CASTLELAKE SHD

Engineering Services Infrastructure Report

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1 INTRODUCTION

1.1 Purpose of the Report

RPS Consulting Engineers have been appointed by BAM Property Ltd to provide for the civil engineering design of the wastewater and surface water sewers, watermains and road vertical geometry design for the proposed Castlelake Strategic Housing Development (SHD) within lands adjacent to the existing Castlelake development at Terrysland, Carrigtwohill, Co. Cork. RPS has previously prepared planning permission documentation to support the existing phases to the Castlelake development.

This report, which provides supporting information on the above, forms part of the SHD planning application for the development and should be read in conjunction with all submitted drawings and reports.

1.2 Background

The Castlelake development lands are located to the west of the town of Carrigtwohill in County Cork. In June 2002, Cork County Council granted planning permission for a proposed development at Castlelake (Planning Reference Nos. 00/7607 and 00/7674). Development on the site to date has been primarily residential. While the original grants of planning permission involved the development of the entire land holding, development to date has been predominantly to the eastern area of the site only, with the remainder of the site typically remaining undeveloped.

It is now proposed to develop the remainder of the site for typically residential use, which will involve the construction of 716nr residential units. It is also proposed to provide a creche within the development. The location of the proposed development within the Castlelake development is shown on the accompanying RPS engineering drawings, and on the architectural drawings which accompany this application.

The sewers and watermains proposed to serve the development will connect to the network of existing sewers and watermains that have been constructed as part of the existing Castlelake development. Sections 3 to 5 below contain information on the design of the proposed wastewater sewer, surface water sewer and watermain networks.

1.3 Proposed Site Location and Description

The proposed site is located on greenfield lands adjacent to the existing Castlelake residential development, in Carrigtwohill, Co Cork. The wider area is currently partially developed, with existing residential dwellings located to the western section of the lands. Access to the site is currently provided via an existing, established junction onto Main Street, and via 2no. new junctions with Station Road, which are currently under construction (under a separate planning permission). The site is bound to the north by the railway line which links Midleton to Cork city at Kent Station, to the west by the existing Castlelake residential development, by Main Street and existing dwelling/development to the south and Station Road to the east.

The development will consist of the construction of a strategic housing development of 716 no. units and a 2 no. storey creche. The proposed development comprises 224 no. houses, 284 no. duplex units and 208 no. apartments. The two storey houses comprise 48 no. detached, 126 no. semi-detached and 50 no. terraced Houses containing 60 no. two bed units, 139 no. three bed units and 25 no. four bed units. The part-one to part-three storey duplex units are contained in 122 no. buildings providing 82 no. one bed units, 142 no. two bed units and 60 no. three bed units. There are 7 no. apartments blocks ranging in height from part-1 to part-5 no. storeys.

- Block 1 is 4 no. storeys and contains 34 no. units (7 no. one bed units, 19 no. two bed units and 8 no. three bed units).
- Block 2 is part-1 to part-5 no. storeys and contains 42 no. units (15 no. one bed units, 20 no. two bed units and 7 no. three bed units).
- Block 3 is 5 no. storeys and contains 17 no. units (8 no. one bed units and 9 no. two bed units).
- Block 4 is 4 no. storeys and contains 13 no. units (6 no. one bed units and 7 no. two bed units).
- Block 5 is 4 no. storeys and contains 13 no. units (6 no. one bed units and 7 no. two bed units).

- Block 6 is 4 no. storeys and contains 13 no. units (6 no. one bed units and 7 no. two bed units).
- Block 7 is 5 no. storeys over basement and contains 76 no. units (23 no. one bed units, 41 no. two bed units and 12 no. three bed units).
- All blocks contain ancillary internal and external resident amenity space.

The proposed development also provides for: hard and soft landscaping; boundary treatments; public realm works; car parking; bicycle stores and shelters; bin stores; lighting; plant rooms; and all ancillary site development works above and below ground.

2 ROADS INFRASTRUCTURE

2.1 General

Vehicular access to the proposed development lands is currently made via the existing, established junction with Main Street. This junction provides for vehicular and pedestrian access to the existing Castlelake development. The existing residential development is served via a network of roads, footways and cycleways which provide access to the existing dwellings.

As part of the separate works to facilitate a new educational campus on lands in the general works area, new infrastructure consisting of roads, footpaths and cycleways have been constructed, along with the provision of 2 no. new access junctions onto Station Road. These works are all being completed under a separate planning permission application.

In order to access the proposed development, it is proposed connect to the existing road infrastructure with new roads, footpath and cycleways to allow for access to be provided throughout the new development. The development's internal layout has been as per the requirements of the Design Manual for Urban Roads and Streets (DMURS) and Cork County Council.

2.2 Road Layout Design

The roads layout for the proposed development can be seen in the accompanying drawings. These drawings provide details on the horizontal and vertical alignment of the proposed road network, including cross-sectional details of same.

The roads proposals typically comprise of the following:

- New 6.0m wide northern spine link road to provide access to lands to north of railway,
- New 6.0m wide road to provide access to the residential core area, located to the north of the existing apartment blocks,
- Local roads of 5.5m carriageway widths have been provided to provide access to the dwellings within the residential development,
- Footpath widths of typically 2.0m have been provided, ,
- Cycle lanes of 1.75m width have been provided along primary northern link road route.

2.3 Proposed Carrigtwohill to Midleton InterUrban Cycleway Route through Proposed Development Lands

Cork County Council have produced a Part 8 planning application of the provision of the Carrigtwohill to Midleton InterUrban Cycleway Phase 1. This Part 8 application was approved by full council on 14th March 2022. Section 1B and 1C of this route is proposed to pass through the Castlelake SHD application site to facilitate access to the Carrigtohill Train Station.

Discussions relating to the proposed route of this cycleway through the application site have been had with Cork County Council at Section 5 pre-consultation stage. A similar, but alternate alignment for this route within the Castlelake SHD application was tabled at this pre-consultation meeting but following these discussions with Cork County Council, the route was subsequently maintained as per the Part 8 alignment. The cycleway arrangement can be seen on the accompanying drawings.

On exit of the existing underpass below the railway line, the proposed Section 1B of the route follows the alignment of the northern spine road to the development, prior to it curving through the greenspace to the south of Apartment A7 block, and then continuing in a southerly direction through third party lands to allow a connection to the proposed educational campus. The Section 1C of the cycleway route is now shown to travel northwards off Section 1A to the rear of the apartment block, prior to turning east to connect to the train station. The horizontal alignment of this revised route has been designed to allow for the provision of this cycleway at gradients no greater than 1:21 where is follows the alignment of the northern spine road.

These gradient soften out to a maximum of 1:70 where the cycleway passes through the greenspace top the south and east of the proposed Apartment A7 block. Details of the proposed cycleway levels and gradients can be seen on drawing MCW1088-RPS-00-XX-DR-C-GE0102.

The cycleway route will be required to pass the vehicular entrance in the Apartment A7 block. An assessment of the level was undertaken to determine if it is feasible to grade separate the cycleway from the apartment entrance at this location.

An assessment on the potential to allow the cycleway route to pass under the vehicular access via an underpass was reviewed. From this assessment, it was determined that there is insufficient distance along its length available to get to the necessary level under the access road to provide suitable clear with the underpass while maintaining incoming and outgoing gradients to the underpass at less than 1:20.

An assessment on the potential to allow the cycleway route to pass over the vehicular access via a bridging type of structure was reviewed. From this assessment, it was again determined that there is insufficient distance along its length available to get to the necessary level over the access road to provide suitable clearance for vehicles passing under while maintaining incoming and outgoing gradients to the underpass at less than 1:20.

Therefore it is proposed that the cycleway route is to pass the entrance to Apartment A7 at similar grade, but the cycleway has been designed to have priority at all times over vehicular traffic entering the car park of Apartment A7. The surface finishes have been designed to indicate that priority is to be provided to the cycleway. Tactile paving will be provided to alert the cycleway users to the upcoming arrangement but they will not be required to yield, as they will have priority.

This format of junction providing priority to cyclists and pedestrians across a vehicular access location is similar to the junctions as proposed along the east-west spine road that has recently been constructed as part of the educational campus works under planning application 19/05707, which was discussed and agreed with Cork County Council Roads Department at that time. This will provide for a level of consistency of cyclist/pedestrian priority junctions within the development area.

3 WASTEWATER DESIGN

3.1 General

The wastewater drainage for the proposed development has been designed in accordance with the requirements of Irish Water, as set out in the document IW-CDS-5030-03, “Code of Practice for Wastewater Infrastructure”, Revision 2. The drainage has also been designed in compliance with IS EN 752 Drain and sewer systems outside buildings, the general principles as set out in Section 3 of the publication “Recommendations for Site Development Works for Housing Areas” published by the Department of the Environment and Local Government, and the EPA publication “Wastewater Treatment Manuals – Treatment Systems for Small Communities, Businesses, Leisure Centres and Hotels” where appropriate.

The wastewater from the existing Castlelake residential development is currently discharged to the public trunk sewer network located to the Main Street. The main trunk wastewater sewers as constructed to the existing Castlelake development have been previously designed to take account of the future development of the entire Castlelake site, i.e. the existing trunk sewer drainage as laid within Castlelake has sufficient capacity to accept the wastewater flow from all existing and proposed development within the subject lands.

Th existing wastewater drainage network as constructed within the existing Castlelake development lands has not as yet been taken in charge by Irish Water and is currently under the control of the applicant.

3.2 Proposed Wastewater Network

It is proposed that a new underground gravity wastewater network will be provided to serve the proposed Castlelake SHD development. This wastewater network has been designed to fall by gravity towards the existing wastewater network as laid for the existing Castlelake development, which ultimately discharges to the public wastewater sewer network at the existing access junction into the development.

3.3 Wastewater Calculations

The proposed Carrigtwohill SHD consists of the provision of 716nr residential dwellings. The proposed wastewater generated from this development has been estimated using the guidance as included within the Irish Water Technical Standard IW-TEC-800-01 “Wastewater Gravity Sewers”, with detailed calculations included as **Appendix A** of this report.

In summary, the wastewater arising from the proposed development is estimated as follows:

- Total Nr of Dwellings = 716nr
- Occupancy Rate = 2.7 per dwelling
- Water Consumption = 150l/p/day
- Domestic Wastewater Contribution = 289,980 litres/day
- Infiltration (10% of Unit Consumption) = 28,998 litres/day
- Dry Weather Flow = 3.7 litres/sec
- Design Flow = 34.2 litres/sec

The MicroDrainage (Innovyze) software package has been used to design the wastewater network and the wastewater network design output is included in **Appendix B**.

3.4 Irish Water Pre-Connection Enquiry

A pre-connection enquiry form was submitted to Irish Water in respect to the wastewater connections from the proposed development. Subsequently, Irish Water confirmed that based on the size of the proposed development and on the capacity currently available, and subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network can be facilitated, with the proviso that some local network upgrades are carried out to the existing public network. A copy of the Confirmation of Feasibility as received from Irish Water has been included as **Appendix C** of this report.

3.5 Irish Water Statement of Design Acceptance

A Statement of Design Acceptance submission was made to Irish Water in respect to the proposed wastewater infrastructure that is to be provided to service the proposed development. Irish Water have returned a Statement of Design Acceptance for the wastewater infrastructure, and a copy of this statement is included as **Appendix D**.

4 SURFACE WATER NETWORK

4.1 Surface Water Strategy

The surface water drainage network for the proposed Castlelake SHD development has been designed in accordance with the principles as set out in Section 3 of the publication “Recommendations for Site Development Works for Housing Areas” published by the Department of the Environment and Local Government, and in accordance with IS EN 752 Drain and sewer systems outside buildings.

The existing stormwater drainage falling onto the northern section of the existing Castlelake development is collected via an underground gravity sewer networks and discharges to the feature amenity attenuation lagoon, which is located centrally to the development lands (discussed further below). It is proposed that the section of the proposed development to the northern extents of the site, which is at an elevated level, is also to discharge to the feature amenity attenuation lagoon. From here, the lagoon will provide for surface water storage prior to the discharge of attenuated run-off to the Woodstock Stream.

The existing stormwater falling onto the existing development to the west of the proposed development is collected via an underground gravity sewer network and discharges towards an underground attenuation system, which is shortly to be under construction by the applicant (discussed further below). This attenuation structure was required to be constructed under the previous planning permissions granted under application reference Nos. 00/7607 and 00/7674 to provide surface water attenuation for the development to the western section of the lands. While it was not installed previously, it has now been designed (by others) and is to be constructed by the applicant as required infrastructure to facilitate the existing development under the previous planning permission. The stormwater drainage for the primarily western section of the development, which is too low lying to connect to the network draining towards the amenity pond, is proposed to be collected via a separate underground gravity sewer network and discharge to this underground attenuation tank. As stated, the tank is shortly to be under construction, and will be in place and operational prior to the commencement of any works on this subject application.

4.2 Proposed Surface Water Network

The surface water falling onto the proposed development will be collected by rainwater pipes to building perimeters and by road gullies to the roads and hardstanding areas, with the run-off directed towards the new surface water gravity sewer system to be provided for the proposed development. The stormwater will flow by gravity towards either the existing attenuation lagoon located centrally to the lands, or the underground attenuation tank (currently under construction under separate planning permission) on lands to the southern section of the site adjacent to Main Street.

The surface water drainage network is designed using the Modified Rational Method, using the following variables:

(i)	Return Period	=	2 Years
(ii)	M5-60(mm)	=	18.0mm
(iii)	Maximum Rainfall	=	50mm/hr
(iv)	Ratio R	=	0.249
(v)	Volumetric Run-Off Coefficient	=	0.75

The surface water run-off from the north-eastern and north-western sections of the proposed development is to be collected by a new stormwater sewer network to be provided for the proposed development. Surface water flows within sections of the proposed network will be attenuated using underground geo-cellular attenuation tanks, with these attenuation tanks strategically located within greenspaces to minimise impact on the landscaping proposal. The purpose of these intermediate attenuation tanks is to restrict the flow entering the existing downstream network, and to reduce the hydraulic loading on the existing networks and amenity lagoon. The flows will ultimately discharge to the existing amenity attenuation lagoon, which is discussed in Section 4.3 below. At this lagoon location, the collected surface water will be attenuated to pre-development greenfield rates of run-off, prior to discharge to the Woodstock Stream.

The surface water run-off from the western section of the proposed development is to be collected by a new stormwater sewer network to be provided for the proposed development. The proposed network will ultimately discharge to an underground attenuation tank system (shortly to be under construction by the applicant) and is discussed in Section 4.3 below. At this tank location, the collected surface water will be attenuated to pre-development greenfield rates of run-off, prior to discharge to the Woodstock Stream.

The surface water network for the proposed development has been modelled with the MicroDrainage (Innovyse) software to ensure that the network will have sufficient capacity to cater conveying the surface water collected from both the existing and proposed development.

The proposed hardstanding areas, in addition to the hardstanding areas within the existing development, have been calculated and these areas were inputted to the MicroDrainage storm network model to allow for the design of the stormwater networks.

Output from the MicroDrainage surface water network design is included in **Appendix E**, along with summaries of simulation results for rainfall events of 5-year and 30-year return periods. The simulation results indicate surcharging in the 5 and 30 year events, but no flooding has been predicted.

4.3 Proposed Surface Water Attenuation Design

4.3.1 Proposed Intermediate Attenuation Tanks

The existing surface water network was originally designed to transfer flows from the proposed development to the existing attenuation lagoon, which is located centrally within the Castlelake lands. The proposed development has a greater extent of hardstanding and greater density of development than that as previously envisaged in the original development masterplan proposed in the 2000's. In addition, requirements regarding attenuation have changed considerably since the original design was undertaken. Therefore, the flows from pre-determined sections of the development require supplementary storage volume to be provided to reduce the hydraulic loading to both the downstream network and also ultimately to the existing amenity lagoon.

As referenced in Section 4.2 above, intermediate attenuation tanks have been strategically located on the proposed surface water network within the development to restrict the flow entering the existing downstream network, and to reduce the hydraulic loading on the existing networks and amenity lagoon. The intermediate attenuation tanks have been designed using the following variables:

(i) M5-60(mm) = 18.0mm
(ii) Ratio R = 0.249
(iii) Volumetric Run-Off Coefficient = 0.75 in Summer, 0.84 in Winter

There are 3no. underground intermediate attenuation tanks proposed in the north-eastern section and 1no. located on the north-western section of the proposed development, with a summary of the tank details as follows:

Table 4-1: Intermediate Attenuation Tanks

Tank No	Plan Area (m^2)	Depth (m)	Invert Level (m OD)	Storage Volume (m^3)	Restricted Outflow (l/s)
1	590	1.600	4.588	900	16.1
2	230	1.600	3.614	345	5.5
3	220	1.075	4.435	200	3.7
4	680	1.600	1.762	1,040	100.0

The proposed tanks are proposed to be constructed using modular geo-cellular units, which will have a void ratio of 95%. The outflows from these tanks will discharge to the surface water network and will flow towards the existing amenity lagoon, where ultimately they will be subjected to further attenuation prior to discharge to the Woodstock Stream (see Section 4.3.2 below).

Detailed MicroDrainage calculation outputs for the design of these 4nr tanks are also included in the surface water network design output included in **Appendix E**.

4.3.2 Analysis of Existing Attenuation Lagoon Serving Northern Lands

As discussed in Section 4.2, the stormwater network to the northern section of the development will collect the run-off from this section of the proposed development and discharge to the existing attenuation lagoon, located centrally to the Castlelake lands. This lagoon was designed and obtained planning permission previously under the applications reg ref 00/7607 and 00/7674, and was originally designed to accommodate flows from approximately 70% of the masterplan lands. Therefore the catchment area for this lagoon has always included lands within the northern section of the site, and the lagoon has originally been designed to accommodate the surface water flows from this development area. Therefore, the lands in the northern section of this subject application are included within the catchment area of the existing amenity lagoon.

As the lagoon has been designed and constructed to accommodate flows from this section of land, it is proposed to utilise the lagoon as an attenuation feature for the proposed SHD site. The lagoon ultimately discharges flows attenuated to greenfield rates to the Woodstock Stream, at a location to the south of the site.

4.3.2.1 Assessment of Allowable Greenfield Runoff from Existing Lagoon

In order to demonstrate that the existing lagoon has sufficient capacity to cater for both the existing incoming flows from the existing development, as well as the additional inflow associated with the proposed SHD, a detailed analysis of the lagoon storage and attenuation capacity has been undertaken.

In order to estimate the pre-development rate of greenfield run-off from the areas connected to the lagoon, a catchment analysis to estimate the areas contributing towards this lagoon has been undertaken. The catchment area for the existing development section to the west of the proposed SHD has been estimated at 8.27 hectares. The catchment area for the proposed SHD application section has been estimated at 18.01 hectares. Therefore the total catchment area contributing to the existing amenity lagoon is 26.28 hectares. This is summarised in **Table 4-2** below.

Table 4-2: Existing Attenuation Lagoon Catchment Areas

Lagoon Catchment Reference	Area (ha)
Existing Developed Area	8.27
Proposed SHD Development Area	18.01
Total Contributing Area	**26.28**

As part of this assessment, the percentage impermeable areas associated with the contributing hardstanding of roads, footpaths, cycleways and roofs within the total contributing area has been estimated at 14.45 hectares. This is approximately equivalent to development 55% density of the total contributing area. An analysis using *IH124 Flood Estimations for Small Catchments* has been undertaken to determine the allowable run-off for the 0.1% AEP event (1 in 100 Year storm) for the total area contributing to the existing lagoon has been undertaken. The calculation has been included in **Appendix F** of this report, and output of the calculation estimates the allowable runoff from this catchment area in a 0.1% AEP event at 129.6l/s.

Therefore the maximum outflow rate from the amenity lagoon shall be required to not exceed 129.6l/s during a 0.1% AEP event (1 in 100 Year).

4.3.2.2 Design Maximum Outflow from Existing Lagoon

An assessment using the MicroDrainage computer design software has been undertaken to ensure that the existing attenuation lagoon has sufficient storage capacity to attenuate the outflow from the entire catchment area to a rate of runoff not to exceed the greenfield run-off values.

The attenuation lagoon design assessment has been undertaken using the following variables:

(i)	M5-60(mm)	=	18.0mm
(ii)	Ratio R	=	0.249
(iii)	Volumetric Run-Off Coefficient	=	0.75 in Summer, 0.84 in Winter
(iv)	Contributing Hardstanding Area	=	14.45 hectares (see Section 4.3.2.1 above)
(v)	Climate Change Allowance	=	10%

As stated above, the MicroDrainage computer design software has been used to analyse the existing attenuation lagoon.

The existing lagoon was designed and constructed as a retention lagoon. Retention lagoons maintain a pool of water throughout the year and hold stormwater runoff following storms. The base level of the lagoon has been designed at +0.0m. The depth of permanent water within the lagoon is 0.8m, which results in a top of permanent water level within the pond of +0.8m. The maximum allowable depth of storage within the pond has been designed as 0.8m, which results in a maximum top water level within the pond of +1.6m. The plan area of the pond at the permanent water level and at the maximum allowable depth of storage level has been calculated from as-built drawings, and this information has been inputted into the MicroDrainage software to develop a model of the existing pond structure.

Using the above referenced variables, a design simulation was run on the attenuation lagoon. The result of this simulation indicates that, during a 0.1% AEP event, the maximum storage depth of water required in the pond is 0.798m, with a maximum outflow from the pond of 129.6l/s.

As this maximum outflow is equal to the allowable runoff from this catchment area in a 0.1% AEP event of 129.6l/s, it is determined that the attenuation lagoon has sufficient storage capacity to restrict the run-off from the developed catchment to that equivalent to the pre-development greenfield rate of run-off.

A summary of the output results for the pond analysis are shown in **Table 4-3** below, with detailed MicroDrainage calculation outputs is included in **Appendix F**.

Table 4-3: Attenuation Lagoon Design Outputs from 0.1% AEP (1 in 100 Year) Event

Base Level of Pond (mOD)	Top Water Level of Permanent Water (mOD)	Top Water Level of Maximum Attenuation (mOD)	Contributing Hardstanding Area (hec)	Maximum Allowable Outflow from Pond (l/s)	Maximum Design Outflow from Pond (l/s)	Storage Volume Required (m^3)	Maximum Storage Volume Provided (m^3)
0.000	0.800	1.600	14.45	129.6	129.6	7,579.1	7,600

From the attenuation lagoon, the stormwater will ultimately flow via a vortex flow restrictor (HydroBrake or similar) to discharge the attenuated outflow from the proposed development site to the Woodstock Stream, at a location to the south of the lands.

Class 1 bypass petrol interceptors have been provided on the inlets to the lagoon to capture hydrocarbons and other contaminants prior to discharge of surface water into the lagoon.

4.3.3 Attenuation Tank Serving Western Lands

The stormwater system to the western section of the development collects the run-off from this section of the proposed development and discharges it towards the underground attenuation tank. This tank is shortly to be under construction (see Section 4.1 above) and is located to the south of the Castlelake lands, adjacent to Main Street. This underground tank was previously part of the surface water strategy included within the planning applications Reg Ref 00/7607 and 00/7674, and includes the western lands of the proposed development within its design catchment area. This construction of this attenuation structure was not previously completed, but it is now proposed to be constructed as it is an essential feature of the

development as proposed under the planning applications Reg Ref 00/7607 and 00/7674. The design of this tank has been undertaken by others, and does not form part of the SHD application.

The hardstanding areas for the sections of the proposed SHD lands that are located to the western area of the lands, adjacent to the existing access road into the development, were included within the catchment area for this attenuation tank. As a result, this attenuation tank has been designed to collect the run-off from this section of the proposed development. The underground tank structure discharges attenuated flows to the Woodstock Stream, to the south of the site.

4.3.3.1 Assessment of Allowable Greenfield Runoff from Attenuation Tank

In order to demonstrate that the attenuation tank has sufficient capacity to cater for both the existing incoming flows from the existing development, as well as the additional inflow associated with the proposed SHD development, a detailed analysis of the storage and attenuation capacity has been undertaken.

In order to estimate the pre-development rate of greenfield run-off from the areas connected to the tank, a catchment analysis to estimate the contributing area to this tank has been undertaken. The entire catchment area for the existing development section has been estimated at 15.77 hectares. The proposed catchment areas for the proposed SHD application sections have been included within this overall area assessment. Therefore the total catchment area contributing to the attenuation tank is 15.77 hectares. This has been summarised in Table 4-4 below.

Table 4-4: Attenuation Tank Catchment Area

Tank Catchment Reference	Area (ha)
Existing Developed Area	15.77
Proposed SHD Development Area	Included in Above
Total Contributing Area	**15.77**

An analysis using *IH124 Flood Estimations for Small Catchments* has been undertaken to determine the allowable run-off for the 0.1% AEP event (1 in 100 Year storm) for the total area contributing to the existing tank has been undertaken. The calculation has been included in **Appendix G** of this report, and output of the calculation estimates the allowable runoff from this catchment area in a 0.1% AEP event at 77.8l/s.

Therefore the maximum outflow rate from the attenuation tank shall be required to not exceed 77.8l/s during a 0.1% AEP event (1 in 100 Year).

4.3.3.2 Design Maximum Outflow from Attenuation Tank

An assessment using the MicroDrainage computer design software has been undertaken by others to ensure that the existing attenuation tank has sufficient storage capacity to attenuate the outflow from the entire catchment area to a rate of runoff not to exceed the greenfield run-off values.

As stated above, the MicroDrainage computer design software has been used to analyse the attenuation tank requirements.

The tank has been designed (by others) as using modular geo-cellular units, which will have a void ratio of 95%. The plan layout of the tank was determined to avoid the existing electrical infrastructure located to the area, while ensuring adequate storage capacity is provided to allow for flow attenuation to greenfield rates of run-off. The plan area of the tank is 2,310m^2 and the depth is 2.0m.

The result of this simulation indicates that, during a 0.1% AEP event, the maximum storage depth of water required in the tank is 1.996m, with a maximum outflow from the tank of 72.0l/s.

As this maximum outflow is less than the allowable runoff from this catchment area in a 0.1% AEP event of 77.8l/s, it is determined that the attenuation tank has been designed to provide sufficient storage capacity to restrict the run-off from the developed catchment to that equivalent to the pre-development greenfield rate of run-off.

A summary of the output results for the tank analysis are shown in Table 4-5 below, with detailed MicroDrainage calculation outputs is included in **Appendix G**.

Table 4-5: Attenuation Tank Design Outputs from 0.1% AEP (1 in 100 Year) Event

Base Level of Tank (mOD)	Maximum Depth of Attenuation Tank (m)	Plan Area of Attenuation Tank (m^2)	Maximum Allowable Outflow from Tank (l/s)	Maximum Design Outflow from Tank (l/s)	Storage Volume Required (m^3)	Maximum Storage Volume Provided (m^3)
0.075	2.00	2,310	77.8	72.0	4,611	4,620

From the attenuation tank, the stormwater will ultimately flow via a vortex flow restrictor (HydroBrake or similar) to discharge the attenuated outflow from the proposed development site to the Woodstock Stream, at a location to the south of the lands.

