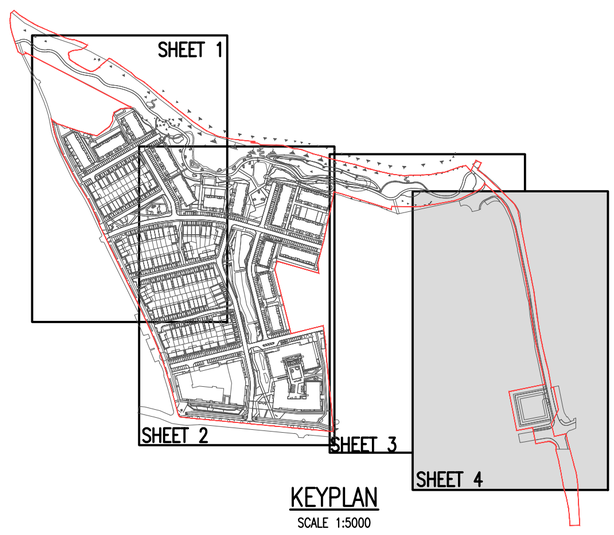

KEYPLAN
SCALE 1:5000

7 March 2022 11:50
- - DRAFT - -
Peter Walker

LEGEND:

XXXmm ø @ 1/XXX — EX-FMH CL X IL X	EXISTING FOUL SEWER & MANHOLE
XXXmm ø @ 1/XXX — EX-SMH CL X IL X	EXISTING SURFACE WATER SEWER & MANHOLE
øXXX←@1:XXX — FX CL X IL X	PROPOSED FOUL WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
XXXø←@1:XXX — SX CL X IL X	PROPOSED SURFACE WATER SEWER WITH PIPE SIZE, GRADE, MANHOLE REF. AND INVERT LEVEL
G	PROPOSED ROAD GULLY
	PROPOSED FOUL WATER HOUSE DRAIN AND ACCESS CHAMBER
	PROPOSED STORM WATER HOUSE DRAIN AND ACCESS CHAMBER
	100Ø HDPE FOUL RISING MAIN
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1:500 0 10.0 20.0 30.0 40.0 50.0m
1:1 0 10 20 30 40 50 60 70 80 90 100

REV.	DATE	AMENDMENT	DRN	APPD
–	**/02/22	FIRST ISSUE	PW	EC

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PROJECT HOLYBANKS SWORDS

TITLE PROPOSED DRAINAGE LAYOUT SHEET 4 OF 4

DRAWN	DESIGNED	APPROVED	DATE
PW	LRG	EC	OCT. 2021
SCALE 1:500 @ A1	JOB NO. 17-088	DRG. NO. P203	REVISION –

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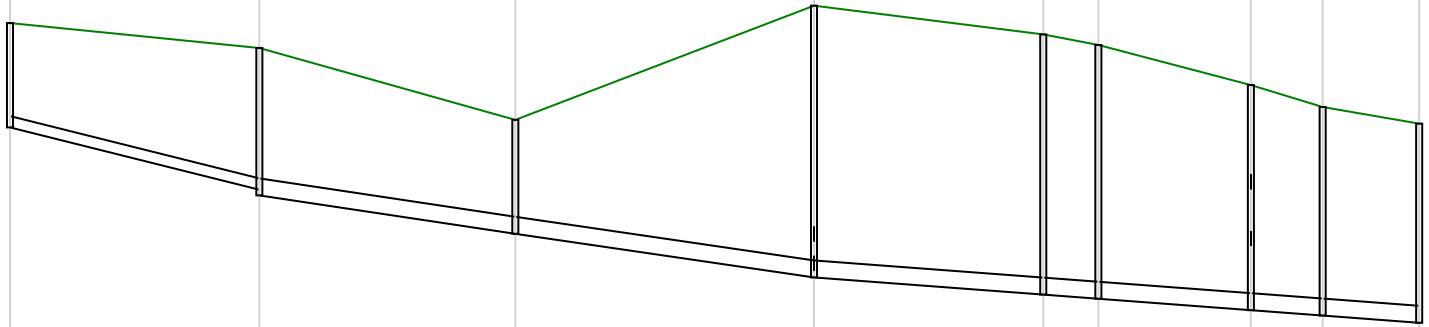
CAUSEWAY	Waterman Moylan Consulting	File: 2022-02-16 Final Network.pfd Network: Foul Laura Ruiz 18/02/2022	Page 1 17-088 Holybanks, Swords Foul Longsections

Node Name	17	16	15	10	9	8	3	2	1



A4 drawing

Hor Scale 1500
Ver Scale 100

Datum (m) 6.000

Link Name	17	16	15	10	9	8	3	2
Section Type	150mm	225mm	225mm	225mm	225m	225mm	225mr	225mm
Slope (1:X)	60.0	100.0	102.7	200.0	200.0	200.0	200.0	200.0
Cover Level (m)	13.730	13.400	12.450	13.960	13.580	13.440	12.910	12.620
Invert Level (m)	12.350 11.526	11.451 10.943	10.943 10.366	10.366 10.139	10.139 10.084	10.084 9.933	9.933 9.862	9.862 9.766
Length (m)	49.461	50.774	59.244	45.473	10.93	30.253	14.237	19.145

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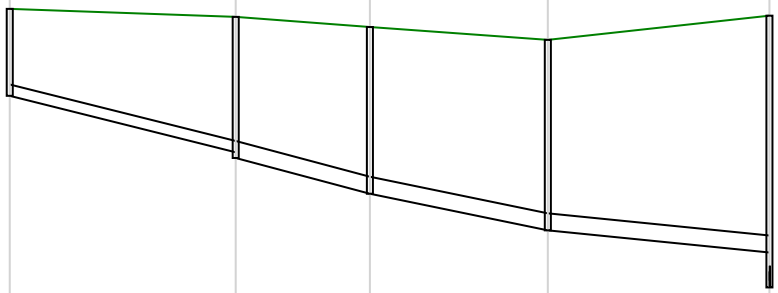
Node Name	69	60	60A	13	10
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 6.000					
Link Name	69	60	60A	13	
Section Type	150mm	225mm	225mm	225mm	
Slope (1:X)	60.0	56.3	72.9	150.0	
Cover Level (m)	14.050	13.944	13.810	13.640	13.960
Invert Level (m)	12.900 12.153	12.078 11.605	11.605 11.121	11.121 10.828	
Length (m)	44.821	26.618	35.292	43.956	

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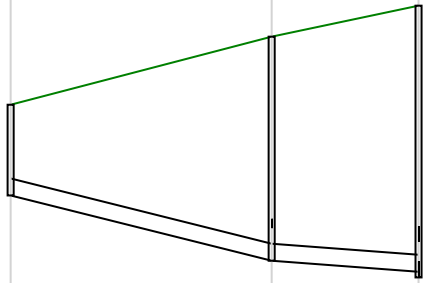
Node Name	75	11	10
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 6.000			
Link Name	75	11	
Section Type	225mm	225mm	
Slope (1:X)	60.0	200.0	
Cover Level (m)	12.650	13.550	13.960
Invert Level (m)	11.450 / 10.587	10.587 / 10.441	
Length (m)	51.776	29.133	

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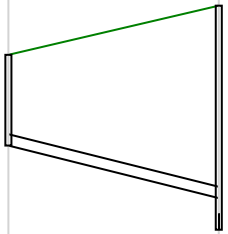
Node Name	59	11
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 6.000		
Link Name	59	
Section Type	150mm	
Slope (1:X)	60.0	
Cover Level (m)	12.900	13.550
Invert Level (m)	11.700	11.005
Length (m)	41.729	

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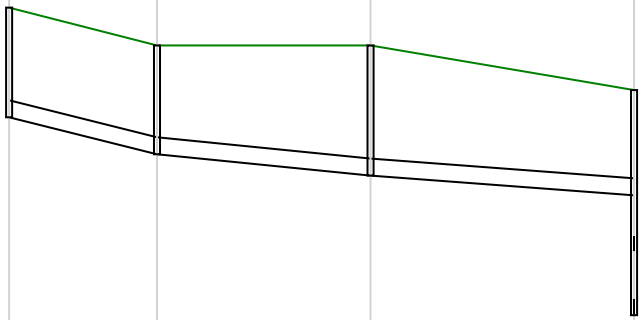
Node Name	53	52	51	3
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 6.000				
Link Name	53	52	51	
Section Type	225mm	225mm	225mm	
Slope (1:X)	60.0	150.0	200.0	
Cover Level (m)	14.000	13.500	13.500	12.910
Invert Level (m)	12.550 / 12.061	12.061 / 11.779	11.779 / 11.518	
Length (m)	29.332	42.357	52.269	

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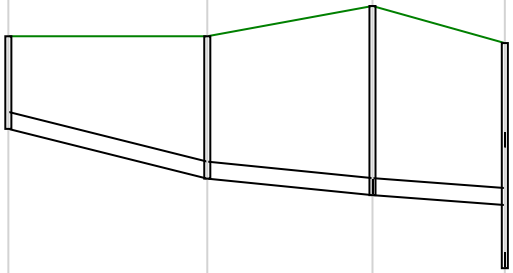
Node Name	74	6	4	3
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 6.000				
Link Name	74	6	4	
Section Type	225mm	225mm	225mm	
Slope (1:X)	60.0	150.0	200.0	
Cover Level (m)	13.000	13.000	13.400	12.910
Invert Level (m)	11.775 / 11.117	11.117 / 10.899	10.899 / 10.768	
Length (m)	39.460	32.766	26.252	

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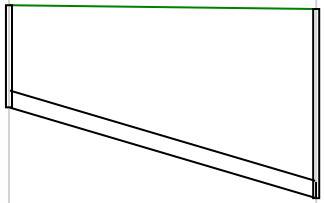
Node Name		5	4
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 6.000			
Link Name		5	
Section Type		225mm	
Slope (1:X)		50.7	
Cover Level (m)		13.450	13.400
Invert Level (m)		12.100	10.899
Length (m)		60.939	

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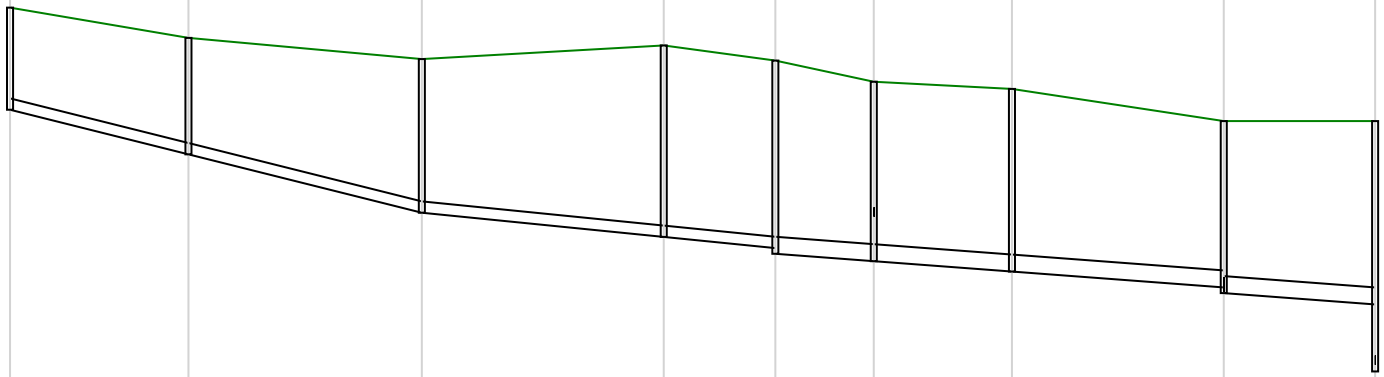
Node Name	66	65	33	25	24	23	22	21	20
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 2.000									
Link Name	66	65	33	25	24	23	22	21	
Section Type	150mm	150mm	150mm	150mm	225mm	225mm	225mm	225mm	
Slope (1:X)	60.0	60.0	150.0	150.0	200.0	200.0	200.0	200.0	
Cover Level (m)	10.000	9.600	9.320	9.500	9.300	9.020	8.925	8.500	8.500
Invert Level (m)	8.650 8.060	8.060 7.288	7.288 6.968	6.968 6.820	6.745 6.647	6.647 6.510	6.510 6.300	6.225 6.075	
Length (m)	35.389	46.290	47.982	22.138	19.525	27.407	42.012	30.025	

