

Engineering Services Report

**COMMERCIAL EXTENSION
FOR TOYOTA IRELAND**

PROJECT NO. T260

29th JUNE 2021



OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers



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for

**Commercial extention,
at Toyota Liffey Valley,**

Co. Dublin.



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ENGINEERING SERVICES REPORT

29TH JUNE 2021

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APPENDICES

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ENGINEERING SERVICES REPORT

29TH June 2021

1 INTRODUCTION

1.1 APPOINTMENT

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Toyota Ireland*; to carry out the design of the civil engineering services associated with the proposed extension to the existing showroom and forecourt at Liffey Valley Motor Mall.

1.2 ADMINISTRATIVE JURISDICTION

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

- South Dublin County Council Development Plan 2016-2022;
- Greater Dublin Strategic Drainage Study (GSDSDS);
- 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 on the eastern edge of Ongar in Co. Dublin, as shown in *Figure 1.1 - Site Location*, and is immediately bound by:

- N4 slip road at junction 2 , to the north;
- Clayton Hotel, to the west;
- Vacant undeveloped lot, to the east;
- Car showroom, to the south.



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

1.4 EXISTING SITE OVERVIEW

The overall site area is **c.1.4-hectares**, and is zoned by South Dublin County Council for **MRC**. This zoning seeks to 'To protect, improve and provide for the future development of a Major Retail Centre'.

Approximately 1.0 ha of the site area consists of the existing Toyota Liffey Showroom and yard. The remaining approximately 0.4ha of the site consists of an undeveloped vacant lot.

The existing levels of the undeveloped section of the site are typically graded from south to north with typical high points along the southern boundary in the order of +61.00mOD. Levels along the northern boundary are typically in the order of +58.25mOD with a low point of approximately +58.00mOD in the north-eastern corner. This gives a typical gradient of approximately 3.3% across the site.

1.5 PROPOSED SITE DESCRIPTION

The development will consist of: the construction of a single storey (double height) extension (c.568 sq m) to the existing Motor Sales Outlet with servicing area which will comprise a car body shop and valet area; a single storey remote sales office (c.20 sq m); a covered bike shelter; ancillary petrol fill area; alterations to vehicle storage area; alterations and relocation of the existing vehicle display provision (resulting in total of 79 no. defined display spaces (59 no. additional) together with indicative display areas with capacity for c. 72 no. vehicles); a reduction in service spaces (resulting in total of 23 no. service spaces (3 no. less)) and relocation and additions to the existing staff car parking provision (resulting in total of 25 no. staff spaces (5 no. additional); and provision of a new pedestrian site entrance.

The development will also consist of signage (3 no. signs (4.45 sq m; 2.71 sq m; 0.58 sq m)); alterations and additions to the soft and hard landscaping, including the removal of existing fence, new boundary treatment and internal vehicle access gate, pedestrian paths and access, paving, tarmac and planting; relocation of vehicle sliding gate; an additional vehicle display podium; additional electric charging bays; new lighting; elevational changes to the existing building to facilitate the extension; an additional attenuation tank; all piped infrastructure and ducting; plant; and all associated site development and excavation works above and below ground.

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 report addresses the following services with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Flood Risk Assessment;
- Traffic and Transport.

This report should be read in conjunction with the following OCSC Civil Engineering design drawings:

T260-OCSC-XX-XX-DR-C-0110 – Swept Path Analysis – Large Car

T260-OCSC-XX-XX-DR-C-0111 – Swept Path Analysis – Fire Tender

T260-OCSC-XX-XX-DR-C-0112 – Swept Path Analysis – Small Oil Tanker

T260-OCSC-XX-XX-DR-C-0500 – Proposed Drainage Design Layout

T260-OCSC-XX-XX-DR-C-0510 – Proposed Drainage Surface Water Longsections

T260-OCSC-XX-XX-DR-C-0520 – Drainage Details Sheet 1 of 2

T260-OCSC-XX-XX-DR-C-0521 – Drainage Details Sheet 2 of 2

T260-OCSC-XX-XX-DR-C-0525 – Attenuation Tank Cross Sections

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 2016-2022;
- Greater Dublin Strategic Drainage Study (GSDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDR COP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03;
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03;
- 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;
- Design Manual for Urban roads and Streets;
- South Dublin County Council and Irish Water Drainage and Watermain Records.

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

3 SURFACE WATER DRAINAGE

3.1 OVERVIEW

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

New developments 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 10% increase in rainfall intensity*. 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.

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.

3.2 EXISTING SITE DRAINAGE

3.2.1 EXISTING SITE CATCHMENT AREAS

As detailed in *Section 1.4*, the existing c.1.4-hectare site consists of developed and undeveloped land. The developed area of the site is 100% hardstanding, comprising of a building covering approximately 2,400m², the remaining area of the site is hardstanding yard used for vehicle storage. The undeveloped c0.4ha section of the site is brownfield in nature. Refer to Figure 3.1 for aerial image of the proposed site, for context.



Figure 3.1 - Existing Site, Aerial Overview (Google Earth)

3.2.2 EXISTING SURFACE WATER DRAINAGE INFRASTRUCTURE

There is an existing 750mm \emptyset public surface water sewer along the northern boundary of the site. Levels indicate that this sewer falls from west to east along the N4.

The vehicle storage yard contains an existing surface water network which was originally designed to accommodate run-off from rainfall events up to an including the 1 in 100-year event. The hardstanding areas are drained using filter drains along the boundary, ground levels on site have been designed to route runoff towards these filter drains. Perforated pipes within this filter drain range in diameter from 225mm to 300mm. Run-off from the network has been limited to 2.195 l/s. This is achieved through the provision of a flow control in

the final manhole prior to discharge. A fuel separator is also included in the existing network prior to discharging to the public sewer.

3.2.3 EXISTING SITE RAINFALL RUNOFF

The existing site currently drains naturally to the site boundaries. Refer to *Section 1.4* for overview details of the existing site topography.

The existing site drainage as detailed above includes a flow control which limits discharge to 2.195 l/s.

Using the ICPSuDS Input, (Flood Studies Report (FSR)) Method, the rainfall runoff discharging from the greenfield site area that is to be developed in its existing condition has been estimated at $QBAR_{RURAL} = 1.3 \text{ l/s}$ (3.16 l/s/ha). Refer to *Figure 3.2* 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).

Due to the size of an orifice that would be required to limit the discharge to the greenfield equivalent, the discharge from the undeveloped site has been limited **2.0l/s**. This flow rate has been provided in order to reduce the risk of blockages within the flow control device. Total discharge from the site is limited to 4.195 l/s (2.99 l/s/ha). This is from the existing 2.195l/s and the 2l/s from the proposed extension of the vehicle parking area. The existing flow control along with the existing network is to be maintained.

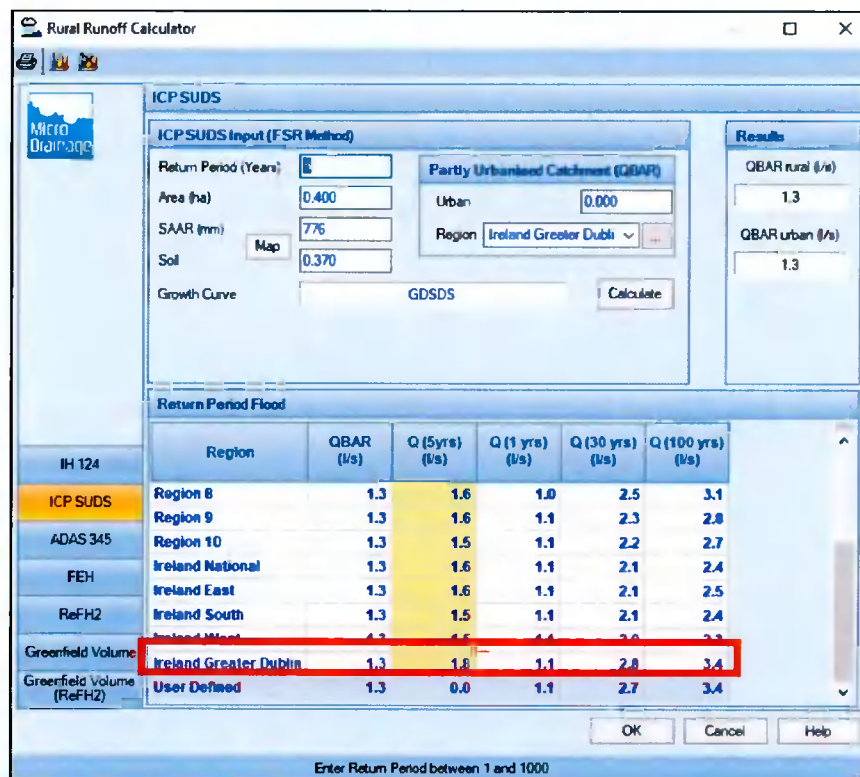


Figure 3.2 - Existing Site Runoff Calculator Results (MicroDrainage Excerpt)

3.3 PROPOSED SURFACE WATER DRAINAGE DESIGN STRATEGY

3.3.1 PROPOSED SURFACE WATER STRATEGY OVERVIEW

It is proposed to provide surface water network to serve the development in accordance with the guidelines in Section 2 above.

3.3.2 PROPOSED SURFACE WATER DESIGN CRITERIA

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in Section 2. Rainfall design data, such as return period rainfall depths for sliding durations and the standard annual average rainfall (SAAR) value were sourced from Met Éireann.

Figure 3.3 – Surface Water Design Criteria (MicroDrainage Excerpt)

As indicated in *Figure 3.3*, the proposed network has been designed to allow for an additional 10% increase in rainfall intensity, to allow for Climate Change, in accordance with the South Dublin County Council Development Plan and the GSDSDS.

3.3.3 PROPOSED SURFACE WATER CATCHMENT AREAS

As previously outlined the proposed development is to consist of the extension of the service area of the car show room along with the provision of additional vehicle parking to the east of the site. The extension of the service area covers an area of approximately 550m². This area is within the existing vehicle yard and will remain as 100% impermeable.

The proposed vehicle parking area is to consist of approximately 2,800m² hardstanding area along with approximately 750m² pervious paving. All hard standing areas have been considered as 100% impermeable.

A flow control has been provided within the final manhole to prior to discharging to the existing surface water network to limit discharge to the green field runoff rate.

For the purpose of the surface water network design simulation, all external hard standing areas (roads, pavement, driveways and roofs) 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.

3.3.4 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 25km² 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 surface water network at the north eastern corner of the site, with the appropriate measures of attenuation provided.

Refer to *Figure 3.2* for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area (c.0.4-hectares), which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of 1.3 l/s (3.25 l/s/ha) along with the calculated runoff for varying Average Recurrence Intervals (ARI). As noted in section 3.2.3 above the discharge from the new network is to be restricted to **2.0l/s**, this has been provided due to the risk of blockage to occurring within the flow control if a smaller orifice is to be provided.

3.3.5 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 roofs and paved areas to the outfall manhole, which will discharge a controlled flow rate to the existing surface water sewer at the northern-eastern boundary of the site.