A class 1 bypass petrol interceptor have been provided on the outlet from the tank to capture hydrocarbons and other contaminants prior to discharge of surface water into the Woodstock Stream.

4.3.4 Total Catchment Assessment

In order to demonstrate the maximum stormwater run-off from the developed site does not exceed the allowable run-of rate, an analysis has been undertaken on the entire catchment area of the proposed site.

The catchment area for the entire site, including both the existing developed lands and the proposed development areas, has been calculated as 42.05 hectares. As discussed in Section 4.3.2 and 4.3.3 above, 26.28 hectares drains towards the existing attenuation lagoon and the remaining 15.77 hectares drains towards a primary attenuation tank located to the south of the development.

Using IH124, the greenfield run-off from the entire catchment area of total allowable runoff for the site has been calculated as 207.4l/s. This represents the maximum allowable outflow from the site during a 0.1% AEP event (1 in 100 Year).

From the calculation undertaken in Sections 4.3.2 and 4.3.3 above, it can be seen that the maximum runoff from the lagoon and the attenuation tank have been estimated at 129.6l/s and 72.0l/s respectively. The sum of these allowable outflows from the existing attenuation lagoon and the underground attenuation tank sums to 201.6l/s, which is less than the maximum allowable outflow of 207.4l/s.

Therefore it is deemed that the proposed attenuation strategy to be provided for the Castlelake SHD will restrict the surface water outflow from the developed site to the Woodstock Stream to a value equivalent to the pre-development greenfield rate of run-off.

Further details on these calculations are given in **Appendix H**.

4.3.5 Infiltration Trench to Low Lying Road Area Adjacent to Underpass

The final section of the northern spine road, prior to it exiting the site boundary and entering the existing underpass under the railway, is located at too low a level to facilitate a gravity connection back to the existing surface water network. When the underpass was originally designed, the proposal at that stage was that the surface water collected at this low point would be discharged towards a pump station, where it would be pumped to a higher level to facilitate a connection to the gravity network. However, in the time frame since the underpass was originally constructed, Cork County Council has advised that they would not take a surface water pumping station in charge. Therefore, an alternate drainage solution will be required for this area.

It is proposed that the final 40m section of this road will instead be drained by the provision of a dedicated soakaway to cater for this short section of road way. Gullies will collect rainwater from this section of road and direct towards a new soakaway, which will be designed in accordance with the requirements of BRE 365 Soakaway design. At detailed design stage, onsite infiltration testing will be undertaken at the actual level of the proposed soakaway to determine the infiltration properties of the subsoil and a detailed design of the soakaway will be carried out.

In advance of this, a design has been undertaken on the proposed soakaway to indicate its appropriateness. The design as done using the MicroDrainage computer software, using the following variables:

(i)	M5-60(mm)	=	18.0mm
(ii)	Ratio R	=	0.249
(iii)	Volumetric Run-Off Coefficient	=	0.75 in Summer, 0.84 in Winter
(iv)	Contributing Area	=	0.11 hectares
(v)	Climate Change Allowance	=	10%
(vi)	Infiltration Value	=	5.0×10^{-5} m/s

A conservative value of 5.0×10^{-5} m/s was used in the design to represent the known ground conditions on site. The output from this design with detailed MicroDrainage collection outputs is included in **Appendix I**.

5 POTABLE WATER DESIGN

5.1 General

The potable water infrastructure for the proposed development has been designed in accordance with the requirements of Irish Water, as set out in the document IW-CDS-5020-03, “Code of Practice for Water Infrastructure”, Revision 2. The water supply has also been designed in accordance with the principles as set out in Section 4 of the publication “Recommendations for Site Development Works for Housing Areas” published by the Department of Environment and Local Government, and in accordance with the Irish Water Code of Practice for Water Infrastructure.

There is currently an existing DN180 PE100 watermain serving the existing section of the Castlelake development. This watermain connects to the existing public infrastructure to Main Street at the access junction into the development. A bulk water-meter has been provided at this location. This existing watermain has not yet been taken in charge by Irish Water and is currently under the control of the applicant.

It is proposed to form a new connection with the existing internal watermain to the development with a new DN180 PE100 watermain to serve the proposed development. The watermains will be provided with fire hydrants at no more than 46m from any dwelling and sluice valves will be provided to isolate the dwellings in groups of no more than 40nr dwellings.

There will be no new connections proposed to the public watermain network external to the development lands. Instead, new connections will be made to the network as constructed within the Castlelake lands, but not yet taken in charge.

5.2 Water Drawdown

The proposed development consists of the provision of 716nr residential units. Section 3.7 of the Irish Water Code of Practice for Water Design states that the average daily domestic demand shall be based on a per-capita consumption of 150 l/person/day and an average occupancy ratio of 2.7 persons per dwelling. The average day/peak week demand should be taken as 1.25 times the average daily domestic demand. The peak demand for sizing the pipe network should normally be 5.0 times the average day/peak week demand.

Based on these figures, the water demand arising from the proposed development is calculated as follows:

Total Number of Dwellings	=	706nr
Occupancy Rate	=	2.7 per dwelling
Population	=	2.7 x 716
	=	1,993nr persons
Consumption	=	150 litres/day/person
Average Daily Domestic Demand	=	1,993 x 150litres/day
	=	289,980 litres/day
Average Day/Peak Week Demand	=	1.25 x 289,980
	=	362,475 litres/day
Peak Demand	=	5 x 362,475
	=	1,812,375 litres/day
	=	1,812m^3/day
	=	20.98l/s

Therefore, Peak Water Demand associated with the new development is 1,812m^3/day.

5.3 Irish Water Pre-Connection Enquiry

A pre-connection enquiry form was submitted to Irish Water in respect to the water connections from the proposed development. Subsequently, Irish Water confirmed that based on the size of the proposed development and on the capacity currently available, and subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network can be facilitated, with the proviso that some local network upgrades are carried out to the existing public network. A copy of the Confirmation of Feasibility as received from Irish Water has been included as **Appendix C** of this report.

5.4 Irish Water Statement of Design Acceptance

A Statement of Design Acceptance submission was made to Irish Water in respect to the proposed water infrastructure that is to be provided to service the proposed development. Irish Water have returned a Statement of Design Acceptance for the water infrastructure, and a copy of this statement is included as **Appendix D**.

6 EXISTING WATERBODIES

6.1 General

The proposed site plan area is currently traversed by 2nr. waterbodies/ditches which will be impacted by the proposed development. The locations of the waterbodies are described as follows:

North to South Waterbody: An existing culvert crosses under the railway line at the northern boundary of the Castlelake lands. The culvert connects to an existing 750mm diameter culvert at the southern side of the railway line, which flows in an easterly direction for approximately 230m. From here, the waterbody turns to flow in a southerly direction through the site before discharging to the Woodstock Stream. This waterbody is to be maintained and incorporated into the proposed landscaping features of the development.

East to West Drainage Ditch: An existing open drainage ditch enters the proposed site on its eastern boundary with Irish Rail lands. This waterbody flows under the railway in an existing culvert, prior to entering the site and flows in a westerly direction to connect to the waterbody traveling south through the site. This waterbody is to be culverted locally to allow the proposed development of the site to take place.

6.2 North to South Waterbody

This waterbody rises to lands to the north of the Castlelake lands and ultimately discharges into the Woodstock Stream. The waterbody runs parallel to the railway line at the northern site boundary and then flows in a southerly direction through the site to where it meets the Woodstock Stream at the location shown on drawings MCW1088-RPS-00-XX-DR-301 01 to 02.

A section of the waterbody running parallel to the railway line has previously been culverted as part of the original Castlelake development works. The culvert, which is 750 mm diameter, forms part of a diversion proposal that was required to allow development of the site to take place.

It is proposed to maintain this waterbody in its open format along its course through the site, up until the location where it reaches the existing culvert under the main distributor road. It is intended that this waterbody will be incorporated into the landscape architecture design for the proposed development. Further and more details in relation to the maintaining of this existing waterbody can be seen within the landscape architect proposal, as included within this application.

6.3 East to West Drainage Ditch

This waterbody rises to the north-east of the Castlelake site and enters the site along its boundary with the Irish Rail lands. The stream crosses under the Cork-Midleton railway line, before flowing in a south-westerly direction through the development. It drains to waterbody that flows in a southerly direction through the Castlelake lands and ultimately discharges to the Woodstock Stream. The drainage ditch is shown on drawings MCW1088-RPS-00-XX-DR-301 01 to 02.

The following data summarises the characteristics of the drainage ditch catchment:

- Total Catchment Area 0.11km^2
- Soil Factor Soil Type S_2
- Average Annual Rainfall 1030mm

Current planning regulations in relation to new developments stipulate the use of SUDS in order to attenuate stormwater discharges to existing greenfield runoff conditions. Consequently, the calculations in this report do not assume a growth in urbanisation beyond the current level, and assume that any future design flows

should be of the same magnitude as those that the catchment currently produces. An allowance for a 20% increase in flows due to climate change has been allowed for within the calculations.

As the contributing area is less than 25 km^2, the catchment response to rainfall was estimated using the Institute of Hydrology, Report No. 124 Method. The Institute of Hydrology Report No. 124 (IH124) Flood Estimation for Small Catchments sets out the Catchment Characteristics Method for estimation of flood flows. The most appropriate method of calculating extreme river flows for a small catchment (<25km^2) uses Equation 7.1 of the report. This method utilises three catchment characteristics to estimate run off from catchments; AREA, SAAR, and SOIL.

The unfactored Mean Annual Flood (MAF) or Qbar is calculated using the following equation:

$$Q_{bar} = 0.00108\ (AREA^{0.89} SAAR^{1.17} SOIL^{1.27})$$

The design flows for various return periods for this waterbody are summarised in **Table 6-1**.

Table 6-1: Design Flows for East to West Drainage Ditch

Annual Flow for T Return Period of Years (Q_T)	Q_T (IH 124) (m^3/s)
Q_{10}	0.10
Q_{50}	0.13
Q_{100}	0.14

The design flow for a 100-year return period to be used in this report is 0.14m^3/s, which is the Q100 as predicted by IH 124.

It is proposed to culvert this waterbody along its course through the site. It is also proposed to divert this stream to flow within the proposed layout, which allows for the relocation of the stream away from the proposed residential units. The proposed culvert arrangement is shown on drawings MCW1088-RPS-00-XX-DR-301 01 to 02.

The proposed structure is a 600mm diameter pipe for its length (twin 450mm diameter for the final 14m length to avoid clashing with the proposed storm and foul drainage), until it ties into existing waterbody flowing from north to south. The 600mm dia. has been selected based on the estimated flows and also to reduce to potential for the occurrence of blockages within the culvert. The proposed culvert has been designed using MicroDrainage software and the proposed IH124 design flows. The culvert has been simulated for the 1, 5, 30 and 100 year return period events and no flooding is predicted in the network.

The proposed invert levels along the length of the culvert range from 6.100m OD upstream to 1.710mOD downstream, where the proposed culvert discharges to the existing North to South waterbody.

7 PUBLIC LIGHTING

As part of the recent project to construct the distributor roads within the Castlelake lands as part of a separate project with planning registration reference PL19/05707, a public lighting layout design for the new roads infrastructure was produced. This proposal consists of a public lighting of design class M4, with C3 lighting class used at conflict areas. The lamps have been provided in a staggered arrangement, installed either side of the road, as this distributes the light more uniformly. The public lighting layout was submitted to Cork County Council Roads Management and Development Department for their agreement. Following the compliance submission, on 28th July 2021 Cork County Council noted their acceptance of the proposed lighting design.

In order to ensure compatibility across the proposed SHD site, it is proposed that the public lighting arrangement for the Castlelake SHD should reflect the existing lighting arrangement as recently installed. Therefore it is proposed that as part of the proposed SHD works, new public lighting consisting of design class M4 lamps, located typically as a staggered arrangement will be provided. The existing lamp specification consists of 9.5klm LED lanterns which are post top mounted on 8m columns. A similar specification is proposed work the Castlelake SHD project.

Plan arrangement drawings, MCW1088-RPS-00-XX-DR-E-PL001 01 to 09 have been produced and have been submitted to accompany this application. In addition, drawings MCW1088-RPS-00-XX-DR-E-PL01-10 has been produced which provides typical cross-sections indicating the proposed locations of the lamp standards relative to the road cross-section.

Appendix A
Wastewater Design Calculations

Wastewater Flows - New Networks

Project:	MCW1088 Carrigtwohill Residential Development
Calculation:	716nr Dwellings
Date:	23/05/2022
Calculation By:	KC
Checked By:	GMcC

Equation 1				
Wastewater Contribution - Domestic				
No. of Dwellings		716		
Occupancy Rate		2.7	per dwelling	IW-TEC-800-01 Section 6.2.1
Population	(P)	1,933		
Water Consumption	(G)	150	l/ca/day	IW-TEC-800-01 Section 6.2.2
Domestic Wastewater Contribution	(PG)	289,980	litres/day	
Wastewater Contribution - Commercial/Trade				
Commercial/Industrial Population	(P_E)	0		
Commercial/Industrial Water Consumption	(G_E)	0	l/ca/day	
Domestic WW Element of Commercial & Industrial Flows	($P_E G_E$)	0	litres/day	
Proposed Trade Flows	(E)	0	litres/day	
Peaking Factors				
Peaking Factor (Domestic)	(Pf_{Dom})	6		IW-TEC-800-01 Table 6.2.5
Peaking Factor (Domestic element of Industrial)	($Pf_{Dom,Ind}$)	3		IW-TEC-800-01 Table 6.2.7
Peaking Factor (Trade Flow)	(Pf_{Trade})	3		IW-TEC-800-01 Table 6.2.9
Infiltration				
Infiltration (Domestic) New = 10% of Unit Consumption (10% PG)	(I)	28,998	litres/day	IW-TEC-800-01 Table 6.2.4
Infiltration (Industrial) New = 10% of Unit Consumption (10% $P_E G_E$)	(I_{Indust})	0	litres/day	IW-TEC-800-01 Table 6.2.5
Design Foul Flow	(Eqn. 1)	**1,768,878**	litres/day	
		1,769	m^3/day	
		20.5	litres/sec	
Dry Weather Flow	(DWF)	**318,978**	litres/day	
		319	m^3/day	
		3.7	litres/sec	

Equation 2				
Modified Rational Method				
Total Site Area		18.82	ha	
Catchment Area		15.6	ha	
Standard Average Annual Rainfall	SAAR	1032	mm	uksuds.com
Percentage Impermeability	PIMP	55.00	%	SPON Urban Drainage value for dense housing
Soil Index	SOIL	0.3		uksuds.com
Urban Catchment Wetness Index	UCWI	116		GDSDS Figure D1
Percentage Runoff >= 0.4*PIMP	PR	41.44	%	
Percentage Runoff <= 0.4*PIMP	PR	22.00	%	
Runoff Coefficient	Cv	0.75		
Routing Coefficient	Cr	1.3		IW-TEC-800-01 Table 6.3.3
Time of Entry	T_e	7	min	IW-TEC-800-01 Table 6.3.2
Longest Pipe Route	L	2500	m	
Assumed Velocity in Pipe	V	1.0	m/s	
Time of Flow	T_f	41.67	min	
Time of Concentration	T_c	48.67	min	
Return Period	RP	2	1-in-(RP)year	IW-TEC-800-01 Table 5.4
Rainfall Intensity	i	19.58	mm/hr	Met Eireann DDF Table
Peak Flow	Qp	**832**	l/s	
	Qp	**0.83**	m^3/s	
	Qp	**71,859,656**	litres/day	
Misconnection Allowance - Domestic				
% of Gross Site Area		3.00	%	IW-TEC-800-01 Table 6.2.10
Surface Water Allowance (Domestic)	SW	13.72	l/s	
Surface Water Allowance (Domestic)		1,185,684	l/day	
Misconnection Allowance - Commercial/Industrial				
% of Gross Site Area		0.00	%	IW-TEC-800-01 Table 6.2.11
Surface Water Allowance (Commercial)	SW_E	0.00	l/s	
Surface Water Allowance (Commercial)		0.00	l/day	

Design Flow (Eqn. 1 + Eqn. 2)		**2,954,562**	litres/day	
		2,955	m^3/day	
		34.2	litres/sec	

Appendix B
MicroDrainage Wastewater Outputs

Innishmore Ballincollig Co. Cork	Residential Development Carrigtwohill Co. Cork Wastewater Drainage
Date 03/06/2022 15:35 File Castlelake Development ...	Designed by KC Checked by GMcC
Micro Drainage	Network 2020.1

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Flow Per Person (l/per/day)	200.00	Maximum Backdrop Height (m)	0.000
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.275
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-1.000	40.866	0.681	60.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-1.001	45.045	0.300	150.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-1.002	29.529	0.299	98.8	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F-2.000	18.612	0.052	360.0	0.000	0	141.0	1.500	o	450	Pipe/Conduit	
F-3.000	13.256	0.221	60.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-3.001	45.772	0.305	150.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-3.002	37.837	0.393	96.3	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F-1.003	63.463	0.988	64.2	0.000	12	0.0	1.500	o	450	Pipe/Conduit	
F-4.000	59.989	0.750	60.0	0.000	11	0.0	1.500	o	225	Pipe/Conduit	
F-4.001	45.315	0.302	150.0	0.000	14	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-1.000	6.600	0.000	0.0	6	0.0	10	0.34	1.48	59.0	0.2
F-1.001	5.919	0.000	0.0	13	0.0	18	0.32	0.94	37.2	0.5
F-1.002	5.619	0.000	0.0	15	0.0	18	0.39	1.16	45.9	0.6
F-2.000	4.408	0.000	141.0	0	0.0	346	1.07	0.95	150.9	141.0
F-3.000	5.500	0.000	0.0	6	0.0	10	0.34	1.48	59.0	0.2
F-3.001	5.279	0.000	0.0	12	0.0	18	0.31	0.94	37.2	0.5
F-3.002	4.974	0.000	0.0	16	0.0	18	0.40	1.17	46.5	0.6
F-1.003	4.356	0.000	141.0	43	0.0	197	2.13	2.25	358.3	142.6
F-4.000	5.150	0.000	0.0	11	0.0	15	0.38	1.48	59.0	0.4
F-4.001	4.150	0.000	0.0	25	0.0	25	0.39	0.94	37.2	0.9

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-4.002	38.214	0.255	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-5.000	15.011	0.250	60.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-6.000	13.167	0.219	60.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-5.001	53.996	0.360	150.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F-5.002	29.769	0.305	97.6	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-1.004	63.971	0.998	64.1	0.000	12	0.0	1.500	o	450	Pipe/Conduit	
F-7.000	59.328	0.989	60.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-7.001	59.328	0.396	150.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-7.002	52.530	0.526	99.9	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-7.003	52.392	0.900	58.2	0.000	12	0.0	1.500	o	225	Pipe/Conduit	
F-8.000	15.011	0.250	60.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-9.000	13.167	0.219	60.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F-8.001	53.996	0.360	150.0	0.000	15	0.0	1.500	o	225	Pipe/Conduit	
F-8.002	32.029	0.531	60.3	0.000	6	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-4.002	3.848	0.000	0.0	25	0.0	25	0.39	0.94	37.2	0.9
F-5.000	4.508	0.000	0.0	6	0.0	10	0.34	1.48	59.0	0.2
F-6.000	4.477	0.000	0.0	6	0.0	10	0.34	1.48	59.0	0.2
F-5.001	4.258	0.000	0.0	20	0.0	22	0.37	0.94	37.2	0.8
F-5.002	3.898	0.000	0.0	20	0.0	20	0.42	1.16	46.2	0.8
F-1.004	3.368	0.000	141.0	100	0.0	199	2.14	2.26	358.7	144.8
F-7.000	5.405	0.000	0.0	6	0.0	10	0.34	1.48	59.0	0.2
F-7.001	4.416	0.000	0.0	12	0.0	18	0.31	0.94	37.2	0.5
F-7.002	4.021	0.000	0.0	18	0.0	19	0.41	1.15	45.7	0.7
F-7.003	3.495	0.000	0.0	30	0.0	22	0.58	1.51	59.9	1.1
F-8.000	3.736	0.000	0.0	6	0.0	10	0.34	1.48	59.0	0.2
F-9.000	3.705	0.000	0.0	3	0.0	8	0.27	1.48	59.0	0.1
F-8.001	3.486	0.000	0.0	24	0.0	24	0.39	0.94	37.2	0.9
F-8.002	3.126	0.000	0.0	30	0.0	22	0.57	1.48	58.8	1.1

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-1.005	75.294	0.209	360.3	0.000	9	0.0	1.500	o	450	Pipe/Conduit	
F-1.006	15.968	0.044	360.0	0.000	0	0.0	1.500	o	450	Pipe/Conduit	
F-1.007	16.002	0.096	166.7	0.000	0	0.0	1.500	o	450	Pipe/Conduit	
F-10.000	15.980	0.107	149.3	0.000	19	0.0	1.500	o	225	Pipe/Conduit	
F-11.000	17.112	0.285	60.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-10.001	55.969	0.373	150.1	0.000	25	0.0	1.500	o	225	Pipe/Conduit	
F-10.002	11.310	0.075	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-10.003	11.263	0.075	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-1.008	29.623	0.082	360.0	0.000	0	0.0	1.500	o	450	Pipe/Conduit	
F-12.000	55.715	0.929	60.0	0.000	10	0.0	1.500	o	225	Pipe/Conduit	
F-12.001	55.715	0.371	150.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-13.000	35.984	0.600	60.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F-12.002	69.886	0.562	124.4	0.000	24	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-1.005	2.370	0.000	141.0	169	0.0	361	1.08	0.95	150.8	147.3
F-1.006	2.161	0.000	141.0	169	0.0	361	1.08	0.95	150.9	147.3
F-1.007	2.117	0.000	141.0	169	0.0	268	1.49	1.40	222.1	147.3
F-10.000	2.318	0.000	0.0	19	0.0	22	0.36	0.94	37.3	0.7
F-11.000	2.496	0.000	0.0	7	0.0	11	0.36	1.48	59.0	0.3
F-10.001	2.211	0.000	0.0	51	0.0	35	0.49	0.94	37.2	1.9
F-10.002	1.838	0.000	0.0	51	0.0	35	0.49	0.94	37.2	1.9
F-10.003	1.763	0.000	0.0	51	0.0	35	0.49	0.94	37.2	1.9
F-1.008	1.463	0.000	141.0	220	0.0	366	1.08	0.95	150.9	149.3
F-12.000	6.258	0.000	0.0	10	0.0	13	0.40	1.48	59.0	0.4
F-12.001	5.329	0.000	0.0	17	0.0	21	0.35	0.94	37.2	0.6
F-13.000	5.558	0.000	0.0	4	0.0	9	0.30	1.48	59.0	0.2
F-12.002	4.958	0.000	0.0	45	0.0	31	0.50	1.03	40.9	1.7

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-14.000	54.722	0.912	60.0	0.000	22	0.0	1.500	o	225	Pipe/Conduit	
F-14.001	54.786	0.365	150.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F-14.002	47.039	0.314	150.0	0.000	11	0.0	1.500	o	225	Pipe/Conduit	
F-14.003	21.437	0.143	150.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F-12.003	44.656	0.298	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-15.000	27.994	0.467	60.0	0.000	76	0.0	1.500	o	225	Pipe/Conduit	
F-15.001	36.576	0.244	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-15.002	7.519	0.050	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-15.003	26.365	0.176	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-15.004	16.836	0.759	22.2	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-15.005	36.837	1.107	33.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-12.004	38.756	0.258	150.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-12.005	25.356	0.707	35.9	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F-16.000	48.121	1.330	36.2	0.000	20	0.0	1.500	o	225	Pipe/Conduit	
F-16.001	44.313	0.295	150.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F-16.002	30.800	0.205	150.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F-16.003	35.409	0.236	150.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-14.000	6.130	0.000	0.0	22	0.0	19	0.52	1.48	59.0	0.8
F-14.001	5.218	0.000	0.0	25	0.0	25	0.39	0.94	37.2	0.9
F-14.002	4.853	0.000	0.0	36	0.0	29	0.44	0.94	37.2	1.4
F-14.003	4.539	0.000	0.0	38	0.0	30	0.45	0.94	37.2	1.4
F-12.003	4.396	0.000	0.0	83	0.0	44	0.57	0.94	37.2	3.1
F-15.000	6.900	0.000	0.0	76	0.0	34	0.76	1.48	59.0	2.9
F-15.001	6.433	0.000	0.0	76	0.0	42	0.55	0.94	37.2	2.9
F-15.002	6.190	0.000	0.0	76	0.0	42	0.55	0.94	37.2	2.9
F-15.003	6.139	0.000	0.0	76	0.0	42	0.55	0.94	37.2	2.9
F-15.004	5.964	0.000	0.0	76	0.0	27	1.08	2.44	97.1	2.9
F-15.005	5.205	0.000	0.0	76	0.0	29	0.93	1.99	79.3	2.9
F-12.004	4.098	0.000	0.0	166	0.0	62	0.69	0.94	37.2	6.2
F-12.005	3.840	0.000	0.0	171	0.0	44	1.16	1.92	76.4	6.4
F-16.000	5.200	0.000	0.0	20	0.0	16	0.60	1.91	76.0	0.8
F-16.001	3.870	0.000	0.0	22	0.0	23	0.38	0.94	37.2	0.8
F-16.002	3.575	0.000	0.0	25	0.0	25	0.39	0.94	37.2	0.9
F-16.003	3.369	0.000	0.0	26	0.0	25	0.40	0.94	37.2	1.0

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-12.006	21.574	0.108	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-12.007	25.063	0.125	200.5	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-17.000	42.824	0.714	60.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F-17.001	7.696	0.051	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-17.002	57.007	0.380	150.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-17.003	5.711	0.038	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-17.004	34.491	0.539	64.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F-18.000	20.534	0.342	60.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-17.005	24.509	0.163	150.4	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F-19.000	22.048	0.375	58.8	0.000	13	0.0	1.500	o	225	Pipe/Conduit	
F-17.006	20.431	0.286	71.4	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-20.000	33.622	1.306	25.7	0.000	10	0.0	1.500	o	225	Pipe/Conduit	
F-17.007	20.060	0.344	58.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-12.008	48.272	0.241	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-12.006	3.133	0.000	0.0	197	0.0	73	0.66	0.81	32.2	7.4
F-12.007	3.025	0.000	0.0	197	0.0	73	0.66	0.81	32.2	7.4
F-17.000	5.415	0.000	0.0	4	0.0	9	0.30	1.48	59.0	0.2
F-17.001	4.701	0.000	0.0	4	0.0	11	0.22	0.94	37.2	0.2
F-17.002	4.650	0.000	0.0	10	0.0	16	0.29	0.94	37.2	0.4
F-17.003	4.270	0.000	0.0	10	0.0	16	0.29	0.94	37.2	0.4
F-17.004	4.232	0.000	0.0	12	0.0	15	0.42	1.44	57.1	0.5
F-18.000	4.035	0.000	0.0	0	0.0	0	0.00	1.48	59.0	0.0
F-17.005	3.693	0.000	0.0	14	0.0	19	0.33	0.94	37.2	0.5
F-19.000	3.905	0.000	0.0	13	0.0	15	0.44	1.50	59.6	0.5
F-17.006	3.530	0.000	0.0	27	0.0	22	0.52	1.36	54.0	1.0
F-20.000	4.550	0.000	0.0	10	0.0	11	0.53	2.27	90.2	0.4
F-17.007	3.244	0.000	0.0	37	0.0	24	0.62	1.50	59.8	1.4
F-12.008	2.900	0.000	0.0	234	0.0	80	0.69	0.81	32.2	8.8