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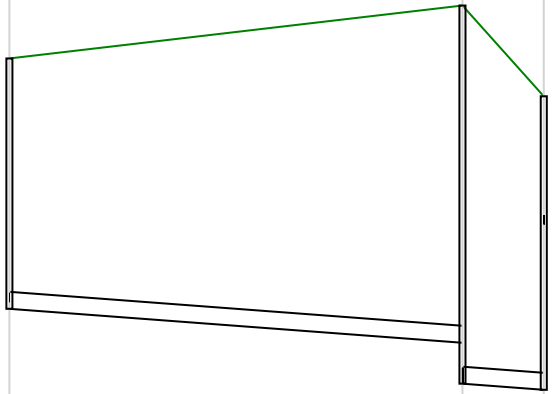
Node Name	20	58	P.Station
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 1.000			
Link Name	20	58	
Section Type	225mm	225mm	
Slope (1:X)	200.0	200.0	
Cover Level (m)	8.500	9.200	8.000
Invert Level (m)	5.189	4.740 4.199	4.118
Length (m)	89.866	16.128	

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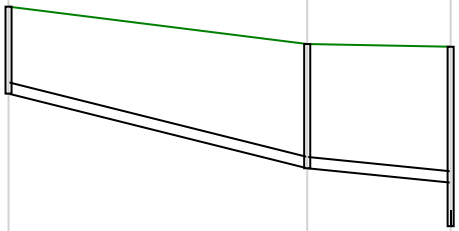
Node Name	35	70	23
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 2.000			
Link Name	35	70	
Section Type	150mm	150mm	
Slope (1:X)	60.0	150.0	
Cover Level (m)	9.550	9.056	9.020
Invert Level (m)	8.400 / 7.413	7.413 / 7.223	
Length (m)	59.244	28.450	

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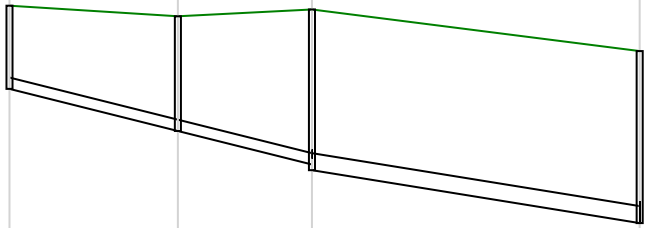
Node Name	64	62	71	21
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 2.000				
Link Name	64	62	71	
Section Type	150mm	150mm	225mm	
Slope (1:X)	60.0	60.0	92.9	
Cover Level (m)	9.100	8.960	9.050	8.500
Invert Level (m)	8.000 / 7.443	7.443 / 7.000	6.925 / 6.225	
Length (m)	33.398	26.594	65.004	

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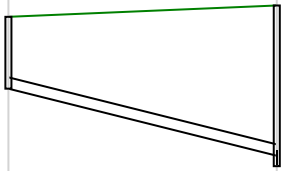
Node Name	63	71
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 2.000		
Link Name	63	
Section Type	150mm	
Slope (1:X)	60.0	
Cover Level (m)	8.900	9.050
Invert Level (m)	7.950	7.063
Length (m)	53.229	

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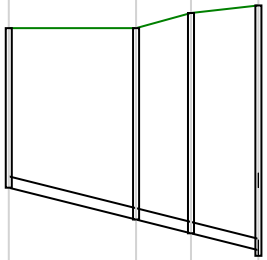
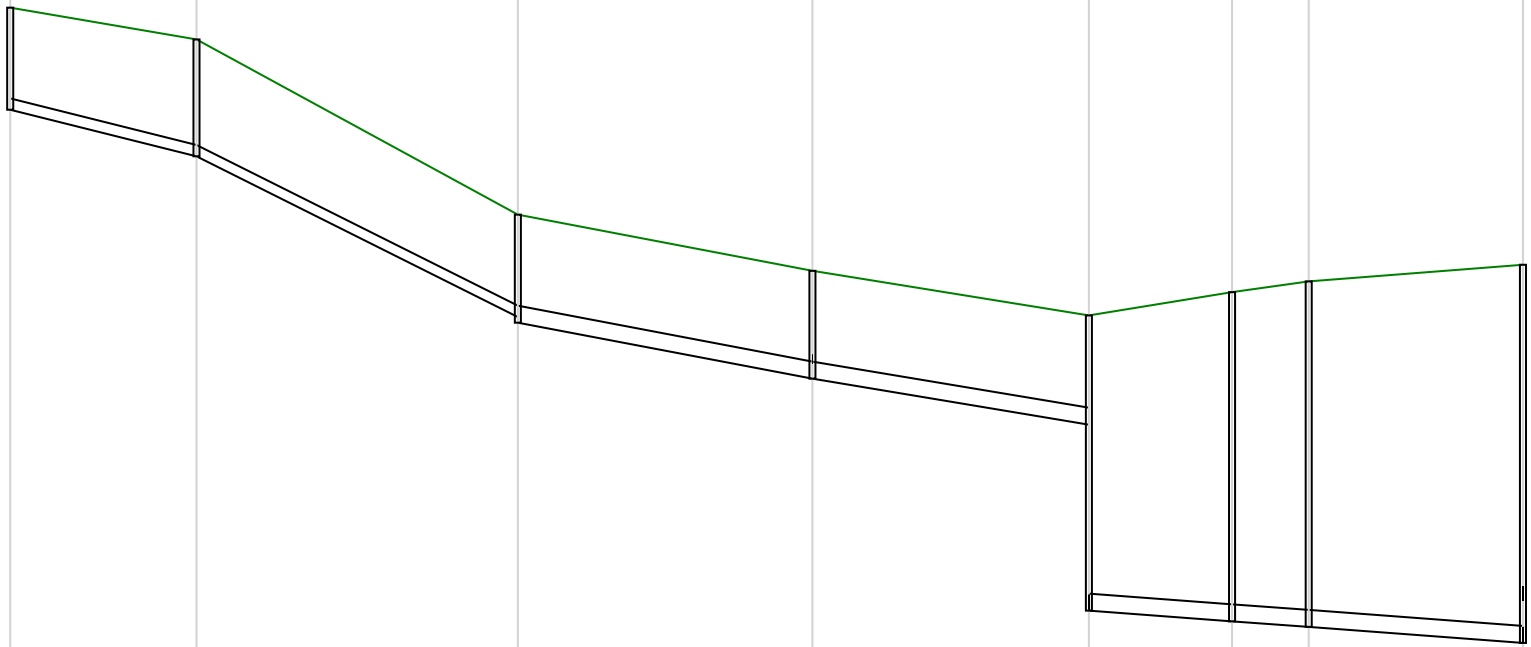
Node Name	38	38A	38B	20
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 1.000				
Link Name	38	38A	38B	
Section Type	150mm	150m	150mı	
Slope (1:X)	60.0	60.0	60.0	
Cover Level (m)	8.200	8.200	8.400	8.500
Invert Level (m)	6.090 5.669	5.669 5.487	5.487 5.264	
Length (m)	25.250	10.89	13.37(	

Node Name	68	67	29	28	27	26	54	58



A4 drawing

Hor Scale 1500
Ver Scale 100

Datum (m) 3.000

Link Name	68	67	29	28	27	26	54
Section Type	150mm	150mm	225mm	225mm	225mm	225mm	225mm
Slope (1:X)	60.0	30.0	79.0	90.0	200.0	208.3	200.0
Cover Level (m)	12.600	12.180	9.863	9.120	8.530	8.838	8.980	9.200
Invert Level (m)	11.250 10.634	10.634 8.509	8.434 7.694	7.694 7.085	4.626 4.484	4.484 4.411	4.411 4.199
Length (m)	36.946	63.743	58.433	54.836	28.395	15.206	42.497

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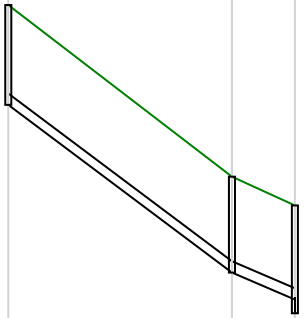
Node Name	32	31	28
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 4.000			
Link Name	32	31	
Section Type	150mm	150m	
Slope (1:X)	20.0	35.0	
Cover Level (m)	11.770	9.500	9.120
Invert Level (m)	10.450 / 8.232	8.232 / 7.875	
Length (m)	44.366	12.48	

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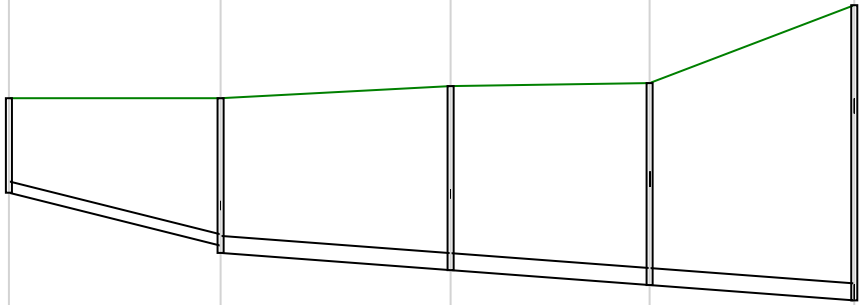
Node Name	72	47	46	41	27
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 1.000					
Link Name	72	47	46	41	
Section Type	150mm	225mm	225mm	225mm	
Slope (1:X)	60.0	200.1	200.0	200.0	
Cover Level (m)	7.300	7.300	7.460	7.500	8.530
Invert Level (m)	6.050 5.350	5.254 5.026	5.026 4.829	4.829 4.626	
Length (m)	41.989	45.624	39.472	40.596	

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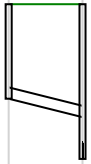
Node Name	73	47
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 1.000		
Link Name	73	
Section Type	150mn	
Slope (1:X)	60.0	
Cover Level (m)	7.300	7.300
Invert Level (m)	6.050	5.806
Length (m)	14.646	

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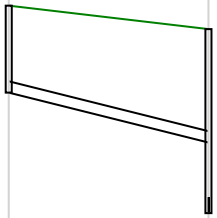
Node Name	76	46
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 1.000		
Link Name	76	
Section Type	150mm	
Slope (1:X)	60.0	
Cover Level (m)	7.770	7.460
Invert Level (m)	6.620	5.960
Length (m)	39.615	

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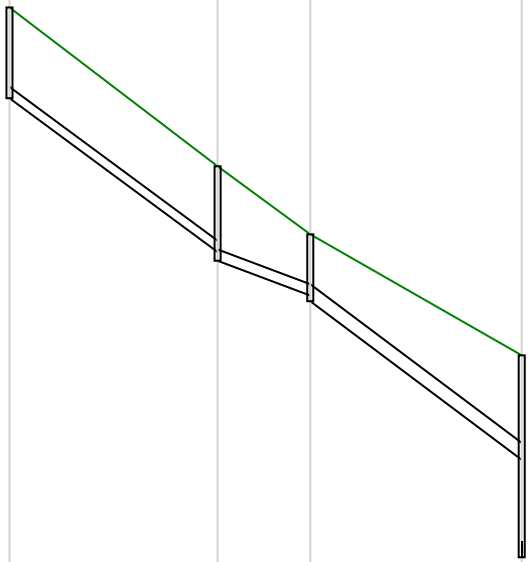
Node Name	45	44	43	41
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 3.000				
Link Name	45	44	43	
Section Type	150mm	150mm	225mm	
Slope (1:X)	20.3	40.0	20.0	
Cover Level (m)	12.100	10.000	9.100	7.500
Invert Level (m)	10.900 / 8.866	8.750 / 8.290	8.215 / 6.118	
Length (m)	41.282	18.387	41.935	

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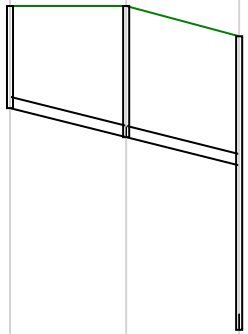
Node Name		56	57	P.Station
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 1.000				
Link Name		56	57	
Section Type		150mm	150mm	
Slope (1:X)		60.0	60.0	
Cover Level (m)		8.400	8.400	8.000
Invert Level (m)		7.050 6.666	6.666 6.292	
Length (m)		23.045	22.411	

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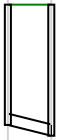
Node Name	57A	57
A4 drawing Hor Scale 1500 Ver Scale 100 Datum (m) 2.000		
Link Name	57A	
Section Type	150	
Slope (1:X)	60.2	
Cover Level (m)	8.400	8.400
Invert Level (m)	6.809 6.809	
Length (m)	8.61	