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 GSDS and the GDR COP 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, with a projected climate change allowance of 10% increase in rainfall intensity.

3.3.6 EXTENSION ROOF DRAINAGE

The existing surface water network around the building is to be maintained. It is proposed to provide connections from the new service bay downpipes to this existing network. The existing area is currently 100% impermeable asphalt and will remain 100% impermeable with the new roof area. Therefore there will be no requirement to modify the existing attenuation and flow control.

3.3.7 PROPOSED SURFACE WATER ATTENUATION

Temporary underground storage is to be provided towards the northern end of the vehicle storage area in order to restrict the run-off to the greenfield equivalent rate, this storage has been designed to temporarily store run-off from events up to an including the 1% AEP event with an increase of 10% in rainfall intensity.

Initial interim attenuation is provided in the base course of the proposed pervious paving in car parking areas to reduce the flow rate & improve water quality prior to entering the main surface water network. The pervious paving has been designed to temporary store and treat runoff for the developments roads as well as the car parking itself. This will aid in increasing the quality of the water entering the developments surface water network. Perforated pipes are to be provided within the pervious paving base course, which will connect to the main surface water drainage network. A total of 66m³ temporary storage is provided within the base course of the pervious paving.

Filter drains are to be provided in order to convey the run-off from the hardstanding area within the vehicle parking area. These filter drains are to be located along the northern and eastern boundaries of the site. Filter drains will aid in increasing the quality of the run-off while also providing temporary

storage within the stone. These filter drains are to contain a perforated pipe which are to connect to the main attenuation.

The development's primary attenuation has been provided in order to limit the runoff rates from the proposed development, and is to be provided in the form of a proprietary product, Y-ESS – Pluvial Cube or similar approved, under the vehicle storage area, towards the north of the site. This temporary storage has been designed in order to store excess runoff from rainfall events up to and including the 1 in 100 ARI allowing for a 10% increase for climate change. A total of 170m³ temporary storage is to be provided. This product has sufficient strength to be utilised under trafficked areas and sufficient cover is to be provided to the units. The discharge from this area of the development is to be restricted by a flow control device in the final manhole, prior to discharging to the existing surface water infrastructure, which limits discharge from the whole site to the Greenfield runoff rate (Q_{bar}) of 2.0 l/s (5.0/s/ha).

An additional 20m³ interception storage is to be provided below the developments primary attenuation. This is to treat the rainfall runoff by allowing the first 5mm rainfall on the development to drain naturally. This runoff will not contribute to the volume of discharge from the development to the existing surface water network. The provision of this interception storage will aid in improving the quality of the runoff being allowed to infiltrate into the ground water Refer to *Section 3.4* below for calculation of required interception storage.

A total of **256m³** temporary storage is to be provided comprising of proprietary attenuation system (170 m³), interception storage (20m³), pervious paving (66m³), as described above.

3.4 SPECIFIC SUDS MEASURES PROPOSED

The proposed development is to contain the following measures of Sustainable Drainage Systems:

Limiting discharge. The design outflow from the overall development (c. 0.40-ha development catchment) is to be restricted to a maximum total

outflow rate of **2.0 l/s** (5.0 l/s/ha), which is the equivalent Greenfield runoff. Refer to *Section 3.2.3* for further details.

Pervious Paving is to be provided within the car parking spaces towards the south of the vehicle storage area. Pervious paving will have 300mm drainage stone below the surface finish. Perforated pipes will be provided within the layer of drainage stone in order to allow excess surface water to enter the main network. A geotextile is to be provided below the stone of all pervious paving in order to allow for interception below, reducing the volume of water entering the main surface water network. This will attenuate rainfall runoff from the road and parking area prior to entering the main surface water drainage network, while also providing at source treatment of rainfall. 66m³ temporary storage is to be provided within the base course of the pervious paving.

Interception storage is to be provided below the developments primary attenuation. This is to be provided to temporarily store and treat the first 5mm rainfall on the development. This interception storage is to be allowed to drain naturally, reducing the volume of water contributing to the main surface water network with the development. A total of 20m³ interception storage is to be provided in open graded crushed rock below the developments primary attenuation.

The interception storage volume requirement was calculated based on the hardstanding area of the proposed development, using 4000m² hard standing area and is designed to intercept the first 5mm rainfall on the proposed development.

4000m² x 0.005m = 20.0m³ interception storage required.

Attenuation Storage will be provided underground, using a proprietary product, Y-ESS – Pluvial Cube or similar approved to temporarily store the 1 in 100 year ARI including a 10% allowance for climate change, which is to be provided below the vehicle storage area towards the north of the site. A total of 170m³ temporary storage is to be provided in the underground attenuation.

A total of **256m³** temporary storage is to be provided comprising of the proprietary system (170 m³), pervious paving (66 m³), and interception storage (20m³). Refer to *Section 3.3.6* for details of proposed attenuation.

Filter Drains are to be provided along the northern and eastern boundary of the development. Hardstanding areas will be allowed to drain into these filter drains which will act as over the edge drainage. These will provide a small amount of attenuation along with providing treatment of runoff through the provision of drainage stone, these filter drains will increase the time of concentration for the runoff entering the surface water network. The proposed filter drains will convey runoff from the hardstanding areas to the main attenuation through the use of perforated pipes.

Water Quality of the surface water, discharging from site, is to be improved with the following provisions:

- Pervious Paving in parking areas, as described above;
- Filter drains to act as over the edge drainage;
- Interception storage below the attenuation;
- Silt traps to be provided on manholes immediately upstream of attenuation systems, 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.

3.5 TAKING IN CHARGE

It is proposed that all new surface water infrastructure, **is not** to be offered to be taken in charge by South Dublin County Council.

3.6 MAINTENANCE

Road gullies, flow control devices and attenuation systems, should be maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

3.7 SURFACE WATER IMPACT ASSESSMENT

The design criteria for the drainage system are established in GSDSDS-RDP Volume 2, Section 6.3.4 and explained further in GSDSDS-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.

3.8 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 3.5*, 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) Pervious Paving to parking areas;
- b) Filter Drains, as over the edge drainage ;
- c) Infiltration;
- d) Silt-traps prior to attenuation storage area;
- e) Fuel separator prior to discharge from the development.

3.9 CRITERION 2 – RIVER REGIME PROTECTION

Surface water discharge from the overall development will be restricted to an equivalent rural runoff rate of **2.0 l/s** (5.0 l/s/ha), as per the South Dublin County Council Development Plan and the GSDSDS. Refer to *Section 3.2.3* for further details.

This will be achieved with the provision of a flow restrictor (Hydro-Brake Optimum, by Hydro-International, or similar approved) upstream of the outfall manhole.

Refer also to **Appendix B** for results QBAR_{RURAL} calculation results, which have been carried out using the ICP SUDS Method on MicroDrainage software.

3.10 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 *GSDSDS 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).

3.10.1 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 10% 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 (incl. 10% climate change allowance) using the *MicroDrainage Network Design Software*, by Innovyze Inc. Refer to **Appendix C** 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.

3.10.2 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 10% increase in rainfall intensity for climate change) without flooding.

The performance of the proposed drainage system in 100-year return period storm events (incl. 10% climate change allowance) has been analysed – Refer **Appendix C** for calculations. The analyses show that no flooding will occur in 100-year return period storm events.

3.10.3 SUB-CRITERION 3.3

Details of the flood risk assessment associated with the proposed development is outlined in *Section 4* 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 10% climate change allowance).

3.10.4 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 10% 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 (incl. 10% climate change allowance) has been analysed – Refer **Appendix C** 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 4* 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 10% climate change allowance).

3.11 CRITERION 4 – RIVER FLOOD PROTECTION

As outlined in *Section 3.10* (Criterion 2), the surface water runoff from the development's catchment will be limited to a maximum of **2.0 l/s** (5.0 l/s/ha).

Refer to *Section 3.2.4* and *Section 3.4* for further details on the limiting discharge rates. The *GSDS 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 10% 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 C** 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 has been designed in accordance with the Irish Water's Code of Practice for Wastewater Infrastructure. This sewer is to be provided to service the proposed extension of service bays

4.2 EXISTING WASTEWATER INFRASTRUCTURE

The site contains an existing wastewater network which serves the existing building, this network was installed as part of the original development and is comprised of 150mm Ø pipes which connect at a single location to an existing 225mm Ø wastewater sewer which bounds the site to the north.

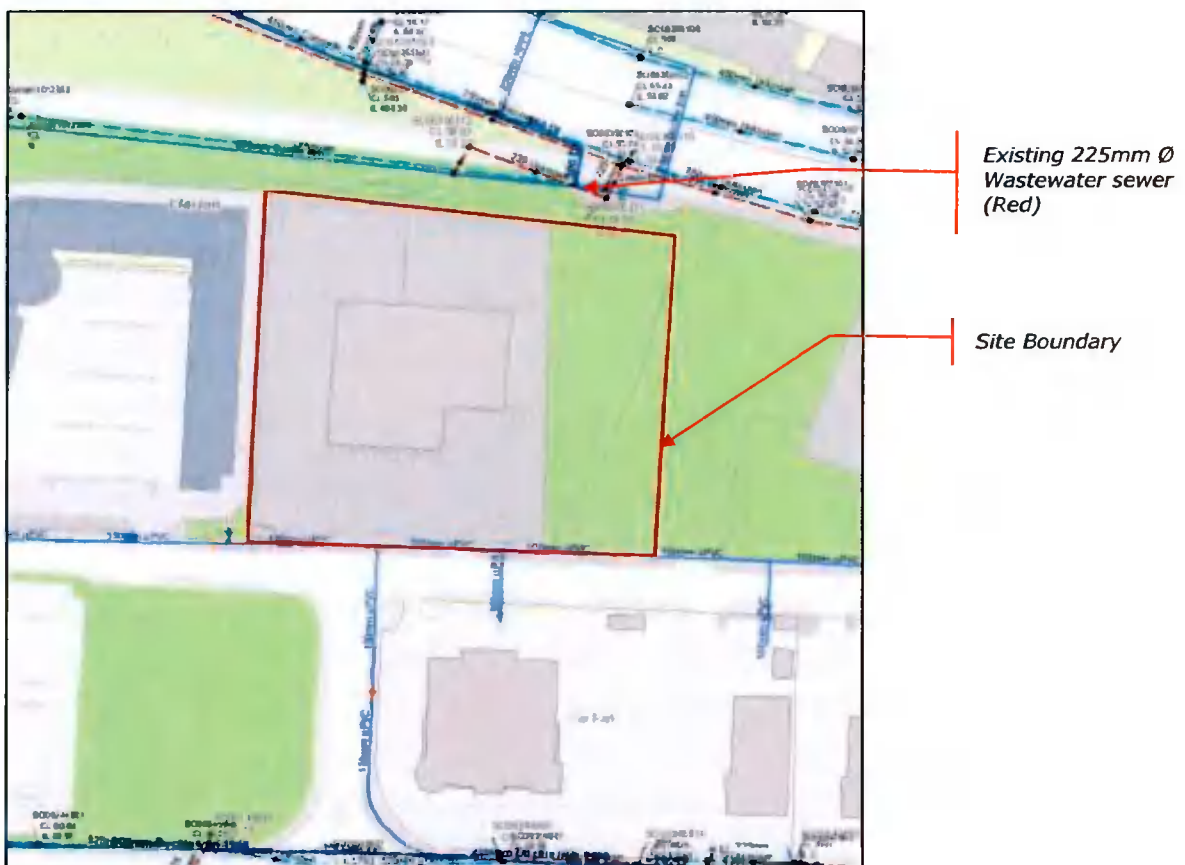


Figure 4.1 – Existing Services (excerpt from www.floodmaps.ie)

Refer to **Appendix A** for existing services records.