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-21.000	41.143	0.890	46.2	0.000	16	0.0	1.500	o	225	Pipe/Conduit	
F-21.001	56.708	0.717	79.1	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-22.000	26.509	0.585	45.3	0.000	12	0.0	1.500	o	225	Pipe/Conduit	
F-22.001	35.791	0.380	94.2	0.000	13	0.0	1.500	o	225	Pipe/Conduit	
F-22.002	7.702	0.051	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-22.003	37.232	0.248	150.0	0.000	21	0.0	1.500	o	225	Pipe/Conduit	
F-22.004	26.487	0.197	134.5	0.000	13	0.0	1.500	o	225	Pipe/Conduit	
F-21.002	13.525	0.068	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-21.003	21.929	0.110	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-21.004	23.702	0.119	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-21.005	10.813	0.054	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-23.000	22.150	0.369	60.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F-23.001	29.449	0.196	150.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F-24.000	18.408	0.500	36.8	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F-23.002	23.019	0.153	150.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F-23.003	16.151	0.108	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-21.000	3.990	0.000	0.0	16	0.0	15	0.51	1.69	67.2	0.6
F-21.001	3.100	0.000	0.0	22	0.0	20	0.47	1.29	51.3	0.8
F-22.000	3.845	0.000	0.0	12	0.0	13	0.47	1.71	67.9	0.5
F-22.001	3.260	0.000	0.0	25	0.0	22	0.46	1.18	47.0	0.9
F-22.002	2.880	0.000	0.0	25	0.0	25	0.39	0.94	37.2	0.9
F-22.003	2.829	0.000	0.0	46	0.0	33	0.47	0.94	37.2	1.7
F-22.004	2.580	0.000	0.0	59	0.0	36	0.53	0.99	39.3	2.2
F-21.002	2.383	0.000	0.0	81	0.0	47	0.51	0.81	32.2	3.0
F-21.003	2.315	0.000	0.0	81	0.0	47	0.51	0.81	32.2	3.0
F-21.004	2.206	0.000	0.0	81	0.0	47	0.51	0.81	32.2	3.0
F-21.005	2.087	0.000	0.0	81	0.0	47	0.51	0.81	32.2	3.0
F-23.000	5.420	0.000	0.0	8	0.0	12	0.37	1.48	59.0	0.3
F-23.001	5.051	0.000	0.0	13	0.0	18	0.32	0.94	37.2	0.5
F-24.000	5.355	0.000	0.0	4	0.0	8	0.35	1.90	75.4	0.2
F-23.002	4.855	0.000	0.0	19	0.0	22	0.36	0.94	37.2	0.7
F-23.003	4.701	0.000	0.0	19	0.0	22	0.36	0.94	37.2	0.7

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-23.004	4.198	0.028	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-23.005	56.839	0.387	146.9	0.000	14	0.0	1.500	o	225	Pipe/Conduit	
F-25.000	27.673	0.461	60.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F-26.000	35.600	0.593	60.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F-25.001	33.080	0.221	150.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
F-27.000	16.692	0.278	60.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-27.001	3.764	0.025	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-25.002	4.901	0.025	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-28.000	19.125	0.319	60.0	0.000	14	0.0	1.500	o	225	Pipe/Conduit	
F-28.001	24.137	0.161	150.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F-28.002	40.864	0.376	108.7	0.000	14	0.0	1.500	o	225	Pipe/Conduit	
F-29.000	8.000	0.053	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-30.000	23.667	0.394	60.1	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-30.001	19.912	0.133	150.0	0.000	9	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-23.004	4.593	0.000	0.0	19	0.0	22	0.36	0.94	37.2	0.7
F-23.005	4.565	0.000	0.0	33	0.0	28	0.43	0.95	37.6	1.2
F-25.000	4.884	0.000	0.0	5	0.0	10	0.32	1.48	59.0	0.2
F-26.000	5.016	0.000	0.0	5	0.0	10	0.32	1.48	59.0	0.2
F-25.001	4.423	0.000	0.0	11	0.0	17	0.30	0.94	37.2	0.4
F-27.000	5.300	0.000	0.0	7	0.0	11	0.36	1.48	59.0	0.3
F-27.001	5.022	0.000	0.0	7	0.0	14	0.26	0.94	37.2	0.3
F-25.002	4.202	0.000	0.0	18	0.0	23	0.32	0.81	32.2	0.7
F-28.000	3.650	0.000	0.0	14	0.0	15	0.45	1.48	59.0	0.5
F-28.001	3.331	0.000	0.0	22	0.0	23	0.38	0.94	37.2	0.8
F-28.002	3.170	0.000	0.0	36	0.0	27	0.49	1.10	43.8	1.4
F-29.000	2.734	0.000	0.0	0	0.0	0	0.00	0.94	37.2	0.0
F-30.000	6.018	0.000	0.0	7	0.0	11	0.36	1.48	58.9	0.3
F-30.001	5.624	0.000	0.0	16	0.0	20	0.34	0.94	37.2	0.6

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-31.000	22.300	0.372	60.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F-31.001	4.294	0.029	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-31.002	13.038	0.087	150.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F-32.000	41.848	0.697	60.0	0.000	42	0.0	1.500	o	225	Pipe/Conduit	
F-32.001	6.976	0.047	150.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F-33.000	36.397	0.607	60.0	0.000	34	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-31.000	5.498	0.000	0.0	7	0.0	11	0.36	1.48	59.0	0.3
F-31.001	5.126	0.000	0.0	7	0.0	14	0.26	0.94	37.2	0.3
F-31.002	5.098	0.000	0.0	13	0.0	18	0.32	0.94	37.2	0.5
F-32.000	2.500	0.000	0.0	42	0.0	25	0.63	1.48	59.0	1.6
F-32.001	1.803	0.000	0.0	42	0.0	32	0.46	0.94	37.2	1.6
F-33.000	1.900	0.000	0.0	34	0.0	23	0.59	1.48	59.0	1.3

Appendix C
Irish Water Confirmation of Feasibility

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

Lyndubh Developments Ltd.
C/o Gary McCormack
RPS
Innishmore
Ballincollig
Cork
P31KR68

2 June 2022

Re: CDS21006488 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 725 unit(s) at Castlelake, Carrigtohill, Co. Cork

Dear Sir/Madam,

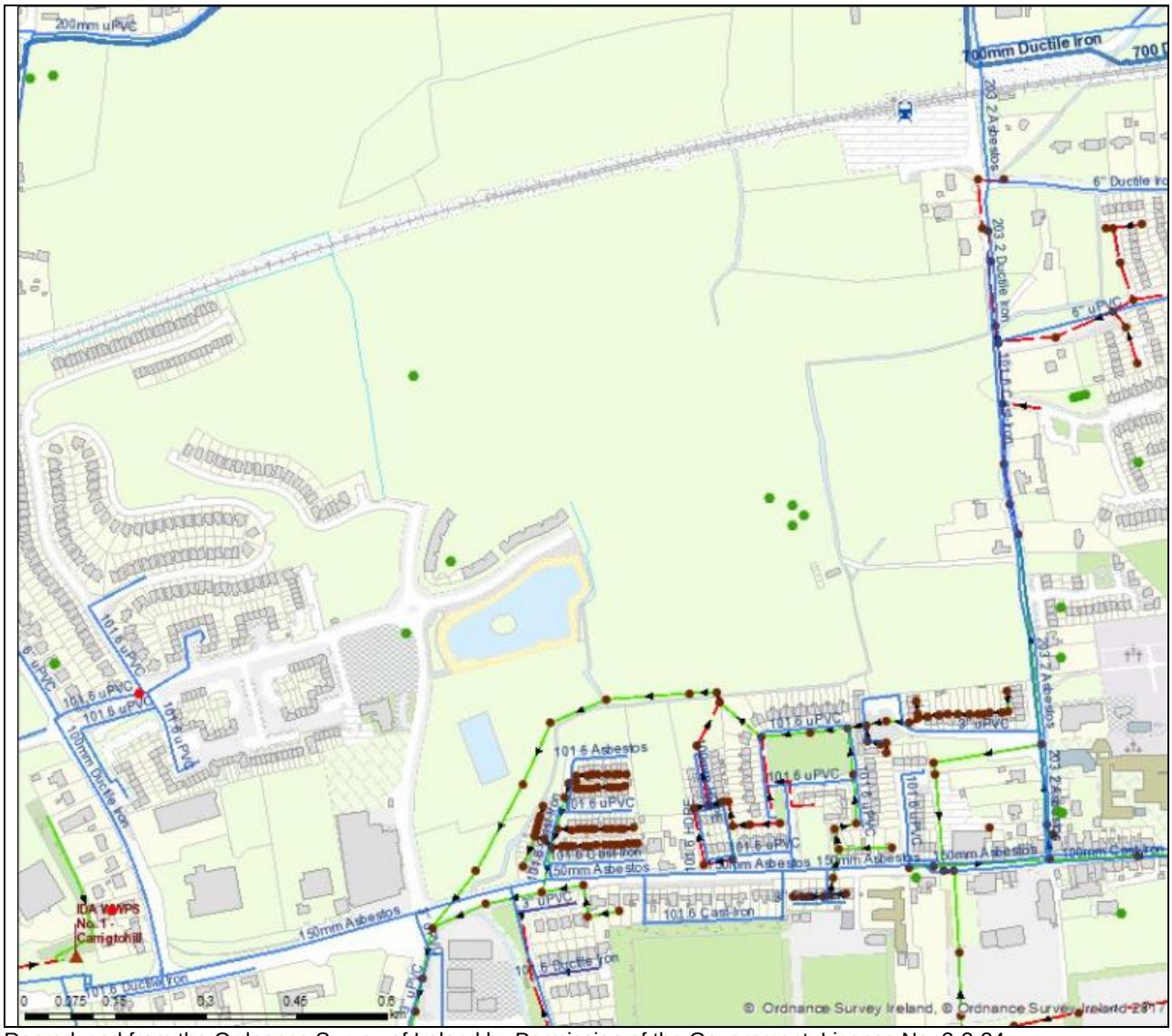
Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Castlelake, Carrigtohill, Co. Cork (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) 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 Subject to network upgrades
Wastewater Connection	Feasible Subject to network upgrades
SITE SPECIFIC COMMENTS	
Water Connection	Water Network: Due to the scale of the development, some watermains will have to be upsized. At connection application stage you will be required to liaise with Irish Water to determine the full extent of upsizing required. These upgrades will be at the applicants expense.
Wastewater Connection	Wastewater Network: Connection to the Networks may be through 3rd party infrastructure. All relevant wayleaves and permissions would need to be obtained by the Client. Due to the scale of the development, some sewers will have to be upsized. At connection application stage you will be required to liaise with Irish water

	to determine the full extent of upsizing required. These upgrades will be at the applicants expense.

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:



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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

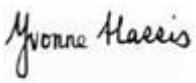
Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence 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 Michael Galvin from the design team at mgalvin@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Appendix D
Irish Water Statement of Design Acceptance

Gary McCormack
Innishmore
Ballincollig
Co. Cork

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

8 June 2022

Re: Design Submission for Castlelake, Carrigtwohill, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS21006488

Dear Gary McCormack,

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: Kyle Jackson
Email: kyle.jackson@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

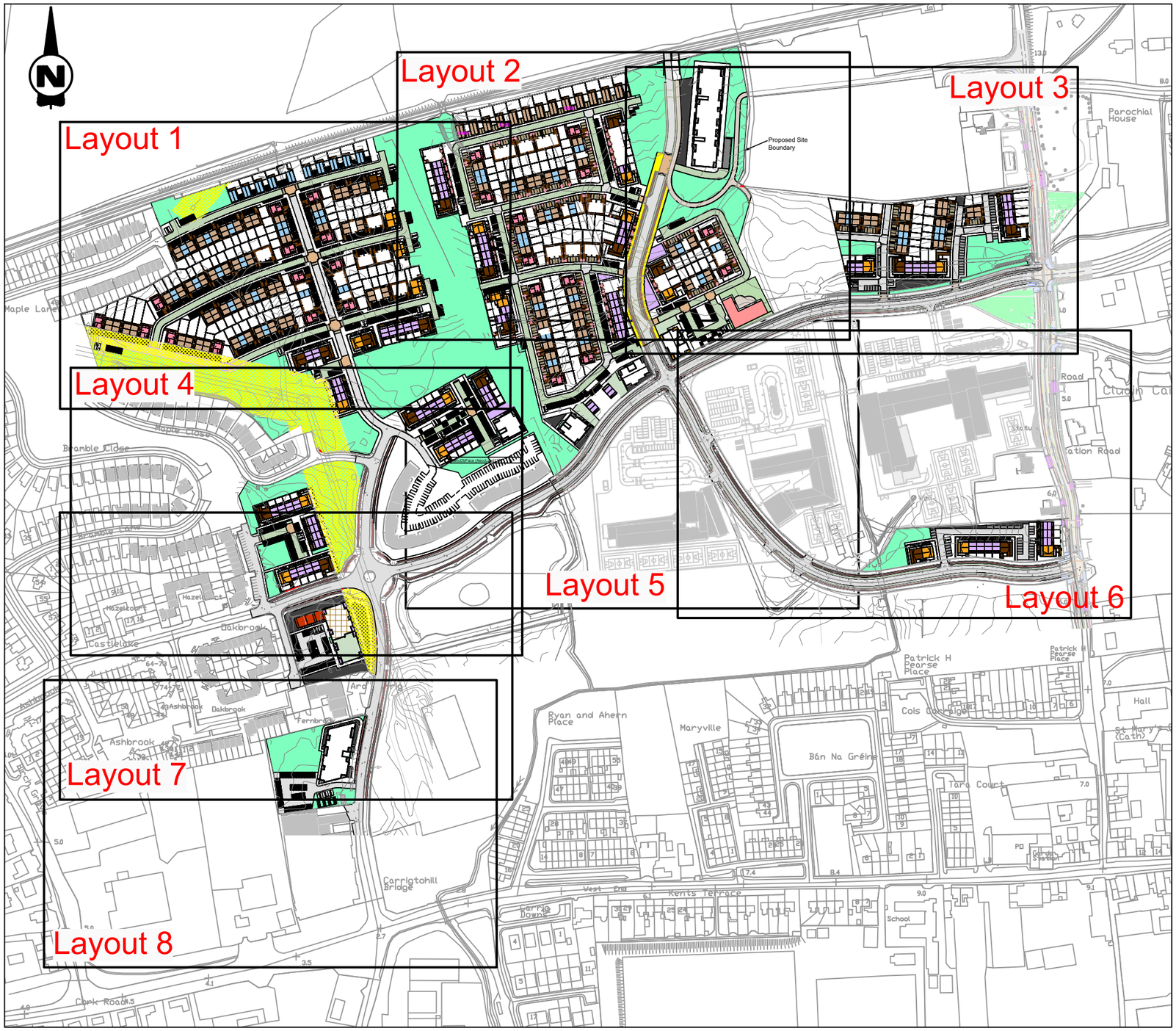
Appendix A

Document Title & Revision

- [MCW1088-RPS-00-XX-DR-C-DR0101 01 to 09 S3 P04]
- [MCW1088-RPS-00-XX-DR-C-DR0102-01 Rev.S3 P03]
- [MCW1088-RPS-00-XX-DR-C-DR0102-02 to 04 Rev.S3 P02]
- [MCW1088-RPS-00-XX-DR-C-UT0101 01 to 09 Rev S3 P03]

*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.



Ordnance Survey Ireland

Client

General Notes

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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P04	08/06/22	PGR / GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR / GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-DR0101

Scale: 1:2000 @ A1, 1:4000 @ A3

Created on: 18/10/2021

Sheets: 01 of 09

Project: Castlelake SHD

Title: Proposed Foul Infrastructure Key Plan

File Identifier: MCW1088-RPS-00-XX-DR-C-DR0101-01

Status: S3

Rev: P04

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Client

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Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P04	08/06/22	PGR / GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR / GMcC	Issued for Information	GMcG

rps

Scale	1:500 @ A1 1:1000 @ A3
Created on	18/10/2021
Sheets	02 of 09
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Drainage Layout (1 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101-02
Status	S3
Rev	P04

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg

Client

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Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P04	08/06/22	JDSR / GMcC	Issue for Review and Comment	BB
S2 P01	26/10/21	PDR / GMcC	Pre-Application Submission	BB

Scale	1:500 @ A1 1:1000 @ A3
Created on	18/10/2021
Sheets	03 of 09
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Drainage Layout (2 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101-03
Status	S3
Rev	P04

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg

Apartment A7
FFL: +8.00m

CONNECTIONS FROM VENT STACKS IN SERVICE RISERS TO WASTEWATER NETWORK SERVING APARTMENT BLOCK TO BE DETERMINED FOLLOWING COMPLETION OF DETAILED DESIGN OF APARTMENTS

EXISTING WASTEWATER NETWORK SHOWN THUS

EXISTING 225Ø FOUL SEWER TO BE DECOMMISSIONED

Creche
FFL: +5.80m

LEGEND:

- Existing Foul Sewers
- Existing Public Foul Sewer
- Existing Foul Manhole
- Existing Foul Sewer to be Decommissioned
- Proposed Foul Sewers
- Proposed Foul Manhole
- Proposed Foul Sewer connection and Inspection Chamber as per IW STD-WW-03

R:\MCW1088 - BAM Castlelake Residential Dwlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg

Client

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Rev	Date	Drn Chk	Amendment / Issue	App
S3 P04	08/06/22	KSR GMcC	Issue for Review and Comment	BB
P01	26/10/21	KSR GMcC	Pre-Application Submission	BB

Scale	1:500 @ A1 1:1000 @ A3
Created on	18/10/2021
Sheets	04 of 09
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Drainage Layout (3 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101-04
Status	S3
Rev	P04

LEGEND:

- Existing Foul Sewers
- Existing Public Foul Sewer
- Existing Foul Manhole
- Existing Foul Sewer to be Decommissioned
- Proposed Foul Sewers
- Proposed Foul Manhole
- Proposed Foul Sewer connection and Inspection Chamber as per IW STD-WW-03

DRAINAGE FOR PROPOSED DEVELOPMENT TO CONNECT TO 450mm Ø FOUL INFRASTRUCTURE CURRENTLY SERVING CASTLELAKE DEVELOPMENT ON INVERT TO INVERT CONNECTION

EXISTING 225Ø FOUL SEWER TO BE DECOMMISSIONED

NEW CONNECTION TO EXISTING INFRASTRUCTURE CURRENTLY SERVING CASTLELAKE DEVELOPMENT

EXISTING 225Ø FOUL SEWER TO BE DECOMMISSIONED

CONNECTIONS FROM VENT STACKS IN SERVICE RISERS TO WASTEWATER NETWORK SERVING APARTMENT BLOCK TO BE DETERMINED FOLLOWING COMPLETION OF DETAILED DESIGN OF APARTMENTS

CONNECTIONS FROM VENT STACKS IN SERVICE RISERS TO WASTEWATER NETWORK SERVING APARTMENT BLOCK TO BE DETERMINED FOLLOWING COMPLETION OF DETAILED DESIGN OF APARTMENTS

Apartment A1
FFL: +3.80m

Apartment A2
FFL: +3.75m

Maple Close
Maple Crescent
Hazelcourt
Castlelake
Oakbrook
Pine Court

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg

Client

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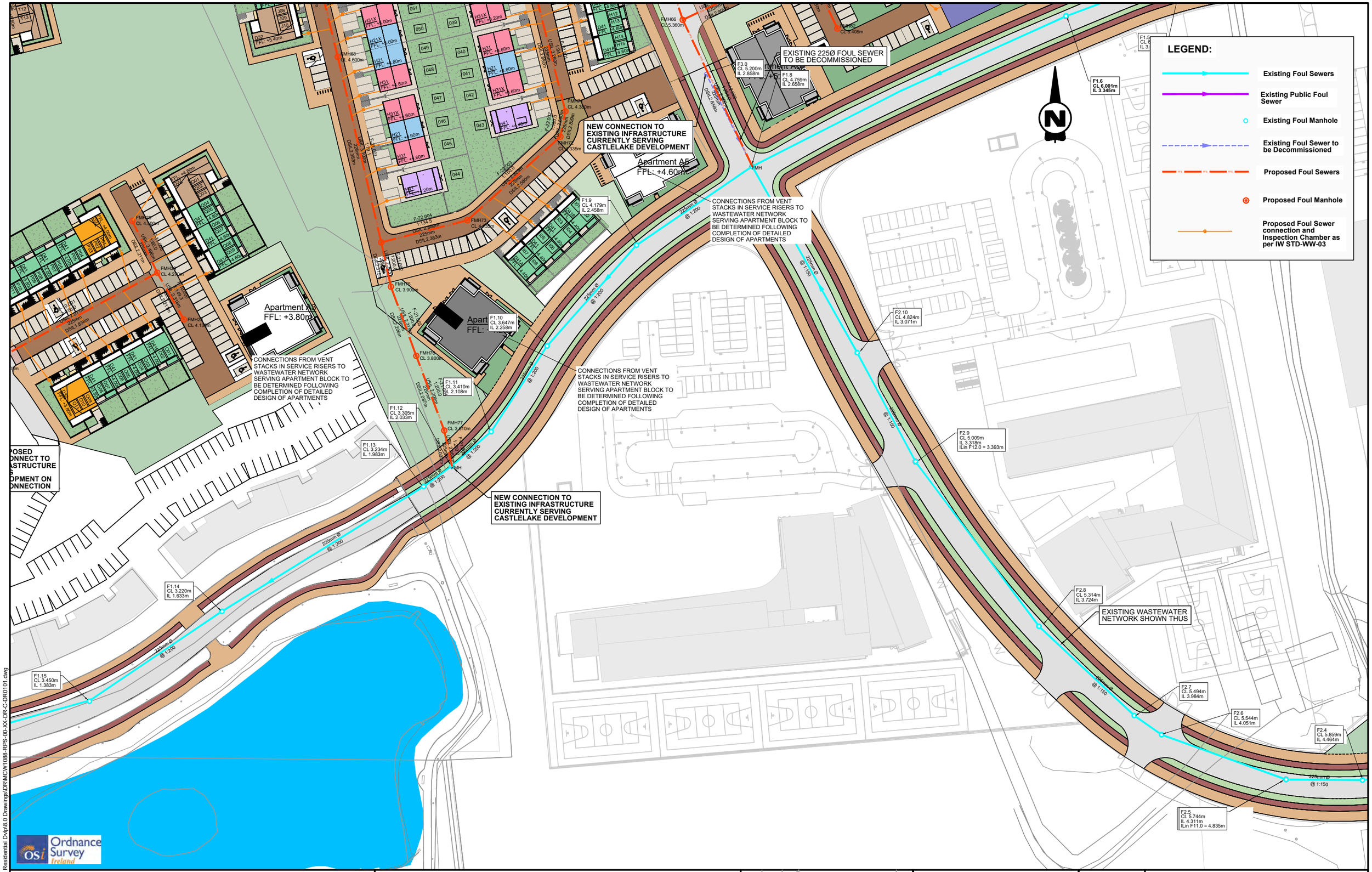
Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P04	08/06/22	JCOR / GMCC	Issue for Review and Comment	BB
P01	26/10/21	PCOR / GMCC	Pre-Application Submission	BB

rps

Scale	1:500 @ A1 1:1000 @ A3
Created on	18/10/2021
Sheets	05 of 09
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Drainage Layout (4 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101-05
Status	S3
Rev	P04



R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg

Client

General Notes

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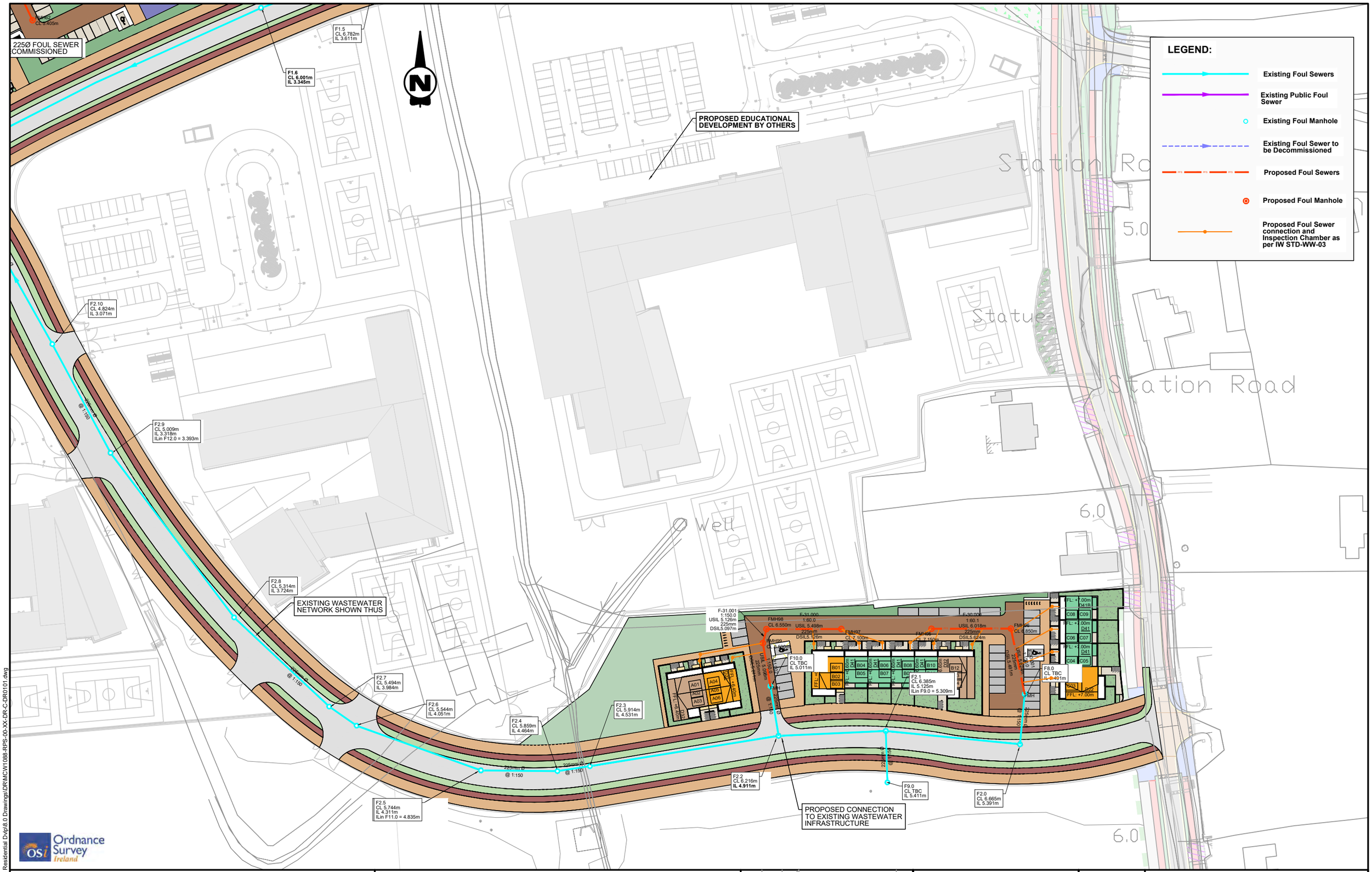
Rev	Date	Drn	Chk	Amendment / Issue	App
S3 P04	08/06/22	PDR	CDASC	Issue for Review and Comment	BB
P01	26/10/21	PDR	CDASC	Pre-Application Submission	BB

Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101
Scale	1:500 @ A1 1:1000 @ A3
Created on	18/10/2021
Sheets	06 of 09
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Drainage Layout (5 of 8)
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101-06
Status	S3
Rev	P04



Ordnance Survey Ireland

Client

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Rev	Date	Dtn	Chk	Amendment / Issue	App
S3 P04	08/06/22	PDR	GMcC	Issue for Review and Comment	BB
P01	26/10/21	PDR	GMcC	Pre-Application Submission	BB

rps

Model File Identifier: MCW1088-RPS-00-XX-DR-C-DR0101

Scale: 1:500 @ A1, 1:1000 @ A3

Created on: 18/10/2021

Sheets: 07 of 09

Project: Castlelake SHD

Title: Proposed Foul Infrastructure Drainage Layout (6 of 8)

File Identifier: MCW1088-RPS-00-XX-DR-C-DR0101-07

Status: S3

Rev: P04

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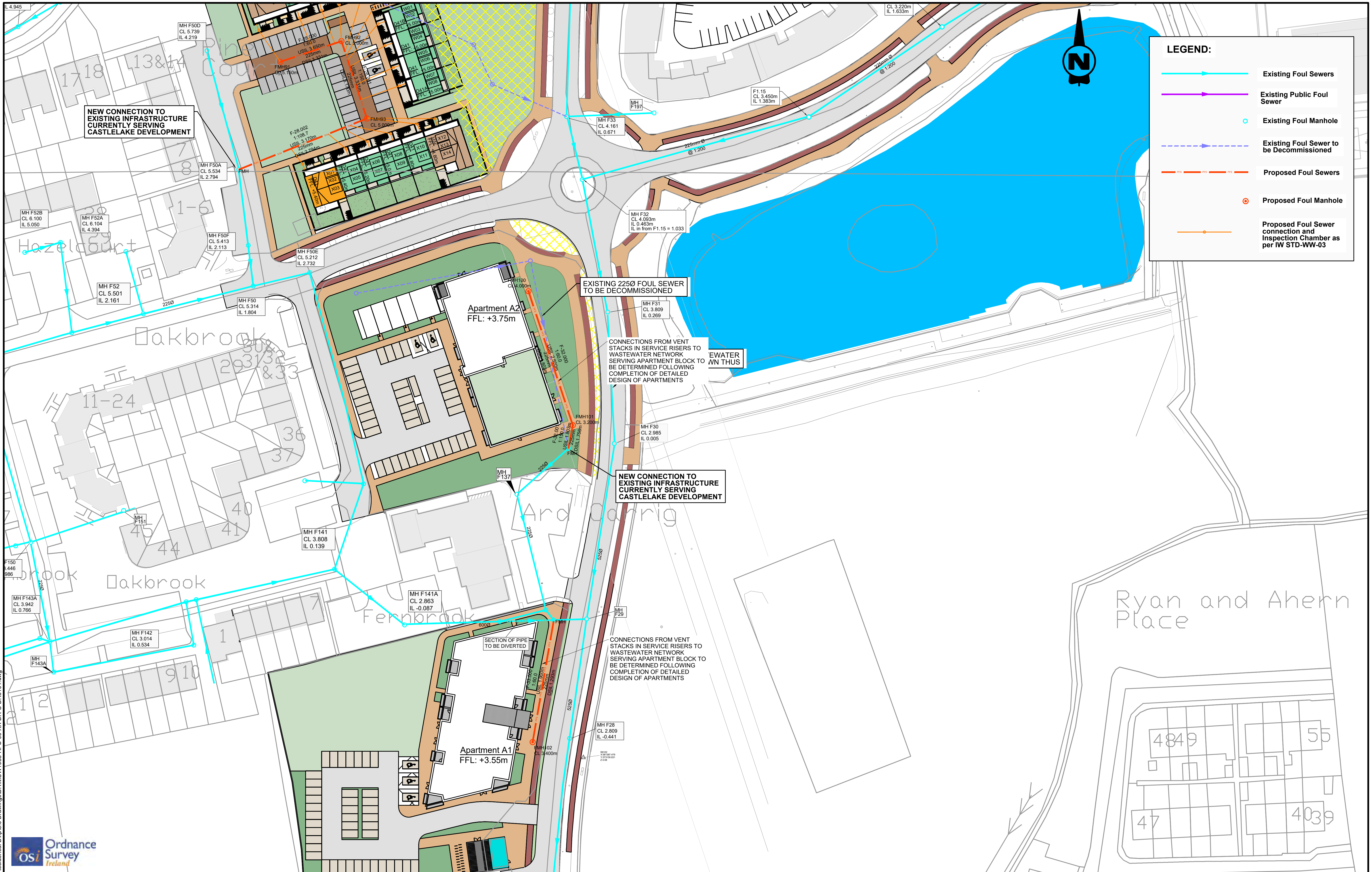

LEGEND:
Existing Foul Sewers
Existing Public Foul Sewer
Existing Foul Manhole
Existing Foul Sewer to be Decommissioned
Proposed Foul Sewers
Proposed Foul Manhole
Proposed Foul Sewer connection and Inspection Chamber as per IW STD-WW-03
NEW CONNECTION TO EXISTING INFRASTRUCTURE CURRENTLY SERVING CASTLELAKE DEVELOPMENT
EXISTING 225Ø FOUL SEWER TO BE DECOMMISSIONED
CONNECTIONS FROM VENT STACKS IN SERVICE RISERS TO WASTEWATER NETWORK SERVING APARTMENT BLOCK TO BE DETERMINED FOLLOWING COMPLETION OF DETAILED DESIGN OF APARTMENTS
NEW CONNECTION TO EXISTING INFRASTRUCTURE CURRENTLY SERVING CASTLELAKE DEVELOPMENT
CONNECTIONS FROM VENT STACKS IN SERVICE RISERS TO WASTEWATER NETWORK SERVING APARTMENT BLOCK TO BE DETERMINED FOLLOWING COMPLETION OF DETAILED DESIGN OF APARTMENTS
SECTION OF PIPE TO BE DIVERTED
Apartment A2
FFL: +3.75m
Apartment A1
FFL: +3.55m
Hazelcourt
Oakbrook
Fernbrook
Ard Carrig
Ryan and Ahern Place
MH F50D CL 5.739 IL 4.219
MH F50A CL 5.534 IL 2.794
MH F52B CL 6.100 IL 5.050
MH F52A CL 6.104 IL 4.394
MH F50F CL 5.413 IL 2.113
MH F50E CL 5.212 IL 2.732
MH F52 CL 5.501 IL 2.161
MH F50 CL 5.314 IL 1.804
MH F33 CL 4.161 IL 0.671
MH F32 CL 4.093m IL 0.463m IL in from F1.15 = 1.033
F1.15 CL 3.450m IL 1.383m
MH F31 CL 3.809 IL 0.269
MH F30 CL 2.985 IL 0.005
MH F141 CL 3.808 IL 0.139
MH F141A CL 2.863 IL -0.087
MH F143A CL 3.942 IL 0.766
MH F142 CL 3.014 IL 0.534
MH F28 CL 2.809 IL -0.441
FMH100 CL 4.000m
FMH101 CL 3.200m
FMH102 CL 3.400m
FMH93 CL 5.000m
FMH92 CL 5.000m
Ordnance Survey Ireland

Client

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Rev	Date	Drn/Chk	Amendment / Issue	App
S3 P04	08/06/22	PGR GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR GMcC	Pre-Application Submission	BB

rps

Model File Identifier
MCW1088-RPS-00-XX-DR-C-DR0101

Scale
1:500 @ A1
1:1000 @ A3

Created on
18/10/2021

Sheets
08 of 09

Project
Castlelake SHD

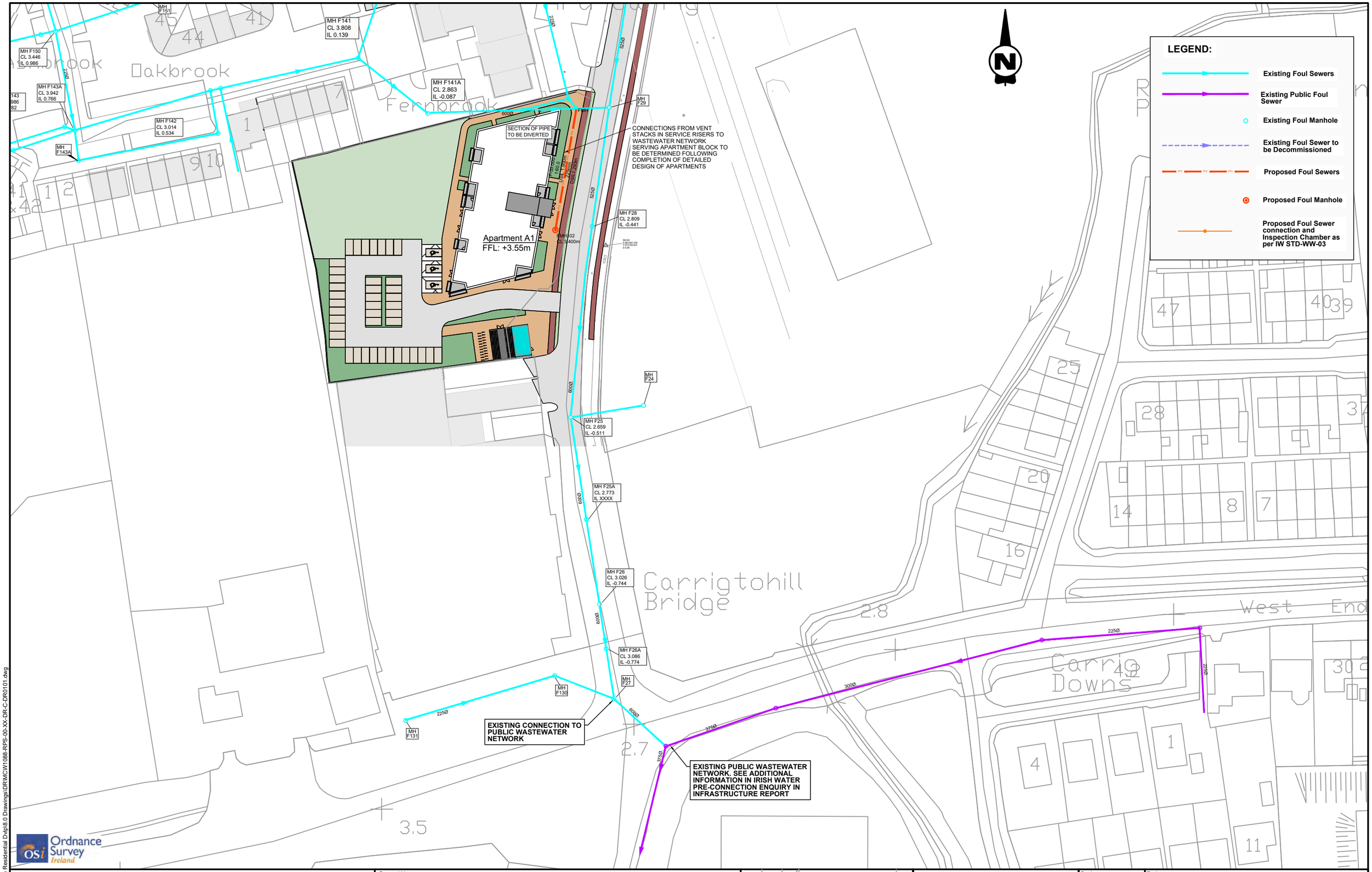
Title
Proposed Foul Infrastructure
Drainage Layout
(7 of 8)

File Identifier
MCW1088-RPS-00-XX-DR-C-DR0101-08

Status
S3

Rev
P04

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg



Ordnance Survey Ireland

Client

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Rev	Date	Dftn Chk	Amendment / Issue	App
S3 P04	08/06/22	PGR GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-DR0101

Scale: 1:500 @ A1, 1:1000 @ A3

Created on: 18/10/2021

Sheets: 09 of 09

Project: Castlelake SHD

Title: Proposed Foul Infrastructure Drainage Layout (8 of 8)

File Identifier: MCW1088-RPS-00-XX-DR-C-DR0101-09

Status: S3

Rev: P04

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\DR\MCW1088-RPS-00-XX-DR-C-DR0101.dwg

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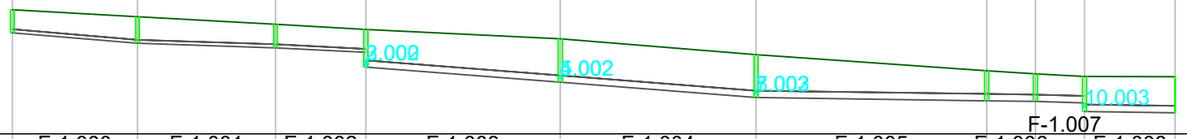
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000										
PN	F-1.000	F-1.001	F-1.002	F-1.003	F-1.004	F-1.005	F-1.006		F-1.008	
Dia (mm)	225	225	225	450	450	450	450	450	450	
Slope (1:X)	60.0	150.0	98.8	64.2	64.1	360.3	360.0	166.7	360.0	
Cover Level (m)	8.100	7.645	7.160	6.820	6.210	5.170	4.115	3.920	3.745	3.731
Invert Level (m)	6.600	5.919 5.919	5.619 5.619	5.320 4.356	3.368 3.368	2.370 2.370	2.161 2.161	2.117 2.117	2.021 1.463 0.002	1.381
Length (m)	40.866	45.045	29.529	63.463	63.971	75.294	15.968		29.623	

MH Name	FMH4	FMH8
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000		
PN	F-2.000	
Dia (mm)	450	
Slope (1:X)	360.0	
Cover Level (m)	7.200	6.820
Invert Level (m)	4.408	4.356
Length (m)	18.612	

MH Name	FMH5	FMH6	FMH7	FMH8
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000				
PN	F-3.000	F-3.001	F-3.002	
Dia (mm)	225	225	225	
Slope (1:X)	60.0	150.0	96.3	
Cover Level (m)	7.000	7.060	6.605	6.820
Invert Level (m)	5.500 5.279 5.279		4.974 4.974	4.581
Length (m)	13.256	45.772	37.837	

MH Name	FMH9	FMH10	FMH11	FMH16
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000				
PN	F-4.000	F-4.001	F-4.002	
Dia (mm)	225	225	225	
Slope (1:X)	60.0	150.0	150.0	
Cover Level (m)	6.400	6.540	6.325	6.210
Invert Level (m)	5.150	4.150 4.150	3.848 3.848	3.593
Length (m)	59.989	45.315	38.214	

MH Name	FMH12	FMH14	FMH15	FMH16
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000				
PN	F-5.000	F-5.001	F-5.002	
Dia (mm)	225	225	225	
Slope (1:X)	60.0	150.0	97.6	
Cover Level (m)	6.345	6.300	6.010	6.210
Invert Level (m)	4.508 4.258 4.258		3.898 3.898	3.593
Length (m)	15.011	53.996	29.769	

MH Name	FMH13	FMH14
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000		
PN	F-6.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	6.350	6.300
Invert Level (m)	4.477 4.258	
Length (m)	13.167	

MH Name	FMH17	FMH18	FMH19	FMH20	FMH25
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000					
PN	F-7.000	F-7.001	F-7.002	F-7.003	
Dia (mm)	225	225	225	225	
Slope (1:X)	60.0	150.0	99.9	58.2	
Cover Level (m)	6.905	6.240	5.580	4.995	5.170
Invert Level (m)	5.405	4.416 4.416	4.021 4.021	3.495 3.495	2.595
Length (m)	59.328	59.328	52.530	52.392	

MH Name	FMH21	FMH23	FMH24	FMH25
Hor Scale 1000 Ver Scale 200 Datum (m) 0.000				
PN	F-8.000	F-8.001	F-8.002	
Dia (mm)	225	225	225	
Slope (1:X)	60.0	150.0	60.3	
Cover Level (m)	5.720	5.740	5.340	5.170
Invert Level (m)	3.736 3.486 3.486		3.126 3.126	2.595
Length (m)	15.011	53.996	32.029	

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Client

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Rev	Date	Dtn Chk	Amendment / Issue	App
S3 P03	18/06/2022	PGR GMcC	Issue for Review and Comment	
S3 P02	03/06/22	PGR GMcC	Issue for Review and Comment	
S3 P01	23/05/22	PGR GMcC	Issue for Review and Comment	
P01	26/10/21	PGR GMcC	Pre-Application Submission	

Model File Identifier: MCW1088-RPS-00-XX-DR-C-DR0102

Scale: As Shown @ A1, Half @ A3

Created on: 24/10/2021

Sheets: 01 of 04

Project: Castlelake SHD

Title: Proposed Foul Infrastructure Longitudinal Sections (1 of 4)

File Identifier: MCW1088-RPS-00-XX-DR-C-DR0102-01

Status: S3

Rev: P03

MH Name	FMH22	FMH23
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000		8.000
PN	F-9.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	5.605	5.740
Invert Level (m)	3.705	3.486
Length (m)	13.167	

MH Name	FMH28	FMH30	FMH31	FMH32	FMH33
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000		11.000			1.007
PN	F-10.000	F-10.001	F-10.002	F-10.003	
Dia (mm)	225	225	225	225	
Slope (1:X)	149.3	150.1	150.0	150.0	
Cover Level (m)	4.135	4.270	3.505	3.625	3.745
Invert Level (m)	2.318	2.211	1.838	1.763	1.688
Length (m)	15.980	55.969	11.263		

MH Name	FMH29	FMH30
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000		10.000
PN	F-11.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	4.500	4.270
Invert Level (m)	2.496	2.211
Length (m)	17.112	

MH Name	FMH34	FMH35	FMH37	FMH42	FMH47	FMH48	FMH53	FMH54	FMH66	FMH
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000			13.000	14.003	15.005		16.003	17.007		
PN	F-12.000	F-12.001	F-12.002	F-12.003	F-12.004	F-12.005	F-12.006	F-12.007	F-12.008	
Dia (mm)	225	225	225	225	225	225	225	225	225	
Slope (1:X)	60.0	150.0	124.4	150.0	150.0	35.9	200.0	200.5	200.0	
Cover Level (m)	7.758	8.115	8.450	7.630	7.300	6.730	6.050	5.730	5.360	4.759
Invert Level (m)	6.258	5.329 / 5.329	4.958 / 4.958	4.396 / 4.396	4.098 / 4.098	3.840 / 3.840	3.133 / 3.133	3.025 / 3.025	2.900 / 2.900	2.658
Length (m)	55.715	55.715	69.886	44.656	38.756	25.356	21.574	25.063	48.272	

MH Name	FMH36	FMH37
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000		12.001
PN	F-13.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	8.715	8.450
Invert Level (m)	5.558	4.958
Length (m)	35.984	

MH Name	FMH38	FMH39	FMH40	FMH41	FMH42
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000					12.002
PN	F-14.000	F-14.001	F-14.002	F-14.003	
Dia (mm)	225	225	225	225	
Slope (1:X)	60.0	150.0	150.0	150.0	
Cover Level (m)	7.630	7.370	7.915	7.835	7.630
Invert Level (m)	6.130	5.218 / 5.218	4.853 / 4.853	4.539 / 4.539	4.396
Length (m)	54.722	54.786	47.039	21.437	

MH Name	FMH43	FMH43a	FMH44	FMH45	FMH45c	FMH46	FMH47
Hor Scale 1000 / Ver Scale 200 / Datum (m) 0.000						12.003	
PN	F-15.000	F-15.001	F-15.002	F-15.003	F-15.004	F-15.005	
Dia (mm)	225	225	225	225	225	225	
Slope (1:X)	60.0	150.0	150.0	150.0	22.2	33.3	
Cover Level (m)	8.000	8.000	8.000	7.900	7.700	6.980	7.300
Invert Level (m)	6.900	6.433 / 6.433	6.190 / 6.190	6.139	5.964 / 5.964	5.205 / 5.205	4.098
Length (m)	27.994	36.576	7.519	26.365	16.836	36.837	

Client: bam

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Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P02	03/06/22	FOR GMcC	Issue for Review and Comment	BB
S3 P01	23/05/22	FOR GMcC	Issue for Review and Comment	BB
P01	26/10/21	FOR GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-DR0102

Scale: As Shown @ A1, Half @ A3

Created on: 24/10/2021

Sheets: 02 of 04

Project: Castlelake SHD

Title: Proposed Foul Infrastructure Longitudinal Sections (2 of 4)

File Identifier: MCW1088-RPS-00-XX-DR-C-DR0102-02

Status: S3

Rev: P02

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MH Name	FMH49	FMH50	FMH51	FMH52	FMH53
Hor Scale 1000 / Ver Scale 200					12.005
Datum (m) 0.000					
PN	F-16.000	F-16.001	F-16.002	F-16.003	
Dia (mm)	225	225	225	225	
Slope (1:X)	36.2	150.0	150.0	150.0	
Cover Level (m)	7.155	5.820	5.675	5.830	6.050
Invert Level (m)	5.200	3.870 / 3.870	3.575 / 3.575	3.369 / 3.369	3.133
Length (m)	48.121	44.313	30.800	35.409	

MH Name	FMH55	FMH56	FMH57	FMH58	FMH59	FMH61	FMH63	FMH65	FMH66
Hor Scale 1000 / Ver Scale 200						18.000	19.000	20.000	12.007
Datum (m) 0.000		F-17.001		F-17.003			F-17.006		
PN	F-17.000		F-17.002		F-17.004	F-17.005		F-17.007	
Dia (mm)	225	225	225	225	225	225	225	225	
Slope (1:X)	60.0	150.0	150.0	150.0	64.0	150.4	71.4	58.3	
Cover Level (m)	6.915	6.590 / 6.530		6.100 / 6.055		5.800	5.610	5.445	5.360
Invert Level (m)	5.415	4.701 / 4.701	4.650 / 4.650	4.270 / 4.270	4.232 / 4.232	3.693 / 3.693	3.530 / 3.530	3.244 / 3.244	2.900
Length (m)	42.824	7.696	57.007	5.711	34.491	24.509	20.431	20.060	

MH Name	FMH60	FMH61
Hor Scale 1000 / Ver Scale 200		17.004
Datum (m) 0.000		
PN	F-18.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	5.610	5.800
Invert Level (m)	4.035	3.693
Length (m)	20.534	

MH Name	FMH62	FMH63
Hor Scale 1000 / Ver Scale 200		17.005
Datum (m) 0.000		
PN	F-19.000	
Dia (mm)	225	
Slope (1:X)	58.8	
Cover Level (m)	5.405	5.610
Invert Level (m)	3.905	3.530
Length (m)	22.048	

MH Name	FMH64	FMH65
Hor Scale 1000 / Ver Scale 200		17.006
Datum (m) 0.000		
PN	F-20.000	
Dia (mm)	225	
Slope (1:X)	25.7	
Cover Level (m)	6.050	5.445
Invert Level (m)	4.550	3.244
Length (m)	33.622	

MH Name	FMH67	FMH68	FMH74	FMH75	FMH76	FMH77	FMH
Hor Scale 1000 / Ver Scale 200					22.004		
Datum (m) 0.000							
PN	F-21.000	F-21.001	F-21.002	F-21.003	F-21.004	F-21.005	
Dia (mm)	225	225	225	225	225	225	
Slope (1:X)	46.2	79.1	200.0	200.0	200.0	200.0	
Cover Level (m)	5.490	4.600	4.100	3.900	3.800	3.610	3.305
Invert Level (m)	3.990	3.100 / 3.100	2.383 / 2.383	2.315 / 2.315	2.206 / 2.206	2.087 / 2.087	2.033
Length (m)	41.143	56.708	13.525	21.929	23.702	10.813	

MH Name	FMH69	FMH70	FMH71	FMH72	FMH73	FMH74
Hor Scale 1000 / Ver Scale 200						21.001
Datum (m) 0.000			F-22.002			
PN	F-22.000	F-22.001		F-22.003	F-22.004	
Dia (mm)	225	225	225	225	225	
Slope (1:X)	45.3	94.2	150.0	150.0	134.5	
Cover Level (m)	5.345	4.760	4.380 / 4.335		4.135	4.100
Invert Level (m)	3.845	3.260 / 3.260	2.880 / 2.880	2.829	2.580 / 2.580	2.383
Length (m)	26.509	35.791	7.702	37.232	26.487	

MH Name	FMH78	FMH79	FMH81	FMH82	FMH83	FMH84	FMH
Hor Scale 1000 / Ver Scale 200				24.000			
Datum (m) 0.000				F-23.003			
PN	F-23.000	F-23.001	F-23.002		F-23.004	F-23.005	
Dia (mm)	225	225	225		225	225	
Slope (1:X)	60.0	150.0	150.0		150.0	146.9	
Cover Level (m)	6.920	6.350	6.755	6.630	6.540 / 6.535		6.850
Invert Level (m)	5.420	5.051 / 5.051	4.855 / 4.855	4.701 / 4.701	4.593 / 4.593 / 4.565	4.565	4.178
Length (m)	22.150	29.449	23.019	16.151	4.198	56.839	

MH Name	FMH80	FMH81
Hor Scale 1000 / Ver Scale 200		23.001
Datum (m) 0.000		
PN	F-24.000	
Dia (mm)	225	
Slope (1:X)	36.8	
Cover Level (m)	6.855	6.755
Invert Level (m)	5.355	4.855
Length (m)	18.408	

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Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P02	03/06/22	PdR / GMcC	Issue for Review and Comment	BR
S3 P01	23/05/22	PdR / GMcC	Issue for Review and Comment	BR
P01	26/10/21	HdR / GMcC	Pre-Application Submission	BR

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Scale	As Shown @ A1 Half @ A3
Created on	24/10/2021
Sheets	03 of 04
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Longitudinal Sections (3 of 4)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0102
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0102-03
Status	S3
Rev	P02

MH Name	FMH85	FMH87	FMH90 FMH
Hor Scale 1000 / Ver Scale 200		26.000	27.001
Datum (m) 0.000		F-25.001	
PN	F-25.000		F-25.002
Dia (mm)	225	225	225
Slope (1:X)	60.0	150.0	200.0
Cover Level (m)	6.560	6.700	6.845 6.850
Invert Level (m)	4.884	4.423 4.423	4.202 4.202 4.177
Length (m)	27.673	33.080	4.901