D. Fingal County Council Pro forma for SUDS

SUDS/Green Infrastructure measures selected for this site

Suds Measures	Measures to be used on this site	Rationale for selecting/not selecting measure
Source Control		
Swales	✓	Sufficient area available on the subject site. Swales provided along roadside verges where possible.
Tree Pits	X	Other SuDS utilised in proposed development.
Rainwater Butts	X	Other SuDS utilised in proposed development.
Rainwater harvesting	X	Other SuDS utilised in proposed development.
Soakaways	Possible	A lined soakaway to prevent infiltration of groundwater referred as attenuation area is used in catchment A before discharging to public Sewer on Glen Ellan Road.
Infiltration trenches	X	Other SuDS utilised in proposed development.
Permeable pavement	✓	Primary treatment of first flush in private carparking areas.
- Grasscrete	X	
- Block paving	✓	As above
- Porous Asphalt	X	
Green Roofs	✓	Green roof used on apartment blocks to reduce peak flow rates of minor storm events
Filter strips	X	Other SuDS utilised in proposed development.
Bio-retention systems/Raingardens	X	Other SuDS utilised in proposed development and not part of landscape architect design
Blue Roofs	X	Attenuation provided in open area is sufficient.
Filter Drain	X	Other SUDS utilized in proposed development
Site Control		
Detention Basins	✓	Large green areas available to facilitate detention basins Located in Catchments B and C
Retentions basins	X	Water holding SUDS features are not in keeping with the landscape design and the proximity of the development to the Broadmeadow River. Detention Basins and swales are incorporated to provide the necessary treatment.
Regional Control		
Ponds	X	Water holding SUDS features are not in keeping with the landscape design and the proximity of the development to the Broadmeadow River. Detention Basins and swales are incorporated to provide the necessary treatment.
Wetlands	X	Water holding SUDS features are not in keeping with the landscape design and the proximity of the development to the Broadmeadow River. Detention Basins and swales are incorporated to provide the necessary treatment.
Other		
Petrol/Oil interceptor	✓	Provides additional treatment of surface water
Attenuation tank – only as a last resort where other measures are not feasible	X	Not needed as storage for 1:30 and 1:100 year storm is being provided at Detention Basin

E. Surface Water Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	15.100	Minimum Backdrop Height (m)	0.300
Ratio-R	0.273	Preferred Cover Depth (m)	1.000
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
51	0.053	4.00		9.567	1200	717598.229	748218.096	1.225
50	0.073	4.00		9.290	1200	717636.448	748229.627	1.225
49	0.042	4.00		8.500	1350	717657.184	748348.898	1.332
48	0.209	4.00		9.092	1200	717573.833	748301.656	1.572
45	0.099	4.00		8.250	1200	717603.257	748365.451	0.887
44				8.550	1350	717629.909	748333.152	1.502
43	0.139	4.00		8.925	1350	717649.415	748300.041	2.031
42		4.00		9.600	1200	717587.874	748229.864	1.425
41	0.068	4.00		9.221	1200	717631.491	748254.806	1.379
40	0.185	4.00		9.000	1350	717664.360	748274.145	2.206
39	0.056	4.00		9.300	1350	717674.246	748258.234	2.600
32	0.140	4.00		9.500	1350	717676.669	748237.047	3.017
31	0.088	4.00		8.970	1350	717715.618	748236.753	2.682
30	0.144	4.00		11.530	1200	717633.678	748153.953	1.225
29	0.221	4.00		9.863	1200	717692.132	748168.016	1.300
28	0.133	4.00		13.730	1200	717665.520	748091.507	1.425
27	0.214	4.00		13.400	1200	717714.097	748104.023	1.910
26	0.144	4.00		12.500	1200	717763.385	748115.310	2.274
26A	0.050	4.00		13.500	1200	717773.188	748076.419	1.425
25A	0.051	4.00		9.750	1350	717743.824	748166.227	2.480
25	0.159	4.00		9.150	1200	717741.245	748178.645	1.742
24A	0.041	4.00		8.540	1200	717751.329	748219.498	1.225
24	0.262	4.00		8.490	1350	717756.909	748231.352	2.723
17	0.014	4.00		8.150	1800	717768.380	748228.468	2.501
16	0.166	4.00		7.830	1200	717872.270	748198.554	1.380
12	0.090	4.00		13.792	1200	717778.035	748059.138	2.022
11	0.144	4.00		12.177	1200	717874.269	748082.564	1.225
10	0.024	4.00		13.523	1350	717806.728	748066.398	3.466
9	0.101	4.00		13.100	1350	717795.931	748112.243	3.278
8	0.040	4.00		9.850	1350	717782.050	748169.843	1.453
8A	0.036	4.00		10.600	1350	717784.147	748154.937	1.450
6a	0.042	4.00		8.100	1200	717791.288	748207.975	1.225
6	0.125	4.00		7.500	1500	717798.346	748219.473	2.210
5	0.074	4.00		7.114	1500	717808.682	748257.995	2.223
4	0.087	4.00		6.900	1800	717818.117	748288.119	2.475
2				6.900	1800	717847.926	748319.486	2.763
52	0.161	4.00		8.900	1200	717547.150	748346.246	0.876
53	0.033	4.00		13.944	1200	717680.567	748033.642	1.425
54	0.301	4.00		13.740	1200	717745.039	748050.352	1.629
44A	0.113	4.00		8.650	1200	717623.984	748329.898	1.568
55				8.600	1500	717749.331	748183.799	1.914

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Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
57				8.600	2100	717767.929	748225.763	2.037
58		4.00		7.300	1200	717875.533	748251.479	1.537
59	0.031	4.00		7.300	1200	717841.351	748261.075	1.724
60	0.016	4.00		7.460	1200	717828.015	748211.183	1.240
61	0.062	4.00		7.300	1200	717847.360	748279.307	1.837
7	0.010	4.00		12.300	1200	717872.806	748087.687	1.193
62	0.063	4.00		13.800	1200	717708.091	748011.566	0.825
63	0.063	4.00		13.800	1200	717750.652	748007.254	1.117
64	0.063	4.00		13.800	1200	717749.827	747994.128	0.825
65	0.063	4.00	4.0	13.800	1200	717746.712	748034.766	1.331
100				12.802	1200	717802.251	747965.760	1.479
66		4.00		13.800		717781.870	748048.165	0.900
67				13.410		717789.819	748010.561	0.900
68				12.802	1200	717782.805	747967.289	1.069
EX SW				12.340	1200	717807.912	747953.262	1.086
68A	0.036	4.00		13.220	1200	717785.716	747991.651	0.996
101				13.142		717788.274	747994.148	0.900
69	0.039	4.00		9.000	1200	717550.056	748288.015	1.225
55A				8.700	1350	717755.246	748171.201	1.720
70	0.086	4.00		13.450	1200	717810.693	747983.375	1.225
71	0.086	4.00		13.450	1200	717812.207	748009.956	1.382
72	0.086	4.00		13.450	1200	717802.464	748051.702	1.635

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
North DB	4	2	43.272	0.600	4.425	4.137	0.288	150.0	750	9.10	44.0
1.012	5	4	31.567	0.600	4.891	4.575	0.316	99.9	600	8.78	44.7
1.011	6	5	39.885	0.600	5.290	4.891	0.399	100.0	600	8.57	45.2
1.010	17	6	31.287	0.600	5.649	5.440	0.209	149.7	450	8.29	45.9
17.000	16	60	46.022	0.600	6.450	6.220	0.230	200.0	225	4.83	50.0
7.008	24	17	11.828	0.600	5.767	5.649	0.118	100.2	450	7.98	46.7
1.009	57	17	2.742	0.600	6.563	6.545	0.018	150.0	375	7.97	0.0
Central DB	55	57	45.901	0.600	6.686	6.570	0.116	395.7	675	7.94	46.8
4.004	25A	55A	12.458	0.600	7.270	7.208	0.062	200.9	375	5.40	50.0
1.006	8	55A	26.838	0.600	8.397	7.055	1.342	20.0	375	7.20	48.8
1.009_1	55A	55	13.918	0.600	6.980	6.911	0.069	201.3	450	7.36	48.3
1.005	8A	8	15.053	0.600	9.150	8.397	0.753	20.0	450	7.09	49.1
1.004	9	8A	44.290	0.600	9.822	9.150	0.672	65.9	450	7.03	49.2
1.003	10	9	47.099	0.600	10.057	9.822	0.235	200.0	450	6.74	50.0
2.000	11	10	69.449	0.600	10.952	10.084	0.868	80.0	225	4.83	50.0
1.002	12	10	29.597	0.600	11.770	11.474	0.296	100.0	300	6.19	50.0
1.001	54	12	34.146	0.600	12.111	11.770	0.341	100.0	300	5.88	50.0
1.000	53	54	66.602	0.600	12.519	12.186	0.333	200.0	225	5.21	50.0
4.003	25	25A	12.683	0.600	7.408	7.345	0.063	201.3	300	4.90	50.0
6.001	29	25	50.250	0.600	8.563	7.408	1.155	43.5	300	4.84	50.0
6.000	30	29	60.122	0.600	10.305	8.638	1.667	36.1	225	4.46	50.0
4.002	26	25A	54.742	0.600	10.226	8.450	1.776	30.8	225	5.29	50.0
4.001	27	26	50.564	0.600	11.490	10.226	1.264	40.0	225	4.91	50.0
5.000	26A	26	40.107	0.600	12.075	11.273	0.802	50.0	225	4.36	50.0
4.000	28	27	50.163	0.600	12.305	11.490	0.815	61.6	225	4.50	50.0

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Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
7.007	31	24	41.643	0.600	6.288	5.767	0.521	79.9	450	7.88	46.9
7.006	32	31	38.950	0.600	6.483	6.288	0.195	199.7	450	7.58	47.7
16.001	50	32	40.900	0.600	8.065	7.824	0.241	169.7	225	5.29	50.0
7.005	39	32	21.325	0.600	6.700	6.558	0.142	150.0	375	7.12	49.0
7.004	40	39	18.732	0.600	6.794	6.700	0.094	199.3	375	6.88	49.7
15.001	41	40	38.136	0.600	7.842	6.960	0.882	43.2	225	5.11	50.0
7.003	43	40	29.899	0.600	6.894	6.794	0.100	299.0	375	6.64	50.0
7.002	44	43	38.429	0.600	7.048	6.894	0.154	249.5	375	6.16	50.0
7.001	44A	44	6.760	0.600	7.082	7.048	0.034	198.8	300	5.60	50.0
9.000	49	44	31.494	0.600	7.168	7.048	0.120	262.4	375	4.47	50.0
7.000	48	44A	57.556	0.600	7.520	7.157	0.363	158.6	300	5.50	50.0
8.001	45	44A	41.154	0.600	7.363	7.157	0.206	199.8	225	4.74	50.0
15.000	42	41	50.245	0.600	8.175	7.842	0.333	150.9	225	4.79	50.0
16.000	51	50	39.921	0.600	8.342	8.065	0.277	144.1	225	4.61	50.0
18.000	52	48	51.964	0.600	8.024	7.595	0.429	121.1	225	4.73	50.0
18.000_1	58	59	35.503	0.600	5.763	5.576	0.187	190.0	225	4.63	50.0
16.001_1	60	6	30.805	0.600	6.220	5.681	0.539	57.2	225	5.13	50.0
18.001_1	59	61	19.197	0.600	5.576	5.463	0.113	169.9	225	4.95	50.0
18.002	61	4	30.542	0.600	5.472	4.966	0.506	60.4	225	5.25	50.0
5.000_1	7	11	5.328	0.600	11.107	10.952	0.155	34.4	225	4.04	50.0
1.000_1	62	63	42.779	0.600	12.975	12.761	0.214	200.0	225	4.77	50.0
2.000_1	64	63	13.152	0.600	12.975	12.683	0.292	45.0	225	4.11	50.0
1.001_1	63	65	27.793	0.600	12.683	12.544	0.139	199.9	225	5.28	50.0
1.002_1	65	54	15.676	0.600	12.469	12.391	0.078	200.0	300	5.51	50.0
19.000	66	67	38.435	0.030	13.500	13.110	0.390	98.6	300	4.72	50.0
19.001	67	101	16.486	0.030	13.110	12.842	0.268	61.5	300	4.93	50.0
19.002	100	EX SW	13.720	0.030	11.323	11.254	0.069	200.0	225	6.82	0.0
Trench 19	66	67	38.435	0.600	12.900	12.510	0.390	98.6	225	4.32	50.0
Trench 19.1	67	101	16.486	0.600	12.510	12.242	0.268	61.5	225	4.39	50.0
19.002_1	101	68A	3.575	0.030	12.242	12.224	0.018	200.0	225	5.10	50.0
19.003	68A	68	24.535	0.030	12.224	11.733	0.491	50.0	225	5.69	50.0
19.004	68	100	19.506	0.030	11.733	11.340	0.393	49.6	225	6.16	50.0
18.001	69	48	27.412	0.600	7.775	7.595	0.180	152.3	225	4.43	50.0
4.000_1	70	71	26.624	0.600	12.225	12.068	0.157	169.6	225	4.44	50.0
4.001_1	71	72	42.868	0.600	12.068	11.815	0.253	169.4	225	5.16	50.0
4.002_1	72	10	15.302	0.600	11.815	11.509	0.306	50.0	225	5.29	50.0
17.000_1	6a	6	13.491	0.600	6.875	6.275	0.600	22.5	225	4.08	50.0
15.000_1	24A	24	13.102	0.600	7.315	7.237	0.078	168.0	225	4.22	50.0

