ENGINEERING SERVICES REPORT

Transitional Care Facility at Unit 21 First Avenue, Cookstown Industrial Estate, Dublin 24

For Bartra Property Cookstown Ltd.

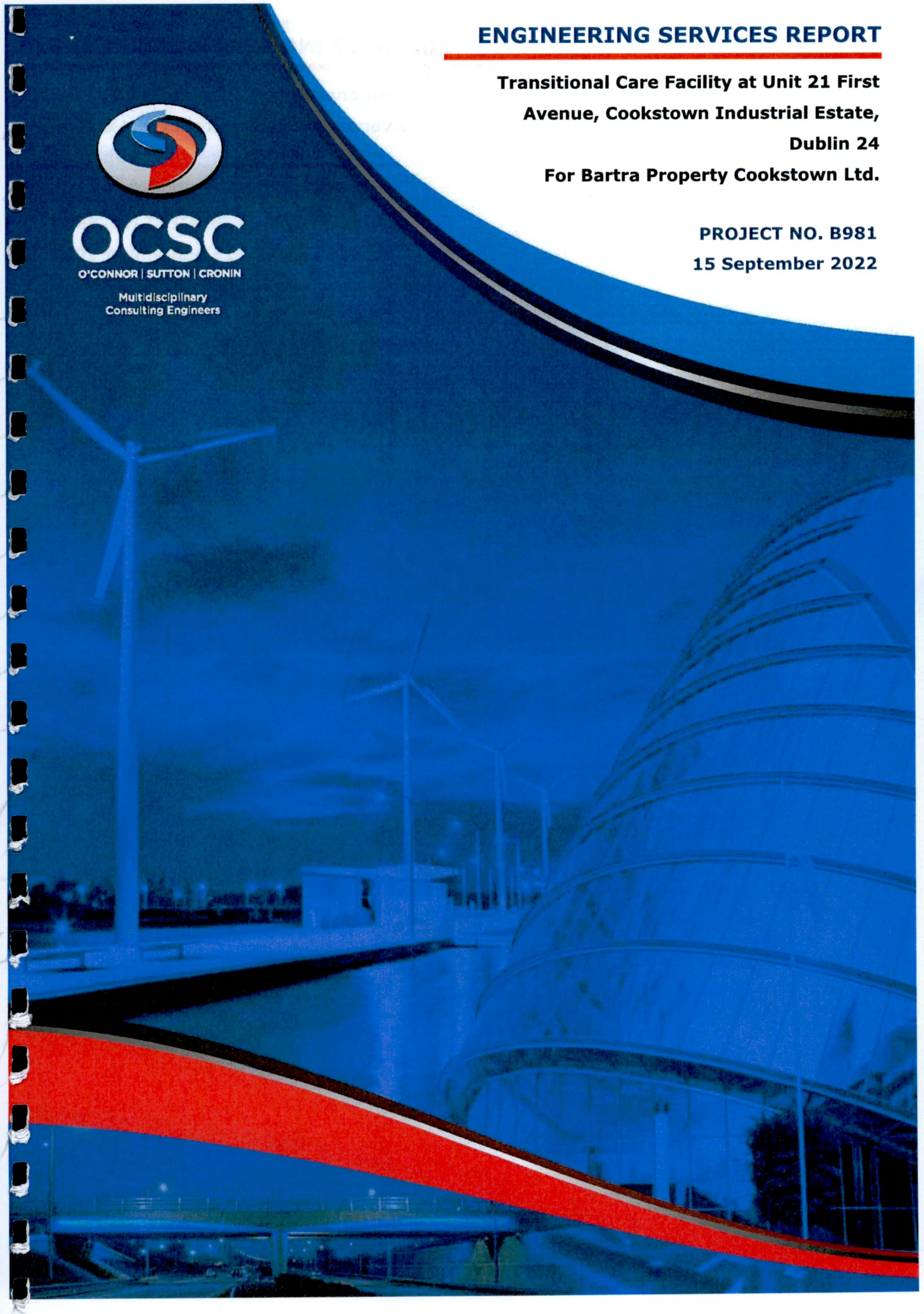
PROJECT NO. B981

15 September 2022

OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers



APPENDICES

1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Bartra Property Cookstown Ltd.* to carry out the design of the Civil Engineering services (surface water, wastewater drainage and watermain) associated with the proposed transitional care facility at Unit 21 First Avenue, Cookstown Industrial Estate, Tallaght, Dublin 24.

1.2 Administrative Jurisdiction

The proposed development is located in the jurisdiction of South Dublin City Council (SDCC), and therefore the engineering services design was carried out with reference to the following:

- South Dublin County Council Development Plan (2022 – 2028);
- Greater Dublin Strategic Drainage Study (GDSDS);
- Tallaght Town Centre Local Area Plan (2020);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works).

1.3 Site Location

The subject site is located at Unit 21 First Avenue, Cookstown, Industrial Estate, Tallaght, Dublin 24, as shown in *Figure 1.1 – Site Location*. The proposed development site is immediately bound by:

- First Avenue, to the north;
- Cookstown Estate Road, to the east;
- Unit 20 Commercial unit, to the west;
- 3nr. commercial units, to the south.

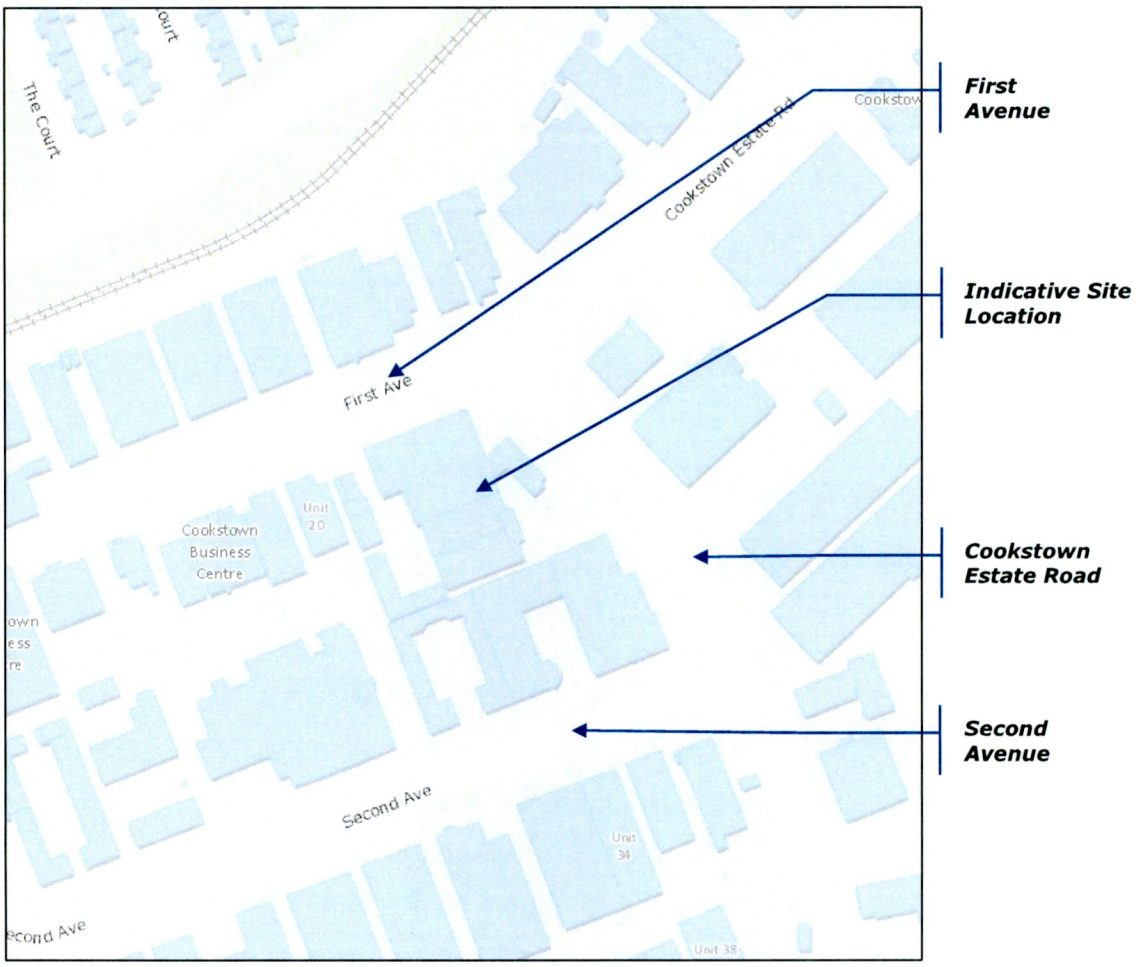


Figure 1.1 - Site Location (www.myplan.ie)

1.4 Existing Site Overview

The development site area is approximately **1.67-hectares** and is currently zoned by South Dublin County Council for ***REGEN***. This zoning seeks *'to facilitate enterprise and/or residential led regeneration'*.

The site is graded naturally towards the southeast corner of the site. For context, the highest part of the site, located in the northwest corner of the site, has an existing level of approximately +104.50m AOD; with the lowest typical level being in the order of +101.75m AOD located in the southeast corner of the site.

The site currently comprises a brownfield area which previously used as a commercial building. The locations of the above building relative to the site are shown in *Figure 1.2* over.

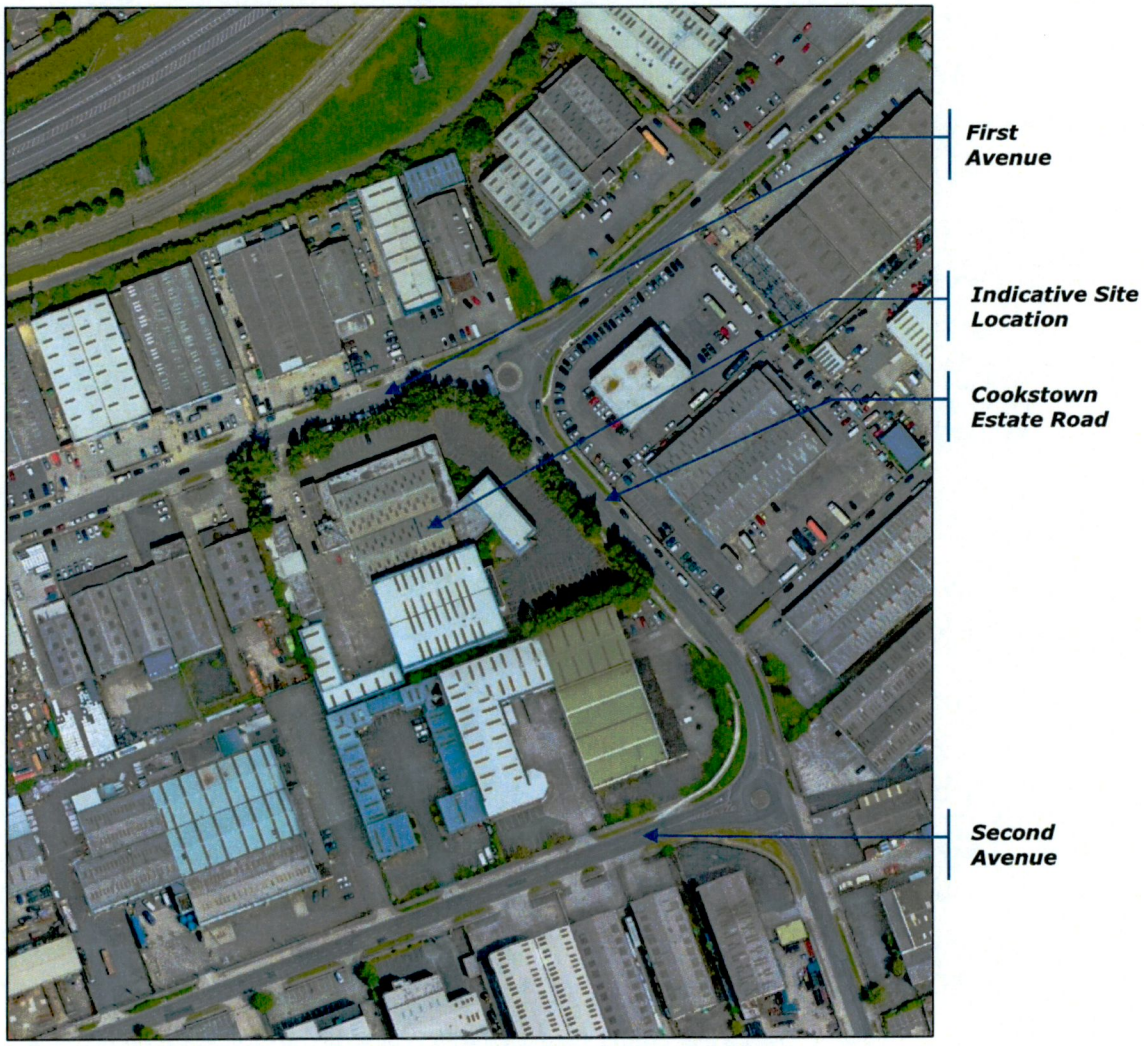


Figure 1.2 – Aerial Overview of the Site

1.5 Proposed Development Context

Bartra Property Cookstown Limited intend to apply for permission for development at a site of c.1.67ha at Unit 21, First Avenue, Cookstown Industrial Estate, Dublin 24. The development will consist of the following:

- Demolition of all existing 1-3 storey industrial/commercial structures and small café on site totalling c.5,500sqm in area;
- Construction of a 1-5 storey Transitional Care Facility (step-up/step-down) providing 131 no. bedspaces over partial basement (total floor area c.6,743sqm) with central courtyard (c.519sqm);

- The basement consists of a sprinkler tank and pump rooms, water tank room, plant room and workshop;
- Provision of dining and kitchen areas, siting/family rooms, activity rooms, coffee dock, hair salon, oratory, lobbies/reception areas, ancillary offices and staff areas, stores, toilets, shower/changing facilities, ESB substation, generator, switchroom, service yard and waste areas serving the facility;
- Lobbies, stair/lifts, photovoltaic panels and green roofs throughout;
- Partial provision of the pocket park identified in the Tallaght LAP (c.1,286sqm);
- New vehicular access from First Avenue and egress onto Cookstown Road via a one-way system through the subject site;
- Entrance signage on the eastern elevation of the proposed facility;
- All associated site development works, services provision, connection to the water supply, foul and surface water networks on First Avenue and Cookstown Road including partial diversion of the foul line to the north east of the site at First Avenue, attenuation/bioretention systems, vehicular and pedestrian access including internal road and footpaths, public realm upgrade works, landscape and boundary treatment works, tree removal, bicycle storage (68 no. spaces), car parking (32 no. spaces), set-down parking spaces, 1 no. ambulance set-down space serving the facility and delivery/loading areas to First Avenue.

It is noted that a portion of the overall site has not been included in this application but is expected to facilitate a residential development which will be subject to a separate and future planning application. On this basis, to ensure the common drainage elements and overall network components are appropriately designed, consideration has been given to the overall development for the site when developing the drainage design requirements.

Refer to Figure 1.3 for the proposed Site Layout subject to this application.

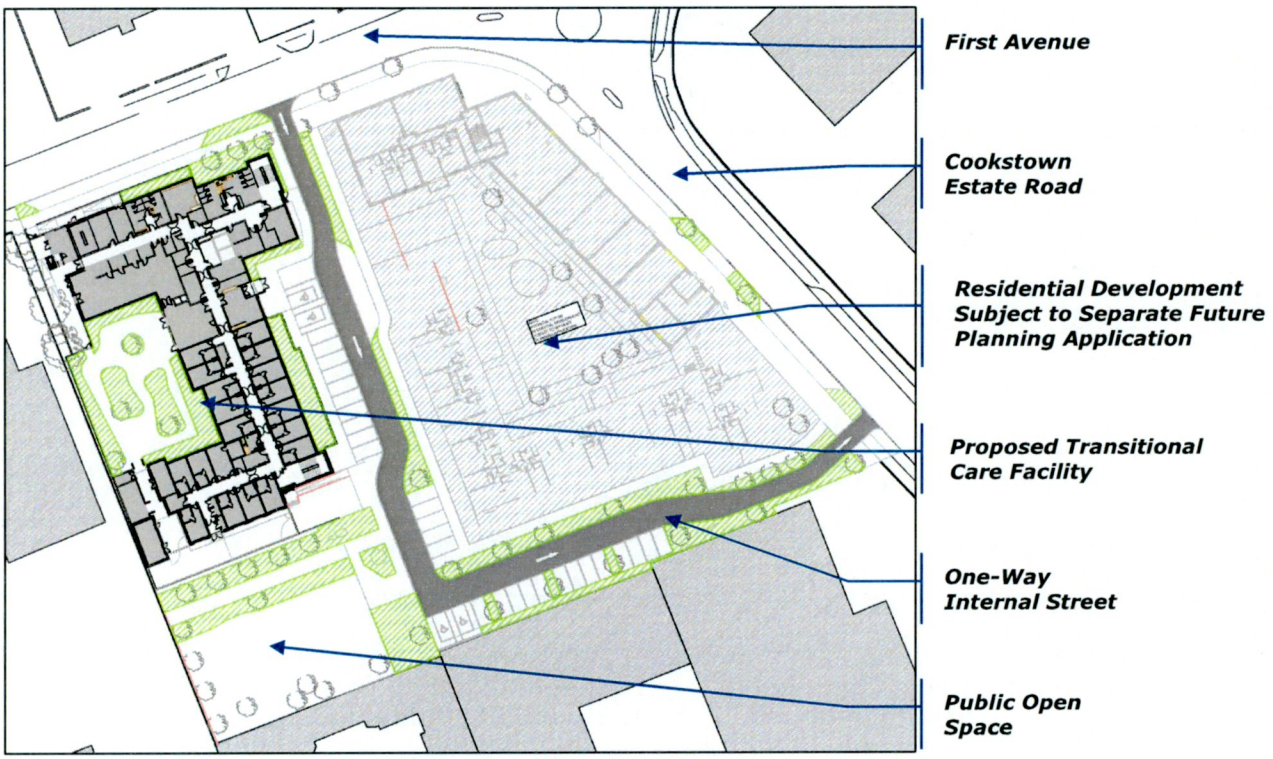


Figure 1.3 – Proposed Site Layout

2 SCOPE OF SERVICES REPORT

This Engineering Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies *i.e.* South Dublin County Council, Irish Water, The OPW, and the wider Design Team.

The following services are addressed within this report, with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Potable Water Supply;
- Site-Specific Flood Risk Assessment.

The proposed design, for the aforementioned services, have been carried out in accordance with the following technical guidelines and information:

- South Dublin County Council Development Plan (2022 – 2028);
- Tallaght Town Centre Local Area Plan (2020);
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water's Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03 (Revision 2 – July 2020);
- Irish Water's Code of Practice for Water Infrastructure, IW-CDS-5020-03 (Revision 2 – July 2020);
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- The Office of Public Works, the Planning System and Flood Risk Management;
- OPW website www.floodinfo.ie & www.floodmaps.ie;
- DECLG website www.myplan.ie;
- EPA website http://gis.epa.ie/EPAMaps;
- Geological Survey of Ireland Maps;
- Architectural drawings;
- Topographical survey of the proposed site;

- South Dublin City Council's and Irish Water's Drainage and Watermain Records.

Members of the wider design team cover all other elements of the application pertaining to traffic, sustainability, landscaping, planning, ecological, and architectural detail.

This report should be read in conjunction with the set of OCSC Civil Engineering design drawings that accompany this submission:

- B981-OCSC-XX-XX-DR-C-0505 – Drainage Network Design Layout;
- B981-OCSC-XX-XX-DR-C-0555 – Water main Network Design Layout.

3 SURFACE WATER DRAINAGE

3.1 Design Guidelines Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements *i.e.* the South Dublin County Council Development Plan, Tallaght Town Centre Local Area Plan, and as such, the Greater Dublin Strategic Drainage Study (Dublin City Council, 2005).

New development must ensure that a comprehensive Sustainable Drainage System (SuDS), is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, surface water volumes from extreme rainfall events up to a 1 in 100-year rainfall event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), *while also allowing for an additional climate change factor of* ***20%*** *increase in rainfall intensity* in accordance with the South Dublin City Council Development Plan (2022 - 2028).

