Proposed Civic Office Development at Roosky Lands

Infrastructure Design Report

220084-RY-00-Z00-XXX-RP-DBFL-CE-0001

INFRASTRUCTURE

November 2023

DBFL CONSULTING ENGINEERS

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0	23/11/2023	Issued for Planning	Kabelo Mokoka	John Carr	Kevin Sturgeon

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1 Introduction

1.1 Background

Monaghan County Council (MCC) has commissioned DBFL Consulting Engineers (DBFL) to develop and provide access and active travel infrastructure links as part of the proposed Civic Office project within land known as the Roosky lands, Monaghan Town.

A separate Infrastructure design report prepared by Cora Consulting Engineers is submitted with this application for the proposed Civic office element of this project and it should be read in conjunction with this report, as indicated in Figure 1-1

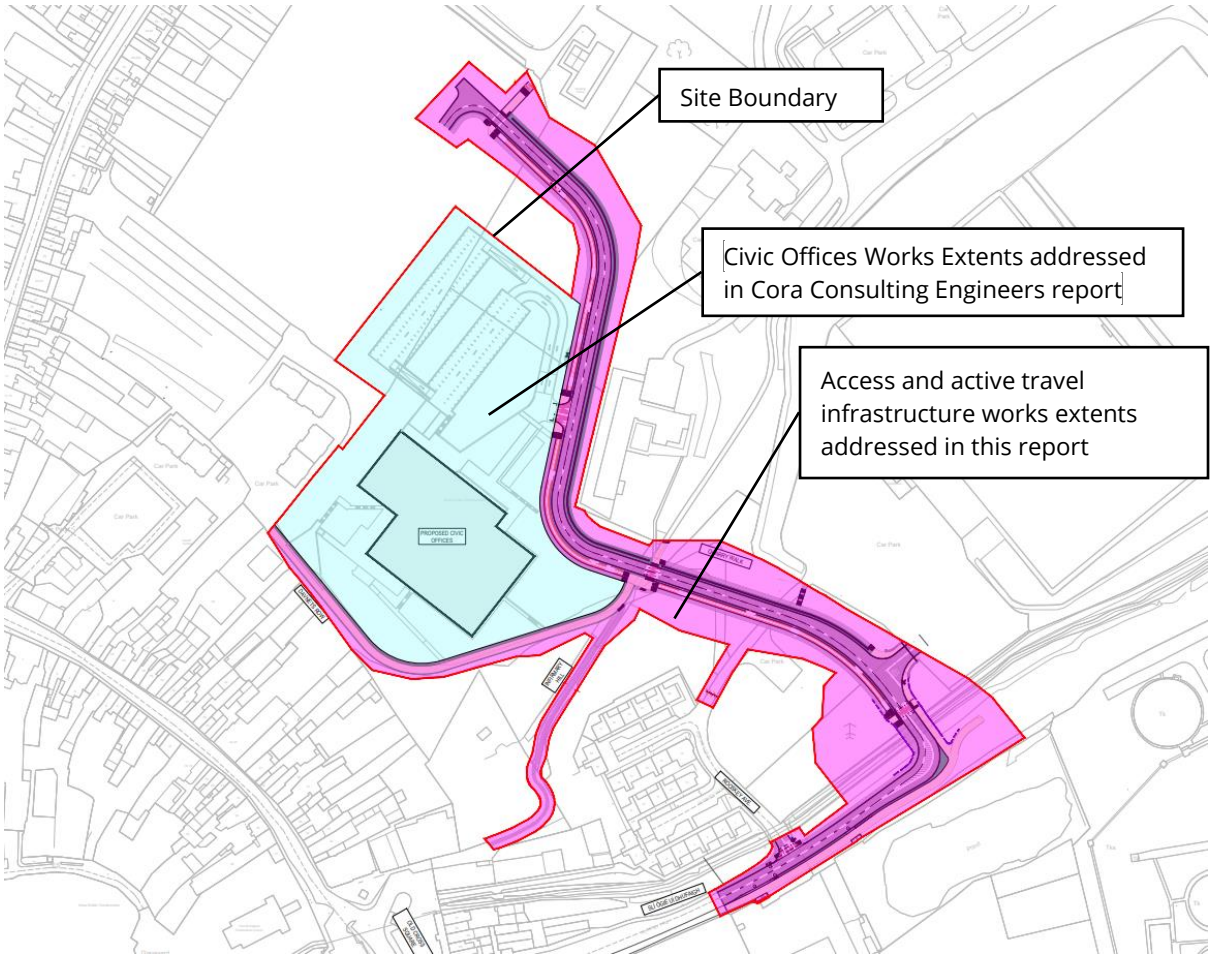


Figure 1-1: Report Coverage

The design as proposed is informed by the Roosky Masterplan.

1.2 Objectives

This report considers the following engineering aspects of the proposed development.

- Preliminary flood risk assessment.
- Road alignment and layout.
- Surface water trunk infrastructure
- Foul sewer trunk infrastructure
- Watermain trunk infrastructure

1.3 Location

The subject site is located in Roosky Lands, north of the existing Ulster Canal greenway route, refer to Figure 1-2. This area is surrounded by the following:

- A portion of the site is located south of the Shambles river and is bounded to the South by residential apartments, industrial buildings and the Monaghan wastewater treatment plant
- The majority of the subject site is bounded to the South by the Shambles River, to the east by Monaghan Harps GAA.
- To the west, the site is bounded by vacant lands designated for future development.
- To the north the site is bounded by Glaslough street and the St. Davnets Hospital.
- Existing boundaries comprise predominantly trees, fencing, hedgerows, boundary/Retaining wall adjacent to the Diamond Apartments.

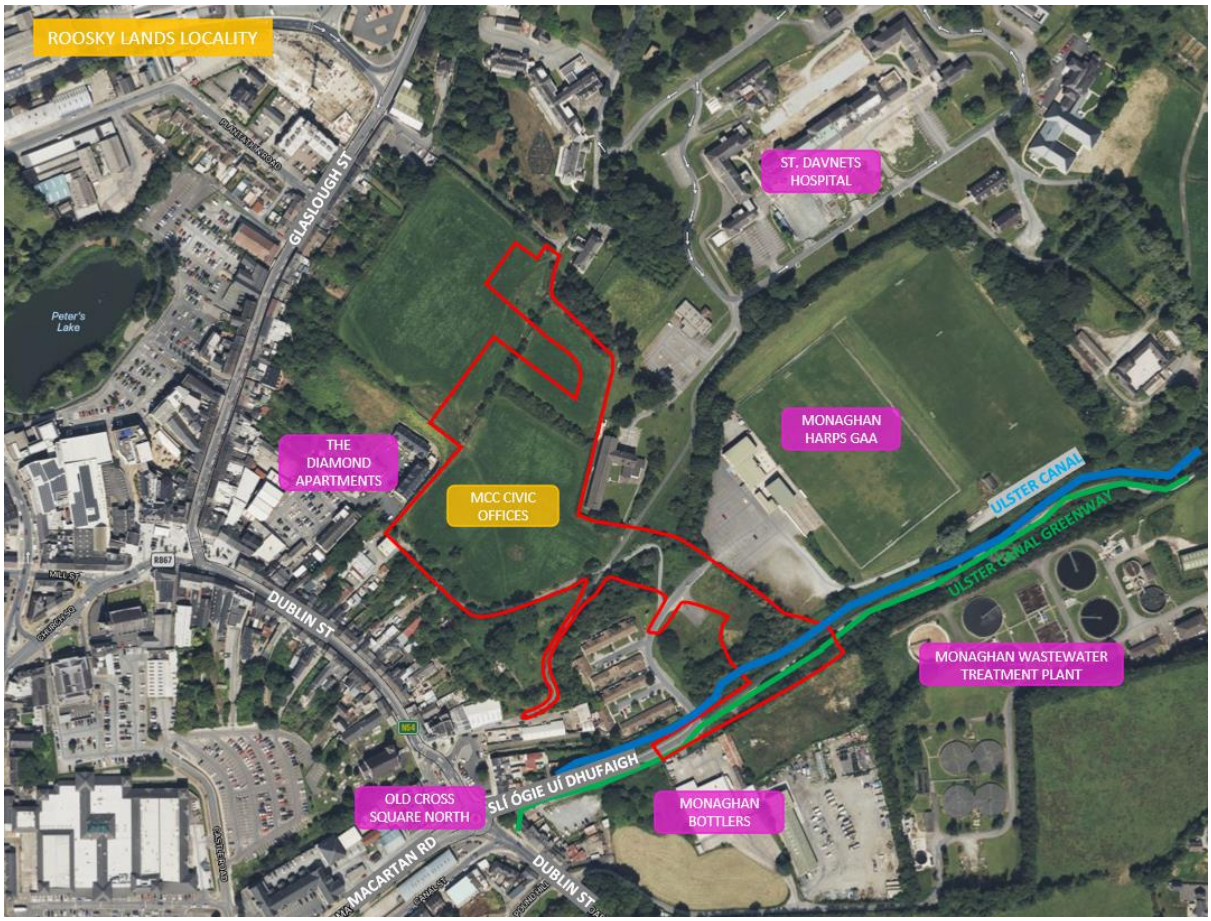


Figure 1-2: Site location (indicative red line)
[Source Bing maps]

1.4 Topography and Site Characteristics

The topography within the proposed development site is steep as you travel northwards, with gradients ranging from 0.5-15%, and reasonably flat as you travel southwards, therefore forming a lower and upper section.

The site is mainly undeveloped. Site levels (excluding road embankments and the Ulster Canal and River Shambles), generally range between 55.84m AOD to 85.89m AOD, see figure below for elevation map.

Figure 1-3: Elevation map

1.5 Proposed Development

A comprehensive description of the proposed development is set out in the Planning Statement. The Statutory Notices should also be referenced.

The proposed works considered in this report relate to the Improvement works to existing road infrastructure and the provision of active travel links (pedestrian, cycle) and vehicular links comprising:

- Extending the existing vehicular route on Slí Ógie Uí Dhufaigh along the route of the existing Ulster Canal Greenway for approximately 120m before crossing the River Shambles. The existing greenway will be re-aligned to run parallel to the new carriageway. Carriageway width to be 6m and greenway width to be 3.5m
- Provision of Public lighting along both the extension and new road.
- Provision of safe pedestrian crossings.
- Amendments to existing roadway serving Roosky Vale to form a priority junction at the interface with the extended Slí Ógie Uí Dhufaigh.
- Provision of a new 13m clear span bridge crossing over the River Shambles for the new links.
- Provision of a replacement access to Monaghan Harps GAA club and associated pedestrian infrastructure links.
- Provision of approximately 460m of new vehicular and active travel link (Quarry Walk) through the proposed development site consisting of 5.5m vehicular carriageway, 2.5m 2-way cycle tracks, 1.8m footpath and roadside 3.3m/2.5m SuDS swale
- Upgrade of existing Davnets Row pedestrian route to form active travel shared link to the town centre. Upgrade to include vertical and horizontal alignment and width suitable for pedestrian and cyclists.
- Upgrades to the existing Infirmary Hill Path to improve link to Old Cross Square.
- Provision of new surface water, foul water and watermain infrastructure within the road corridor.
- Provision of surface water attenuation.

- Diversion of existing watermain infrastructure and provision of watermain spurs for the development lands.
- Associated earthworks, landscaping, utilities, boundary treatments and ancillary works.

1.6 Existing Ground Conditions

A site investigation was undertaken by IGSL limited between April and May 2023. The purpose of the site investigation was to investigate the existing ground conditions of the subject site relevant to the vehicular link and active travel infrastructure, utilizing a variety of investigative methods in accordance with the specifications for ground investigation in Ireland 2nd edition 2016.

The scope of the work (see Figure 1-4) undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 9 No. Trial Pits to a maximum depth of 3.30m BGL
- Carry out 6 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 9 No. Plate bearing tests to ascertain the subgrade modulus
- Carry out 2 No. Boreholes to refusal to determine subsoil profile
- Carry out 4 No. Slit trench to determine location and depth of underground services
- Carry out 3 No. Shear vane test to determine shear strength of cohesive soils
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

The sequence of strata encountered were variable across the site and generally comprised;

- Topsoil/surfacing from approximately 0 - 0.25m
- MADE GROUND from approximately 0.25m- 0.5m depth (comprised of brown/grey sandy gravelly clay, angular stones, red brick pieces, roots)
- MADE GROUND from approximately 0.25-0.85m depth (comprised of soft grey/dark brown/brown sandy gravelly clay/silt, angular cobbles and boulders, organic matter)
- Cohesive Deposits, Soft to firm from approximately 2.0- to end depth (comprised of , grey, slightly sandy gravelly silty CLAY with medium cobbles and organic matter content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded)

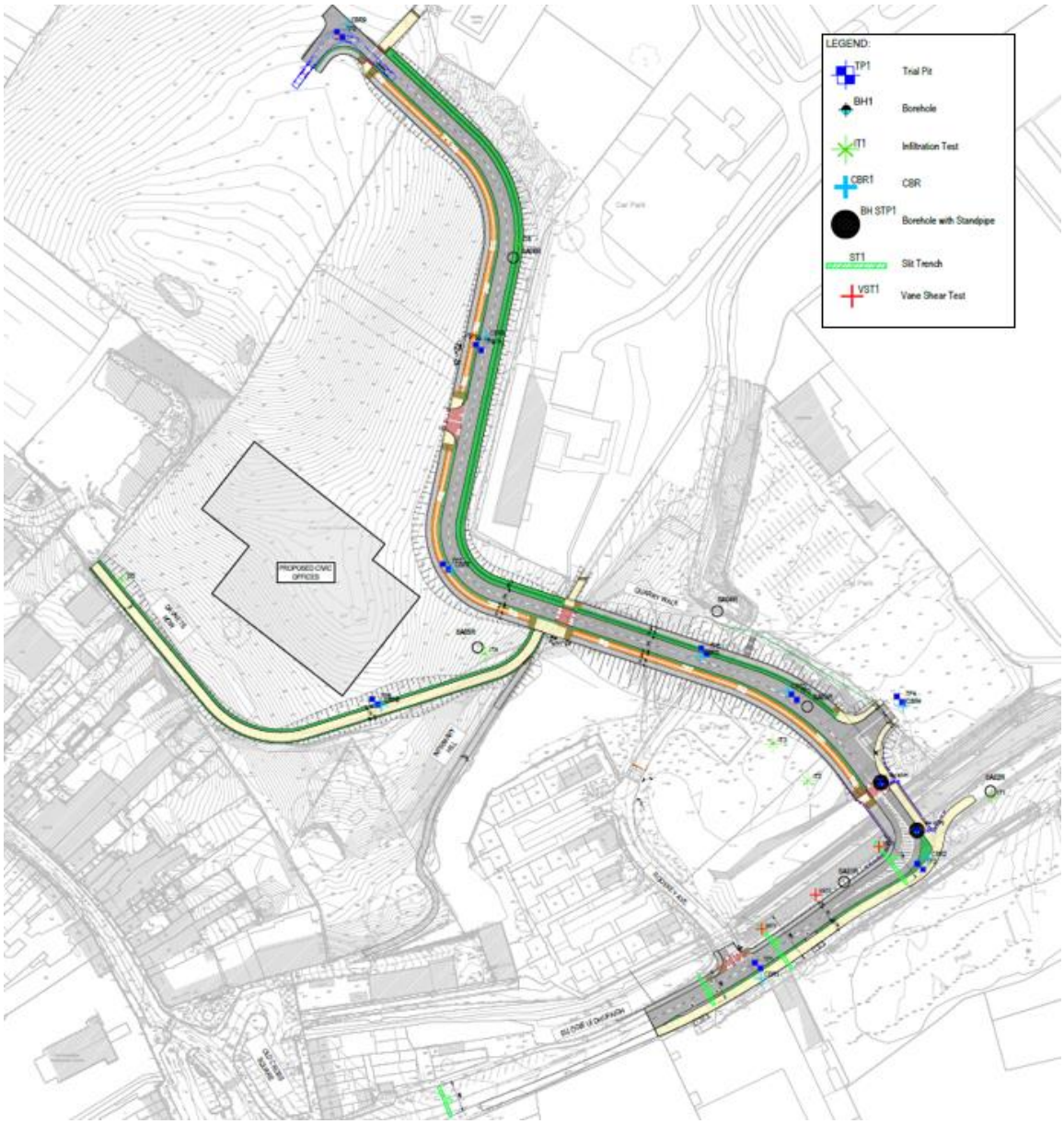


Figure 1-4: Extract from Site Investigation Plan

- Trial Pits were conducted to sample soil samples for geotechnical test. Results from the test conducted on samples are summarised below:
    - from Slí Ógie Uí Dhufaigh (Roosky Vale) to the proposed bridge location. This section parallels the Ulster Canal Greenway on level ground, with MADE GROUND identified in Trial Pits, Window Samples, and Slit Trenches. The MADE GROUND is variable in composition and strength, consisting of brick, plastic, timber, and concrete fragments in a gravelly SILT/CLAY matrix. Firm grey brown gravelly SILT/CLAY (TILL) was noted in places below the FILL. CBR values of 1 to 2% were recorded at 0.50 metres BGL.

- from the proposed bridge to Davnets Row link along the proposed Quarry walk, with ground level increasing from 56 meters to 72 meters. The lower part of the route has MADE GROUND overlying firm grey, brown sandy gravelly CLAY. TP07R encountered virgin soils with stiff brown boulder clay, with CBR values ranging from 1% to 3%.
- from Davnets Row link along Quarry walk to the proposed hammerhead. This section slopes steeply in glacial till deposits, with a thin, soft clay layer over firm to stiff grey brown gravelly clay. A CBR of at least 3% is assumed at 0.50 meters BGL, with CBR values increasing significantly in stiff gravelly boulder clay. The boulder clay is suitable for road construction, but significant cut and fill operations may be required due to site levels variations.

- Soakaway test results found varying infiltration rates across the site ranging from zero to 0.00102 m/min.
- Bedrock was noted at about 7.50m at both Borehole locations (BH01 and BH02), of which 3m of solid core was recovered. Strong to Very strong blue grey grained Limestone was identified. Ground water ingress was noted in both locations in association with gravel stratum, standpipes were installed to allow long term groundwater observation.
- According to the Waste Characterisation Assessment, the site does not contain any hazardous materials. The majority of the material along the Active Travel Links route may be repurposed, with the exception of material located near the attenuation pond. This material consists of made ground and does not meet soil recovery requirements. In spite of this, they are deemed acceptable for disposal in a landfill.

2 Flood Risk

2.1 Existing Flood Risk

A preliminary flood risk assessment was undertaken to evaluate the flood risk to the subject site and determine if the development proposals are suitable in accordance with The Planning System and Flood Risk Guidelines.

The OPW Eastern Catchment Flood risk assessment and management (CFRAM) mapping indicates the majority of the subject site as located in flood zone C, refer to Figure 2-1 below. This indicates low flood risk and thus, is deemed acceptable in accordance with the Guidelines.

A portion of the proposed developments' infrastructure is located within close proximity to the River Shambles which poses flood risk as it is within a fluvial flood zone. The estimated fluvial flood levels for the Shambles River are 53.18m OD for the 1% AEP (1 in 100 year) flood event. The lowest level on the subject site is at 55.68m OD which is the finished road level (FRL) at chainage 73 along the proposed access road which is safely (approx 2.5m) above the predicted fluvial flood level, refer to Appendix D :for Flood mapping data.

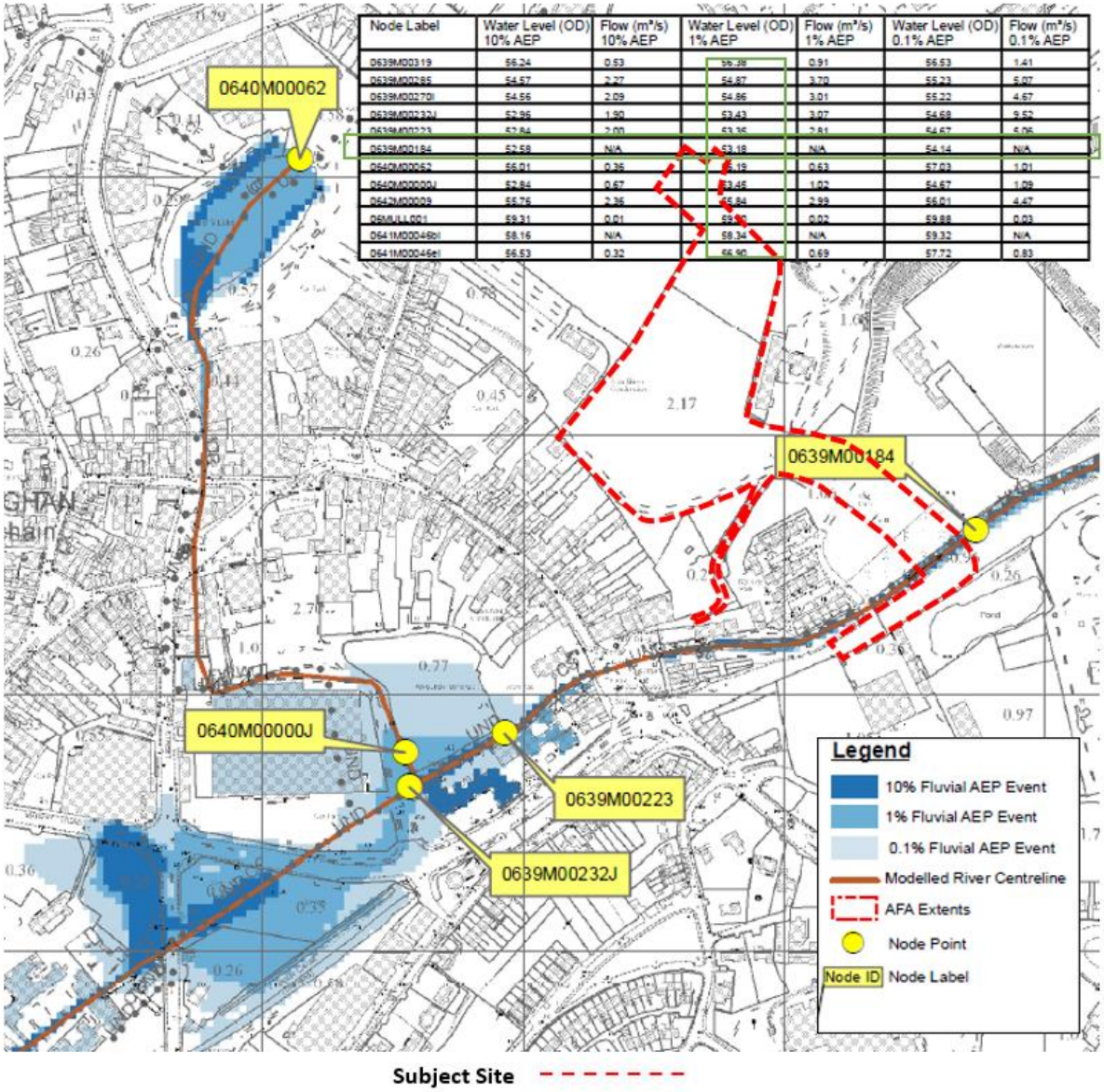


Figure 2-1: CFRAM Fluvial Flood extents records
Extracted from OPW Eastern Catchment Flooding Risk Assessment and Management (CFRAM) Mapping [Source OPW]

There are no historical flood incidences recorded for the subject site or in the immediate vicinity of the site, refer to Appendix D :for OPW Historical records. The nearest recorded flood events were recorded along the Shambles River circa 1.2km upstream from the subject site. These were 2 single events recorded on the 5th December 2015 (Flood Summary (ID-13380) and on 24th October 2011 both occurring along the Shambles river. A recurring event, flood Summary (ID-3207) was recorded along the shambles river due to heavy rain causing the river to overflow its banks. These events occurred in the Monaghan Emyvale area and did not affect the site (refer to Figure 2-2).

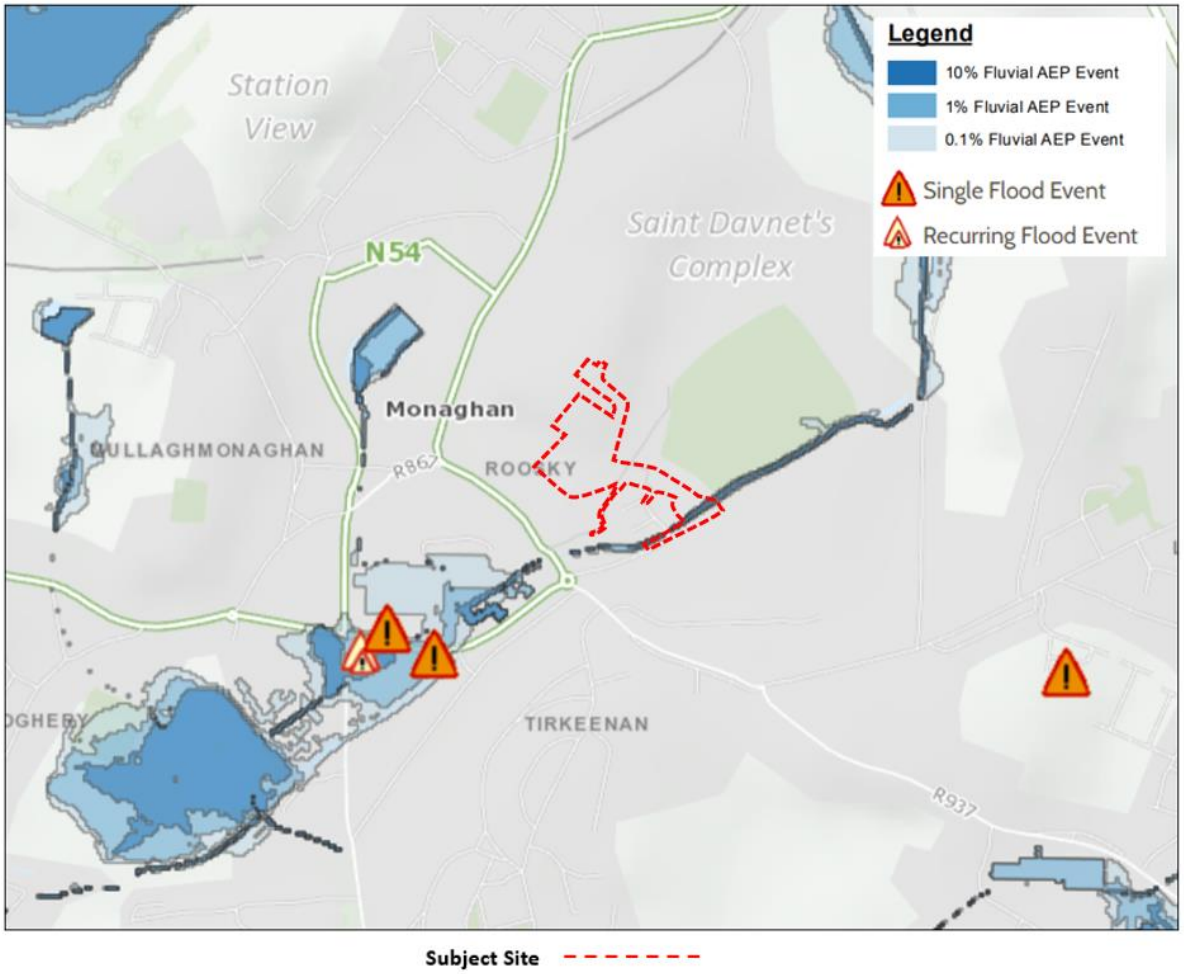


Figure 2-2: Flood extents and historical flood records extracted from OPW (CFRAM) [Source OPW]

2.2 Flood Risk Management Guidelines

The OPW document "The Planning System and Flood Risk Management Guidelines (November 2009)" requires that the proposed type of development be located with an appropriate existing flood risk zone.