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	15.100	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.137	Product Number	CTL-SHE-0170-1960-2800-1960
Design Depth (m)	2.800	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	19.6	Min Node Diameter (mm)	1800

Node 57 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	6.563	Product Number	CTL-SHE-0360-8500-1720-8500
Design Depth (m)	1.720	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	85.0	Min Node Diameter (mm)	-1

Node 100 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.323	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.107	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 57 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.880
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	58

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	1.401	1000.0	0.0	1.721	0.0	0.0
1.400	300.0	0.0	1.720	1300.0	0.0			

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.137
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	30.0	0.0	1.314	1700.0	0.0	2.764	2200.0	0.0
1.313	30.0	0.0	2.763	2200.0	0.0			

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Node 67 Link Infiltration Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	19.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.110		
Safety Factor	2.0	Time to half empty (mins)			

Node 67 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	Trench 19
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.510	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	0	Diameter (mm)	600

Node 101 Link Infiltration Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	19.001
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.842		
Safety Factor	2.0	Time to half empty (mins)			

Node 101 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	Trench 19.1
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.242	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	3	Diameter (mm)	600

Node 100 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	11.340
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	252

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	65.0	0.0	0.900	65.0	0.0	0.901	0.0	0.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	8.425	0.083	12.9	0.1665	0.0000	OK
15 minute winter	50	10	8.213	0.148	30.5	0.3429	0.0000	OK
15 minute winter	49	12	7.598	0.430	10.7	0.8875	0.0000	SURCHARGED
15 minute winter	48	13	7.776	0.256	66.1	0.7811	0.0000	OK
15 minute winter	45	13	7.748	0.385	26.3	1.7309	0.0000	SURCHARGED
15 minute winter	44	12	7.593	0.545	109.2	0.7798	0.0000	SURCHARGED
15 minute winter	43	12	7.502	0.608	120.1	1.7035	0.0000	SURCHARGED
15 minute summer	42	1	8.175	0.000	0.0	0.0000	0.0000	OK
15 minute winter	41	10	7.911	0.069	16.6	0.1473	0.0000	OK
15 minute winter	40	12	7.394	0.600	164.9	1.8643	0.0000	SURCHARGED
15 minute winter	39	12	7.248	0.548	167.3	1.0207	0.0000	SURCHARGED
15 minute winter	32	12	7.066	0.583	225.1	1.3766	0.0000	SURCHARGED
15 minute winter	31	12	6.866	0.578	235.2	1.2075	0.0000	SURCHARGED
15 minute winter	30	10	10.406	0.101	35.0	0.3508	0.0000	OK
15 minute winter	29	10	8.721	0.158	88.6	0.7155	0.0000	OK
15 minute winter	28	10	12.415	0.110	32.3	0.3291	0.0000	OK
15 minute winter	27	11	11.648	0.158	67.1	0.5314	0.0000	OK
15 minute winter	26	12	10.752	0.526	112.6	1.2605	0.0000	SURCHARGED
15 minute winter	26A	10	12.138	0.063	12.2	0.1148	0.0000	OK
15 minute winter	25A	11	8.104	0.834	212.2	1.5379	0.0000	SURCHARGED
15 minute winter	25	11	8.281	0.873	114.2	2.5801	0.0000	SURCHARGED
15 minute summer	24A	10	7.395	0.080	10.0	0.1445	0.0000	OK
15 minute winter	24	11	6.636	0.869	274.9	2.9158	0.0000	SURCHARGED
15 minute winter	17	11	6.488	0.839	355.5	2.2298	0.0000	SURCHARGED
15 minute winter	16	10	6.659	0.209	40.5	0.7409	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	16.000	50	12.9	0.645	0.297	0.8179	
15 minute winter	50	16.001	32	29.0	1.086	0.728	1.0959	
15 minute winter	49	9.000	44	15.5	0.249	0.126	3.4737	
15 minute winter	48	7.000	44A	64.1	1.126	0.728	3.8690	
15 minute winter	45	8.001	44A	26.1	0.735	0.712	1.6367	
15 minute winter	44	7.002	43	113.1	1.038	0.896	4.2386	
15 minute winter	43	7.003	40	124.0	1.124	1.077	3.2978	
15 minute summer	42	15.000	41	0.0	0.000	0.000	0.2606	
15 minute winter	41	15.001	40	16.5	1.274	0.208	0.9563	
15 minute winter	40	7.004	39	153.7	1.394	1.088	2.0661	
15 minute winter	39	7.005	32	164.2	1.611	1.007	2.3521	
15 minute winter	32	7.006	31	213.8	1.799	0.937	6.1714	
15 minute winter	31	7.007	24	229.3	1.517	0.634	6.5981	
15 minute winter	30	6.000	29	34.8	2.054	0.401	1.0189	
15 minute winter	29	6.001	25	86.0	1.402	0.509	2.7125	
15 minute winter	28	4.000	27	32.3	1.395	0.486	1.1890	
15 minute winter	27	4.001	26	65.4	1.839	0.794	1.7564	
15 minute winter	26	4.002	25A	97.2	2.536	1.034	2.1771	
15 minute winter	26A	5.000	26	12.1	1.366	0.165	0.3566	
15 minute winter	25A	4.004	55A	211.0	1.913	1.499	1.3741	
15 minute winter	25	4.003	25A	105.3	1.496	1.349	0.8931	
15 minute summer	24A	15.000_1	24	10.0	0.817	0.250	0.1604	
15 minute winter	24	7.008	17	268.5	1.695	0.831	1.8741	
15 minute winter	17	1.010	6	358.5	2.263	1.359	4.9572	
15 minute winter	16	17.000	60	39.2	1.267	1.071	1.4529	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	12	11	12.207	0.437	127.9	0.8841	0.0000	SURCHARGED
15 minute winter	11	10	11.080	0.128	36.7	0.4456	0.0000	OK
15 minute winter	10	11	10.428	0.371	226.3	0.5821	0.0000	OK
15 minute winter	9	11	10.103	0.281	248.2	0.5765	0.0000	OK
15 minute winter	8	11	8.648	0.251	263.4	0.4972	0.0000	OK
15 minute winter	8A	11	9.357	0.207	255.5	0.3983	0.0000	OK
15 minute summer	6a	10	6.923	0.048	10.2	0.0870	0.0000	OK
960 minute winter	6	930	6.275	0.985	99.6	2.8545	0.0000	SURCHARGED
960 minute winter	5	930	6.275	1.384	100.4	3.3674	0.0000	SURCHARGED
960 minute winter	4	930	6.275	1.850	103.6	6.0082	0.0000	SURCHARGED
960 minute winter	2	930	6.275	2.138	103.4	1563.1270	0.0000	OK
15 minute winter	52	11	8.157	0.133	30.4	0.6386	0.0000	OK
15 minute winter	53	12	12.617	0.098	8.0	0.1555	0.0000	OK
15 minute winter	54	11	12.615	0.504	126.3	2.4337	0.0000	SURCHARGED
15 minute winter	44A	13	7.658	0.576	113.1	1.4816	0.0000	SURCHARGED
60 minute winter	55	51	7.611	0.925	320.5	1.6343	0.0000	SURCHARGED
60 minute winter	57	51	7.608	1.045	312.4	222.0207	0.0000	SURCHARGED
960 minute winter	58	930	6.275	0.512	0.3	0.5789	0.0000	SURCHARGED
960 minute winter	59	930	6.275	0.699	0.7	1.0420	0.0000	SURCHARGED
15 minute winter	60	10	6.354	0.134	43.0	0.1855	0.0000	OK
960 minute winter	61	930	6.275	0.812	1.7	1.4662	0.0000	SURCHARGED
15 minute winter	7	11	11.271	0.164	2.4	0.2130	0.0000	OK
15 minute winter	62	12	13.059	0.084	10.9	0.2243	0.0000	OK
15 minute winter	63	13	12.856	0.173	32.8	0.3902	0.0000	OK
15 minute winter	64	12	13.032	0.057	10.9	0.1507	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	12	1.002	10	127.6	1.813	1.148	2.0289	
15 minute winter	11	2.000	10	36.5	1.030	0.628	2.1916	
15 minute winter	10	1.003	9	227.2	1.855	0.997	5.7464	
15 minute winter	9	1.004	8A	248.0	2.828	0.622	3.8814	
15 minute winter	8	1.006	55A	262.1	2.540	0.584	2.5312	
15 minute winter	8A	1.005	8	255.1	3.349	0.352	1.2175	
15 minute summer	6a	17.000_1	6	10.2	1.702	0.093	0.0809	
960 minute winter	6	1.011	5	98.8	1.159	0.144	11.2347	
960 minute winter	5	1.012	4	100.3	1.112	0.146	8.8917	
960 minute winter	4	North DB	2	103.4	0.726	0.103	19.0449	
960 minute winter	2	Hydro-Brake®		18.6				1174.6
15 minute winter	52	18.000	48	29.8	1.247	0.631	1.4413	
15 minute winter	53	1.000	54	7.8	0.407	0.212	1.8734	
15 minute winter	54	1.001	12	109.3	1.552	0.983	2.4045	
15 minute winter	44A	7.001	44	100.8	1.432	1.284	0.4760	
60 minute winter	55	Central DB	57	312.4	1.038	0.666	16.3857	
60 minute winter	57	Hydro-Brake®	17	85.0				
960 minute winter	58	18.000_1	59	-0.3	-0.008	-0.008	1.4120	
960 minute winter	59	18.001_1	61	0.5	0.146	0.012	0.7635	
15 minute winter	60	16.001_1	6	43.1	1.777	0.625	0.9710	
960 minute winter	61	18.002	4	1.9	0.463	0.028	1.2147	
15 minute winter	7	Hydro-Brake®	11	1.8				
15 minute winter	62	1.000_1	63	11.0	0.768	0.300	0.6233	
15 minute winter	63	1.001_1	65	32.3	1.058	0.882	0.8470	
15 minute winter	64	2.000_1	63	10.9	0.586	0.140	0.2658	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	65	11	12.664	0.195	47.3	0.4053	0.0000	OK
180 minute winter	100	148	11.909	0.586	7.0	15.4750	0.0000	SURCHARGED
15 minute winter	66	12	12.911	0.011	0.4	0.0000	0.0000	OK
15 minute winter	19.000:10%	11	13.505	0.044	8.8	0.0000	0.0000	OK
15 minute winter	67	11	12.564	0.054	8.4	0.0199	0.0000	OK
60 minute summer	19.001:10%	31	13.120	0.037	9.4	0.0000	0.0000	OK
180 minute winter	68	148	11.910	0.177	7.1	0.2003	0.0000	OK
15 minute summer	EX SW	1	11.254	0.000	1.8	0.0000	0.0000	OK
15 minute winter	68A	11	12.387	0.163	23.8	0.3023	0.0000	OK
15 minute winter	101	11	12.421	0.179	15.8	0.1215	0.0000	OK
15 minute summer	69	10	7.847	0.072	9.5	0.1275	0.0000	OK
15 minute winter	55A	11	7.868	0.888	473.1	1.2712	0.0000	SURCHARGED
15 minute winter	70	12	12.319	0.094	14.7	0.2374	0.0000	OK
15 minute winter	71	13	12.212	0.144	29.4	0.3422	0.0000	OK
15 minute winter	72	11	11.990	0.175	60.4	0.5660	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	65	1.002_1	54	47.0	1.102	0.600	0.8229	
180 minute winter	100	Hydro-Brake®	EX SW	1.8				30.1
15 minute winter	66	19.000	19.000:10%	-0.4	-0.029	-0.001	0.0566	
15 minute winter	66	Trench 19	67	0.2	0.070	0.004	0.1503	
15 minute winter	66	19.000	67	7.6	0.354	0.017	0.7460	
15 minute winter	67	19.001	19.001:10%	-0.8	-0.069	-0.001	0.0205	
15 minute winter	67	Trench 19.1	101	8.4	0.405	0.126	0.3393	
15 minute winter	67	19.001	101	7.9	0.421	0.014	0.2808	
180 minute winter	68	19.004	100	7.0	0.368	0.255	0.7149	
15 minute winter	68A	19.003	68	24.0	0.771	0.874	0.7764	
15 minute winter	101	19.002_1	68A	16.0	0.494	1.164	0.1157	
15 minute summer	69	18.001	48	9.5	0.705	0.226	0.4030	
15 minute winter	55A	1.009_1	55	471.8	2.978	2.076	2.2052	
15 minute winter	70	4.000_1	71	14.7	0.703	0.368	0.5619	
15 minute winter	71	4.001_1	72	28.7	1.031	0.721	1.2562	
15 minute winter	72	4.002_1	10	60.4	1.945	0.819	0.4740	