4.3 PROPOSED WASTEWATER DRAINAGE STRATEGY

It is proposed to separate the wastewater and surface water networks which are to serve the proposed development. A new wastewater sewer is to be installed within the site to serve the proposed extension. A class 1 fuel separator is to be provided on this sewer to aid in removing gross pollutants, prior to connecting to the existing wastewater sewer on site. The new wastewater sewer is to consist of 150mm Ø pipes.

In order to serve the proposed fuel fill area a connection is to be provided to the existing wastewater sewer. This wastewater sewer contains a class 1 fuel separator which is to be utilised by this new connection.

Refer to detailed drawing **T260-OCSC-XX-XX-DR-C-0500** for the proposed drainage layout.

5 FLOOD RISK ASSESSMENT

This section assesses the potential flood risks associated with the proposed development, as per the regulations and guidelines outlined in *Section 2*.

The risk of a flood event is a function of the probability of occurrence in any given year. Traditionally, this has been expressed as a return period (e.g. 1-in-100-year return period). However, this has led to misconceptions about the likelihood of repeat occurrences. A less ambiguous expression of probability is the *Annual Exceedance Probability (AEP)*, which may be defined as the probability of a flood event being exceeded in any given year. A 1-in-100-year return period flood event is therefore expressed as a 1% AEP flood event. Likewise, a 1-in-1year return period flood event is expressed as a 100% AEP flood event.

The *Greater Dublin Strategic Drainage Study (GSDSDS)*, published by the Local Authorities in the Greater Dublin Region, and *The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM)* set out the best practice standards for flood risk in Ireland. These are summarised in *Table 1 - Summary Level of Service*, below.

Flooding Source	Drainage	River	Tidal/Coastal
Residential	1% AEP	0.1% AEP	0.1% AEP
Commercial	1% AEP	1% AEP	0.5% AEP
Water-compatible	-	>1% AEP	>0.5% AEP

Table 1 - Summary Level of Service

In addition, the *GSDSDS* requires that ground floor levels of houses be provided with a 500mm freeboard over the 1% AEP fluvial flood level.

5.4 CLIMATE CHANGE

Both the *GSDSDS* and *PSFRM* Guidelines require that account be taken of the effects of climate change over the design life of a development, typically 100 years. Design parameters to take account of climate change were established in the *GSDSDS* and revised following later studies (as advised by Dublin City Council). These parameters are set out in **Table 2 - Climate Change - Impact on Design Parameters**, below.

Design Category	Impact of Climate Change
Drainage	10% increase in rainfall
Fluvial (River)	20% increase in flood flow
Tidal/Coastal	Sea level rise of 500mm

Table 2 - Climate Change - Impact on Design Parameters

5.5 FLOOD RISK ZONES

The *PSFRM Guidelines* adopt a sequential approach to managing flood risk by reducing exposure to flooding through land-use planning. The approach adopted by the *PSFRM Guidelines* establishes three zones (*PSFRM Guidelines paragraph 2.23*) on a sliding scale of flood risk – refer to **Table 3 - Flood Risk Zones**, below.

Zone A	<p>High Probability of Flooding</p> <p>Where the annual probability of flooding is: greater than 1% for fluvial flooding or greater than 0.5% for coastal flooding</p>
Zone B	<p>Moderate Probability of Flooding</p> <p>Where the annual probability of flooding is: between 0.1% and 1% for fluvial flooding or between 0.1% and 0.5% for coastal flooding</p>

Zone C	Low Probability of Flooding Where the annual probability of flooding is: less than 0.1% for fluvial flooding and less than 0.1% for coastal flooding
-------------------	--

Table 3 - Flood Risk Zones

Flood risk zones are determined on the basis of the probability of river and coastal flooding only (*PSFRM Guidelines paragraph 2.24*). Other sources of flooding (such as groundwater, infrastructure and pluvial) do not affect the delineation of flood risk zones. These other sources of flooding should be considered and mitigated in design. Flood risk zones are determined on the basis of the current flood risk, i.e. without the inclusion of climate change factors (*PSFRM Guidelines paragraph 2.24*).

5.6 DEVELOPMENT VULNERABILITY

The *PSFRM Guidelines* classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in *Table 3.1* of the *PSFRM Guidelines*, which is reproduced in **Table 4 - Development Vulnerability Class**, below.

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).

Table 4 - Development Vulnerability Class

The proposed development is for the extension to a commercial building and vehicle storage area, therefore, the proposed development is considered **Less Vulnerable Development**.

5.7 DEVELOPMENT 'APPROPRIATENESS'

The *PSFRM Guidelines* define the zones in which each class of development is appropriate – this is summarised in *Table 5 - "Appropriateness" Matrix*, below. The *PSFRM Guidelines* recognises that flood risks should not be the only deciding factor in zoning for development. They also recognise that circumstances will exist where development of a site within a floodplain is

desirable; in order to achieve compact and sustainable development of the core of urban settlements. In order to allow consideration of such development, the *PSFRM Guidelines* provide a **Justification Test**, which establishes the criteria under which desirable development of a site in 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

Table 5 - "Appropriateness" Matrix

The proposed residential development is considered a **Less Vulnerable Development**, and in Flood Zone C and therefore does not require a justification test to be carried out.

5.8 HISTORICAL FLOODING

The OPW collates reports of flooding, these reports are available at the OPW website www.floodinfo.ie

There is one reported incident of flooding in the vicinity of the site. The flooding occurred in 2002. The flood reported covers a large area within the Fingal county council area, with no specific cause of flooding identified. There is no reported incidence of flooding within the site

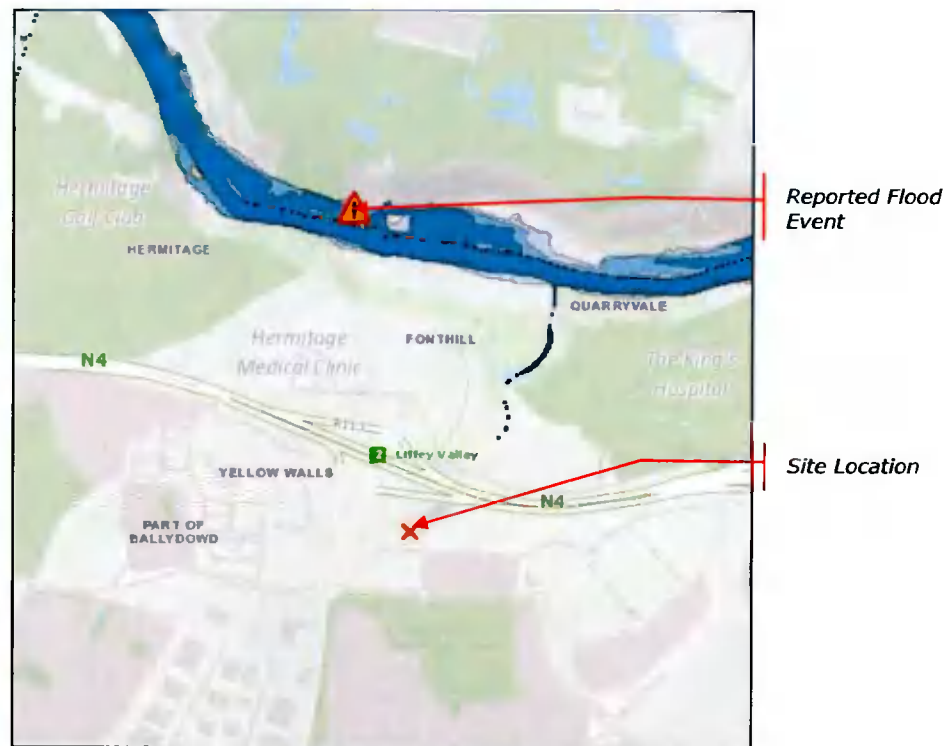


Figure 5.1 - National Flood Hazard Mapping (excerpt from www.floodmaps.ie)

5.9 FLUVIAL FLOODING

The proposed development is located approximately 600m south of the River Liffey. A review of the OPWs Catchment Flood Risk Assessment Mapping (CFRAM) indicates that the proposed development is located outside of Flood Zone A and Flood Zone B of the predicted 1% AEP flood extent of the River Liffey. The excerpt below shows the extent of the flooding modelled for the River Liffey.



Figure 5.2 - River Liffey CFRAM extent (excerpt from www.floodinfo.ie)

Therefore, the proposed development is not considered at risk of fluvial flooding from the River Liffey and is deemed acceptable for use.

5.10 COASTAL FLOODING

The proposed development is not at risk of coastal flooding, due to the location of the site which is approximately 15km from the eastern coast.

5.11 PLUVIAL FLOODING

A review of the OPW's online pluvial flood risk mapping does not indicate pluvial flooding within the site

As detailed within *Section 3* of this report, the proposed surface water drainage network of this development has been designed to ensure that no flooding is experienced during design rainfall events up to and including the 1% AEP including an additional 10% intensity for climate change projections.

The above ensures that pluvial flooding is not considered a significant risk to the proposed the development, nor as a result of the proposed development.

6 Traffic and Transport

6.1 SITE ACCESSIBILITY

BUS

There are a number of Dublin Bus routes serving stops in the local area within an approximate 15 minute walk from the development site, as outlined in the figure below.