The proposed development is classified as "Less vulnerable development" (Table 3.1 of the Guidelines) and are appropriate if located within Flood Zone 'C' (Table 3.2 of the Guidelines) i.e., majority of the site is outside the 0.1% AEP flood extents.

The proposed road development is therefore suitable for the site's low fluvial flood risk / Flood Zone C and the Planning Guidelines Sequential Approach is passed, refer to Figure 2-3 below.

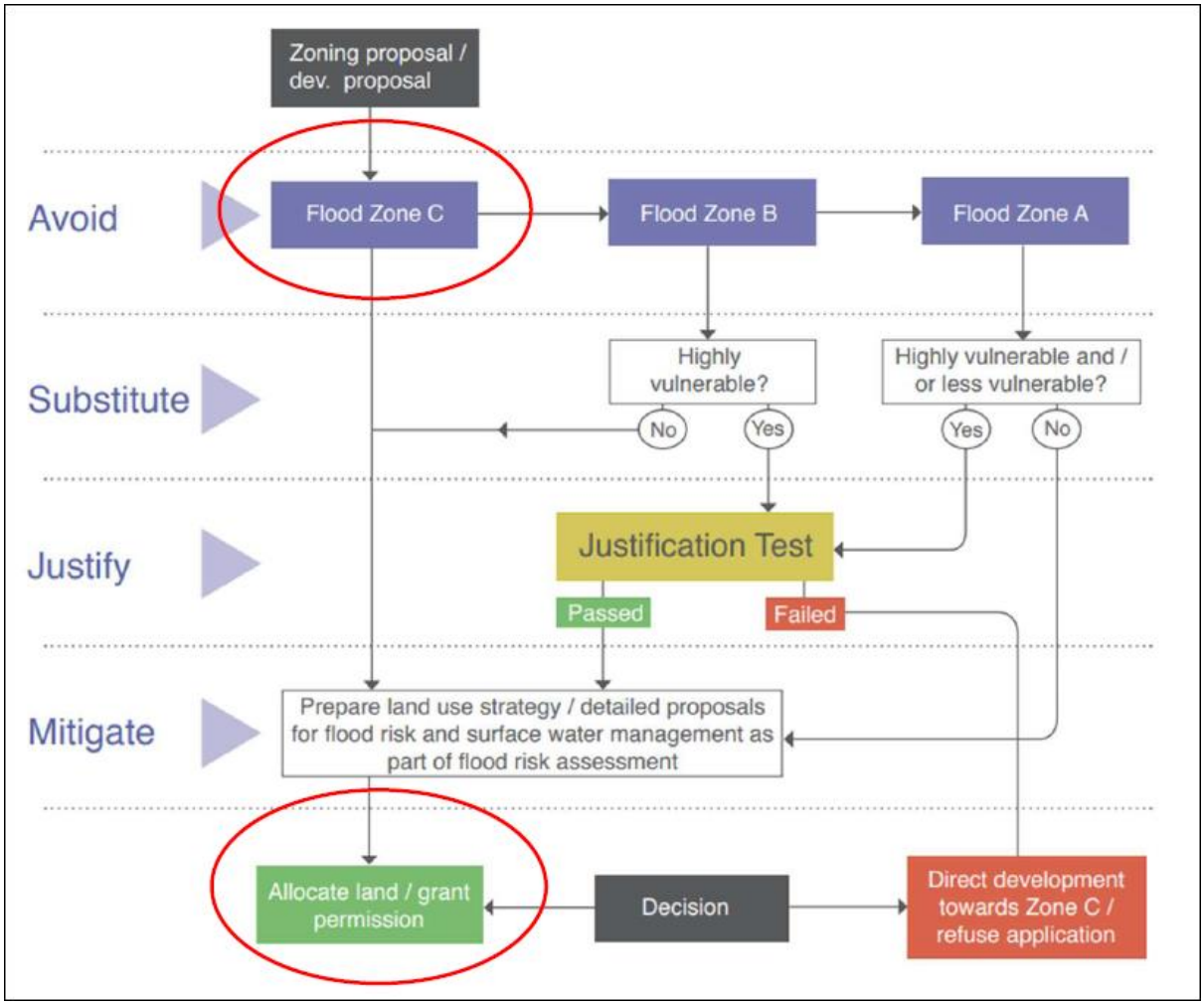


Figure 2-3: Sequential Approach mechanism in the Planning process

The proposed development's surface water drainage network, detailed in section 5 is designed to comply with the guidelines and addresses pluvial flood risk within the scheme. Stormwater drainage is designed to facilitate a 1 in 100-year event with climate change allowance of 20%. Furthermore, the lowest FRL along the access road (55.68m) is sufficiently higher than Top Water Level (TWL) of the attenuation basin (53.18m).

It is concluded that.

- The development proposed is appropriate for the Site's flood zone C category.
- The Planning System and Flood Risk Management Guidelines Sequential Approach is considered to have been met and the 'Avoid' principal achieved and a justification test is not required.
- Finished road levels (FRL) have been designed to provide sufficient freeboard to the predicted flood levels for the Shambles River and the top water level (TWL) of the attenuation storage structures.

3 Road Layout and Access

3.1 Existing Layout and Linkages

The subject site can be accessed from the south from Old Cross Square roundabout via Slí Ógie Uí Dhufaigh road which crosses the Shambles River into Rooskey Avenue, refer to Figure 3-1: Overview of existing access and linkages. This road also provides access to Monaghan Harps GAA Club.

North of the site can be accessed via existing pedestrian routes from Glaslough Street and St Davnets Hospital. The west access is provided by an existing path (Davnets Row) from Diamond apartments, and the southeast access is provided by an existing pedestrian link (Infirmary Hill link) from Old Cross Square.

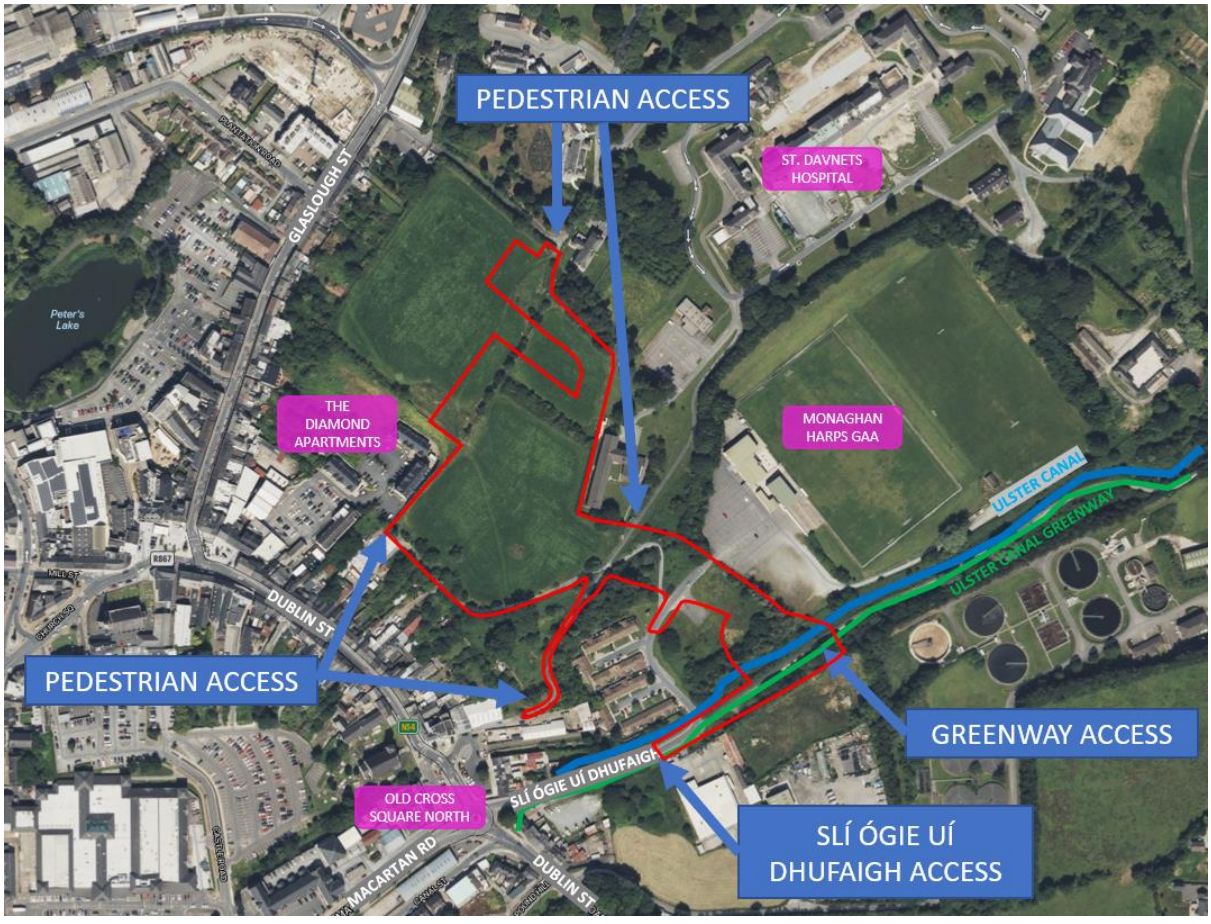


Figure 3-1: Overview of existing access and linkages

3.2 Proposed Layout

The proposed infrastructure for the access and active travel links consists of various components as shown in Figure 3-2 below. These include the extension of the existing vehicular route on Slí Ógie Uí Dhufaigh along the route of the existing Ulster Canal Greenway for approximately 120m before crossing the River Shambles. The existing greenway will be re-aligned to run parallel to the new carriageway.

From the bridge crossing, approximately 430m of Link Street (Quarry Walk) through the Roosky Lands will provide access to the MCC Civic offices and future development lands. Provision of active travel paths (cycle and footpath) are proposed to run alongside the Link Street. Replacement access to Monaghan Harps GAA club and associated pedestrian infrastructure links will be provided. The existing pedestrian links to St Davnets, Glaslough Street, and to the alternative route to the Ulster Canal greenway will be incorporated into Quarry Walk, providing links to the development area and adjacent destinations.

The existing Davnets Row pedestrian route (200m) and Infirmary Hill Path (160m) will be upgraded to form active travel shared and pedestrian links to the town centre from the Diamond Apartments car park and Old Cross Square respectively. These linkages will be tied into the proposed Quarry Walk.

The junctions along Slí Ógie Uí Dhufaigh, access, at Rooskey Vale Avenue, and the entrance to Monaghan Bottlers will be upgraded to form pedestrian and active travel priority crossings.

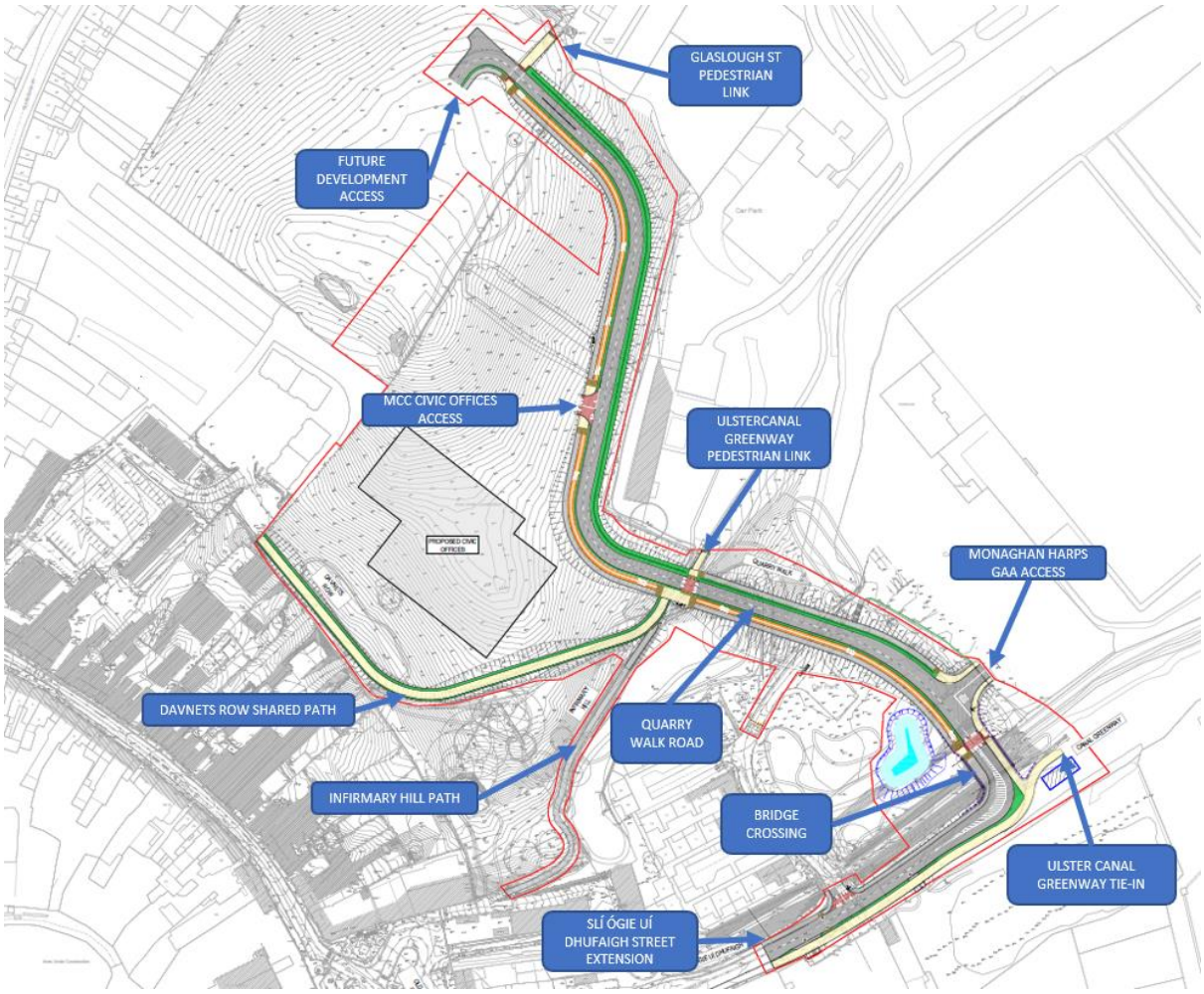


Figure 3-2: Overview of road access and active travel links

3.3 Design Guidance

The access road and active travel links have been designed with reference to the Design Manual for Urban Roads and Streets (DMURS 2019), the National Transport Authority National Cycle Manual (NCM), and the Transport Infrastructure Ireland Rural Cycleway Design (Offline & Greenway) guidelines.

- DMURS provided comprehensive guidelines for urban road and street design, ensuring efficiency, safety, and suitability for the specific urban context.
- The NCM guided the design of cycling infrastructure, promoting safe and convenient cycling through considerations such as cycle lane design, signage, and junctions.
- The Transport Infrastructure Ireland Rural Cycleway Design guidelines were followed, ensuring enjoyable and safe experiences on rural cycleways.

By adhering to these standards, the designs prioritized safety, functionality, and the promotion of sustainable and inclusive transportation options.

3.4 Road Alignment

The proposed horizontal alignment is largely based on the road corridor identified in the statutory Roosky Masterplan. Horizontal curves were designed to comply with the proposed design speed 30km/h and are generally between 26 – 100m Radius. At the low-speed areas such as access entrances and bridge approaches the horizontal radius was determined by vehicle tracking, as discussed in section 3.11. Refer to DBFL drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1201 and 1202 for the general arrangement.

The subject area has a very steep topography with approximately 27m level gain between the bank level at the Shambles River and the termination of the vehicle route in the vicinity of the proposed future development lands, thus a comparative options analysis for Quarry walk was conducted.

The design balances constructability, integration with proposed and existing links, cost-effectiveness, and lower overall environmental impact. Measures such as rest areas, speed reduction measures have been incorporated to accommodate active travel users. All sections with gradient>5% are less than 150m in length in accordance with TII Rural Cycleway design (offline & Greenway) recommendations.

The vertical curves were designed with a maximum gradient of 8% and Vertical sag curves K Value of 2.3 for 30km/h design speed. Refer to DBFL drawings 220084-RY-04-Z00-XXX-DR-DBFL-CE-3201 and 3202 for Quarry Walk Long sections.

3.4.1 Davnets Row Shared Path

The horizontal alignment closely tracks the existing path, a slight realignment of the path was completed to accommodate the proposed Civic office building and to maximise spatial usage without affecting the surrounding environment. Refer to DBFL drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1201 for the general arrangement.

The vertical alignment was designed to ensure that cyclist and pedestrians can comfortably utilize the route, this resulted in a maximum gradient of 5% and vertical curves of minimum k-value of 2. Refer to DBFL drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-3203 for the longitudinal Section.

3.5 Design Speed

The vehicular design speed for the scheme is 30km/hr which is appropriate for an urban site and reflects the high pedestrian and cyclist activity associated with the Canal Greenway and Monaghan Harps GAA Club.

3.6 Traffic Calming

DMURS recommends the use of the physical and psychological measures used in combination to have an impact on driver behaviour. The scheme includes measures such as narrowed carriageway widths, speed reduction bends, tabletop ramps and raised side road entries to ensure low vehicle speed. Segregated cycle lanes have been provided with chicanes at 40m centres for the downhill cycle lane as a speed control element.

3.7 Sightlines

Sightlines for the new Civic offices and Monaghan Harps GAA vehicular entrances are 2.4m x 23m (Set back and Sight stopping distance) as per the DMURS for a 30kmph speed limit, refer to DBFL drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1201 to 1202 for sightlines.

3.8 Road Cross Sections

The proposed cross sections have been developed in conjunction with the project landscape architect and have been agreed with MCC's Transportation Department during the pre-planning design stage following a rigorous options assessment. These cross sections comply with DMURS 2019 and NTA National cycle manual.

Cross sections at 10m intervals can be seen Quarry Walk on DBFL drawings 220084-RY-04-Z00-XXX-DR-DBFL-CE-3211 to 3216 and for Davnets row on 220084-RY-04-Z00-XXX-DR-DBFL-CE-3221 to 3223.

The typical cross-section details for the proposed works is detailed below:

The proposed extension of Slí Ógie Uí Dhufaigh typical cross section (see, Figure 3-3) has a total width 12.4m and consists of the following elements:

SLI OGIE UI DHUFAIGH	
Refer to 220084-RY-04-Z00-XXX-DR-DBFL-CE-5201 Construction Details Section A-A	
Carriageway elements	• 1 x 3.0m wide Traffic Lane – in each direction • 1.8m wide Footpath • 1.0m wide grass verge /Buffer • 3.6m wide shared path / greenway

Table 3-1: Sli Ogue Ui Dhufaigh road cross-section elements

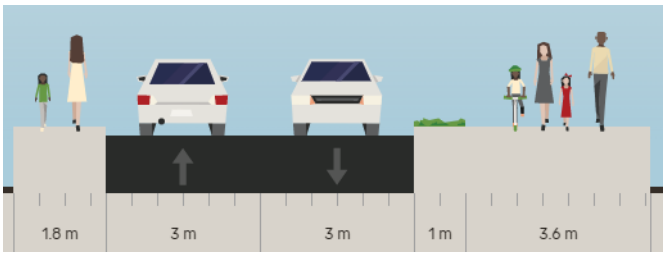


Figure 3-3: Slí Ógie Uí Dhufaigh street cross section

The proposed Quarry Walk access typical cross section (see Figure 3-4) has a total width of 14m and comprises of the following elements:

QUARRY WALK- Main Link Road	
Refer to 220084-RY-04-Z00-XXX-DR-DBFL-CE-5201 Construction Details Section B-B	
Carriageway elements	• 1 x 2.75m wide traffic lanes – in each direction • 2.0m wide Footpath • 2.5m wide 2-way Cycle path • 1.0m wide grass verge /Buffer • 3.3m grass swale

Table 3-2: Quarry Walk road cross-section elements

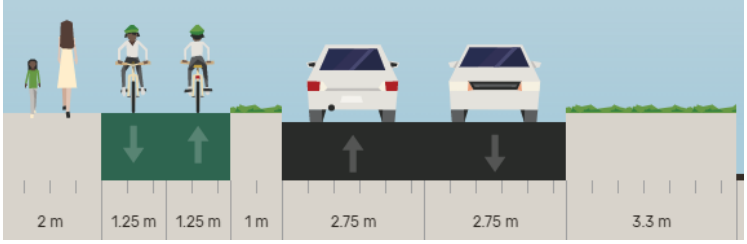


Figure 3-4: Quarry walk road cross section

The proposed Davnets Row shared link typical cross section (see Figure 3-5), has a total width of 5m and consists of the following elements:

DAVNETS ROW	
Refer to 220084-RY-04-Z00-XXX-DR-DBFL-CE-5202 Construction Details Section E-E	
Carriageway elements	• 3.5m wide Shared Path • 0.5m wide grass verge • 1 x 0.5m wide Hard verge – In each direction

Table 3-3: Davnets Row Path cross-section elements

Figure 3-5: Davnets Row shared path cross section

3.9 Traffic Flows

The road cross sections, pavement build-up, pedestrian crossings and other design elements have been informed by the predicted traffic flows for the proposed development. A detailed transport modelling and options assessment exercise has been undertaken to establish these flows. Refer to Traffic and Transportation Assessment Report submitted with this planning application for details.

3.10 Pedestrian and Cycle Infrastructure

Cycle facilities and footpaths are provided along the proposed access roads within the scheme to encourage, maximize sustainable transport and active travel. The requirements for pedestrians and cyclists have been incorporated into the design. Best practice guidance from the National Cycle Manual and DMURS has been implemented on the scheme including:

- Provision of 2.5m wide 2-way segregated cycle tracks in accordance with the requirements of the National Cycle Manual.

- 1.0m wide grass verge separates the segregated cycle track from the carriageway
- Footpaths have been provided with a minimum width of 1.8m.
- Shared areas for pedestrians and cyclists are provided at the toucan crossing waiting areas.
- Extension of 3.6m wide shared path/greenway which ties into the existing Ulster Canal Greenway
- 1.0m wide grass verge separates the greenway from the carriageway
- 2No. Rest

3.11 Pedestrian crossings

Provision of pedestrian crossing facilities along key travel desire lines throughout the scheme in addition to those located at street nodes. Types and treatments of crossings have been detailed in the table below.

Crossing	Location	Width	Treatment
Uncontrolled Courtesy crossing	Sli Ogie Ui Dhufaigh	2m	Dropped kerb
Uncontrolled Courtesy crossing -	Quarry Walk	4m	Flat top raised table
Toucan crossing	Quarry Walk	4m	Flat top raised table

Table 3-4:Types of Pedestrian crossings and their location

3.12 Pavement Design standards

Proposed access roads, shared paths, footpaths, and cycle paths within the subject site are designed in accordance with the Department of the Environment Recommendations for Site Development Works, the Design Manual for Urban Roads and Streets (DMURS), NTA Cycle Manual and Local Authority and TII Specifications for Road Works series 900 requirements.

3.13 Vehicle Tracking

The proposed roads will accommodate large trucks, refuse trucks, busses, and fire engines. Refer to DBFL general arrangement drawings no. drawings 220084-RY-04-Z00-XXX-DR-DBFL-CE-1201 &1202 for vehicle tracking paths.

Access tracking was completed for Monaghan Bottlers and Rooskey Avenue, to ensure access for Articulated vehicles and Large Refuse vehicles respectively, see Figure 3-6 below.

- Articulated Vehicle dimensions - Width 2.55m Length 16.480m
- Large refuse vehicle dimensions - Width 2.45m Length 9.860m

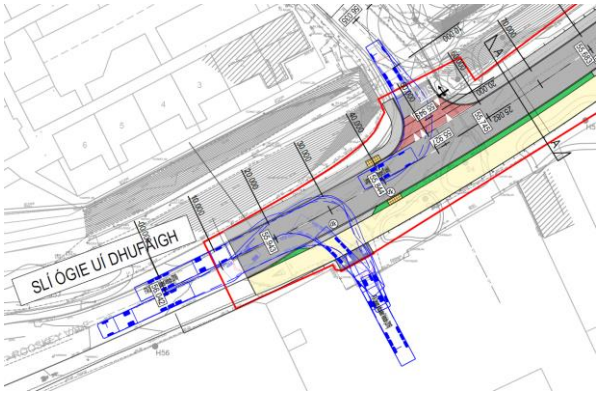


Figure 3-6: Vehicle Tracking analysis for Monaghan bottlers access and Rooskey avenue

The proposed access vehicle route into Roosky Lands has a 90-degree bend from Slí Ógie Uí Dhufaigh road leading to Quarry walk, this portion of road is designed to ensure that buses and cars would be able to manoeuvre past the bend to access the Monaghan Harps GAA club. Tracking analysis was completed to ensure that there is adequate space for a bus and private vehicle to comfortably track the bend in either direction and to access the Monaghan Harps GAA club, refer to Figure 3-7 below.

- Standard Rigid Bus dimensions - Width 2.55m Length 12.0m
- Standard Design Vehicle dimensions - Width 2.0m Length 4.8m.