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Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	8.448	0.106	20.0	0.2124	0.0000	OK
15 minute winter	50	11	8.303	0.238	47.4	0.5532	0.0000	SURCHARGED
15 minute winter	49	12	8.445	1.277	44.6	2.6333	0.0000	FLOOD RISK
15 minute winter	48	13	8.746	1.226	93.8	3.7429	0.0000	SURCHARGED
30 minute winter	45	18	8.250	0.887	69.7	3.9835	20.9134	FLOOD
15 minute winter	44	12	8.442	1.394	129.0	1.9942	0.0000	FLOOD RISK
15 minute winter	43	12	8.383	1.489	139.0	4.1704	0.0000	SURCHARGED
15 minute winter	42	13	8.310	0.135	15.0	0.1524	0.0000	OK
15 minute winter	41	12	8.308	0.466	40.1	0.9900	0.0000	SURCHARGED
15 minute winter	40	12	8.285	1.491	179.2	4.6347	0.0000	SURCHARGED
15 minute winter	39	12	8.115	1.415	190.4	2.6328	0.0000	SURCHARGED
15 minute winter	32	12	7.891	1.408	244.5	3.3250	0.0000	SURCHARGED
15 minute winter	31	12	7.597	1.309	267.6	2.7337	0.0000	SURCHARGED
15 minute summer	30	10	10.433	0.128	54.3	0.4455	0.0000	OK
15 minute winter	29	12	9.489	0.926	137.7	4.1988	0.0000	SURCHARGED
15 minute winter	28	13	13.076	0.771	50.1	2.3097	0.0000	SURCHARGED
15 minute winter	27	13	12.985	1.495	97.0	5.0413	0.0000	SURCHARGED
15 minute winter	26	12	11.799	1.573	134.5	3.7706	0.0000	SURCHARGED
15 minute summer	26A	10	12.153	0.078	18.9	0.1422	0.0000	OK
30 minute winter	25A	22	8.804	1.534	246.1	2.8274	0.0000	SURCHARGED
15 minute winter	25	12	9.049	1.641	146.0	4.8499	0.0000	FLOOD RISK
15 minute winter	24A	10	7.418	0.103	15.5	0.1854	0.0000	OK
30 minute summer	24	19	7.249	1.482	351.9	4.9693	0.0000	SURCHARGED
30 minute summer	17	19	6.998	1.349	421.9	3.5849	0.0000	SURCHARGED
15 minute winter	16	11	7.170	0.720	62.8	2.5501	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	16.000	50	20.0	0.695	0.462	1.1619	
15 minute winter	50	16.001	32	43.4	1.171	1.090	1.4886	
15 minute winter	49	9.000	44	-34.9	-0.316	-0.284	3.4737	
15 minute winter	48	7.000	44A	78.9	1.134	0.896	4.0531	
30 minute winter	45	8.001	44A	-34.2	-0.860	-0.934	1.6367	
15 minute winter	44	7.002	43	134.7	1.221	1.068	4.2386	
15 minute winter	43	7.003	40	149.2	1.353	1.296	3.2978	
15 minute winter	42	15.000	41	-15.0	-0.472	-0.355	1.6220	
15 minute winter	41	15.001	40	33.0	1.296	0.416	1.5167	
15 minute winter	40	7.004	39	186.1	1.687	1.317	2.0661	
15 minute winter	39	7.005	32	196.7	1.784	1.206	2.3521	
15 minute winter	32	7.006	31	246.9	1.774	1.082	6.1714	
15 minute winter	31	7.007	24	269.5	1.701	0.745	6.5981	
15 minute summer	30	6.000	29	54.3	2.050	0.625	1.8959	
15 minute winter	29	6.001	25	102.6	1.546	0.607	3.5386	
15 minute winter	28	4.000	27	48.3	1.483	0.727	1.9950	
15 minute winter	27	4.001	26	80.1	2.025	0.971	2.0110	
15 minute winter	26	4.002	25A	118.0	2.967	1.255	2.1771	
15 minute summer	26A	5.000	26	19.0	1.501	0.258	1.0144	
30 minute winter	25A	4.004	55A	241.9	2.194	1.719	1.3741	
15 minute winter	25	4.003	25A	137.7	1.955	1.764	0.8931	
15 minute winter	24A	15.000_1	24	15.5	0.915	0.388	0.2222	
30 minute summer	24	7.008	17	345.8	2.183	1.071	1.8741	
30 minute summer	17	1.010	6	420.9	2.657	1.595	4.9572	
15 minute winter	16	17.000	60	50.8	1.309	1.389	1.8303	

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Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	12	11	12.560	0.790	165.5	1.5967	0.0000	SURCHARGED
15 minute winter	11	11	11.313	0.361	56.1	1.2565	0.0000	SURCHARGED
15 minute winter	10	11	10.688	0.631	302.7	0.9907	0.0000	SURCHARGED
15 minute winter	9	11	10.168	0.346	335.7	0.7095	0.0000	OK
15 minute winter	8	13	9.400	1.003	340.1	1.9882	0.0000	SURCHARGED
15 minute winter	8A	13	9.654	0.504	345.5	0.9723	0.0000	SURCHARGED
15 minute winter	6a	10	6.935	0.060	15.8	0.1094	0.0000	OK
1440 minute winter	6	1380	6.825	1.535	112.1	4.4456	0.0000	SURCHARGED
1440 minute winter	5	1380	6.824	1.933	113.6	4.7032	0.0000	FLOOD RISK
1440 minute winter	4	1380	6.824	2.399	117.6	7.7911	0.0000	FLOOD RISK
1440 minute winter	2	1380	6.824	2.687	117.4	2705.4810	0.0000	OK
15 minute winter	52	12	8.900	0.876	47.2	4.2109	1.7305	FLOOD
15 minute winter	53	11	13.230	0.711	23.8	1.1330	0.0000	SURCHARGED
15 minute winter	54	12	13.211	1.100	158.1	5.3093	0.0000	SURCHARGED
15 minute winter	44A	12	8.476	1.394	129.4	3.5855	0.0000	FLOOD RISK
60 minute winter	55	57	8.312	1.626	458.8	2.8726	0.0000	FLOOD RISK
60 minute winter	57	59	8.306	1.743	456.7	452.6151	0.0000	FLOOD RISK
1440 minute winter	58	1380	6.824	1.061	0.2	1.1997	0.0000	SURCHARGED
1440 minute winter	59	1380	6.824	1.248	0.7	1.8604	0.0000	SURCHARGED
1440 minute winter	60	1380	6.825	0.605	4.3	0.8368	0.0000	SURCHARGED
1440 minute winter	61	1380	6.824	1.361	2.1	2.4575	0.0000	SURCHARGED
15 minute winter	7	13	11.525	0.418	3.8	0.5435	0.0000	SURCHARGED
15 minute winter	62	13	13.575	0.600	27.6	1.5947	0.0000	FLOOD RISK
15 minute winter	63	13	13.511	0.828	53.8	1.8708	0.0000	FLOOD RISK
15 minute winter	64	13	13.531	0.556	16.9	1.4766	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	12	1.002	10	166.3	2.361	1.496	2.0631	
15 minute winter	11	2.000	10	50.2	1.302	0.863	2.7621	
15 minute winter	10	1.003	9	303.2	1.967	1.330	6.8158	
15 minute winter	9	1.004	8A	334.0	2.868	0.838	6.3639	
15 minute winter	8	1.006	55A	329.6	2.989	0.734	2.9602	
15 minute winter	8A	1.005	8	327.2	3.225	0.451	2.3850	
15 minute winter	6a	17.000_1	6	15.8	1.918	0.143	0.1112	
1440 minute winter	6	1.011	5	111.9	1.150	0.163	11.2347	
1440 minute winter	5	1.012	4	113.5	1.110	0.165	8.8917	
1440 minute winter	4	North DB	2	117.4	0.363	0.116	19.0449	
1440 minute winter	2	Hydro-Brake®		19.2				1745.9
15 minute winter	52	18.000	48	39.2	1.216	0.831	2.0667	
15 minute winter	53	1.000	54	14.8	0.399	0.403	2.6488	
15 minute winter	54	1.001	12	141.1	2.003	1.270	2.4045	
15 minute winter	44A	7.001	44	116.0	1.647	1.477	0.4760	
60 minute winter	55	Central DB	57	456.7	1.279	0.973	16.3857	
60 minute winter	57	Hydro-Brake®	17	85.5				
1440 minute winter	58	18.000_1	59	-0.2	-0.008	-0.005	1.4120	
1440 minute winter	59	18.001_1	61	0.6	0.144	0.015	0.7635	
1440 minute winter	60	16.001_1	6	4.3	0.822	0.062	1.2251	
1440 minute winter	61	18.002	4	2.0	0.463	0.029	1.2147	
15 minute winter	7	Hydro-Brake®	11	2.0				
15 minute winter	62	1.000_1	63	20.6	0.764	0.562	1.7014	
15 minute winter	63	1.001_1	65	60.6	1.523	1.654	1.1054	
15 minute winter	64	2.000_1	63	20.7	0.629	0.266	0.5231	

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Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.06%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	65	12	13.280	0.811	69.5	1.6843	0.0000	SURCHARGED
240 minute winter	100	188	12.610	1.287	8.2	24.8819	0.0000	FLOOD RISK
15 minute winter	66	11	12.926	0.026	1.6	0.0000	0.0000	OK
15 minute winter	19.000:10%	10	13.514	0.053	13.6	0.0000	0.0000	OK
15 minute winter	67	12	12.629	0.119	14.2	0.0878	0.0000	OK
15 minute winter	19.001:10%	10	13.127	0.044	13.6	0.0000	0.0000	OK
240 minute winter	68	188	12.613	0.880	9.0	0.9949	0.0000	FLOOD RISK
15 minute summer	EX SW	1	11.254	0.000	1.8	0.0000	0.0000	OK
240 minute winter	68A	184	12.616	0.392	9.0	0.7263	0.0000	SURCHARGED
15 minute winter	101	12	12.634	0.392	25.3	0.6124	0.0000	SURCHARGED
15 minute winter	69	13	8.755	0.980	33.0	1.7334	0.0000	FLOOD RISK
30 minute winter	55A	23	8.548	1.568	554.8	2.2445	0.0000	FLOOD RISK
15 minute winter	70	13	12.617	0.392	22.7	0.9948	0.0000	SURCHARGED
15 minute winter	71	13	12.559	0.491	43.8	1.1672	0.0000	SURCHARGED
15 minute winter	72	12	12.229	0.414	85.3	1.3392	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	65	1.002_1	54	76.0	1.192	0.970	1.1039	
240 minute winter	100	Hydro-Brake®	EX SW	2.1				45.9
15 minute winter	66	19.000	19.000:10%	-1.6	-0.084	-0.004	0.0773	
15 minute winter	66	Trench 19	67	1.5	0.196	0.029	0.4536	
15 minute winter	66	19.000	67	11.1	0.402	0.025	0.9628	
15 minute winter	67	19.001	19.001:10%	-2.0	-0.122	-0.004	0.0277	
15 minute winter	67	Trench 19.1	101	13.6	0.457	0.205	0.5031	
15 minute winter	67	19.001	101	11.6	0.476	0.021	0.3630	
240 minute winter	68	19.004	100	8.2	0.392	0.299	0.7758	
240 minute winter	68A	19.003	68	9.0	0.606	0.327	0.9758	
15 minute winter	101	19.002_1	68A	20.6	0.519	1.500	0.1422	
15 minute winter	69	18.001	48	-18.3	0.707	-0.436	1.0902	
30 minute winter	55A	1.009_1	55	553.0	3.491	2.433	2.2052	
15 minute winter	70	4.000_1	71	23.3	0.760	0.587	1.0589	
15 minute winter	71	4.001_1	72	45.0	1.175	1.131	1.7049	
15 minute winter	72	4.002_1	10	83.2	2.091	1.128	0.6028	