Any new development must also have the physical capacity to retain surface water volumes as directed under the Greater Dublin Strategic Drainage Strategy (GDSDS) and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate, not greater than the greenfield runoff equivalent.

A further component of the SuDS protocol is to increase the overall water quality of surface water runoff before it enters a natural watercourse or a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of surface water quality.

As a result of the above, the surface water strategy for the proposed development is to include a number of Sustainable Drainage Systems, prior to discharging an attenuated flow to the existing public surface water approximately 40m to the south-east of the development site. Development discharge rates are to be restricted to the greenfield runoff equivalent.

SuDS are designed in accordance with best practice and the CIRIA C753 (The SuDS Manual) guidance material.

3.2 Surface Water Design Strategy Overview

The proposed development is to be served by a gravity surface water drainage network containing one catchment area, as a result of the natural topography, with attenuated surface water runoff, generated within the new development site boundary, ultimately discharging to the existing 450mm-diameter surface water approximately 40m at the south-eastern of the development site on Cookstown Estate Road.

Sustainable Drainage Systems are to be provided, wherever practicable, and these are discussed in more detail in *Section 3.5*, with discharge rates from site being restricted to the greenfield equivalent runoff rate, for design rainfall events up to, and including, the 1% AEP, in accordance with the South Dublin County Council Development Plan (2022-2028), Tallaght Town Centre Local Area Plan (2020) and the GDSDS.

3.3 Existing Site Drainage

3.3.1 Existing Site Catchment Area

As detailed in *Section 1.4*, the existing site is brownfield, the site is currently graded to lower levels in the north-west to south-east direction. The site therefore naturally drains in the direction of the Cookstown Estate Road located at eastern boundary of the site.

3.3.2 Existing Surface Water Drainage Infrastructure

There is significant surface water drainage infrastructure along Cookstown Industrial Estate, which appears to serve the local road areas. The presence of the existing surface water infrastructure has been identified and confirmed by South Dublin County Council records.

There is an existing 300mm-diameter public surface water sewer which travels along the northern boundary of the site at the First Avenue and goes through Cookstown Estate Road. An existing 225mm-diameter public surface water sewer which travels along the eastern boundary of the site connects to the 300mm-diameter public surface water sewer.

There is an existing 300mm-diameter public surface water sewer which travels along the Second Avenue, the sewer later becomes a 375mm-diameter sewer before travelling in a northerly direction along Cookstown Estate Road located approximately 40m southeast of the proposed development.

Refer to *Figure 3.1* for an excerpt from the public surface water infrastructure records, which are also provided in **Appendix A**, for indicative locations of existing infrastructure.

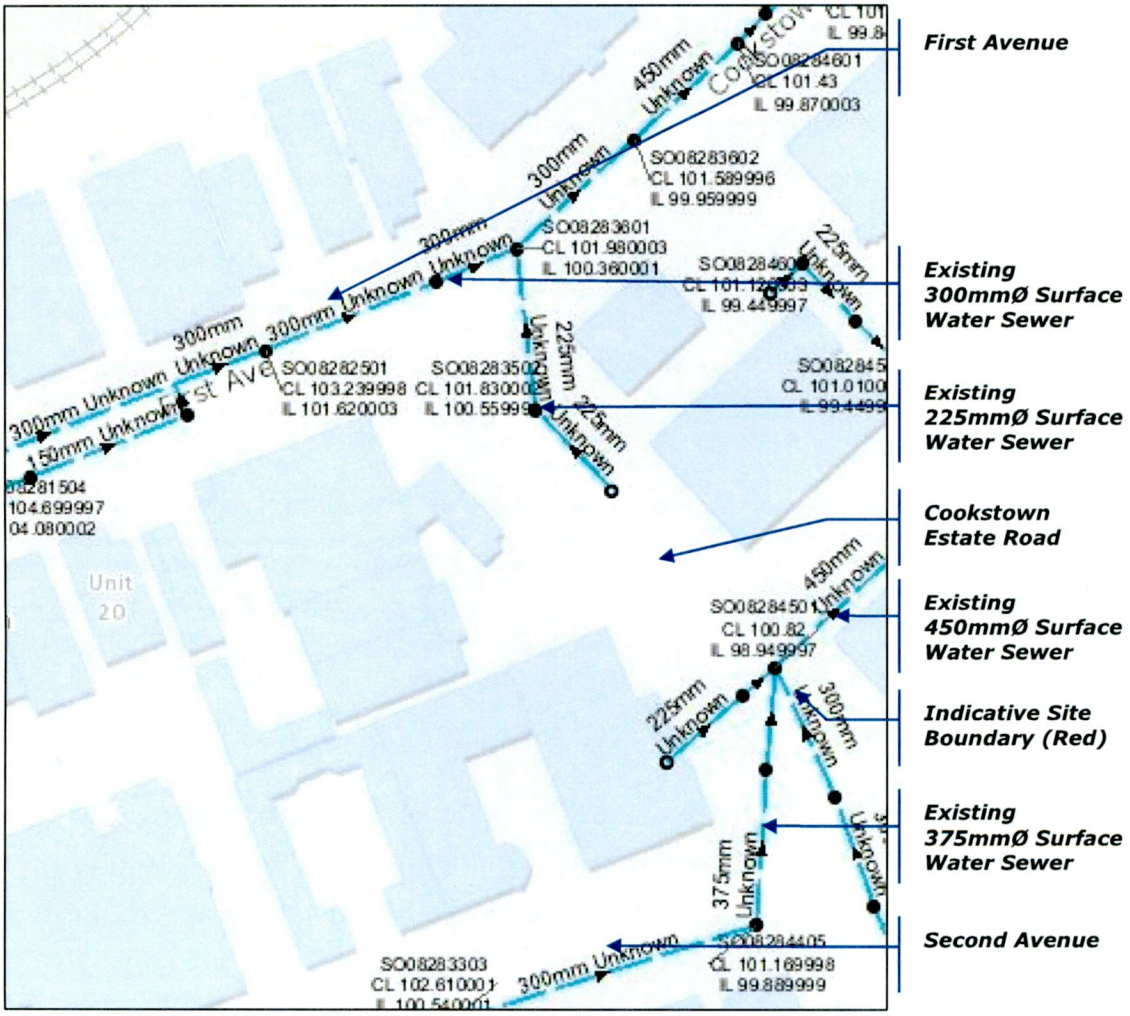


Figure 3.1 – Existing Surface Water Infrastructure Records

3.3.3 Existing Site Rainfall Runoff

All surface water runoff, on the existing site, currently infiltrates to the natural ground or discharges to the local sewers. Refer to *Section 3.3* for further details of existing site runoff.

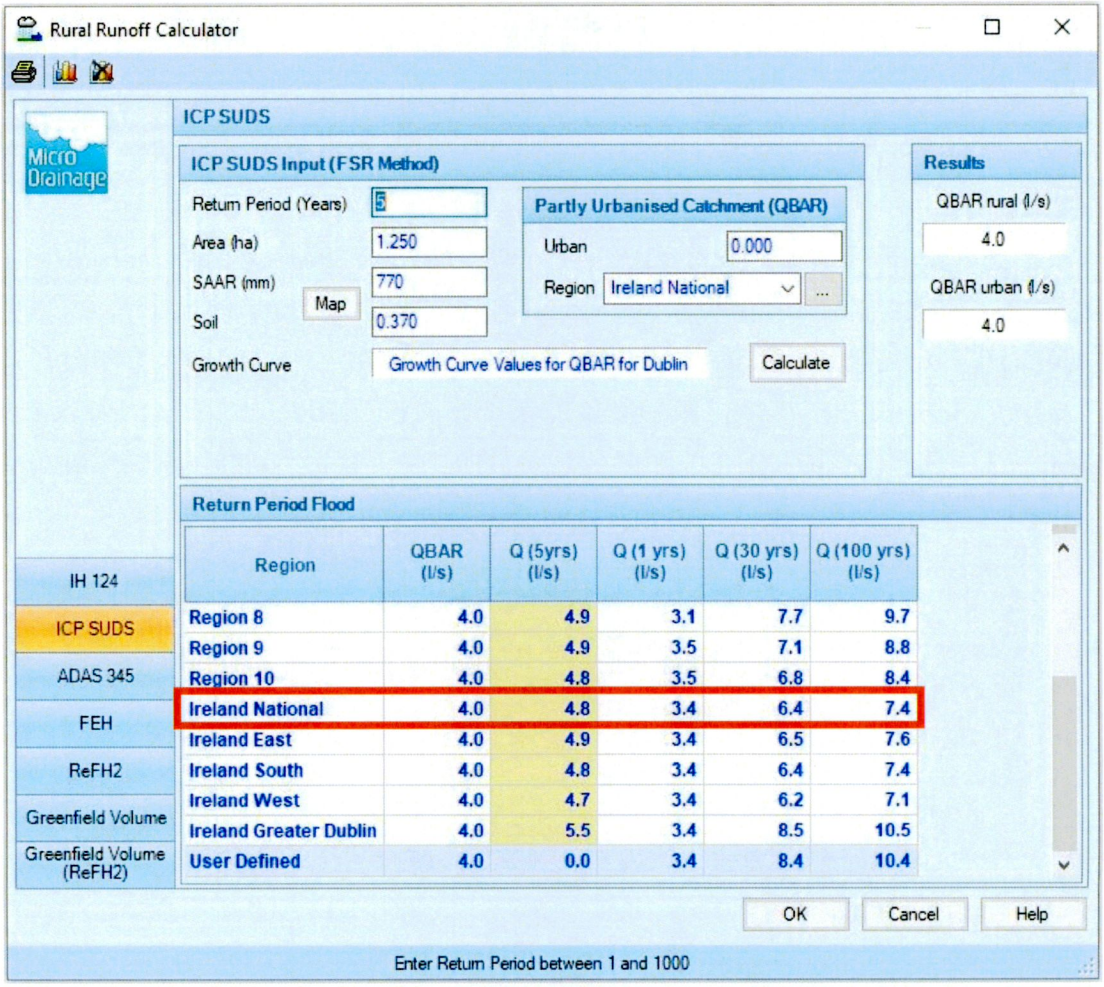
The soil value can be calculated from *Figure 1.4.18 (institute of Hydrology, 1978)* which shows the various soil types. The soil classifications are also available from the *Wallingford Procedure, Volume 3, Maps, "Winter rain acceptance potential"*. The equation was first published in FSSR 16, 1985. Refer to *Figure 3.2* for the "Soil" value in MicroDrainage that consider the SPR value and it can be obtained at *Greater Dublin Strategic Drainage Study – Regional Drainage Policies Volume 2 – New Development at section 6.7.2*.

SOIL	SPR value (% runoff)
1	0.1
2	0.3
3	0.37
4	0.47
5	0.53

Figure 3.2 – SPR Values for Soil (Excerpt from GDSDS: Table 6.7)

From the aforementioned mapping, a **Soil Type 3** was used in design calculations along with the local Standard Annual Average Rainfall (SAAR) equivalent of **770mm**, as received from Met Éireann, was used to determine the rainfall runoff rate. Refer to the **Appendix B** for the Return Period Rainfall Depths for Sliding Durations from Met Éireann.

Using the ICPSuDS Input, {Flood Studies Report (FSR)} Method, the rainfall runoff discharging from the total brownfield site area that is to be developed (i.e., 1.25 ha), in its existing condition, has been estimated at **$QBAR_{RURAL}$ = 4.0 l/s** (*i.e., 3.2 l/s/ha*). Refer to *Figure 3.3* for an excerpt of the results from the MicroDrainage Runoff Calculator, which also provides the calculated QBAR runoff rate along with the discharge rate for varying Annual Recurrence Intervals (ARI). Refer to the **Appendix C** for the QBAR runoff calculations.



Region	QBAR (l/s)	Q (5yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 8	4.0	4.9	3.1	7.7	9.7
Region 9	4.0	4.9	3.5	7.1	8.8
Region 10	4.0	4.8	3.5	6.8	8.4
Ireland National	4.0	4.8	3.4	6.4	7.4
Ireland East	4.0	4.9	3.4	6.5	7.6
Ireland South	4.0	4.8	3.4	6.4	7.4
Ireland West	4.0	4.7	3.4	6.2	7.1
Ireland Greater Dublin	4.0	5.5	3.4	8.5	10.5
User Defined	4.0	0.0	3.4	8.4	10.4

Figure 3.3 - Existing Site Runoff Calculator Results (MicroDrainage Excerpt)

3.4 Proposed Surface Water Drainage Design Strategy

3.4.1 Proposed Surface Water Strategy Overview

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the local surface water and wastewater sewer network, respectively.

Refer to *Section 4* for details of the proposed wastewater drainage design.

Refer to detailed drawing **B981-OCSC-XX-XX-DR-C-0505** for the proposed drainage network layout, which is to serve the proposed development.

3.4.2 Climate Change Allowance

The proposed surface water network has been designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change projections, in accordance with the South Dublin County Council Development Plan (2022-2028) and the GDSDS.

All discussion within this report, with regards to surface water network design calculation and results, include for the allowance of an increase of 20% in rainfall intensity, as required.

3.4.3 Proposed Surface Water Network Strategy

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the adjacent local surface water and wastewater sewer network infrastructure, respectively. Refer to *Section 4* for details of the proposed wastewater drainage design strategy.

The proposed surface water network is to discharge an attenuated flow rate to the existing 450mm-diameter surface water sewer approximately 40m south-eastern boundary of the development on the Cookstown Estate Road.

Refer to *Figure 3.4* for the Proposed Surface Water Drainage Strategy.

Refer to detailed drawing **B981-OCSC-XX-XX-DR-C-0505** for the proposed drainage network layout, which is to serve the proposed development.

The surface water network is to typically comprise a gravity pipe network, with significant Sustainable Drainage Systems implemented, where practicable.

The typical traditional and Sustainable Drainage Systems (SuDS) provided, all of which have been designed in accordance with CIRIA C753, the SuDS Manual, and the design guidance material listed in *Section 2* of this report, are listed and detailed in order of general sequence within the drainage network, as follows:

3.4.3.1 Pervious Paving

Pervious pavements provide a pavement finish suitable for both pedestrian and vehicular traffic, while also allowing rainwater to infiltrate the surface layer and

into the underlying pervious structural layers. Here, the rainwater is temporarily stored beneath the overlying finished surface before either infiltration to the ground or / and discharge to the main surface water drainage network.

Pervious paving systems are an efficient means of treating the rainwater at source by providing initial interception of the rainwater, reducing the volume and frequency of the runoff, and improving the surface water quality by providing at source treatment of the rainfall runoff leaving the site. This is achieved by helping remove and retain pollutants prior to discharge to the drainage system and / or groundwater system.

A **Type B** pervious paving, with a 300mm (typical) depth of open graded crushed rock as base course, is to be provided in all car parking spaces, within the proposed development. An overflow pipe, from the base-course, will be provided to the drainage network, which will allow for interception of initial rainfall, groundwater discharge, with an attenuated outflow to the main network in extreme rainfall events.

Refer to *Figure 3.5* for the detail of pervious paving below.

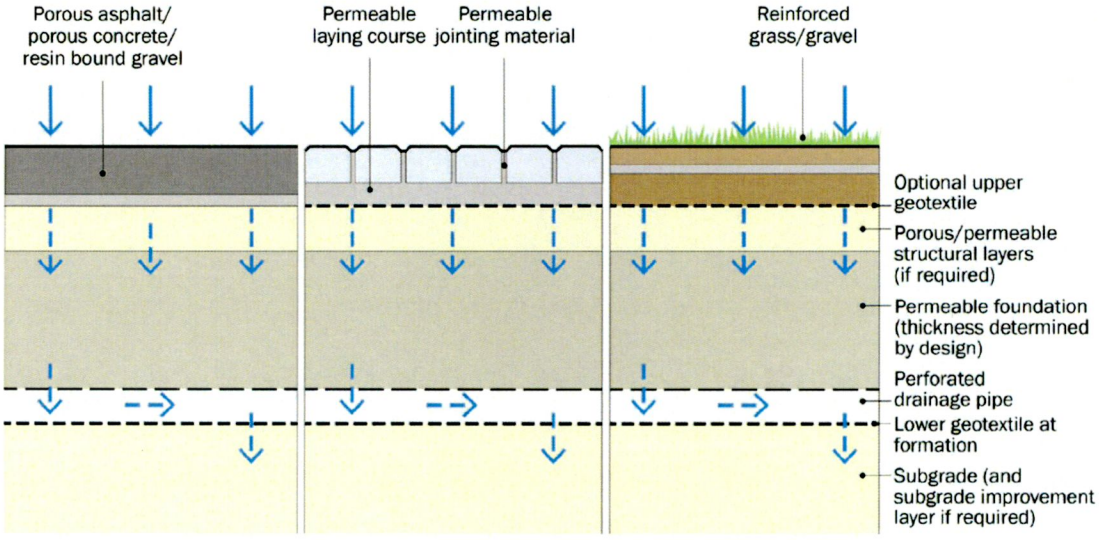


Figure 3.5 - Detail of Type B Pervious Paving (CIRIA C753)

3.4.3.2 Green Roofs

Green roofs are areas of living vegetation, installed on the top of buildings, for a range of reasons including visual benefits, ecological value, enhanced building performance and the reduction of surface water runoff.

A green roof consists of a system in which several materials are layered to achieve the desired vegetative cover and drainage characteristics. Design components vary depending on the green roof type and site constraints, but typically include the elements shown in *Figure 3.6.*

It is proposed to provide a total area of 530m^2 green roof on the transitional care facility which has been maximised while considering other roof level requirements including plant and PV panels. Refer to the architectural roof layout for details on green roof proposals.

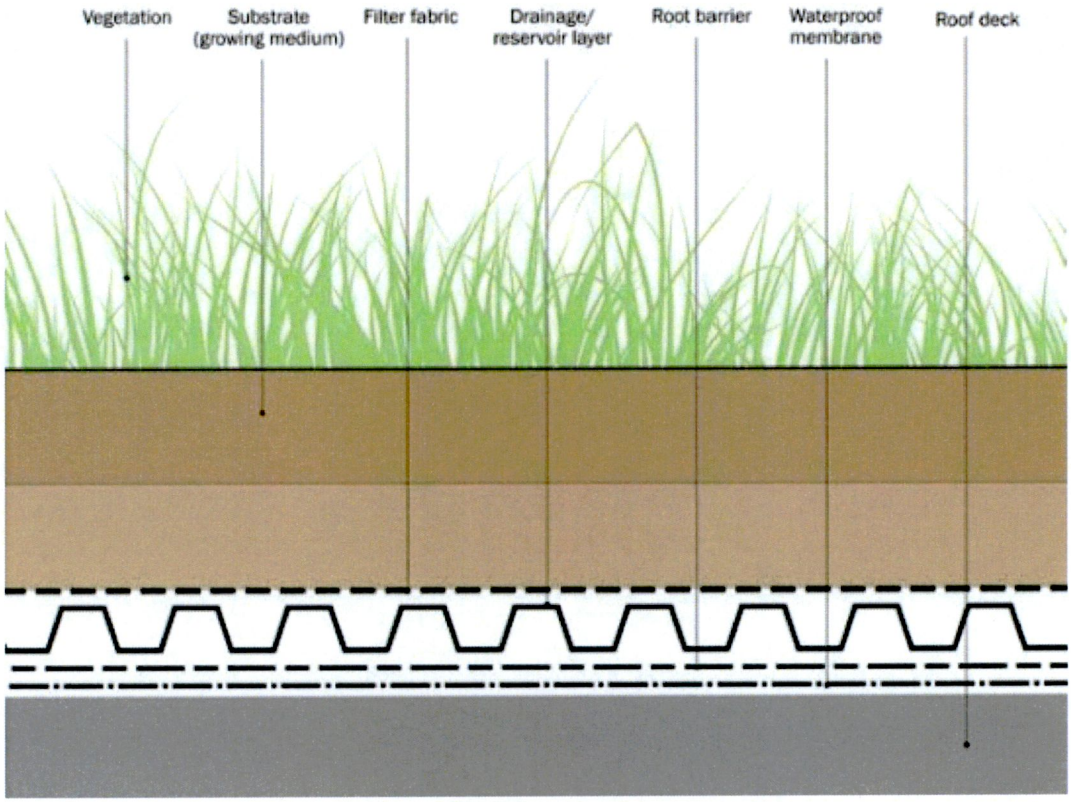


Figure 3.6 – Section showing typical extensive green roof components

3.4.3.3 Tree Pits

Tree pits are only intended to manage surface water runoff from the local area (typically a similar area that would drain to a single road gully). They should not be used to manage large volumes of water that have been collected via numerous gullies and/or channels within a large sub-catchment.