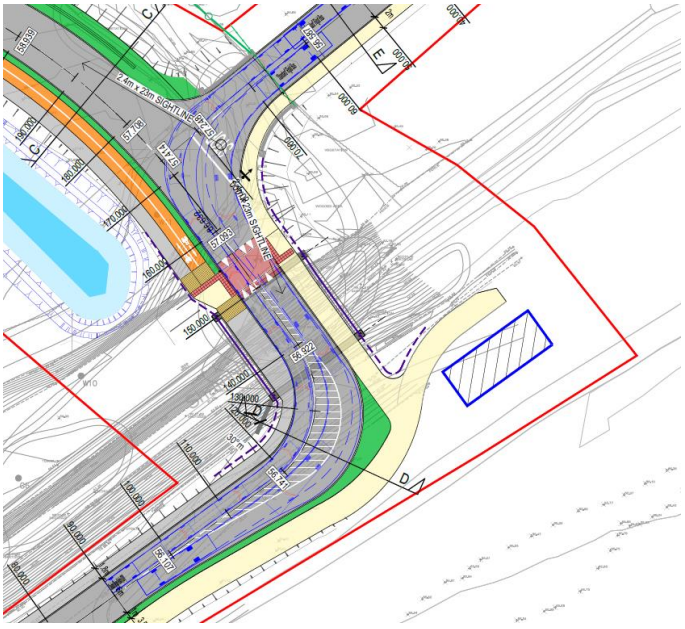


Figure 3-7: Vehicle Tracking analysis for 90 deg bend and Monaghan Harps GAA access

The proposed Civic offices access has been designed to ensure access for large refuse and fire engine trucks. Vehicle tracking analysis was completed, refer to Figure 3-8

- Large refuse vehicle dimensions - Width 2.45m Length 9.860m

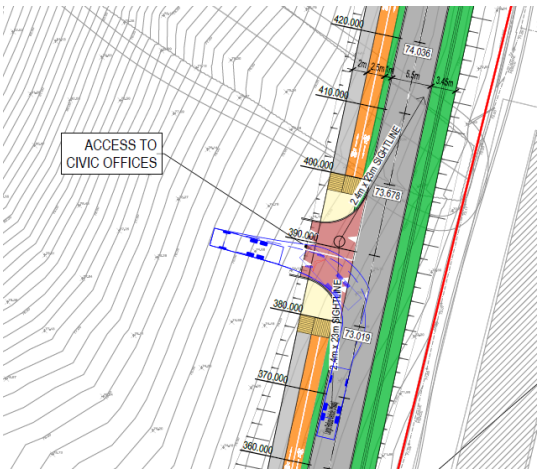


Figure 3-8: Vehicle Tracking analysis for the Civic Offices access

3.14 Road Safety Audit / Quality Audit

A Stage 1 Road Safety Audit has been undertaken and is included in Appendix F :. All the problems identified by the auditor have been resolved as per auditors' recommendation or alternative measures were implemented in agreement with the auditor. A Quality audit has also been completed and is included in Appendix G :

4 Water Crossing

The proposed access route requires a watercourse crossing of the River Shambles in the form of a 13m clear-span bridge, refer to DBFL drawing 220084-RY-02-Z00-XXX-DR-DBFL-CE-5001 for water crossing detail.

4.1 Bridge Characteristics

The bridge structure consists of MY4 precast concrete bridge beams supported by piled foundations at the abutments. To enhance safety, parapets will be installed on precast edge beams, and guardrails will be provided at both ends of the bridge.

The bridge beam has a depth of 0.5m, and the soffit level is set at 55.99m, which is 1.84m above the 0.1% Annual Exceedance Probability (AEP) Flood level of 54.14m and 2.8m above the 1.0% AEP Flood level of 53.18m , refer to Appendix D :for CRFAM maps.

4.2 Cross Sectional Dimensions

The bridge deck will have a total width of 14m, accommodating various components to cater to different modes of transportation. This includes a 3.6m wide footpath, a 3m wide shared greenway for pedestrians and cyclists, a 6m wide carriageway for vehicles, and a 1.4m wide median.

4.3 Vertical & Horizontal Alignments

The proposed bridge will have a straight horizontal alignment and a flat vertical alignment with a gradient of 0.75%. For effective drainage, a horizontal cross fall of 2.5% will be applied from the bridge centreline to both sides. This ensures proper water runoff and minimizes the risk of water accumulation on the bridge surface.

4.4 Foundation

A Ground investigation has been undertaken as described in Section 1.6. A summary of the findings at the bridge location is summarised below.

Rock testing was carried out on 6 samples recovered from the two boreholes BH01 and BH02, which presented the following soil composition: At BH01 firm grey gravelly CLAY was identified within the range of 1.10 to 3.20 meters, followed by very stiff gravelly CLAY and dense GRAVEL from 4.00 to 4.60 meters. Solid limestone bedrock was encountered at depths of 7.50 meters.

Similarly, BH02 successfully reached a depth of 2.20 meters by penetrating through MADE GROUND, revealing an overlay of stiff grey gravelly CLAY and GRAVEL from depths 3.50 to 4.40

meters. This investigation also confirmed the presence of bedrock at a depth of 7.50 meters below ground level.

While traditional methods for abutment construction remain viable, piled foundations are proposed to support the bridge as the presence of limestone bedrock at 7.50 meters, presents an ideal foundation for piling.

4.5 Hydrology and hydraulic Summary

An OPW Section 50 application for the proposed bridge will be submitted in parallel with this planning application. The Section 50 application demonstrates that the bridge meets required design standards and utilized flood modelling to establish a sufficient freeboard between the bridge soffit level and the estimated flood level.

5 Surface Water Drainage

5.1 Existing Surface Water

The topography of the site generally slopes from North to South. Surface water drainage within the vicinity of the proposed development comprises the following;

- MCC service records indicate that there is no existing public stormwater network within the subject site or in close proximity to the subject site, see Appendix E :for MCC records.
- The Shambles river runs through the southern section of the subject site and flows in West-East direction discharging into the Blackwater river 1.5km downstream, refer to Figure 5-1.

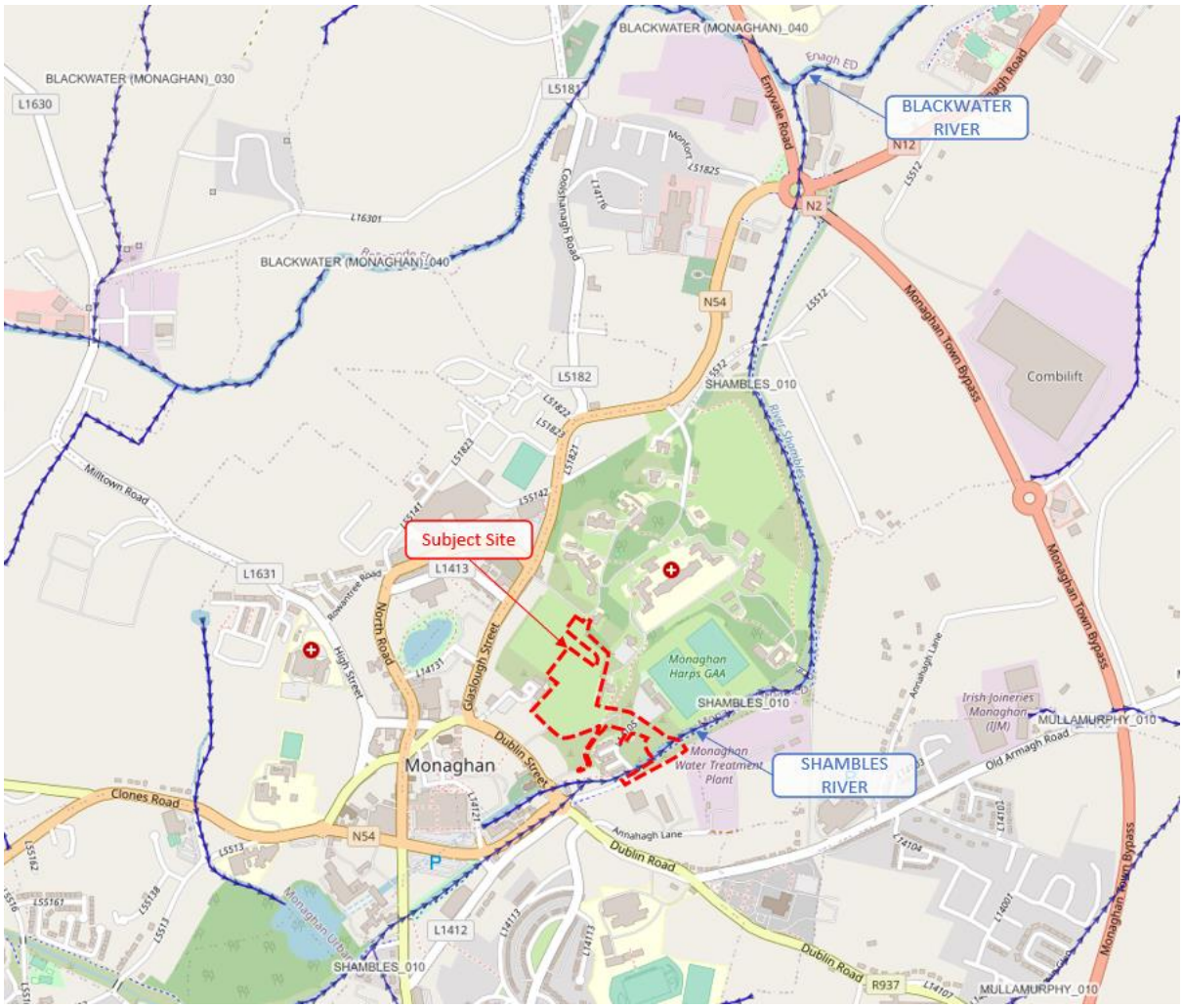


Figure 5-1: Blackwater river EPA map

5.2 Surface Water Catchments

The total Catchment area draining to the proposed surface water network is 4.66ha. The catchment is be split into 4 surface water catchments, where catchment 1A is located South of the

Shambles river and Catchments 1B, 1C and 2 are located North of the Shambles river, refer to Figure 5-2: Surface water Catchments below which outlines the location of each surface water.

Catchment 1A has a total area of 0.2ha of which the contributing run off area is from the Slí Ógie Uí Dhufaigh road extension. Catchment 1B has a total area of 0.64ha of which the contributing run off area is from the Quarry walk access link. Catchment 2 has a total area of 3.82ha of which the contributing run off area is from the Civic office project and future development area. Catchment 1C is a small area (0.07ha) serving only the upgraded Davnets Row, and it discharges via infiltration.

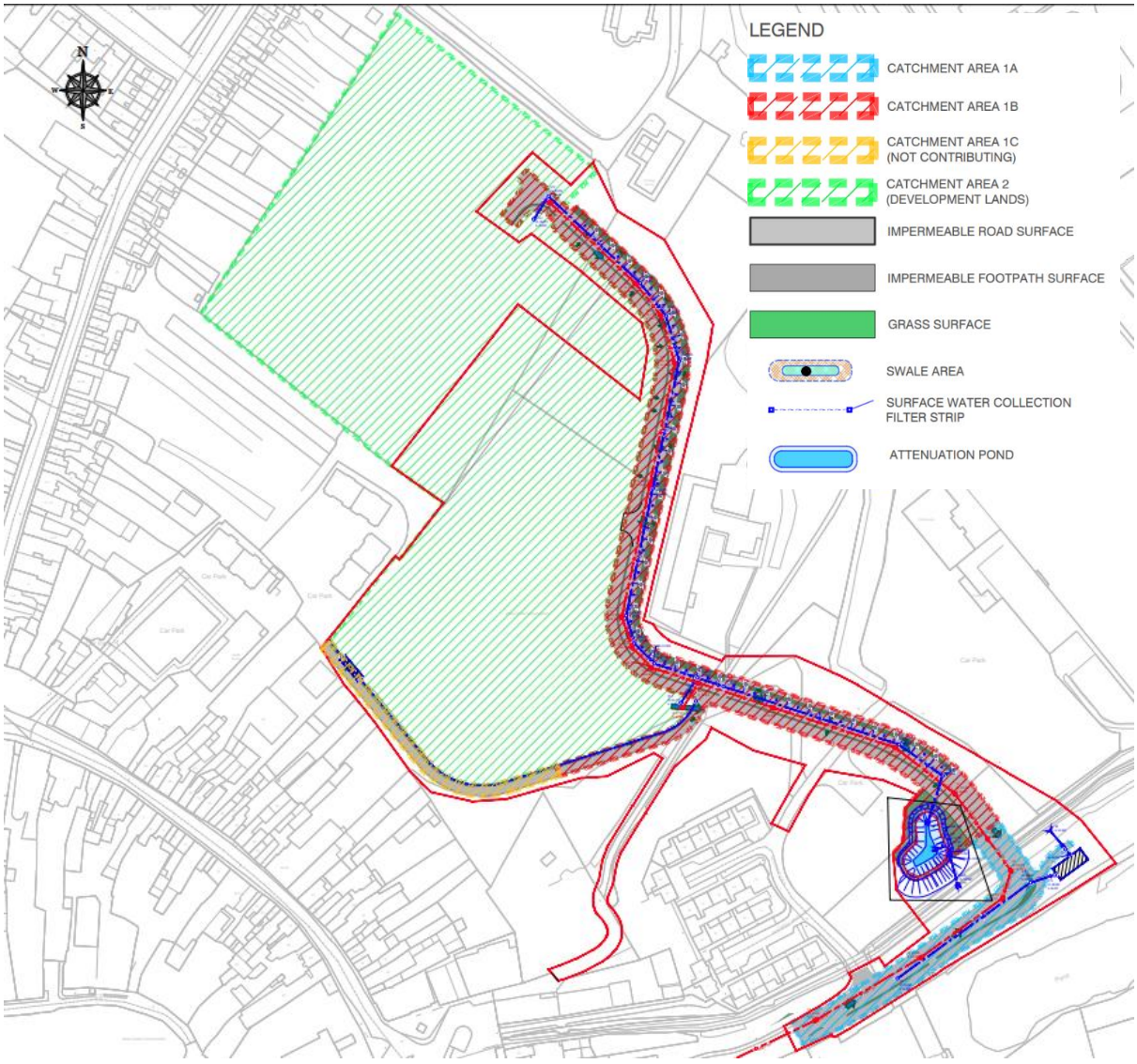


Figure 5-2: Surface water Catchments

5.3 Surface Water Drainage Strategy

The overall proposed drainage strategy primarily collects runoff from the subject site via Sustainable Urban Drainage Systems and then through piped systems which route to attenuation storage areas. Surface water runoff from the subject site will be attenuated to Qbar "Greenfield Runoff" as required in the GDSDS, with runoff exceeding the allowable outflow stored on site for up to a 1% AEP (Annual Exceedance Probability) event, plus 20% for climate change. Outflows are then routed though petrol interceptors before discharging to the Shambles River. The drainage network is intended to serve the Civic Office site and other future development lands within the Roosky Masterplan area as per the catchment plan. however, these developments shall be required to have their own on-site flow controls and attenuation prior to discharging to the road network.

5.3.1 Southern Catchment (1A)

The stormwater system is designed to effectively drain the road (catchment 1A) area of 0.2ha. This runoff is attenuated in an underground cellular storage system with a flow restrictor to limit discharge to 2l/s. The discharge will flow through a petrol interceptor before discharging to the Shambles River.

5.3.2 Northern Catchment (1B &2)

The stormwater system is designed to facilitate the efficient flow and management of surface water from the combined catchments 1B (0.64ha) and 2 (3.82ha)

In addition to the roadway/active travel links, the drainage network is intended to serve the Civic Office site and other future development lands as per the catchment plan however these developments shall be required to have their own on site flow controls and attenuation prior to discharging to the road network.

Quarry Walk road access is designed with a cross fall which directs runoff toward kerb inlets which allow runoff to flow directly from the road surface into the grass swale SuDS feature that runs along the length of Quarry Walk.

Footpaths and Cycle path along the road access are to direct run-off over the adjacent grass verge for infiltration and onwards to carriageway surface .

The proposed swale is a shallow vegetated channel, that conveys runoff from catchment 1B discharge points along the stormwater network to the outfall point. Check dams are to be located along the swale to provide additional attenuation and to prevent erosion.

The runoff from catchment 1B is to be attenuated in a detention basin, where the discharge will be restricted to 29.3l/s. The combined discharge from catchment 1B+2 will then be allowed to flow through a petrol interceptor before discharging to the Shambles River.

5.3.3 Northern Catchment (1C)

As part of the stormwater management system, Davnets Row Path (catchment 1C) is designed as a one-way cross-fall, which directs runoff towards an infiltration trench that runs along the length of the shared path. This system is designed to effectively drain an area of 0.07 ha of the shared path at Davnets row. A cellular storage system is located at the low point to provide storage for the Q100+CC event and from where runoff allowed to infiltrate into the soil.

5.4 Impermeable Areas: Strategy

The various impermeability factors used for the subject site were determined and agreed with MCC drainage department, see Table 5-1 below.

	Impermeability Factors
Roads and Footpaths - Type 1 (Draining to gullies) (m^2)	0.95
Roads and Footpaths - Type 2 (Draining to Suds features - Swale) (m^2)	0.7
Roads and Footpaths - Type 2 (Draining to Suds features - Infiltration trench) (m^2)	0.4
Grass Areas (m^2)	0.35
Development Areas (Site assumed as 70% impermeable)	0.7

Table 5-1: Impermeability factors

Table 5-2, Table 5-3 , Table 5-4 and Table 5-5 below provide an overview of the impermeable areas both non-contributing and contributing to the surface water drainage network The non-contributing runoff area . By applying the impermeability factor to the runoff area, impermeable areas were calculated for each catchment area. As a result, catchments 1A, 1B, and 2 have impermeable areas of 0.19ha, 0.39ha, and 2.67ha, respectively.

CATCHMENT 1A	Runoff Area	Runoff Coeff.	Effective Runoff Area
Roads and Footpaths - Type 1 (Draining to gullies) (m^2)	1902	0.95	1807
Grassed Areas (m^2)	143	0.35	50
Catchment area (ha)	0.20		
Impermeable area (ha)	0.19		

Table 5-2: Catchment 1A - Impermeable run-off area

CATCHMENT 1B	Runoff Area	Runoff Coeff.	Effective Runoff Area
Roads and Footpaths - Type 1 (Draining to gullies) (m^2)	373	0.95	354
Roads and Footpaths - Type 2 (Draining to Suds features) (m^2)	4128	0.70	2890
Grassed Areas (m^2)	1892	0.35	662
Catchment area (ha)	0.64		
Impermeable area (ha)	0.39		

Table 5-3: Catchment 1B - Impermeable run-off area

CATCHMENT 1C	Runoff Area	Runoff Coeff.	Effective Runoff Area
Roads and Footpaths - Type 2 (Draining to Suds features - Infiltration trench) (m^2)	490	0.40	196
Grass Areas (m^2)	210	0.35	73.5
Catchment area (ha)	0.07		
Impermeable area (ha)	0.027		

Table 5-4: Catchment 1C - Impermeable runoff area

CATCHMENT 2	Runoff Area	Runoff Coeff.	Effective Runoff Area
Developed Area (Site assumed as 70% impermeable)	38183	0.70	26728
Catchment area (ha)	3.82		
Impermeable area (ha)	2.67		

Table 5-5: Catchment 2A - Impermeable run-off area

5.5 Compliance with Surface Water Policy

Surface water management for the proposed development is designed to comply with the Greater Dublin Strategic Drainage Study (GDSDS) policies and guidelines and the requirements of Monaghan County Council. The GDSDS guidelines require the following main 4 main criteria to be provided by the development's surface water design;

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage and treatment of run-off within the SUDS features e.g. infiltration to ground in Swales and attenuation, filtration and uptake by SuDS vegetation, downstream petrol interceptor
- Criterion 2: River Regime Protection – satisfied by attenuating run-off with flow control device prior to discharge to the existing ditch to the south of the site.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the site being outside the 1000 year coastal and fluvial flood levels. Pluvial flood risk addressed by development designed to accommodate a 100-year storm as per GDSDS. Planned flood routing for storms greater than 100-year level considered in design and development run-off contained within site.
- Criterion 4: River flood protection – attenuation and flow restriction to Qbar provided in SUDS features

5.6 Surface Water Drainage Design Standards

The mean annual catchment runoff from the site (Q_{bar}) was calculated using the Institute of Hydrology equation, refer to Appendix C : for permissible stormwater discharge and Met Eireann Rainfall data.

Storm water drainage for the proposed development is designed using the recommendations of the GDSDS, EN752 and BS8301:1985, with the following parameters applied:

- Return period for pipe network 2 years,
    - check 30-year 15 minute, no flooding;
    - check 100-year flooding in designated areas;
- Time of entry 4 minutes
- Pipe Friction (Ks) (concrete) 0.6 mm
- Minimum Velocity 1.0 m/s
- Standard Average Annual Rainfall 987mm
- M5-60 16.1mm
- Ratio r (M5-60/M5-2D) 0.271
- Storage System Storm Return Event GDSDS Volume 2, p61, Criterion 3
    - 10-year no flooding on site
    - 30-year no flooding on site
    - 100-year check no internal property flooding. Flood routing plan. Lowest levl along road is + 500mm freeboard above 100-year flood level. No flooding to adjacent areas.
- Climate Change 20%
- C_v winter 0.84
- C_v summer 0.75

(Note on C_v Factors; value of 0.84 for Winter and 0.75 for Summer is standard practice and is appropriate for this site.)

Surface water sewers have been designed in accordance with IS EN 752 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS). The minimum pipe diameter for public surface water sewers is 225mm. Standard drainage details are as per drawing 220084-RY-05-Z00-XXX-DR-DBFL-CE-5001, 5002 and 5003 in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

The Network Module of Microdrainage has been used to assess the performance of the proposed surface water network. This analysis indicated that the pipe sizes and grades are adequate for storm events up to the 1% AEP refer to Appendix A : for the Stormwater Network analysis.

Refer to DBFL drawing reference 220084-RY-05-Z00-XXX-DR-DBFL-CE-1301 & 1302 for the proposed surface water layout and the Surface water longitudinal sections are shown in DBFL drawing 220084-RY-05-Z00-XXX-DR-DBFL-CE-3301 & 3302.

5.7 Discharge Rate

Surface water runoff volumes from the development is attenuated to flow rates equal to the greenfield runoff (Qbar), in accordance with the recommendations of the GDSDS. Qbar is calculated using the Institute of Hydrology equation, as recommended in the Greater Dublin Strategic Drainage Study (GDSDS), as follows:

$$Q_{bar\ [rural]} = 0.00108\ x\ AREA^{0.89} x\ SAAR^{1.17} x\ Soil^{2.17}$$

Where:

- Qbar [rural] is the mean catchment annual flow from a 50 ha rural catchment in m3/s;
- SAAR is the standard average annual rainfall = 987mm.
- SOIL is the soil index, with 5 soil types used and SPR values (standard percentage runoff) applied to each soil type.

  The SPR values for the 5 soil types are as follows:

  Soil 1 = 0.1; Soil 2 = 0.3; Soil 3 = 0.37; Soil 4 = 0.47; Soil 5 = 0.53;

SPR value of 0.3 (Soil Type 2) is applied for the catchment 1A and. SPR value of 0.47 (Soil Type 4) is chosen for both Catchment 1B, 1C & 2. The Soil types are chosen based on site specific conditions, as confirmed using preliminary site investigations.

Greenfield run-off rates were calculated for Catchments 1A, 1B, 1C, and 2 on the subject site, as shown in Table 5-6 with the relevant runoff area. Note, Catchment 1C does not contribute to the Overall Subject Site discharge, the runoff generated from this catchment will be allowed to infiltrate into the ground. The discharge values have been agreed with Monaghan County Council's drainage department. Refer to Appendix C :for the Permissible Stormwater Discharge calculations and the relevant Rainfall data.

	CATCHMENTS			
	1A	1B	1C	2
Site area (ha)	0.20	0.64	0.07	3.82
Total Effective runoff area (ha)	0.19	0.39	0.02	2.67
Discharge rates (l/s)	2	4.2	N/A	25.1

Table 5-6: Discharge rates generated by each catchment

Surface water run-off from catchment areas will be attenuated using a vortex flow control device (Hydrobrake or equivalent) within the proposed storage system.

5.8 Surface Water Storage

Catchment 1B&2 attenuation storage is provided in a detention basin and Catchment 1A and 1C in separate underground cellular storage systems (“Pluvial Cube” system or similar approved)

The detention basin is to be a vegetated depression with gently sloping banks (3H:1V). It will be normally dry and only fill temporarily in response to rainfall. Maximum water level is proposed to be 1.2m. A level access/maintenance bench will be provided around the perimeter of the basin. The basin will accommodate wetland planting within the basin and native planting/screening around the perimeter.

The cellular storage systems for 1A and 1C has been chosen as the there is insufficient space to accommodate an open Suds feature alongside the greenway and the Davnets Row respectively, due to the invert depth required and space constraints. The system is unlined which facilitates infiltration to ground replicating natural processes. For the 1A system the open space above the storage system can be used for soft landscaping to complement the Ulster Canal.

The total storage volume required has been calculated using the “Source Control Module” of “Microdrainage” as 73.5m3 ,196.6m3 and 16.9m3 for Catchment 1A , Catchment 1B+2 and Catchment 1C respectively, refer to Appendix B :for Windes attenuation calculations. The storage provided is 96m3, 200m3 and 19.8m3 for Catchment 1A , Catchment 1B+2 and Catchment 1C respectively.

The volume has been calculated based on drainage levels, ground levels, type of storage system and the allowable outflow rate. The water storage requirements are calculated with an allowance of 20% increase in rainfall rates due to climate change. Typical details and cross-sections of each proprietary attenuation system is provided on DBFL drawings 220084-RY-05-Z00-XXX-DR-DBFL-CE-5302and 220084-RY-05-Z00-XXX-DR-DBFL-CE-5304.

5.9 Suds

SuDS features will be integrated into the surface water drainage network for the proposed development, with the objective of controlling the quantity of surface water runoff, managing the quality of runoff to prevent pollution, and creating and sustaining local ecosystems.

The four main categories of benefits that can be achieved by SuDS are water quantity, quality, amenity, and biodiversity. SuDS features can take many forms both above and below ground and can include planting and proprietary / manufactured products.

SuDS features deliver high-quality drainage while supporting urban areas to cope better with severe rainfall now and in the future. They also counteract some of the impacts on the water cycle caused by increased urbanisation, such as reduced infiltration, which can result in diminished groundwater supplies. They are used in conjunction with traditional drainage systems, and the use of SuDS features are a requirement of the GDSDS (Greater Dublin Strategic Drainage Study).

The SuDs features proposed for the development include the following:

- Swales
- Check Dams
- Detention basins
- Underground cellular storage
- Hydrobrake' flow controls.
- Petrol Interceptors.

The proposed surface water drainage layout is detailed in DBFL drawing no 220084-RY-05-Z00-XXX-DR-DBFL-CE-1301 and 1302. The SUDs Typical details are shown on DBFL drawing 220084-RY-05-Z00-XXX-DR-DBFL-CE-5303.The combination of these elements forms a comprehensive surface water strategy for the road catchment area. It ensures efficient capture, conveyance, and management of surface water runoff, minimizing the risk of flooding and improving overall water quality within the infrastructure design.