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	15.100	Minimum Backdrop Height (m)	0.300
Ratio-R	0.273	Preferred Cover Depth (m)	1.000
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
51	0.053	4.00		9.567	1200	717598.229	748218.096	1.225
50	0.073	4.00		9.290	1200	717636.448	748229.627	1.225
49	0.042	4.00		8.500	1350	717657.184	748348.898	1.332
48	0.209	4.00		9.092	1200	717573.833	748301.656	1.572
45	0.099	4.00		8.250	1200	717603.257	748365.451	0.887
44				8.550	1350	717629.909	748333.152	1.502
43	0.139	4.00		8.925	1350	717649.415	748300.041	2.031
42		4.00		9.600	1200	717587.874	748229.864	1.425
41	0.068	4.00		9.221	1200	717631.491	748254.806	1.379
40	0.185	4.00		9.000	1350	717664.360	748274.145	2.206
39	0.056	4.00		9.300	1350	717674.246	748258.234	2.600
32	0.140	4.00		9.500	1350	717676.669	748237.047	3.017
31	0.088	4.00		8.970	1350	717715.618	748236.753	2.682
30	0.144	4.00		11.530	1200	717633.678	748153.953	1.225
29	0.221	4.00		9.863	1200	717692.132	748168.016	1.300
28	0.133	4.00		13.730	1200	717665.520	748091.507	1.425
27	0.214	4.00		13.400	1200	717714.097	748104.023	1.910
26	0.144	4.00		12.500	1200	717763.385	748115.310	2.274
26A	0.050	4.00		13.500	1200	717773.188	748076.419	1.425
25A	0.051	4.00		9.750	1350	717743.824	748166.227	2.480
25	0.159	4.00		9.150	1200	717741.245	748178.645	1.742
24A	0.041	4.00		8.540	1200	717751.329	748219.498	1.225
24	0.262	4.00		8.490	1350	717756.909	748231.352	2.723
17	0.014	4.00		8.150	1800	717768.380	748228.468	2.501
16	0.166	4.00		7.830	1200	717872.270	748198.554	1.380
12	0.090	4.00		13.792	1200	717778.035	748059.138	2.022
11	0.144	4.00		12.177	1200	717874.269	748082.564	1.225
10	0.024	4.00		13.523	1350	717806.728	748066.398	3.466
9	0.101	4.00		13.100	1350	717795.931	748112.243	3.278
8	0.040	4.00		9.850	1350	717782.050	748169.843	1.453
8A	0.036	4.00		10.600	1350	717784.147	748154.937	1.450
6a	0.042	4.00		8.100	1200	717791.288	748207.975	1.225
6	0.125	4.00		7.500	1500	717798.346	748219.473	2.210
5	0.074	4.00		7.114	1500	717808.682	748257.995	2.223
4	0.087	4.00		6.900	1800	717818.117	748288.119	2.475
2				6.900	1800	717847.926	748319.486	2.763
52	0.161	4.00		8.900	1200	717547.150	748346.246	0.876
53	0.033	4.00		13.944	1200	717680.567	748033.642	1.425
54	0.301	4.00		13.740	1200	717745.039	748050.352	1.629
44A	0.113	4.00		8.650	1200	717623.984	748329.898	1.568
55				8.600	1500	717749.331	748183.799	1.914

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Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
57				8.600	2100	717767.929	748225.763	2.037
58		4.00		7.300	1200	717875.533	748251.479	1.537
59	0.031	4.00		7.300	1200	717841.351	748261.075	1.724
60	0.016	4.00		7.460	1200	717828.015	748211.183	1.240
61	0.062	4.00		7.300	1200	717847.360	748279.307	1.837
7	0.010	4.00		12.300	1200	717872.806	748087.687	1.193
62	0.063	4.00		13.800	1200	717708.091	748011.566	0.825
63	0.063	4.00		13.800	1200	717750.652	748007.254	1.117
64	0.063	4.00		13.800	1200	717749.827	747994.128	0.825
65	0.063	4.00	4.0	13.800	1200	717746.712	748034.766	1.331
100				12.802	1200	717802.251	747965.760	1.479
66		4.00		13.800		717781.870	748048.165	0.900
67				13.410		717789.819	748010.561	0.900
68				12.802	1200	717782.805	747967.289	1.069
EX SW				12.340	1200	717807.912	747953.262	1.086
68A	0.036	4.00		13.220	1200	717785.716	747991.651	0.996
101				13.142		717788.274	747994.148	0.900
69	0.039	4.00		9.000	1200	717550.056	748288.015	1.225
55A				8.700	1350	717755.246	748171.201	1.720
70	0.086	4.00		13.450	1200	717810.693	747983.375	1.225
71	0.086	4.00		13.450	1200	717812.207	748009.956	1.382
72	0.086	4.00		13.450	1200	717802.464	748051.702	1.635

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
North DB	4	2	43.272	0.600	4.425	4.137	0.288	150.0	750	9.10	44.0
1.012	5	4	31.567	0.600	4.891	4.575	0.316	99.9	600	8.78	44.7
1.011	6	5	39.885	0.600	5.290	4.891	0.399	100.0	600	8.57	45.2
1.010	17	6	31.287	0.600	5.649	5.440	0.209	149.7	450	8.29	45.9
17.000	16	60	46.022	0.600	6.450	6.220	0.230	200.0	225	4.83	50.0
7.008	24	17	11.828	0.600	5.767	5.649	0.118	100.2	450	7.98	46.7
1.009	57	17	2.742	0.600	6.563	6.545	0.018	150.0	375	7.97	0.0
Central DB	55	57	45.901	0.600	6.686	6.570	0.116	395.7	675	7.94	46.8
4.004	25A	55A	12.458	0.600	7.270	7.208	0.062	200.9	375	5.40	50.0
1.006	8	55A	26.838	0.600	8.397	7.055	1.342	20.0	375	7.20	48.8
1.009_1	55A	55	13.918	0.600	6.980	6.911	0.069	201.3	450	7.36	48.3
1.005	8A	8	15.053	0.600	9.150	8.397	0.753	20.0	450	7.09	49.1
1.004	9	8A	44.290	0.600	9.822	9.150	0.672	65.9	450	7.03	49.2
1.003	10	9	47.099	0.600	10.057	9.822	0.235	200.0	450	6.74	50.0
2.000	11	10	69.449	0.600	10.952	10.084	0.868	80.0	225	4.83	50.0
1.002	12	10	29.597	0.600	11.770	11.474	0.296	100.0	300	6.19	50.0
1.001	54	12	34.146	0.600	12.111	11.770	0.341	100.0	300	5.88	50.0
1.000	53	54	66.602	0.600	12.519	12.186	0.333	200.0	225	5.21	50.0
4.003	25	25A	12.683	0.600	7.408	7.345	0.063	201.3	300	4.90	50.0
6.001	29	25	50.250	0.600	8.563	7.408	1.155	43.5	300	4.84	50.0
6.000	30	29	60.122	0.600	10.305	8.640	1.665	36.1	225	4.46	50.0
4.002	26	25A	54.742	0.600	10.226	8.449	1.777	30.8	225	5.29	50.0
4.001	27	26	50.564	0.600	11.490	10.226	1.264	40.0	225	4.91	50.0
5.000	26A	26	40.107	0.600	12.075	11.273	0.802	50.0	225	4.36	50.0
4.000	28	27	50.163	0.600	12.305	11.491	0.814	61.6	225	4.50	50.0

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Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
7.007	31	24	41.643	0.600	6.288	5.767	0.521	79.9	450	7.88	46.9
7.006	32	31	38.950	0.600	6.483	6.288	0.195	199.7	450	7.58	47.7
16.001	50	32	40.900	0.600	8.065	7.824	0.241	169.7	225	5.29	50.0
7.005	39	32	21.325	0.600	6.700	6.558	0.142	150.0	375	7.12	49.0
7.004	40	39	18.732	0.600	6.794	6.700	0.094	199.3	375	6.88	49.7
15.001	41	40	38.136	0.600	7.842	6.959	0.883	43.2	225	5.11	50.0
7.003	43	40	29.899	0.600	6.894	6.794	0.100	299.0	375	6.64	50.0
7.002	44	43	38.429	0.600	7.048	6.894	0.154	249.5	375	6.16	50.0
7.001	44A	44	6.760	0.600	7.082	7.048	0.034	198.8	300	5.60	50.0
9.000	49	44	31.494	0.600	7.168	7.048	0.120	262.4	375	4.47	50.0
7.000	48	44A	57.556	0.600	7.520	7.157	0.363	158.6	300	5.50	50.0
8.001	45	44A	41.154	0.600	7.363	7.157	0.206	199.8	225	4.74	50.0
15.000	42	41	50.245	0.600	8.175	7.842	0.333	150.9	225	4.79	50.0
16.000	51	50	39.921	0.600	8.342	8.065	0.277	144.1	225	4.61	50.0
18.000	52	48	51.964	0.600	8.024	7.595	0.429	121.1	225	4.73	50.0
18.000_1	58	59	35.503	0.600	5.763	5.576	0.187	190.0	225	4.63	50.0
16.001_1	60	6	30.805	0.600	6.220	5.681	0.539	57.2	225	5.13	50.0
18.001_1	59	61	19.197	0.600	5.576	5.463	0.113	169.9	225	4.95	50.0
18.002	61	4	30.542	0.600	5.472	4.966	0.506	60.4	225	5.25	50.0
5.000_1	7	11	5.328	0.600	11.107	10.952	0.155	34.4	225	4.04	50.0
1.000_1	62	63	42.779	0.600	12.975	12.761	0.214	200.0	225	4.77	50.0
2.000_1	64	63	13.152	0.600	12.975	12.683	0.292	45.0	225	4.11	50.0
1.001_1	63	65	27.793	0.600	12.683	12.544	0.139	199.9	225	5.28	50.0
1.002_1	65	54	15.676	0.600	12.469	12.391	0.078	200.0	300	5.51	50.0
19.000	66	67	38.435	0.030	13.500	13.110	0.390	98.6	300	4.72	50.0
19.001	67	101	16.486	0.030	13.110	12.842	0.268	61.5	300	4.93	50.0
19.002	100	EX SW	13.720	0.030	11.323	11.254	0.069	200.0	225	6.82	0.0
Trench 19	66	67	38.435	0.600	12.900	12.510	0.390	98.6	225	4.32	50.0
Trench 19.1	67	101	16.486	0.600	12.510	12.242	0.268	61.5	225	4.39	50.0
19.002_1	101	68A	3.575	0.030	12.242	12.224	0.018	200.0	225	5.10	50.0
19.003	68A	68	24.535	0.030	12.224	11.733	0.491	50.0	225	5.69	50.0
19.004	68	100	19.506	0.030	11.733	11.340	0.393	49.6	225	6.16	50.0
18.001	69	48	27.412	0.600	7.775	7.595	0.180	152.3	225	4.43	50.0
4.000_1	70	71	26.624	0.600	12.225	12.068	0.157	169.6	225	4.44	50.0
4.001_1	71	72	42.868	0.600	12.068	11.815	0.253	169.4	225	5.16	50.0
4.002_1	72	10	15.302	0.600	11.815	11.509	0.306	50.0	225	5.29	50.0
17.000_1	6a	6	13.491	0.600	6.875	6.275	0.600	22.5	225	4.08	50.0
15.000_1	24A	24	13.102	0.600	7.315	7.237	0.078	168.0	225	4.22	50.0

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	15.100	Drain Down Time (mins)	240
Ratio-R	0.273	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.137	Product Number	CTL-SHE-0170-1960-2800-1960
Design Depth (m)	2.800	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	19.6	Min Node Diameter (mm)	1800

Node 57 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	6.563	Product Number	CTL-SHE-0360-8500-1720-8500
Design Depth (m)	1.720	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	85.0	Min Node Diameter (mm)	-1

Node 100 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.323	Product Number	CTL-SHE-0064-2000-1200-2000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.107	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 57 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.880
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	58

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	1.401	1000.0	0.0	1.721	0.0	0.0
1.400	300.0	0.0	1.720	1300.0	0.0			

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.137
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	30.0	0.0	1.314	1700.0	0.0	2.764	2200.0	0.0
1.313	30.0	0.0	2.763	2200.0	0.0			

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Node 67 Link Infiltration Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	19.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.110		
Safety Factor	2.0	Time to half empty (mins)			

Node 67 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	Trench 19
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.510	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	0	Diameter (mm)	600

Node 101 Link Infiltration Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	19.001
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.842		
Safety Factor	2.0	Time to half empty (mins)			

Node 101 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	Trench 19.1
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.242	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	3	Diameter (mm)	600

Node 100 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	11.340
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.40	Time to half empty (mins)	252

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	65.0	0.0	0.900	65.0	0.0	0.901	0.0	0.0