Tree pits can be planted within a range of infiltration SuDS components (e.g., Bioretention systems, detention basins, swales) to improve their performance, or they can be used as standalone features within soil-filled tree pits, tree planters or structural soils. The proposed landscape design proposes a number of trees throughout the layout which will be utilised to provide tree pit systems as indicated on the proposed drainage layout.

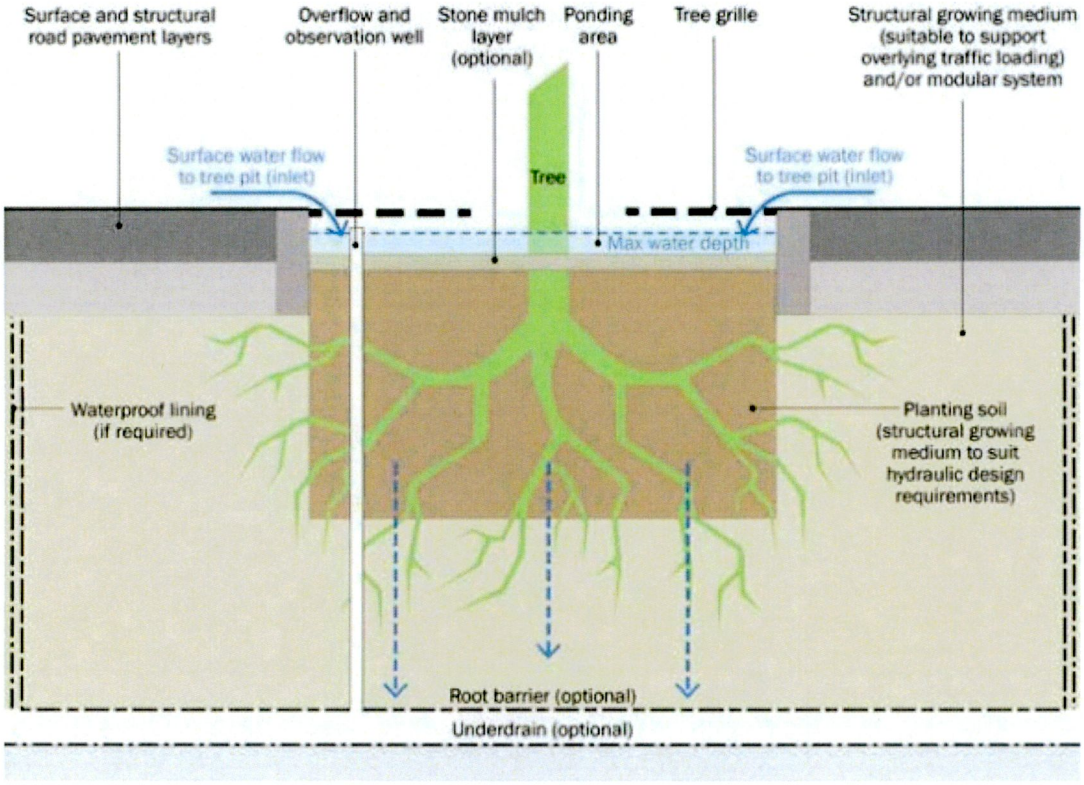


Figure 3.8 – Components of a tree pit system (CIRIA C753)

3.4.3.4 Trapped Road Gullies

All road gullies serving the proposed development are to be trapped, to help prevent sediment and gross pollutants from entering the surface water network, and thus improving the water quality discharging from site.

The grated covers are to have a minimum load classification of D400, for frequent vehicular traffic.

Refer to *Figure 3.9* for the typical detail of trapped road gully.

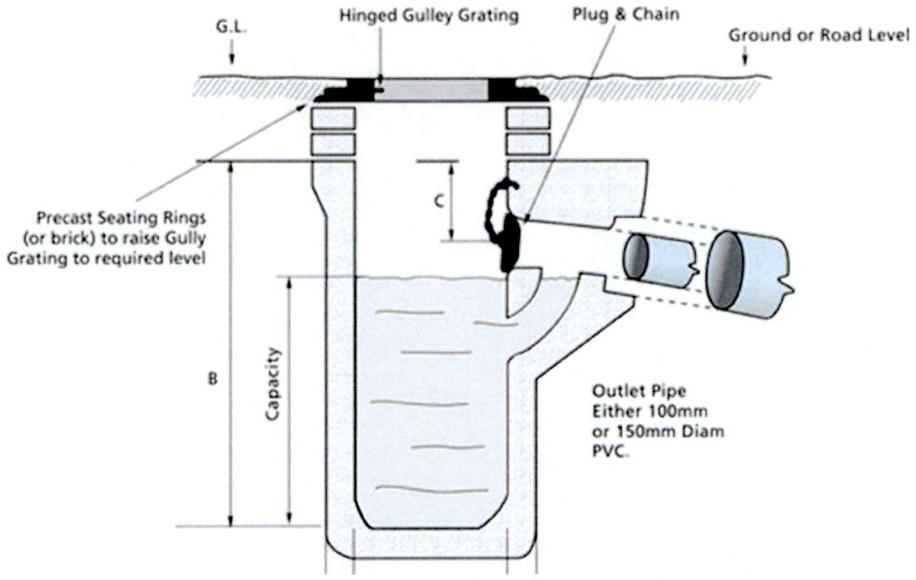


Figure 3.9 - Trapped Road Gully (Typical Detail)

3.4.3.5 Underground Pipe Network

A traditional gravity pipe and manhole network will be provided, to convey the collected rainfall runoff as far as the development's outfall. Manholes, compliant with the GDSDS and GDRCOP, are provided for maintenance access at branched connections, change in pipe size and gradient, and at intervals no greater than 90m distance.

3.4.3.6 Silt Traps

A manhole upstream of attenuation system is to contain a 600mm sump, below invert level of outlet pipe, in order to trap sediment and other gross pollutants, and prevent from entering the downstream watercourse; thus, improving the water quality discharging from site.

Refer to *Figure 3.10* for the typical detail of silt trap manhole.

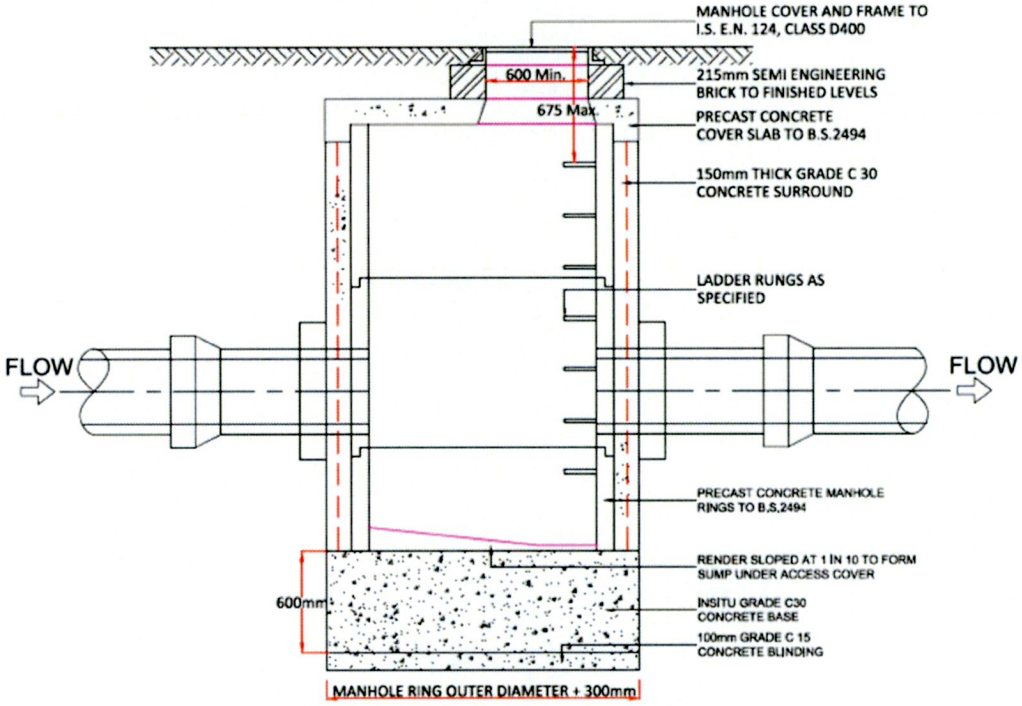


Figure 3.10 - Typical Detail of Silt Trap Manhole

3.4.3.7 Geocellular Storage Systems

Unlined proprietary geocellular storage units are to be provided for the attenuation of rainfall runoff for the catchment area.

These systems are to provide sufficient temporary storage volume for rainfall events up to, and including, the design 1% AEP rainfall event (including climate change). Typical geocellular storage systems comprise plastic cellular units of high porosity (typically >95%), structurally arranged in rows and layers, with a perforated distribution pipe through the centre.

These systems also allow for interception of initial rainfall to be provided at the base of the system, by elevating the outlet relative to the systems base.

Access chambers for inspection and maintenance are also to be provided.

Refer to *Figure 3.11* for the detail of typical section of geocellular system. Refer to **Appendix D** for details of the Cellular Attenuation System.

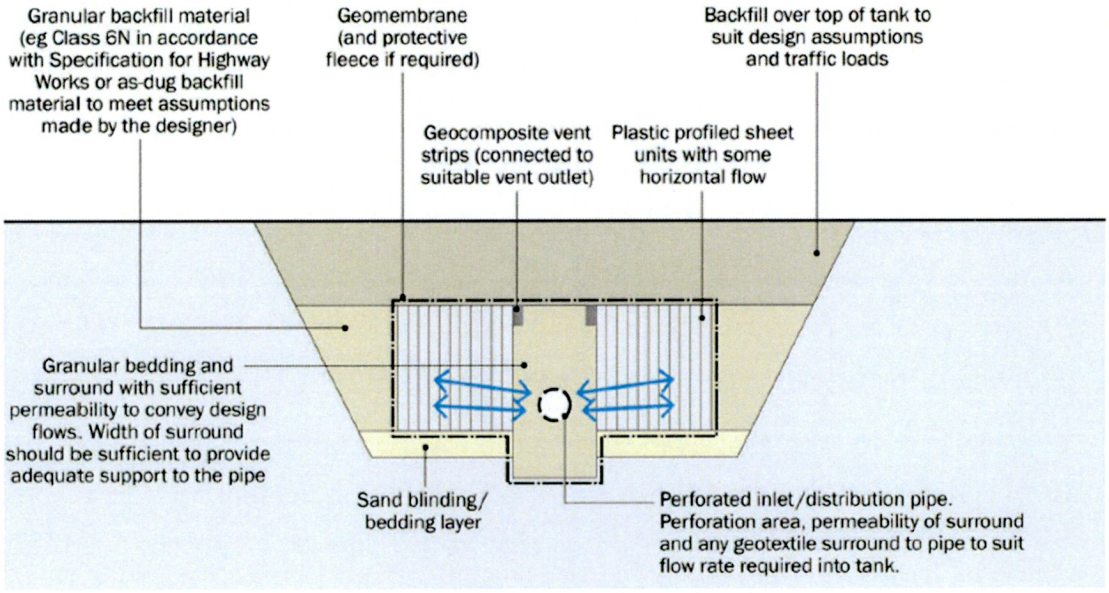


Figure 3.11 - Typical Section of Geocellular System (CIRIA C753)

It is noted that this design element has taken into consideration the overall site area, a portion of which is expected to facilitate a residential development which will be subject to a separate and future planning application. Nevertheless, to ensure the common drainage elements and overall network components are appropriately designed, consideration has been given to the overall development for the site when establishing the flow rate and associated attenuation storage requirements for the site.

3.4.3.8 Interception Storage

When rainfall takes place on greenfield sites there is, for the majority of rainfall events during the year (which are small), no discernible surface water runoff to receiving water bodies and in winter it can also result in groundwater recharge. However, impermeable surfaces generate runoff from virtually all rainfall events, and this can have a negative impact on the morphology and ecology of receiving water bodies. Interception is aimed at trying to replicate greenfield runoff conditions.

Interception mechanisms are based on runoff retention. This can be achieved using rainwater harvesting or using soil storage and evaporation. Either infiltration or transpiration rates can dispose of the runoff from minor events

to enable the next event to be captured. Infiltration rates of soils can be very low and still be effective at providing interception.

Interception storage is to provide a volume of at least the first 5mm of rainfall.

3.4.3.9 Flow Control Device

A flow Control device is to be provided immediately downstream of attenuation system, in order to restrict the surface water discharge from site to a flow rate equivalent, or below, the natural greenfield runoff rate.

The flow rate for the proposed development would be no greater than **4.0 l/s** (i.e., 3.2 l/s/ha), which is the greenfield runoff equivalent, as described in *Section 3.3.3*. Again, this is based on the masterplan development for the site.

It is proposed to provide the Hydro-brake optimum vortex flow control unit (or similar approved by SDCC) at the strategic locations, downstream of the attenuation systems.

Further, it is noted that the required aperture of the proposed Hydro-Brake outlet has been designed to be **greater than 150mm diameter**, to mitigate the risk of blockage.

The flow control chamber is to be fitted with a penstock valve at the inlet and a bypass lever at the outlet (if required), to allow for easy access and maintenance.

Refer to *Figure 3.12* for the vortex hydro-brake flow control unit.

Figure 3.12 - Vortex Hydro-Brake Flow Control Unit (Hydro International)

3.4.3.10 Fuel Separator

Fuel separators are designed to separate gross amounts of oil and large (>250µm) suspended solids from the surface water, mainly through sedimentation process.

A Class 1 bypass fuel separator is to be provided immediately downstream of the attenuation system, as an additional and final mitigation measure, prior to surface water discharge from each unit sub-catchment to the surface water network.

Refer to *Figure 3.13* for the typical section detail of fuel separator.

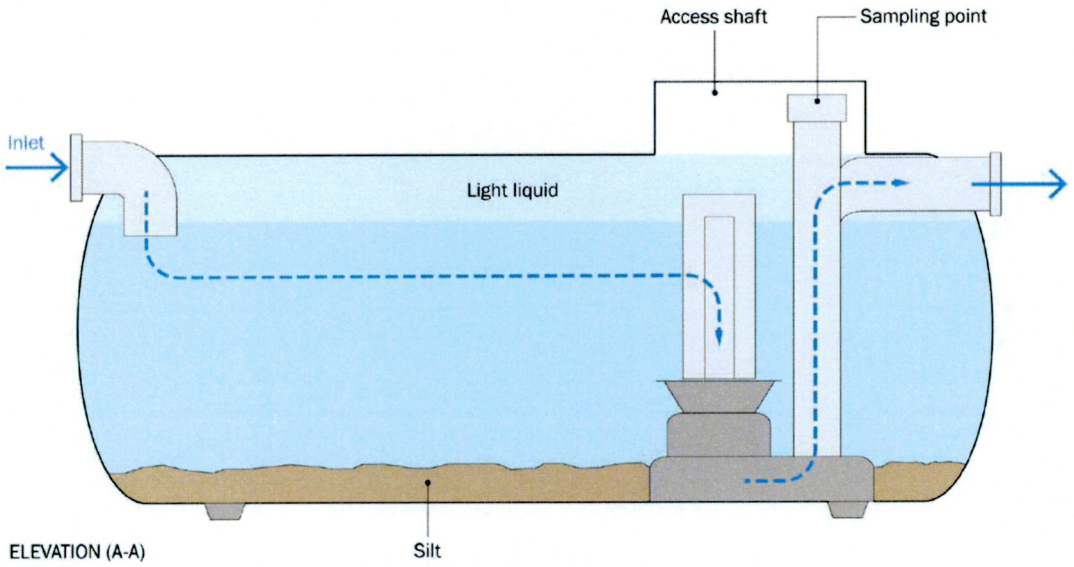


Figure 3.13 - Typical Section Detail of Fuel Separator (CIRIA C753)

3.5 Proposed Surface Water Network Detailed Design

3.5.1 Software Design Criteria

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in *Section 2*, using MicroDrainage Network Design package, by Innovyze Inc., which simulates the performance of the integrated drainage network for varying rainfall return periods and storm durations.

The MicroDrainage Network Design software applies the Flood Studies Report (FSR) methodology for analysis of the rainfall profiles. However, the input

design parameters that were used, as part of this design, were based on the available Flood Studies Update (FSU) data, *i.e.* the return period rainfall depths for sliding durations, which determine the **M_{5-60}** and **R** values, and the standard annual average rainfall (SAAR); as sourced from Met Éireann.

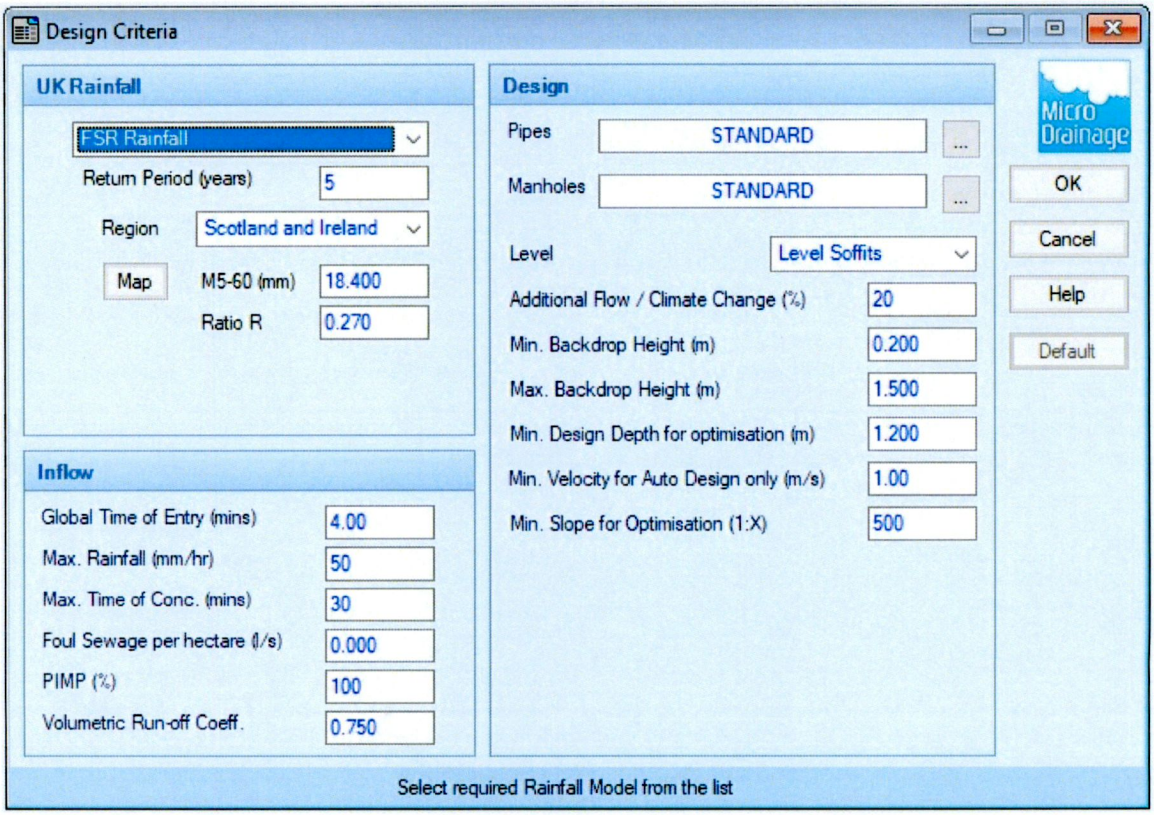


Figure 3.14 - Surface Water Network Design Criteria (MicroDrainage Excerpt)

3.5.2 Proposed Surface Water Catchment Area

Due to the natural topography of the existing site, the proposed development has one surface water catchment area, discharging attenuated flows to the existing public surface water at Cookstown Estate Road. Refer to design layout drawing **B981-OCSC-XX-XX-DR-C-0505** for information. As noted previously, this area considers the overall site area with allowance for an expected future residential development on the east portion of the site, to ensure that common drainage elements are suitably designed and sized.