MH Name	FMH86	FMH87
Hor Scale 1000 / Ver Scale 200		25.000
Datum (m) 0.000		
PN	F-26.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	6.450	6.700
Invert Level (m)	5.016	4.423
Length (m)	35.600	

MH Name	FMH88	FMH89 FMH90
Hor Scale 1000 / Ver Scale 200		25.001
Datum (m) 0.000	F-27.000	
PN	F-27.001	
Dia (mm)	225	225
Slope (1:X)	60.0	150.0
Cover Level (m)	6.800	6.885 6.845
Invert Level (m)	5.300	5.022 4.997 3.764
Length (m)	16.692	

MH Name	FMH91	FMH92	FMH93	FMH
Hor Scale 1000 / Ver Scale 200				
Datum (m) 0.000	F-28.001			
PN	F-28.000		F-28.002	
Dia (mm)	225	225	225	
Slope (1:X)	60.0	150.0	108.7	
Cover Level (m)	5.150	5.000	5.000	5.534
Invert Level (m)	3.650	3.331 3.331	3.170 3.170	2.794
Length (m)	19.125	24.137	40.864	

MH Name	FMH94	FMH
Hor Scale 1000 / Ver Scale 200		
Datum (m) 0.000		
PN	F-29.000	
Dia (mm)	225	
Slope (1:X)	150.0	
Cover Level (m)	5.500	4.473
Invert Level (m)	2.734	2.681
Length (m)	8.000	

MH Name	FMH95	FMH96 FMH
Hor Scale 1000 / Ver Scale 200		
Datum (m) 0.000		F-30.001
PN	F-30.000	
Dia (mm)	225	225
Slope (1:X)	60.1	150.0
Cover Level (m)	7.150	6.850 6.780
Invert Level (m)	6.018	5.624 5.624 5.491
Length (m)	23.667	19.912

MH Name	FMH97	FMH98	FMH99	FMH
Hor Scale 1000 / Ver Scale 200				
Datum (m) 0.000		F-31.001		
PN	F-31.000		F-31.002	
Dia (mm)	225	225	225	
Slope (1:X)	60.0	150.0	150.0	
Cover Level (m)	7.100	6.550	6.500	6.000
Invert Level (m)	5.498	5.126 5.098	5.098	5.011
Length (m)	22.300	4.294	13.038	

MH Name	FMH100	FMH101 FMH
Hor Scale 1000 / Ver Scale 200		
Datum (m) 0.000		
PN	F-32.000	F-32.001
Dia (mm)	225	225
Slope (1:X)	60.0	150.0
Cover Level (m)	4.000	3.200 3.200
Invert Level (m)	2.500	1.803 1.803 1.756
Length (m)	41.848	6.976

MH Name	FMH102	FMH
Hor Scale 1000 / Ver Scale 200		
Datum (m) 0.000		
PN	F-33.000	
Dia (mm)	225	
Slope (1:X)	60.0	
Cover Level (m)	3.400	3.300
Invert Level (m)	1.900	1.293
Length (m)	36.397	

Client

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Rev	Date	Dtn Chk	Amendment / Issue	App
S3 P02	03/06/22	PGR GMcC	Issue for Review and Comment	BB
S3 P01	23/05/22	PGR GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR GMcC	Pre-Application Submission	BB

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Scale	As Shown @ A1 Half @ A3
Created on	24/10/2021
Sheets	04 of 04
Project	Castlelake SHD
Title	Proposed Foul Infrastructure Longitudinal Sections (4 of 4)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101
File Identifier	MCW1088-RPS-00-XX-DR-C-DR0101-04
Status	S3
Rev	P02

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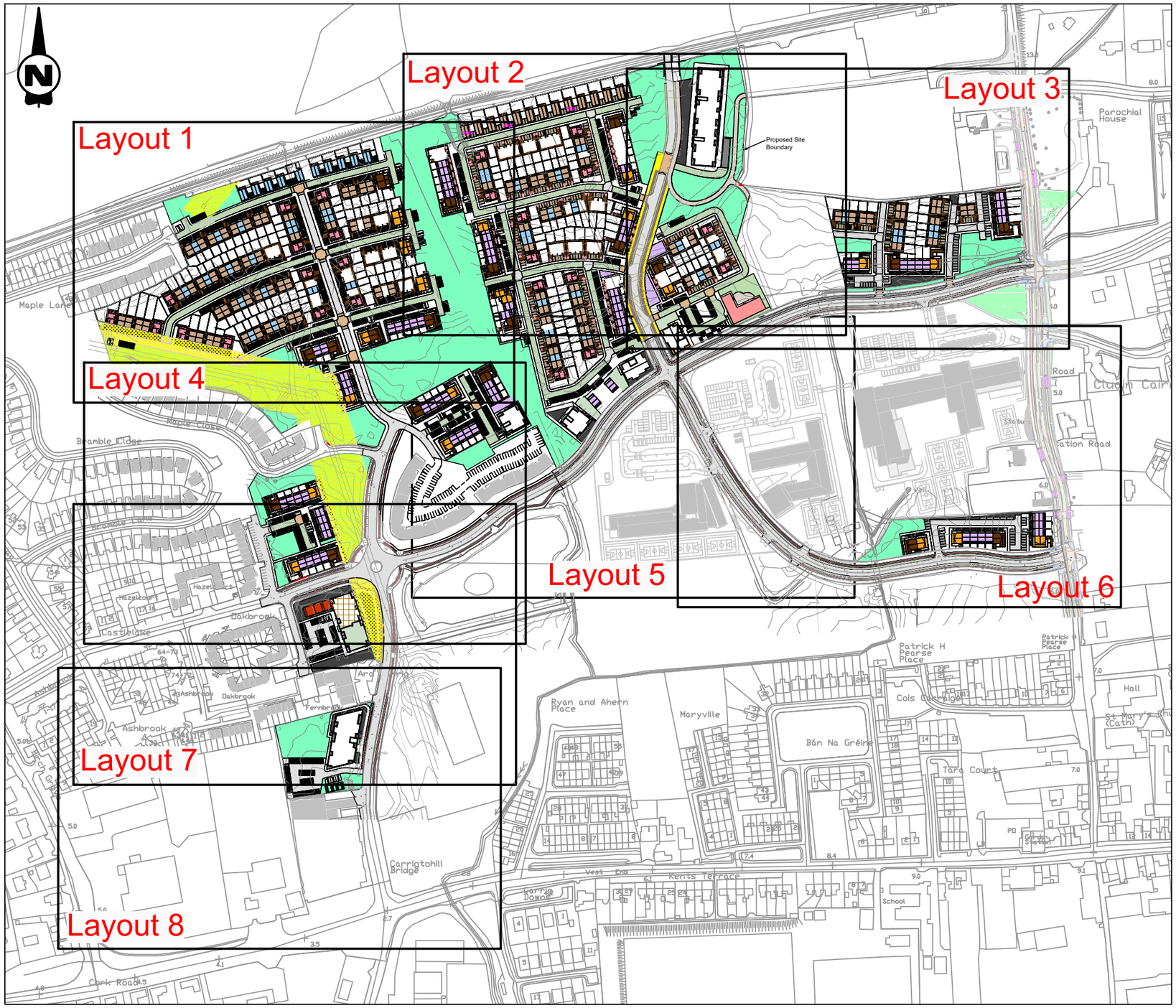

Ordnance Survey Ireland

Client

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Rev	Date	Dim / Chk	Amendment / Issue	App
S3 p03	08/06/22	PGR / GMcC	Issue for Review and Comment	BB
S3 P02	03/06/22	PGR / GMcC	Issue for Review and Comment	BB
S3 P01	23/05/22	PGR / GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR / GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101

Scale: 1:2000 @ A1, 1:4000 @ A3

Created on: 13/09/2021

Sheets: 01 of 09

Project: Castlelake SHD

Title: Proposed Watermain Infrastructure Key Plan

File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101-01

Status: S3

Rev: P03

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LEGEND:

- Existing Watermains
- Existing Watermains to be Decommisioned
- Proposed DN180 SDR17 PE100 Watermains
- Proposed 100mm dia Water Connection
- (SV) Proposed Sluice Valve
- (FH) Proposed Hydrant
- (AV) Proposed Air Valve
- (ScV) Proposed Scour Valve
- (WO) Proposed Washout Hydrant
- Proposed Boundary Box
- Proposed Bulk Meter
- Proposed Manifold with Individual Meters

WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

R:\MCW1088 - BAM Castlelake Residential D\dp\8.0 Drawings\UT\MCW1088-RPS-00-XX-DR-C-UT0101.dwg

Client

General Notes
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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Drn / Chk	Amendment / Issue	App
S3 p03	08/06/22	PGR / GMcC	Issued fro Review and Comment	BB
S3 P02	03/06/22	PGR / GMcC	Issue for Review and Comment	BB
S3 P01	23/05/22	PGR / GMcC	Issue fot Review and Comment	BB
P01	26/10/21	PGR / GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101

Scale: 1:500 @ A1, 1:1000 @ A3
Created on: 13/09/2021
Sheets: 02 of 09

Project: Castlelake SHD
Title: Proposed Watermain Infrastructure Watermain Layout (1 of 8)

File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101-02
Status: S3
Rev: P03

Train Line

Train Line

PROPOSED BOUNDARY BOX ON SERVICE CONNECTION TO EACH DWELLING Ref. STD-W-03

OFF-LINE SCOUR VALVE CONNECTED TO STORM MANHOLE TO STD-W-30 (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

MANIFOLD WITH INDIVIDUAL METERS

Apartment A7
FFL: +8.00m

TOTAL No. OF APARTMENTS IN APARTMENT BLOCK A7 = 76

MANIFOLD WITH INDIVIDUAL METERS

BULK METER Ref. STD-W-26A

WASHOUT HYDRANT TO STD-W-30A (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

PROPOSED WATERMAIN NETWORK SHOWN THUS

BULK METER FOR CRECHE DEVELOPMENT Ref. STD-W-26A

Creche
FFL: +5.80m

Apartment A6
FFL: +5.60m

WASHOUT HYDRANT TO STD-W-30A (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

EXISTING WATERMAIN NETWORK SHOWN THUS

LEGEND:

- Existing Watermains
- Existing Watermains to be Decommisioned
- Proposed DN180 SDR17 PE100 Watermains
- Proposed 100mm dia Water Connection
- SV — Proposed Sluice Valve
- FH — Proposed Hydrant
- AV — Proposed Air Valve
- ScV — Proposed Scour Valve
- WO — Proposed Washout Hydrant
- Proposed Boundary Box
- Proposed Bulk Meter
- Proposed Manifold with Individual Meters

WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

Client

General Notes

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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Dftn / Chk	Amendment / Issue	App
S3 P03	08/06/22	PDR / GMcC	Issue for Review and Comment	BB
S3 P02	03/06/22	PDR / GMcC	Issue for Review and Comment	BB
S3 P01	23/05/22	PDR / GMcC	Issue for Review and Comment	BB
P01	26/10/21	PDR / GMcC	Pre-Application Submission	BB

rps

Scale	1:500 @ A1 1:1000 @ A3
Created on	13/09/2021
Sheets	03 of 09
Project	Castlelake SHD
Title	Proposed Watermain Infrastructure Watermain Layout (2 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101
File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101-03
Status	S3
Rev	P03

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WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

LEGEND:

- Existing Watermains
- Existing Watermains to be Decommisioned
- Proposed DN180 SDR17 PE100 Watermains
- Proposed 100mm dia Water Connection
- SV — Proposed Sluice Valve
- FH — Proposed Hydrant
- AV — Proposed Air Valve
- ScV — Proposed Scour Valve
- WO — Proposed Washout Hydrant
- Proposed Boundary Box
- Proposed Bulk Meter
- Proposed Manifold with Individual Meters

MANIFOLD WITH INDIVIDUAL METERS

Apartment A7
FFL: +8.00m

TOTAL No. OF APARTMENTS IN APARTMENT BLOCK A7 = 76

MANIFOLD WITH INDIVIDUAL METERS

BULK METER Ref. STD-W-26A

PROPOSED BOUNDARY BOX ON SERVICE CONNECTION TO EACH DWELLING Ref. STD-W-03

WASHOUT HYDRANT TO STD-W-30A (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

WASHOUT HYDRANT TO STD-W-30A (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

PROPOSED WATERMAIN NETWORK SHOWN THUS

BULK METER FOR CRECHE DEVELOPMENT Ref. STD-W-26A

Creche
FFL: +5.80m

EXISTING WATERMAIN NETWORK SHOWN THUS

NEW CONNECTION TO EXISTING INFRASTRUCTURE

CONNECTION TO EXISTING PUBLIC WATERMAIN AS PER CDS2000002101

EXISTING 8"Ø AC PUBLIC WATERMAIN

Apartment A6
+5.60m

METERS FOR THE APARTMENTS WILL

Ordnance Survey Ireland

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\UT\MCW1088-RPS-00-XX-DR-C-UT0101.dwg

Client

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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P03	08/06/22	PGR / GMcC	Issue for Review and Comment	
S3 P02	03/06/22	PGR / GMcC	Issue for Review and Planning	
S3 P01	23/05/22	PGR / GMcC	Issue for Review and Comment	
P01	26/10/21	PGR / GMcC	Pre-Application Submission	

Model File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101

Scale: 1:500 @ A1, 1:1000 @ A3
Created on: 13/09/2021
Sheets: 04 of 09

Project: Castlelake SHD

Title: Proposed Watermain Infrastructure Watermain Layout (3 of 8)

File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101-04
Status: S3
Rev: P03

LEGEND:

- Existing Watermains
- Existing Watermains to be Decommisioned
- Proposed DN180 SDR17 PE100 Watermains
- Proposed 100mm dia Water Connection
- SV — Proposed Sluice Valve
- FH — Proposed Hydrant
- AV — Proposed Air Valve
- ScV — Proposed Scour Valve
- WO — Proposed Washout Hydrant
- Proposed Boundary Box
- Proposed Bulk Meter
- Proposed Manifold with Individual Meters

WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

PROPOSED BOUNDARY BOX ON SERVICE CONNECTION TO EACH DWELLING Ref. STD-W-03

OFF-LINE SCOUR VALVE CONNECTED TO STORM MANHOLE TO STD-W-30 (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

NEW CONNECTION TO EXISTING INFRASTRUCTURE

METERS F… BE INSTAL… THE PREM… CONTROLS REQUIREM… REVIEW BY… TOTAL No.…

OFF-LINE SCOUR VALVE CONNECTED TO STORM MANHOLE TO STD-W-30 (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

PROPOSED WATERMAIN NETWORK SHOWN THUS

NEW CONNECTION TO EXISTING INFRASTRUCTURE

PROPOSED BOUNDARY BOX ON SERVICE CONNECTION TO EACH DWELLING Ref. STD-W-03

EXISTING WATERMAIN NETWORK SHOWN THUS

PROPOSED BOUNDARY BOX ON SERVICE CONNECTION TO EACH DWELLING Ref. STD-W-03

PROPOSED WATERMAIN NETWORK SHOWN THUS

MANIFOLD WITH INDIVIDUAL METERS

NEW CONNECTION TO EXISTING INFRASTRUCTURE

BULK METER Ref. STD-W-26A

TOTAL No. OF APARTMENTS IN APARTMENT BLOCK A2 = 42

Apartment A2
FFL: +3.75m

Apartment A3
FFL: +3.80m

Maple Close

Maple Crescent

Hazelcourt

Oakbrook

Castlelake

Ordnance Survey Ireland

Client

General Notes
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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Drn Chk	Amendment / Issue	App
S3 P03	08/06/2022	PGR GMcC	Issue for Review and Comment	
S3 P02	03/06/22	PGR GMcC	Issue for Review and Comment	
S3 P01	23/05/22	PGR GMcC	Issue for Review and Comment	
P01	26/10/21	PGR GMcC	Pre-Application Submission	

rps

Scale	1:500 @ A1 1:1000 @ A3
Created on	13/09/2021
Sheets	05 of 09
Project	Castlelake SHD
Title	Proposed Watermain Infrastructure Watermain Layout (4 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101
File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101-05
Status	S3
Rev	P03

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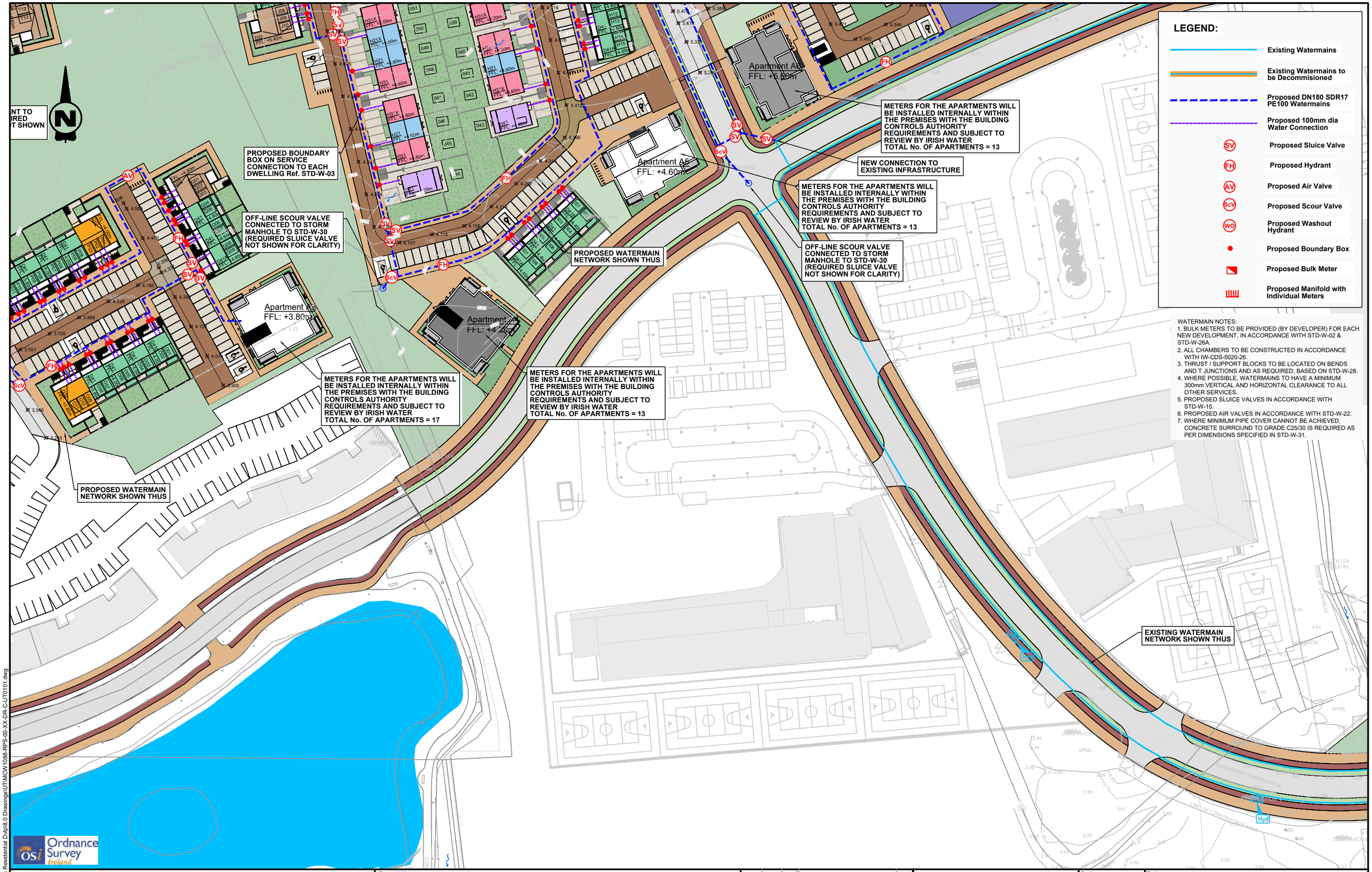

Client

General Notes

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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Dftn Chk	Amendment / Issue	App
S3 P03	08/06/22	PDR GMcC	Issue for Review and Comment	BB
P01	26/10/21	PDR GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101

Scale: 1:500 @ A1, 1:1000 @ A3

Created on: 13/09/2021

Sheets: 06 of 09

Project: Castlelake SHD

Title: Proposed Watermain Infrastructure Watermain Layout (5 of 8)

File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101-06

Status: S3

Rev: P03

R:\MCW1088 - BAM Castlelake Residential Dwlp\8.0 Drawings\UT\MCW1088-RPS-00-XX-DR-C-UT0101.dwg

METERS FOR THE APARTMENTS WILL BE INSTALLED INTERNALLY WITHIN THE PREMISES WITH THE BUILDING CONTROLS AUTHORITY REQUIREMENTS AND SUBJECT TO REVIEW BY IRISH WATER TOTAL No. OF APARTMENTS = 13

NEW CONNECTION TO EXISTING INFRASTRUCTURE

METERS FOR THE APARTMENTS WILL BE INSTALLED INTERNALLY WITHIN THE PREMISES WITH THE BUILDING CONTROLS AUTHORITY REQUIREMENTS AND SUBJECT TO REVIEW BY IRISH WATER TOTAL No. OF APARTMENTS = 13

OFF-LINE SCOUR VALVE CONNECTED TO STORM MANHOLE TO STD-W-30 (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

PROPOSED EDUCATIONAL DEVELOPMENT BY OTHERS

WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

LEGEND:

- Existing Watermains
- Existing Watermains to be Decommisioned
- Proposed DN180 SDR17 PE100 Watermains
- Proposed 100mm dia Water Connection
- SV Proposed Sluice Valve
- FH Proposed Hydrant
- AV Proposed Air Valve
- ScV Proposed Scour Valve
- WO Proposed Washout Hydrant
- Proposed Boundary Box
- Proposed Bulk Meter
- Proposed Manifold with Individual Meters

PROPOSED BOUNDARY BOX ON SERVICE CONNECTION TO EACH DWELLING Ref. STD-W-03

EXISTING 8"Ø AC PUBLIC WATERMAIN

EXISTING WATERMAIN NETWORK SHOWN THUS

WASHOUT HYDRANT TO STD-W-30A (REQUIRED SLUICE VALVE NOT SHOWN FOR CLARITY)

CONNECTION TO EXISTING PUBLIC WATERMAIN AS PER CDS2000602101

Station Road

Statue

Well

Ordnance Survey Ireland

Client

General Notes

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Rev	Date	Drn	Chk	Amendment / Issue	App
S3 P03	08/06/22		FOR AGREEMENT	Issue for Review and Comment	BB
P01	26/10/21		FOR AGREEMENT	Pre-Application Submission	BB

rps

Scale	1:500 @ A1 1:1000 @ A3
Created on	13/09/2021
Sheets	07 of 09
Project	Castlelake SHD
Title	Proposed Watermain Infrastructure Watermain Layout (6 of 8)
Model File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101
File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101-07
Status	S3
Rev	P03

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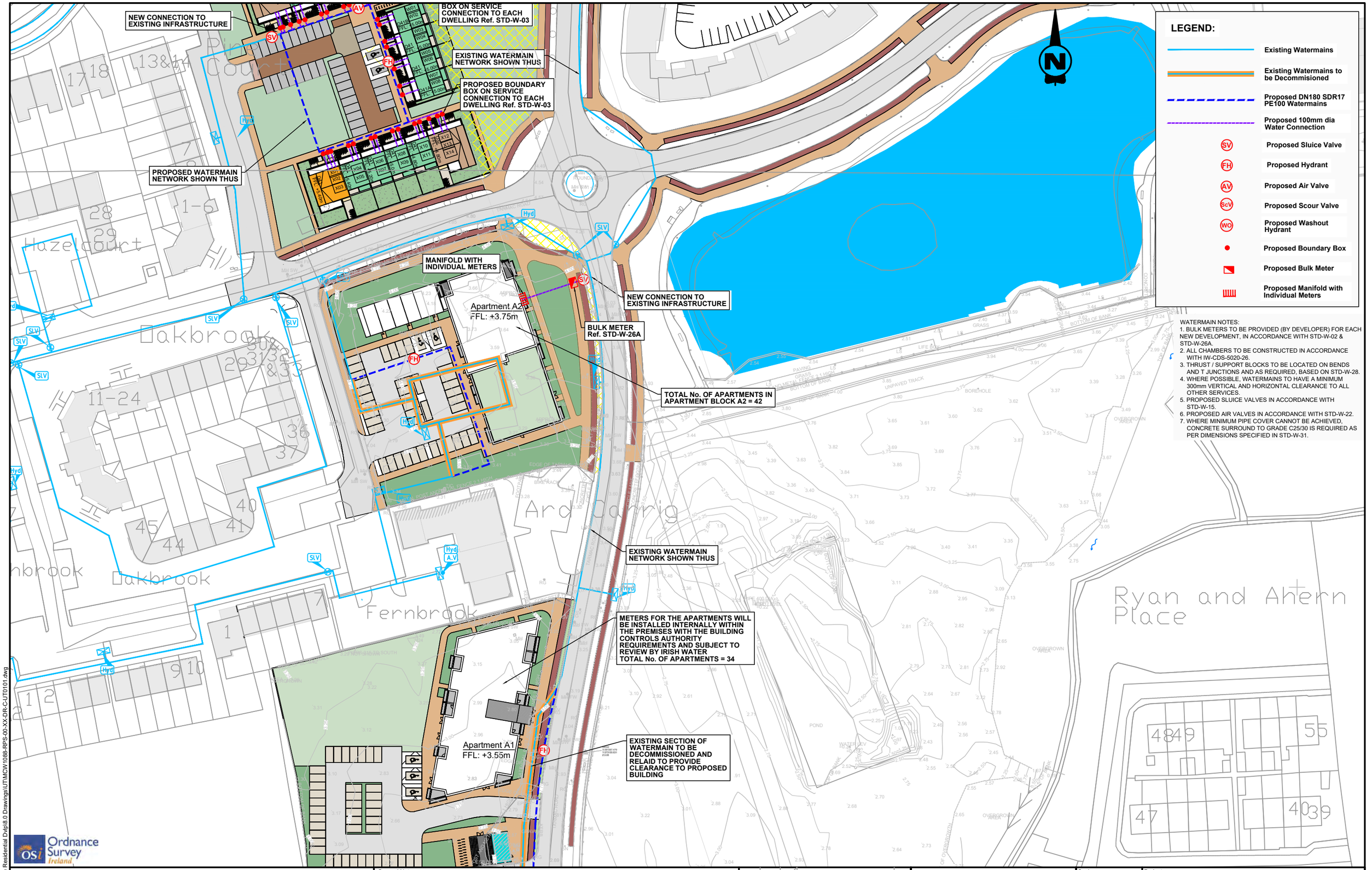

WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\UT\MCW1088-RPS-00-XX-DR-C-UT0101.dwg

Client

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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