5.10 Climate Change

Surface water calculations for the proposed development are based on Met Eireann rainfall values with rainfall intensities increased by a factor of 20% to allow for climate change, as required by the GDSDS. Refer to Appendix C : for the applicable Met Eireann Rainfall data

5.11 Pluvial Flooding Provision

The surface water network, attenuation storage and road levels are designed to accommodate a 100-year storm event within the subject site. A 20% climate change provision has been included. Finished road levels and manhole cover levels are set above the 100-year flood level by a minimum of 0.3m for protection. The TWL for the cellular storage and attenuation basin serving catchment 1A, Catchment 1B+2 and 1C respectively are 55.338m, 56.7m and 64.850m. The lowest proposed level within catchment 1A, Catchment 1B+2 and Catchment 1C is 55.680m, 57.971m and 65.310m, which provide a freeboard of 0.342m,1.271m and 0.46m respectively. Exceedance flow routes are along the road carriageway towards the Shambles River and away from sensitive receptors.

6 Wastewater

6.1 Existing Foul Water sewer

There is an existing 225mm DIA foul sewer main to the west of the subject site. This sewer main follows a north to south route along Dublin St North, and a west to east route along the Old Cross pedestrian link, connecting to the south of Sli Ogie Dhufaigh road and continuing westbound along Sli Ogie Dhufaigh and MdCarton road. Refer to Appendix E : for existing Irish Water foul sewer records.

6.2 Design Strategy

The general foul sewer strategy for the development aims to provide trunk foul sewer main along Quarry walk that will service both the civic office and future mixed-used development. This sewer main will discharge by gravity to the existing public 225mm diameter foul sewer located along Sli Ogie Ui Dhufaigh, South-West of the subject site. Refer to DBFL drawings 220084-RY-05-Z00-XXX-DR-DBFL-CE-1301 & 1302.

All main sewers up to the connection point will be minimum 225m DIA as per Irish water guidelines. Irish water Code of Practice indicates a 225mm sewer at 1 in 100 gradient will serve up to 330 units, proposed sewer gradients are in excess of this providing additional capacity.

6.3 Compliance with Irish Water Standards

The foul drainage network for the proposed development has been designed in accordance with the Irish Water requirements for the design of wastewater gravity sewers as set out in Appendix B of Irish Water Code of Practice.

7 Water supply

7.1 Existing Water Supply

There is an existing public 200mm DIA watermain. This pipe runs from Old Cross to St Davnets Hospital in a south to north direction through Roosky lands. Refer to Appendix E :for existing Irish watermain records.

7.2 Watermain Layout Strategy

The Roosky Lands development has water demand from the Civic Offices development and the intended future mixed-use development on the surrounding vacant lands.

A watermain diversion is required to facilitate the development of the Civic Offices. The diversion involves rerouting the existing watermain along Davnets Row and Quarry Walk, forming a trunk water main along Quarry Walk, which reconnects to the existing network north of the site. The planned diversion indicated on DBFL drawings 220084-RY-93-Z00-XXX-DR-DBFL-CE-1401 and 220084-RY-93-Z00-XXX-DR-DBFL-CE-3401. A Diversion application has been made to Irish Water for the watermain diversion.

The proposed layout consists of a 225mm DIA PE100 pipe with spurs for both the Civic offices and the future mixed-use development.

7.3 Fire Fighting

The proposed watermain layout, includes multiple fire hydrants along Quarry walk. These hydrants will serve the purpose of facilitating firefighting operations.

Hydrants shall comply with the requirements of BS 750:2012 and shall be installed in accordance with Irish Water's Code of Practice and Standard Details.

7.4 Compliance with Irish Water Standards

The water main layout and details are in accordance with Irish Water's Code of Practice and Standard Details. All valves, hydrant and metering fittings/details shall be in accordance with the requirements of Irish Water.

Appendix A : SURFACE WATER DRAINAGE NETWORK 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)	100	PIMP (%)	100
M5-60 (mm)	16.100	Add Flow / Climate Change (%)	20
Ratio R	0.271	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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.130	4-8	0.056

Total Area Contributing (ha) = 0.186

Total Pipe Volume (m³) = 4.487

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	72.148	0.361	199.9	0.093	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	12.775	0.064	199.6	0.093	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	11.639	0.058	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	16.284	0.651	25.0	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)
S1.000	50.00	5.31	54.746	0.093	0.0	0.0	2.5	0.92	36.6	15.1
S1.001	50.00	5.54	54.385	0.186	0.0	0.0	5.0	0.92	36.7	30.2
S1.002	50.00	5.75	54.321	0.186	0.0	0.0	5.0	0.92	36.6	30.2
S1.003	50.00	5.85	54.263	0.186	0.0	0.0	5.0	2.63	104.5	30.2

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S17	55.697	0.951	Open Manhole	1200	S1.000	54.746	225				
S16	56.844	2.459	Open Manhole	1200	S1.001	54.385	225	S1.000	54.385	225	
S15	56.942	2.621	Open Manhole	1200	S1.002	54.321	225	S1.001	54.321	225	
S14	55.850	1.587	Open Manhole	1200	S1.003	54.263	225	S1.002	54.263	225	
S00	NaN	0.000	Open Manhole	0		OUTFALL		S1.003	53.611	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S17	667618.335	833664.287	667618.335	833664.287	Required	
S16	667676.909	833706.410	667676.909	833706.410	Required	
S15	667689.676	833706.867	667689.676	833706.867	Required	
S14	667695.894	833716.706	667695.894	833716.706	Required	
S00	667685.612	833729.333			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S17	55.697	54.746	0.726	Open Manhole	1200
S1.001	o	225	S16	56.844	54.385	2.234	Open Manhole	1200
S1.002	o	225	S15	56.942	54.321	2.396	Open Manhole	1200
S1.003	o	225	S14	55.850	54.263	1.362	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	72.148	199.9	S16	56.844	54.385	2.234	Open Manhole	1200
S1.001	12.775	199.6	S15	56.942	54.321	2.396	Open Manhole	1200
S1.002	11.639	200.0	S14	55.850	54.263	1.362	Open Manhole	1200
S1.003	16.284	25.0	S00	NaN	53.611	NaN	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.093	0.093	0.093
1.001	-	-	100	0.093	0.093	0.093
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.186	0.186	0.186

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	S17	225	0.726	2.234	Unclassified	1200	0	0.726	Unclassified
S1.001	S16	225	2.234	2.396	Unclassified	1200	0	2.234	Unclassified
S1.002	S15	225	1.362	2.396	Unclassified	1200	0	2.396	Unclassified
S1.003	S14	225	1.362	1.362	Unclassified	1200	0	1.362	Unclassified

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)
S1.003	S00	NaN	53.611	53.244	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.100	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.003, Volume (m³): 2.2

Unit Reference	MD-SHE-0070-2000-0800-2000
Design Head (m)	0.800
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	54.263
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	2.0
Flush-Flo™	0.240	2.0
Kick-Flo®	0.504	1.6
Mean Flow over Head Range	-	1.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	2.4	3.000	3.7	7.000	5.5
0.200	2.0	1.400	2.6	3.500	3.9	7.500	5.6
0.300	2.0	1.600	2.7	4.000	4.2	8.000	5.8
0.400	1.9	1.800	2.9	4.500	4.4	8.500	6.0
0.500	1.6	2.000	3.0	5.000	4.7	9.000	6.2
0.600	1.8	2.200	3.2	5.500	4.9	9.500	6.3
0.800	2.0	2.400	3.3	6.000	5.1		
1.000	2.2	2.600	3.4	6.500	5.3		

Storage Structures for Storm

Cellular Storage Manhole: S14, DS/PN: S1.003

Invert Level (m) 52.850 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	85.0	0.0	1.001	0.0	0.0
1.000	85.0	0.0			

1 year Return Period 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	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S17	15 minute 1 year Winter I+20%	55.697	54.840	-0.131	0.000	0.34
S1.001	S16	15 minute 1 year Winter I+20%	56.844	54.523	-0.087	0.000	0.69
S1.002	S15	15 minute 1 year Winter I+20%	56.942	54.460	-0.086	0.000	0.70
S1.003	S14	7200 minute 1 year Winter I+20%	55.850	54.301	-0.187	0.000	0.01

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S17		0.101	11.9	OK
S1.001	S16		0.474	21.7	OK
S1.002	S15		0.356	21.8	OK
S1.003	S14		86.735	0.6	OK

30 year Return Period 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	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S17	2160 minute 30 year Winter I+20%	55.697	55.116	0.145	0.000	0.05
S1.001	S16	2160 minute 30 year Winter I+20%	56.844	55.364	0.754	0.000	0.12
S1.002	S15	2160 minute 30 year Winter I+20%	56.942	55.502	0.956	0.000	0.10
S1.003	S14	2160 minute 30 year Winter I+20%	55.850	55.633	1.145	0.307	0.02

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S17		0.413	1.8	SURCHARGED
S1.001	S16		3.923	3.9	SURCHARGED
S1.002	S15		1.790	3.2	SURCHARGED
S1.003	S14		88.585	2.1	FLOOD

100 year Return Period 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	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S17	1440 minute 100 year Winter I+20%	55.697	55.699	0.728	2.864	0.07
S1.001	S16	960 minute 100 year Winter I+20%	56.844	55.883	1.273	0.000	0.20
S1.002	S15	960 minute 100 year Winter I+20%	56.942	55.864	1.318	0.000	0.20
S1.003	S14	1440 minute 100 year Winter I+20%	55.850	55.851	1.363	1.153	0.03

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
S1.000	S17		2.768	2.3	FLOOD
S1.001	S16		4.510	6.2	SURCHARGED
S1.002	S15		2.200	6.2	SURCHARGED
S1.003	S14		89.974	2.6	FLOOD

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)	100	PIMP (%)	100
M5-60 (mm)	16.100	Add Flow / Climate Change (%)	0
Ratio R	0.271	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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.233	4-8	0.156

Total Area Contributing (ha) = 0.389

Total Pipe Volume (m³) = 30.708

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	12.000	0.200	60.0	0.000	4.00	13.8	0.600	o	225	Pipe/Conduit	
S1.001	12.000	0.164	73.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	55.552	2.200	25.3	0.037	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	18.381	0.613	30.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	20.644	0.800	25.8	0.035	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)
S1.000	50.00	4.12	79.500	0.000	13.8	0.0	0.0	1.69	67.3	13.8
S1.001	50.00	4.25	79.300	0.000	13.8	0.0	0.0	1.53	60.9	13.8
S1.002	50.00	4.60	79.136	0.037	13.8	0.0	0.0	2.61	104.0	18.8
S1.003	50.00	4.73	75.284	0.072	13.8	0.0	0.0	2.40	95.4	23.5
S1.004	50.00	4.86	74.672	0.107	13.8	0.0	0.0	2.59	102.8	28.3

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
S1.005	57.196	1.907	30.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	57.196	1.430	40.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	12.612	0.420	30.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	12.531	0.418	30.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	30.897	1.349	22.9	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	15.000	0.546	27.5	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	15.000	0.600	25.0	0.000	0.00	11.3	0.600	o	225	Pipe/Conduit	
S1.010	82.563	3.753	22.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	23.620	1.027	23.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	15.458	0.300	51.5	0.037	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.013	18.750	0.123	152.4	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.014	2.877	0.131	22.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	5.118	0.233	22.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	11.643	0.250	46.6	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)	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)
S1.005	50.00	5.26	73.222	0.142	13.8	0.0	0.0	2.40	95.3	33.0
S1.006	50.00	5.72	70.000	0.177	13.8	0.0	0.0	2.07	82.5	37.8
S1.007	50.00	5.81	67.920	0.212	13.8	0.0	0.0	2.40	95.3	42.5
S1.008	50.00	5.90	67.500	0.247	13.8	0.0	0.0	2.40	95.4	47.2
S1.009	50.00	6.08	64.782	0.282	13.8	0.0	0.0	2.75	109.2	52.0
S2.000	50.00	4.10	64.000	0.000	0.0	0.0	0.0	2.51	99.6	0.0
S2.001	50.00	4.19	63.454	0.000	11.3	0.0	0.0	2.63	104.5	11.3
S1.010	50.00	6.57	61.289	0.317	25.1	0.0	0.0	2.80	111.4	68.0
S1.011	50.00	6.72	57.536	0.352	25.1	0.0	0.0	2.74	108.9	72.8
S1.012	50.00	6.84	56.123	0.389	25.1	0.0	0.0	2.20	155.2	77.8
S1.013	50.00	6.96	55.823	0.389	25.1	0.0	0.0	2.54	1613.1	77.8
S1.014	50.00	6.98	55.700	0.389	25.1	0.0	0.0	2.80	111.5	77.8
S1.015	50.00	7.01	55.569	0.389	25.1	0.0	0.0	2.80	111.5	77.8
S1.016	50.00	7.11	53.036	0.389	25.1	0.0	0.0	1.92	76.4«	77.8

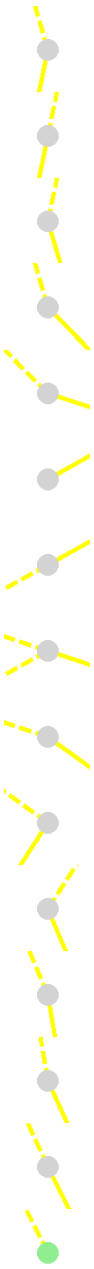
Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Ba
SDUMMY 15-1-1	83.527	4.027	Open Manhole	1200	S1.000	79.500	225				
S15-1	83.268	3.968	Open Manhole	1200	S1.001	79.300	225	S1.000	79.300	225	
S15	82.636	3.500	Open Manhole	1200	S1.002	79.136	225	S1.001	79.136	225	
S14	78.740	3.456	Open Manhole	1200	S1.003	75.284	225	S1.002	76.936	225	
S13	77.269	2.598	Open Manhole	1200	S1.004	74.672	225	S1.003	74.671	225	
S12	75.655	2.433	Open Manhole	1200	S1.005	73.222	225	S1.004	73.872	225	
S11	73.762	3.762	Open Manhole	1200	S1.006	70.000	225	S1.005	71.315	225	
S10	70.806	2.886	Open Manhole	1200	S1.007	67.920	225	S1.006	68.570	225	
S9	69.762	2.262	Open Manhole	1200	S1.008	67.500	225	S1.007	67.500	225	
S8	68.734	3.952	Open Manhole	1200	S1.009	64.782	225	S1.008	67.082	225	
SDUMMY 7-1-1	68.283	4.283	Open Manhole	1200	S2.000	64.000	225				
S7-1	67.454	4.000	Open Manhole	1200	S2.001	63.454	225	S2.000	63.454	225	
S7	66.240	4.951	Open Manhole	1200	S1.010	61.289	225	S1.009	63.433	225	
								S2.001	62.854	225	
S6	59.621	2.085	Open Manhole	1200	S1.011	57.536	225	S1.010	57.536	225	
S5	57.971	1.848	Open Manhole	1200	S1.012	56.123	300	S1.011	56.509	225	
S4	57.500	1.677	Open Manhole	1800	S1.013	55.823	900	S1.012	55.823	300	
S3	57.024	1.324	Open Manhole	1800	S1.014	55.700	225	S1.013	55.700	900	
S2	57.482	1.913	Open Manhole	1200	S1.015	55.569	225	S1.014	55.569	225	
S1	56.500	3.464	Open Manhole	1200	S1.016	53.036	225	S1.015	55.336	225	
S	55.220	2.434	Open Manhole	0		OUTFALL		S1.016	52.786	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SDUMMY 15-1-1	667451.559	833988.060	667451.559	833988.060	Required	
S15-1	667458.206	833998.070	667458.206	833998.070	Required	
S15	667464.710	834008.152	667464.710	834008.152	Required	
S14	667505.106	833970.018	667505.106	833970.018	Required	
S13	667516.434	833955.542	667516.434	833955.542	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S12	667522.239	833935.731	667522.239	833935.731	Required	
S11	667510.573	833879.737	667510.573	833879.737	Required	
S10	667498.908	833823.743	667498.908	833823.743	Required	
S9	667502.488	833811.650	667502.488	833811.650	Required	
S8	667511.283	833802.723	667511.283	833802.723	Required	
SDUMMY 7-1-1	667514.376	833778.567	667514.376	833778.567	Required	
S7-1	667527.505	833785.819	667527.505	833785.819	Required	
S7	667540.633	833793.071	667540.633	833793.071	Required	
S6	667619.019	833767.142	667619.019	833767.142	Required	
S5	667638.185	833753.338	667638.185	833753.338	Required	
S4	667629.769	833740.372	667629.769	833740.372	Required	
S3	667637.075	833723.104	667637.075	833723.104	Required	
S2	667637.548	833720.266	667637.548	833720.266	Required	
S1	667639.681	833715.614	667639.681	833715.614	Required	
S	667644.919	833705.216			No Entry	



PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	SDUMMY 15-1-1	83.527	79.500	3.802	Open Manhole	1200
S1.001	o	225	S15-1	83.268	79.300	3.743	Open Manhole	1200
S1.002	o	225	S15	82.636	79.136	3.275	Open Manhole	1200
S1.003	o	225	S14	78.740	75.284	3.231	Open Manhole	1200
S1.004	o	225	S13	77.269	74.672	2.372	Open Manhole	1200
S1.005	o	225	S12	75.655	73.222	2.208	Open Manhole	1200
S1.006	o	225	S11	73.762	70.000	3.537	Open Manhole	1200
S1.007	o	225	S10	70.806	67.920	2.661	Open Manhole	1200
S1.008	o	225	S9	69.762	67.500	2.037	Open Manhole	1200
S1.009	o	225	S8	68.734	64.782	3.727	Open Manhole	1200
S2.000	o	225	SDUMMY 7-1-1	68.283	64.000	4.058	Open Manhole	1200
S2.001	o	225	S7-1	67.454	63.454	3.775	Open Manhole	1200
S1.010	o	225	S7	66.240	61.289	4.726	Open Manhole	1200
S1.011	o	225	S6	59.621	57.536	1.860	Open Manhole	1200
S1.012	o	300	S5	57.971	56.123	1.548	Open Manhole	1200
S1.013	o	900	S4	57.500	55.823	0.777	Open Manhole	1800
S1.014	o	225	S3	57.024	55.700	1.099	Open Manhole	1800
S1.015	o	225	S2	57.482	55.569	1.688	Open Manhole	1200
S1.016	o	225	S1	56.500	53.036	3.239	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	12.000	60.0	S15-1	83.268	79.300	3.743	Open Manhole	1200
S1.001	12.000	73.2	S15	82.636	79.136	3.275	Open Manhole	1200
S1.002	55.552	25.3	S14	78.740	76.936	1.579	Open Manhole	1200
S1.003	18.381	30.0	S13	77.269	74.671	2.373	Open Manhole	1200
S1.004	20.644	25.8	S12	75.655	73.872	1.558	Open Manhole	1200
S1.005	57.196	30.0	S11	73.762	71.315	2.222	Open Manhole	1200
S1.006	57.196	40.0	S10	70.806	68.570	2.011	Open Manhole	1200
S1.007	12.612	30.0	S9	69.762	67.500	2.037	Open Manhole	1200
S1.008	12.531	30.0	S8	68.734	67.082	1.427	Open Manhole	1200
S1.009	30.897	22.9	S7	66.240	63.433	2.582	Open Manhole	1200
S2.000	15.000	27.5	S7-1	67.454	63.454	3.775	Open Manhole	1200
S2.001	15.000	25.0	S7	66.240	62.854	3.161	Open Manhole	1200
S1.010	82.563	22.0	S6	59.621	57.536	1.860	Open Manhole	1200
S1.011	23.620	23.0	S5	57.971	56.509	1.237	Open Manhole	1200
S1.012	15.458	51.5	S4	57.500	55.823	1.377	Open Manhole	1800
S1.013	18.750	152.4	S3	57.024	55.700	0.424	Open Manhole	1800
S1.014	2.877	22.0	S2	57.482	55.569	1.688	Open Manhole	1200
S1.015	5.118	22.0	S1	56.500	55.336	0.939	Open Manhole	1200
S1.016	11.643	46.6	S	55.220	52.786	2.209	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.037	0.037	0.037
1.003	-	-	100	0.035	0.035	0.035
1.004	-	-	100	0.035	0.035	0.035
1.005	-	-	100	0.035	0.035	0.035
1.006	-	-	100	0.035	0.035	0.035
1.007	-	-	100	0.035	0.035	0.035
1.008	-	-	100	0.035	0.035	0.035
1.009	-	-	100	0.035	0.035	0.035
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.035	0.035	0.035
1.011	-	-	100	0.035	0.035	0.035
1.012	-	-	100	0.037	0.037	0.037
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.389	0.389	0.389

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	SDUMMY 15-1-1	225	3.743	3.802	Unclassified	1200	0	3.802	Unclassified
S1.001	S15-1	225	3.275	3.743	Unclassified	1200	0	3.743	Unclassified
S1.002	S15	225	1.579	3.275	Unclassified	1200	0	3.275	Unclassified
S1.003	S14	225	2.373	3.231	Unclassified	1200	0	3.231	Unclassified
S1.004	S13	225	1.558	2.372	Unclassified	1200	0	2.372	Unclassified
S1.005	S12	225	1.840	2.222	Unclassified	1200	0	2.208	Unclassified
S1.006	S11	225	2.011	3.537	Unclassified	1200	0	3.537	Unclassified
S1.007	S10	225	2.037	2.661	Unclassified	1200	0	2.661	Unclassified
S1.008	S9	225	1.427	2.037	Unclassified	1200	0	2.037	Unclassified
S1.009	S8	225	2.582	3.727	Unclassified	1200	0	3.727	Unclassified
S2.000	SDUMMY 7-1-1	225	3.775	4.058	Unclassified	1200	0	4.058	Unclassified
S2.001	S7-1	225	3.161	3.775	Unclassified	1200	0	3.775	Unclassified
S1.010	S7	225	1.860	4.726	Unclassified	1200	0	4.726	Unclassified
S1.011	S6	225	1.237	1.860	Unclassified	1200	0	1.860	Unclassified
S1.012	S5	300	1.181	1.778	Unclassified	1200	0	1.548	Unclassified
S1.013	S4	900	0.424	0.777	Unclassified	1800	0	0.777	Unclassified
S1.014	S3	225	1.099	1.722	Unclassified	1800	0	1.099	Unclassified
S1.015	S2	225	0.736	1.688	Unclassified	1200	0	1.688	Unclassified
S1.016	S1	225	1.173	3.239	Unclassified	1200	0	3.239	Unclassified

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)
S1.016	S	55.220	52.786	0.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.271
Return Period (years)	2	Profile Type	Summer
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.840

Synthetic Rainfall Details

Storm Duration (mins) 30

1 year Return Period 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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.830

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS 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)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDUMMY 15-1-1	120 Summer	1	+20%				
S1.001	S15-1	15 Summer	1	+20%				
S1.002	S15	15 Winter	1	+20%				
S1.003	S14	15 Winter	1	+20%				
S1.004	S13	15 Winter	1	+20%				
S1.005	S12	15 Winter	1	+20%				
S1.006	S11	15 Winter	1	+20%	100/15 Summer			
S1.007	S10	15 Winter	1	+20%	100/15 Summer			
S1.008	S9	15 Winter	1	+20%	30/15 Summer			
S1.009	S8	15 Winter	1	+20%	100/15 Summer			
S2.000	SDUMMY 7-1-1	15 Summer	1	+20%				
S2.001	S7-1	120 Winter	1	+20%				
S1.010	S7	15 Winter	1	+20%	30/15 Summer			
S1.011	S6	15 Winter	1	+20%	30/15 Summer			
S1.012	S5	15 Winter	1	+20%	30/15 Summer			
S1.013	S4	15 Winter	1	+20%	100/15 Summer			
S1.014	S3	15 Winter	1	+20%	1/15 Summer			
S1.015	S2	15 Winter	1	+20%	30/15 Summer			
S1.016	S1	15 Winter	1	+20%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S1.000	SDUMMY 15-1-1	79.574	-0.151	0.000	0.24			13.8
S1.001	S15-1	79.381	-0.144	0.000	0.27			14.0
S1.002	S15	79.200	-0.161	0.000	0.18			17.8
S1.003	S14	75.361	-0.148	0.000	0.25			21.6
S1.004	S13	74.752	-0.145	0.000	0.27			25.5
S1.005	S12	73.309	-0.138	0.000	0.32			29.4
S1.006	S11	70.101	-0.124	0.000	0.42			33.2
S1.007	S10	68.026	-0.119	0.000	0.45			36.8
S1.008	S9	67.612	-0.113	0.000	0.49			40.5
S1.009	S8	64.886	-0.121	0.000	0.43			44.1
S2.000	SDUMMY 7-1-1	64.000	-0.225	0.000	0.00			0.0
S2.001	S7-1	63.506	-0.173	0.000	0.12			11.3
S1.010	S7	61.408	-0.106	0.000	0.54			58.9
S1.011	S6	57.665	-0.096	0.000	0.62			62.4
S1.012	S5	56.275	-0.148	0.000	0.51			66.1
S1.013	S4	56.012	-0.711	0.000	0.07			65.2
S1.014	S3	55.985	0.060	0.000	1.24			63.2
S1.015	S2	55.740	-0.054	0.000	0.93			63.3
S1.016	S1	53.212	-0.049	0.000	0.97			63.2

PN	US/MH Name	Status	Level Exceeded
S1.000	SDUMMY 15-1-1	OK	
S1.001	S15-1	OK	
S1.002	S15	OK	
S1.003	S14	OK	
S1.004	S13	OK	
S1.005	S12	OK	
S1.006	S11	OK	
S1.007	S10	OK	
S1.008	S9	OK	
S1.009	S8	OK	
S2.000	SDUMMY 7-1-1	OK	
S2.001	S7-1	OK	
S1.010	S7	OK	
S1.011	S6	OK	
S1.012	S5	OK	
S1.013	S4	OK	
S1.014	S3	SURCHARGED	
S1.015	S2	OK	
S1.016	S1	OK	

30 year Return Period 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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.830