3.5.3 Proposed Development Rainfall Runoff

It is proposed to reduce and restrict the rainfall runoff, discharging from the proposed development, to the greenfield equivalent, $QBAR_{RURAL}$, runoff rate, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than $25km^2$ in area.

This is to be achieved with the provision of a flow restrictor (Hydro-Brake Optimum by Hydro-International, or similar approved) prior to discharging to the existing 450mm-diameter public surface water sewer approximately 40m at the south eastern corner of the site, with the appropriate measures of attenuation provided. Sub-catchment flow-control devices and associated attenuation are also to be strategically provided, in order to maximise SuDS benefits and avail of the central open space for preliminary attenuation.

Refer to *Figure 3.3*, in *Section 3.3.3*, for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area (c.1.25-hectares), which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of **4.0 l/s** (i.e., 3.2 l/s/ha) along with the calculated runoff for varying Average Recurrence Intervals (ARI).

For the purpose of the surface water network design simulation, we have considered all external (roads, pavement, and roofs) areas as being 100% impermeable; giving a *winter* global runoff coefficient, C_v, of 0.84, in accordance with the HR Wallingford and Modified Rational Method for runoff. The proposed car parking areas comprise pervious paving above a drainage layer base course. A reduced percentage impermeable factor of 80% has been applied for these locations, which conservatively accounts for initial interception from the pervious paving build-up.

3.5.4 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving the proposed development, is to consist of a gravity sewer network that will convey runoff from the green roofs and paved areas to the outfall manhole. The new gravity networks will discharge a controlled attenuated flow rate to the existing public network at the south-eastern of the site, as outlined in *Section 3.4.3*.

The proposed piped network has been designed in accordance with BS EN 752 and all new infrastructure is to be compliant with the requirements of the GDSDS and the GDRCOP for Drainage Works, with minimum full bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been sized to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI event.

Refer to drawing **B981-OCSC-XX-XX-DR-C-0505** for the proposed drainage infrastructure layout.

3.6 Proposed Surface Water Attenuation Storage

The proposed development is to attenuate its own rainfall runoff, prior to discharging to the existing public surface water network. The primary function of the attenuation systems will be to temporarily store excessive rainfall runoff, during significant rainfall events, due to the restricted discharge rates (to greenfield equivalent runoff rates) from the development outfalls.

Attenuation is to be provided in the form of a proprietary, modular system (such as the geocellular Y-ESS Pluvial Cube, or similar approved) under the internal road/car parking, prior to discharging the attenuated flows to the existing public surface water network.

A minimum total geocellular storage volume of **357.4m³** is to be provided as part of the proposed development and a volume of **62.5m³** of interception storage for the first 5mm of rainfall. The attenuation system has been designed to temporarily store the surface water runoff for design rainfall events up to, and including, the 1% AEP with a 20% increase in rainfall intensity, along with the associated integrated surface water drainage network.

Refer to *Section 3.4.3.7* for further details of the proposed geocellular systems.

3.7 Surface Water Outfall Location

The surface water drainage is to discharge attenuated flows to the public surface water network, at a location adjacent of 40m south-eastern corner of the site.

The discharge rate at the outfall location is to be restricted to a maximum flow rate of **4.0 l/s** (i.e., 3.2 l/s/ha), which is less than the current greenfield equivalent runoff rate, as discussed in *Section 3.3.3*.

The above is to ensure that there is no increase in flow rates and volumes, from the development site, being discharged to the receiving infrastructure; thus, causing no adverse impact on adjoining and other downstream properties.

3.8 Water Quality

The quality of the surface water discharging from site is to be improved through the following provisions, each of which is discussed in greater detail in *Section 3.4.3*:

- Green Roofs on proposed buildings;
- Pervious Paving in the internal car parking areas;
- Intensive landscaping, where practical;
- Tree pits, where feasible;
- Trapped road gullies on the road carriageway, to trap silt and gross pollutants;
- Interception storage at attenuation system;
- Silt trap to be provided on manhole immediately upstream of attenuation system, as a further preventative measure to trap silt and other gross pollutants;
- Class 1 bypass fuel separator to be provided prior to discharging from site.

3.9 Maintenance

The proposed surface water drainage network has been carefully designed, minimise risk of blockage throughout the network, mainly through the following provisions that limit and restrict the size of pollutants entering the network:

- Green Roof;
- Pervious paving;
- Tree pits;
- Trapped road gullies;

- Silt trap manhole;
- Flow control greater than 150mm diameter.

All devices, including green roofs, bioretention system, tree pits, road gullies, silt trap, flow control device and attenuation system, should be inspected regularly and maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

Items such as the flow controls and fuel separators have been located so as to provide easy vehicular access for inspection and maintenance.

3.10 Surface Water Impact Assessment

The design criteria for the drainage system are established in *GDSDS-RDP Volume 2, Section 6.3.4* and explained further in *GDSDS-RDP Volume 2, Appendix E*. There are four design criteria, each of which has been considered for the subject site:

- River Water Quality Protection;
- River Regime Protection;
- Level of Service (flooding) for the site and;
- River Flood Protection.

3.11 Criterion 1 – River Water Quality Protection

It is proposed that the overall drainage system, serving this development, will contain a range of surface water treatment methods, as outlined previously in *Section 3.4,* which will improve the quality of surface water being discharged from the proposed development.

Gross pollutants, sediments, hydrocarbons, and other impurities, will be removed at source with the following provisions:

a) Green roofs at proposed buildings;
b) Pervious Paving to all internal car parking areas;
c) Intensive landscaping, where practicable;
d) Tree pits, where feasible;
e) All road gullies and linear channel drains are to be trapped;
f) Interception storage at attenuation system;

g) Silt-trap prior to attenuation storage area;
h) Class 1 fuel separator prior to discharge from the development.

3.12 Criterion 2 – River Regime Protection

Surface water discharge from the overall development will be restricted to an equivalent rural runoff rate of **4.0 l/s**, as per GDSDS and South Dublin County Council requirements. Refer to *Section 3.3.3* for further details of the proposed development rainfall runoff calculations.

This will be achieved with the provision of a flow control devices (Hydro-Brake Optimum, by Hydro-International, or similar approved) upstream of the outfall manhole. Refer to *Section 3.4.3.8* for further details.

3.13 Criterion 3 – Level of Service (Flooding) Site

There are four sub-criteria for the required level of service, for a new development; as set out in the *GDSDS Volume 2, Section 6.3.4 (Table 6.3).*

- No flooding on site except where planned (30-year high intensity rainfall event);
- No internal property flooding (100-year high intensity rainfall event);
- No internal property flooding (100-year river event and critical duration for site) and;
- No flood routing off site except where specifically planned. (100-year high intensity rainfall event).

3.13.1 Sub-Criterion 3.1

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding. Therefore, the system has capacity for the 30-year return period rainfall event without flooding.

The performance of the proposed drainage system has been analysed for design rainfall events up to, and including, the 1% AEP event (including 20% climate change allowance) using the *MicroDrainage Network Design Software*, by Innovyze Inc. Refer to **Appendix E** for details of design

criteria, calculations, and results. The analyses indicate that no flooding will occur for design rainfall events up to, and including, the 1% AEP.

3.13.2 Sub-Criterion 3.2

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding.

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) has been analysed – Refer **Appendix E** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

3.13.3 Sub-Criterion 3.3

Details of the flood risk assessment associated with the proposed development is outlined in *Section 7* of this report. The assessment indicates that there is no apparent risk of internal property flooding for a design 100-year return period pluvial rainfall event (including 20% climate change allowance).

3.13.4 Sub-Criterion 3.4

The surface water drainage systems, serving the proposed development, have been designed to accommodate the 100-year return period rainfall event (including an allowance of 20% increase in rainfall intensity for climate change) without flooding, so no flood routing off site will be experienced for such a rainfall event.

The performance of the proposed drainage system in 100-year return period storm events (including 20% climate change allowance) has been analysed – Refer **Appendix E** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

Details of the flood risk assessment associated with the proposed development is outlined in *Section 7* of this report. This assessment, along with the network design simulation results, from the MicroDrainage Network

Analysis, indicates that no internal property flooding will occur in a 100-year return period fluvial flood event (including 20% climate change allowance).

3.14 Criterion 4 – River Flood Protection

As outlined in *Section 3.13* (Criterion 2), the surface water runoff from the development's catchment will be limited to a maximum of **4.0 l/s** (i.e., 3.2 l/s/ha).

Refer to *Section 3.3.3* and *Section 3.5* of this report for further details on the limiting discharge rates. The *GDSDS Volume 2, Appendix E* states that this practice ensures *"that sufficient stormwater runoff retention is achieved to protect the river during extreme events".*

Attenuation storage is to be provided for the 100-year return period rainfall event (including an increased 20% rainfall intensity; to allow for climate change). Discharge from site is to be achieved through the use of a vortex flow control device (e.g., Hydro-Brake Optimum, by Hydro-International, or similar approved), which will reduce the risk of blockage present with other flow devices.

Refer to **Appendix E** for details of hydraulic modelling calculations of attenuation and flow control facilities, as carried out using MicroDrainage software by Innovyze Inc.

4 WASTEWATER DRAINAGE

4.1 Overview

The proposed gravity wastewater sewer design has been carried out in accordance with Irish Water's Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03 (Revision 2 – July 2020). The existing site is currently brownfield, with existing wastewater that discharge to the public wastewater infrastructure.

4.2 Existing Wastewater Drainage

There is an existing building on the proposed site and there is an apparent public wastewater infrastructure in the immediate boundary of the proposed development.

The Irish Water public drainage records indicate that there is an existing 300mm-diameter public wastewater sewer located at north boundary of the proposed development at First Avenue. There is an existing 300mm-diameter public wastewater sewer located in the south part of the site at Second Avenue that goes through the Cookstown Estate Road and directs towards north-east direction.

Refer to *Figure 4.1* for an excerpt from the public wastewater infrastructure from Irish Water Records, which are also provided in **Appendix A**, for indicative locations of existing infrastructure.

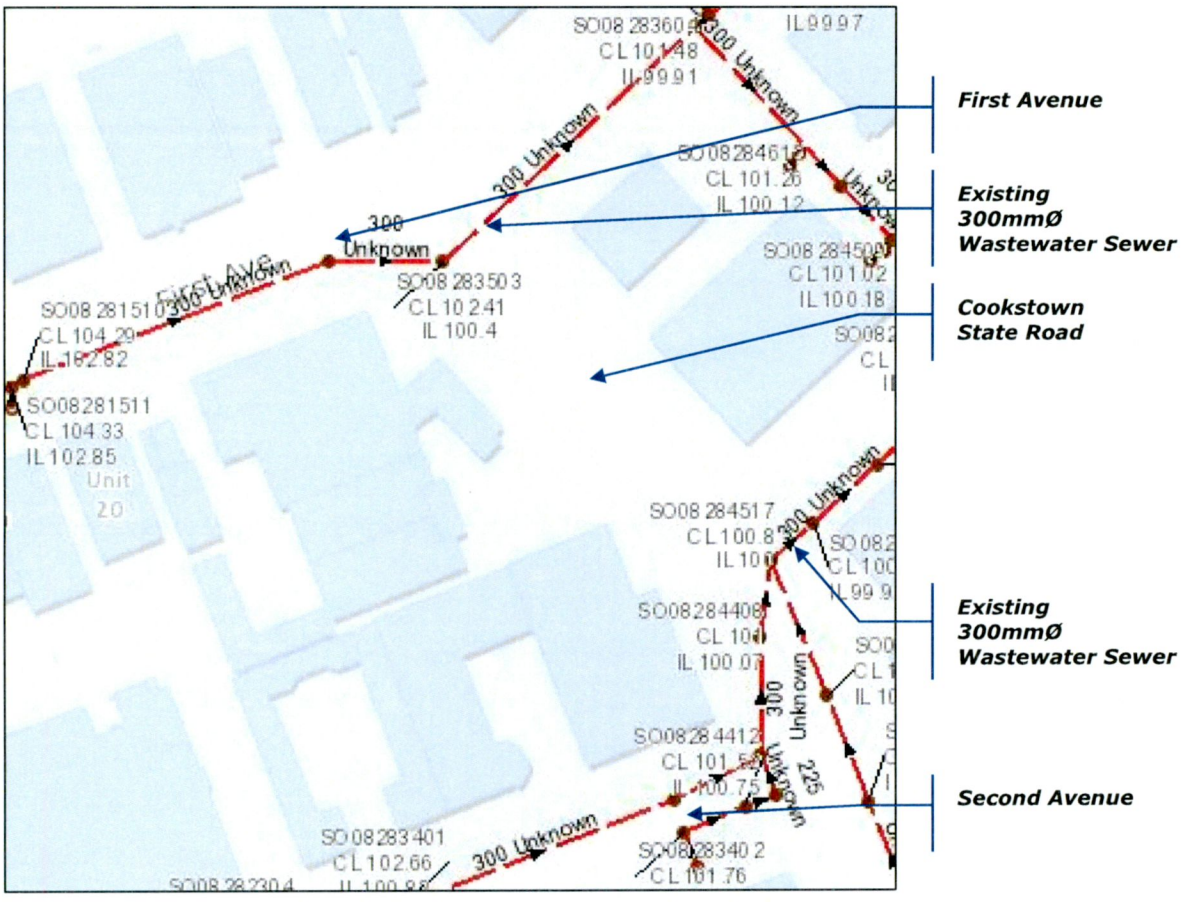


Figure 4.1 – Existing Wastewater Infrastructure Records

4.3 Consultation

A Pre-Connection Enquiry Form ***(IW Ref Nr. CDS22003324)*** was submitted 10th February 2021 to Irish Water for a total of 139nr. residential units, 131nr. bed transitional care facility and 2nr. commercial units, thereby considering the expected masterplan development for the site but with elements other than the transitional care facility to be subject to a separate, future planning application.

Irish Water have issued a Confirmation of Feasibility which confirms that the development is feasible without upgrade to infrastructure. However, they also advised the following:

"*Peak discharge flow from the development site has to be limited to 5l/s due to downstream network constraints. This can be achieved with the provision*

of an on-site foul pumping station (PS) with a maximum capacity of 5l/s. The PS may be designed to be bypassed at a future date."

The Confirmation of Feasibility can be found in ***Appendix J*** of this report.

4.4 Proposed Wastewater Network Strategy

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the public wastewater infrastructure.

Refer to *Section 3.4.3* for details of the proposed surface water network strategy.

The overall development is to be drained by a gravity wastewater network, based on the natural topography of the development site. The buildings wastewater network is to connect to the new development's gravity wastewater network at the ground level and discharges to the existing 300mm-diameter public wastewater sewer located approximately 40m south-eastern boundary of the proposed development, which has been designed in accordance with the Irish Water Code of Practice for Wastewater Infrastructure.

As required by Irish Water, a pump station is to be provided on-site. Reference was had to Irish Waters Code of Practice for Wastewater Infrastructure. A Type 3 pump station is proposed as it will serve more than 20 dwellings. It is to be located in the southwest corner of the development site to ensure appropriate access is provided and provide the necessary distance from the adjacent structures.

With respect to the location, it is noted that section 5.5 of the Irish Water guidance indicates a 15m offset from adjacent properties to minimise risk of odour, noise and vibration. However, it is stressed that due to the temporary nature of the pump station in question, it is not proposed to be taken in charge by Irish Water. Furthermore, the development site is brownfield in a constrained location which limits the availability of space while the Irish Water standards are generally understood to consider greenfield developments.

Taking this into consideration, it is proposed to put in place a series of mitigation measures to eliminate the risk of odour, noise and vibration impact as follows:

- Venting from the pump station is to be routed to discharge above roof level of the proposed facility;
- Polychloroprene seals are to be installed to prevent odour escape, with all manholes sealed;
- Estimated noise level of submerged pump operating under normal conditions not greater than 70 dB(A). For context, this is less than a standard washing machine on spin cycle;
- A comprehensive maintenance strategy to ensure the pump station is kept in optimal working order.

Notwithstanding the above, a 15m exclusion zone has been indicated around the proposed pumping chamber which is the source of any potential noise or vibration and indicates that this does not overlap with any of the proposed structures nor the existing structures on adjacent sites.

Allowance has also been made for the future bypass of the pump station to allow the design revert to a traditional gravity system if and when this is confirmed as acceptable by Irish Water.

Refer to detailed drawing **B981-OCSC-XX-XX-DR-C-0505** for the proposed drainage network layout, which is to serve the proposed development.

4.5 Wastewater Network Design Calculations

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the adjacent local wastewater sewer network and local surface water sewer network, respectively.

Wastewater design calculations comply with *Irish Water's Code of Practice Wastewater Infrastructure, IW-CDS-5030-03 (Revision 2 – July 2020)* and are included in **Appendix F**. Pipe design calculations comply using MicroDrainage software and are included in **Appendix F**. Design flow has been calculated using the Discharge Unit method described in *I.S. EN 752*. The calculations

demonstrate that conveyance capacity is provided for all development of zoned lands within the catchment, that self-cleansing velocity will be achieved with the expected design flow rates and that the flow velocities will not exceed the upper limit of 3.0m/s.

5 POTABLE WATER SUPPLY

5.1 Overview

All proposed potable water design has been carried out in accordance with *Irish Water's Code of Practice for Water Infrastructure, IW-CDS-5020-03 (Revision 2 – July 2020).*

A new 150mm-diameter HDPE watermain connection is to be provided from the existing public 12" AC watermain at Cookstown Estate Road/First Avenue.

5.2 Existing Watermain Infrastructure

The Irish Water public records indicate that there is an existing public 101.6mm-diameter uPVC 1975 watermain along the footpath on Cookstown Estate Road and First Avenue located to the north and east boundary of the site.

There is an existing public 12" Asbestos 1975 watermain that runs on the road along the Cookstown Estate Road and First Avenue. There is an existing public 6" uPVC 1975 watermain located approximately 90m to the south-east of the site at Second Avenue with Cookstown Estate Road.

Refer to *Figure 5.1* for an excerpt from the public watermain infrastructure from Irish Water Records, which are also provided in **Appendix A**, for indicative locations of existing infrastructure.

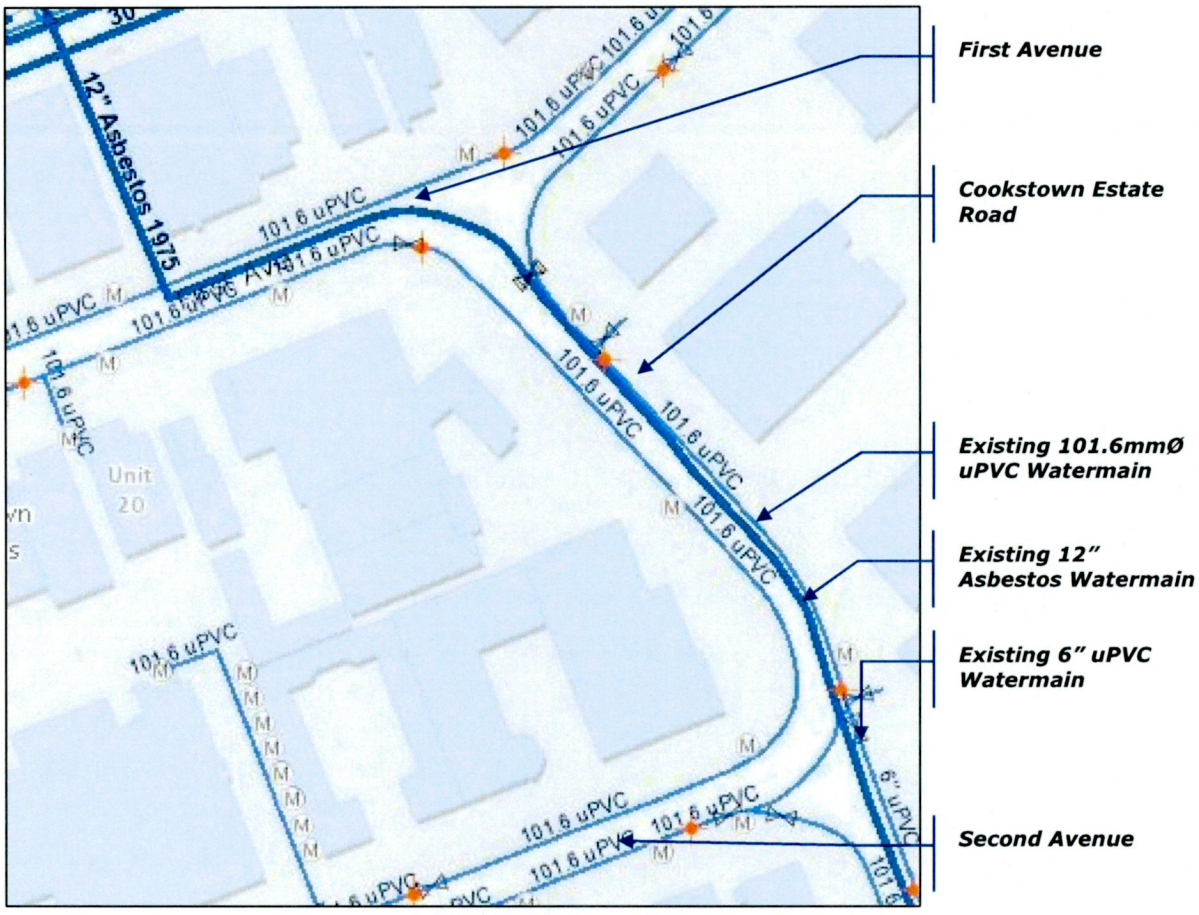


Figure 5.1 – Existing Watermain Infrastructure Records

5.3 Consultation

A Pre-Connection Enquiry Form ***(IW Ref Nr. CDS22003324)*** was submitted 10th February 2021 to Irish Water for a total of 139nr. residential units, 131nr. Bed transitional care facility and 2nr. commercial units.