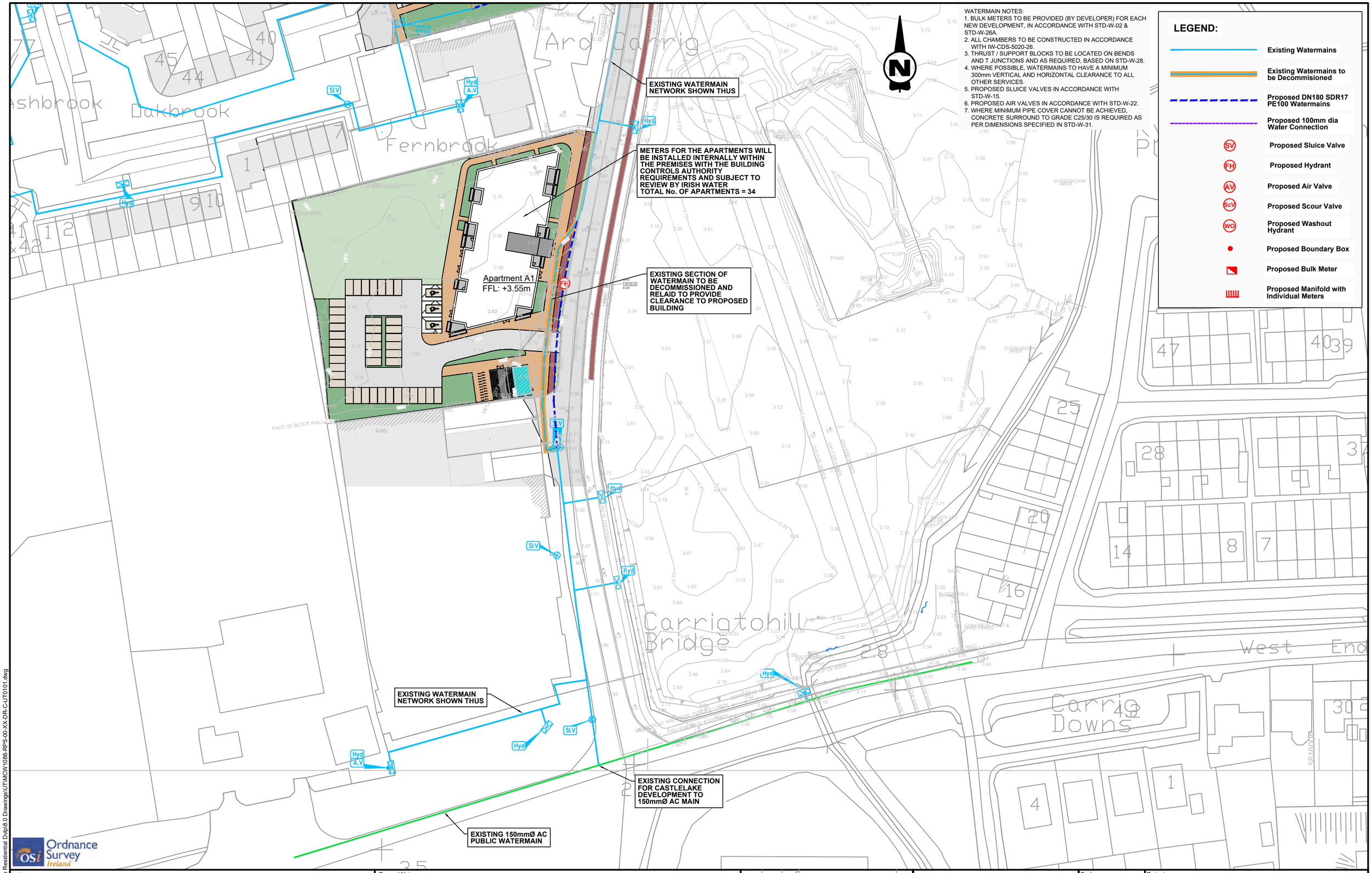
Rev	Date	Drn	Chk	Amendment / Issue	App
S3 P03	08/06/22	PGR	GMcC	Issue for Review and Comment	BB
P01	26/10/21	PGR	GMcC	Pre-Application Submission	BB

Model File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101

Scale: 1:500 @ A1, 1:1000 @ A3
Created on: 03/09/2021
Sheets: 08 of 09

Project: Castlelake SHD
Title: Proposed Watermain Infrastructure Watermain Layout (7 of 8)

File Identifier: MCW1088-RPS-00-XX-DR-C-UT0101-08
Status: S3
Rev: P03



WATERMAIN NOTES:
1. BULK METERS TO BE PROVIDED (BY DEVELOPER) FOR EACH NEW DEVELOPMENT, IN ACCORDANCE WITH STD-W-02 & STD-W-26A.
2. ALL CHAMBERS TO BE CONSTRUCTED IN ACCORDANCE WITH IW-CDS-5020-26.
3. THRUST / SUPPORT BLOCKS TO BE LOCATED ON BENDS AND T JUNCTIONS AND AS REQUIRED, BASED ON STD-W-28.
4. WHERE POSSIBLE, WATERMAINS TO HAVE A MINIMUM 300mm VERTICAL AND HORIZONTAL CLEARANCE TO ALL OTHER SERVICES.
5. PROPOSED SLUICE VALVES IN ACCORDANCE WITH STD-W-15.
6. PROPOSED AIR VALVES IN ACCORDANCE WITH STD-W-22.
7. WHERE MINIMUM PIPE COVER CANNOT BE ACHIEVED, CONCRETE SURROUND TO GRADE C25/30 IS REQUIRED AS PER DIMENSIONS SPECIFIED IN STD-W-31.

LEGEND:

- Existing Watermains
- Existing Watermains to be Decommisioned
- Proposed DN180 SDR17 PE100 Watermains
- Proposed 100mm dia Water Connection
- SV — Proposed Sluice Valve
- FH — Proposed Hydrant
- AV — Proposed Air Valve
- ScV — Proposed Scour Valve
- WO — Proposed Washout Hydrant
- Proposed Boundary Box
- Proposed Bulk Meter
- Proposed Manifold with Individual Meters

Client

General Notes

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(v) All Levels refer to Ordnance Survey Datum, Malin Head.

Rev	Date	Drn / Chk	Amendment / Issue	App
S3 P03	08/06/22	BOR / GEAGC	Issue for Review and Comment	BB
P01	26/10/21	BOR / GEAGC	Pre-Application Submission	BB

Model File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101
Scale	1:500 @ A1 1:1000 @ A3
Created on	13/09/2021
Sheets	09 of 09
Project	Castlelake SHD
Title	Proposed Watermain Infrastructure Watermain Layout (8 of 8)
File Identifier	MCW1088-RPS-00-XX-DR-C-UT0101-09
Status	S3
Rev	P03

R:\MCW1088 - BAM Castlelake Residential Dvlp\8.0 Drawings\UT\MCW1088-RPS-00-XX-DR-C-UT0101.dwg

Appendix E
MicroDrainage Stormwater Outputs

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	10
Ratio R	0.249	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.275
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-1.000	42.725	0.465	91.9	0.141	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-1.001	44.570	0.490	91.0	0.136	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-1.002	29.285	0.802	36.5	0.059	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-2.000	16.597	0.097	171.0	0.041	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-2.001	48.868	0.303	161.3	0.129	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-2.002	38.884	0.227	171.3	0.093	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-1.003	63.774	0.671	95.0	0.240	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-3.000	64.117	0.375	171.0	0.239	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-1.000	50.00	4.52	6.630	0.141	0.0	0.0	1.9	1.36	54.3	21.1
S-1.001	50.00	5.06	6.165	0.277	0.0	0.0	3.8	1.37	54.5	41.3
S-1.002	50.00	5.29	5.675	0.337	0.0	0.0	4.6	2.17	86.4	50.1
S-2.000	50.00	4.28	5.500	0.041	0.0	0.0	0.6	1.00	39.6	6.1
S-2.001	50.00	5.07	5.403	0.169	0.0	0.0	2.3	1.03	40.8	25.2
S-2.002	48.95	5.72	5.100	0.263	0.0	0.0	3.5	1.00	39.6	38.3
S-1.003	47.20	6.29	4.723	0.840	0.0	0.0	10.7	1.86	205.3	118.1
S-3.000	50.00	5.07	4.875	0.239	0.0	0.0	3.2	1.00	39.6	35.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-3.001	47.134	0.191	247.0	0.236	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-3.002	34.771	0.107	325.0	0.042	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-4.000	13.570	0.151	89.9	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-5.000	17.242	0.101	171.0	0.040	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-4.001	58.479	0.342	171.0	0.216	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-4.002	30.194	0.155	194.8	0.038	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-1.004	63.545	0.868	73.2	0.243	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-6.000	59.281	0.670	88.5	0.154	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-6.001	59.281	0.670	88.5	0.131	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-6.002	52.672	0.595	88.5	0.131	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-6.003	49.103	0.151	325.0	0.177	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-7.000	17.242	0.101	171.0	0.044	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-8.000	13.570	0.251	54.1	0.034	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-7.001	61.058	0.247	247.0	0.215	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-3.001	48.51	5.86	4.425	0.475	0.0	0.0	6.2	1.00	70.4	68.7
S-3.002	46.78	6.44	4.159	0.518	0.0	0.0	6.6	1.00	110.4	72.1
S-4.000	50.00	4.16	4.850	0.000	0.0	0.0	0.0	1.38	54.9	0.0
S-5.000	50.00	4.29	4.800	0.040	0.0	0.0	0.5	1.00	39.6	6.0
S-4.001	50.00	5.27	4.699	0.257	0.0	0.0	3.5	1.00	39.6	38.3
S-4.002	48.98	5.71	4.282	0.295	0.0	0.0	3.9	1.12	79.4	43.0
S-1.004	45.55	6.89	3.977	1.895	0.0	0.0	23.4	2.38	378.3	257.2
S-6.000	50.00	4.71	5.420	0.154	0.0	0.0	2.1	1.39	55.3	22.9
S-6.001	49.94	5.42	4.750	0.285	0.0	0.0	3.9	1.39	55.3	42.4
S-6.002	48.25	5.95	4.005	0.416	0.0	0.0	5.4	1.67	118.2	59.8
S-6.003	45.88	6.76	3.335	0.593	0.0	0.0	7.4	1.00	110.4	81.0
S-7.000	50.00	4.29	4.100	0.044	0.0	0.0	0.6	1.00	39.6	6.5
S-8.000	50.00	4.13	4.250	0.034	0.0	0.0	0.5	1.78	70.9	5.0
S-7.001	50.00	5.31	3.924	0.293	0.0	0.0	4.0	1.00	70.4	43.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-7.002	30.321	0.418	72.5	0.077	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-1.005	35.791	0.199	179.9	0.044	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-9.000	19.627	0.115	171.0	0.041	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-1.006	41.828	0.515	81.2	0.099	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-1.007	17.293	0.200	86.5	0.022	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-1.008	15.019	0.110	136.5	0.015	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-10.000	26.058	0.152	171.4	0.142	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-11.000	23.350	0.377	61.9	0.089	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-10.001	60.547	0.245	247.1	0.236	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-10.002	13.128	0.040	325.0	0.015	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-10.003	12.009	0.037	325.0	0.024	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-1.009	23.178	0.024	975.0	0.044	0.00	0.0	0.600	o	900	Pipe/Conduit	
S-1.010	30.179	0.031	975.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S-1.011	48.163	0.024	2006.8	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S-1.012	24.661	0.060	412.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-7.002	49.40	5.58	3.677	0.370	0.0	0.0	4.9	1.85	130.6	54.4
S-1.005	44.70	7.21	2.959	2.901	0.0	0.0	35.1	1.81	512.5	386.4
S-9.000	50.00	4.33	3.250	0.041	0.0	0.0	0.6	1.00	39.6	6.1
S-1.006	44.06	7.47	2.760	3.041	0.0	0.0	36.3	2.70	764.5	399.1
S-1.007	43.79	7.58	2.245	3.063	0.0	0.0	36.3	2.62	740.8	399.6
S-1.008	43.50	7.70	2.045	3.078	0.0	0.0	36.3	2.08	588.8	399.6
S-10.000	50.00	4.44	2.800	0.142	0.0	0.0	1.9	1.00	39.6	21.2
S-11.000	50.00	4.23	3.025	0.089	0.0	0.0	1.2	1.66	66.2	13.3
S-10.001	49.84	5.45	2.573	0.468	0.0	0.0	6.3	1.00	70.4	69.4
S-10.002	49.12	5.67	2.253	0.483	0.0	0.0	6.4	1.00	110.4	70.7
S-10.003	48.49	5.87	2.213	0.507	0.0	0.0	6.7	1.00	110.4	73.2
S-1.009	42.61	8.09	1.760	3.629	0.0	0.0	41.9	1.00	633.0	460.6
S-1.010	41.51	8.60	1.736	3.629	0.0	0.0	41.9	1.00	633.0	460.6
S-1.011	39.60	9.57	1.705	3.629	0.0	0.0	41.9	0.83	933.8	460.6
S-1.012	50.00	4.41	1.681	0.000	100.0	0.0	9.1	1.00	158.3	100.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-12.000	59.069	0.345	171.0	0.201	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-12.001	58.734	0.238	247.0	0.150	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-13.000	38.044	1.598	23.8	0.108	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-12.002	71.451	0.240	297.7	0.280	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-14.000	48.554	0.270	179.8	0.286	4.00	0.0	0.600	o	300	Pipe/Conduit	
S-14.001	50.398	0.204	247.0	0.094	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-14.002	50.398	0.155	325.0	0.195	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-14.003	23.889	0.074	325.0	0.052	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-12.003	39.667	0.389	102.0	0.072	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-15.000	65.311	0.264	247.0	0.321	4.00	0.0	0.600	o	300	Pipe/Conduit	
S-15.001	5.361	0.022	247.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-15.002	45.902	1.439	31.9	0.039	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-16.000	19.233	0.112	171.0	0.036	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-15.003	36.127	0.146	247.0	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-12.000	50.00	4.99	6.230	0.201	0.0	0.0	2.7	1.00	39.6	29.9
S-12.001	48.17	5.97	5.810	0.351	0.0	0.0	4.6	1.00	70.4	50.4
S-13.000	50.00	4.24	7.245	0.108	0.0	0.0	1.5	2.69	107.1	16.2
S-12.002	44.97	7.11	5.497	0.739	0.0	0.0	9.0	1.04	115.4	99.0
S-14.000	50.00	4.69	6.035	0.286	0.0	0.0	3.9	1.17	82.7	42.6
S-14.001	49.56	5.54	5.765	0.381	0.0	0.0	5.1	1.00	70.4	56.2
S-14.002	46.96	6.38	5.486	0.576	0.0	0.0	7.3	1.00	110.4	80.5
S-14.003	45.85	6.77	5.331	0.628	0.0	0.0	7.8	1.00	110.4	85.7
S-12.003	44.04	7.48	5.257	1.439	0.0	0.0	17.2	1.79	198.2	188.8
S-15.000	50.00	5.09	6.825	0.321	0.0	0.0	4.3	1.00	70.4	47.8
S-15.001	50.00	5.18	6.561	0.321	0.0	0.0	4.3	1.00	70.4	47.8
S-15.002	49.82	5.46	6.539	0.360	0.0	0.0	4.9	2.79	197.5	53.4
S-16.000	50.00	4.32	5.276	0.036	0.0	0.0	0.5	1.00	39.6	5.3
S-15.003	47.89	6.06	5.089	0.447	0.0	0.0	5.8	1.00	70.4	63.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-12.004	11.888	0.020	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-12.005	17.783	0.030	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-12.006	7.444	0.005	1488.9	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S-12.007	1.751	0.003	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S-12.008	43.651	0.177	247.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-12.009	43.382	0.687	63.1	0.188	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-17.000	47.357	1.476	32.1	0.251	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-18.000	21.528	0.126	171.0	0.044	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-17.001	44.448	0.180	247.0	0.070	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-17.002	26.984	0.109	247.0	0.068	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-17.003	34.361	0.139	247.0	0.058	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-12.010	23.928	0.058	412.0	0.042	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-12.011	25.184	0.116	217.1	0.047	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-19.000	27.762	0.162	171.0	0.118	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-20.000	45.521	0.345	131.9	0.109	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-12.004	43.56	7.68	4.643	1.886	0.0	0.0	22.2	1.00	281.4	244.7
S-12.005	42.87	7.98	4.623	1.886	0.0	0.0	22.2	1.00	281.4	244.7
S-12.006	42.52	8.13	4.593	1.886	0.0	0.0	22.2	0.80	510.8	244.7
S-12.007	42.46	8.16	4.588	1.886	0.0	0.0	22.2	1.00	281.4	244.7
S-12.008	50.00	4.73	4.585	0.000	16.1	0.0	1.5	1.00	70.4	16.1
S-12.009	50.00	5.10	4.408	0.188	16.1	0.0	4.2	1.98	140.1	45.7
S-17.000	50.00	4.34	5.700	0.251	0.0	0.0	3.4	2.32	92.2	37.3
S-18.000	50.00	4.36	4.350	0.044	0.0	0.0	0.6	1.00	39.6	6.5
S-17.001	50.00	5.10	4.149	0.365	0.0	0.0	4.9	1.00	70.4	54.3
S-17.002	49.49	5.56	3.969	0.433	0.0	0.0	5.8	1.00	70.4	63.9
S-17.003	47.69	6.13	3.860	0.491	0.0	0.0	6.3	1.00	70.4	69.8
S-12.010	46.52	6.53	3.571	0.721	16.1	0.0	10.7	1.00	158.3	117.7
S-12.011	45.69	6.84	3.513	0.768	16.1	0.0	11.1	1.38	218.8	122.3
S-19.000	50.00	4.46	3.997	0.118	0.0	0.0	1.6	1.00	39.6	17.6
S-20.000	50.00	4.67	5.435	0.109	0.0	0.0	1.5	1.14	45.2	16.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-20.001	5.510	0.060	91.8	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-20.002	53.628	0.410	130.8	0.125	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-20.003	5.565	0.060	92.8	0.006	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-20.004	36.150	0.614	58.9	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-21.000	25.564	0.149	171.0	0.133	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-20.005	25.036	0.111	225.6	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-19.001	16.906	0.053	320.0	0.023	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-22.000	35.714	0.768	46.5	0.065	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-19.002	11.793	0.037	320.0	0.022	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-23.000	1.912	0.005	382.3	0.000	4.00	0.0	0.600	o	450	Pipe/Conduit	
S-23.001	5.679	0.014	412.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-19.003	11.793	0.048	247.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-12.012	18.485	0.045	412.0	0.031	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-20.001	50.00	4.73	5.090	0.115	0.0	0.0	1.6	1.36	54.3	17.1
S-20.002	49.62	5.52	5.030	0.240	0.0	0.0	3.2	1.14	45.4	35.5
S-20.003	49.39	5.59	4.620	0.245	0.0	0.0	3.3	1.36	54.0	36.1
S-20.004	48.27	5.94	4.560	0.297	0.0	0.0	3.9	1.71	67.9	42.8
S-21.000	50.00	4.43	4.095	0.133	0.0	0.0	1.8	1.00	39.6	19.8
S-20.005	47.07	6.34	3.871	0.480	0.0	0.0	6.1	1.04	73.7	67.3
S-19.001	46.28	6.62	3.685	0.621	0.0	0.0	7.8	1.01	111.3	85.6
S-22.000	50.00	4.31	4.550	0.065	0.0	0.0	0.9	1.92	76.5	9.7
S-19.002	45.75	6.81	3.632	0.708	0.0	0.0	8.8	1.01	111.3	96.5
S-23.000	50.00	4.03	3.614	0.000	0.0	0.0	0.0	1.03	164.4	0.0
S-23.001	50.00	4.13	3.609	0.000	0.0	0.0	0.0	1.00	158.3	0.0
S-19.003	50.00	4.20	3.595	0.000	5.5	0.0	0.5	1.00	70.4	5.5
S-12.012	44.87	7.15	3.396	0.799	21.6	0.0	11.9	1.00	158.3	130.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-24.000	44.836	0.262	171.0	0.202	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-24.001	57.558	0.987	58.3	0.143	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-25.000	26.864	0.620	43.3	0.168	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-25.001	38.083	0.225	169.3	0.161	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-26.000	17.375	0.102	170.3	0.051	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-25.002	10.343	0.042	247.0	0.061	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-25.003	38.930	0.122	320.0	0.099	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-25.004	28.665	0.090	320.0	0.049	0.00	0.0	0.600	o	375	Pipe/Conduit	
S-24.002	10.501	0.025	412.0	0.066	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-24.003	22.840	0.055	412.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-24.004	23.402	0.057	412.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-24.005	9.493	0.073	130.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-24.006	5.743	0.288	19.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-27.000	51.515	0.330	156.1	0.089	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-27.001	5.643	0.033	171.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-27.002	32.659	0.191	171.0	0.079	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-27.003	5.501	0.032	171.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-24.000	50.00	4.75	4.050	0.202	0.0	0.0	2.7	1.00	39.6	30.1
S-24.001	50.00	5.31	3.788	0.345	0.0	0.0	4.7	1.72	68.2	51.4
S-25.000	50.00	4.22	3.900	0.168	0.0	0.0	2.3	1.99	79.2	25.0
S-25.001	50.00	4.75	3.205	0.329	0.0	0.0	4.5	1.21	85.2	49.0
S-26.000	50.00	4.29	3.157	0.051	0.0	0.0	0.7	1.00	39.7	7.6
S-25.002	50.00	4.92	2.980	0.441	0.0	0.0	6.0	1.00	70.4	65.7
S-25.003	49.45	5.57	2.863	0.540	0.0	0.0	7.2	1.01	111.3	79.6
S-25.004	47.95	6.04	2.741	0.589	0.0	0.0	7.6	1.01	111.3	84.1
S-24.002	47.42	6.22	2.576	1.000	0.0	0.0	12.8	1.00	158.3	141.3
S-24.003	46.33	6.60	2.551	1.000	0.0	0.0	12.8	1.00	158.3	141.3
S-24.004	45.27	6.99	2.496	1.000	0.0	0.0	12.8	1.00	158.3	141.3
S-24.005	45.04	7.08	2.439	1.000	0.0	0.0	12.8	1.78	283.3	141.3
S-24.006	44.99	7.10	2.366	1.000	0.0	0.0	12.8	4.57	726.7	141.3
S-27.000	50.00	4.82	5.350	0.089	0.0	0.0	1.2	1.04	41.5	13.2
S-27.001	50.00	4.92	5.020	0.089	0.0	0.0	1.2	1.00	39.6	13.2
S-27.002	49.80	5.46	4.987	0.168	0.0	0.0	2.3	1.00	39.6	24.9
S-27.003	49.49	5.56	4.796	0.168	0.0	0.0	2.3	0.99	39.5	24.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-28.000	14.450	0.085	171.0	0.042	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-28.001	6.410	0.115	55.7	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-27.004	23.947	0.097	247.0	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-29.000	25.520	0.783	32.6	0.082	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-27.005	17.786	0.072	247.0	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-27.006	2.166	0.009	247.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-27.007	7.301	0.011	663.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-27.008	1.133	0.005	247.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-27.009	1.839	0.022	83.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-30.000	26.940	0.350	77.0	0.081	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-31.000	40.958	0.240	171.0	0.101	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-30.001	30.499	0.178	171.0	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-30.002	6.023	0.035	171.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-32.000	15.684	0.092	171.0	0.070	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-28.000	50.00	4.24	5.370	0.042	0.0	0.0	0.6	1.00	39.6	6.3
S-28.001	50.00	4.30	5.285	0.077	0.0	0.0	1.0	1.76	69.8	11.5
S-27.004	48.22	5.96	4.689	0.296	0.0	0.0	3.9	1.00	70.4	42.6
S-29.000	50.00	4.18	5.450	0.082	0.0	0.0	1.1	2.30	91.4	12.2
S-27.005	47.32	6.25	4.592	0.418	0.0	0.0	5.4	1.00	70.4	59.0
S-27.006	47.21	6.29	4.520	0.418	0.0	0.0	5.4	1.00	70.4	59.0
S-27.007	46.63	6.49	4.446	0.418	0.0	0.0	5.4	0.60	42.6«	59.0
S-27.008	46.58	6.51	4.435	0.418	0.0	0.0	5.4	1.00	70.4	59.0
S-27.009	50.00	4.02	4.430	0.000	3.7	0.0	0.3	1.43	56.9	3.7
S-30.000	50.00	4.30	5.045	0.081	0.0	0.0	1.1	1.49	59.3	12.0
S-31.000	50.00	4.68	4.935	0.101	0.0	0.0	1.4	1.00	39.6	15.1
S-30.001	50.00	5.19	4.695	0.246	0.0	0.0	3.3	1.00	39.6	36.6
S-30.002	50.00	5.30	4.517	0.246	0.0	0.0	3.3	1.00	39.6	36.6
S-32.000	50.00	4.26	5.300	0.070	0.0	0.0	0.9	1.00	39.6	10.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-32.001	5.582	0.033	171.0	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-30.003	4.566	0.018	247.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-33.000	24.783	0.145	171.0	0.134	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-33.001	28.205	0.165	171.0	0.105	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-33.002	41.137	0.167	247.0	0.090	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-34.000	16.771	0.041	409.0	0.000	4.00	0.0	0.600	o	450	Pipe/Conduit	
S-34.001	43.363	0.600	72.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S-35.000	20.252	0.118	171.6	0.147	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-35.001	12.023	0.070	171.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-36.000	38.527	1.198	32.2	0.148	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-37.000	16.575	0.097	171.0	0.038	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-37.001	13.453	0.303	44.4	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-38.000	16.808	0.300	56.0	0.051	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-38.001	9.233	0.100	92.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-32.001	50.00	4.36	5.208	0.089	0.0	0.0	1.2	1.00	39.6	13.3
S-30.003	50.00	5.37	4.065	0.335	0.0	0.0	4.5	1.00	70.4	49.9
S-33.000	50.00	4.41	3.936	0.134	0.0	0.0	1.8	1.00	39.6	20.0
S-33.001	50.00	4.89	3.791	0.239	0.0	0.0	3.2	1.00	39.6	35.6
S-33.002	49.43	5.57	3.551	0.329	0.0	0.0	4.4	1.00	70.4	48.4
S-34.000	50.00	4.28	2.816	0.000	0.0	0.0	0.0	1.00	158.9	0.0
S-34.001	50.00	4.58	2.775	0.000	0.0	0.0	0.0	2.39	380.7	0.0
S-35.000	50.00	4.34	2.100	0.147	0.0	0.0	2.0	1.00	39.6	21.9
S-35.001	50.00	4.54	1.982	0.147	0.0	0.0	2.0	0.99	39.5	21.9
S-36.000	50.00	4.28	1.900	0.148	0.0	0.0	2.0	2.32	92.1	22.1
S-37.000	50.00	4.28	1.600	0.038	0.0	0.0	0.5	1.00	39.6	5.6
S-37.001	50.00	4.39	1.503	0.060	0.0	0.0	0.8	1.97	78.3	8.9
S-38.000	50.00	4.16	1.600	0.051	0.0	0.0	0.7	1.75	69.6	7.6
S-38.001	50.00	4.27	1.300	0.051	0.0	0.0	0.7	1.36	54.1	7.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-37.002	36.810	0.215	171.0	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-37.003	10.480	0.061	171.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-37.004	15.333	0.216	71.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-39.000	19.807	0.116	170.7	0.066	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-39.001	4.945	0.029	171.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-39.002	18.427	0.108	171.0	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
S-40.000	24.030	0.141	170.4	0.071	4.00	0.0	0.600	o	225	Pipe/Conduit	
S-40.001	25.710	0.150	171.0	0.104	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-37.002	50.00	5.01	1.200	0.149	0.0	0.0	2.0	1.00	39.6	22.2
S-37.003	50.00	5.18	0.985	0.149	0.0	0.0	2.0	1.00	39.6	22.2
S-37.004	50.00	5.35	0.923	0.149	0.0	0.0	2.0	1.55	61.8	22.2
S-39.000	50.00	4.33	5.573	0.066	0.0	0.0	0.9	1.00	39.7	9.8
S-39.001	50.00	4.41	5.457	0.066	0.0	0.0	0.9	1.00	39.6	9.8
S-39.002	50.00	4.72	5.428	0.102	0.0	0.0	1.4	1.00	39.6	15.1
S-40.000	50.00	4.40	5.839	0.071	0.0	0.0	1.0	1.00	39.7	10.5
S-40.001	50.00	4.83	5.698	0.175	0.0	0.0	2.4	1.00	39.6	26.1