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS 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)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDUMMY 15-1-1	120 Summer	30	+20%				
S1.001	S15-1	15 Summer	30	+20%				
S1.002	S15	15 Summer	30	+20%				
S1.003	S14	15 Summer	30	+20%				
S1.004	S13	15 Summer	30	+20%				
S1.005	S12	15 Summer	30	+20%				
S1.006	S11	15 Summer	30	+20%	100/15 Summer			
S1.007	S10	15 Summer	30	+20%	100/15 Summer			
S1.008	S9	15 Summer	30	+20%	30/15 Summer			
S1.009	S8	15 Summer	30	+20%	100/15 Summer			
S2.000	SDUMMY 7-1-1	15 Summer	30	+20%				
S2.001	S7-1	120 Winter	30	+20%				
S1.010	S7	15 Winter	30	+20%	30/15 Summer			
S1.011	S6	15 Winter	30	+20%	30/15 Summer			
S1.012	S5	15 Winter	30	+20%	30/15 Summer			
S1.013	S4	15 Winter	30	+20%	100/15 Summer			
S1.014	S3	15 Winter	30	+20%	1/15 Summer			
S1.015	S2	15 Winter	30	+20%	30/15 Summer			
S1.016	S1	15 Winter	30	+20%	30/15 Summer			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S1.000	SDUMMY 15-1-1	79.574	-0.151	0.000	0.24			13.8
S1.001	S15-1	79.381	-0.144	0.000	0.27			14.0
S1.002	S15	79.212	-0.149	0.000	0.25			25.3
S1.003	S14	75.386	-0.123	0.000	0.42			36.2
S1.004	S13	74.786	-0.111	0.000	0.50			47.1
S1.005	S12	73.352	-0.095	0.000	0.63			57.7
S1.006	S11	70.162	-0.063	0.000	0.85			67.8
S1.007	S10	68.143	-0.002	0.000	0.95			77.6
S1.008	S9	67.763	0.038	0.000	1.06			86.5
S1.009	S8	64.955	-0.052	0.000	0.93			95.5
S2.000	SDUMMY 7-1-1	64.000	-0.225	0.000	0.00			0.0
S2.001	S7-1	63.506	-0.173	0.000	0.12			11.3
S1.010	S7	62.081	0.567	0.000	1.02			111.0
S1.011	S6	58.141	0.380	0.000	1.17			116.9
S1.012	S5	56.733	0.310	0.000	0.93			121.3
S1.013	S4	56.548	-0.175	0.000	0.12			116.2
S1.014	S3	56.540	0.615	0.000	1.93			98.6
S1.015	S2	56.042	0.248	0.000	1.45			98.9
S1.016	S1	53.579	0.318	0.000	1.51			98.4

PN	US/MH Name	Status	Level Exceeded
S1.000	SDUMMY 15-1-1	OK	
S1.001	S15-1	OK	
S1.002	S15	OK	
S1.003	S14	OK	
S1.004	S13	OK	
S1.005	S12	OK	
S1.006	S11	OK	
S1.007	S10	OK	
S1.008	S9	SURCHARGED	
S1.009	S8	OK	
S2.000	SDUMMY 7-1-1	OK	
S2.001	S7-1	OK	
S1.010	S7	SURCHARGED	
S1.011	S6	SURCHARGED	
S1.012	S5	SURCHARGED	
S1.013	S4	OK	
S1.014	S3	SURCHARGED	
S1.015	S2	SURCHARGED	
S1.016	S1	SURCHARGED	

100 year Return Period 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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.100	Cv (Winter)	0.830

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS 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)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDUMMY 15-1-1	120 Summer	100	+20%				
S1.001	S15-1	15 Summer	100	+20%				
S1.002	S15	15 Summer	100	+20%				
S1.003	S14	15 Summer	100	+20%				
S1.004	S13	15 Summer	100	+20%				
S1.005	S12	15 Summer	100	+20%				
S1.006	S11	15 Summer	100	+20%	100/15 Summer			
S1.007	S10	15 Summer	100	+20%	100/15 Summer			
S1.008	S9	15 Winter	100	+20%	30/15 Summer			
S1.009	S8	15 Winter	100	+20%	100/15 Summer			
S2.000	SDUMMY 7-1-1	15 Summer	100	+20%				
S2.001	S7-1	15 Winter	100	+20%				
S1.010	S7	15 Winter	100	+20%	30/15 Summer			
S1.011	S6	15 Winter	100	+20%	30/15 Summer			
S1.012	S5	15 Winter	100	+20%	30/15 Summer			
S1.013	S4	15 Winter	100	+20%	100/15 Summer			
S1.014	S3	15 Winter	100	+20%	1/15 Summer			
S1.015	S2	15 Winter	100	+20%	30/15 Summer			
S1.016	S1	15 Winter	100	+20%	30/15 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S1.000	SDUMMY 15-1-1	79.574	-0.151	0.000	0.24			13.8
S1.001	S15-1	79.381	-0.144	0.000	0.27			14.0
S1.002	S15	79.218	-0.143	0.000	0.29			28.7
S1.003	S14	75.397	-0.112	0.000	0.50			42.8
S1.004	S13	74.800	-0.097	0.000	0.61			57.0
S1.005	S12	73.371	-0.076	0.000	0.77			70.7
S1.006	S11	70.354	0.129	0.000	1.04			82.9
S1.007	S10	68.534	0.389	0.000	1.13			93.0
S1.008	S9	67.981	0.256	0.000	1.26			103.6
S1.009	S8	65.346	0.339	0.000	1.12			113.9
S2.000	SDUMMY 7-1-1	64.000	-0.225	0.000	0.00			0.0
S2.001	S7-1	63.535	-0.144	0.000	0.13			12.0
S1.010	S7	63.512	1.998	0.000	1.15			124.4
S1.011	S6	58.650	0.889	0.000	1.27			126.8
S1.012	S5	57.155	0.732	0.000	1.01			131.8
S1.013	S4	56.910	0.187	0.000	0.13			126.8
S1.014	S3	56.901	0.976	0.000	2.27			115.9
S1.015	S2	56.223	0.429	0.000	1.70			115.8
S1.016	S1	53.798	0.537	0.000	1.77			115.4

PN	US/MH Name	Status	Level Exceeded
S1.000	SDUMMY 15-1-1	OK	
S1.001	S15-1	OK	
S1.002	S15	OK	
S1.003	S14	OK	
S1.004	S13	OK	
S1.005	S12	OK	
S1.006	S11	SURCHARGED	
S1.007	S10	SURCHARGED	
S1.008	S9	SURCHARGED	
S1.009	S8	SURCHARGED	
S2.000	SDUMMY 7-1-1	OK	
S2.001	S7-1	OK	
S1.010	S7	SURCHARGED	
S1.011	S6	SURCHARGED	
S1.012	S5	SURCHARGED	
S1.013	S4	SURCHARGED	
S1.014	S3	FLOOD RISK	
S1.015	S2	SURCHARGED	
S1.016	S1	SURCHARGED	

Appendix B : SURFACE WATER DRAINAGE ATTENUATION CALCULATIONS

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 369 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	54.576	0.311	0.0	1.8	1.8	28.0	O K
30 min Summer	54.689	0.424	0.0	1.8	1.8	38.2	O K
60 min Summer	54.800	0.535	0.0	1.8	1.8	48.2	O K
120 min Summer	54.897	0.632	0.0	1.8	1.8	56.9	O K
180 min Summer	54.938	0.673	0.0	1.8	1.8	60.5	O K
240 min Summer	54.955	0.690	0.0	1.8	1.8	62.1	O K
360 min Summer	54.956	0.691	0.0	1.8	1.8	62.2	O K
480 min Summer	54.951	0.686	0.0	1.8	1.8	61.8	O K
600 min Summer	54.945	0.680	0.0	1.8	1.8	61.2	O K
720 min Summer	54.938	0.673	0.0	1.8	1.8	60.6	O K
960 min Summer	54.921	0.656	0.0	1.8	1.8	59.1	O K
1440 min Summer	54.878	0.613	0.0	1.8	1.8	55.1	O K
2160 min Summer	54.800	0.535	0.0	1.8	1.8	48.2	O K
2880 min Summer	54.701	0.436	0.0	1.8	1.8	39.2	O K
4320 min Summer	54.532	0.267	0.0	1.8	1.8	24.1	O K
5760 min Summer	54.421	0.156	0.0	1.8	1.8	14.1	O K
7200 min Summer	54.352	0.087	0.0	1.7	1.7	7.8	O K
8640 min Summer	54.308	0.043	0.0	1.6	1.6	3.9	O K
10080 min Summer	54.281	0.016	0.0	1.6	1.6	1.5	O K
15 min Winter	54.616	0.351	0.0	1.8	1.8	31.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	83.784	0.0	29.8	18
30 min Summer	58.213	0.0	41.4	33
60 min Summer	38.020	0.0	54.0	62
120 min Summer	24.094	0.0	68.7	122
180 min Summer	18.291	0.0	78.1	182
240 min Summer	15.014	0.0	85.6	240
360 min Summer	11.333	0.0	96.9	324
480 min Summer	9.271	0.0	105.7	386
600 min Summer	7.928	0.0	112.9	452
720 min Summer	6.975	0.0	119.2	520
960 min Summer	5.696	0.0	129.9	658
1440 min Summer	4.280	0.0	146.4	938
2160 min Summer	3.214	0.0	164.7	1360
2880 min Summer	2.621	0.0	179.1	1756
4320 min Summer	1.963	0.0	201.3	2460
5760 min Summer	1.597	0.0	218.4	3120
7200 min Summer	1.361	0.0	232.7	3816
8640 min Summer	1.194	0.0	245.0	4496
10080 min Summer	1.069	0.0	255.8	5144
15 min Winter	83.784	0.0	33.4	18

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	54.746	0.481	0.0	1.8	1.8	43.3	O K
60 min Winter	54.873	0.608	0.0	1.8	1.8	54.8	O K
120 min Winter	54.989	0.724	0.0	1.8	1.8	65.2	O K
180 min Winter	55.043	0.778	0.0	1.8	1.8	70.0	O K
240 min Winter	55.070	0.805	0.0	1.8	1.8	72.5	O K
360 min Winter	55.085	0.820	0.0	1.8	1.8	73.8	O K
480 min Winter	55.076	0.811	0.0	1.8	1.8	72.9	O K
600 min Winter	55.063	0.798	0.0	1.8	1.8	71.8	O K
720 min Winter	55.050	0.785	0.0	1.8	1.8	70.7	O K
960 min Winter	55.022	0.757	0.0	1.8	1.8	68.1	O K
1440 min Winter	54.948	0.683	0.0	1.8	1.8	61.5	O K
2160 min Winter	54.819	0.554	0.0	1.8	1.8	49.9	O K
2880 min Winter	54.651	0.386	0.0	1.8	1.8	34.7	O K
4320 min Winter	54.423	0.158	0.0	1.8	1.8	14.2	O K
5760 min Winter	54.314	0.049	0.0	1.7	1.7	4.4	O K
7200 min Winter	54.267	0.002	0.0	1.5	1.5	0.2	O K
8640 min Winter	54.265	0.000	0.0	1.3	1.3	0.0	O K
10080 min Winter	54.265	0.000	0.0	1.2	1.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	58.213	0.0	46.4	33
60 min Winter	38.020	0.0	60.5	62
120 min Winter	24.094	0.0	76.9	120
180 min Winter	18.291	0.0	87.5	178
240 min Winter	15.014	0.0	95.8	234
360 min Winter	11.333	0.0	108.5	342
480 min Winter	9.271	0.0	118.4	440
600 min Winter	7.928	0.0	126.4	476
720 min Winter	6.975	0.0	133.5	552
960 min Winter	5.696	0.0	145.4	712
1440 min Winter	4.280	0.0	163.9	1022
2160 min Winter	3.214	0.0	184.5	1472
2880 min Winter	2.621	0.0	200.8	1844
4320 min Winter	1.963	0.0	225.4	2508
5760 min Winter	1.597	0.0	244.7	3120
7200 min Winter	1.361	0.0	260.7	3680
8640 min Winter	1.194	0.0	274.4	0
10080 min Winter	1.069	0.0	286.6	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.100	Shortest Storm (mins)	15
Ratio R	0.271	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.190

Time (mins) From:	To:	Area (ha)
0	4	0.190

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 56.950

Cellular Storage Structure

Invert Level (m) 54.265 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	90.0	0.0	1.001	0.0	0.0
1.000	90.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0065-2000-1173-2000
Design Head (m)	1.173
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	65
Invert Level (m)	54.165
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.173	2.0
Flush-Flo™	0.286	1.8
Kick-Flo®	0.576	1.4
Mean Flow over Head Range	-	1.6

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	1.5	1.200	2.0	3.000	3.1	7.000	4.6
0.200	1.7	1.400	2.2	3.500	3.3	7.500	4.7
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.9
0.400	1.7	1.800	2.4	4.500	3.7	8.500	5.0
0.500	1.6	2.000	2.5	5.000	3.9	9.000	5.1
0.600	1.5	2.200	2.7	5.500	4.1	9.500	5.3
0.800	1.7	2.400	2.8	6.000	4.2		
1.000	1.9	2.600	2.9	6.500	4.4		

Cascade Summary of Results for 220084 - Source Control Catchment 1B_29.3litrespersec.SRCX

Upstream Structures	Outflow To	Overflow To
220084 - Source Control Catchment 2(Dev)25.1litrespersec.SRCX	(None)	(None)

Half Drain Time : 51 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	54.997	0.297	0.0	22.6	22.6	59.3	O K
30 min Summer	55.105	0.405	0.0	28.6	28.6	81.0	O K
60 min Summer	55.214	0.514	0.0	29.2	29.2	102.9	O K
120 min Summer	55.321	0.621	0.0	29.2	29.2	124.2	O K
180 min Summer	55.376	0.676	0.0	29.2	29.2	135.2	O K
240 min Summer	55.408	0.708	0.0	29.2	29.2	141.6	O K
360 min Summer	55.445	0.745	0.0	29.2	29.2	149.1	O K
480 min Summer	55.468	0.768	0.0	29.2	29.2	153.6	O K
600 min Summer	55.481	0.781	0.0	29.2	29.2	156.3	O K
720 min Summer	55.488	0.788	0.0	29.2	29.2	157.7	O K
960 min Summer	55.488	0.788	0.0	29.2	29.2	157.7	O K
1440 min Summer	55.459	0.759	0.0	29.2	29.2	151.7	O K
2160 min Summer	55.385	0.685	0.0	29.2	29.2	137.1	O K
2880 min Summer	55.309	0.609	0.0	29.2	29.2	121.7	O K
4320 min Summer	55.186	0.486	0.0	29.1	29.1	97.3	O K
5760 min Summer	55.105	0.405	0.0	28.6	28.6	81.0	O K
7200 min Summer	55.053	0.353	0.0	27.9	27.9	70.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	83.784	0.0	278.6	18
30 min Summer	58.213	0.0	463.1	33
60 min Summer	38.020	0.0	685.5	62
120 min Summer	24.094	0.0	918.0	122
180 min Summer	18.291	0.0	1070.7	180
240 min Summer	15.014	0.0	1188.9	240
360 min Summer	11.333	0.0	1370.0	302
480 min Summer	9.271	0.0	1510.2	368
600 min Summer	7.928	0.0	1626.3	434
720 min Summer	6.975	0.0	1726.2	504
960 min Summer	5.696	0.0	1894.0	642
1440 min Summer	4.280	0.0	2152.8	910
2160 min Summer	3.214	0.0	2476.2	1300
2880 min Summer	2.621	0.0	2705.2	1672
4320 min Summer	1.963	0.0	3050.1	2380
5760 min Summer	1.597	0.0	3346.1	3112
7200 min Summer	1.361	0.0	3573.2	3752

Cascade Summary of Results for 220084 - Source Control Catchment 1B_29.3litrespersec.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	55.031	0.331	0.0	27.0	27.0	66.3	O K
10080 min Summer	55.014	0.314	0.0	24.9	24.9	62.7	O K
15 min Winter	55.032	0.332	0.0	27.1	27.1	66.4	O K
30 min Winter	55.156	0.456	0.0	29.0	29.0	91.2	O K
60 min Winter	55.281	0.581	0.0	29.2	29.2	116.1	O K
120 min Winter	55.404	0.704	0.0	29.2	29.2	140.7	O K
180 min Winter	55.469	0.769	0.0	29.2	29.2	153.8	O K
240 min Winter	55.510	0.810	0.0	29.2	29.2	162.0	O K
360 min Winter	55.555	0.855	0.0	29.2	29.2	170.9	O K
480 min Winter	55.572	0.872	0.0	29.2	29.2	174.3	O K
600 min Winter	55.580	0.880	0.0	29.2	29.2	176.0	O K
720 min Winter	55.581	0.881	0.0	29.2	29.2	176.3	O K
960 min Winter	55.566	0.866	0.0	29.2	29.2	173.1	O K
1440 min Winter	55.497	0.797	0.0	29.2	29.2	159.4	O K
2160 min Winter	55.369	0.669	0.0	29.2	29.2	133.9	O K
2880 min Winter	55.255	0.555	0.0	29.2	29.2	111.0	O K
4320 min Winter	55.102	0.402	0.0	28.6	28.6	80.4	O K
5760 min Winter	55.033	0.333	0.0	27.2	27.2	66.5	O K
7200 min Winter	55.006	0.306	0.0	23.9	23.9	61.2	O K
8640 min Winter	54.987	0.287	0.0	21.2	21.2	57.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.194	0.0	3766.9	4416
10080 min Summer	1.069	0.0	3932.0	5144
15 min Winter	83.784	0.0	335.4	18
30 min Winter	58.213	0.0	542.1	32
60 min Winter	38.020	0.0	790.0	62
120 min Winter	24.094	0.0	1050.3	120
180 min Winter	18.291	0.0	1221.3	176
240 min Winter	15.014	0.0	1353.7	234
360 min Winter	11.333	0.0	1556.4	344
480 min Winter	9.271	0.0	1713.3	442
600 min Winter	7.928	0.0	1843.3	476
720 min Winter	6.975	0.0	1955.2	550
960 min Winter	5.696	0.0	2142.9	702
1440 min Winter	4.280	0.0	2432.5	984
2160 min Winter	3.214	0.0	2795.0	1384
2880 min Winter	2.621	0.0	3052.1	1756
4320 min Winter	1.963	0.0	3440.3	2464
5760 min Winter	1.597	0.0	3769.0	3000
7200 min Winter	1.361	0.0	4023.7	3744
8640 min Winter	1.194	0.0	4241.5	4496

Cascade Summary of Results for 220084 - Source Control Catchment 1B_29.3litrespersec.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	54.974	0.274	0.0	19.1	19.1	54.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.069	0.0	4428.7	5192

Cascade Rainfall Details for 220084 - Source Control Catchment 1B_29.3litrespersec.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.100	Shortest Storm (mins)	15
Ratio R	0.271	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.392

Time (mins) From:	To:	Area (ha)
0	4	0.392

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Cascade Model Details for 220084 - Source Control Catchment 1B_29.3litrespersec.SRCX

Storage is Online Cover Level (m) 57.700

Cellular Storage Structure

Invert Level (m) 54.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

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

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0230-2930-1320-2930
Design Head (m)	1.320
Design Flow (l/s)	29.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	230
Invert Level (m)	54.800
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.320	29.3
Flush-Flo™	0.427	29.2
Kick-Flo®	0.921	24.7
Mean Flow over Head Range	-	24.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.7	1.200	28.0	3.000	43.5	7.000	65.5
0.200	23.1	1.400	30.1	3.500	46.8	7.500	67.7
0.300	28.6	1.600	32.1	4.000	49.9	8.000	69.9
0.400	29.2	1.800	34.0	4.500	52.9	8.500	72.0
0.500	29.1	2.000	35.7	5.000	55.6	9.000	74.0
0.600	28.7	2.200	37.4	5.500	58.3	9.500	76.0
0.800	27.2	2.400	39.0	6.000	60.8		
1.000	25.7	2.600	40.6	6.500	63.2		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 1708 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.251	0.251	0.1	4.2	O K
30 min Summer	0.346	0.346	0.1	5.8	O K
60 min Summer	0.447	0.447	0.1	7.4	O K
120 min Summer	0.555	0.555	0.1	9.2	O K
180 min Summer	0.620	0.620	0.1	10.3	O K
240 min Summer	0.667	0.667	0.1	11.1	O K
360 min Summer	0.732	0.732	0.1	12.2	O K
480 min Summer	0.774	0.774	0.1	12.9	O K
600 min Summer	0.804	0.804	0.1	13.4	O K
720 min Summer	0.825	0.825	0.1	13.7	O K
960 min Summer	0.850	0.850	0.1	14.1	O K
1440 min Summer	0.863	0.863	0.1	14.3	O K
2160 min Summer	0.857	0.857	0.1	14.3	O K
2880 min Summer	0.845	0.845	0.1	14.0	O K
4320 min Summer	0.811	0.811	0.1	13.5	O K
5760 min Summer	0.770	0.770	0.1	12.8	O K
7200 min Summer	0.726	0.726	0.1	12.1	O K
8640 min Summer	0.679	0.679	0.1	11.3	O K
10080 min Summer	0.632	0.632	0.1	10.5	O K
15 min Winter	0.281	0.281	0.1	4.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	83.677	0.0	19
30 min Summer	58.176	0.0	34
60 min Summer	38.020	0.0	64
120 min Summer	24.108	0.0	124
180 min Summer	18.308	0.0	182
240 min Summer	15.031	0.0	242
360 min Summer	11.350	0.0	362
480 min Summer	9.286	0.0	482
600 min Summer	7.943	0.0	602
720 min Summer	6.989	0.0	722
960 min Summer	5.708	0.0	960
1440 min Summer	4.291	0.0	1370
2160 min Summer	3.224	0.0	1728
2880 min Summer	2.629	0.0	2108
4320 min Summer	1.969	0.0	2940
5760 min Summer	1.603	0.0	3752
7200 min Summer	1.366	0.0	4608
8640 min Summer	1.199	0.0	5368
10080 min Summer	1.073	0.0	6160
15 min Winter	83.677	0.0	19

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.389	0.389	0.1	6.5	O K
60 min Winter	0.503	0.503	0.1	8.4	O K
120 min Winter	0.626	0.626	0.1	10.4	O K
180 min Winter	0.701	0.701	0.1	11.7	O K
240 min Winter	0.756	0.756	0.1	12.6	O K
360 min Winter	0.832	0.832	0.1	13.8	O K
480 min Winter	0.884	0.884	0.1	14.7	O K
600 min Winter	0.922	0.922	0.1	15.3	O K
720 min Winter	0.950	0.950	0.1	15.8	O K
960 min Winter	0.987	0.987	0.1	16.4	O K
1440 min Winter	1.019	1.019	0.1	16.9	O K
2160 min Winter	1.013	1.013	0.1	16.8	O K
2880 min Winter	0.992	0.992	0.1	16.5	O K
4320 min Winter	0.938	0.938	0.1	15.6	O K
5760 min Winter	0.869	0.869	0.1	14.4	O K
7200 min Winter	0.793	0.793	0.1	13.2	O K
8640 min Winter	0.716	0.716	0.1	11.9	O K
10080 min Winter	0.639	0.639	0.1	10.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	58.176	0.0	33
60 min Winter	38.020	0.0	62
120 min Winter	24.108	0.0	122
180 min Winter	18.308	0.0	180
240 min Winter	15.031	0.0	240
360 min Winter	11.350	0.0	358
480 min Winter	9.286	0.0	474
600 min Winter	7.943	0.0	590
720 min Winter	6.989	0.0	706
960 min Winter	5.708	0.0	934
1440 min Winter	4.291	0.0	1384
2160 min Winter	3.224	0.0	2008
2880 min Winter	2.629	0.0	2276
4320 min Winter	1.969	0.0	3200
5760 min Winter	1.603	0.0	4096
7200 min Winter	1.366	0.0	4976
8640 min Winter	1.199	0.0	5872
10080 min Winter	1.073	0.0	6656

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.100	Shortest Storm (mins)	15
Ratio R	0.270	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.027

Time (mins) From:	To:	Area (ha)
0	4	0.027

Model Details

Storage is Online Cover Level (m) 1.200

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.01709 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.01709

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	17.5	17.5	1.080	0.0	17.5
1.075	17.5	17.5			

Appendix C : PERMISSIBLE SITE DISCHARGE AND APPLICABLE MET EIREANN RAINFALL DATA

PROJECT			JOB REF.
Civic Offices			220084
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge - Catchment 1A			2.1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1301	KMM	JPC	08/02/2023

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **0.20** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment (This refers to the entire site area)	1A	
Area		Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	2	Class
Permeability Group above Impermeable Layers	3	Class
Slope (o)	1	Class
SOIL Type	3	From FSR Table
[1]SOIL Index	0.40	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.40**

Site SPR Value **0.37**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? Yes

What is the overall site area for Catchment 1? 0.20 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roads and Footpaths - Type 1 (Draining to gullies)	1902	0.95	1806.9
Roads and Footpaths - Type 2 (Draining to Suds features)	0	0.70	0.0
Grassed Areas	143.00	0.35	50.1

Include Public Open Space in Effective Catchment Area 1? No — Assumed open space area does not drain to surface water network

Catchment 1 - Effective Catchment Area **1857.0** m^2

Catchment 1 - Effective Catchment Runoff Coefficient **0.91**

Long-Term Storage

Is long-term Storage provided? Yes

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 987.0 mm — From Met Eireann, Co-ordinates 327000, 217000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 1.0 Litres/sec

[7]Site Discharge = **2.0** Litres/sec

9.78 l/s/ha

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

PROJECT			JOB REF.
Civic Offices			220084
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge - Catchment 1B			1.1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1001	KMM	JPC	08/02/2023

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **0.64** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment (This refers to the entire site area)	1B	
Area		Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	3	Class
Permeability Group above Impermeable Layers	3	Class
Slope (o)	2	Class
SOIL Type	4	From FSR Table
[1]SOIL Index	0.45	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.45**

Site SPR Value **0.47**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? Yes

What is the overall site area for Catchment 1? 0.64 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roads and Footpaths - Type 1 (Draining to gullies)	373	0.95	354.4
Roads and Footpaths - Type 2 (Draining to Suds features)	4128	0.70	2889.6
Grassed Areas	1892.00	0.35	662.2

Include Public Open Space in Effective Catchment Area 1? No — Assumed open space area does not drain to surface water network

Catchment 1 - Effective Catchment Area **3906.2** m^2

Catchment 1 - Effective Catchment Runoff Coefficient **0.61**

Long-Term Storage

Is long-term Storage provided? Yes

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 987.0 mm — From Met Eireann, Co-ordinates 327000, 217000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 4.2 Litres/sec

[7]Site Discharge = **4.2** Litres/sec

6.57 l/s/ha

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

PROJECT			JOB REF.
Civic Offices			220084
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge - Catchment 1C			3.1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1301	KMM	JPC	08/02/2023

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **0.07** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment (This refers to the entire site area)	1C	
Area		Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	3	Class
Permeability Group above Impermeable Layers	3	Class
Slope (o)	2	Class
SOIL Type	4	From FSR Table
[1]SOIL Index	0.45	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.45**

Site SPR Value **0.47**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? No

What is the overall site area for catchment? 0.070 Hectares (ha)

Catchment	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roads and Footpaths - Type 2 (Draining to Infiltration Trench)	490	0.40	196.0
Grassed Areas	210	0.35	73.5

Include Public Open Space in Effective Catchment Area? No — Assumed open space area does not drain to surface water network

Effective Catchment Area **269.5** m^2

Effective Catchment Runoff Coefficient **0.39**

Long-Term Storage

Is long-term Storage provided? Yes

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 987.0 mm — From Met Eireann, Co-ordinates 327000, 217000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 0.5 Litres/sec

[7]Site Discharge = **2.0** Litres/sec

28.57 l/s/ha

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

PROJECT			JOB REF.
Civic Offices			220084
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge - Catchment 2			3.1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1301	KMM	JPC	08/02/2023

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **3.82** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment This refers to the entire site area	2	
Area		Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	3	Class
Permeability Group above Impermeable Layers	3	Class
Slope (o)	2	Class
SOIL Type	4	From FSR Table
[1]**SOIL Index**	0.45	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.45**

Site SPR Value **0.47**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? No

What is the overall site area for catchment? 3.818 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Developed Area (Site assumed as 70% impermeable)	38183	0.70	26728.1

Include Public Open Space in Effective Catchment Area? No — Assumed open space area does not drain to surface water network

Effective Catchment Area **26728.1** m^2

Effective Catchment Runoff Coefficient **0.70**

Long-Term Storage

Is long-term Storage provided? Yes

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 987.0 mm — From Met Eireann, Co-ordinates 327000, 217000

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 25.1 Litres/sec

[7]Site Discharge = **25.1** Litres/sec

6.57 l/s/ha

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).
2. SPR value calculated from GDSDS - Table 6.7.
3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.
4. Long-term storage Vol_{xs} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).
   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.
5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies
   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.
6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.
7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

PROJECT			JOB REF.
Civic Offices			220084
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - - Soil Characteristics from FSR - Catchment 1A			2.2
Drawing ref.	**Calculations by**	**Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1301	KMM	JPC	08/02/2023

Estimation of flood peaks from catchment characteristics

Property		Classes
A	Drainage group	1 Rarely waterlogged within 60 cm at any time (well and moderately well drained) 2 Commonly waterlogged within 60 cm during winter (imperfect and poor) 3 Commonly waterlogged within 60 cm during winter and summer (very poorly drained)
B	Depth to 'impermeable' layers	1 >80 cm 2 80–40 cm 3 <40 cm
C	Permeability group (above 'impermeable' layers or to 80 cm)	1 Rapid 2 Medium 3 Slow
D	Slope	1 0–2° 2 2–8° 3 >8°

Table 4.4 Classification of soil factors.