Irish Water have issued a Confirmation of Feasibility which confirms that the development is feasible without upgrade to infrastructure. They further advise that a 150mm connection should made to the existing 12" AC water main on First Avenue, though it is noted that this extends to Cookstown Estate Road where it is proposed to connect.

5.4 Connection to the Existing Network

It is proposed to serve the proposed development by providing a new 150mm high density polyethylene (HDPE) connection to the existing public 12"

Asbestos watermain on the Cookstown Estate Road, adjacent to the development's proposed south-eastern entrance.

The proposed connection is to be carried out in accordance with *Irish Water's Code of Practice for Water Infrastructure, IW-CDS-5020-03 (Revision 2 – July 2020)*, following a New Connection agreement with Irish Water, with a bulk water meter to be provided at the development's entrance.

Refer to drawing **B981-OCSC-XX-XX-DR-C-0555** for the proposed watermain layout.

5.5 Water Saving Devices

Water saving devices are to be considered for use within the proposed development units, in order to conserve the use of water, as part of the internal fit-out.

5.6 Water Meters

A bulk water meter is to be provided at the connection to the public watermain, at the development entrance, along with individual meters provided at the connection to each unit. All metering is to be provided in accordance with Irish Water's requirements.

6 FLOOD RISK ASSESSMENT

6.1 Design Guidelines Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements *i.e.* the South Dublin County Council Development Plan, Tallaght Town Centre Local Areal Plan, and as such, The Planning System and Flood Risk Management (FRM), Guidelines for Planning Authorities, in which, its Technical Appendices outline the requirements for a Site Specific Flood Risk Assessment.

6.2 The Planning System and Flood Management, Guidelines for Planning Authorities

The FRM Guidelines outline methodologies for the "transparent consideration of flood risk at all levels of the planning process, ensuring consistency of approach throughout the country".

"The core objectives of the FRM Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface runoff;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restrictions of national, regional, or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management flood risk management."

In order to achieve the aims and objectives that are set out in the FRM Guidelines, the key principles that should be applied to new development are as follow:

- Avoid the risk, where possible;

- Substitute less vulnerable uses, where avoidance is not possible; and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

Justification for development is required in situations where 'avoid' and 'substitute' principles cannot be applied. This is further summarised in the FRM Guidelines Sequential Approach, as illustrated in *Figure 6.1*.

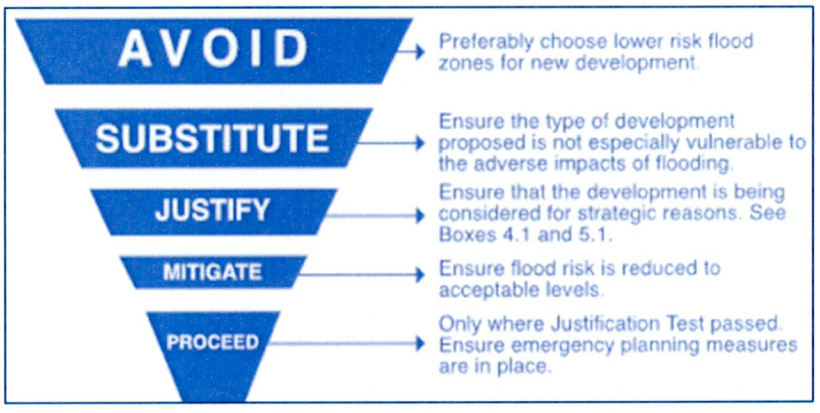


Figure 6.1 – Sequential Approach Principles in Flood Risk Management

6.3 Flood Risk Assessment

The assessment of flood risk requires an understanding of where the water comes from (*i.e.* the source), how and where it flows (*i.e.* the pathways) and the people and assets that if affects (*i.e.* the receptors). This is illustrated further in *Figure 6.2*, as sourced from the FRM Guidelines.

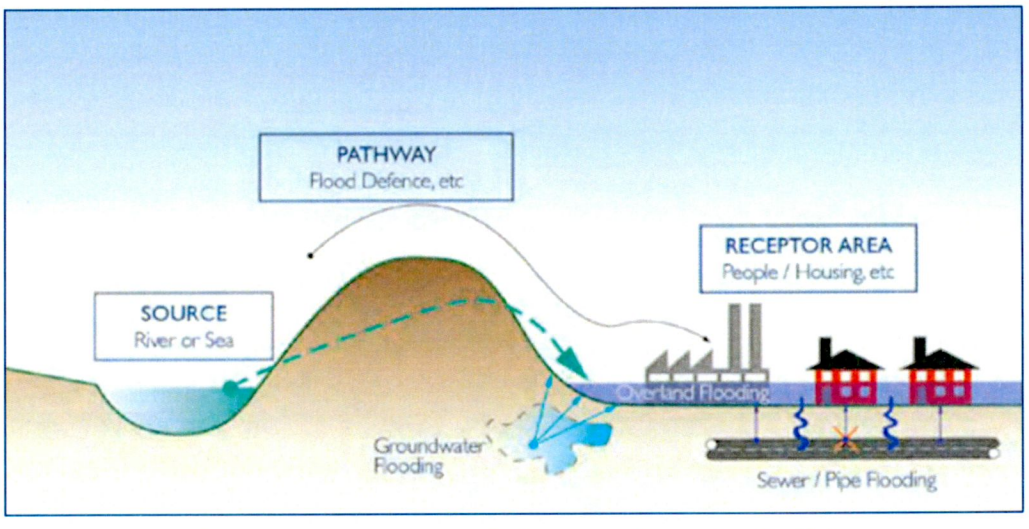


Figure 6.2 – Source – Pathway – Receptor Model

The main sources of flooding are rainfall or higher than normal sea or river levels.

The main pathways include rivers, streams, sewers, drains, overland flow, and river and costal floodplains and their assets.

Receptors typically include people, their property, and their environment.

All three elements of this model must be examined as part of the flood risk assessment, including the vulnerability and exposure of receptors. In order to determine its potential consequence.

Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. Flood risk assessment should cover all sources of flooding, including effects of run-off from a development locally and beyond the development site.

6.3.1 Flood Risk Assessment Stages

The FRM Guidelines outline that a staged approach should be adopted when carrying out a flood risk appraisal or assessment of flood risk for individual planning applications. These stages are:

- **Stage 1** – Flood risk identification
- **Stage 2** – Initial flood risk assessment
- **Stage 3** – Detailed flood risk assessment

6.4 Flood Zones

The FRM Guidelines identifies three types, or levels, of flooding zones, which are defined as follows:

1. **Flood Zone A** – where the probability of flooding from rivers and sea is highest (greater than 1% AEP for fluvial, or 0.5% AEP for coastal flooding);
2. **Flood Zone B** – where the probability of flooding from river and sea is moderate (between 0.1% AEP and 1% AEP for fluvial and between 0.1% AEP and 0.5% AEP for coastal flooding);
3. **Flood Zone C** – where the probability of flooding from rivers and sea is low (less than 0.1% AEP for both fluvial and coastal flooding).

6.5 Climate Change

The *FRM Guidelines* require that account be taken of the effects of climate change over the design of a development, typically 100 years. Design parameters to take account of climate change were established in the *GDSDS* and revised following later studies, as directed within the Local Authority's Development Plan. These parameters are set out in the *Figure 6.3 – Climate Change – Impact on Design Parameters*, below.

Design Category	Impact of Climate Change
Drainage	20% increase in rainfall
Fluvial (River)	20% increase in flood flow
Tidal / Coastal	Sea level rise of 500mm

Figure 6.3 – Climate Change – Impact on Design Parameters

6.6 Development Vulnerability

Table 3.1 of the PSFRM Guidelines, reproduced in *Figure 6.4* below, classifies the proposed residential development and the residential care home as being **'Highly Vulnerable Development'**, based on its proposed land use and type of development.

Vulnerability Class	Land uses and types of development which include:
Highly Vulnerable Development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; ***Dwelling houses***, student halls of residence and hostels; **Residential institutions such as residential care homes**, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less Vulnerable Development	Buildings used for: retail, leisure, warehousing, *commercial*, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible Development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

Figure 6.4 – Development Vulnerability Class

Table 3.2 of the PSFRM Guidelines, reproduced in *Figures 6.5* below, illustrates the types of development that are considered appropriate to each flood zone, and those that would be required to meet the criteria of a Justification Test, which establishes the criteria under which desirable development of a site within a floodplain may be warranted.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-compatible Development	Appropriate	Appropriate	Appropriate

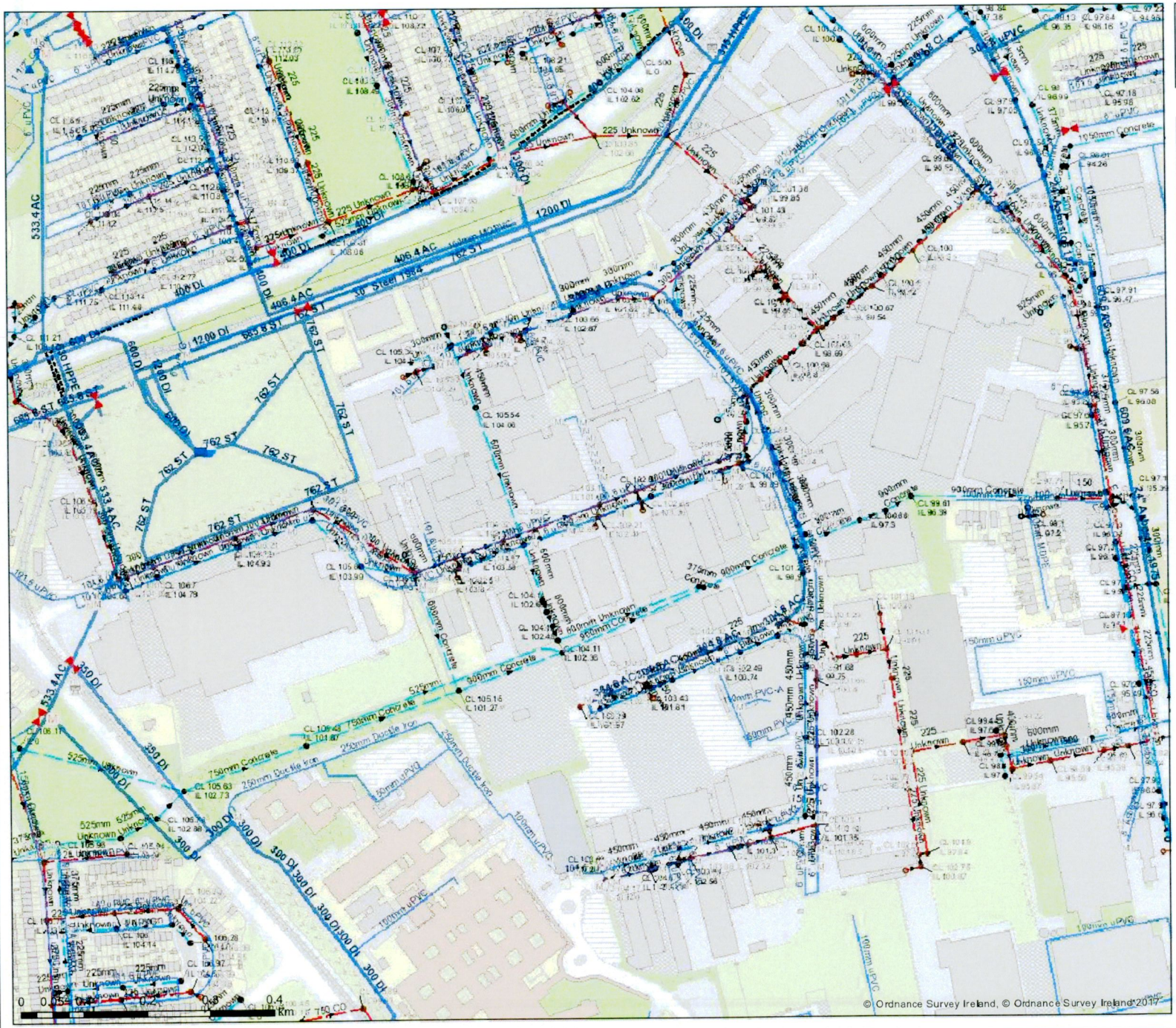
Figure 6.5 - Matrix of Vulnerability Vs. Flood Zone

Therefore, based on the table above, *Highly Vulnerable Development*, such as dwelling houses and *residential care homes*, is classified as **'appropriate'** if it is located within Flood Zone C.

6.7 Sequential Approach

A sequential approach, based on the development vulnerability and location with respect to flood zones, is a key tool in ensuring new development is first and foremost directed towards land that is at low risk of flooding. This approach is illustrated further in *Figure 6.6* below.

Irish Water Web Map



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

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings

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

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

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

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

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

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

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

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

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

Sewer Fittings
- Vent/Gri
- Other, Unknown

Storm Water Network

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

Inlet Type
- Gully
- Standard
- Other, Unknown

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

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

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

ESB Networks

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

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

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

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

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

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

APPENDIX B. RETURN PERIOD RAINFALL DEPTHS

Appendix B

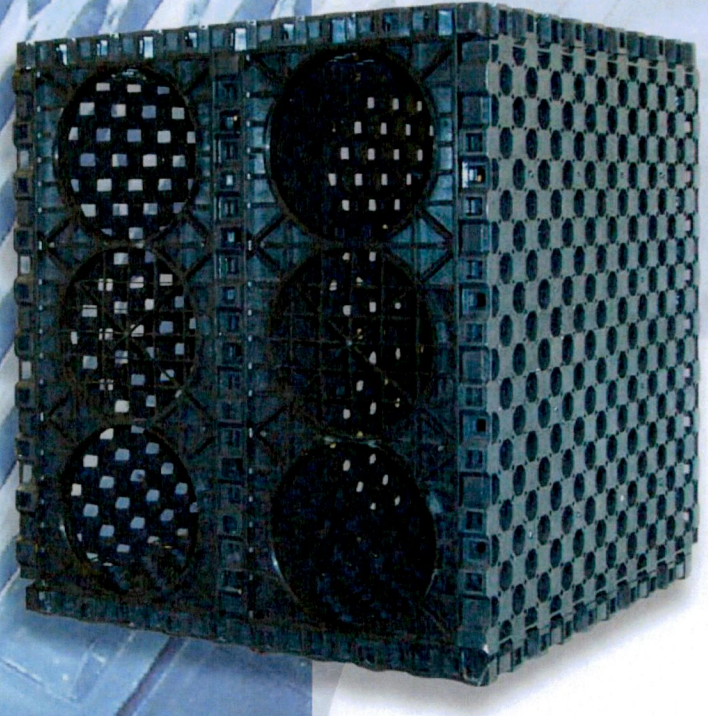
Return Period Rainfall Depths for Sliding Durations from Met Éireann

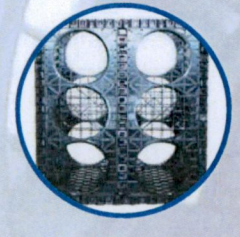
Modular Geo-Void Systems

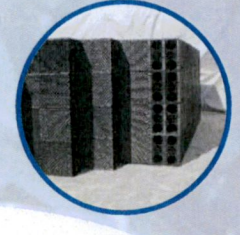
Total Water Management

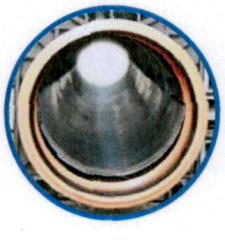
Pluvial Cube

Total Linear Access Precipitation Collection System





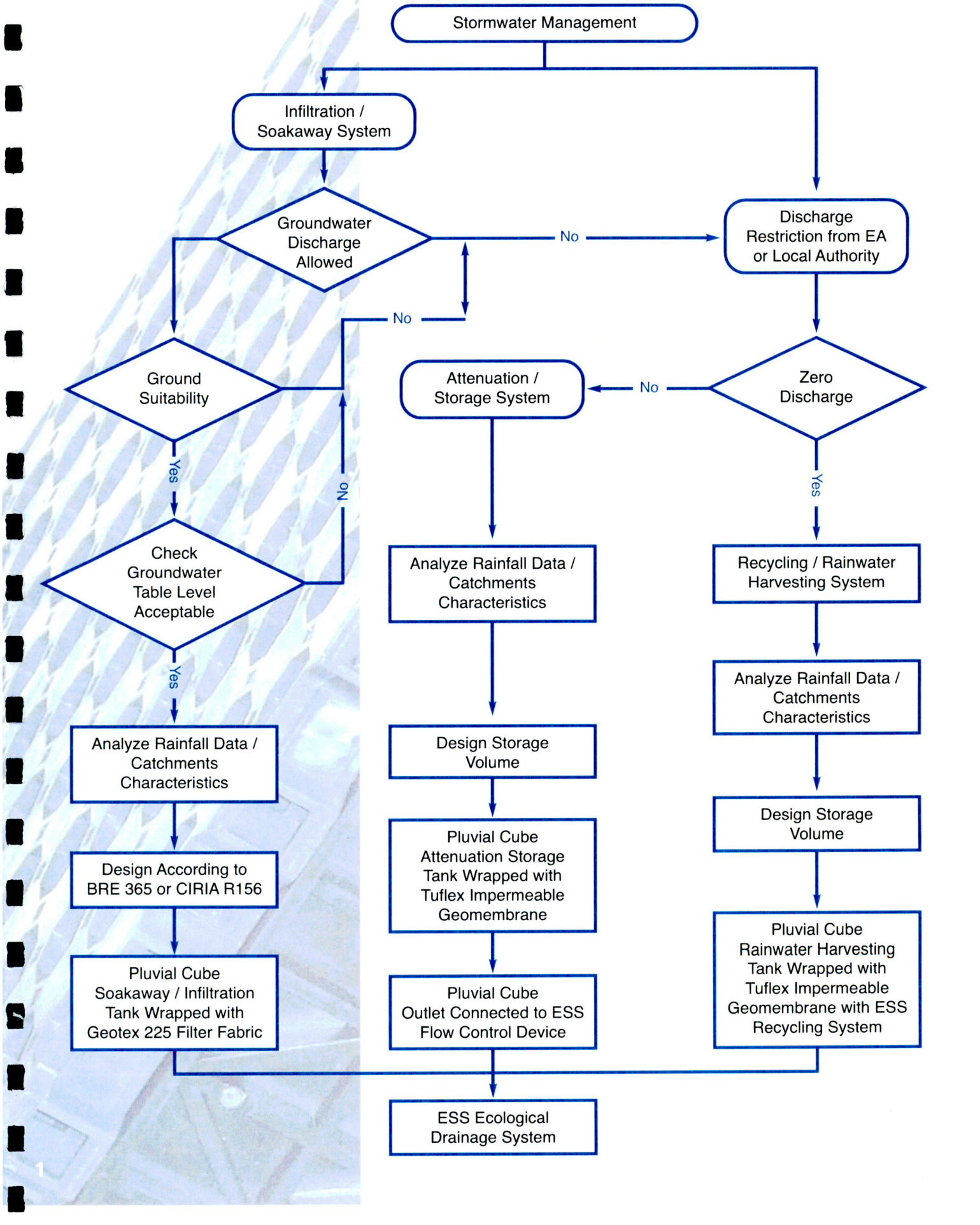




Unique Low Flow Channel System

ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Flow Chart


Stormwater Management
Infiltration / Soakaway System
Groundwater Discharge Allowed
No
Discharge Restriction from EA or Local Authority
No
Ground Suitability
Attenuation / Storage System
No
Zero Discharge
Yes
No
Yes
Check Groundwater Table Level Acceptable
Yes
Analyze Rainfall Data / Catchments Characteristics
Design Storage Volume
Recycling / Rainwater Harvesting System
Analyze Rainfall Data / Catchments Characteristics
Design Storage Volume
Design According to BRE 365 or CIRIA R156
Pluvial Cube Attenuation Storage Tank Wrapped with Tuflex Impermeable Geomembrane
Pluvial Cube Rainwater Harvesting Tank Wrapped with Tuflex Impermeable Geomembrane with ESS Recycling System
Pluvial Cube Soakaway / Infiltration Tank Wrapped with Geotex 225 Filter Fabric
Pluvial Cube Outlet Connected to ESS Flow Control Device
ESS Ecological Drainage System

Modular Geo-Cell Tank System

Infiltration, Detention and Re-use made easy...