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.300	Storm Duration (mins)	30
Ratio R	0.273		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SMH37, DS/PN: S-1.012, Volume (m³): 59.4

Unit Reference	MD-SHE-0387-1000-1600-1000
Design Head (m)	1.600
Design Flow (l/s)	100.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	387
Invert Level (m)	1.681
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	99.8
Flush-Flo™	0.619	99.7
Kick-Flo®	1.194	86.6
Mean Flow over Head Range	-	82.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.8	1.200	86.8	3.000	135.5	7.000	205.1
0.200	38.4	1.400	93.5	3.500	146.1	7.500	212.1
0.300	73.4	1.600	99.8	4.000	155.9	8.000	218.9
0.400	96.3	1.800	105.7	4.500	165.2	8.500	225.5
0.500	98.8	2.000	111.2	5.000	173.9	9.000	232.0
0.600	99.6	2.200	116.5	5.500	182.2	9.500	238.2
0.800	98.4	2.400	121.5	6.000	190.1		
1.000	94.9	2.600	126.4	6.500	197.7		

Hydro-Brake® Optimum Manhole: SMH55, DS/PN: S-12.007, Volume (m³): 10.2

Unit Reference	MD-SHE-0172-1610-1600-1610
Design Head (m)	1.600
Design Flow (l/s)	16.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	4.588
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum Manhole: SMH55, DS/PN: S-12.007, Volume (m³): 10.2

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	16.1
Flush-Flo™	0.472	16.0
Kick-Flo®	1.012	12.9
Mean Flow over Head Range	-	13.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	14.0	3.000	21.7	7.000	32.6
0.200	14.2	1.400	15.1	3.500	23.4	7.500	33.7
0.300	15.5	1.600	16.1	4.000	24.9	8.000	34.8
0.400	16.0	1.800	17.0	4.500	26.3	8.500	35.8
0.500	16.0	2.000	17.9	5.000	27.7	9.000	36.8
0.600	15.9	2.200	18.7	5.500	29.0	9.500	37.8
0.800	15.2	2.400	19.5	6.000	30.3		
1.000	13.2	2.600	20.3	6.500	31.4		

Hydro-Brake® Optimum Manhole: SMH78, DS/PN: S-19.003, Volume (m³): 4.4

Unit Reference	MD-SHE-0102-5500-1600-5500
Design Head (m)	1.600
Design Flow (l/s)	5.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	3.595
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	5.5
Flush-Flo™	0.442	5.3
Kick-Flo®	0.906	4.2
Mean Flow over Head Range	-	4.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.300	5.2	0.500	5.3	0.800	4.8
0.200	4.8	0.400	5.3	0.600	5.2	1.000	4.4

Hydro-Brake® Optimum Manhole: SMH78, DS/PN: S-19.003, Volume (m³): 4.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	4.8	2.400	6.6	5.000	9.4	8.000	11.8
1.400	5.2	2.600	6.9	5.500	9.8	8.500	12.1
1.600	5.5	3.000	7.4	6.000	10.2	9.000	12.4
1.800	5.8	3.500	7.9	6.500	10.6	9.500	12.8
2.000	6.1	4.000	8.5	7.000	11.0		
2.200	6.4	4.500	8.9	7.500	11.4		

Hydro-Brake® Optimum Manhole: SMH104, DS/PN: S-27.008, Volume (m³): 2.3

Unit Reference	MD-SHE-0091-3700-1000-3700
Design Head (m)	1.000
Design Flow (l/s)	3.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	91
Invert Level (m)	4.435
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.7
Flush-Flo™	0.299	3.7
Kick-Flo®	0.631	3.0
Mean Flow over Head Range	-	3.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	4.0	3.000	6.2	7.000	9.2
0.200	3.6	1.400	4.3	3.500	6.6	7.500	9.5
0.300	3.7	1.600	4.6	4.000	7.1	8.000	9.8
0.400	3.6	1.800	4.9	4.500	7.5	8.500	10.1
0.500	3.5	2.000	5.1	5.000	7.8	9.000	10.4
0.600	3.2	2.200	5.3	5.500	8.2	9.500	10.6
0.800	3.3	2.400	5.6	6.000	8.6		
1.000	3.7	2.600	5.8	6.500	8.9		

Storage Structures for Storm

Tank or Pond Manhole: SMH37, DS/PN: S-1.012

Invert Level (m) 1.681

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	650.0	1.600	650.0	1.601	0.0

Tank or Pond Manhole: SMH55, DS/PN: S-12.007

Invert Level (m) 4.588

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	565.0	1.600	565.0	1.601	0.0

Tank or Pond Manhole: SMH76, DS/PN: S-23.000

Invert Level (m) 3.614

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	215.0	1.600	215.0	1.601	0.0

Tank or Pond Manhole: SMH104, DS/PN: S-27.008

Invert Level (m) 4.435

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	200.0	1.000	200.0	1.001	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.249
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 5, 30
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S-1.000	SMH1	15 Winter	30	+0%	30/15 Summer				7.022
S-1.001	SMH2	15 Winter	30	+0%	30/15 Summer				6.804
S-1.002	SMH3	15 Winter	30	+0%	30/15 Summer				5.978
S-2.000	SMH4	15 Winter	30	+0%	30/15 Summer				6.073
S-2.001	SMH5	15 Winter	30	+0%	30/15 Summer				6.057
S-2.002	SMH6	15 Winter	30	+0%	5/15 Summer				5.768
S-1.003	SMH7	15 Winter	30	+0%	30/15 Summer				5.292
S-3.000	SMH8	15 Winter	30	+0%	5/15 Summer				6.002
S-3.001	SMH9	15 Winter	30	+0%	5/15 Summer				5.284
S-3.002	SMH10	15 Winter	30	+0%	30/15 Summer				4.917
S-4.000	SMH11	15 Winter	30	+0%	30/15 Summer				5.524
S-5.000	SMH12	15 Winter	30	+0%	30/15 Summer				5.546
S-4.001	SMH13	15 Winter	30	+0%	5/15 Winter				5.529
S-4.002	SMH14	15 Winter	30	+0%	30/15 Summer				4.914
S-1.004	SMH15	15 Winter	30	+0%	30/15 Summer				4.819
S-6.000	SMH16	15 Winter	30	+0%	30/15 Summer				5.787
S-6.001	SMH17	15 Winter	30	+0%	30/15 Summer				5.449
S-6.002	SMH18	15 Winter	30	+0%	30/15 Summer				4.439

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S-1.000	SMH1	0.167	0.000	0.73			37.5	SURCHARGED	
S-1.001	SMH2	0.414	0.000	1.31			68.2	SURCHARGED	
S-1.002	SMH3	0.078	0.000	0.98			78.8	SURCHARGED	
S-2.000	SMH4	0.348	0.000	0.27			9.5	SURCHARGED	
S-2.001	SMH5	0.429	0.000	0.98			38.3	SURCHARGED	
S-2.002	SMH6	0.443	0.000	1.54			57.7	SURCHARGED	
S-1.003	SMH7	0.194	0.000	0.96			185.6	SURCHARGED	
S-3.000	SMH8	0.902	0.000	1.39			53.5	SURCHARGED	
S-3.001	SMH9	0.559	0.000	1.59			105.1	SURCHARGED	
S-3.002	SMH10	0.383	0.000	1.05			103.7	SURCHARGED	
S-4.000	SMH11	0.449	0.000	0.06			3.0	SURCHARGED	
S-5.000	SMH12	0.521	0.000	0.26			9.2	SURCHARGED	
S-4.001	SMH13	0.605	0.000	1.51			57.8	SURCHARGED	
S-4.002	SMH14	0.332	0.000	0.76			54.8	SURCHARGED	
S-1.004	SMH15	0.392	0.000	1.00			348.8	SURCHARGED	
S-6.000	SMH16	0.142	0.000	0.78			41.4	SURCHARGED	
S-6.001	SMH17	0.474	0.000	1.25			66.4	SURCHARGED	
S-6.002	SMH18	0.134	0.000	0.83			92.5	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S-6.003	SMH19	15 Winter	30	+0%	30/15 Summer			
S-7.000	SMH20	15 Winter	30	+0%	30/15 Summer			
S-8.000	SMH21	15 Winter	30	+0%				
S-7.001	SMH22	15 Winter	30	+0%	30/15 Summer			
S-7.002	SMH23	15 Winter	30	+0%	30/15 Summer			
S-1.005	SMH24	15 Winter	30	+0%	30/15 Summer			
S-9.000	SMH25	15 Winter	30	+0%	30/15 Summer			
S-1.006	SMH26	15 Winter	30	+0%	30/15 Summer			
S-1.007	SMH27	15 Winter	30	+0%	5/15 Summer			
S-1.008	SMH28	15 Winter	30	+0%	5/15 Summer			
S-10.000	SMH29	15 Winter	30	+0%	5/15 Winter			
S-11.000	SMH30	15 Winter	30	+0%	30/15 Summer			
S-10.001	SMH31	15 Winter	30	+0%	5/15 Summer			
S-10.002	SMH32	15 Winter	30	+0%	5/15 Summer			
S-10.003	SMH33	15 Winter	30	+0%	5/15 Summer			
S-1.009	SMH34	120 Winter	30	+0%	5/15 Summer			
S-1.010	SMH35	120 Winter	30	+0%	30/120 Winter			
S-1.011	SMH36	120 Winter	30	+0%				
S-1.012	SMH37	120 Winter	30	+0%	5/30 Summer			
S-12.000	SMH38	15 Winter	30	+0%	5/15 Summer			
S-12.001	SMH39	15 Winter	30	+0%	30/15 Summer			
S-13.000	SMH40	15 Winter	30	+0%				
S-12.002	SMH41	15 Winter	30	+0%	5/15 Winter			
S-14.000	SMH42	15 Winter	30	+0%	30/15 Summer			
S-14.001	SMH43	15 Winter	30	+0%	30/15 Summer			
S-14.002	SMH44	15 Winter	30	+0%	5/15 Winter			
S-14.003	SMH45	15 Winter	30	+0%	5/15 Summer			
S-12.003	SMH46	15 Winter	30	+0%	5/15 Summer			
S-15.000	SMH47	15 Winter	30	+0%	30/15 Summer			
S-15.001	SMH48	15 Winter	30	+0%	5/15 Summer			
S-15.002	SMH49	15 Winter	30	+0%				
S-16.000	SMH50	15 Winter	30	+0%	30/15 Summer			
S-15.003	SMH51	15 Winter	30	+0%	5/15 Summer			
S-12.004	SMH52	720 Winter	30	+0%	1/15 Summer			
S-12.005	SMH53	720 Winter	30	+0%	5/180 Winter			
S-12.006	SMH54	720 Winter	30	+0%	30/180 Winter			
S-12.007	SMH55	720 Winter	30	+0%	5/180 Winter			
S-12.008	SMH56	2160 Winter	30	+0%				
S-12.009	SMH57	15 Winter	30	+0%				
S-17.000	SMH58	15 Winter	30	+0%	30/15 Winter			
S-18.000	SMH59	15 Winter	30	+0%	30/15 Summer			
S-17.001	SMH60	15 Winter	30	+0%	5/15 Summer			
S-17.002	SMH61	15 Winter	30	+0%	5/15 Summer			
S-17.003	SMH62	15 Winter	30	+0%	5/15 Summer			
S-12.010	SMH63	15 Winter	30	+0%	30/15 Summer			
S-12.011	SMH64	15 Winter	30	+0%	30/15 Summer			
S-19.000	SMH65	480 Winter	30	+0%	5/15 Summer			
S-20.000	SMH66	15 Winter	30	+0%	30/15 Summer			
S-20.001	SMH67	15 Winter	30	+0%	30/15 Summer			

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S-6.003	SMH19	4.107	0.397	0.000	1.24			126.7	SURCHARGED
S-7.000	SMH20	4.387	0.062	0.000	0.36			12.7	SURCHARGED
S-8.000	SMH21	4.380	-0.095	0.000	0.16			10.0	OK
S-7.001	SMH22	4.363	0.139	0.000	1.19			79.5	SURCHARGED
S-7.002	SMH23	4.097	0.120	0.000	0.75			89.0	SURCHARGED
S-1.005	SMH24	3.950	0.391	0.000	1.23			529.4	SURCHARGED
S-9.000	SMH25	3.655	0.180	0.000	0.35			12.7	SURCHARGED
S-1.006	SMH26	3.646	0.287	0.000	0.83			543.8	SURCHARGED
S-1.007	SMH27	3.287	0.442	0.000	1.22			545.9	SURCHARGED
S-1.008	SMH28	2.989	0.344	0.000	1.58			547.0	SURCHARGED
S-10.000	SMH29	3.660	0.635	0.000	0.91			33.4	SURCHARGED
S-11.000	SMH30	3.584	0.334	0.000	0.36			22.1	SURCHARGED
S-10.001	SMH31	3.533	0.660	0.000	1.61			107.9	SURCHARGED
S-10.002	SMH32	2.856	0.228	0.000	1.32			109.7	SURCHARGED
S-10.003	SMH33	2.777	0.189	0.000	1.40			114.2	SURCHARGED
S-1.009	SMH34	2.720	0.060	0.000	1.32			399.4	SURCHARGED
S-1.010	SMH35	2.713	0.077	0.000	1.07			394.4	SURCHARGED
S-1.011	SMH36	2.706	-0.199	0.000	0.39			384.9	OK
S-1.012	SMH37	2.657	0.526	0.000	0.75			99.5	SURCHARGED
S-12.000	SMH38	7.260	0.805	0.000	1.13			43.0	SURCHARGED
S-12.001	SMH39	6.916	0.806	0.000	1.03			68.8	SURCHARGED
S-13.000	SMH40	7.334	-0.136	0.000	0.33			33.8	OK
S-12.002	SMH41	6.683	0.811	0.000	1.36			148.5	SURCHARGED
S-14.000	SMH42	6.892	0.557	0.000	0.95			73.9	SURCHARGED
S-14.001	SMH43	6.784	0.719	0.000	1.20			79.9	SURCHARGED
S-14.002	SMH44	6.574	0.713	0.000	1.06			108.7	SURCHARGED
S-14.003	SMH45	6.408	0.702	0.000	1.20			113.9	SURCHARGED
S-12.003	SMH46	6.299	0.668	0.000	1.49			268.1	SURCHARGED
S-15.000	SMH47	7.401	0.276	0.000	1.26			84.7	SURCHARGED
S-15.001	SMH48	6.939	0.079	0.000	1.79			85.0	SURCHARGED
S-15.002	SMH49	6.690	-0.149	0.000	0.50			92.5	OK
S-16.000	SMH50	5.799	0.298	0.000	0.22			8.0	SURCHARGED
S-15.003	SMH51	5.788	0.399	0.000	1.55			100.6	SURCHARGED
S-12.004	SMH52	5.732	0.489	0.000	0.49			65.2	SURCHARGED
S-12.005	SMH53	5.730	0.507	0.000	0.40			65.0	SURCHARGED
S-12.006	SMH54	5.728	0.235	0.000	0.15			64.5	SURCHARGED
S-12.007	SMH55	5.727	0.539	0.000	0.07			16.0	SURCHARGED
S-12.008	SMH56	4.685	-0.200	0.000	0.24			16.0	OK
S-12.009	SMH57	4.549	-0.159	0.000	0.45			58.4	OK
S-17.000	SMH58	5.931	0.006	0.000	0.84			74.3	SURCHARGED
S-18.000	SMH59	5.146	0.571	0.000	0.34			12.2	SURCHARGED
S-17.001	SMH60	5.127	0.678	0.000	1.35			88.8	SURCHARGED
S-17.002	SMH61	4.796	0.527	0.000	1.62			102.5	SURCHARGED
S-17.003	SMH62	4.506	0.346	0.000	1.73			112.1	SURCHARGED
S-12.010	SMH63	4.079	0.059	0.000	1.24			162.9	SURCHARGED
S-12.011	SMH64	3.992	0.030	0.000	0.92			168.4	SURCHARGED
S-19.000	SMH65	4.667	0.445	0.000	0.14			5.2	SURCHARGED
S-20.000	SMH66	5.874	0.214	0.000	0.69			29.6	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S-20.001	SMH67	5.793	0.478	0.000	0.74			25.5	SURCHARGED

PN	US/MH Name	Level Exceeded
S-6.003	SMH19	
S-7.000	SMH20	
S-8.000	SMH21	
S-7.001	SMH22	
S-7.002	SMH23	
S-1.005	SMH24	
S-9.000	SMH25	
S-1.006	SMH26	
S-1.007	SMH27	
S-1.008	SMH28	
S-10.000	SMH29	
S-11.000	SMH30	
S-10.001	SMH31	
S-10.002	SMH32	
S-10.003	SMH33	
S-1.009	SMH34	
S-1.010	SMH35	
S-1.011	SMH36	
S-1.012	SMH37	
S-12.000	SMH38	
S-12.001	SMH39	
S-13.000	SMH40	
S-12.002	SMH41	
S-14.000	SMH42	
S-14.001	SMH43	
S-14.002	SMH44	
S-14.003	SMH45	
S-12.003	SMH46	
S-15.000	SMH47	
S-15.001	SMH48	
S-15.002	SMH49	
S-16.000	SMH50	
S-15.003	SMH51	
S-12.004	SMH52	
S-12.005	SMH53	
S-12.006	SMH54	
S-12.007	SMH55	
S-12.008	SMH56	
S-12.009	SMH57	
S-17.000	SMH58	
S-18.000	SMH59	
S-17.001	SMH60	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S-17.002	SMH61	
S-17.003	SMH62	
S-12.010	SMH63	
S-12.011	SMH64	
S-19.000	SMH65	
S-20.000	SMH66	
S-20.001	SMH67	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S-20.002	SMH68	15 Winter	30	+0%	30/15 Summer			
S-20.003	SMH69	15 Winter	30	+0%	5/15 Summer			
S-20.004	SMH70	15 Winter	30	+0%	30/15 Summer			
S-21.000	SMH71	15 Winter	30	+0%	5/15 Summer			
S-20.005	SMH72	480 Winter	30	+0%	1/15 Summer			
S-19.001	SMH73	480 Winter	30	+0%	1/15 Summer			
S-22.000	SMH74	480 Winter	30	+0%				
S-19.002	SMH75	480 Winter	30	+0%	1/15 Summer			
S-23.000	SMH76	480 Winter	30	+0%	5/120 Winter			
S-23.001	SMH77	480 Winter	30	+0%	5/120 Summer			
S-19.003	SMH78	480 Winter	30	+0%	1/15 Summer			
S-12.012	SMH79	15 Winter	30	+0%	30/15 Summer			
S-24.000	SMH80	15 Winter	30	+0%	5/15 Summer			
S-24.001	SMH81	15 Winter	30	+0%	30/15 Summer			
S-25.000	SMH82	15 Winter	30	+0%	30/15 Summer			
S-25.001	SMH83	15 Winter	30	+0%	30/15 Summer			
S-26.000	SMH84	15 Winter	30	+0%	30/15 Summer			
S-25.002	SMH85	15 Winter	30	+0%	5/15 Summer			
S-25.003	SMH86	15 Winter	30	+0%	5/15 Winter			
S-25.004	SMH87	15 Winter	30	+0%	5/15 Summer			
S-24.002	SMH88	15 Winter	30	+0%	5/15 Summer			
S-24.003	SMH89	15 Winter	30	+0%	5/15 Summer			
S-24.004	SMH90	15 Winter	30	+0%	5/15 Summer			
S-24.005	SMH91	15 Winter	30	+0%	30/15 Summer			
S-24.006	SMH92	15 Winter	30	+0%				
S-27.000	SMH93	15 Winter	30	+0%	30/15 Summer			
S-27.001	SMH94	15 Winter	30	+0%	30/15 Summer			
S-27.002	SMH95	15 Winter	30	+0%	30/15 Summer			
S-27.003	SMH96	15 Winter	30	+0%	5/15 Summer			
S-28.000	SMH97	15 Winter	30	+0%				
S-28.001	SMH98	15 Winter	30	+0%				
S-27.004	SMH99	15 Winter	30	+0%	5/15 Summer			
S-29.000	SMH100	15 Winter	30	+0%				
S-27.005	SMH101	15 Winter	30	+0%	5/15 Summer			
S-27.006	SMH102	720 Winter	30	+0%	5/15 Summer			
S-27.007	SMH103	720 Winter	30	+0%	5/15 Summer			
S-27.008	SMH104	720 Winter	30	+0%	5/60 Winter			
S-27.009	SMH105	120 Summer	30	+0%				
S-30.000	SMH106	15 Winter	30	+0%	30/15 Summer			
S-31.000	SMH107	15 Winter	30	+0%	30/15 Summer			
S-30.001	SMH108	15 Winter	30	+0%	5/15 Summer			
S-30.002	SMH109	15 Winter	30	+0%	5/15 Summer			
S-32.000	SMH110	15 Winter	30	+0%				
S-32.001	SMH111	15 Summer	30	+0%				
S-30.003	SMH112	15 Winter	30	+0%	5/15 Summer			
S-33.000	SMH113	15 Winter	30	+0%	30/15 Summer			
S-33.001	SMH114	15 Winter	30	+0%	5/15 Summer			
S-33.002	SMH115	15 Winter	30	+0%	30/15 Summer			
S-34.000	SMH116	15 Summer	1	+0%				

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S-20.002	SMH68	5.730	0.475	0.000	1.12			48.9	SURCHARGED
S-20.003	SMH69	5.269	0.424	0.000	1.49			51.5	SURCHARGED
S-20.004	SMH70	5.151	0.366	0.000	0.91			58.1	SURCHARGED
S-21.000	SMH71	4.810	0.490	0.000	0.92			33.7	SURCHARGED
S-20.005	SMH72	4.713	0.543	0.000	0.32			21.2	SURCHARGED
S-19.001	SMH73	4.702	0.643	0.000	0.30			27.0	SURCHARGED
S-22.000	SMH74	4.663	-0.112	0.000	0.04			3.0	OK
S-19.002	SMH75	4.697	0.691	0.000	0.40			33.0	SURCHARGED
S-23.000	SMH76	4.655	0.591	0.000	0.05			7.0	SURCHARGED
S-23.001	SMH77	4.695	0.636	0.000	0.05			5.9	SURCHARGED
S-19.003	SMH78	4.703	0.808	0.000	0.09			5.3	SURCHARGED
S-12.012	SMH79	3.881	0.035	0.000	1.49			177.8	SURCHARGED
S-24.000	SMH80	4.967	0.692	0.000	1.23			46.6	SURCHARGED
S-24.001	SMH81	4.624	0.611	0.000	1.14			74.8	SURCHARGED
S-25.000	SMH82	4.211	0.086	0.000	0.68			50.1	SURCHARGED
S-25.001	SMH83	4.037	0.532	0.000	1.03			81.7	SURCHARGED
S-26.000	SMH84	3.842	0.460	0.000	0.31			10.9	SURCHARGED
S-25.002	SMH85	3.821	0.541	0.000	1.85			102.7	SURCHARGED
S-25.003	SMH86	3.679	0.440	0.000	1.21			121.8	SURCHARGED
S-25.004	SMH87	3.527	0.411	0.000	1.33			130.1	SURCHARGED
S-24.002	SMH88	3.376	0.350	0.000	2.23			212.6	SURCHARGED
S-24.003	SMH89	3.229	0.228	0.000	1.61			210.7	SURCHARGED
S-24.004	SMH90	3.084	0.138	0.000	1.59			209.1	SURCHARGED
S-24.005	SMH91	2.939	0.050	0.000	1.24			209.7	SURCHARGED
S-24.006	SMH92	2.643	-0.173	0.000	0.69			210.1	OK
S-27.000	SMH93	5.668	0.093	0.000	0.64			25.4	SURCHARGED
S-27.001	SMH94	5.598	0.353	0.000	0.79			23.5	SURCHARGED
S-27.002	SMH95	5.557	0.345	0.000	0.98			36.5	SURCHARGED
S-27.003	SMH96	5.368	0.347	0.000	1.30			38.3	SURCHARGED
S-28.000	SMH97	5.466	-0.129	0.000	0.38			13.2	OK
S-28.001	SMH98	5.399	-0.112	0.000	0.50			24.0	OK
S-27.004	SMH99	5.290	0.301	0.000	1.03			64.7	SURCHARGED
S-29.000	SMH100	5.534	-0.141	0.000	0.30			25.5	OK
S-27.005	SMH101	5.185	0.293	0.000	1.55			93.5	SURCHARGED
S-27.006	SMH102	5.133	0.313	0.000	0.27			14.5	SURCHARGED
S-27.007	SMH103	5.132	0.386	0.000	0.38			14.5	SURCHARGED
S-27.008	SMH104	5.130	0.395	0.000	0.06			3.7	SURCHARGED
S-27.009	SMH105	4.482	-0.173	0.000	0.12			3.7	OK
S-30.000	SMH106	5.397	0.127	0.000	0.42			23.1	SURCHARGED
S-31.000	SMH107	5.456	0.296	0.000	0.65			24.6	SURCHARGED
S-30.001	SMH108	5.349	0.429	0.000	1.60			59.1	SURCHARGED
S-30.002	SMH109	4.873	0.131	0.000	1.98			59.3	SURCHARGED
S-32.000	SMH110	5.429	-0.096	0.000	0.62			21.8	OK
S-32.001	SMH111	5.380	-0.053	0.000	0.93			27.5	OK
S-30.003	SMH112	4.443	0.078	0.000	1.75			82.7	SURCHARGED
S-33.000	SMH113	4.520	0.359	0.000	0.93			33.8	SURCHARGED
S-33.001	SMH114	4.392	0.376	0.000	1.63			60.0	SURCHARGED
S-33.002	SMH115	3.939	0.088	0.000	1.24			81.1	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S-34.000	SMH116	2.816	-0.450	0.000	0.00			0.0	OK

