BOWE CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Civil Engineering Site Services Report

Proposed Enterprise Campus, O'Brien Road, Carlow

This report takes into account the particular instructions and requirements of our Client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

CONTENTS

1. INTRODUCTION

The purpose of this report is to outline the design recommendations and construction methodology associated with the Bowe Consulting Engineering's drainage design for the proposed development of an Enterprise Campus to be located on the O'Brien Road, Carlow.

Bowe Consulting Engineers were engaged by Carlow County Council to work in association with O'Driscoll Lynn Architects and Brennan Associated Project Managers in the preparation of a drainage design solution for the proposed development.

2. PROPOSED DRAINAGE DESIGN

2.1 Storm Drainage Design

In order to comply with the requirements of Carlow County Council it is necessary to include a SuDs based storm water management system in accordance with the Carlow County Council SuDS policy document, CIRA C753 and Greater Dublin Strategic Drainage Study (GDSDS).

The system will utilise the benefits of permeable paving which will provide attenuation for storage of the 100-year storm event prior to a controlled discharge to the proposed storm sewer manhole located in the O'Brien Road and adjoins the northern boundary of the proposed development.

Please refer to Bowe Consulting Engineers drawing ref. no.'s 20P1457-01 to 03, attached to this submission, for the proposed storm water layout and associated construction details.

2.1.1 Flow Control Device

We have proposed the use of a JFC Hydro-Valve flow control system. The JFC Hydro-Valve is a vortex flow control device for controlling fluid flow by hydraulic effect without requiring moving parts, the unit is independently tested and certified by the WRc (British Water Research Council).

During operation at low flow rates, water enters through the inlet and passes through the vortex chamber to the outlet with no restriction. As head height increases hydrostatic pressure also increases, this pressure forces fluid through the valve with enough energy to create a vortex in the vortex chamber. This results in a considerable pressure drop between the inlet and outlet restricting flow to the required discharge rate of 3.7 l/s.

A bypass separator by Premier Tech (ref.CNSB10S/21) is proposed upstream of the flow control manhole. See Appendix A1.2 for the technical details and a typical installation drawing for the Hydro-Valve and Premier Tech Bypass Seperator.

2.1.2 Permeable Paving

Storm water will be collected and stored in permeable paving, located in the carpark area between the public road and the existing building. The discharge from the permeable paving will be controlled by means of the Hydro-Valve flow control device located in storm manhole ref.S1.4.

It has also been found that the quality of water discharged from permeable paving is comparable to that discharged from a modern-day wastewater treatment plan. The stone layers and geotextile at the base act as a trickle filter which catches organic matter, silt and loam. Hydrocarbons are digested within the sub-base by a population of naturally occurring microbes.

It has also been determined by specialist suppliers that approximately 30% of water entering the permeable paving system is lost through evaporation and will next leave the system in the form of exit water. The structural depth to be provided in accordance with the manufacturers structural design requirements for a CBR 2-5% is a minimum of 450mm.

2.1.3 Attenuation Design

We have calculated that 174m^3 of storage volume is required in the attenuation structure for the 100 year event for this 1.3 acre site. We propose to provide this storage within sub-base of portion of the proposed pavement buildup. It has been determined by specialist suppliers that approximately 30% of water entering the permeable paving system is lost through evaporation and will next leave the system in the form of exit water.

It has also been found that the quality of water discharged from permeable paving is comparable to that discharged from a modern-day wastewater treatment plan. The stone layers and geotextile at the base act as a trickle filter which catches organic matter, silt and loam. Hydrocarbons are digested within the sub-base by a population of naturally occurring microbes.

The structural depth to be provided in accordance with the manufacturers structural design requirements for a CBR 2-5% is a minimum of 450mm. The provided area of the permeable paving extends to 1289m^2. With a min. sub-base depth of 450mm throughout and voids ratio of 30%, a minimum potential storage volume of 174m^3 is provided. This volume equates to the total storage volume require for a 1 in 100 year storm event.

See Appendix A1.2 for the Qbar and attenuation volume calculations.

2.2 Sustainable Drainage Systems

The development of the site will result in increased paved and impermeable areas that could create pressure on the receiving environment and existing infrastructure dur to the generation of increased stormwater run-off. To avoid this, the proposed development will be designed in accordance with the principals of sustainable Drainage Systems (SuDs) as embodied in the recommendations of the Carlow County Council SuDS policy document CIRA C753 and Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimize the impact of urbanization by replicating the run-off characterises of the greenfield site. The criteria provide a consistent approach to addressing the increase in both rate and volume of run-off, as well as ensuring the environment is protected from any pollution from roads and buildings. These drainage design criteria are as follows:

Criterion 1 – River Water Quality Protection
Criterion 2 – River Regime Protection
Criterion 3 – Flood Risk Assessment
Criterion 4 – River Flood Protection

In the case of the subject site, interception will be provided from permeable paving. Given that the surface water runoff will be fully intercepted there will be no requirement for treatment or long-term storage.

2.2.1 Criterion 1 – River Water Quality Protection

Urban run-off, when drained by pipe systems, results in run-off from virtually every rainfall event with high levels of pollution, particularly in the first phase of run-off, with little rainfall percolating to the ground. To prevent this happening, Criterion 1 requires that interception storage and/or treatment storage is provided, thereby replicating the run-off characteristics of the pre-development greenfield site.

Interception storage where provided, should ensure that, at a minimum, the first 5mm of rainfall is intercepted on site and does not find its way to the receiving water. In the context of the subject site the total area discharging to the drainage system = 4,762m^2. Providing a minimum of 5mm interception storage equates to a volume of 24m^3. Interception storage for this development will be provided by permeable paving over the proposed carpark to the development.

Interception storage = 30% (evaporation) x 532m^2 x 0.45m (permeable paving)
= 72m^3

In summary, the provided interception storage is above the minimum volume (5mm) required by the GDSDS. Thus Criterion 1 is satisfied.

2.2.2 Criterion 2 – River Regime Protection

The GDSDS requires that no flooding should occur on site for storms up to and including the 1 in 30 year event. The pipe network and the attenuation storage volumes should, therefore, be checked for such storms to ensure that no site flooding occurs although partial surcharging of the system is allowed as long as it does not threaten to flood.

For the 1 in 100 year event, the pipe network can fully surcharge and cause site flooding, but the top water level due to any such flooding must be at least 500mm below any vulnerable internal floor level, and the flood waters should be contained within the site.

Appendix A1.1 outlines the storm drainage pipe network design, which was carried out in accordance with Institute of Hydrology Report No. 124, recommendations for site Development works (Department of the Environment) and were modelled using the Rational Method.

In summary the network does surcharge but does not flood for the 100 year event. Therefore Criterion 3 is satisfied.

2.2.3 Criterion 3 – Flood Risk Assessment

Regardless of the rainfall event, unchecked run-off from the developed site through traditional pipe networks will discharge into receiving waters at rates that are an order of magnitude greater than that prior to development. This can cause flash flow in the outfall river / stream that can cause scour and erosion. Attenuation storage is provided to prevent this occurring by limiting the rate of run-off to that which took place from the pre-development greenfield site.

In practice, the rate of run-off needs to be appropriately low for the majority of rainfall events, and attenuation storage volumes should be provided for the 1 and 100 year storm event. The rate of outflow from such storage should be controlled so that it does not exceed the greenfield run-off rate of Qbar, which can be factored upwards by factors appropriate to the various return periods if long term storage is provided.

Qbar for the site has been designated in accordance with Carlow County Council policy as 3.7 l/sec. A ‘Hydro-valve’ limited to a flow rate of 3.7 l/sec is proposed to be used downstream of the permeable paving to restrict flow to the Qbar rate.

As the surface runoff flow rate generated on site does not exceed Qbar, there is no requirement for long-term storage to limit the impact on the receiving watercourse.

2.2.4 Criterion 4 – River Flood Protection

Criterion 4 is intended to prevent flooding of the receiving system / watercourse by either limiting the volume of run-off to the pre-development greenfield volume using 'long-term storage' (Option 1) or by limiting the rate of run-off for the 1 in 100 year storm to QBAR without applying growth factors using 'extended attenuation storage' (Option 2).

Long-term storage will be provided in the form of interception storage on this site. This does not, however, equate to full long-term storage volume and due a lack of usable space on site it is not feasible to provide additional storage areas elsewhere on site to achieve the required volume.

Option 2 has therefore been used to comply with Criterion 4 and an attenuation tank will be provided to limit the rate of discharge in the 1 in 100 year storm event to Qbar without growth factors applied.

The proposed flow-control device, located in the discharge manhole ref. S1.4, is set so that the rate of outflow from the development site does not exceed Qbar during the 1 in 100 year storm event, thus Criterion 4 is satisfied.

2.3 Foul Drainage Design Methodology

The proposed foul drainage system consists of a gravity system on the site which conveys the effluent to an existing 225mm dia. sewer located in the public road adjoining the northern boundary of the site.

The foul sewer has been designed in accordance with the Colebrook-White formulas, B.S.752:2008, Drina & Sewer Systems and the current Building Regulations. Calculation of the design flows were carried out using the Discharge Unit Method in accordance with BS EN 12056-2:2000.

Please refer to Bowe Consulting Engineers drawing ref. no.'s 20P1457-01 to 03, attached to this submission, for the proposed foul sewer layout and associated construction details.

The pipe for the foul sewerage system consists of 150mm dia. uPVC, laid at a gradient of 1:60.

Appendix A1.1 outlines the foul drainage pipe network design. The flow rate for the system was determined by using the discharge unit's method of BS EN 12056-2:2000 Gravity Drainage Systems. It can be seen in Appendix A that all pipe have been designed with adequate capacity and partial velocities, thereby ensuring adequate self-cleansing velocities for the entire system.

2.4 Watermain Design Methodology

It is proposed that the existing watermain will serve the proposed development. The existing site supply is metered in accordance with the requirements of the Local Authority / Irish Water.

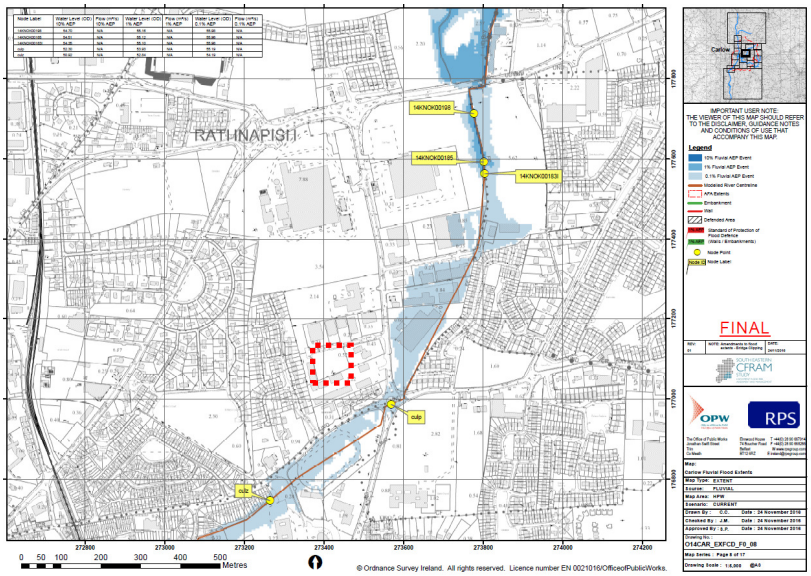
A summary of the expected average and daily demand is shown in the Table below.

Estimated Average Flows	
Total Number of Persons	80 (calculated with reference to the proposed schedule of unit areas)
Demand (Litres/person/day)	200
Average Daily Demand (lt/sec)	80 x 200 / 24 = 667 l/hr 667 / (60x60) = 0.185 l/s
Peak Daily Demand (lt/sec)	0.185 x 6 = 1.11 l/s

Please refer to Bowe Consulting Engineers drawing ref.20P1457-01 attached to this submission, for the proposed watermain layout plan.

3. FLOOD RISK ASSESSMENT

A review of the Floodmap.ie and Floodinfo.ie website-based flood history records confirms that there is no history of flooding on the proposed development site. In summary the proposed development is not located within a flood zone.



Map of relevant CFRAM Carlow Fluvial Flood Extents taken Floodmaps.ie

4. CONCLUSIONS

- ✓ The storm management system on the site has sufficient capacity and connection to an appropriate outfall can be established without difficulty, thus ensuring adequate drainage for the proposed development.

- ✓ This engineering services design report has shown that the foul drainage proposed for the site has sufficient capacity. A connection to the appropriate public mains can be established without difficulty, thus ensuring adequate foul drainage for the proposed development.

- ✓ A connection to a potable water supply can be made via an existing watermain located on the O'Brien Road fronting the site.

- ✓ There is no history of flooding to the site and the site is currently not located within a flood zone.

Should you have any queries regarding the above, please contact the office of Bowe Consulting Engineers.

Signed: _____ Date: 2nd of April 2021

IVOR BOWE
Chartered Engineer on behave of
Bowe Consulting Engineers

APPENDIX 1.1 Foul Drainage Design Spreadsheet

APPENDIX 1.2 Attenuation Design & Flow Control Details

ISSUE REGISTRATION:

Project: Proposed Enterprise Campus, O'Brien Road, Carlow. **Project No:** 20P1457-C.06

Rev.	Date	Purpose of Issue/Nature of Revision	Prepared by.	Issue Authorised by.
R1	2nd of Dec '21	Issued to Design Team	Ivor Bowe BSc(Eng), Dip Eng, CEng, MIEI	

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