Total Stormwater Management

E.S.S. Geo-Cell Modular Tank systems use surface and sub-surface infiltration techniques, resulting in clean water that can be re-used or allowed to re-enter the natural water system. E.S.S. Geo-Cell Modular Systems offer a highly efficient option for Stormwater Management in any kind of soils.

Water Quality

E.S.S. Geo-Cell Modular Tank Systems excel when there is a requirement to achieve a high water quality, particularly in the effective removal of nutrients and gross pollutants. In addition to the obvious environmental benefits, the sub-surface location of the tank system provides more usable space and an enhanced aesthetic setting compared to above ground concrete or plastic tanks.

The Modular Advantage

E.S.S. Geo-Cell Modular Tank System performance supersedes outdated aggregate trenches. The E.S.S. System provides a void space of over 90% compared to less than 20% in typical aggregate trenches. Consequently, the E.S.S. System offers a smaller footprint to achieve the same storage capacity as an aggregate trench. This saves time and money in installation and civil works costs. The lightweight design of E.S.S. Modular Tank Modules also make installation quicker, safer and cheaper. No sediment build up occurs in the E.S.S. System, unlike the clogging that is characteristic of aggregate based approaches.

System Components

Pluvial Cube Geo-Cell Tank Modules

EcoSand biologically engineered soils

E.S.S. Filtration Unit

Geotex Filtration Fabric

Tuflex Waterproofing Membrane

Geotex Protection Fleece

Ventilation Units

Preformed Pipe Connection Covers

Aquabrake Flow Control Devices and Chambers

Refer to separate data sheets

Benefits...

Complete Linear Access

Quick
Reduce site access delays

Lightweight
No cranes required

Strong
Designed for car loadings

Modular
Easily create any shape

Economical
Cheaper than concrete

Maintenance Free Tank
All debris and sediment is pre-filtered

Determinate Volume
One cubic metre of Pluvial Cube modules contain 950 litres of water

Cost Effective
Reduces excavation and disposal by two thirds compared with conventional soak wells

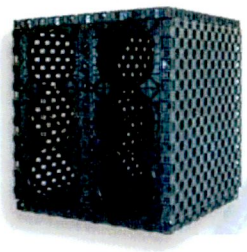
High Infiltration
90% void surface area

Structurally Designed
Supports shear loadings

Unique Low Flow Channels
Ensuring complete removal of any silts

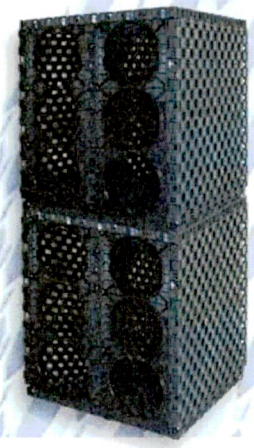
Permeable Paving

Single Module



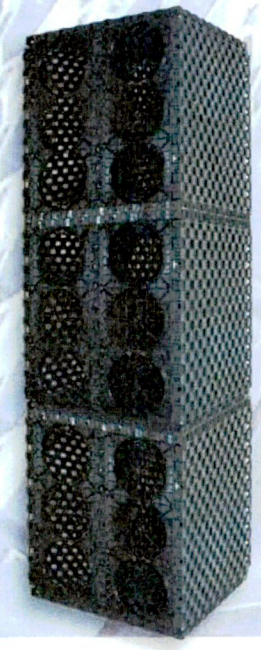
Size: 50cms x 50cms x 55cms
Units / m3: 0.1375m3
7.27 per m3

Double Module



Size: 50cms x 50cms x 107.5cms
Units / m3: 0269m3
3.72 per m3

Triple Module



Size: 50cms x 50cms x 160cms
Units / m3: 0.40m3
2.50 per m3

Clear Linear Access Through Open Subterranean Channels

Water sensitive Urban Channels

The Channel Systems are based on permeable sub-surface waterways that restore water quality and recharge the natural environment. The sub-surface E.S.S. Channel System provides a unique way of working with nature to solve the enormous problems currently associated with open concrete channels and swales.

Traditional Concrete Channels

Open concrete channels and swales are currently one of the main methods of transporting large quantities of Stormwater for discharge into streams, rivers and oceans. Open channels are used widely in the urban landscape even though they are considered unsafe. Channels are also a breeding ground for vermin and vector that endangers human health. In addition to the health and safety problem, large concrete channels take up vast areas of land and have a negative impact on the amenity of the area.

Pluvial Cube Module Dimensions* (mm)	Module Configuration	Units per m^3	Module Volume (m^3)
500 (L) x 500 (W) x 550 (D)	Single	7.27	0.1375
500 (L) x 500 (W) x 1075 (D)	Double	3.72	0.2688
500 (L) x 500 (W) x 1600 (D)	Triple	2.5	0.4

Product Data	Standard Pluvial Cube Module	Heavy Duty Pluvial Cube Module
Application	Stormwater Management	Stormwater Management
Average Weight (kg) - single module	6.05	7.05
Compressive Strength* (kN/m^2)	240	400
lateral Strength* (kN/m^2)	120	200
Long Term Creep Testing** (kN/m^2)	90	120
Void Ratio (%)	96	96
Surface Void Ratio (%)	Greater than 90	Greater than 90
Minimum Backfill Cover# (mm)	450	450
Maximum Backfill Cover (mm)	3000	4750
Material	Propylene	Propylene
Chemical Resistance	Good	Good
Bacterial Resistance	Good	Good
UV Resistance	Good	Good

Note: Other Modules with Compressive Strength more than 1500 kN/m^2 available
* Modules tested using UKAS calibrated test machine, range 0 - 60 Tons, UDL, loading rate 0.2 kN/m^2
** Modules tested for long term creep testing for 90 and 180 days
# Any cover less than 450 mm - contact ESS design department

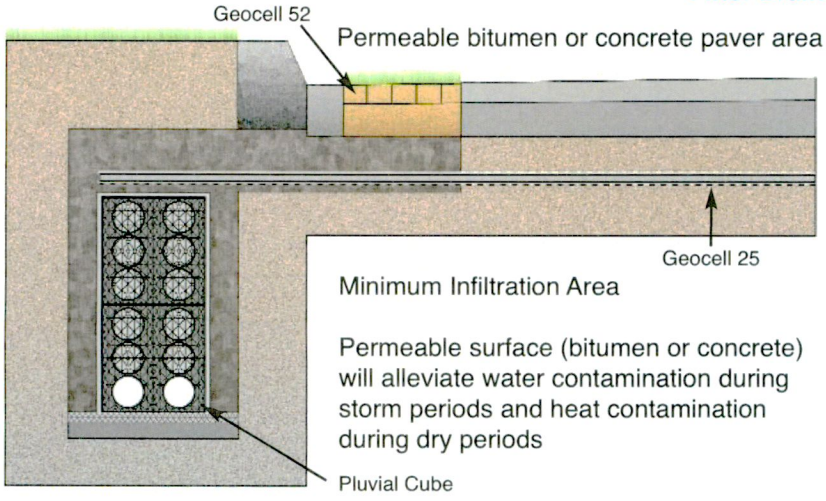
E.S.S. Channel System

E.S.S. Channels

With the E.S.S. Channel System being a sub-surface system, these problems with open concrete channels are rectified. The permeable channel system can be designed to follow the inherent contours of the landform and emulate the flow of natural waterways. The curvilinear channel design creates vertical flow, turbulence and reduces the overall flow of velocity while increasing the self cleansing capacity of the channel bed to create healthy aerobic conditions. The clear access channels allow for continual and future maintenance

Road Edge Infiltration Area.

High Traffic Areas



Filter Drain

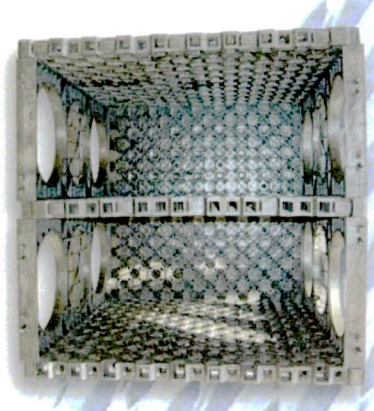
Environmental Benefits

By replacing open concrete channels or swales with E.S.S. Channel Systems, cities can now benefit from increased environmental amenities, greater recreational space and healthier conditions by using the vast tracts of land once given over to rapid flowing concrete channels.

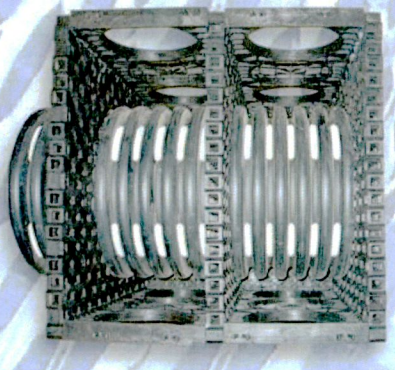
Car Park Infiltration Area.

Low Flow Channel System

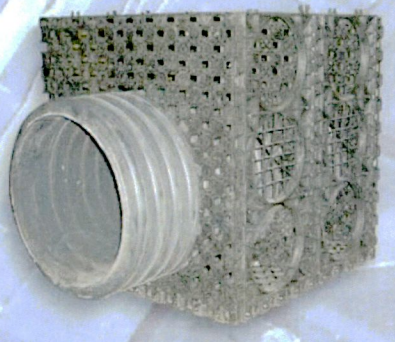
Self Cleaning at High Flow Velocity



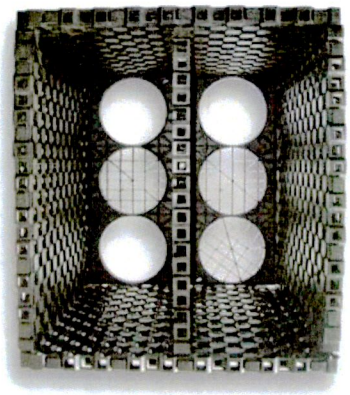
Top View
Showing Clear Channel



225 or 300mm
Internal Dia Channel

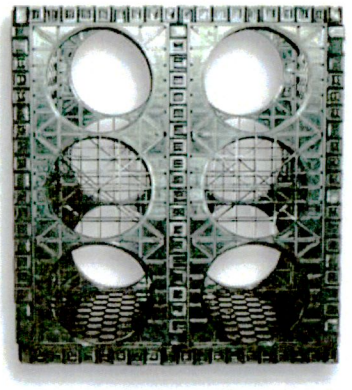


Provides Total Linear Access



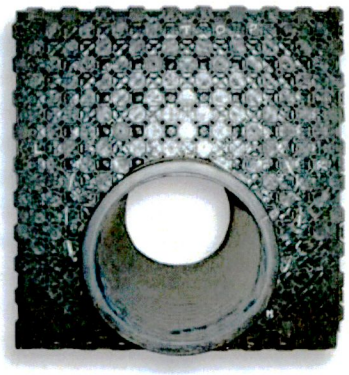
2 Clear Channels
500mm x 210mm per 0.5mt width

Controls Silt at Low Flow Velocity

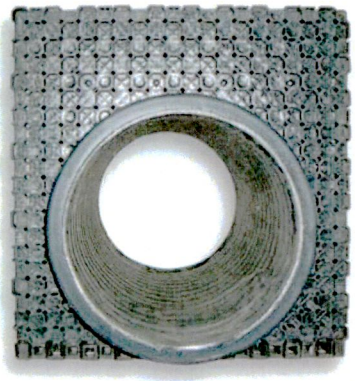


4 x160mm Pipe
Access Point

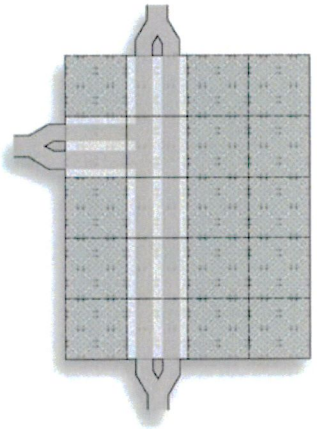
The above channels can be multi-connected using preformed connecters to larger inlet / outlet pipes



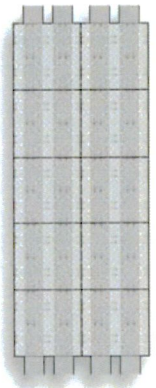
225 Low Flow Channel
(if required)



300mm Dia Low Flow Channel
(if required)



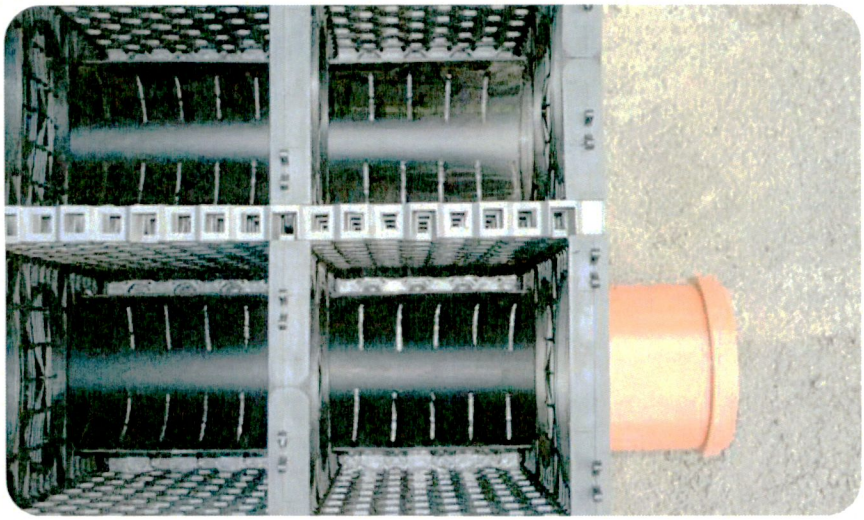
Typical Installation
Tank Format



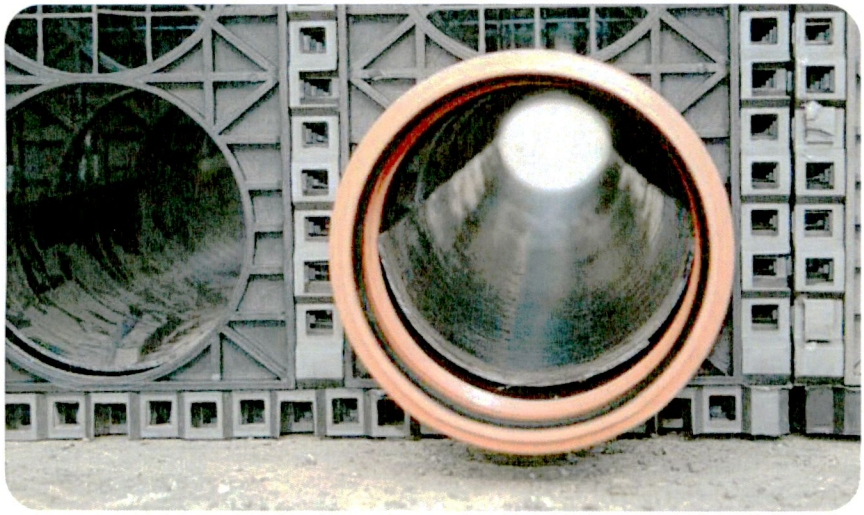
Typical Installation Channel Format
4 Clear Access Channels x 210mm

Linear Access Channel.

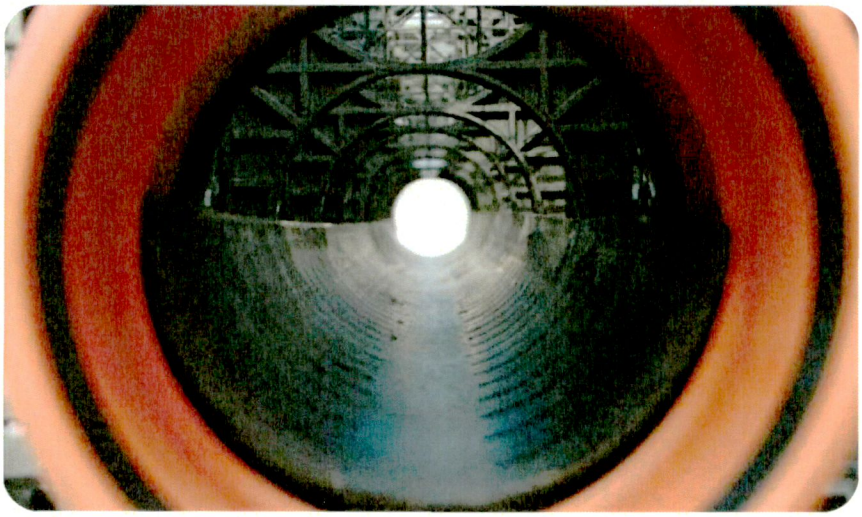
With slotted low flow silt control channel installed



Top view showing low flow maintenance channel.

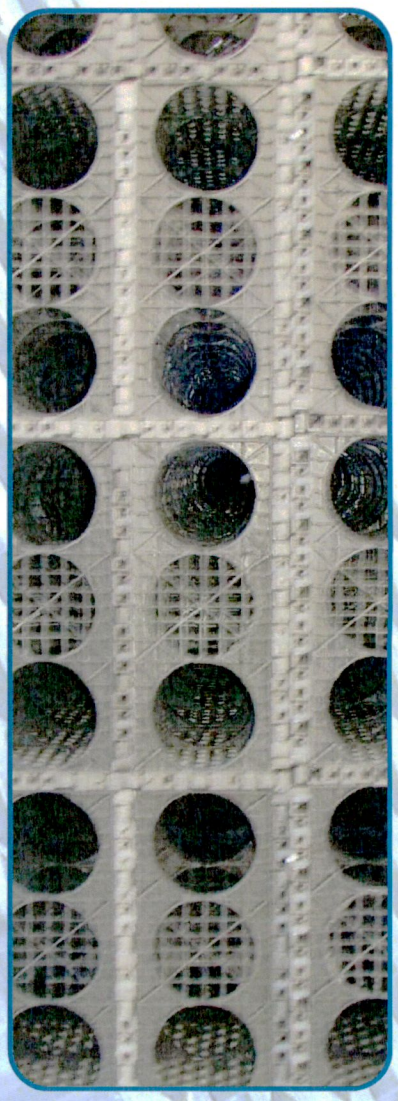


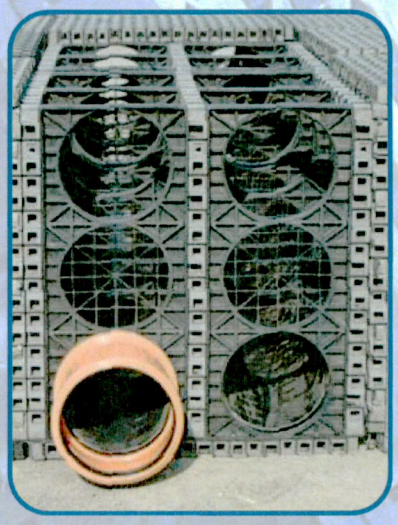
Self cleaning channels.