PN	US/MH Name	Level Exceeded
S-20.002	SMH68	
S-20.003	SMH69	
S-20.004	SMH70	
S-21.000	SMH71	
S-20.005	SMH72	
S-19.001	SMH73	
S-22.000	SMH74	
S-19.002	SMH75	
S-23.000	SMH76	
S-23.001	SMH77	
S-19.003	SMH78	
S-12.012	SMH79	
S-24.000	SMH80	
S-24.001	SMH81	
S-25.000	SMH82	
S-25.001	SMH83	
S-26.000	SMH84	
S-25.002	SMH85	
S-25.003	SMH86	
S-25.004	SMH87	
S-24.002	SMH88	
S-24.003	SMH89	
S-24.004	SMH90	
S-24.005	SMH91	
S-24.006	SMH92	
S-27.000	SMH93	
S-27.001	SMH94	
S-27.002	SMH95	
S-27.003	SMH96	
S-28.000	SMH97	
S-28.001	SMH98	
S-27.004	SMH99	
S-29.000	SMH100	
S-27.005	SMH101	
S-27.006	SMH102	
S-27.007	SMH103	
S-27.008	SMH104	
S-27.009	SMH105	
S-30.000	SMH106	
S-31.000	SMH107	
S-30.001	SMH108	
S-30.002	SMH109	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Level Exceeded
S-32.000	SMH110	
S-32.001	SMH111	
S-30.003	SMH112	
S-33.000	SMH113	
S-33.001	SMH114	
S-33.002	SMH115	
S-34.000	SMH116	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S-34.001	SMH117	15 Summer	1	+0%					2.775
S-35.000	SMH118	15 Winter	30	+0%	30/15 Summer				2.433
S-35.001	SMH119	15 Winter	30	+0%	30/15 Summer				2.246
S-36.000	SMH120	15 Winter	30	+0%					2.017
S-37.000	SMH121	15 Winter	30	+0%					1.690
S-37.001	SMH122	15 Summer	30	+0%					1.583
S-38.000	SMH123	15 Winter	30	+0%					1.677
S-38.001	SMH124	15 Winter	30	+0%					1.510
S-37.002	SMH125	15 Winter	30	+0%	30/15 Summer				1.489
S-37.003	SMH126	15 Winter	30	+0%	30/15 Summer				1.233
S-37.004	SMH127	15 Winter	30	+0%					1.069
S-39.000	SMH128	15 Winter	30	+0%					5.695
S-39.001	SMH129	15 Winter	30	+0%					5.607
S-39.002	SMH130	15 Winter	30	+0%					5.591
S-40.000	SMH131	15 Winter	30	+0%	30/15 Summer				6.106
S-40.001	SMH132	15 Winter	30	+0%	30/15 Summer				6.045

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S-34.001	SMH117	-0.450	0.000	0.00			0.0	OK	
S-35.000	SMH118	0.108	0.000	1.20			43.1	SURCHARGED	
S-35.001	SMH119	0.039	0.000	1.30			43.9	SURCHARGED	
S-36.000	SMH120	-0.108	0.000	0.53			46.2	OK	
S-37.000	SMH121	-0.135	0.000	0.33			11.8	OK	
S-37.001	SMH122	-0.145	0.000	0.27			18.6	OK	
S-38.000	SMH123	-0.148	0.000	0.26			15.9	OK	
S-38.001	SMH124	-0.015	0.000	0.31			13.9	OK	
S-37.002	SMH125	0.064	0.000	1.09			40.9	SURCHARGED	
S-37.003	SMH126	0.023	0.000	1.24			41.2	SURCHARGED	
S-37.004	SMH127	-0.079	0.000	0.75			41.1	OK	
S-39.000	SMH128	-0.103	0.000	0.57			20.5	OK	
S-39.001	SMH129	-0.075	0.000	0.70			20.1	OK	
S-39.002	SMH130	-0.062	0.000	0.86			30.5	OK	
S-40.000	SMH131	0.042	0.000	0.55			20.0	SURCHARGED	
S-40.001	SMH132	0.122	0.000	1.34			49.0	SURCHARGED	

Appendix F
Existing Attenuation Lagoon Assessment

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.045	0.245	60.8	0.0	60.8	2238.6	O K
30 min Summer	1.136	0.336	100.1	0.0	100.1	3084.3	O K
60 min Summer	1.226	0.426	126.2	0.0	126.2	3939.0	O K
120 min Summer	1.320	0.520	129.2	0.0	129.2	4840.6	O K
180 min Summer	1.373	0.573	129.6	0.0	129.6	5352.6	O K
240 min Summer	1.407	0.607	129.6	0.0	129.6	5686.0	O K
360 min Summer	1.447	0.647	129.6	0.0	129.6	6079.7	O K
480 min Summer	1.473	0.673	129.6	0.0	129.6	6334.8	O K
600 min Summer	1.491	0.691	129.6	0.0	129.6	6515.0	O K
720 min Summer	1.504	0.704	129.6	0.0	129.6	6644.8	O K
960 min Summer	1.520	0.720	129.6	0.0	129.6	6800.4	O K
1440 min Summer	1.525	0.725	129.6	0.0	129.6	6847.1	O K
2160 min Summer	1.500	0.700	129.6	0.0	129.6	6600.9	O K
2880 min Summer	1.461	0.661	129.6	0.0	129.6	6212.4	O K
4320 min Summer	1.376	0.576	129.6	0.0	129.6	5384.6	O K
5760 min Summer	1.303	0.503	128.9	0.0	128.9	4676.5	O K
7200 min Summer	1.247	0.447	127.1	0.0	127.1	4134.4	O K
8640 min Summer	1.206	0.406	125.1	0.0	125.1	3742.8	O K
10080 min Summer	1.180	0.380	118.3	0.0	118.3	3504.3	O K
15 min Winter	1.074	0.274	73.2	0.0	73.2	2504.5	O K
30 min Winter	1.175	0.375	116.2	0.0	116.2	3451.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	84.119	0.0	1669.4	0.0	26
30 min Summer	58.884	0.0	2509.7	0.0	40
60 min Summer	38.654	0.0	3809.0	0.0	68
120 min Summer	24.725	0.0	4954.3	0.0	126
180 min Summer	18.893	0.0	5718.2	0.0	184
240 min Summer	15.573	0.0	6309.0	0.0	242
360 min Summer	11.832	0.0	7220.0	0.0	336
480 min Summer	9.725	0.0	7927.2	0.0	398
600 min Summer	8.348	0.0	8513.3	0.0	464
720 min Summer	7.369	0.0	9018.0	0.0	530
960 min Summer	6.051	0.0	9862.4	0.0	670
1440 min Summer	4.579	0.0	11124.6	0.0	946
2160 min Summer	3.458	0.0	13202.4	0.0	1360
2880 min Summer	2.830	0.0	14391.4	0.0	1756
4320 min Summer	2.132	0.0	16125.1	0.0	2508
5760 min Summer	1.744	0.0	17975.0	0.0	3224
7200 min Summer	1.492	0.0	19192.3	0.0	3896
8640 min Summer	1.313	0.0	20219.3	0.0	4584
10080 min Summer	1.180	0.0	21055.5	0.0	5256
15 min Winter	84.119	0.0	1920.1	0.0	26
30 min Winter	58.884	0.0	2868.8	0.0	39

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	1.278	0.478	128.2	0.0	128.2	4431.0	O K
120 min Winter	1.385	0.585	129.6	0.0	129.6	5471.9	O K
180 min Winter	1.446	0.646	129.6	0.0	129.6	6072.4	O K
240 min Winter	1.487	0.687	129.6	0.0	129.6	6474.3	O K
360 min Winter	1.537	0.737	129.6	0.0	129.6	6968.3	O K
480 min Winter	1.563	0.763	129.6	0.0	129.6	7230.1	O K
600 min Winter	1.576	0.776	129.6	0.0	129.6	7363.6	O K
720 min Winter	1.588	0.788	129.6	0.0	129.6	7477.7	O K
960 min Winter	1.598	0.798	129.6	0.0	129.6	7579.1	O K
1440 min Winter	1.587	0.787	129.6	0.0	129.6	7470.2	O K
2160 min Winter	1.533	0.733	129.6	0.0	129.6	6932.9	O K
2880 min Winter	1.462	0.662	129.6	0.0	129.6	6224.8	O K
4320 min Winter	1.327	0.527	129.3	0.0	129.3	4903.1	O K
5760 min Winter	1.228	0.428	126.3	0.0	126.3	3957.6	O K
7200 min Winter	1.178	0.378	117.5	0.0	117.5	3484.8	O K
8640 min Winter	1.149	0.349	105.8	0.0	105.8	3206.5	O K
10080 min Winter	1.127	0.327	96.4	0.0	96.4	3000.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
60 min Winter	38.654	0.0	4303.1	0.0	68
120 min Winter	24.725	0.0	5585.2	0.0	124
180 min Winter	18.893	0.0	6440.0	0.0	182
240 min Winter	15.573	0.0	7101.0	0.0	238
360 min Winter	11.832	0.0	8119.7	0.0	350
480 min Winter	9.725	0.0	8910.1	0.0	456
600 min Winter	8.348	0.0	9565.5	0.0	500
720 min Winter	7.369	0.0	10129.7	0.0	570
960 min Winter	6.051	0.0	11072.1	0.0	724
1440 min Winter	4.579	0.0	12472.7	0.0	1032
2160 min Winter	3.458	0.0	14811.0	0.0	1472
2880 min Winter	2.830	0.0	16150.6	0.0	1876
4320 min Winter	2.132	0.0	18118.1	0.0	2600
5760 min Winter	1.744	0.0	20151.8	0.0	3280
7200 min Winter	1.492	0.0	21521.1	0.0	3896
8640 min Winter	1.313	0.0	22682.3	0.0	4600
10080 min Winter	1.180	0.0	23644.4	0.0	5344

Project: Castlelake SHD
Project No.: MCW1088
Calculation: 100-yr Greenfield Runoff
Calcs By: KC
Checked By: GMcC
Date: 24/05/2022

Site Location:	Castlelake Main Pond			
Design Storm Return Period:	100 years			
Climate Change Factor:	10 %			
Soil Type:	2			
Total Site Area (m^2):	262754 m^2			
Total Site Area (ha):	26.28 ha			
Percentage Runoff - Hardstanding:	55 %		55% Density	
Percentage Runoff - Grass/Verge:	0 %			
Percentage Runoff - Cutting:	0 %			
Hardstanding Area:	14.45 ha	.....@	Permeability	100%
Grass/Verge Area:	11.82 ha	.....@	Permeability	0%
Effective Impermeable Area:	14.45 ha			

Allowable Outflow	**Calculate**
IH124: $QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$	
AREA:	0.26 km^2
SAAR:	947 mm
SOIL:	0.3
QBAR/ha	2.60 l/s/ha
Allowable Outflow (QBAR)	**68.20 l/s**

Storm Event Return Period	**Growth Curve Factor (South)**	**Factored Q**	**Allowable Outflow**	
		l/s	**l/s**	
1 year return period:	0.85	2.21	57.97	
2 year return period:	0.96	2.49	65.47	
5 year return period:	1.21	3.14	82.52	
10 year return period:	1.38	3.58	94.11	
25 year return period:	1.59	4.13	108.43	
30 year return period:	1.62	4.20	110.48	
50 year return period:	1.74	4.52	118.66	
100 year return period:	1.90	4.93	**129.58**	
200 year return period:	2.05	5.32	139.81	

Appendix G
Existing Attenuation Tank Assessment

Project: Castlelake SHD
Project No.: MCW1088
Calculation: 100-yr Greenfield Runoff
Calcs By: KC
Checked By: GMcC
Date: 24/05/2022

Site Location:	Castlelake Attenuation Tank	
Design Storm Return Period:	100 years	
Climate Change Factor:	10 %	
Soil Type:	2	
Total Site Area (m^2):	157782 m^2	
Total Site Area (ha):	15.78 ha	

Allowable Outflow	**Calculate**
IH124: $QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$	
AREA:	0.16 km^2
SAAR:	947 mm
SOIL:	0.3
QBAR/ha	2.60 l/s/ha
Allowable Outflow (QBAR)	**40.95 l/s**

Storm Event Return Period	**Growth Curve Factor (South)**	**Factored Q**	**Allowable Outflow**	
		l/s	**l/s**	
1 year return period:	0.85	2.21	34.81	
2 year return period:	0.96	2.49	39.31	
5 year return period:	1.21	3.14	49.55	
10 year return period:	1.38	3.58	56.51	
25 year return period:	1.59	4.13	65.11	
30 year return period:	1.62	4.20	66.34	
50 year return period:	1.74	4.52	71.26	
100 year return period:	1.90	4.93	**77.81**	
200 year return period:	2.05	5.32	83.95	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.611	0.611	71.8	1410.5	O K
30 min Summer	0.844	0.844	71.8	1949.6	O K
60 min Summer	1.085	1.085	71.8	2506.0	O K
120 min Summer	1.336	1.336	71.8	3086.7	O K
180 min Summer	1.481	1.481	71.8	3420.6	O K
240 min Summer	1.570	1.570	71.8	3627.0	O K
360 min Summer	1.668	1.668	71.8	3852.3	O K
480 min Summer	1.709	1.709	71.8	3946.8	O K
600 min Summer	1.732	1.732	71.8	4000.6	O K
720 min Summer	1.745	1.745	71.8	4030.8	O K
960 min Summer	1.752	1.752	71.8	4046.5	O K
1440 min Summer	1.721	1.721	71.8	3975.3	O K
2160 min Summer	1.628	1.628	71.8	3759.9	O K
2880 min Summer	1.514	1.514	71.8	3497.2	O K
4320 min Summer	1.228	1.228	71.8	2837.1	O K
5760 min Summer	0.972	0.972	71.8	2244.6	O K
7200 min Summer	0.769	0.769	71.8	1775.4	O K
8640 min Summer	0.615	0.615	71.8	1421.4	O K
10080 min Summer	0.503	0.503	71.2	1162.5	O K
15 min Winter	0.686	0.686	71.8	1585.7	O K
30 min Winter	0.950	0.950	71.8	2194.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	87.244	0.0	1410.8	25
30 min Summer	60.780	0.0	1983.4	40
60 min Summer	39.838	0.0	2660.9	68
120 min Summer	25.434	0.0	3403.9	128
180 min Summer	19.424	0.0	3902.2	186
240 min Summer	16.003	0.0	4288.2	244
360 min Summer	12.152	0.0	4885.9	362
480 min Summer	9.984	0.0	5352.9	452
600 min Summer	8.569	0.0	5742.5	508
720 min Summer	7.563	0.0	6080.5	572
960 min Summer	6.209	0.0	6651.7	702
1440 min Summer	4.695	0.0	7525.6	984
2160 min Summer	3.543	0.0	8604.2	1404
2880 min Summer	2.899	0.0	9384.9	1820
4320 min Summer	2.183	0.0	10583.6	2600
5760 min Summer	1.784	0.0	11575.9	3304
7200 min Summer	1.526	0.0	12375.1	4032
8640 min Summer	1.344	0.0	13069.1	4672
10080 min Summer	1.207	0.0	13678.5	5352
15 min Winter	87.244	0.0	1585.8	25
30 min Winter	60.780	0.0	2226.3	40

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	1.224	1.224	71.8	2828.0	O K
120 min Winter	1.514	1.514	71.8	3497.3	O K
180 min Winter	1.677	1.677	71.8	3873.8	O K
240 min Winter	1.782	1.782	71.8	4117.2	O K
360 min Winter	1.905	1.905	71.8	4399.9	O K
480 min Winter	1.963	1.963	71.8	4535.1	O K
600 min Winter	1.987	1.987	71.8	4589.9	O K
720 min Winter	1.992	1.992	71.9	4602.7	O K
960 min Winter	1.996	1.996	72.0	4611.3	O K
1440 min Winter	1.935	1.935	71.8	4470.4	O K
2160 min Winter	1.774	1.774	71.8	4098.2	O K
2880 min Winter	1.584	1.584	71.8	3659.3	O K
4320 min Winter	1.107	1.107	71.8	2556.5	O K
5760 min Winter	0.734	0.734	71.8	1695.4	O K
7200 min Winter	0.494	0.494	71.1	1140.5	O K
8640 min Winter	0.361	0.361	68.1	833.3	O K
10080 min Winter	0.314	0.314	63.5	724.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	39.838	0.0	2983.2	68
120 min Winter	25.434	0.0	3815.0	126
180 min Winter	19.424	0.0	4373.0	182
240 min Winter	16.003	0.0	4805.1	240
360 min Winter	12.152	0.0	5474.3	352
480 min Winter	9.984	0.0	5996.8	462
600 min Winter	8.569	0.0	6432.7	566
720 min Winter	7.563	0.0	6810.7	600
960 min Winter	6.209	0.0	7448.8	746
1440 min Winter	4.695	0.0	8420.4	1058
2160 min Winter	3.543	0.0	9638.5	1520
2880 min Winter	2.899	0.0	10512.7	1968
4320 min Winter	2.183	0.0	11860.8	2736
5760 min Winter	1.784	0.0	12966.8	3408
7200 min Winter	1.526	0.0	13862.6	4040
8640 min Winter	1.344	0.0	14641.3	4592
10080 min Winter	1.207	0.0	15328.6	5160

Model Details

Storage is Online Cover Level (m) 3.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2310.0	2.000	2310.0	2.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0331-7220-2000-7220
Design Head (m)	2.000
Design Flow (l/s)	72.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	331
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	72.1
Flush-Flo™	0.634	71.8
Kick-Flo®	1.372	60.1
Mean Flow over Head Range	-	61.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.8	1.200	66.4	3.000	87.7	7.000	132.5
0.200	33.8	1.400	60.6	3.500	94.5	7.500	137.0
0.300	60.4	1.600	64.7	4.000	100.9	8.000	141.4
0.400	69.3	1.800	68.5	4.500	106.8	8.500	145.7
0.500	71.1	2.000	72.1	5.000	112.4	9.000	149.8
0.600	71.8	2.200	75.5	5.500	117.8	9.500	153.8
0.800	71.2	2.400	78.7	6.000	122.9		
1.000	69.6	2.600	81.8	6.500	127.8		

Appendix H
Calculations for Overall Run-Off from Entire Development

Project: Castlelake SHD
Project No.: MCW1088
Calculation: 100-yr Greenfield Runoff
Calcs By: KC
Checked By: GMcC
Date: 09/09/2021

Site Location:	Castlelake Total Catchment	
Design Storm Return Period:	100 years	
Climate Change Factor:	10 %	
Soil Type:	2	
Total Site Area (m^2):	420536 m^2	
Total Site Area (ha):	42.05 ha	

Allowable Outflow	**Calculate**
IH124: QBAR = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$	
AREA:	0.42 km^2
SAAR:	947 mm
SOIL:	0.3
QBAR/ha	2.60 l/s/ha
Allowable Outflow (QBAR)	**109.15 l/s**

Storm Event Return Period	**Growth Curve Factor (South)**	**Factored Q**	**Allowable Outflow**	
		l/s	**l/s**	
1 year return period:	0.85	2.21	92.78	
2 year return period:	0.96	2.49	104.78	
5 year return period:	1.21	3.14	132.07	
10 year return period:	1.38	3.58	150.63	
25 year return period:	1.59	4.13	173.55	
30 year return period:	1.62	4.20	176.82	
50 year return period:	1.74	4.52	189.92	
100 year return period:	1.90	4.93	**207.38**	
200 year return period:	2.05	5.32	223.76	

Appendix I
Infiltration Trench Design Outputs

Summary of Results for 30 year Return Period (+10%)

Half Drain Time : 88 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	3.106	1.106	1.8	11.6	O K
30 min Summer	3.478	1.478	2.1	15.5	O K
60 min Summer	3.778	1.778	2.3	18.7	O K
120 min Summer	3.964	1.964	2.5	20.6	O K
180 min Summer	4.022	2.022	2.5	21.2	O K
240 min Summer	4.028	2.028	2.5	21.3	O K
360 min Summer	3.984	1.984	2.5	20.8	O K
480 min Summer	3.918	1.918	2.5	20.1	O K
600 min Summer	3.847	1.847	2.4	19.4	O K
720 min Summer	3.774	1.774	2.3	18.6	O K
960 min Summer	3.632	1.632	2.2	17.1	O K
1440 min Summer	3.383	1.383	2.0	14.5	O K
2160 min Summer	3.091	1.091	1.8	11.5	O K
2880 min Summer	2.870	0.870	1.6	9.1	O K
4320 min Summer	2.559	0.559	1.3	5.9	O K
5760 min Summer	2.354	0.354	1.2	3.7	O K
7200 min Summer	2.209	0.209	1.0	2.2	O K
8640 min Summer	2.111	0.111	1.0	1.2	O K
10080 min Summer	2.050	0.050	0.9	0.5	O K
15 min Winter	3.250	1.250	1.9	13.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	64.776	0.0	23
30 min Summer	45.106	0.0	36
60 min Summer	29.822	0.0	60
120 min Summer	19.270	0.0	94
180 min Summer	14.827	0.0	130
240 min Summer	12.287	0.0	164
360 min Summer	9.409	0.0	232
480 min Summer	7.778	0.0	300
600 min Summer	6.707	0.0	368
720 min Summer	5.942	0.0	434
960 min Summer	4.908	0.0	564
1440 min Summer	3.745	0.0	814
2160 min Summer	2.854	0.0	1188
2880 min Summer	2.352	0.0	1556
4320 min Summer	1.790	0.0	2288
5760 min Summer	1.474	0.0	3000
7200 min Summer	1.268	0.0	3688
8640 min Summer	1.121	0.0	4416
10080 min Summer	1.011	0.0	5080
15 min Winter	64.776	0.0	24

Summary of Results for 30 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	3.676	1.676	2.3	17.6	O K
60 min Winter	4.030	2.030	2.5	21.3	O K
120 min Winter	4.241	2.241	2.7	23.5	O K
180 min Winter	4.293	2.293	2.8	24.1	O K
240 min Winter	4.279	2.279	2.8	23.9	O K
360 min Winter	4.174	2.174	2.7	22.8	O K
480 min Winter	4.043	2.043	2.6	21.5	O K
600 min Winter	3.919	1.919	2.5	20.1	O K
720 min Winter	3.799	1.799	2.4	18.9	O K
960 min Winter	3.583	1.583	2.2	16.6	O K
1440 min Winter	3.233	1.233	1.9	12.9	O K
2160 min Winter	2.861	0.861	1.6	9.0	O K
2880 min Winter	2.604	0.604	1.4	6.3	O K
4320 min Winter	2.272	0.272	1.1	2.9	O K
5760 min Winter	2.078	0.078	0.9	0.8	O K
7200 min Winter	2.045	0.045	0.8	0.5	O K
8640 min Winter	2.040	0.040	0.7	0.4	O K
10080 min Winter	2.036	0.036	0.7	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	45.106	0.0	36
60 min Winter	29.822	0.0	62
120 min Winter	19.270	0.0	100
180 min Winter	14.827	0.0	138
240 min Winter	12.287	0.0	176
360 min Winter	9.409	0.0	250
480 min Winter	7.778	0.0	320
600 min Winter	6.707	0.0	390
720 min Winter	5.942	0.0	458
960 min Winter	4.908	0.0	592
1440 min Winter	3.745	0.0	850
2160 min Winter	2.854	0.0	1220
2880 min Winter	2.352	0.0	1592
4320 min Winter	1.790	0.0	2300
5760 min Winter	1.474	0.0	3000
7200 min Winter	1.268	0.0	3560
8640 min Winter	1.121	0.0	4352
10080 min Winter	1.011	0.0	5064

Appendix J
MicroDrainage Culvert Outputs

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Culverts

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.249	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	105	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.275
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Culverts

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
C-1.000	4.916	0.074	66.4	0.000	20.00	140.0	0.600	o	600	Pipe/Conduit	
C-1.001	4.916	0.008	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.002	43.848	0.660	66.4	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.003	26.005	0.200	130.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.004	8.067	0.045	179.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.005	45.395	0.683	66.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.006	45.395	0.077	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.007	27.018	0.046	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.008	45.575	0.077	590.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.009	49.011	0.333	147.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
C-1.010	14.190	0.034	412.0	0.000	0.00	0.0	0.600	oo	43	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
C-1.000	66.45	20.03	6.100	0.000	140.0	0.0	0.0	2.99	845.6	140.0
C-1.001	66.31	20.11	5.275	0.000	140.0	0.0	0.0	1.00	281.4	140.0
C-1.002	65.90	20.35	5.085	0.000	140.0	0.0	0.0	2.99	845.6	140.0
C-1.003	65.57	20.56	4.425	0.000	140.0	0.0	0.0	2.13	603.4	140.0
C-1.004	65.45	20.63	4.225	0.000	140.0	0.0	0.0	1.82	513.4	140.0
C-1.005	65.05	20.88	3.487	0.000	140.0	0.0	0.0	2.99	845.2	140.0
C-1.006	63.86	21.64	2.804	0.000	140.0	0.0	0.0	1.00	281.4	140.0
C-1.007	63.18	22.10	2.200	0.000	140.0	0.0	0.0	1.00	281.4	140.0
C-1.008	62.07	22.86	2.154	0.000	140.0	0.0	0.0	1.00	281.4	140.0
C-1.009	61.50	23.27	2.077	0.000	140.0	0.0	0.0	2.01	567.0	140.0
C-1.010	61.17	23.51	1.744	0.000	140.0	0.0	0.0	1.00	316.5	140.0

Simulation Criteria for Culverts

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.300	Storm Duration (mins)	30
Ratio R	0.273		

Summary of Critical Results by Maximum Level (Rank 1) for Culverts

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.249
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 5, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
C-1.000	CMH1	10080 Summer	100	+0%					6.379
C-1.001	CMH2	15 Summer	1	+0%					5.651
C-1.002	CMH3	15 Summer	1	+0%					5.275
C-1.003	CMH4	15 Summer	1	+0%					4.667
C-1.004	CMH5	15 Summer	1	+0%					4.532
C-1.005	CMH6	15 Summer	1	+0%					3.673
C-1.006	CMH7	15 Summer	1	+0%					3.151
C-1.007	CMH8	10080 Winter	100	+0%					2.585
C-1.008	CMH9	1440 Winter	100	+0%					2.500
C-1.009	CMH10	1440 Winter	30	+0%					2.305
C-1.010	CMH11	2160 Winter	5	+0%					2.012

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
C-1.000	CMH1	-0.321	0.000	0.44			154.0	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Culverts

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
C-1.001	CMH2	-0.224	0.000	0.71			154.2	OK	
C-1.002	CMH3	-0.410	0.000	0.21			154.8	OK	
C-1.003	CMH4	-0.358	0.000	0.34			154.0	OK	
C-1.004	CMH5	-0.293	0.000	0.51			154.1	OK	
C-1.005	CMH6	-0.414	0.000	0.21			154.2	OK	
C-1.006	CMH7	-0.254	0.000	0.63			154.0	OK	
C-1.007	CMH8	-0.215	0.000	0.71			154.0	OK	
C-1.008	CMH9	-0.254	0.000	0.63			154.0	OK	
C-1.009	CMH10	-0.372	0.000	0.31			154.0	OK	
C-1.010	CMH11	-0.182	0.000	0.75			154.0	OK	