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage class Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80					2		3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80				5			—		
	40 - 80							—		
	<40									

Winter rain acceptance indices: 1, very high; 2, high; 3, moderate; 4, low; 5, very low. Upland peat and peaty soils are in Class 5. Urban areas are unclassified.

1. Soil index (SPR) value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

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PROJECT		JOB REF.
Civic Offices		220084
SUBJECT		**Calc. Sheet No.**
Surface Water Calculations - Soil Characteristics from FSR - Catchment 1B		1.2
Drawing ref.	**Calculations by Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1001	KMM JPC	08/02/2023

Property		Classes
A	Drainage group	1 Rarely waterlogged within 60 cm at any time (well and moderately well drained) 2 Commonly waterlogged within 60 cm during winter (imperfect and poor) 3 Commonly waterlogged within 60 cm during winter and summer (very poorly drained)
B	Depth to 'impermeable' layers	1 >80 cm 2 80–40 cm 3 <40 cm
C	Permeability group (above 'impermeable' layers or to 80 cm)	1 Rapid 2 Medium 3 Slow
D	Slope	1 0–2° 2 2–8° 3 >8°

Table 4.4 Classification of soil factors.

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage ~~class~~ Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80					2		3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80					5		—		
	40 - 80							—		
	<40									

Winter rain acceptance indices: 1, very high; 2, high; 3, moderate; 4, low; 5, very low. Upland peat and peaty soils are in Class 5. Urban areas are unclassified.

1. Soil index (SPR) value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

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PROJECT		JOB REF.
Civic Offices		220084
SUBJECT		**Calc. Sheet No.**
Surface Water Calculations - Soil Characteristics from FSR - Catchment 1C		3.2
Drawing ref.	**Calculations by Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1301	KMM JPC	08/02/2023

Property		Classes
A	Drainage group	1 Rarely waterlogged within 60 cm at any time (well and moderately well drained) 2 Commonly waterlogged within 60 cm during winter (imperfect and poor) 3 Commonly waterlogged within 60 cm during winter and summer (very poorly drained)
B	Depth to 'impermeable' layers	1 >80 cm 2 80–40 cm 3 <40 cm
C	Permeability group (above 'impermeable' layers or to 80 cm)	1 Rapid 2 Medium 3 Slow
D	Slope	1 0–2° 2 2–8° 3 >8°

Table 4.4 Classification of soil factors.

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage ~~class~~ Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80					2		3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80					5		—		
	40 - 80							—		
	<40									

Winter rain acceptance indices: 1, very high; 2, high; 3, moderate; 4, low; 5, very low. Upland peat and peaty soils are in Class 5. Urban areas are unclassified.

1. Soil index (SPR) value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

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PROJECT		JOB REF.
Civic Offices		220084
SUBJECT		**Calc. Sheet No.**
Surface Water Calculations - Soil Characteristics from FSR - Catchment 2		3.2
Drawing ref.	**Calculations by Checked by**	**Date**
220084-RY-05-Z00-XXX-SK-DBFL-CE-1301	KMM JPC	08/02/2023

Property		Classes
A	Drainage group	1 Rarely waterlogged within 60 cm at any time (well and moderately well drained) 2 Commonly waterlogged within 60 cm during winter (imperfect and poor) 3 Commonly waterlogged within 60 cm during winter and summer (very poorly drained)
B	Depth to 'impermeable' layers	1 >80 cm 2 80–40 cm 3 <40 cm
C	Permeability group (above 'impermeable' layers or to 80 cm)	1 Rapid 2 Medium 3 Slow
D	Slope	1 0–2° 2 2–8° 3 >8°

Table 4.4 Classification of soil factors.

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage ~~class~~ Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80				2			3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80	5						—		
	40 - 80							—		
	<40									

Winter rain acceptance indices: 1, very high; 2, high; 3, moderate; 4, low; 5, very low. Upland peat and peaty soils are in Class 5. Urban areas are unclassified.

1. Soil index (SPR) value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

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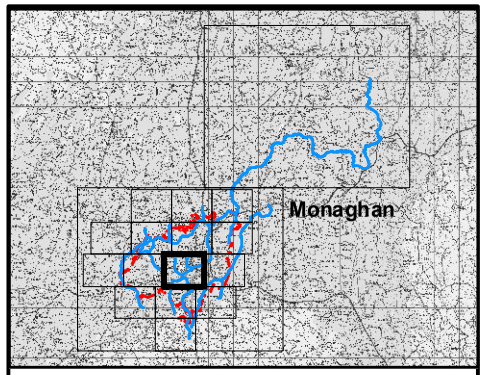
Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 267523, Northing: 333787,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.6,	4.1,	5.0,	5.6,	6.0,	7.5,	9.2,	10.4,	12.0,	13.4,	14.5,	16.2,	17.6,	18.7,	N/A ,
10 mins	3.5,	4.9,	5.7,	6.9,	7.8,	8.4,	10.5,	12.9,	14.4,	16.7,	18.7,	20.2,	22.6,	24.5,	26.0,	N/A ,
15 mins	4.1,	5.8,	6.8,	8.2,	9.1,	9.9,	12.3,	15.1,	17.0,	19.6,	22.0,	23.8,	26.6,	28.8,	30.6,	N/A ,
30 mins	5.4,	7.6,	8.8,	10.5,	11.7,	12.6,	15.6,	19.0,	21.3,	24.4,	27.2,	29.4,	32.7,	35.3,	37.5,	N/A ,
1 hours	7.2,	9.9,	11.4,	13.5,	15.0,	16.1,	19.8,	23.9,	26.6,	30.4,	33.8,	36.4,	40.3,	43.4,	45.9,	N/A ,
2 hours	9.5,	12.9,	14.7,	17.4,	19.2,	20.6,	25.1,	30.1,	33.4,	37.9,	41.9,	44.9,	49.6,	53.2,	56.2,	N/A ,
3 hours	11.1,	15.1,	17.2,	20.2,	22.3,	23.8,	28.9,	34.4,	38.1,	43.1,	47.5,	50.9,	56.0,	60.0,	63.3,	N/A ,
4 hours	12.5,	16.8,	19.1,	22.5,	24.7,	26.4,	31.8,	37.9,	41.8,	47.2,	51.9,	55.6,	61.1,	65.3,	68.8,	N/A ,
6 hours	14.7,	19.7,	22.3,	26.0,	28.5,	30.5,	36.6,	43.3,	47.7,	53.7,	58.9,	62.9,	69.0,	73.7,	77.5,	N/A ,
9 hours	17.3,	23.0,	25.9,	30.2,	33.0,	35.2,	42.0,	49.5,	54.4,	61.0,	66.8,	71.2,	77.9,	83.0,	87.2,	N/A ,
12 hours	19.4,	25.7,	28.9,	33.5,	36.6,	38.9,	46.4,	54.5,	59.7,	66.8,	73.0,	77.8,	84.9,	90.4,	94.9,	N/A ,
18 hours	22.9,	30.0,	33.6,	38.9,	42.3,	44.9,	53.3,	62.3,	68.1,	76.0,	82.8,	88.0,	95.9,	101.9,	106.8,	N/A ,
24 hours	25.7,	33.5,	37.4,	43.2,	46.9,	49.8,	58.8,	68.5,	74.7,	83.2,	90.6,	96.2,	104.6,	111.0,	116.2,	134.0,
2 days	33.2,	41.9,	46.3,	52.5,	56.5,	59.5,	68.9,	78.9,	85.2,	93.7,	101.0,	106.4,	114.6,	120.8,	125.8,	142.7,
3 days	39.6,	49.1,	53.8,	60.4,	64.6,	67.8,	77.6,	87.9,	94.3,	103.0,	110.3,	115.8,	124.0,	130.1,	135.1,	151.7,
4 days	45.3,	55.5,	60.4,	67.4,	71.8,	75.1,	85.3,	95.9,	102.5,	111.3,	118.8,	124.3,	132.6,	138.7,	143.7,	160.3,
6 days	55.7,	67.0,	72.4,	79.9,	84.7,	88.2,	99.1,	110.3,	117.1,	126.2,	133.9,	139.6,	148.0,	154.2,	159.3,	175.9,
8 days	65.2,	77.4,	83.2,	91.2,	96.3,	100.0,	111.4,	123.1,	130.2,	139.6,	147.4,	153.2,	161.8,	168.1,	173.2,	190.0,
10 days	74.2,	87.2,	93.3,	101.8,	107.0,	111.0,	122.8,	134.9,	142.2,	151.8,	159.9,	165.8,	174.5,	180.9,	186.1,	203.0,
12 days	82.7,	96.4,	102.9,	111.7,	117.2,	121.3,	133.5,	145.9,	153.4,	163.3,	171.5,	177.5,	186.4,	192.9,	198.1,	215.1,
16 days	99.1,	114.0,	120.9,	130.4,	136.2,	140.6,	153.5,	166.5,	174.4,	184.6,	193.1,	199.3,	208.3,	215.0,	220.3,	237.6,
20 days	114.6,	130.5,	137.9,	147.9,	154.1,	158.6,	172.2,	185.7,	193.8,	204.3,	213.0,	219.4,	228.6,	235.4,	240.8,	258.3,
25 days	133.4,	150.4,	158.2,	168.8,	175.3,	180.0,	194.2,	208.2,	216.5,	227.4,	236.3,	242.8,	252.2,	259.1,	264.6,	282.3,

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

Appendix D : FLOOD RISK SUPPORTING DATA

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
0639M00319	56.24	0.53	56.38	0.91	56.53	1.41
0639M00285	54.57	2.27	54.87	3.70	55.23	5.07
0639M00270I	54.56	2.09	54.86	3.01	55.22	4.67
0639M00232J	52.96	1.90	53.43	3.07	54.68	9.52
0639M00223	52.84	2.00	53.35	2.81	54.67	5.06
0639M00184	52.58	N/A	53.18	N/A	54.14	N/A
0640M00062	56.01	0.36	56.19	0.63	57.03	1.01
0640M00000J	52.84	0.67	53.45	1.02	54.67	1.09
0642M00009	55.76	2.36	55.84	2.99	56.01	4.47
06MULL001	59.31	0.01	59.50	0.02	59.88	0.03
0641M00046bI	58.16	N/A	58.34	N/A	59.32	N/A
0641M00046eI	56.53	0.32	56.90	0.69	57.72	0.83



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
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:

NORTH WESTERN NEAGH BANN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW Oifig na nOibreacha Poiblí The Office of Public Works

RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Monaghan Fluvial Flood Extents

Map Type:	EXTENT		
Source:	FLUVIAL		
Map Area:	HPW		
Scenario:	CURRENT		
Drawn By :	F.M.C.	Date :	15 July 2016
Checked By :	E.H.	Date :	15 July 2016
Approved By :	S.P.	Date :	15 July 2016

Drawing No. : N06MGN_EXFCD_F0_12

Map Series : Page 12 of 17

Drawing Scale : 1:5,000 @A3

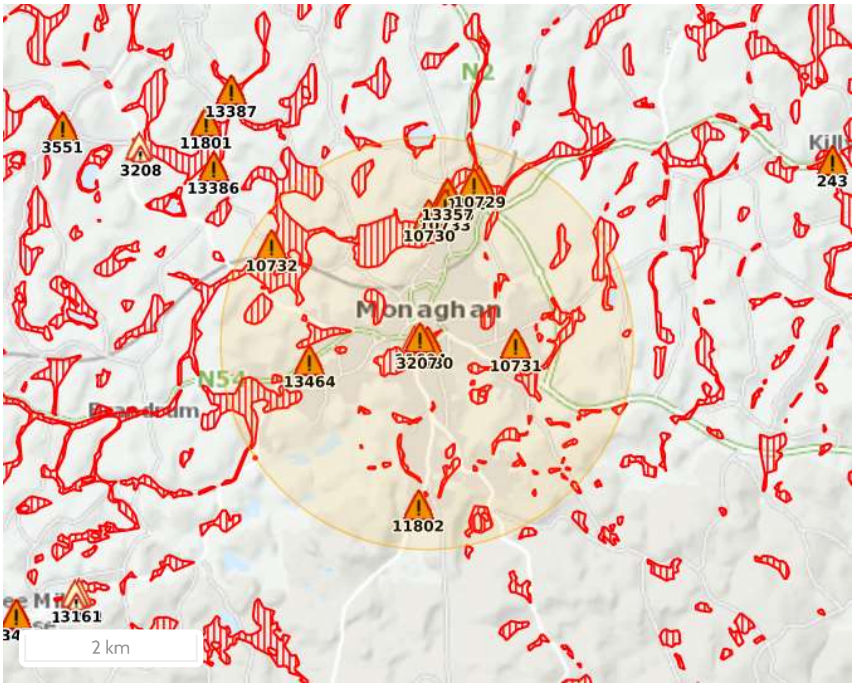
0 50 100 200 300 400 500 Metres

Past Flood Event Local Area Summary Report

Report Produced: **19/4/2023 16:29**

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

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



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

13 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Monaghan Town Cootehill Rd Monaghan 24th Oct 2011 (ID-11802)	23/10/2011	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Monaghan Recurring (ID-3207)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (2)		
3.	Flooding at Ballyalbany on 05/12/2015 (ID-13357)	05/12/2015	Approximate Point
	Additional Information: Reports (0) Press Archive (0)		
4.	Flooding at Coolshannagh on 05/12/2015 (ID-13369)	05/12/2015	Approximate Point
	Additional Information: Reports (0) Press Archive (0)		
5.	Flooding at Monaghan on 05/12/2015 (ID-13380)	05/12/2015	Approximate Point
	Additional Information: Reports (0) Press Archive (0)		
6.	Flooding at Monaghan on 28/12/2015 (ID-13464)	28/12/2015	Approximate Point
	Additional Information: Reports (0) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Monaghan C115 Ballyalbony 20th Nov 2009 (ID-10730) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point
8.	Shambles Monaghan Town 20th Nov 2009 (ID-10731) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point
9.	Monaghan Crover 20th Nov 2009 (ID-10732) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point
10.	Monaghan C115 Coolshannagh 20th Nov 2009 (ID-10733) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point
11.	Monaghan C115 Creamery 20th Nov 2009 (ID-10729) **Additional Information:** Reports (1) Press Archive (0)	19/11/2009	Approximate Point
12.	Monaghan Blackwater Monaghan Town Creamery 24th October 2011 (ID-11691) **Additional Information:** Reports (1) Press Archive (0)	23/10/2011	Approximate Point
13.	Shambles River Monaghan Town 24th October 2011 (ID-11694) **Additional Information:** Reports (1) Press Archive (0)	23/10/2011	Approximate Point

Appendix E : EXISTING SERVICES

UISCE ÉIREANN : IRISH WATER

Legend

- Location
- **Sewer Manholes**
  - Standard
  - Backdrop
- **Sewer Discharge Points**
  - Outfall
  - Overflow
- **Sewer Inlets**
  - Standard
- **Sewer Fittings**
  - Vent/Col
- **Sewer Mains (Irish Water)**
  - Gravity - Foul
  - Pumping - Foul
- **Sewer Mains (Private)**
  - Gravity - Foul
- **Pump Station**
  - Pump Station
- **Waste Water Treatment Plant**
  - Waste Water Treatment Plant

0 60 120 240 m

Coordinate System: TM65 Irish Grid
Projection: Transverse Mercator

Scale @ A3:	**1:2,540**
Drawing No.:	**IW-AGG-2018-000**
Drawn By:	**Mo Ismail**
Checked By:	**<Add Name>**
Approved By:	**<Add Name>**
Drawn Date	**25/04/2023**
Checked Date:	**<dd/mm/yyyy>**
Approved Date:	**<dd/mm/yyyy>**

Sewer Network
Monaghan Active travel Scheme

UISCE ÉIREANN : IRISH WATER

Legend

- Location

Flow Control Valves
- Non-return
- PRV

Boundary Valves
- Closed

Non Boundary Valves
- Open
- Closed

Air Control Valves
- Air Control Valves

Water Stop Valves
- Water Stop Valves

Non Boundary Meter
- Meter

Boundary Meter
- District (Boundary Meter)

Water Hydrants
- Fire Hydrant

Reservoir
- Potable

Pump Stations
- Pump Stations

Water Network Structures
- Water Network Structures

Abstraction Point
- Abstraction Point

Water Fittings
- Cap
- Other Fitting

Water Mains(Irish Water Owned)
- Potable Water

Water Mains(Non Irish Water Owned)
- Potable Water

Water Abandoned Lines
- Water Abandoned Lines

0 60 120 240 m

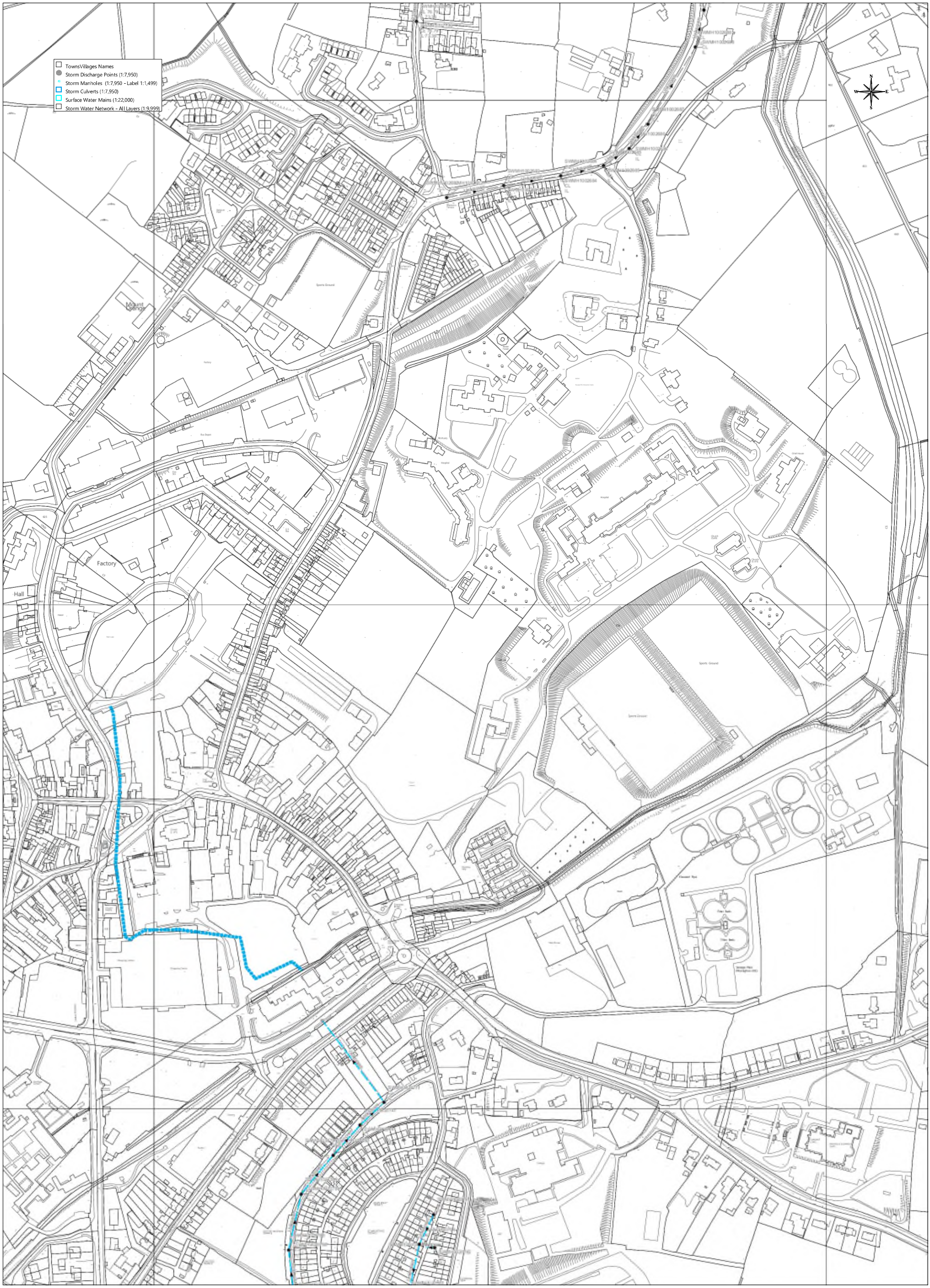
Coordinate System: TM65 Irish Grid
Projection: Transverse Mercator

Scale @ A3:	**1:2,540**
Drawing No.:	**IW-AGG-2018-000**
Drawn By:	**Mo Ismail**
Checked By:	**<Add Name>**
Approved By:	**<Add Name>**
Drawn Date	**25/04/2023**
Checked Date:	**<dd/mm/yyyy>**
Approved Date:	**<dd/mm/yyyy>**

N

Water Distribution
Monaghan Active travel Scheme

STORM WATER



Comhairle Chontae Mhuineacháin,
Oifigí Contae,
An Gleann,
Muineachán.
Guthá 047 30500

Monaghan County Council,
County Offices,
The Glen, Monaghan
Phone: 047 30500
Fax: 047 82739

Comhairle Contae Mhuineacháin
Monaghan County Council

Project:

Drawn By:	RT
Survey By:	
Date:	07:07:22
Scale:	1:2000

Appendix F : ROAD SAFETY AUDIT

Title: **Stage 1 ROAD SAFETY AUDIT**

For;

Proposed Civic Office at Roosky Lands, Monaghan.

Client: **DBFL Consulting Engineers**

Date: **July 2023**

Report reference: **1885R01**

VERSION: **FINAL (Sept 2023)**

Prepared By:

Bruton Consulting Engineers Ltd

Glaspistol
Clogherhead
Drogheda
Co. Louth.

Tel: 041 9881456
Mob: 086 8067075
E: admin@brutonceng.ie
W: www.brutonceng.ie

CONTENTS SHEET

Contents

1.0 Introduction

This report was prepared in response to a request from Mr. John Carr, DBFL Consulting Engineers, for a Stage 1 Road Safety Audit for the proposed road and active travel links being part of an overall scheme for Monaghan County Council's new civic offices.

The Road Safety Audit Team comprised of;

Team Leader: **Norman Bruton**, BE CEng FIEI, Cert Comp RSA.

TII Auditor Approval no. NB 168446

Team Member: **Owen O'Reilly**, B.SC. Eng Dip Struct. Eng NCEA Civil Dip Civil. Eng CEng MIEI

TII Auditor Approval no. OO1291756

The Road Safety Audit involved the examination of drawings and other material provided by DBFL and a site visit by the Audit Team together on the 13th of June 2023.

The weather at the time of the site visit was dry and the road surface was also dry.

This Stage 1 Road Safety Audit has been carried out in accordance with the requirements of TII Publication Number GE-STY-01024, dated December 2017.

The scheme has been examined and this report compiled in respect of the consideration of those matters that have an adverse effect on road safety. It has not been examined or verified for compliance with any other standards or criteria.

The problems identified in this report are considered to require action in order to improve the safety of the scheme for road users.

If any of the recommendations within this safety audit report are not accepted, a written response is required, stating reasons for non-acceptance. Comments made within the report under the heading of Observation are intended to be for information only. Written responses to Observations are not required.

The information supplied to the Audit Team is listed in **Appendix A.**

The feedback form is contained in **Appendix B.**

A plan drawing showing the problem locations is contained in **Appendix C**.

2.0 Background

It is proposed to provide a new road and greenway/active travel links to undeveloped lands to the east of Glaslough Street and Dublin Street in Monaghan. The road and greenway would join the L14105 which currently leads to the Monaghan Harps GAA grounds and continues to close to the Glaslough Street pathway entrance to the St Davnet's Hospital. A temporary turning head is to be provided until the future Roosky square development is constructed.

A shared use path link to the Diamond is to be provided and the existing Infirmary Hill path leading to Old Cross Square is to be upgraded.

The existing topography is hilly and the design is therefore constrained with regard to gradients available for vulnerable road users.

The site location is shown below.

Image courtesy of openstreetmap.org

3.0 Items Raised in This Stage 1 Road Safety Audit.

3.1 Problem

LOCATION

Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0, vertical alignment.

PROBLEM

The vertical alignment of the two-way cycle track could result in excessive downhill speeds which could lead to loss of control by cyclists or collisions with other cyclists. It could also lead to collisions with vehicles exiting the civic offices or other development accesses.

RECOMMENDATION

It is recommended that speed control features be provided to prevent excessive downhill cyclist speeds.

3.2 Problem

LOCATION

Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0, vertical alignment.

PROBLEM

The vertical alignment of the footpath may lead to difficulty for some mobility impaired pedestrians to access the civic offices and future Rooskey development on foot. Although the topography is steep a lack of aid could lead to possible falls or inaccessibility.

RECOMMENDATION

It is recommended that local widening be provided at regular intervals with rest areas/benches.

3.3 Problem

LOCATION

Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0, existing pathway to Glaslough Street.

PROBLEM

The existing pathway to Glaslough Street is very steep and may lead to loss of control for cyclists or overshoot into the carriageway by cyclists.

RECOMMENDATION

It is recommended that speed control measures be provided on the existing path.

3.4 Problem

LOCATION

Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0, winter maintenance.

PROBLEM

The steep slopes on the carriageway and cycle, footpath and shared use paths combined with the high elevation and shaded area within cuts could lead to areas with frost and ice in winter time. A lack of grip could lead to loss of control and loss of traction for motorists and cyclists and slips and falls for pedestrians.

RECOMMENDATION

It is recommended that the layout be designed such that winter maintenance vehicles can access all areas for spreading of salt/grit.

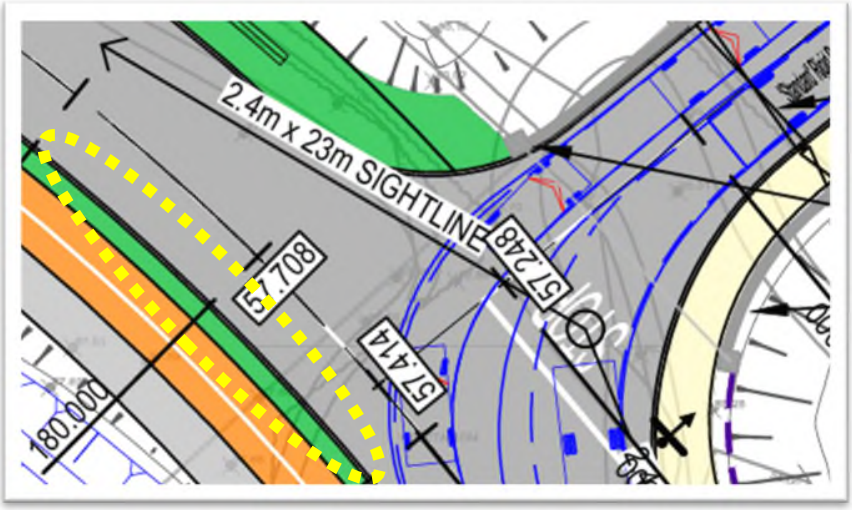
3.5 Problem

LOCATION

Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0, GAA grounds.

PROBLEM

There is a risk that during high attendance fixtures at the GAA grounds that drivers will park on the verge and partially on the two-way cycle track thereby blocking the route for cyclists and leading to possible collisions with opening doors. Parking may also occur on the swale side of the new road.



RECOMMENDATION

It is recommended that preventative measures be provided to avoid parking overspill from the GAA grounds.

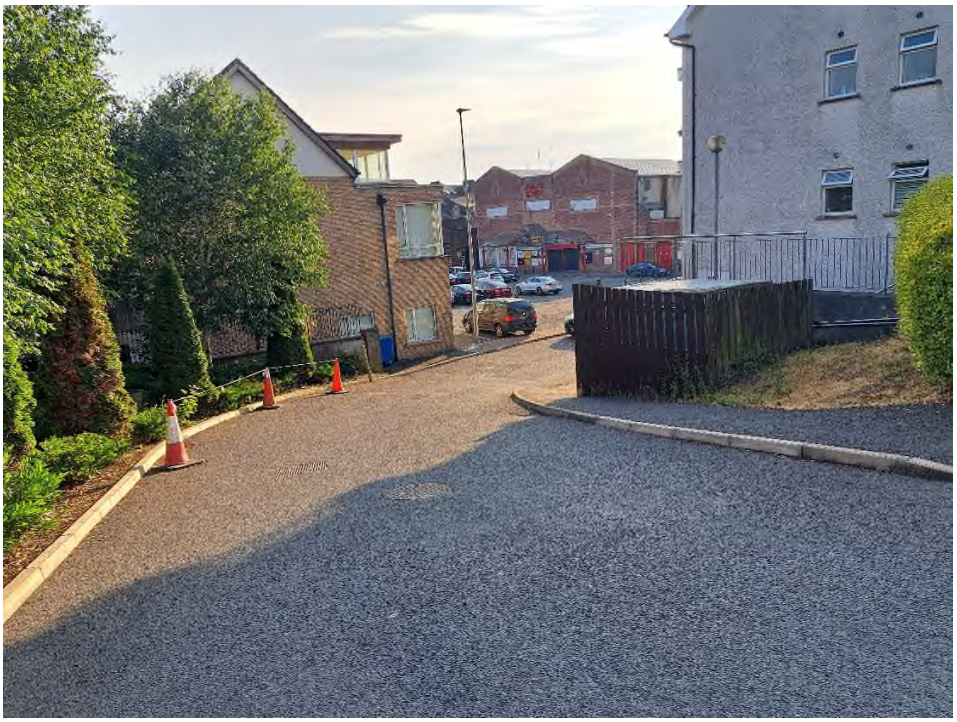
3.6 Problem

LOCATION

Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0, Tie in at The Diamond.

PROBLEM

The proposed shared path leads to the car parking area at the Diamond. The existing link from there to the main car park and access to the shopping area is not suitable for mobility impaired pedestrians.



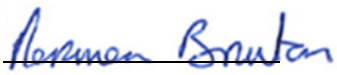
RECOMMENDATION

It is recommended that an alternative route for pedestrians be provided with more suitable gradients.

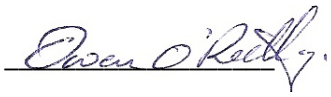
4.0 Audit Statement

We certify that we have examined the information provided and the site. The examination has been carried out with the sole purpose of identifying any features of the design which could be removed or modified in order to improve the safety of the scheme.

The problems identified have been noted in this report together with associated safety improvement suggestions which we would recommend should be studied for implementation. The audit has been carried out by the persons named below who have not been involved in any design work on this scheme as a member of the Design Team.

Norman Bruton **Signed:** 

(Audit Team Leader) **Dated:** ____29-9-2023_____

Owen O'Reilly **Signed:** 

(Audit Team Member) **Dated:** ____29-9-2023_____

Appendix A

List of Material Supplied for this Road Safety Audit;

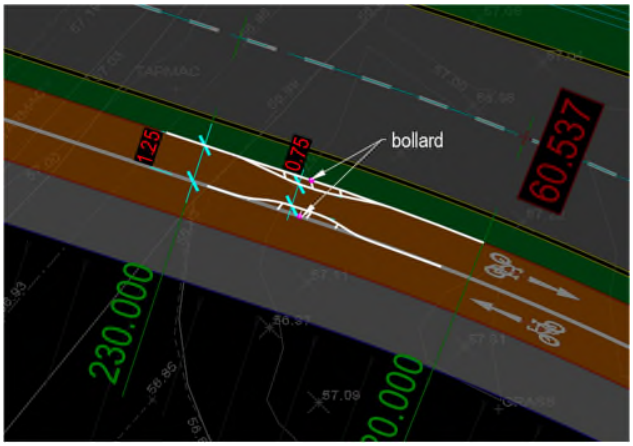
- Drawing 220084-RY-04-Z00-XXX-DR-DBFL-CE-1001 Rev 0 and 1002 rev 0

Appendix B

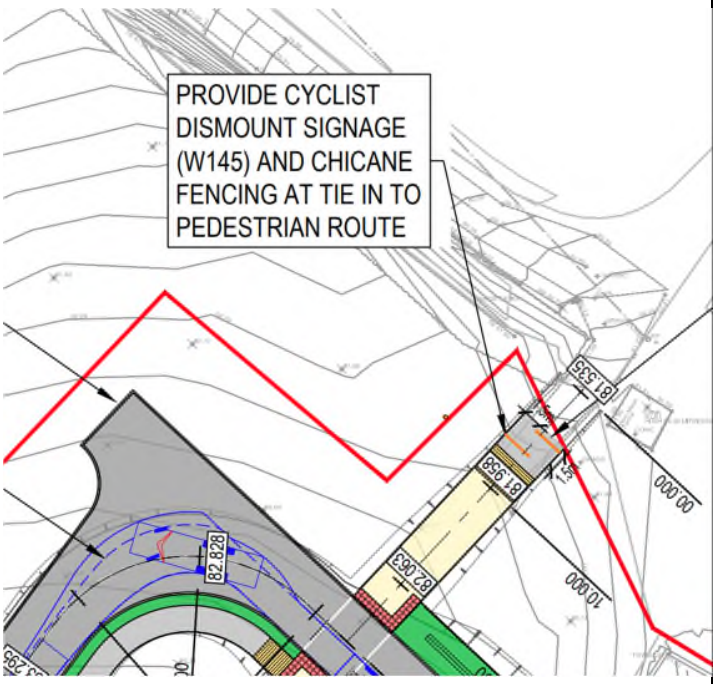
Feedback Form

SAFETY AUDIT FORM – FEEDBACK ON AUDIT REPORT

Scheme: Civic Offices
Stage: 1 Road Safety Audit
Date Audit (Site Visit) Completed: 13-6-2023

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
3.1	yes	yes	Speed control on new steep cycle tracks. • Bollards (circa 1000mm hight flexible removable bollard) at centre and outside of lanes complete with narrowing road markings to give the impression of gateway feature to reduce speed (see snip below). Would propose at roughly 40m centres on steep sections • Provision of Sign W105 (8%) warning both vehicles and cyclists of steep gradients 	

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
3.2	yes	yes	Rest areas • Rest areas to be provided on buildout at back of path, bench and Sheffield stand to be provided 	
3.3	yes	yes	Speed control on existing path to Glaslough St • It is noted that lands beyond the red line are not in the control of the applicant.	

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
			• Therefore it is proposed to provide cyclist discount signage and chicane fencing the tie in to the pedestrian route of the lane to force dismount and avoid cycle overshoot • It is further noted that there is an existing gate further down the lane with a normally closed vehicle gate and small pedestrian openings which will also encourage cyclists to remain dismounted approaching Glaslough Street 	

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
				
3.4	no	no	Winter maintenance access • 4.5m width (2.5m cycle+2m path) with only 50mm kerb between considered appropriate for maintenance vehicles access to treat surfaces. • Bollards along the path are removable and flexible. They will not prevent maintenance access.	Yes
3.5	yes	yes	Parking overspill on verge • Swale geometry will naturally prevent parking on one side, bollards/trees to be provided on verge locally to prevent parking	
3.6	yes	yes	Offsite links at the Diamond. • Accessible route provided to site boundary. It is the intention of Monaghan County Council to deliver onwards accessible links as part of future separate scheme	

Signed……… **Date**…20/09/2023……..

Design Team Leader

Signed…… **Date**……29-9-2023……

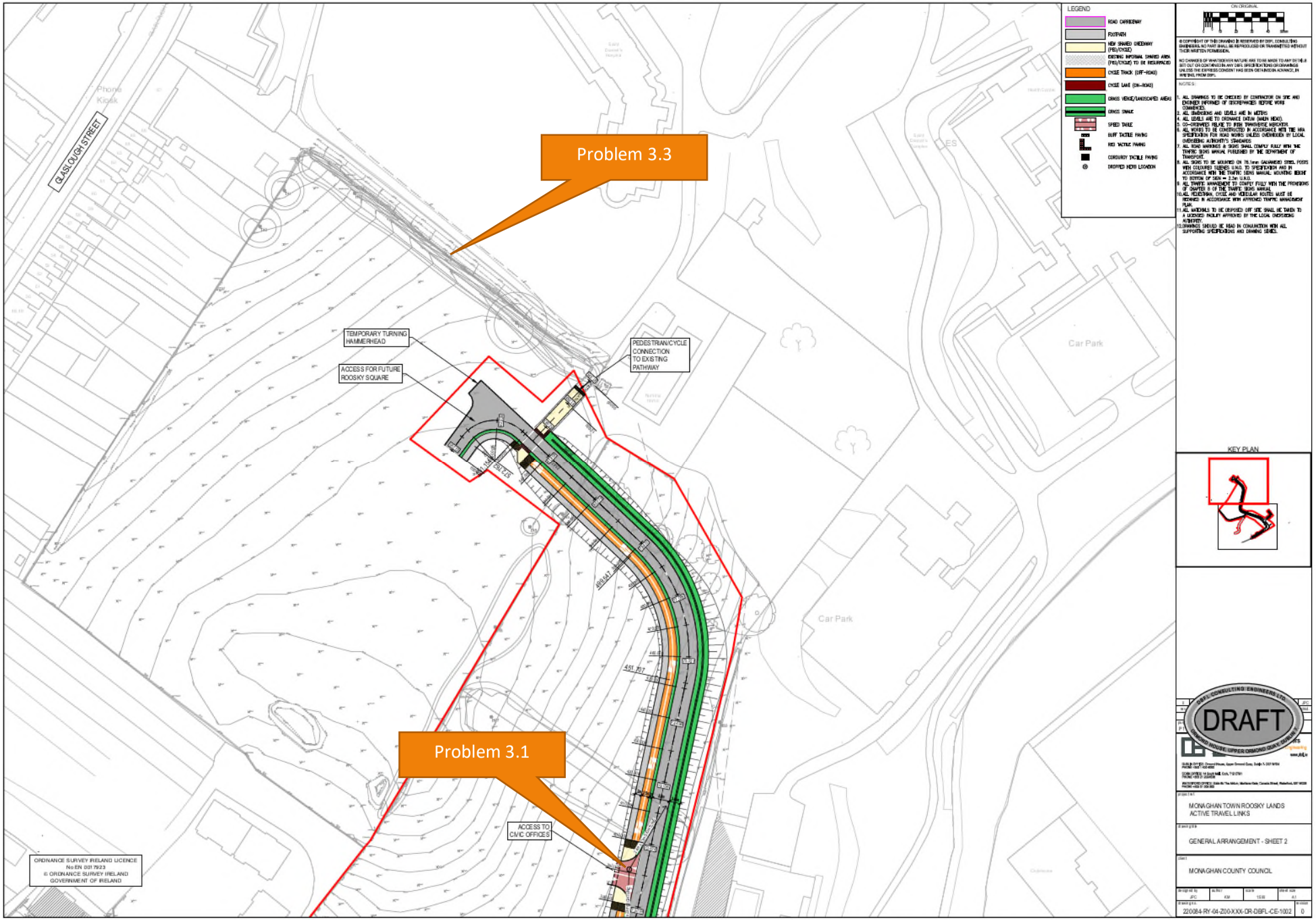
Audit Team Leader

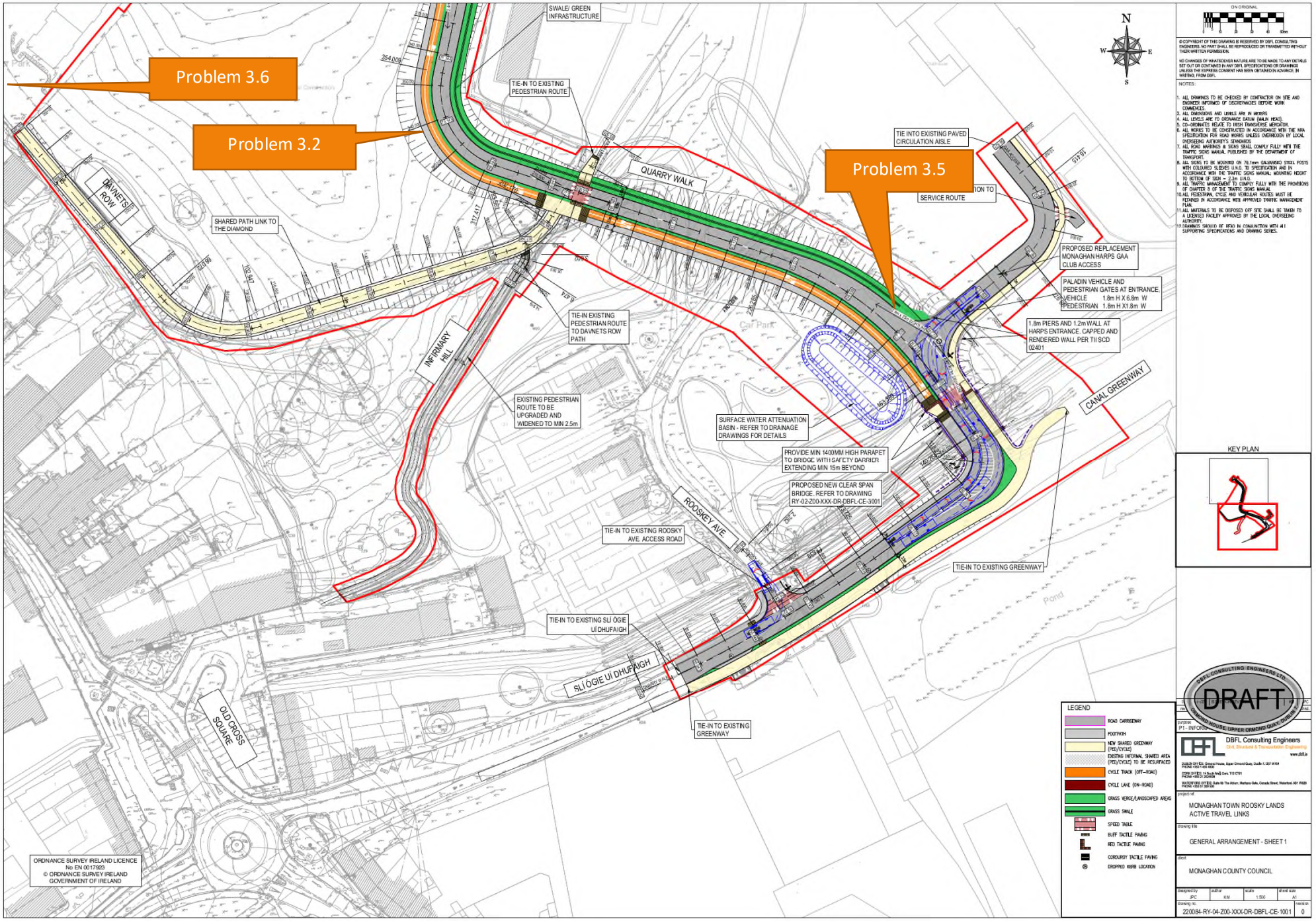
Signed…….. **Date**……

Employer/Developer

Appendix C

Problem Location Plan.


Problem 3.3
Problem 3.1
GLASLOUGH STREET
TEMPORARY TURNING HAMMERHEAD
ACCESS FOR FUTURE ROOSKY SQUARE
PEDESTRIAN/CYCLE CONNECTION TO EXISTING PATHWAY
ACCESS TO C/VIC OFFICES
Car Park
Car Park
LEGEND
ROAD CARRIAGEWAY
FOOTPATH
NEW SHARED SHEDWAY (PED/CYCLE)
EXISTING INFORMAL SHARED AREA (PED/CYCLE) TO BE RESURFACED
CYCLE TRACK (OFF-ROAD)
CYCLE LANE (ON-ROAD)
GRASS VERGE/LANDSCAPED AREAS
GRASS SWALE
SPEED TABLE
BUFF TACTILE PAVING
RED TACTILE PAVING
CORDUROY TACTILE PAVING
DROPPED KERB LOCATION
KEY PLAN
DRAFT
ORDNANCE SURVEY IRELAND LICENCE No.EN 0017923
© ORDNANCE SURVEY IRELAND
GOVERNMENT OF IRELAND
MONAGHAN TOWN ROOSKY LANDS ACTIVE TRAVEL LINKS
GENERAL ARRANGEMENT - SHEET 2
MONAGHAN COUNTY COUNCIL
2200B4-RY-04-Z00-XXX-DR-DBFL-CE-1002


Problem 3.6
Problem 3.2
Problem 3.5
SWALE/ GREEN INFRASTRUCTURE
TIE-IN TO EXISTING PEDESTRIAN ROUTE
QUARRY WALK
TIE INTO EXISTING PAVED CIRCULATION AISLE
SERVICE ROUTE
DAVNETS ROW
SHARED PATH LINK TO THE DIAMOND
PROPOSED REPLACEMENT MONAGHAN HARPS GAA CLUB ACCESS
PALADIN VEHICLE AND PEDESTRIAN GATES AT ENTRANCE.
VEHICLE 1.8m H X 6.8m W
PEDESTRIAN 1.8m H X1.8m W
1.8m PIERS AND 1.2m WALL AT HARPS ENTRANCE. CAPPED AND RENDERED WALL PER TII SCD 02401
TIE-IN EXISTING PEDESTRIAN ROUTE TO DAVNETS ROW PATH
INFIRMARY HILL
EXISTING PEDESTRIAN ROUTE TO BE UPGRADED AND WIDENED TO MIN 2.5m
CANAL GREENWAY
SURFACE WATER ATTENUATION BASIN - REFER TO DRAINAGE DRAWINGS FOR DETAILS
PROVIDE MIN 1400MM HIGH PARAPET TO BRIDGE WITH SAFETY BARRIER EXTENDING MIN 15m BEYOND
PROPOSED NEW CLEAR SPAN BRIDGE. REFER TO DRAWING RY-02-Z00-XXX-DR-DBFL-CE-3001
ROOSKEY AVE
TIE-IN TO EXISTING ROOSKY AVE. ACCESS ROAD
TIE-IN TO EXISTING GREENWAY
TIE-IN TO EXISTING SLÍ ÓGIE UÍ DHUFAIGH
SLÍ ÓGIE UÍ DHUFAIGH
TIE-IN TO EXISTING GREENWAY
OLD CROSS SQUARE
Car Park
Pond
N
S
W
E
KEY PLAN
LEGEND
ROAD CARRIGWAY
FOOTPATH
NEW SHARED GREENWAY (PED/CYCLE)
EXISTING INFORMAL SHARED AREA (PED/CYCLE) TO BE RESURFACED
CYCLE TRACK (OFF-ROAD)
CYCLE LANE (ON-ROAD)
GRASS VERGE/LANDSCAPED AREAS
GRASS SWALE
SPEED TABLE
BUFF TACTILE PAVING
RED TACTILE PAVING
CORDUROY TACTILE PAVING
DROPPED KERB LOCATION
DRAFT
DBFL Consulting Engineers
MONAGHAN TOWN ROOSKY LANDS ACTIVE TRAVEL LINKS
GENERAL ARRANGEMENT - SHEET 1
MONAGHAN COUNTY COUNCIL
220084-RY-04-Z00-XXX-DR-DBFL-CE-1001
ORDNANCE SURVEY IRELAND LICENCE No EN 0017923
© ORDNANCE SURVEY IRELAND
GOVERNMENT OF IRELAND

3.1.1

Appendix G : ROAD QUALITY AUDIT

Proposed Civic Office Development at Roosky Lands

Preliminary Design Stage Quality Audit

220084-RY-90-Z000-XXX-RP-DBFL-CE-0006

TRANSPORTATION

November 2023

DBFL CONSULTING ENGINEERS

Project Title:	**Proposed Civic Office Development at Roosky Lands**		
Document Title:	**Preliminary Design Stage Quality Audit**		
File Ref:	**220084-RY-90-Z000-XXX-RP-DBFL-CE-0006**		
Status:	**P1 - Information**	Rev:	**0**
	S - Issued		

Rev.	Date	Description	Prepared	Reviewed	Approved
0	20/11/23	First Issue	Sayed Saeed	Mark McKenna	Mark McKenna
1	20/11/23	Final	Sayed Saeed	Mark McKenna	Mark McKenna

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1 INTRODUCTION

1.1 BACKGROUND

This report describes a Preliminary Design Stage Quality Audit (QA) carried out on behalf of Monaghan County Council. It considers site accessibility issues and safety. As per Section 6.0 of DMURS Advice Note 4, this QA has been undertaken by the Design Team and considers pedestrians, cyclists, mobility impaired and visually impaired users. A separate Stage 1 Road Safety Audit was undertaken by independent auditors Bruton Consulting Engineers and is submitted under a separate cover as part of the subject application documentation. Accordingly, this Quality Audit Report comprises the following key design audits : -

- Road Safety Audit undertaken by independent firm Bruton Consulting Engineers (Separate Document)
- Pedestrian and cycling Audit undertaken by the Design Team
- Mobility Impaired and Visually Impaired Users Audit undertaken by the Design Team

The subject development comprises a new Monaghan County Council Civic Office building and associated works including the provision of active travel links and a vehicular link to the Roosky lands. The general location of the subject site is illustrated in **Figure 1-1** below.

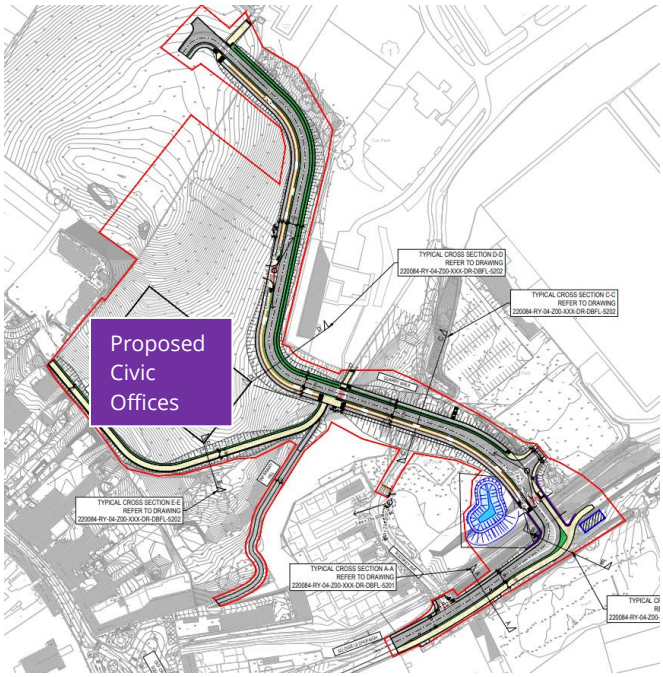


Figure 1-1 Subject Site Location

1.2 SCOPE OF QUALITY AUDIT

The geographical scope of this Quality Audit considers all internal transport infrastructure. The immediate approaches leading to/from the proposed scheme is also included in the scope of the QA, as illustrated in **Figure 1-2** below.

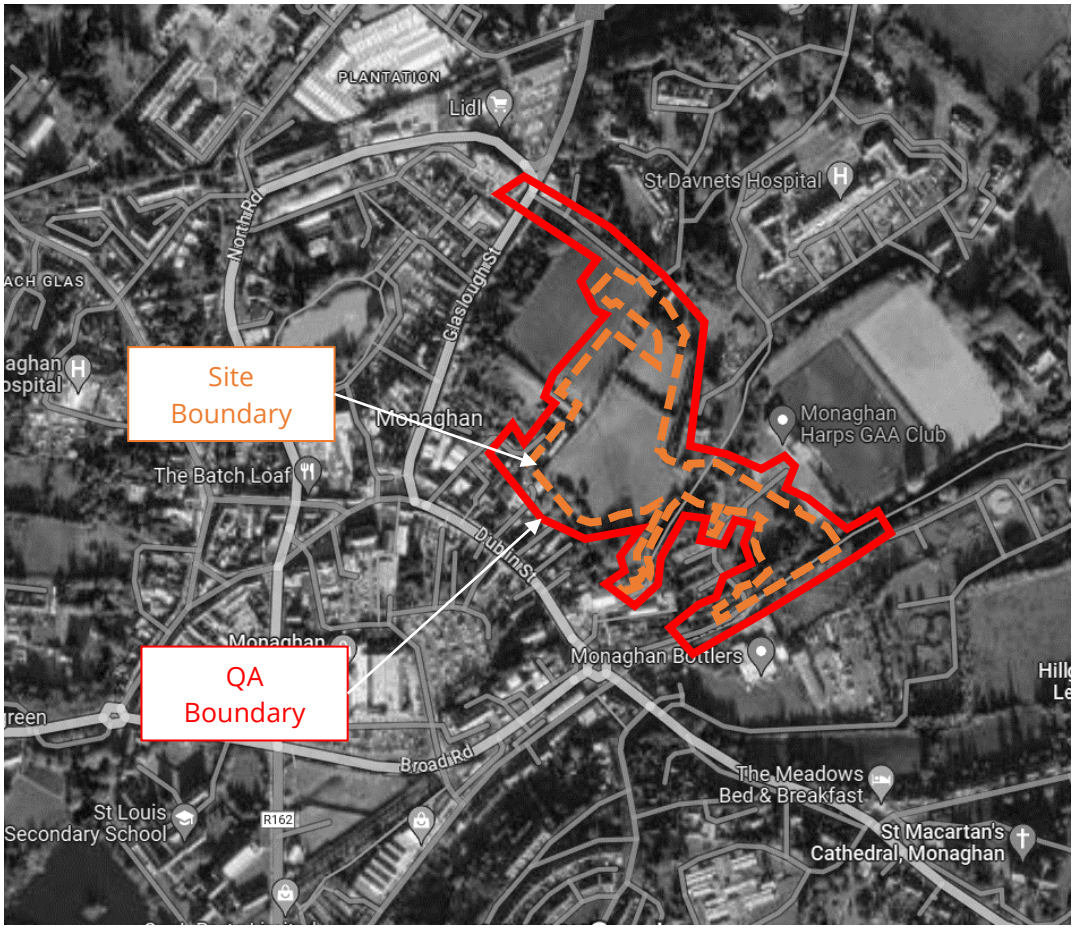


Figure 1-2 Geographical Scope of Quality Audit

1.3 QUALITY AUDIT PROCEDURE

The definition of a Quality Audit is provided within the Department for Transport (UK) Traffic Advisory Leaflet 5/11 "Quality Audit", and states: -

"QA is a defined process, independent of, but involving, the design team, that through planning, design, construction and management stages of a project, provides a check that high quality places are delivered and maintained by all relevant parties, for the benefit of all end users. QA is a process, applied

to highway, traffic management or development schemes, which systematically reviews projects using a series of discrete but linked evaluations and ensures that the broad objectives of a place, functionality, maintenance and safety are achieved."

The Design Manual for Urban Roads and Streets (DMURS) states that; "*the intention of a Quality Audit is not to pass or fail a design rather it is intended as an assessment tool that highlights the strengths and weaknesses of a design and a documented process of how decisions were made.*"

DMURS Advice Note No. 4 provides designers with guidance in relation to the preparation and content of Quality Audits in Ireland. The Quality Audit report structure has been compiled in reference to DMURS Advice Note No. 4 and international best practice guidance including, amongst others, the Department for Transport (UK) Traffic Advisory Leaflet 5/11 "Quality Audit", and the CIHT document "Manual for Streets 2". Through the adoption of the guidance detailed within the aforementioned documents, DBFL submit that this Quality Audit complies fully with the requirements introduced in DMURS.

2 CHARACTERISTICS OF PROPOSALS

2.1 OVERVIEW

The subject scheme involves the provision of a new Civic Office building and active travel and vehicular links to the subject lands.

The proposed works will involve :-

- Extending the existing vehicular route on Slí Ógie Uí Dhufaigh along the route of the existing Ulster Canal Greenway for approximately 120m before crossing the River Shambles. The existing greenway will be re-aligned to run parallel to the new carriageway. Carriageway width to be 6m and greenway width to be 3m
- Amendments to existing roadway serving Roosky Vale to form a priority-controlled junction at the interface with the extended Slí Ógie Uí Dhufaigh
- Provision of a new clear span bridge crossing over the River Shambles for the new links
- Provision of approximately 460m of new vehicular and active travel link (Quarry Walk) through the Roosky Lands consisting of 6m vehicular carriageway, 2-way cycle tracks, 1.8m footpath and roadside SuDS swale
- Upgrades to existing lane/pathway to form an active travel link to the town centre at the Diamond Car Park (Davnets Row)
- Provision of surface water attenuation basins
- Provision of new surface water, foul water and watermain infrastructure within the road corridor
- Associated earthworks, utilities, boundary treatments and ancillary works

The purpose of the proposed active travel and vehicular links within the Roosky lands is to provide access to the proposed new Civic Building including improved non-vehicular connectivity to Monaghan Town Centre thereby improving the 10-minute town concept within Monaghan which aims to have all community facilities and services within a 10-minute walk or cycle from homes.

2.2 INTEGRATION WITH EXISTING NETWORK

The subject active travel links within the Roosky lands seek to retain and improve linkages to adjoining infrastructure and trip attractors. Existing linkages to the St Davnets complex to the northeast and Old Cross Square to the southwest have been retained and improved. In addition, an existing link between the Roosky Lands and The Diamond Centre car park (via the Diamond Centre apartments) has been retained and upgraded to a high quality 3.5m wide shared cycle / pedestrian facility.

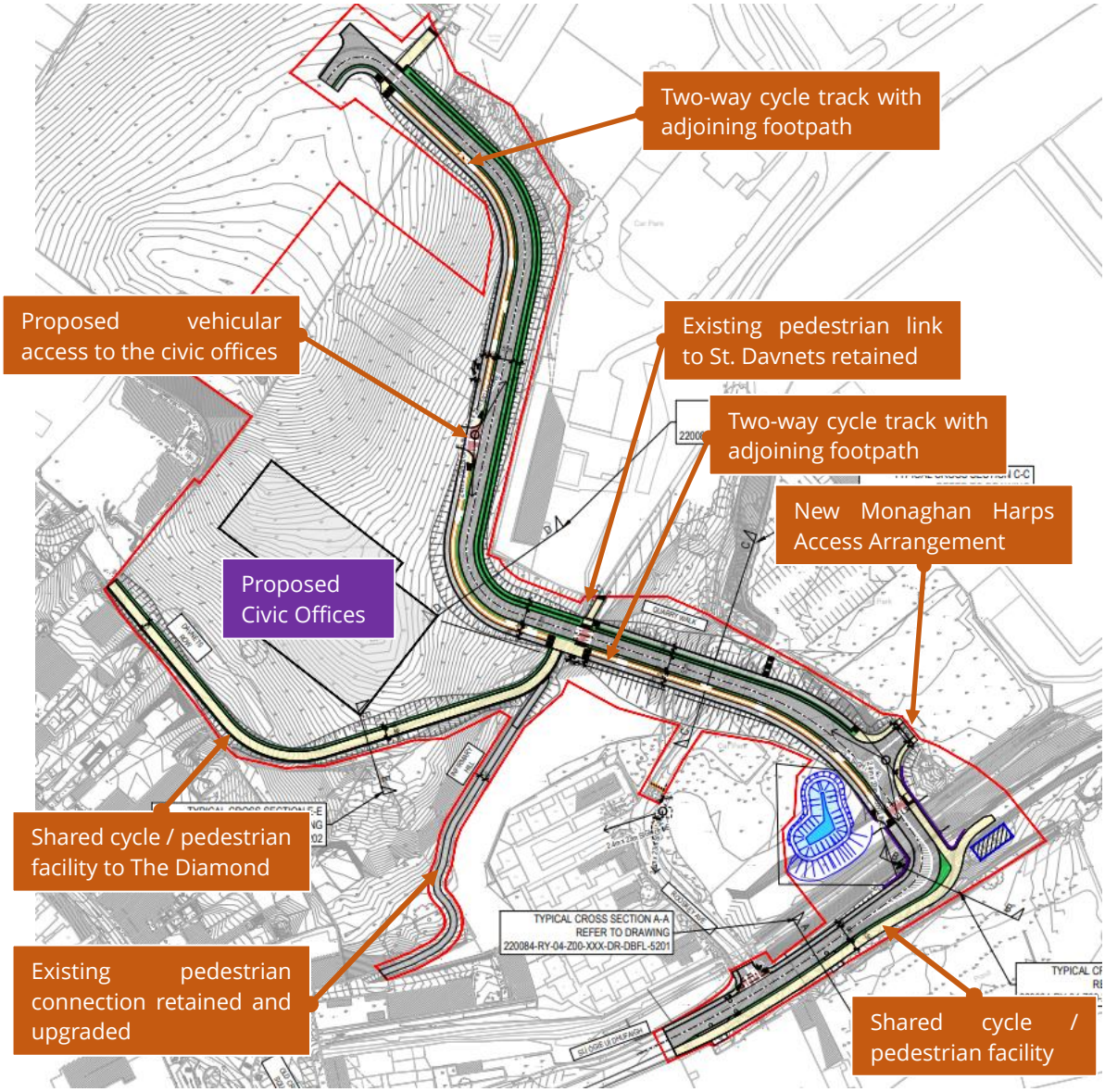


Figure 2-1 Proposed Active Travel Links

3 QUALITY AUDIT CONTEXT

3.1 INTRODUCTION

This section describes the general context of the Quality Audit which encompasses a Walking & Cycling Audit, a Mobility & Visually impaired Audit and an Access Audit. As introduced earlier a separate Stage 1-2 Road Safety Audit was undertaken by independent auditors Bruton Consulting Engineers. The scope of the audit considers the subject development site and the immediate pedestrian/cycle/vehicular routes leading to/from the development site.

This Quality Audit has been carried out to respecting the DMURS requirements of the Walking & Cycling Audit, a Mobility & Visually impaired Audit (incorporating an Access Audit). The problems identified and described in this report are considered by the Audit Team to require action in order to improve accessibility, enhance comfort and safety levels of the scheme.

3.2 COLLISION HISTORY

With the objective of ascertaining the road safety record of the immediate routes leading to/from the subject site, DBFL contacted the Road Safety Authority to obtain the recorded accident information in the area. The information received from the RSA highlighted that 3 no. accidents occurred within the immediate area of influence as presented in **Figure 3-1** below. These accidents occurred between the available years including 2016-2020. At the time of writing the 2021 & 2022 data is being analysed.

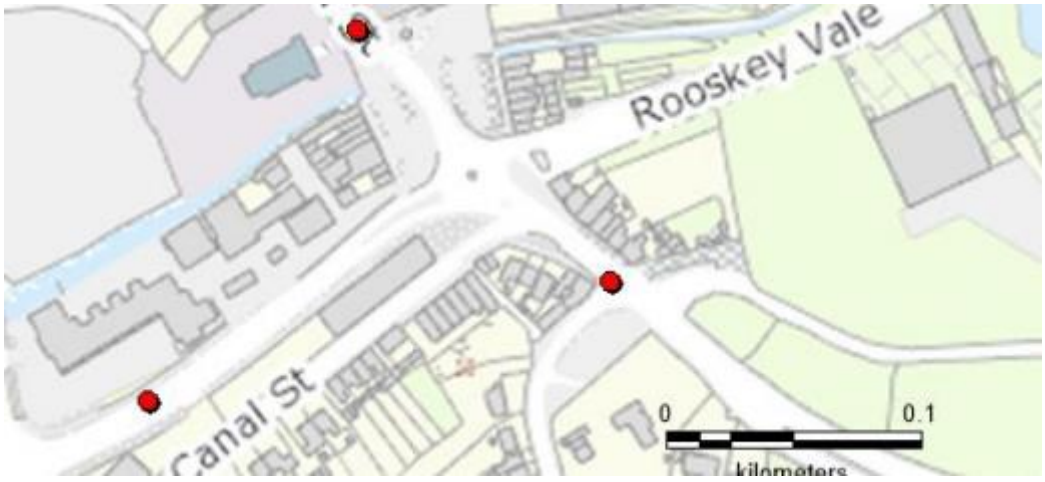


Figure 3-1 Road Safety Record (Source : Road Safety Authority)

4 ITEMS RAISED

4.1 PEDESTRIAN AND CYCLE AUDIT

4.1.1 Problem (PC1) – Proposed Toucan Crossings

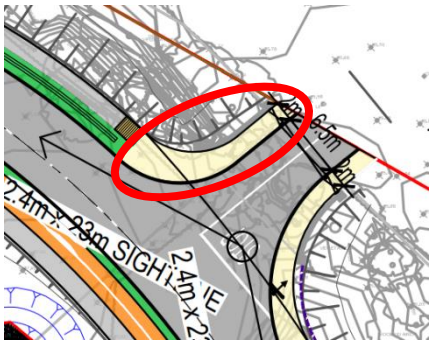
The proposed Toucan crossings do not show vehicular stop lines. Failure to provide appropriate road markings could result in vehicles failing to stop at the crossing resulting in vehicle / pedestrian / cyclist conflicts.

Recommendation:

At detailed design stage ensure appropriate road markings are provided in line with the Traffic Signs Manual / Cycle Design Manual.

4.1.2 Problem (PC2) – Shared Surface at Monaghan Harps Access

The shared surface on the northern side of the proposed new Monaghan Harps access does not connect to cycle facilities on either side of the facility. Cyclists exiting Monaghan Harps may assume this shared facility leads to dedicated cycle infrastructure only to be directed to a footpath or vehicular carriageway.

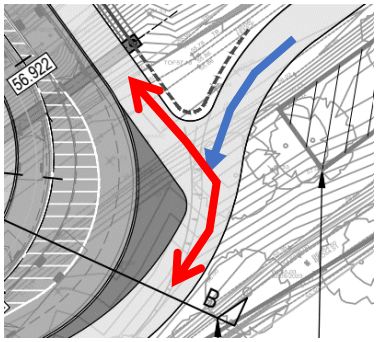


Recommendation:

It is recommended that this facility is for pedestrians only so that it is obvious to northbound cyclists that they must use the shared facility on the southern side of the access which leads to a Toucan crossing and two-way cycle track on the opposite side of the road.

4.1.3 Problem (PC3) – Priority at Greenway Junction

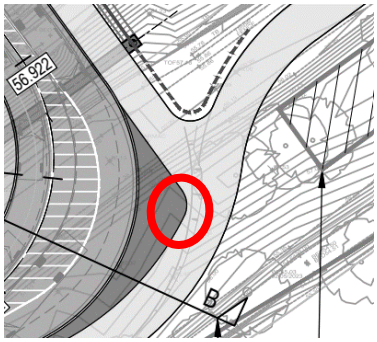
At the tie-in to the existing Greenway, there is no indication as to which direction of travel has priority. Should cyclists be travelling at speed along the Greenway, they could continue into the path of cyclysist / pedestrians travelling to / from Quarry Walk leading to potential collisions.



Recommendation:

It is recommended that priority is established at this location with cycle calming features implemented on the Greenway approach to this active travel junction.

4.1.4 Problem (PC4) – Sharp Bend



There is a tight radius proposed along the shared facility in the vicinity of the off-road Greenway tie-in. This tight bend reduces comfort levels for cyclists and may result in loss on momentum or control.

Recommendation:

Should this be deemed the priority route at this location, it is recommended that this radii be increased in-line with Section 4.1.4 of the current Cycle Design Manual.

4.2 MOBILITY & VISUALLY IMPAIRED AUDIT

4.2.1 Problem (MV1) – Drop Kerbs at Pedestrian Desire Line

Pedestrians travelling on the eastern / north eastern side of Quarry Walk between the existing Greenway and the pedestrian connections north of the Monaghan Harps access have to navigate full height kerbs to cross the Monaghan Harps access causing difficulty for mobility impaired users.

Recommendation:

It is recommended that tactile paving and drop kerbs are provided at this desire ine.

4.2.2 Problem (MV2) – Tactile Paving at Civic Office Access

There are no pedestrian crossing facilities provided on the pedestrian crossing desire line at the Civic Office access junction. As a result, visually impaired pedestrians may not be aware of the presence of a vehicular access and enter into the road carriageway when it is unsafe to do so, leading to conflict with vehicles.

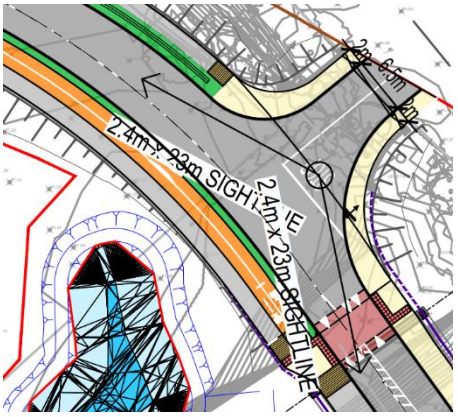
Recommendation:

Appropriately placed crossing facilities should be provided, with dropped kerbs (if necessary) & tactile paving, to cater for the pedestrian crossing.

5 COMMENTS

5.1.1 Comment (C1) – Visibility Splays

The visibility splays indicated on the General Arrangement drawings are not indicated as per DMURS guidance and accordingly may not give a true representation of visibility at the junction.



Recommendation:

Ensure visibility splays are drawn as per Section 4.4.5 of DMURS.

6 AUDIT TEAM STATEMENT

6.1 AUDIT TEAM STATEMENT

I certify that I have examined the drawings and other information listed in Chapter 7. This Audit has been carried out with the sole purpose of identifying any features of the Design that could be removed or modified to improve the quality of the scheme for all road users. The problems that have been identified have been noted in the report, together with suggestions for improvement which we recommend should be studied for implementation.

Mr. Mark McKenna ***BEng (Hons) MSc CEng MIEI***
DBFL Consulting Engineers

Signed: 

Date: 15/11/2023

Mr. Sayed Ahmad Saeed ***BEng Tech BEng (Hons) MEng MIEI***
DBFL Consulting Engineers

Signed: 

Date: 15/11/2023

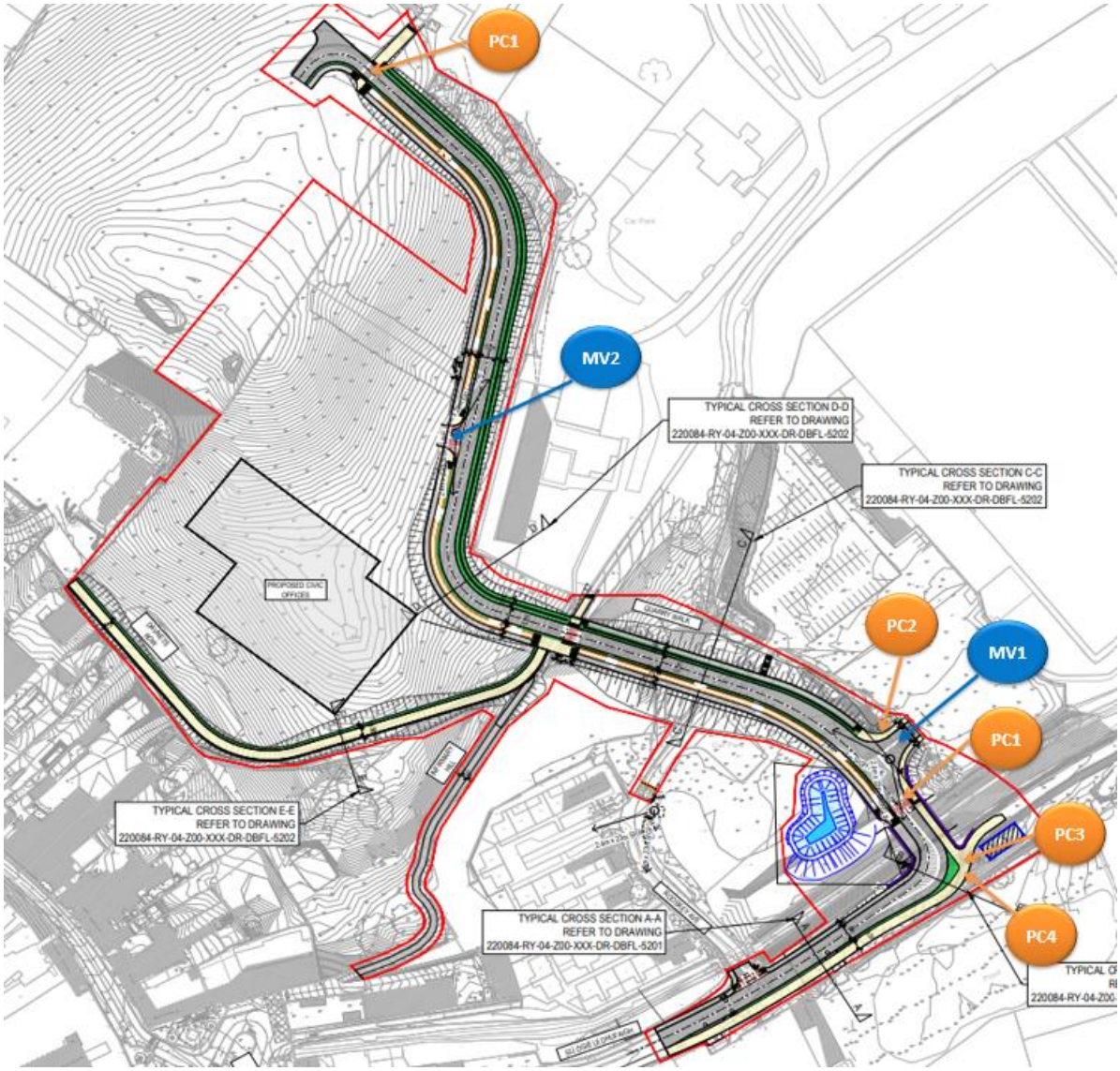
7 LIST OF INFORMATION RECEIVED

Items Received		Yes/No	Details
1	Scheme Description	Yes	Draft TTA Provided
2	Project Brief	No	
3	Scheme / Project Drawings	Yes	DBFL Drawings: • RY-04-Z00-XXX-DR-DBFL-CE-1200 General Arrangement – Overview • RY-04-Z00-XXX-DR-DBFL-CE-3201 Quarry Walk - Long Sections - Sheet 1 • RY-04-Z00-XXX-DR-DBFL-CE-3202 Quarry Walk - Long Sections - Sheet 2 • RY-04-Z00-XXX-DR-DBFL-CE-3203 Davnets Row - Long Sections • RY-04-Z00-XXX-DR-DBFL-CE-3211 Quarry Walk - Cross Sections - Sheet 1 • RY-04-Z00-XXX-DR-DBFL-CE-3212 Quarry Walk - Cross Sections - Sheet 2 • RY-04-Z00-XXX-DR-DBFL-CE-3213 Quarry Walk - Cross Sections - Sheet 3 • RY-04-Z00-XXX-DR-DBFL-CE-3214 Quarry Walk - Cross Sections - Sheet 4 • RY-04-Z00-XXX-DR-DBFL-CE-3215 Quarry Walk - Cross Sections - Sheet 5 • RY-04-Z00-XXX-DR-DBFL-CE-3216 Quarry Walk - Cross Sections - Sheet 6 • RY-04-Z00-XXX-DR-DBFL-CE-3221 Davnets Row Cross Section Plan - Sheet 1 • RY-04-Z00-XXX-DR-DBFL-CE-3222 Davnets Row Cross Section Plan - Sheet 2 • RY-04-Z00-XXX-DR-DBFL-CE-3223 Davnets Row Cross Section Plan - Sheet 3 • RY-05-Z00-XXX-DR-DBFL-CE-1301 Drainage Layout - Sheet 1 • RY-05-Z00-XXX-DR-DBFL-CE-1302 Drainage Layout - Sheet 2 CORA Drawings • MCC-CORA-ZZ-ZZ-DR-C-0002 - OVERALL SITE PLAN • MCC-CORA-ZZ-ZZ-DR-C-2401 - SURFACE WATER LONGSECTIONS – 1 • MCC-CORA-ZZ-ZZ-DR-C-2402 - SURFACE WATER LONGSECTIONS - 2
4	Departures from Standard	No	
5	Traffic Signal Information	N/A	
6	Road Signs & Road Marking Details	Yes	• RY-04-Z00-XXX-DR-DBFL-CE-1201 General Arrangement - Sheet 1

			• RY-04-Z00-XXX-DR-DBFL-CE-1202 General Arrangement - Sheet 2
7	Traffic Count Information	Yes	
8	Speed Survey Data	Yes	
9	Collision Data	Yes	Draft TTA Provided
10	Previous Road Safety Audit Reports	N/A	
11	Relevant Design Standards	No	
12	Public Transport Information	Yes	Draft TTA Provided
13	Other Information	No	

Table 7-1 Information Received as basis for Quality Audit

Appendix A : Problem Location Figure


PC1
MV2
TYPICAL CROSS SECTION D-D
REFER TO DRAWING
220084-RY-04-Z00-XXX-DR-DBFL-5202
TYPICAL CROSS SECTION C-C
REFER TO DRAWING
220084-RY-04-Z00-XXX-DR-DBFL-5202
PROPOSED CIVIC OFFICES
PC2
MV1
PC1
TYPICAL CROSS SECTION E-E
REFER TO DRAWING
220084-RY-04-Z00-XXX-DR-DBFL-5202
PC3
TYPICAL CROSS SECTION A-A
REFER TO DRAWING
220084-RY-04-Z00-XXX-DR-DBFL-5201
PC4

Appendix B : Feedback Form

22084

QUALITY AUDIT FEEDBACK FORM

Scheme: Proposed Civic Office Development at Roosky Lands.

Date Audit Completed: November 2023

To be Completed By Designer				To be Completed by Audit Team Leader
Problem No. in Quality Audit Report	**Problem accepted (yes/no)**	**Recommended measure accepted (yes/no)**	**Describe alternative measure(s). Give reasons for not accepting recommended measure. Only complete if recommended measure is not accepted.**	**Alternative measures or reasons accepted by Auditors (yes/no)**
PC1	YES	YES		
PC2	YES	YES		
PC3	YES	YES		
PC4	YES	YES		
MV1	YES	YES		
MV2	YES	YES		

Signed: _____ **Designer:** John Carr **Date:** 20/11/2023

Signed: _____ **Audit Team :** Mark McKenna **Date:** 20/11/2023

Signed: _____ **Employer:** Paul Connolly **Date:** 01/12/2023

Please complete and return to auditor.

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