Connection to low flow maintenance channel at invert level.

Attenuation Tank Highlighting Number and Position of Access Points.





E.S.S. Systems Permeable Paving

Cover Materials

Cover materials are an essential part of the infiltration process. E.S.S. **EcoSand** Biologically Engineered sand is designed to provide maximum permeability through optimum physical, chemical and biological characteristics. To retain infiltration performance it is essential to choose the appropriate cover material and constantly maintain pH levels between 6 and 7.5.

Type 1 - Road run off

Type 2 - Road run off

Type 3

Type 4

Type 5 - Compactable

Type 1 - Road run off

The filter sand is engineered to installation and E.A. requirements. Depending on site contaminants expected.

Trafficable Landscape - Compaction Prevention:

If a trafficable, soft landscape surface is required (i.e. grass or gravel car parks, road verges etc.), it is recommended to use **E.S.S. GeoCell 52** grass reinforcement structure. The addition of product will allow long-term permeability of the cover soil.

Loading	Minimum Cover
Pedestrian	300mm
Occasional traffic	500mm

Infiltration Tank

Attenuation Tank.

2mts deep tank with 3mts cover

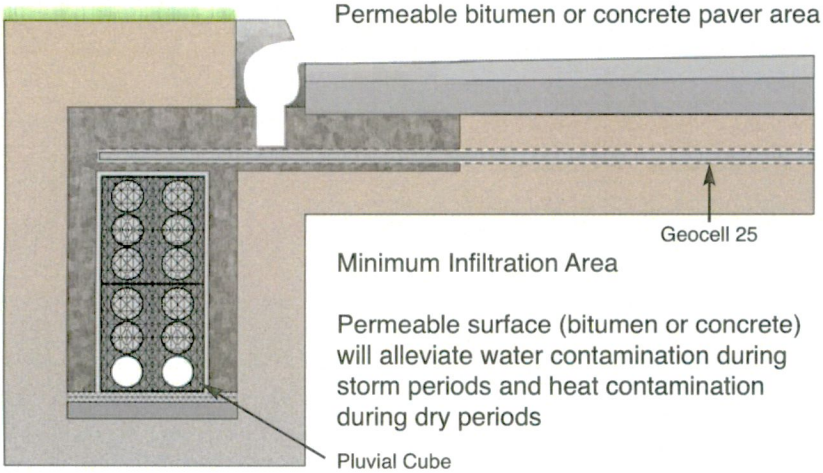
Infiltration Swales & Underground Channels

Subsurface Road Channels / Swales

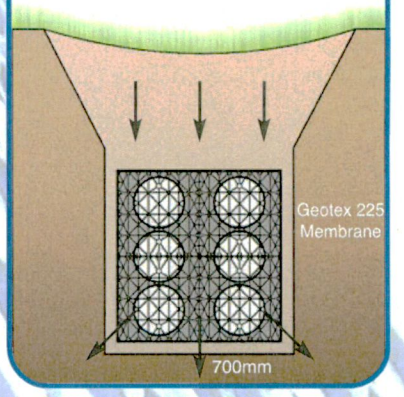
Pluvial Cube Tanking System provides an efficient way of managing road stormwater runoff. It allows high infiltration areas, preventing road accidents, water ponding, and mosquito infestation Provides new accessible space

Attenuation Tank under Park and Ride Scheme showing versatility of modular system.

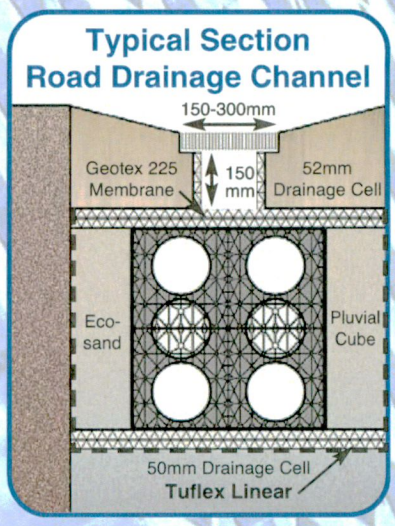
High Traffic Areas

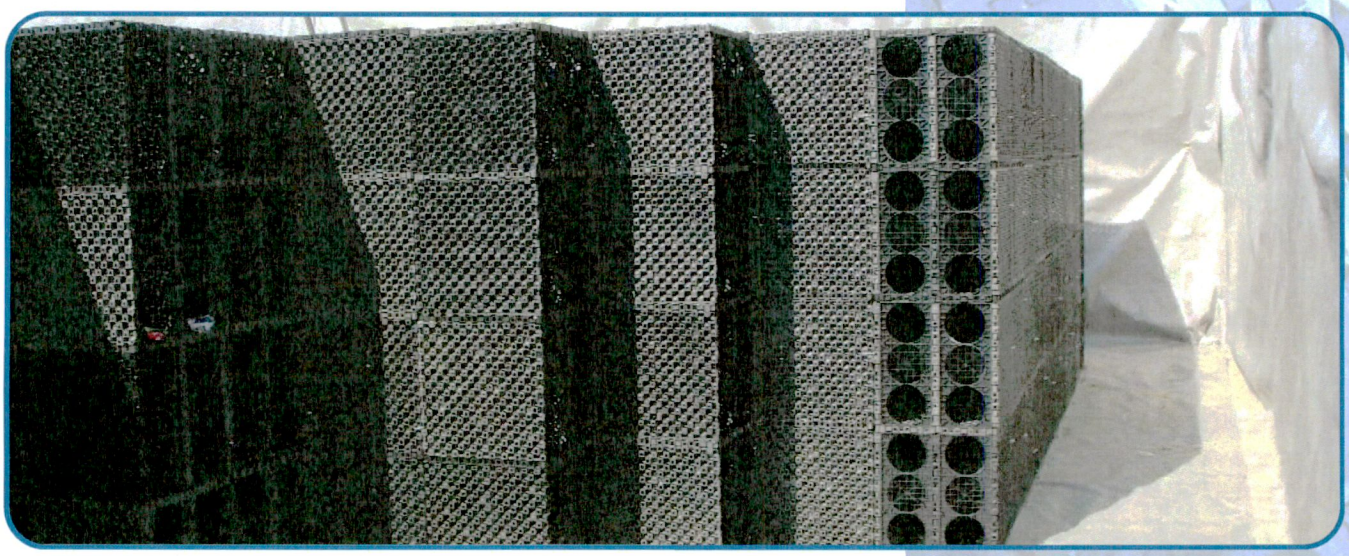


Typical Pluvial Cube Infiltration Swale Detail



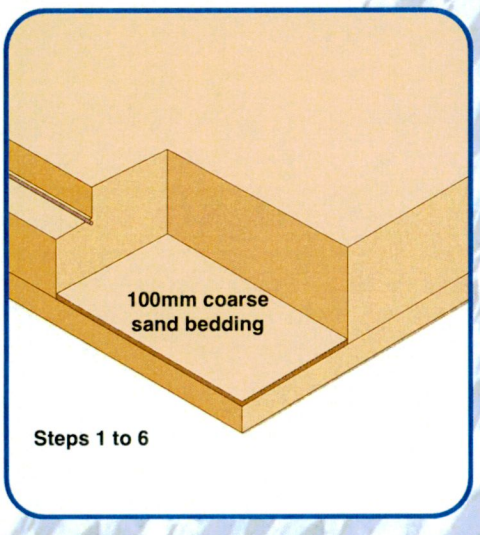
Typical Section Road Drainage Channel



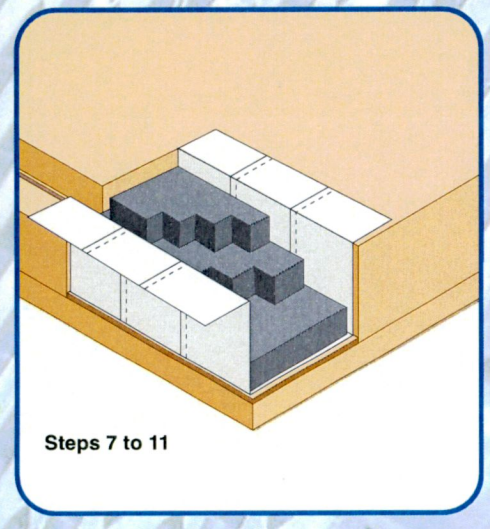


Tank 2mts deep with access channels.

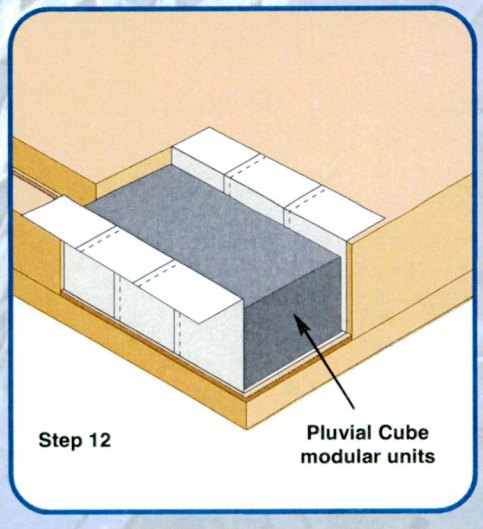
Installation Procedures



Steps 1 to 6



Steps 7 to 11



Step 12

Infiltration Tanks

Installation Steps

1. Excavate the pipe trench and lay the inlet pipe to the required fall and install silt traps in appropriate locations in the pipe run.

2. Excavate the hole or trench to the required dimensions to modular units, and any external inspection chamber(s) and / or silt trap(s).

3. Ensure that the base plan dimensions of the hole allows sufficient working space for the site operatives to manoeuvre the units and geotextile into position.

4. Ensure that the base of the excavation is flat and level, batter back the sides of the excavation to a safe angle, and ensure that the safe access is provided for the site operatives.

5. Remove any soft spots from the excavation and replace with compacted granular material.

6. a) **For Soakaway,** lay 100mm coarse sand bedding to the base of the excavation and level.
   b) **For Attenuation,** lay 100mm (minimum) compact solid level base (site concrete preferably).

7. a) **For Soakaway,** lay the geotextile, Geotex 225ff, over the base and up the sides of the excavation with minimum 200mm overlap joints between strips.
   b) **For Attenuation,** repeat procedure with Tuflex Geo Membrane.

8. Ensure there is a minimum 200mm over-run of geo-textile at the end of the modular unit.

9. Inspect geotextile for damage.
   Tuflex for Attenuation, ensuring integrity of all welded laps.

10. Assemble the module tanks to required dimensions.

    The illustrations show the correct relationships, orientation, and sequence of connection of each panel to form a basic full module tank (500 x 500 x depth).

11. Assemble the Pluvial Cube Modules in orientation as per drawing. L x W x D.

Installation Procedures

12. To receive the inlet pipe (and outlet/ inspection pipe if required). Insert tank connector and, using geotextile, form a wrap around apron of the tank connector spigot and secure using tape or jubilee clip. Ensure a minimum 50mm of spigot remains exposed.
For Attenuation tanks, all inlets and outlets are sealed with welded preformed pipe flanges.

13. **a) For Soakaway,** Continue with the geotextile encapsulation of the Pluvial Cube tank.
b) For Attenuation, use Tuflex Geo Membranes.

14. Fold the corners of the geotextile over-run at each end of the infiltration tank as shown, welting all corners. The same method applies for Tuflex Geo Membranes ensuring all corners are welted and folded (not cut).

15. **a) For Soakaway,** Complete the encapsulation by wrapping the geotextile horizontally around the tank and tape into position.
b) For Attenuation, use Tuflex Geo Membranes.

16. Connect inlet / outlet / vent pipe and inspection chambers using appropriate adaptors.

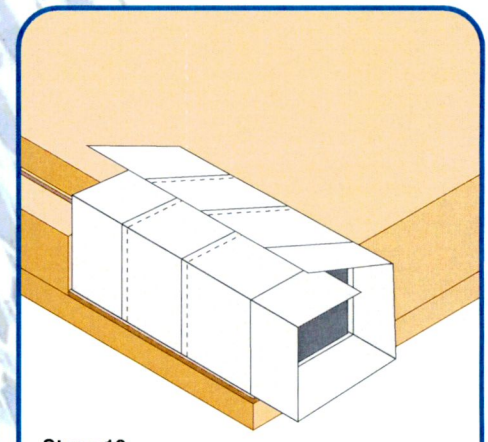
17. Backfill around excavation using type 1 or 2 sub base or selected granular material, and compact in layers of not less than 150mm. The first 500mm of any installation should be compacted by hand.

18. Use a coarse sand protection layer over the top of the Pluvial Cube tanks and geotextile and the back fill to the required depth using Type 1 or 2 sub base material. If the area is to be trafficked. Where the area is to be landscaped then as-dug material may be used provided sharp or large solid matter is removed.

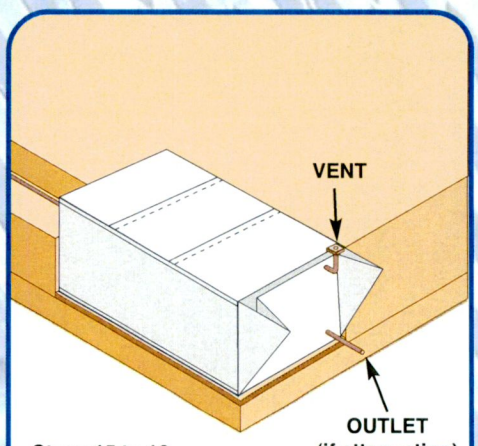
19. The area should then be compacted using suitable compaction equipment in accordance with specification for highway Works.

20. **For Attenuation tank,** steps 7-16 are also followed to encapsulate the Tuflex Geo Membranes lined tanks with Geotex 300 protection membrane prior to backfill.

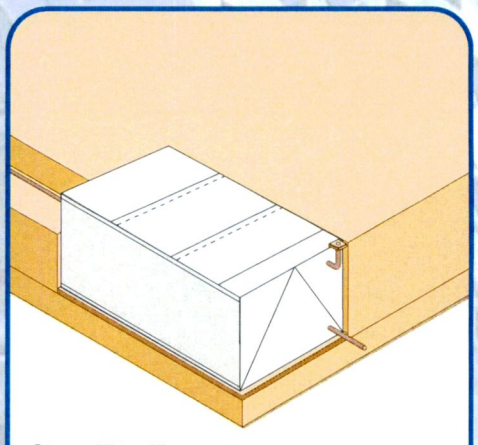
N.B. Please refer to full sequence of works data for more detailed instructions.



Steps 13



Steps 15 to 16



Steps 17 to 19

All products are manufactured to the highest quality, being subject to rigid quality control. However, the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. ESS Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products. All transactions are subject to our standard condition of sale, copies of which are available on request.

To find out more about these systems and products please contact us

Pluvial Cube

Environmental Sustainable Solutions Ltd

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tel: 01706 374416, fax: 01706 376785

email: technical@y-ess.com
http: www.y-ess.com

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

APPENDIX E. SURFACE WATER DESIGN CALCULATIONS

- Design Criteria;
- Area Summary;
- Network Design & Results Table;
- Simulation Criteria;
- Hydrobrake / Controls & Storage Design;
- Summary of Results.

Appendix E

Surface Water Design Calculations

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)	5	PIMP (%)	100
M5-60 (mm)	18.400	Add Flow / Climate Change (%)	20
Ratio R	0.270	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
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

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
S1.000	42.826	0.252	170.0	0.058	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	20.001	0.301	66.4	0.084	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	3.829	0.023	170.0	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	9.097	0.054	170.0	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	39.591	0.233	170.0	0.082	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	9.998	0.059	169.5	0.030	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	30.131	0.177	170.0	0.145	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	23.529	0.072	325.0	0.032	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	4.090	0.013	325.0	0.018	0.00	0.0	0.600	o	375	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)
S1.000	50.00	4.71	102.575	0.058	0.0	0.0	1.6	1.00	39.8	9.4
S1.001	50.00	4.92	102.323	0.142	0.0	0.0	3.8	1.61	63.9	23.1
S2.000	50.00	4.06	102.045	0.000	0.0	0.0	0.0	1.00	39.8	0.0
S1.002	50.00	5.07	102.022	0.150	0.0	0.0	4.1	1.00	39.8	24.4
S1.003	50.00	5.73	101.968	0.232	0.0	0.0	6.3	1.00	39.8	37.7
S3.000	50.00	4.17	102.720	0.030	0.0	0.0	0.8	1.00	39.8	4.8
S3.001	50.00	4.67	102.661	0.175	0.0	0.0	4.7	1.00	39.8	28.4
S1.004	50.00	6.13	101.586	0.439	0.0	0.0	11.9	1.00	110.4	71.3
S1.005	50.00	6.19	101.513	0.457	0.0	0.0	12.4	1.00	110.4	74.3

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
S1.006	44.362	0.136	325.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	1.451	0.004	325.0	0.026	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.000	17.746	0.180	98.6	0.026	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	1.738	0.010	173.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.009	6.875	0.040	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	9.527	0.056	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	20.552	0.121	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	39.609	0.233	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	9.303	0.055	170.0	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)
S1.006	50.00	6.93	101.501	0.457	0.0	0.0	12.4	1.00	110.4	74.3
S1.007	50.00	6.96	101.364	0.483	0.0	0.0	13.1	1.00	110.4	78.5
S4.000	50.00	4.22	100.257	0.026	0.0	0.0	0.7	1.32	52.4	4.3
S1.008	50.00	6.98	99.927	0.509	0.0	0.0	13.8	1.37	151.5	82.7
S1.009	50.00	4.11	99.917	0.000	4.6	0.0	0.8	1.00	39.8	4.6
S1.010	50.00	4.27	99.877	0.000	4.6	0.0	0.9	1.00	39.8	5.5
S1.011	50.00	4.62	99.821	0.000	4.6	0.0	0.9	1.00	39.8	5.5
S1.012	50.00	5.28	99.700	0.000	4.6	0.0	0.9	1.00	39.8	5.5
S1.013	50.00	5.43	99.467	0.000	4.6	0.0	0.9	1.00	39.8	5.5

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	As Zoned	Roof	100	0.363	0.363	0.363
		Landscape	30	0.001	0.000	0.011
	As Zoned	Roof	100	0.047	0.047	0.411
		Hardstand	100	0.003	0.003	0.058
1.001	As Zoned	Default	100	0.050	0.050	0.050
	As Zoned	Roof	100	0.067	0.067	0.117
		Landscape	30	0.000	0.000	0.084
2.000	-	-	100	0.000	0.000	0.000
1.002	As Zoned	Road	100	0.003	0.003	0.003
		Hardstand	100	0.004	0.004	0.007
		Landscape	30	0.005	0.001	0.008
1.003	As Zoned	Default	100	0.008	0.008	0.008
		Roof	100	0.000	0.000	0.008
		Road	100	0.019	0.019	0.027
		Hardstand	100	0.035	0.035	0.062
		Pervious Paving	70	0.026	0.018	0.079
		Landscape	30	0.008	0.002	0.082
3.000	As Zoned	Roof	100	0.000	0.000	0.000
		Hardstand	100	0.052	0.052	0.052
		Landscape	30	0.032	0.010	0.030
3.001	As Zoned	Hardstand	100	0.016	0.016	0.016
		Pervious Paving	70	0.000	0.000	0.016
		Landscape	30	0.081	0.024	0.041
	As Zoned	Roof	100	0.135	0.135	0.175
		Hardstand	100	0.001	0.001	0.176
		Landscape	30	0.000	0.000	0.068
	As Zoned	Roof	100	0.067	0.067	0.243
		Hardstand	100	0.003	0.003	0.246
		Landscape	30	0.000	0.000	0.145
1.004	As Zoned	Default	100	0.001	0.001	0.001
		Road	100	0.011	0.011	0.013
		Hardstand	100	0.014	0.014	0.027
		Pervious Paving	70	0.006	0.004	0.031
		Landscape	30	0.001	0.000	0.032
1.005	As Zoned	Road	100	0.021	0.021	0.021
		Hardstand	100	0.008	0.008	0.029
		Pervious Paving	70	0.017	0.012	0.041
		Landscape	30	0.155	0.047	0.018
1.006	-	-	100	0.000	0.000	0.000
1.007	As Zoned	Road	100	0.012	0.012	0.012
		Hardstand	100	0.005	0.005	0.016
		Pervious Paving	70	0.003	0.002	0.019
		Landscape	30	0.023	0.007	0.026
4.000	As Zoned	Default	100	0.002	0.002	0.002
		Road	100	0.009	0.009	0.011
		Hardstand	100	0.010	0.010	0.021
		Landscape	30	0.018	0.006	0.026
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.342	0.509	0.509