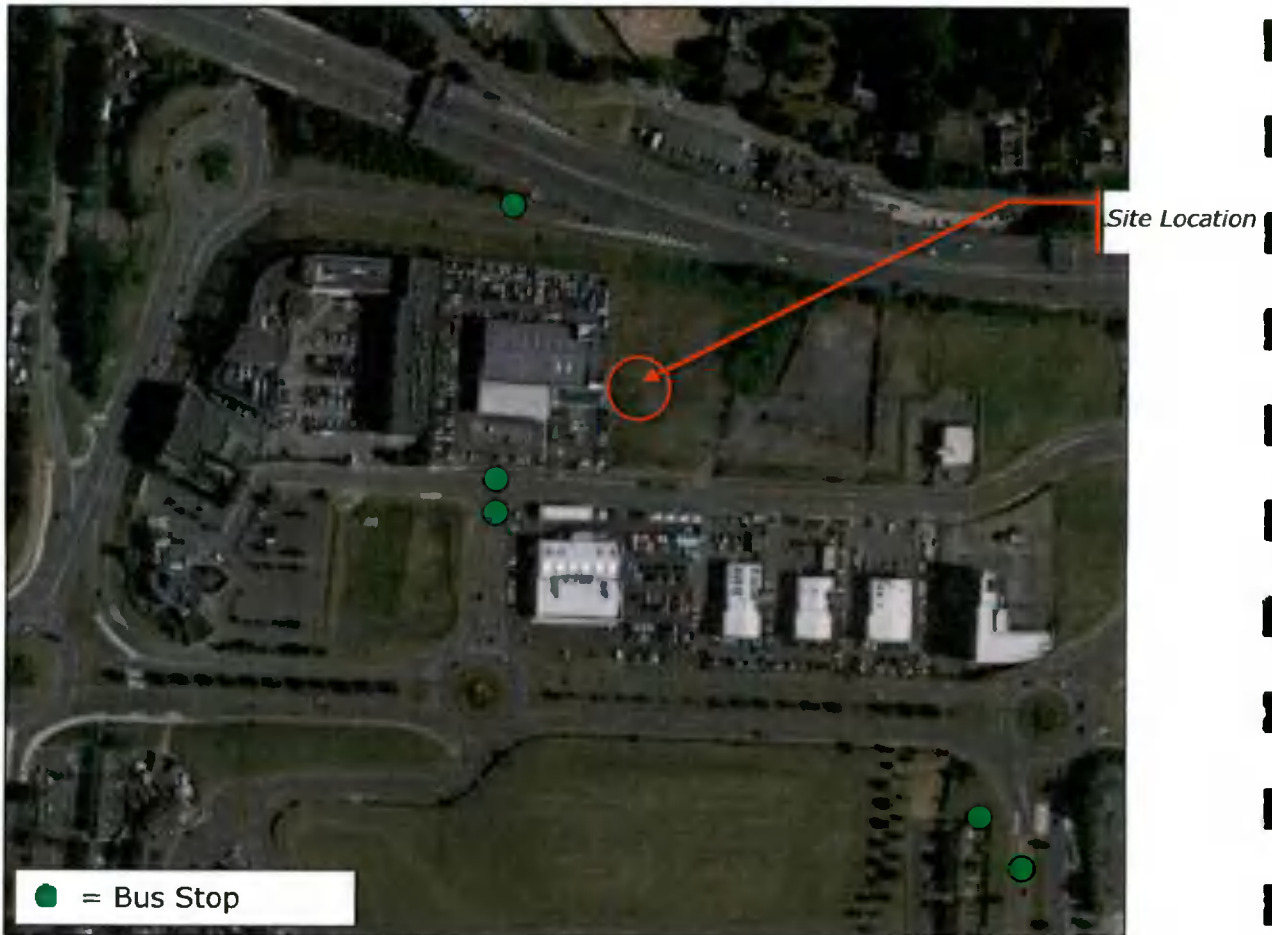


Figure 6.1: Local Bus Facilities

As can be seen, the nearest bus stop is located directly adjacent to the development site. The bus services located within 15 minutes walking from the proposed development site are summarised following.

Route	Description	Service Frequency
25	Merrion Square - Lucan	60 mins
25a	Merrion Square - Lucan	30 mins
25b	Merrion Square - Adamstown Rail Station	30 mins
66 / 67	Merrion Square - Maynooth	30 mins
66a /b	Merrion Square - Leixlip	60 mins
767	Dublin Airport - Maynooth	30 mins

Table 6: Local Bus Services

Relative to the development site, the existing cycle facilities are shown following.

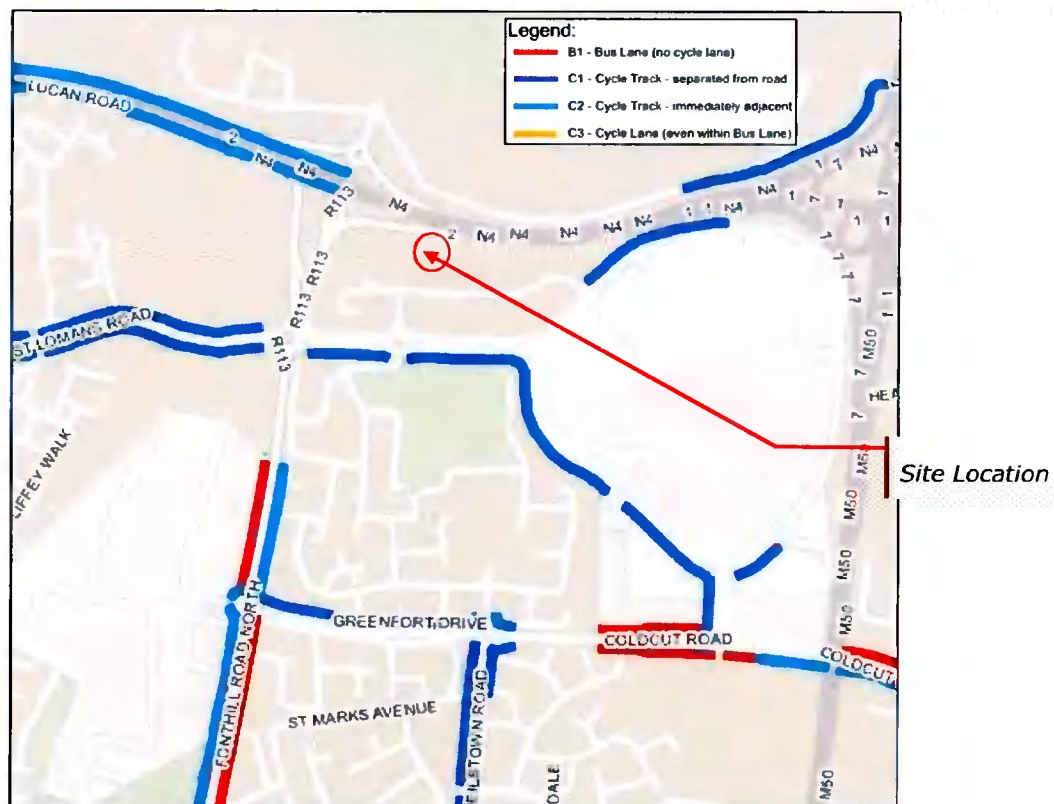


Figure 6.2: Local Cycle Infrastructure

There are segregated cycle lanes along a number of the roads locally including many of the key arteries such as the N4

In term of pedestrian access, the existing footpaths locally are in good condition with public lighting provided and dedicated crossing facilities at the major junctions locally including at the Fonthill Road/ St. Loman's Road roundabout and on the internal access road south of the development site



Figure 6.3: Existing Zebra Crossing South of Development Site

6.2 PARKING PROVISION

The proposed development will see the building extension located on existing hardstanding space in the north east corner of the site which facilitated storage and display of vehicles for sale as well as staff parking. This parking will be relocated to the expanded eastern portion of the site with the majority of this space again dedicated to storage and display of vehicles for sale. Relative to the existing provision, the proposals will result in the following:

- Increase in staff parking spaces by 5 no.;
- Decrease in services bays by 3 no.;
- Increase in spaces for display of vehicles for sale by 59 no.

The South Dublin County Council Development Plan 2016-2022 sets out standards for the provision of parking at various types of development in Table 11.23. However, car show rooms are not specified in this table with the Plan stating:

"For any commercial use not specified within Table 11.23 the default parking rate will be calculated based on those of a comparable use and/or determined as part of Transport and Traffic Assessment".

The increased spaces for storage and display of vehicles for sale would not be considered car parking in the traditional sense and would be more appropriately classed as storage space for retail goods which are delivered in bulk. Similarly, the service bays are directly linked to the commercial activity

at the development, facilitating storage and working on cars that are being serviced at the development.

On this basis, the effective increase in car parking is limited to an additional 5 no. staff parking spaces which is considered proportional to the increase in the size and activity at the development as a result of the proposed works. Thus, the proposed car parking provision is considered to be in line with the Development Plan standards.

With respect to cycle parking, the Development Plan sets out standards for the provision of same in Table 11.22. Again, a car show room use is not specified in that table. As a result, a proportional increase of 2 no spaces in addition to the existing 14 no. spaces is proposed which is considered appropriate.

6.3 POTENTIAL IMPACT OF DEVELOPMENT CONSTRUCTION

Relative to the operation stage, the construction period will be temporary in nature. Construction traffic is expected to consist of the following categories:

- Private vehicles owned and driven by site construction staff and by full time site supervisory staff and occasional professional supervisory staff i.e. design team members and supervisory staff from utility companies;
- Materials delivery and removal vehicles.

It is difficult to assess the exact quantum of traffic that will be generated during the construction period as it will vary throughout the construction process as different activities have different associated transportation needs. However, the following points are noted with regard to construction traffic:

- In general, the construction day will begin and end outside of peak travel hours. As a result, the majority of workers travelling to and from the site will arrive before the a.m. peak hour and depart after the p.m. peak hour;
- No on-site parking will be provided for use by critical staff only with the remainder of staff encouraged to travel by the numerous public transport options serving the locality;
- Adequate on-site compounding will be provided to prevent any potential overflow onto the local transport network;
- The potential for construction staff to be brought to the site in vans/minibuses will be investigated;
- Excavation and materials delivery vehicles travelling to and from the site will be spread across the course of the working day meaning the number of HGV's travelling during the peak hours will be relatively low.

Overall, it is expected that the level of traffic generated by the construction works will be extremely low given the relatively simple nature of the project and will generally occur outside of peak traffic times making any associated impact negligible.

Nevertheless, prior to construction, it is expected that a Construction Management Plan will be submitted by the appointed contractor to the Local Authority for agreement prior to the commencement of construction, giving details on the following:

- Daily and weekly working hours;
- Agreed haul routes for incoming materials;
- Licensed hauliers to be used;
- Disposal sites;
- Travel arrangements for construction personnel;
- Appropriate on-site parking arrangements for construction personnel to prevent overspill parking on the local road network;
- Temporary construction entrances to be provided;
- Wheel wash facilities if required;
- Road cleaning and sweeping measures to be put in place if required;
- Temporary construction signage to be put in place and maintained;
- Any proposed traffic management measures such as temporary traffic lights and signage on any public roads.

6.4 POTENTIAL IMPACT OF DEVELOPMENT OPERATION

The nature of the proposed development will see a minor increase in capacity at the existing development, providing increased space for storage of vehicles for sale at the existing car showroom and a slight relatively minor of the existing maintenance activity.

The *Traffic and Transport Assessment Guidelines* (Transport Infrastructure Ireland, 2014) provides guidance as to when the potential impact of a development require further detailed assessment and analysis.

Section 2 of TII Guidelines document highlights the thresholds where a Traffic & Transport Assessment is required, the primary thresholds are set out in Table 2.1 of the guidance, and are as follows:

- Traffic to and from the development exceeds 10% of the traffic flow on the adjoining road;
- Traffic to and from the development exceeds 5% of the traffic flow on the adjoining road where congestion exists or the location is sensitive;
- Residential development in excess of 200 dwellings;
- Retail and leisure development in excess of 1,000m²;
- Office, education and hospital development in excess of 2,500m²;
- Industrial development in excess of 5,000m²;
- Distribution and warehousing in excess of 10,000m²

The scale of development is considerably below the threshold for industrial uses set out above which is considered to be the most comparable to the proposed use.

With respect to the increase in traffic on the local road network, it is again noted that the majority of spaces are to be used for the storage and display of vehicles for sale. Such vehicles will be transported to the site by low loader or similar, at staggered intervals, significantly reducing the associated number of trips to negligible levels. Such servicing activity will follow the existing strategy and systems in place at the site meaning there will be a negligible impact on the public road network.

Similarly, the loss of 3 no. servicing bays is expected to result in a very small decrease in associated daily traffic which will be spread across the course of the day. Staff parking is proposed to increase by just 5 no. spaces which will, assuming a worst case scenario, result in an additional 5 no. arrivals during the A.M. peak hour and 5 no. departures during the P.M. peak hour which is considered to be a negligible increase in the context of the traffic on the existing wider road network.

Taking the above into consideration, the proposed development is expected to result in negligible increases in traffic associated with the site, particularly during peak hours and so is considered to be below the aforementioned TII thresholds.

Nevertheless, Section 2 of TII Guidance sets out a further series of sub-thresholds where if two or more are breached, a detailed assessment is recommended. These thresholds criteria are listed in following:

- The character and total number of trips in / out combined per day are such that as to cause concern;
- The site is not consistent with national guidance or local plan policy or accessibility criteria contained in the Development Plan;
- The development is part of incremental development that will have significant transport implications;
- The development may generate traffic at peak times in heavily trafficked/ congested area or near a junction with a main traffic route;
- The development may generate traffic, particularly heavy vehicles in a residential area;
- There are concerns over the development's potential effects on road safety;
- The development is in a tourist area with potential to cause congestion;
- The planning authority considers that the proposal will result in a material change in trips patterns or raises other significant transport implications.

Taking into consideration the nature of the proposed development as an extension to an existing facility and the aforementioned limited additional trip generation potential, it is considered that the proposed development does not

exceed more than two of these criteria based on the nature and scale of the proposed development.

Thus, the development is shown to be below all applicable thresholds set by the TII Guidance which is the industry standard in this regard. It is therefore considered that the further detailed traffic analysis is not deemed necessary and the overall impact of the development operation will be negligible.

Daire O Mahoney
(B.Eng M.Eng MIEI)

For OCSC MULTIDISCIPLINARY CONSULTING ENGINEERS



**APPENDIX A. SOUTH DUBLIN COUNTY COUNCIL AND IRISH WATER
PUBLIC RECORDS**

Appendix A

South Dublin Co.Co. & Irish Water Public Records



APPENDIX B. QBAR RUNOFF CALCULATIONS & MET EIREANN DATA

Appendix B
QBAR Runoff Calculations

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 306638, Northing: 235056,

DURATION	Interval	Years													
		2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3, 3.4,	4.1,	5.0,	5.6,	6.2,	7.9,	9.8,	11.2,	13.1,	14.8,	16.2,	18.3,	19.9,	21.3,	N/A,
10 mins	3.3, 4.8,	5.7,	7.0,	7.9,	8.6,	11.0,	13.7,	15.6,	18.2,	20.6,	22.5,	25.5,	27.8,	29.7,	N/A,
15 mins	3.8, 5.7,	6.7,	8.2,	9.3,	10.1,	12.9,	16.1,	18.3,	21.4,	24.3,	26.5,	29.9,	32.7,	34.9,	N/A,
30 mins	5.1, 7.4,	8.6,	10.6,	11.9,	12.9,	16.3,	20.3,	22.9,	26.7,	30.1,	32.7,	36.9,	40.1,	42.8,	N/A,
1 hour	6.7, 9.6,	11.2,	13.6,	15.2,	16.5,	20.7,	25.5,	28.7,	33.2,	37.3,	40.5,	45.4,	49.2,	52.4,	N/A,
2 hours	8.9, 12.5,	14.5,	17.5,	19.5,	21.1,	26.2,	32.1,	36.0,	41.4,	46.3,	50.0,	55.9,	60.4,	64.2,	N/A,
3 hours	10.4, 14.6,	16.9,	20.3,	22.6,	24.3,	30.1,	36.7,	41.0,	47.1,	52.5,	56.7,	63.1,	68.1,	72.2,	N/A,
4 hours	11.7, 16.4,	18.8,	22.5,	25.0,	27.0,	33.3,	40.4,	45.0,	51.6,	57.4,	61.9,	68.8,	74.1,	78.6,	N/A,
6 hours	13.8, 19.1,	21.9,	26.1,	28.9,	31.1,	38.2,	46.1,	51.4,	58.6,	65.1,	70.0,	77.7,	83.6,	88.4,	N/A,
9 hours	16.2, 22.3,	25.5,	30.3,	33.5,	35.9,	43.9,	52.8,	58.6,	66.7,	73.8,	79.3,	87.7,	94.2,	99.6,	N/A,
12 hours	18.2, 24.9,	28.4,	33.6,	37.1,	39.8,	48.4,	58.0,	64.3,	73.0,	80.7,	86.6,	95.6,	102.6,	108.3,	N/A,
18 hours	21.5, 29.1,	33.1,	39.0,	42.9,	45.9,	55.6,	66.4,	73.4,	83.0,	91.5,	98.0,	108.0,	115.6,	121.9,	N/A,
24 hours	24.1, 32.5,	36.9,	43.3,	47.6,	50.9,	61.4,	73.0,	80.5,	90.9,	100.1,	107.1,	117.7,	125.9,	132.6,	155.8,
3 days	34.8, 45.2,	50.4,	58.0,	63.0,	66.8,	78.7,	91.6,	99.7,	110.9,	120.6,	127.9,	138.9,	147.3,	154.2,	177.5,
4 days	39.0, 50.1,	55.7,	63.8,	69.0,	73.0,	85.5,	98.9,	107.4,	118.9,	128.9,	136.4,	147.7,	156.2,	163.2,	186.9,
6 days	46.3, 58.7,	64.9,	73.7,	79.4,	83.7,	97.2,	111.5,	120.6,	132.8,	143.2,	151.1,	162.9,	171.8,	179.1,	203.5,
8 days	52.8, 66.3,	73.0,	82.4,	88.5,	93.1,	107.5,	122.6,	132.1,	144.9,	155.8,	164.0,	176.2,	185.5,	192.9,	218.1,
10 days	58.8, 73.2,	80.3,	90.4,	96.8,	101.7,	116.7,	132.6,	142.5,	155.8,	167.1,	175.6,	188.2,	197.7,	205.4,	231.3,
12 days	64.3, 79.6,	87.1,	97.7,	104.5,	109.6,	125.3,	141.8,	152.0,	165.8,	177.5,	186.3,	199.3,	209.1,	217.0,	243.4,
16 days	74.7, 91.5,	99.7,	111.2,	118.5,	124.0,	140.9,	158.6,	169.5,	184.1,	196.5,	205.7,	219.4,	229.6,	237.9,	265.5,
20 days	84.2, 102.4,	111.2,	123.5,	131.4,	137.2,	155.2,	173.8,	185.3,	200.7,	213.6,	223.3,	237.6,	248.2,	256.8,	285.4,
25 days	95.4, 115.1,	124.6,	137.9,	146.2,	152.5,	171.6,	191.4,	203.5,	219.7,	233.3,	243.4,	258.3,	269.5,	278.4,	308.1,

NOTES:


N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',

Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	Toyota Liffey Valley	
Date 31/03/2021 File	Designed by DOM Checked by AH	
XP Solutions	Source Control 2019.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	5	Soil	0.370
Area (ha)	0.600	Urban	0.000
SAAR (mm)	776	Region Number	User Defined

User Defined Growth Curve

Filename GSDSDS.gcfx Description GSDSDS

Return Period Growth Curve
(years) Factor

1	0.850
2	0.000
5	0.000
10	0.000
20	0.000
25	0.000
30	2.100
50	0.000
100	2.600
200	0.000
500	0.000
1000	0.000

Results 1/s

QBAR Rural 1.9
QBAR Urban 1.9

Q5 years 0.0

Q1 year 1.7
Q30 years 4.1
Q100 years 5.1

APPENDIX C. SURFACE WATER DESIGN & ATTENUATION CALCULATIONS

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

Appendix C

Surface Water Design and Attenuation Calculations

O'Connor Sutton Cronin		Page 1	
9 Prussia Street Dublin 7 Ireland		Toyota Liffey Valley	
Date 23/04/2021		Designed by DOM	
File T260-OCSC-XX-XX-MD-0004 (NEW ONLY).MDX		Checked by BM	
XP Solutions		Network 2019.1	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	4.000
M5-60 (mm)	16.500	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	0.900
Ratio R	0.276	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	10	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	2.000		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.220	4-8	0.140
Total Area Contributing (ha) = 0.360			
Total Pipe Volume (m³) = 8.254			

Network Design Table for Storm



O'Connor Sutton Cronin
 9 Prussia Street
 Dublin 7
 Ireland

Toyota Liffey Valley

Date 23/04/2021
 File I260-OCSC-XX-XX-MD-0004 (NEW ONLY).MDX
 XP Solutions

Designed by DOM
 Checked by BM
 Network 2019.1

Network Design Table for Storm

PN Length Fall Slope I.Area T.E. Base k HYD DIA Section Type Auto
 (m) (m) (1:X) (ha) (mins) Flow (l/s) (mm) SECT (mm) Design

Network Results Table

PN Rain T.C. US/IL I I.Area E Base Foul Add Flow Vel Cap Flow
 (mm/hr) (mins) (m) (ha) Flow (l/s) (l/s) (m/s) (L/s) (L/s)



O'Connor Sutton Cronin		Toyota Liffey Valley	
9 Prussia Street Dublin 7 Ireland		Designed by DOM Checked by BM	
Date 23/04/2021		Network 2019.1	
File I260-OCSC-XX-XX-MD-0004 (NEW ONLY).MDX			
XP Solutions			

Network Design Table for Storm

PN	Length (m)	Fall (1:X)	Slope (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	32.953	0.439	75.1	0.102	4.00	0.0	0.600	o 225	Pipe/Conduit	🟡
S2.000	29.705	0.508	58.5	0.030	4.00	0.0	0.600	o 100	Pipe/Conduit	🟢
S2.001	8.001	0.133	60.0	0.000	0.00	0.0	0.600	o 100	Pipe/Conduit	🟡
S1.001	47.663	0.636	75.0	0.182	0.00	0.0	0.600	o 225	Pipe/Conduit	🟢
S3.000	36.372	0.364	100.0	0.046	4.00	0.0	0.600	o 225	Pipe/Conduit	🟡
S3.001	8.581	0.287	29.9	0.000	0.00	0.0	0.600	o 225	Pipe/Conduit	🟢

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ I.Base Flow (l/s)	Foul Flow (l/s)	Add Flow (l/s)	Vel (m/s)	Cap Flow (l/s)	Flow (l/s)
S1.000	50.00	4.36	58.441	0.102	0.0	0.0	1.4	1.51	60.1	15.2
S2.000	50.00	4.49	59.100	0.030	0.0	0.0	0.4	1.01	7.9	4.5
S2.001	50.00	4.62	58.592	0.030	0.0	0.0	0.4	1.00	7.8	4.5
S1.001	50.00	5.15	58.002	0.314	0.0	0.0	4.2	1.51	60.1	46.7
S3.000	50.00	4.46	57.250	0.046	0.0	0.0	0.6	1.31	52.0	6.8
S3.001	50.00	4.52	56.886	0.046	0.0	0.0	0.6	2.40	95.5	6.8



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 Ireland
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Toyota Liffey Valley
 Designed by DOM
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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
S1.002	7.999	0.047	170.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	☑
S1.003	18.792	0.077	244.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	☑
S1.004	8.516	0.050	170.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	☑
S1.005	18.420	0.108	170.6	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)	I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap Flow (l/s)
S1.002	50.00	5.26	56.524	0.360	0.0	0.0	4.9	1.20	85.0
S1.003	50.00	5.57	56.477	0.360	0.0	0.0	4.9	1.00	70.8
S1.004	50.00	4.14	56.400	0.000	2.0	0.0	0.2	1.00	39.7
S1.005	50.00	4.45	56.350	0.000	2.0	0.0	0.2	1.00	39.7



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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	As Zoned	Road	100	0.102	0.102	0.102
		Pervious Paving	100	0.044	0.044	0.146
		Hardstanding	100	0.000	0.000	0.102
2.000	As Zoned	Road	100	0.000	0.000	0.000
		Pervious Paving	100	0.030	0.030	0.030
		Hardstanding	100	0.000	0.000	0.030
2.001	-	-	100	0.000	0.000	0.000
1.001	As Zoned	Default	100	0.001	0.001	0.001
		Road	100	0.177	0.177	0.178
		Hardstanding	100	0.000	0.000	0.178
		Building	100	0.003	0.003	0.182
3.000	As Zoned	Default	100	0.003	0.003	0.003
		Road	100	0.042	0.042	0.046
3.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
		Total		0.404	0.360	0.360



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Free Flowing Outfall Details for Storm

Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (mm)	D, L (mm)	W (mm)
S1.005	S28	58.920	56.242	0.000	1200	0

Simulation Criteria for Storm

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.500 Cv (Summer) 0.750
 Return Period (years) 100 Ratio R 0.276 Cv (Winter) 0.840
 Region Scotland and Ireland Profile Type Summer Storm Duration (mins) 30



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Online Controls for Storm


Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.004, Volume (m³): 4.2

Unit Reference MD-SHE-0060-2000-1600-2000	Sump Available	Yes
Design Head (m) 1.600	Diameter (mm)	60
Design Flow (l/s) 2.0	Invert Level (m)	56.400
Flush-Flow™	Calculated Minimum Outlet Pipe Diameter (mm)	75
Objective Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	2.0	Kick-Flow®	0.536	1.2
Flush-Flow™	0.263	1.5	Mean Flow over Head Range	-	1.5

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	1.3	0.600	1.3	1.600	2.0	2.600	2.5
0.200	1.5	0.800	1.5	1.800	2.1	3.000	2.7
0.300	1.5	1.000	1.6	2.000	2.2	3.500	2.9
0.400	1.5	1.200	1.8	2.200	2.3	4.000	3.0
0.500	1.3	1.400	1.9	2.400	2.4	4.500	3.2
						5.000	3.4
						5.500	3.5
						6.000	3.7
						6.500	3.8
						7.000	4.0
						7.500	4.1
						8.000	4.2
						8.500	4.3
						9.000	4.4
						9.500	4.6

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Storage Structures for Storm

Porous Car Park Manhole: S3, DS/PN: S2.001

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30 Slope (1:X) 0.0
 Membrane Percolation (mm/hr) 1000 Invert Level (m) 58.592 Depression Storage (mm) 0
 Max Percolation (l/s) 83.3 Width (m) 10.0 Evaporation (mm/day) 0
 Safety Factor 2.0 Length (m) 30.0 Cap Volume Depth (m) 0.300

Cellular Storage Manhole: S9, DS/PN: S1.004

Invert Level (m) 56.401 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	110.0	0.0	1.600	110.0	0.0
			1.601	0.0	0.0



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

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model Region Scotland and Ireland FSR M5-60 (mm) 16.500 Cv (Summer) 0.750
 Ratio R 0.276 Cv (Winter) 0.840

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

Profile(s)
 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) 30, 100
 Climate Change (%) 10, 10

US/MH	Return Climate	First (X)	First (Y)	First (Z)	Overflow Act.	Water Surcharged Flooded	Pipe			
PN	Name	Storm	Period	Change	Surcharge	Flow	Overflow			
						Depth	Flow /			
						(m)	Cap.			
						(m)	(l/s)			
						(m ³)	(l/s)			
							(l/s)			
S1.000	S1	15 Winter	100	+10%	100/15 Summer	59.045	0.379	0.000	0.59	33.2

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

PN	US/MH Name	Status	Level Exceeded
S1.000	S1	SURCHARGED	



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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Pipe Flow (l/s)
S2.000	S2	15 Winter	100	+10%	30/15 Summer			59.409	0.209	0.000	1.18	9.1
S2.001	S3	15 Winter	100	+10%				58.651	-0.041	0.000	0.66	4.7
S1.001	S4	15 Winter	100	+10%	30/15 Summer			58.896	0.669	0.000	1.43	82.1
S3.000	S5	960 Winter	100	+10%	30/360 Winter			57.936	0.461	0.000	0.03	1.4
S3.001	S6	960 Winter	100	+10%	30/120 Summer			57.935	0.824	0.000	0.02	1.1
S1.002	S7	960 Winter	100	+10%	30/15 Summer			57.935	1.111	0.000	0.17	10.6
S1.003	S8	960 Winter	100	+10%	30/15 Summer			57.936	1.158	0.000	0.17	10.5
S1.004	S9	960 Winter	100	+10%	30/15 Summer			57.931	1.306	0.000	0.06	2.0
S1.005	S10	960 Winter	100	+10%				56.384	-0.191	0.000	0.05	2.0

PN	US/MH Name	Status	Level Exceeded
S2.000	S2	FLOOD RISK	
S2.001	S3	OK	
S1.001	S4	SURCHARGED	
S3.000	S5	SURCHARGED	
S3.001	S6	SURCHARGED	
S1.002	S7	SURCHARGED	
S1.003	S8	SURCHARGED	
S1.004	S9	SURCHARGED	
S1.005	S10	OK	



OCSC

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Multidisciplinary
Consulting Engineers

APPENDIX D. ATTENUATION DETAILS

Appendix D

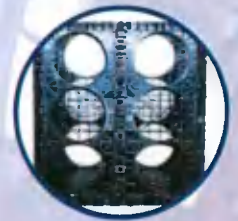
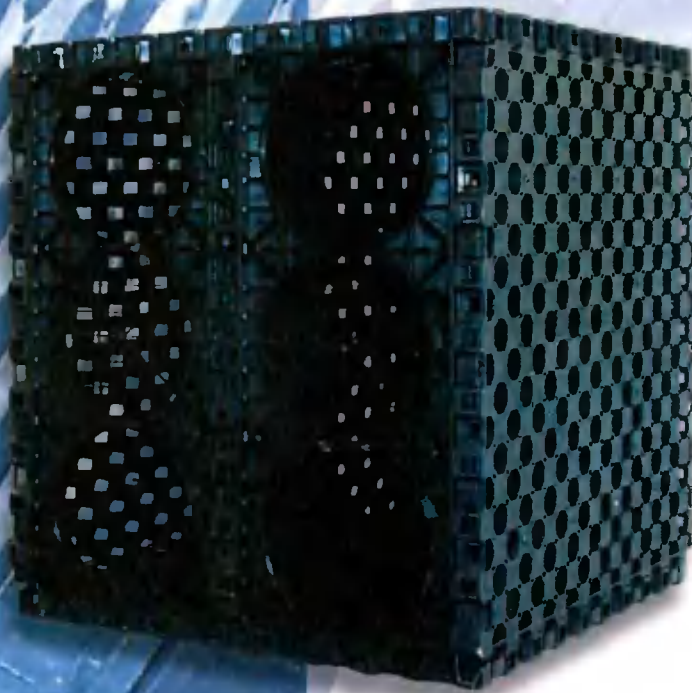
Attenuation Details



Modular Geo-Void
Systems
Total Water Management

Pluvial Cube

Total Linear Access
Precipitation Collection System

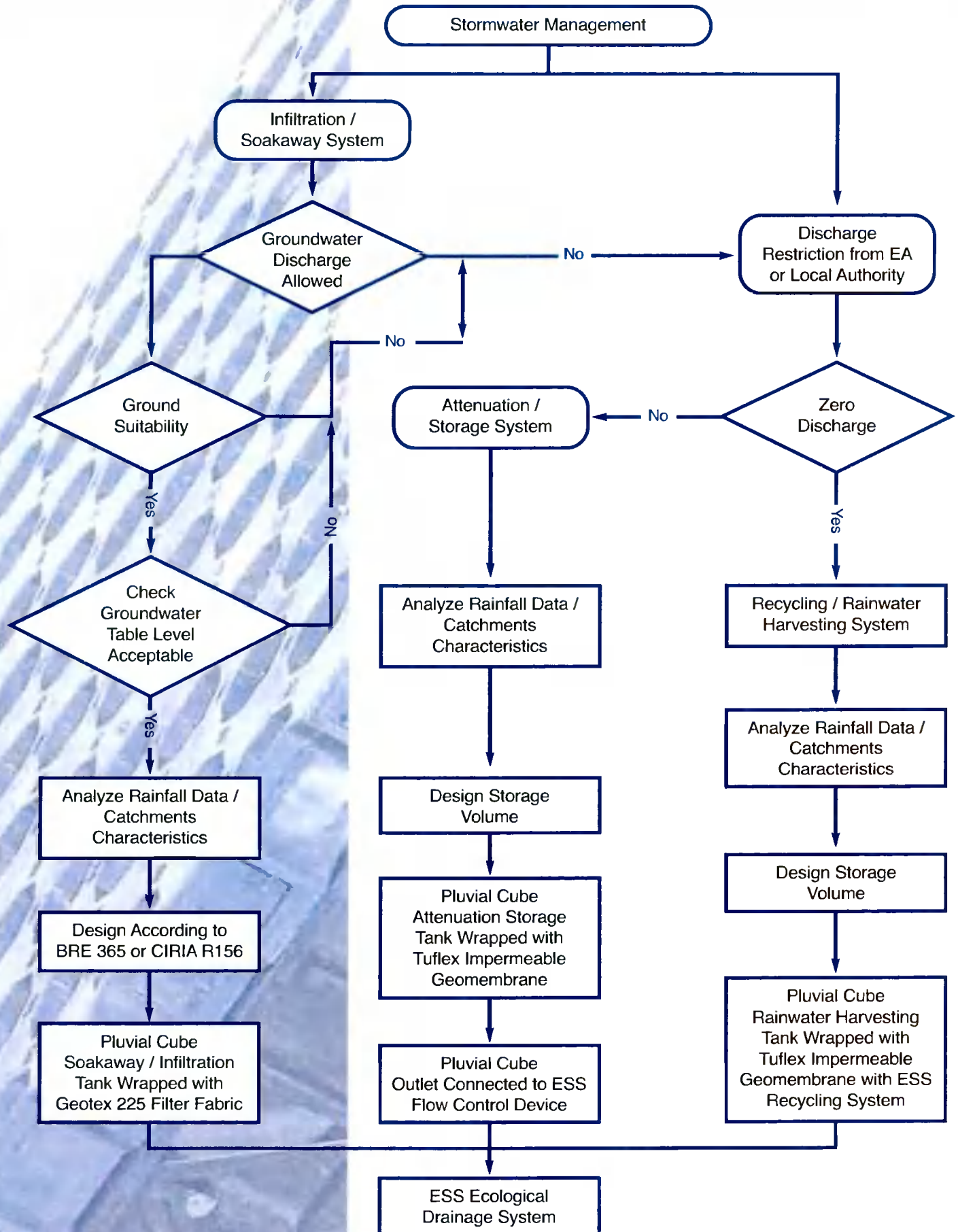


Unique Low Flow
Channel System



ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Flow Chart



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

Aquabrace 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: 0.269m³
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/m² available

* Modules tested using UKAS calibrated test machine, range 0 - 60 Tons. UDL, loading rate 0.2 kN/m²

** 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

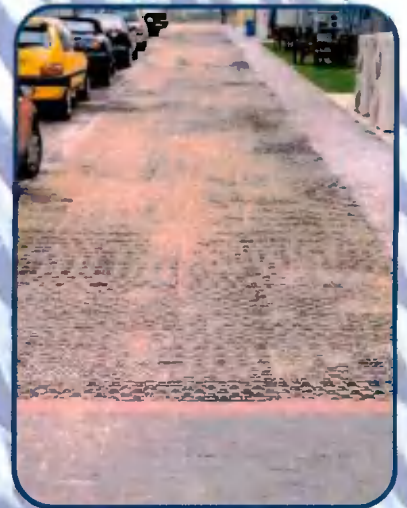
With the E.S.S. Channel System being a sub-surface system, these problems with open concrete channels are rectified. The permeable channel system can be designed to follow the inherent contours of the landform and emulate the flow of natural waterways. The curvilinear channel design creates vertical 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.



Environmental Benefits

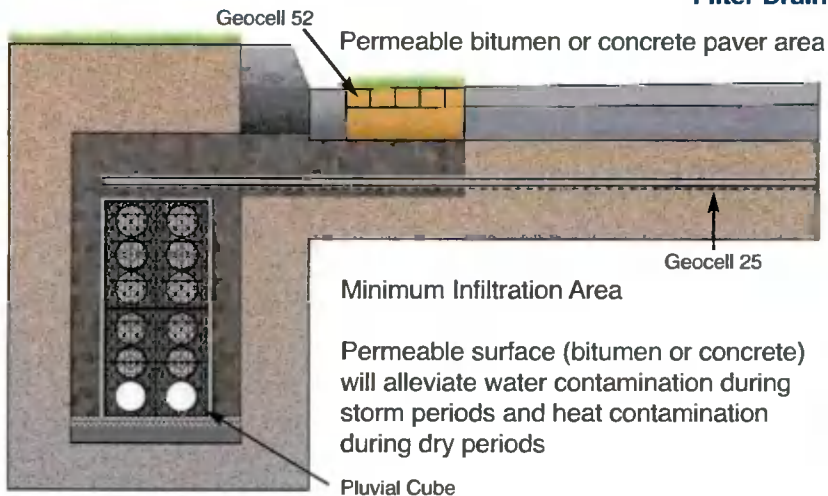
By replacing open concrete channels or swales with E.S.S. Channel Systems, cities can now benefit from increased environmental amenities, greater recreational space and healthier conditions by using the vast tracts of land once given over to rapid flowing concrete channels.



Car Park Infiltration Area.

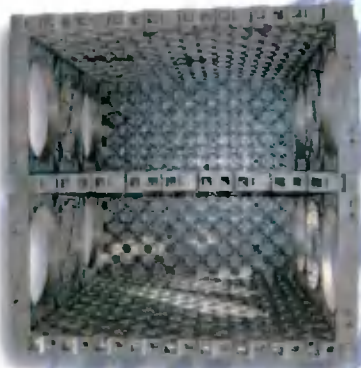
High Traffic Areas

Filter Drain



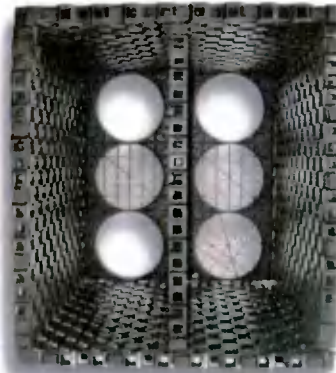
Low Flow Channel System

Self Cleaning at High Flow Velocity



Top View
Showing Clear Channel

Provides Total Linear Access



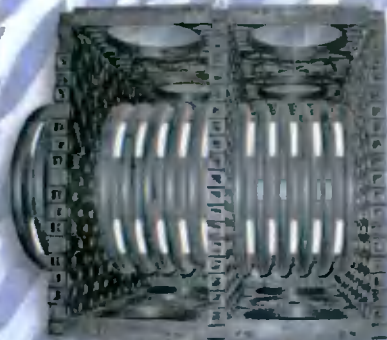
2 Clear Channels
500mm x 210mm per 0.5mt width

Controls Silt at Low Flow Velocity

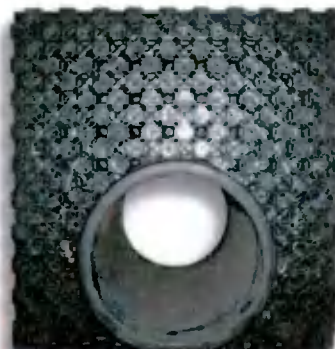


4 x 160mm Pipe
Access Point

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



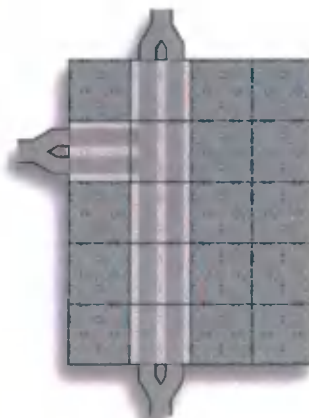
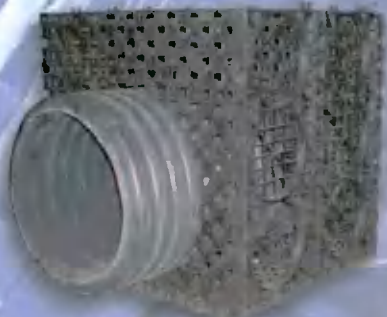
225 or 300mm
Internal Dia Channel



225 Low Flow Channel
(if required)



300mm Dia Low Flow Channel
(if required)



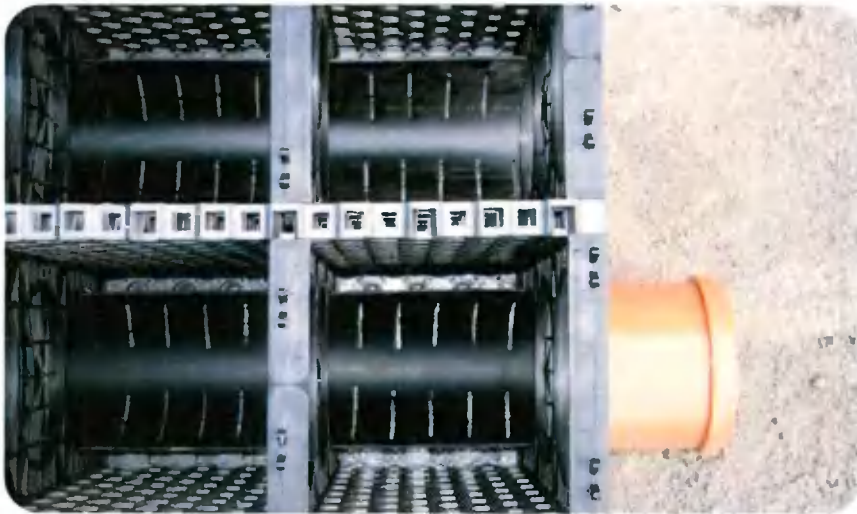
Typical Installation
Tank Format



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

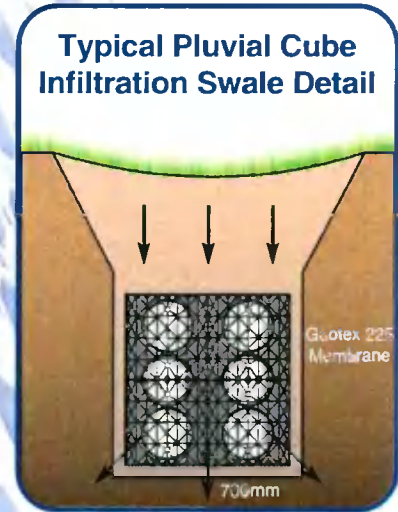
Infiltration Swales & Underground Channels

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

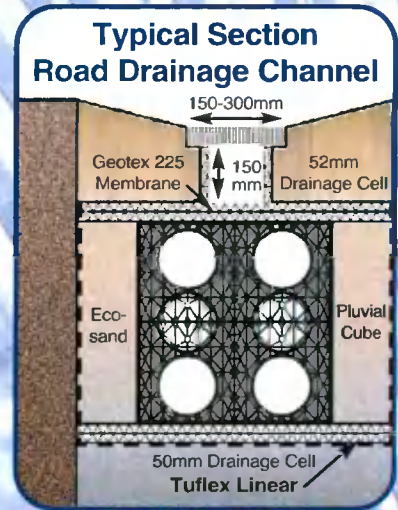
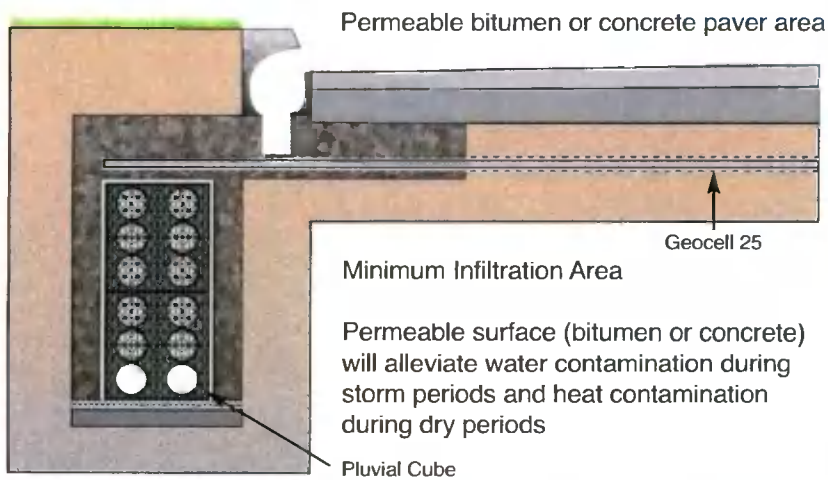


Attenuation Tank under Park and Ride Scheme showing versatility of modular system.



High Traffic Areas

Filter Drain



Tank 2mts deep with access channels.

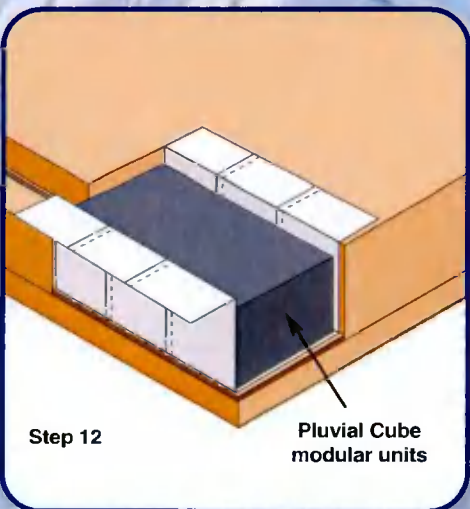
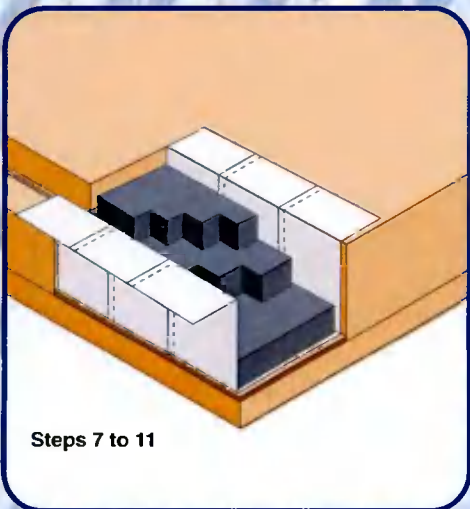
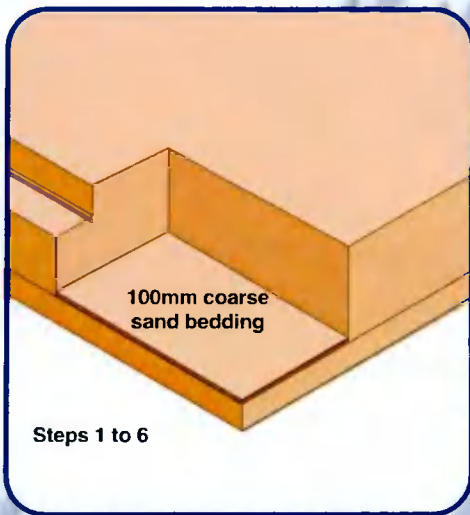
Installation Procedures

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, wetting all corners. The same method applies for Tuflex Geo Membranes ensuring all corners are wetted 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.

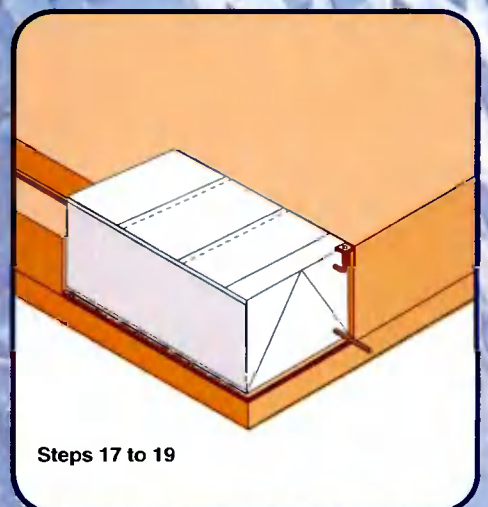
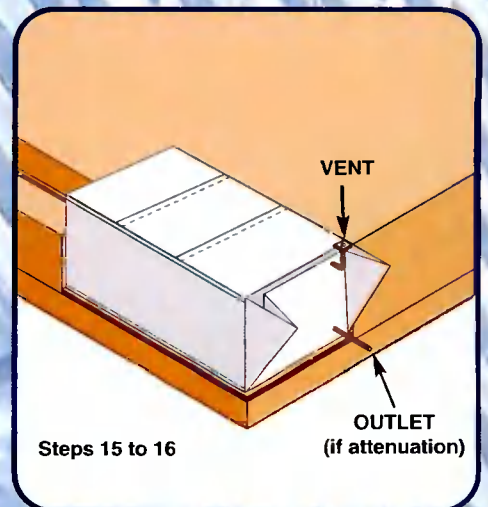
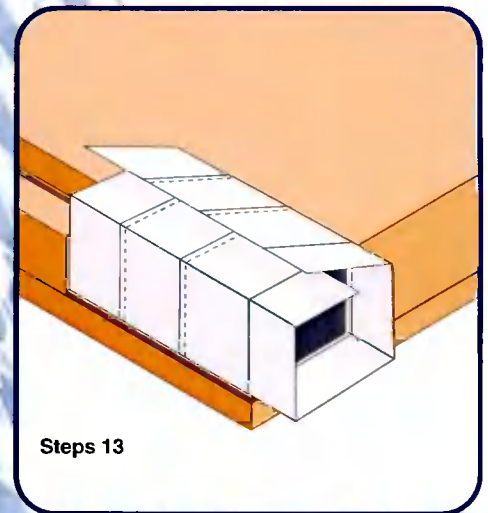
17. Backfill around excavation using type 1 or 2 sub base or selected granular material, and compact in layers of not less than 150mm. The first 500mm of any installation should be compacted by hand.

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.



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

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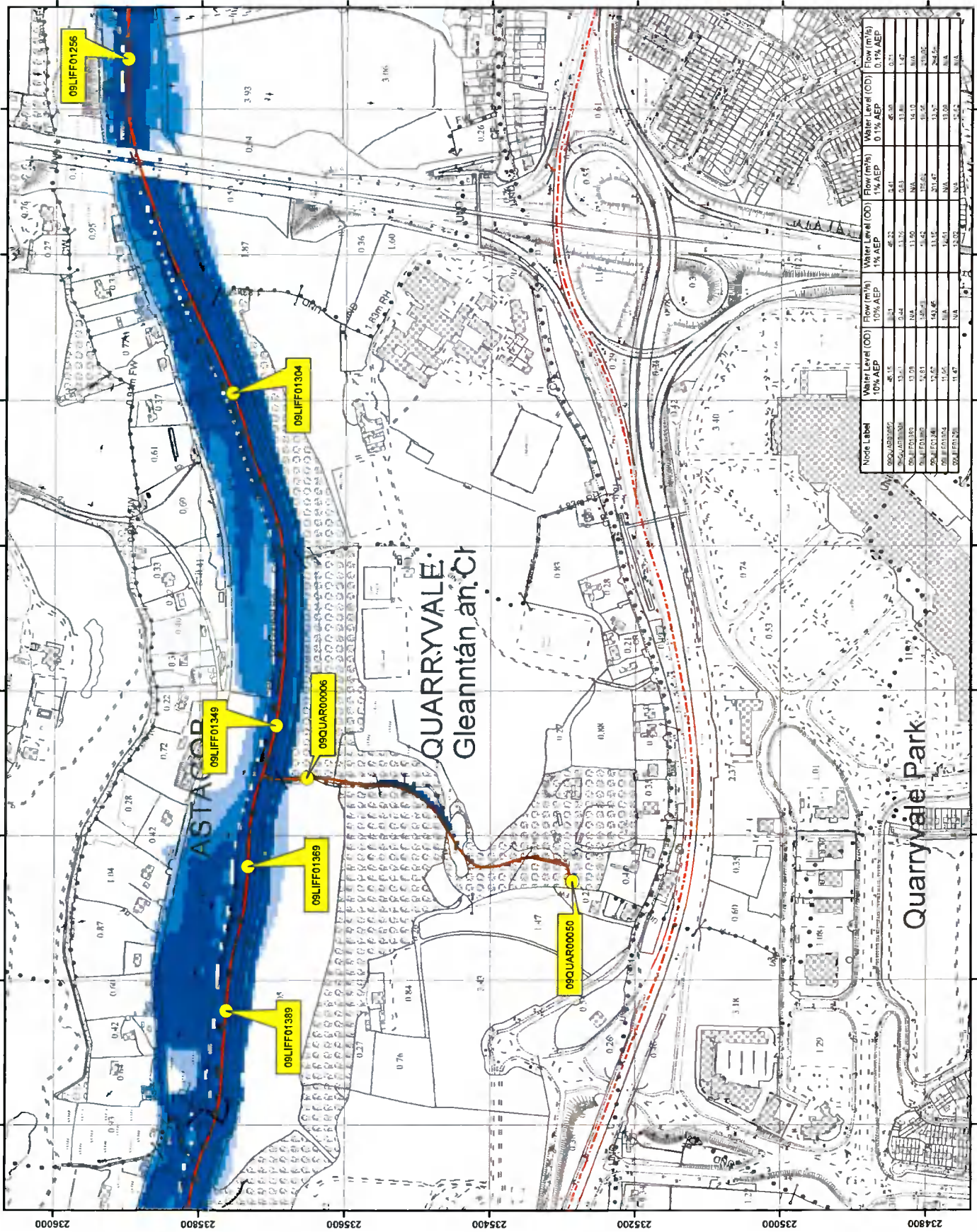
<http://www.y-ess.com>

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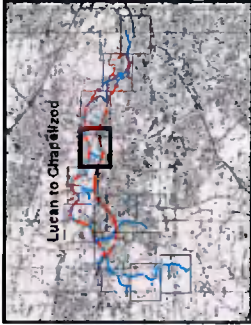


APPENDIX E. OPW FLOOD MAPS

Appendix E
OPW Flood Maps



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF01389	4.15	3.41	4.22	3.41	4.30	3.71
09LIFF01349	5.11	3.41	5.17	3.41	5.25	3.71
09LIFF01369	3.33	3.41	3.39	3.41	3.47	3.71
09LIFF01304	3.33	N/A	3.39	N/A	3.47	N/A
09LIFF01255	3.33	3.41	3.39	3.41	3.47	3.71
09QUAR00050	4.22	3.41	4.28	3.41	4.36	3.71
09QUAR00006	4.22	3.41	4.28	3.41	4.36	3.71



IMPORTANT USER NOTE
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- APAE Extents
- Node Point
- Node Label

FINAL

REV. NOTE DATE

CFRAM

RPS

OPW

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Elmwood House
1-44/46 St. John's Road
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D04 N104
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Map: Lucan to Chapelizod Fluvial Flood Extents

Map Type: EXTENT

Source: FLUVIAL

Map Area: HW

Scenario: CURRENT

Drawn By: C.C. Date: 27 July 2016

Checked By: S.P. Date: 27 July 2016

Approved By: G.G. Date: 27 July 2016

Drawing No.: E09LUC_EXCFD_F0_09

Map Series: Page 9 of 12

Drawing Scale: 1:5,000 @ A3