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	8.425	0.083	12.9	0.1665	0.0000	OK
15 minute winter	50	10	8.213	0.148	30.5	0.3429	0.0000	OK
15 minute winter	49	12	7.601	0.433	10.6	0.8937	0.0000	SURCHARGED
15 minute winter	48	13	7.778	0.258	66.1	0.7874	0.0000	OK
15 minute winter	45	13	7.751	0.388	26.3	1.7405	0.0000	SURCHARGED
15 minute winter	44	12	7.598	0.550	109.4	0.7864	0.0000	SURCHARGED
15 minute winter	43	12	7.507	0.613	120.1	1.7158	0.0000	SURCHARGED
15 minute summer	42	1	8.175	0.000	0.0	0.0000	0.0000	OK
15 minute winter	41	10	7.911	0.069	16.5	0.1464	0.0000	OK
15 minute winter	40	12	7.395	0.601	164.9	1.8686	0.0000	SURCHARGED
15 minute winter	39	12	7.251	0.551	167.2	1.0269	0.0000	SURCHARGED
15 minute winter	32	12	7.071	0.588	225.0	1.3879	0.0000	SURCHARGED
15 minute winter	31	12	6.870	0.582	235.1	1.2161	0.0000	SURCHARGED
15 minute winter	30	10	10.406	0.101	35.0	0.3510	0.0000	OK
15 minute winter	29	10	8.721	0.158	88.5	0.7140	0.0000	OK
15 minute winter	28	10	12.415	0.110	32.3	0.3294	0.0000	OK
15 minute winter	27	11	11.649	0.159	67.1	0.5377	0.0000	OK
15 minute winter	26	12	10.768	0.542	113.2	1.2987	0.0000	SURCHARGED
15 minute winter	26A	10	12.138	0.063	12.2	0.1148	0.0000	OK
15 minute winter	25A	11	8.107	0.837	212.6	1.5423	0.0000	SURCHARGED
15 minute winter	25	11	8.283	0.875	114.1	2.5858	0.0000	SURCHARGED
15 minute summer	24A	10	7.395	0.080	10.0	0.1445	0.0000	OK
15 minute winter	24	11	6.643	0.876	274.9	2.9408	0.0000	SURCHARGED
15 minute winter	17	11	6.498	0.849	356.4	2.2558	0.0000	SURCHARGED
15 minute winter	16	10	6.658	0.208	40.4	0.7368	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	16.000	50	12.9	0.645	0.297	0.8180	
15 minute winter	50	16.001	32	29.0	1.086	0.728	1.0960	
15 minute winter	49	9.000	44	15.7	0.250	0.127	3.4737	
15 minute winter	48	7.000	44A	64.1	1.126	0.728	3.8814	
15 minute winter	45	8.001	44A	26.0	0.735	0.711	1.6367	
15 minute winter	44	7.002	43	113.1	1.038	0.897	4.2386	
15 minute winter	43	7.003	40	124.0	1.125	1.077	3.2978	
15 minute summer	42	15.000	41	0.0	0.000	0.000	0.2594	
15 minute winter	41	15.001	40	16.4	1.272	0.207	0.9554	
15 minute winter	40	7.004	39	153.6	1.392	1.087	2.0661	
15 minute winter	39	7.005	32	163.8	1.611	1.004	2.3521	
15 minute winter	32	7.006	31	213.8	1.799	0.937	6.1714	
15 minute winter	31	7.007	24	228.9	1.516	0.632	6.5981	
15 minute winter	30	6.000	29	34.8	2.053	0.401	1.0194	
15 minute winter	29	6.001	25	85.9	1.401	0.509	2.7111	
15 minute winter	28	4.000	27	32.3	1.387	0.486	1.1937	
15 minute winter	27	4.001	26	66.0	1.850	0.801	1.7661	
15 minute winter	26	4.002	25A	97.7	2.544	1.039	2.1771	
15 minute winter	26A	5.000	26	12.1	1.366	0.165	0.3566	
15 minute winter	25A	4.004	55A	211.5	1.918	1.503	1.3741	
15 minute winter	25	4.003	25A	105.2	1.494	1.347	0.8931	
15 minute summer	24A	15.000_1	24	10.0	0.817	0.250	0.1604	
15 minute winter	24	7.008	17	269.3	1.700	0.834	1.8741	
15 minute winter	17	1.010	6	359.1	2.267	1.361	4.9572	
15 minute winter	16	17.000	60	39.2	1.269	1.070	1.4514	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	12	11	12.207	0.437	127.9	0.8838	0.0000	SURCHARGED
15 minute winter	11	10	11.080	0.128	36.8	0.4470	0.0000	OK
15 minute winter	10	11	10.428	0.371	226.4	0.5822	0.0000	OK
15 minute winter	9	11	10.104	0.282	248.3	0.5766	0.0000	OK
15 minute winter	8	11	8.648	0.251	263.5	0.4976	0.0000	OK
15 minute winter	8A	11	9.357	0.207	255.5	0.3983	0.0000	OK
15 minute winter	6a	10	6.923	0.048	10.2	0.0870	0.0000	OK
960 minute winter	6	915	6.362	1.072	99.4	3.1064	0.0000	SURCHARGED
960 minute winter	5	930	6.362	1.471	100.7	3.5780	0.0000	SURCHARGED
960 minute winter	4	930	6.361	1.936	104.1	6.2894	0.0000	SURCHARGED
960 minute winter	2	930	6.361	2.224	104.0	1736.4270	0.0000	OK
15 minute winter	52	11	8.157	0.133	30.4	0.6386	0.0000	OK
15 minute winter	53	12	12.616	0.097	8.0	0.1551	0.0000	OK
15 minute winter	54	11	12.615	0.504	126.4	2.4326	0.0000	SURCHARGED
15 minute winter	44A	12	7.661	0.579	113.1	1.4900	0.0000	SURCHARGED
60 minute winter	55	51	7.612	0.926	320.5	1.6357	0.0000	SURCHARGED
60 minute winter	57	51	7.608	1.045	312.5	222.2577	0.0000	SURCHARGED
960 minute winter	58	930	6.361	0.598	0.2	0.6768	0.0000	SURCHARGED
960 minute winter	59	930	6.361	0.785	0.7	1.1711	0.0000	SURCHARGED
960 minute winter	60	915	6.362	0.142	3.8	0.1971	0.0000	OK
960 minute winter	61	930	6.361	0.898	1.8	1.6225	0.0000	SURCHARGED
15 minute winter	7	11	11.271	0.164	2.4	0.2130	0.0000	OK
15 minute winter	62	12	13.059	0.084	10.9	0.2243	0.0000	OK
15 minute winter	63	13	12.856	0.173	32.8	0.3902	0.0000	OK
15 minute winter	64	12	13.032	0.057	10.9	0.1507	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	12	1.002	10	127.6	1.813	1.148	2.0289	
15 minute winter	11	2.000	10	36.6	1.032	0.630	2.1933	
15 minute winter	10	1.003	9	227.3	1.855	0.997	5.7479	
15 minute winter	9	1.004	8A	248.1	2.829	0.622	3.8822	
15 minute winter	8	1.006	55A	262.2	2.540	0.584	2.5324	
15 minute winter	8A	1.005	8	255.2	3.348	0.352	1.2184	
15 minute winter	6a	17.000_1	6	10.2	1.702	0.093	0.0809	
960 minute winter	6	1.011	5	99.1	1.075	0.144	11.2347	
960 minute winter	5	1.012	4	100.6	0.970	0.146	8.8917	
960 minute winter	4	North DB	2	104.0	0.727	0.103	19.0449	
960 minute winter	2	Hydro-Brake®		18.6				1006.2
15 minute winter	52	18.000	48	29.8	1.247	0.631	1.4507	
15 minute winter	53	1.000	54	7.8	0.407	0.212	1.8714	
15 minute winter	54	1.001	12	109.2	1.552	0.983	2.4045	
15 minute winter	44A	7.001	44	100.9	1.433	1.285	0.4760	
60 minute winter	55	Central DB	57	312.5	1.039	0.666	16.3857	
60 minute winter	57	Hydro-Brake®	17	85.0				
960 minute winter	58	18.000_1	59	-0.2	-0.012	-0.006	1.4120	
960 minute winter	59	18.001_1	61	0.5	0.097	0.013	0.7635	
960 minute winter	60	16.001_1	6	3.8	0.831	0.055	1.0189	
960 minute winter	61	18.002	4	1.7	0.425	0.026	1.2147	
15 minute winter	7	Hydro-Brake®	11	1.8				
15 minute winter	62	1.000_1	63	11.0	0.768	0.300	0.6233	
15 minute winter	63	1.001_1	65	32.3	1.058	0.882	0.8470	
15 minute winter	64	2.000_1	63	10.9	0.586	0.140	0.2658	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	65	11	12.664	0.195	47.3	0.4052	0.0000	OK
180 minute winter	100	148	11.909	0.586	7.0	15.4750	0.0000	SURCHARGED
15 minute winter	66	12	12.911	0.011	0.4	0.0000	0.0000	OK
15 minute winter	19.000:10%	11	13.505	0.044	8.8	0.0000	0.0000	OK
15 minute winter	67	11	12.564	0.054	8.4	0.0199	0.0000	OK
15 minute winter	19.001:10%	10	13.119	0.036	8.8	0.0000	0.0000	OK
180 minute winter	68	148	11.910	0.177	7.1	0.2003	0.0000	OK
15 minute summer	EX SW	1	11.254	0.000	1.8	0.0000	0.0000	OK
15 minute winter	68A	11	12.387	0.163	23.8	0.3023	0.0000	OK
15 minute winter	101	11	12.421	0.179	15.8	0.1215	0.0000	OK
15 minute summer	69	10	7.847	0.072	9.5	0.1275	0.0000	OK
15 minute winter	55A	11	7.870	0.890	473.7	1.2730	0.0000	SURCHARGED
15 minute winter	70	12	12.319	0.094	14.7	0.2374	0.0000	OK
15 minute winter	71	13	12.212	0.144	29.4	0.3422	0.0000	OK
15 minute winter	72	11	11.990	0.175	60.4	0.5660	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	65	1.002_1	54	47.0	1.102	0.600	0.8223	
180 minute winter	100	Hydro-Brake®	EX SW	1.8				30.1
15 minute winter	66	19.000	19.000:10%	-0.4	-0.029	-0.001	0.0566	
15 minute winter	66	Trench 19	67	0.2	0.070	0.004	0.1503	
15 minute winter	66	19.000	67	7.6	0.354	0.017	0.7460	
15 minute winter	67	19.001	19.001:10%	-0.8	-0.069	-0.001	0.0205	
15 minute winter	67	Trench 19.1	101	8.4	0.405	0.126	0.3393	
15 minute winter	67	19.001	101	7.9	0.421	0.014	0.2808	
180 minute winter	68	19.004	100	7.0	0.368	0.255	0.7149	
15 minute winter	68A	19.003	68	24.0	0.771	0.874	0.7762	
15 minute winter	101	19.002_1	68A	16.0	0.494	1.164	0.1157	
15 minute summer	69	18.001	48	9.5	0.705	0.226	0.4030	
15 minute winter	55A	1.009_1	55	472.3	2.981	2.078	2.2052	
15 minute winter	70	4.000_1	71	14.7	0.703	0.368	0.5619	
15 minute winter	71	4.001_1	72	28.7	1.031	0.721	1.2561	
15 minute winter	72	4.002_1	10	60.4	1.945	0.819	0.4740	

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Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	51	10	8.448	0.106	20.0	0.2124	0.0000	OK
15 minute winter	50	11	8.303	0.238	47.5	0.5532	0.0000	SURCHARGED
15 minute winter	49	12	8.447	1.279	44.8	2.6369	0.0000	FLOOD RISK
15 minute winter	48	13	8.747	1.227	93.8	3.7438	0.0000	SURCHARGED
30 minute winter	45	18	8.250	0.887	69.8	3.9835	20.9599	FLOOD
15 minute winter	44	12	8.443	1.395	128.9	1.9963	0.0000	FLOOD RISK
15 minute winter	43	12	8.385	1.491	138.9	4.1736	0.0000	SURCHARGED
15 minute winter	42	13	8.310	0.135	14.9	0.1528	0.0000	OK
15 minute winter	41	12	8.306	0.464	39.4	0.9833	0.0000	SURCHARGED
15 minute winter	40	12	8.286	1.492	179.3	4.6374	0.0000	SURCHARGED
15 minute winter	39	12	8.116	1.416	190.2	2.6364	0.0000	SURCHARGED
15 minute winter	32	12	7.893	1.410	244.5	3.3255	0.0000	SURCHARGED
15 minute winter	31	12	7.599	1.311	267.6	2.7372	0.0000	SURCHARGED
15 minute winter	30	10	10.433	0.128	54.3	0.4457	0.0000	OK
15 minute winter	29	12	9.490	0.927	137.6	4.1982	0.0000	SURCHARGED
15 minute winter	28	13	13.090	0.785	50.2	2.3529	0.0000	SURCHARGED
15 minute winter	27	13	12.998	1.508	97.1	5.0866	0.0000	SURCHARGED
15 minute winter	26	12	11.809	1.583	135.0	3.7953	0.0000	SURCHARGED
15 minute summer	26A	10	12.153	0.078	18.9	0.1421	0.0000	OK
30 minute winter	25A	22	8.805	1.535	246.1	2.8295	0.0000	SURCHARGED
15 minute winter	25	12	9.050	1.642	146.0	4.8530	0.0000	FLOOD RISK
15 minute winter	24A	10	7.418	0.103	15.5	0.1854	0.0000	OK
30 minute summer	24	19	7.251	1.484	351.9	4.9810	0.0000	SURCHARGED
30 minute summer	17	19	7.001	1.352	421.4	3.5924	0.0000	SURCHARGED
15 minute winter	16	11	7.169	0.719	62.6	2.5438	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	51	16.000	50	20.0	0.695	0.462	1.1619	
15 minute winter	50	16.001	32	43.4	1.171	1.090	1.4886	
15 minute winter	49	9.000	44	-35.1	-0.318	-0.286	3.4737	
15 minute winter	48	7.000	44A	78.9	1.134	0.896	4.0531	
30 minute winter	45	8.001	44A	-34.3	-0.862	-0.936	1.6367	
15 minute winter	44	7.002	43	134.6	1.221	1.067	4.2386	
15 minute winter	43	7.003	40	149.2	1.353	1.296	3.2978	
15 minute winter	42	15.000	41	-14.9	-0.467	-0.354	1.6235	
15 minute winter	41	15.001	40	33.0	1.293	0.415	1.5167	
15 minute winter	40	7.004	39	185.9	1.686	1.315	2.0661	
15 minute winter	39	7.005	32	196.5	1.782	1.205	2.3521	
15 minute winter	32	7.006	31	246.9	1.774	1.082	6.1714	
15 minute winter	31	7.007	24	269.5	1.701	0.745	6.5981	
15 minute winter	30	6.000	29	54.3	2.113	0.625	1.8963	
15 minute winter	29	6.001	25	102.5	1.546	0.607	3.5386	
15 minute winter	28	4.000	27	48.3	1.452	0.728	1.9950	
15 minute winter	27	4.001	26	80.1	2.034	0.972	2.0110	
15 minute winter	26	4.002	25A	118.2	2.972	1.257	2.1771	
15 minute summer	26A	5.000	26	19.0	1.501	0.258	1.0144	
30 minute winter	25A	4.004	55A	242.0	2.194	1.719	1.3741	
15 minute winter	25	4.003	25A	137.6	1.955	1.763	0.8931	
15 minute winter	24A	15.000_1	24	15.5	0.914	0.388	0.2222	
30 minute summer	24	7.008	17	345.8	2.182	1.071	1.8741	
30 minute summer	17	1.010	6	420.3	2.653	1.593	4.9572	
15 minute winter	16	17.000	60	50.7	1.306	1.386	1.8303	

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Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	12	11	12.560	0.790	165.5	1.5969	0.0000	SURCHARGED
15 minute winter	11	11	11.316	0.364	56.2	1.2681	0.0000	SURCHARGED
15 minute winter	10	11	10.688	0.631	302.8	0.9913	0.0000	SURCHARGED
15 minute winter	9	11	10.169	0.347	335.8	0.7098	0.0000	OK
15 minute winter	8	13	9.401	1.004	340.0	1.9909	0.0000	SURCHARGED
15 minute winter	8A	13	9.656	0.506	345.6	0.9751	0.0000	SURCHARGED
15 minute winter	6a	10	6.935	0.060	15.8	0.1094	0.0000	OK
1440 minute winter	6	1380	6.888	1.598	111.7	4.6319	0.0000	SURCHARGED
1440 minute winter	5	1380	6.888	1.997	113.1	4.8584	0.0000	FLOOD RISK
1440 minute winter	4	1380	6.887	2.462	117.1	7.9982	0.0000	FLOOD RISK
1440 minute winter	2	1380	6.887	2.750	116.9	2844.9400	0.0000	OK
15 minute winter	52	12	8.900	0.876	47.2	4.2109	1.7370	FLOOD
15 minute winter	53	11	13.230	0.711	23.8	1.1328	0.0000	SURCHARGED
15 minute winter	54	12	13.211	1.100	158.4	5.3096	0.0000	SURCHARGED
15 minute winter	44A	12	8.477	1.395	129.4	3.5886	0.0000	FLOOD RISK
60 minute winter	55	57	8.312	1.626	458.8	2.8730	0.0000	FLOOD RISK
60 minute winter	57	59	8.307	1.744	456.7	452.8226	0.0000	FLOOD RISK
1440 minute winter	58	1380	6.887	1.124	0.2	1.2718	0.0000	SURCHARGED
1440 minute winter	59	1380	6.887	1.311	1.6	1.9554	0.0000	SURCHARGED
1440 minute winter	60	1380	6.888	0.668	4.3	0.9284	0.0000	SURCHARGED
1440 minute winter	61	1380	6.887	1.424	2.1	2.5726	0.0000	SURCHARGED
15 minute winter	7	13	11.526	0.419	3.8	0.5440	0.0000	SURCHARGED
15 minute winter	62	13	13.575	0.600	27.6	1.5950	0.0000	FLOOD RISK
15 minute winter	63	13	13.511	0.828	53.8	1.8710	0.0000	FLOOD RISK
15 minute winter	64	13	13.531	0.556	16.9	1.4769	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	12	1.002	10	166.3	2.362	1.496	2.0631	
15 minute winter	11	2.000	10	50.3	1.303	0.864	2.7621	
15 minute winter	10	1.003	9	303.3	1.968	1.330	6.8167	
15 minute winter	9	1.004	8A	334.0	2.868	0.838	6.3659	
15 minute winter	8	1.006	55A	329.6	2.988	0.734	2.9602	
15 minute winter	8A	1.005	8	327.1	3.225	0.451	2.3850	
15 minute winter	6a	17.000_1	6	15.8	1.918	0.143	0.1112	
1440 minute winter	6	1.011	5	111.4	1.066	0.162	11.2347	
1440 minute winter	5	1.012	4	113.0	0.959	0.164	8.8917	
1440 minute winter	4	North DB	2	116.9	0.266	0.116	19.0449	
1440 minute winter	2	Hydro-Brake®		19.4				1591.2
15 minute winter	52	18.000	48	39.3	1.216	0.832	2.0667	
15 minute winter	53	1.000	54	14.8	0.399	0.404	2.6488	
15 minute winter	54	1.001	12	141.1	2.003	1.270	2.4045	
15 minute winter	44A	7.001	44	115.9	1.646	1.476	0.4760	
60 minute winter	55	Central DB	57	456.7	1.279	0.973	16.3857	
60 minute winter	57	Hydro-Brake®	17	85.5				
1440 minute winter	58	18.000_1	59	1.0	0.029	0.027	1.4120	
1440 minute winter	59	18.001_1	61	0.6	0.102	0.015	0.7635	
1440 minute winter	60	16.001_1	6	4.3	0.756	0.062	1.2251	
1440 minute winter	61	18.002	4	2.0	0.423	0.030	1.2147	
15 minute winter	7	Hydro-Brake®	11	2.0				
15 minute winter	62	1.000_1	63	20.6	0.763	0.562	1.7014	
15 minute winter	63	1.001_1	65	60.6	1.523	1.654	1.1054	
15 minute winter	64	2.000_1	63	20.7	0.629	0.266	0.5231	

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Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	65	12	13.280	0.811	69.5	1.6845	0.0000	SURCHARGED
240 minute winter	100	188	12.610	1.287	8.2	24.8818	0.0000	FLOOD RISK
15 minute winter	66	11	12.926	0.026	1.6	0.0000	0.0000	OK
15 minute winter	19.000:10%	10	13.514	0.053	13.6	0.0000	0.0000	OK
15 minute winter	67	12	12.629	0.119	14.2	0.0878	0.0000	OK
15 minute winter	19.001:10%	10	13.127	0.044	13.6	0.0000	0.0000	OK
240 minute winter	68	188	12.613	0.880	9.0	0.9949	0.0000	FLOOD RISK
15 minute summer	EX SW	1	11.254	0.000	1.8	0.0000	0.0000	OK
240 minute winter	68A	184	12.616	0.392	9.0	0.7263	0.0000	SURCHARGED
15 minute winter	101	12	12.634	0.392	25.3	0.6125	0.0000	SURCHARGED
15 minute winter	69	13	8.756	0.981	33.1	1.7340	0.0000	FLOOD RISK
30 minute winter	55A	23	8.550	1.570	554.8	2.2473	0.0000	FLOOD RISK
15 minute winter	70	13	12.618	0.393	22.7	0.9950	0.0000	SURCHARGED
15 minute winter	71	13	12.559	0.491	43.8	1.1674	0.0000	SURCHARGED
15 minute winter	72	12	12.229	0.414	85.3	1.3394	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	65	1.002_1	54	76.0	1.192	0.970	1.1039	
240 minute winter	100	Hydro-Brake®	EX SW	2.1				45.9
15 minute winter	66	19.000	19.000:10%	-1.6	-0.084	-0.004	0.0773	
15 minute winter	66	Trench 19	67	1.5	0.196	0.029	0.4535	
15 minute winter	66	19.000	67	11.1	0.402	0.025	0.9628	
15 minute winter	67	19.001	19.001:10%	-2.0	-0.122	-0.004	0.0277	
15 minute winter	67	Trench 19.1	101	13.6	0.457	0.205	0.5031	
15 minute winter	67	19.001	101	11.6	0.476	0.021	0.3630	
240 minute winter	68	19.004	100	8.2	0.392	0.298	0.7758	
240 minute winter	68A	19.003	68	9.0	0.606	0.327	0.9758	
15 minute winter	101	19.002_1	68A	20.6	0.519	1.500	0.1422	
15 minute winter	69	18.001	48	-18.4	0.707	-0.437	1.0902	
30 minute winter	55A	1.009_1	55	553.0	3.491	2.433	2.2052	
15 minute winter	70	4.000_1	71	23.3	0.760	0.587	1.0589	
15 minute winter	71	4.001_1	72	45.0	1.175	1.131	1.7049	
15 minute winter	72	4.002_1	10	83.2	2.091	1.128	0.6028	

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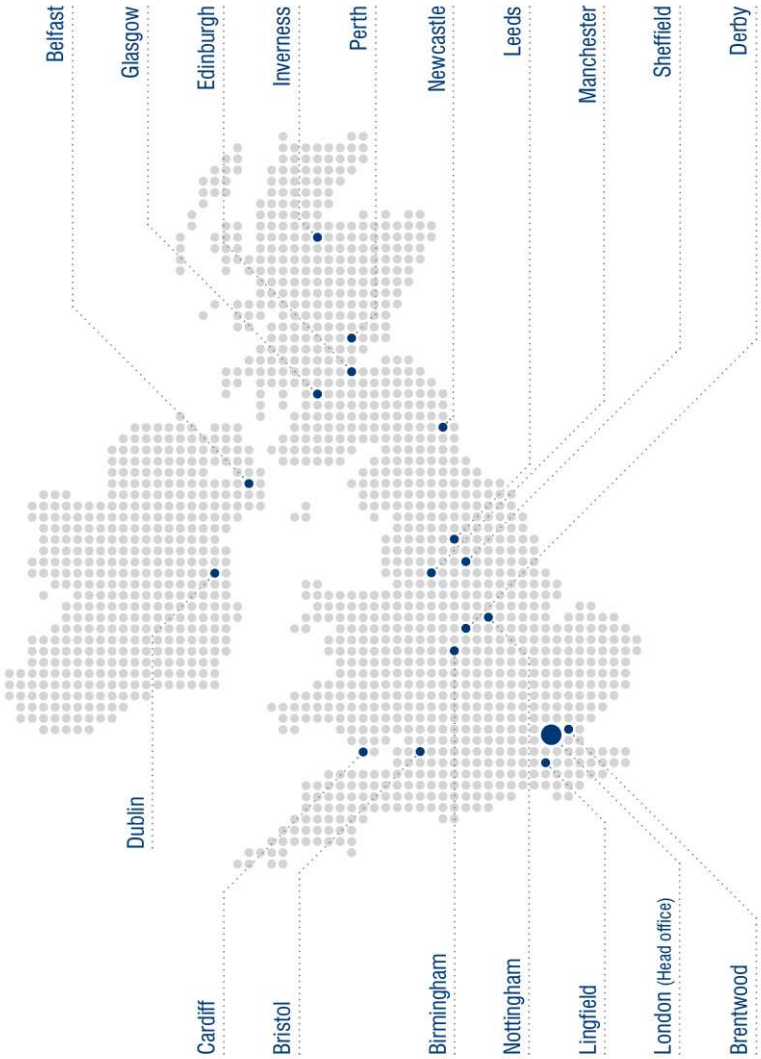
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