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.013	S	100.700	99.412	98.950	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S19, DS/PN: S1.008, Volume (m³): 4.1

Unit Reference	MD-SHE-0084-4600-2400-4600
Design Head (m)	2.400
Design Flow (l/s)	4.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	99.927
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	4.6
Flush-Flo™	0.368	3.3
Kick-Flo®	0.748	2.7
Mean Flow over Head Range	-	3.5

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	2.5	1.200	3.3	3.000	5.1	7.000	7.6
0.200	3.1	1.400	3.6	3.500	5.5	7.500	7.9
0.300	3.3	1.600	3.8	4.000	5.8	8.000	8.1
0.400	3.3	1.800	4.0	4.500	6.2	8.500	8.3
0.500	3.3	2.000	4.2	5.000	6.5	9.000	8.6
0.600	3.2	2.200	4.4	5.500	6.8	9.500	8.8
0.800	2.8	2.400	4.6	6.000	7.1		
1.000	3.1	2.600	4.8	6.500	7.3		

Storage Structures for Storm

Cellular Storage Manhole: S19, DS/PN: S1.008

Invert Level (m) 99.927 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	350.0	0.0	1.201	0.0	0.0
1.200	350.0	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	0.000
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	1
Number of Online Controls	1	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.270
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	18.400	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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)	100
Climate Change (%)	20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flow / Cap.	Pipe Flow (l/s)
S1.000	S1	15 minute 100 year Winter I+20%	104.000	103.322	0.522	0.57	21.6
S1.001	S2	15 minute 100 year Winter I+20%	103.900	103.276	0.727	0.78	45.1
S2.000	S3	15 minute 100 year Winter I+20%	103.470	103.132	0.862	0.54	14.7
S1.002	S4	15 minute 100 year Winter I+20%	103.470	103.135	0.888	1.41	45.8
S1.003	S8	15 minute 100 year Winter I+20%	103.400	103.054	0.861	1.64	61.9
S3.000	S9	15 minute 100 year Winter I+20%	103.470	103.348	0.403	0.39	12.9
S3.001	S10	15 minute 100 year Winter I+20%	103.470	103.334	0.448	1.88	69.7
S1.004	S11	15 minute 100 year Winter I+20%	103.200	102.412	0.451	1.47	138.8
S1.005	S12	15 minute 100 year Winter I+20%	102.400	102.260	0.372	1.79	142.6
S1.006	S13	15 minute 100 year Winter I+20%	102.400	102.126	0.250	1.38	140.0
S1.007	S14	15 minute 100 year Winter I+20%	102.300	101.854	0.115	1.61	144.4
S4.000	S18	960 minute 100 year Winter I+20%	102.100	100.982	0.500	0.02	0.9
S1.008	S19	960 minute 100 year Winter I+20%	102.300	100.982	0.680	0.04	3.3
S1.009	S20	7200 minute 100 year Winter I+20%	102.300	99.967	-0.175	0.11	3.3
S1.010	S21	7200 minute 100 year Winter I+20%	102.200	99.924	-0.177	0.10	3.3
S1.011	S22	7200 minute 100 year Winter I+20%	102.000	99.866	-0.179	0.09	3.3
S1.012	S23	7200 minute 100 year Winter I+20%	101.100	99.745	-0.180	0.09	3.3
S1.013	S24	7200 minute 100 year Winter I+20%	101.100	99.514	-0.177	0.10	3.3

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

PN	US/MH Name	Status
S1.000	S1	SURCHARGED
S1.001	S2	SURCHARGED
S2.000	S3	SURCHARGED
S1.002	S4	SURCHARGED
S1.003	S8	SURCHARGED
S3.000	S9	FLOOD RISK
S3.001	S10	FLOOD RISK
S1.004	S11	SURCHARGED
S1.005	S12	FLOOD RISK
S1.006	S13	FLOOD RISK
S1.007	S14	SURCHARGED
S4.000	S18	SURCHARGED
S1.008	S19	SURCHARGED
S1.009	S20	OK
S1.010	S21	OK
S1.011	S22	OK
S1.012	S23	OK
S1.013	S24	OK

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APPENDIX F. WASTEWATER DESIGN CALCULATIONS

- As per Irish Water Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03 (Revision 2 - 2020);
- Network Design Tables.

Appendix F

Wastewater Design Calculations

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)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
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
F1.000	42.465	0.212	200.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.001	19.874	0.099	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.002	6.180	0.031	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.003	39.605	0.198	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.004	5.458	0.027	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F2.000	8.044	0.040	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.005	2.070	0.010	207.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	11.705	0.059	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.007	16.946	0.085	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.008	57.584	0.288	199.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	15.120	0.076	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.010	18.328	0.092	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)
F1.000	102.575	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.001	102.363	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.002	102.264	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.003	102.233	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.004	102.035	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F2.000	101.975	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.005	100.251	0.000	0.0	0	0.0	0	0.00	0.80	31.7	0.0
F1.006	100.241	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.007	100.182	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.008	100.098	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.009	99.810	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.010	99.734	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0

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
F1.011	36.130	0.181	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.012	7.757	0.039	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)
F1.011	99.643	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0
F1.012	99.462	0.000	0.0	0	0.0	0	0.00	0.81	32.2	0.0

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APPENDIX G. PAST FLOOD EVENT LOCAL AREA SUMMARY REPORT

Appendix G

Past Flood Event Local Area Summary Report

Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: 22/3/2021 12:37

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

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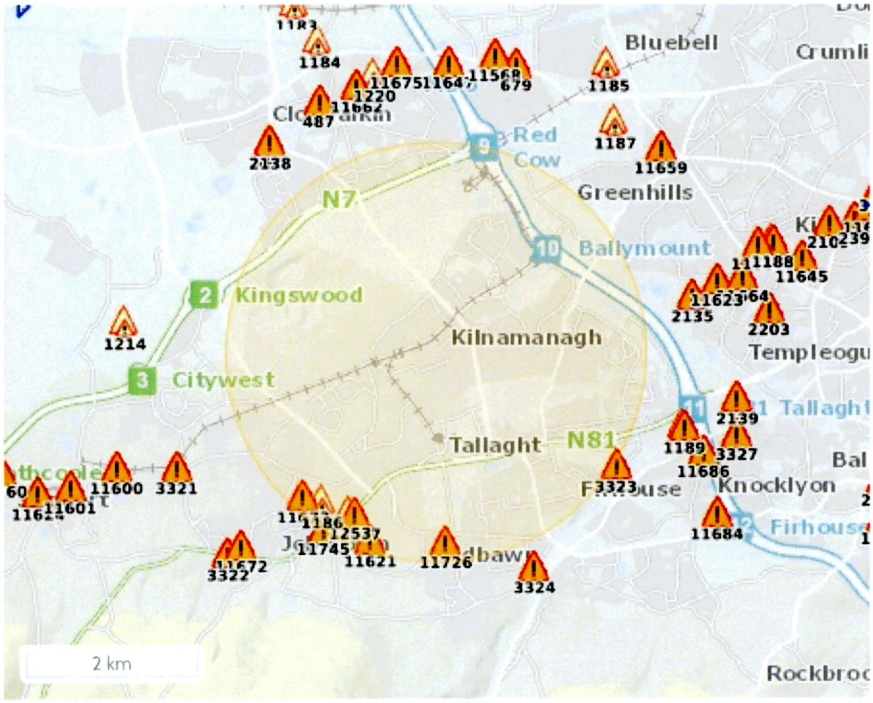

Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

7 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Killinarden Stream Jobstown recurring (ID-1186) **Additional Information:** Reports (2) Press Archive (1)	n/a	Approximate Point
2.	Killinarden Stream N81 Jobstown Recurring (ID-1253) **Additional Information:** Reports (1) Press Archive (1)	n/a	Approximate Point
3.	Flooding at Whitestown Way, Tallaght, Dublin 24 on 24th Oct 2011 (ID-11726) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Exact Point
4.	Flooding at Blessington Road, Tallaght, Dublin 24 on 1st May 2012 (ID-11745) **Additional Information:** Reports (1) Press Archive (0)	05/01/2012	Exact Point
5.	Flooding at Knockmore, Tallaght, Co. Dublin on 24th Oct 2011 (ID-11621) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Approximate Point
6.	Flooding at Tallaght Pass, N81, Dublin 24 on 24th Oct 2011 (ID-11657) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Exact Point

	Name (Flood_ID)	Start Date	Event Location
7.	Flooding at Bawnlea Crescent and Avenue, Tallaght, Co. Dublin on 24th Oct 2011 (ID-11673)	24/10/2011	Exact Point
	Additional Information: Reports (1) Press Archive (0)		

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APPENDIX H. FLUVIAL FLOOD RISK MAP

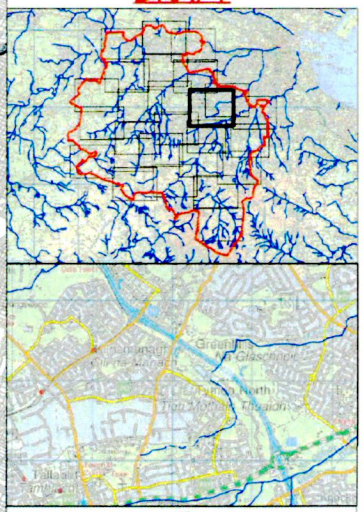
Appendix H

Fluvial Flood Risk Map

Legend

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

DRAFT



Comhairle Contae
Átha Cliath Theas
South Dublin County Council

Project Strategic Flood Risk Assessment

Title Fluvial Flood Zone Mapping

Figure MDW657_0010

RPS Consulting Engineers
West Pier Business Campus
Dun Laoghaire
Co. Dublin
Tel: +353 1 488 2900
Fax: +353 1 462 0814

Issue Details

Drawn:	BT	Project No.	MDW0657
Checked:	JH	File Ref	MDW0657QG0010F02
Approved:	JH		
Scale:	1:6000 @ A1	Drawing No.	Projection
Date:	14/01/2016	10 of 26	IG

Notes 1. The viewer of this map should refer to the SFRA Report and Disclaimer

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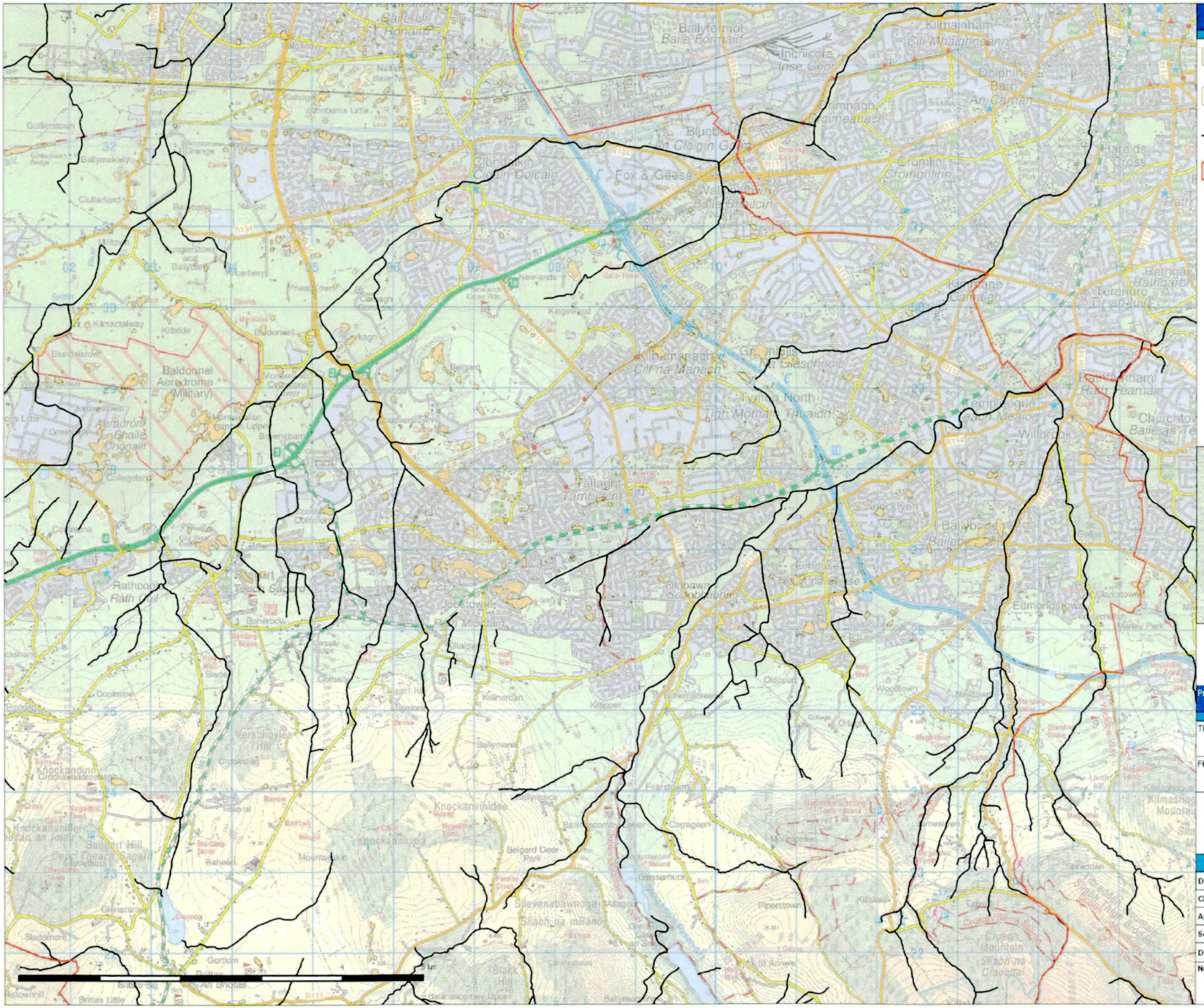
APPENDIX I. PLUVIAL FLOOD RISK MAP

Appendix I

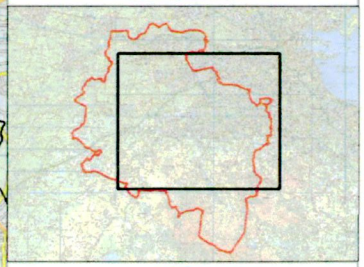
Pluvial Flood Risk Map



Legend

- Pluvial - 1% AEP Flood Extent (1 in100 chance in any given year)
- Pluvial - 0.1% AEP Flood Extent (1 in1000 chance in any given year)
- Watercourses
- County Boundary

DRAFT



Comhairle Contae Átha Cliath Theas
South Dublin County Council

Project: Strategic Flood Risk Assessment

Title: PFRA Indicative Pluvial Flood Zone Mapping

Figure: MDW0657_00029

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Issue Details

Drawn:	BT	Project No.	MDW0657
Checked:	JH	File Ref	MDW0657QG0012F02
Approved:	JH		
Scale:	1:20000	Drawing No.	Projection
Date:	14/01/2016	3 of 4	IG

Notes

1. The viewer of this map should refer to the SFRA Report and Disclaimer

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APPENDIX J. IRISH WATER CONFIRMATION OF FEASIBILITY

Appendix J

Irish Water Confirmation of Feasibility

Eoghan Healy
OCSC,
9 Prussia Street
Stoneybatter
Dublin 7
Co. Dublin
D07KT57

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

31 May 2022

Re: CDS22003324 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 139 Apartments, a 128 unit Residential Care Home and 2 Retail Units at 21 First Avenue, Cookstown, Dublin

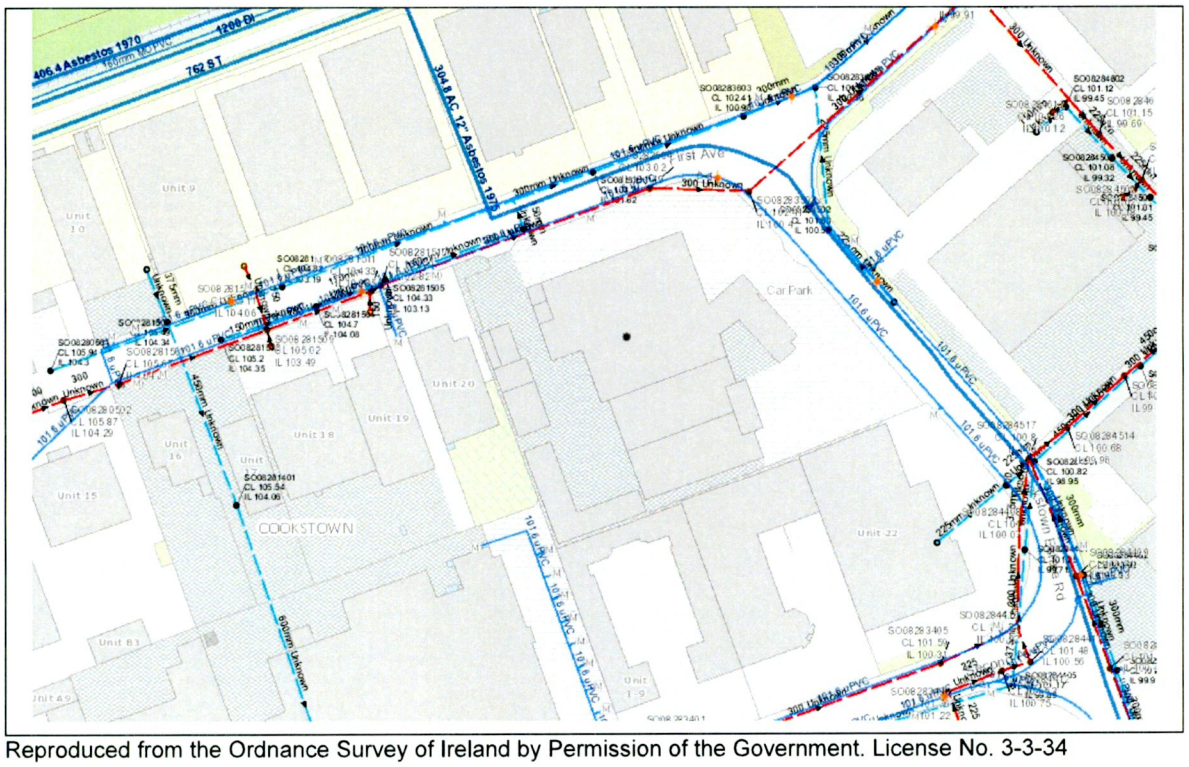
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at 21 First Avenue, Cookstown, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water 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 without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	A 150mm connection should made to the existing 12" AC water main on First Avenue A bulk meter will be required on this connection main.
Wastewater Connection	Peak discharge flow from the development site has to be limited to 5l/s due to downstream network constraints. This can be achieved with the provision of an on-site foul pumping station (PS) with a maximum capacity of 5l/s. The PS may be designed to be bypassed at a future date.

	The proposed Development indicates that Irish Water assets are present on the site. The Developer has to demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. Drawings (showing clearance distances, changing to ground levels) and Method Statements should be included in the Detailed Design of the Development. A wayleave in favour of Irish Water will be required over the assets that are not located within the Public Space. For design submissions and queries related to diversion/build near or over, please contact IW Diversion Team via email address diversions@water.ie
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 Kevin McManmon from the design team at kmcmanmon@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations