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20047

PROPOSED RESIDENTIAL DEVELOPMENT AT CLONBRONE, LUCAN

October 2022

Prepared For:
Nacul Developments Ltd.

Revision Register

Revision	Description	Prepared By	Checked By	Date
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TABLE OF CONTENTS

INTRODUCTION

It is proposed by our client, Nacul Developments Ltd, to construct a new residential development at Clonbrone, Lucan. The site location is indicated in figure 1 below. The project comprises the construction of 7 No. detached houses on a 0.3Ha site currently occupied by a single house. To the North, the site is bounded by sloping ground leading down to the R835 Lucan Road, to the South and East the site is bounded by existing residential properties and to the West the site is bounded by the Lucan Newlands Road.

The following report details the proposals for water services associated with the development and includes a flood risk appraisal.

Figure 1- Proposed Site Location

EXISTING SERVICES

Following instruction to proceed on the above project, Downes Associates made initial enquiries in relation to drainage and water supply services with South Dublin County County Council. There follows a summary of the current situation with regard to civil engineering services:

Water Supply

Record maps of the existing watermains in the immediate area indicate a 150mm diameter cast iron watermain (1932) along one side the Lucan Newlands Road as shown below.

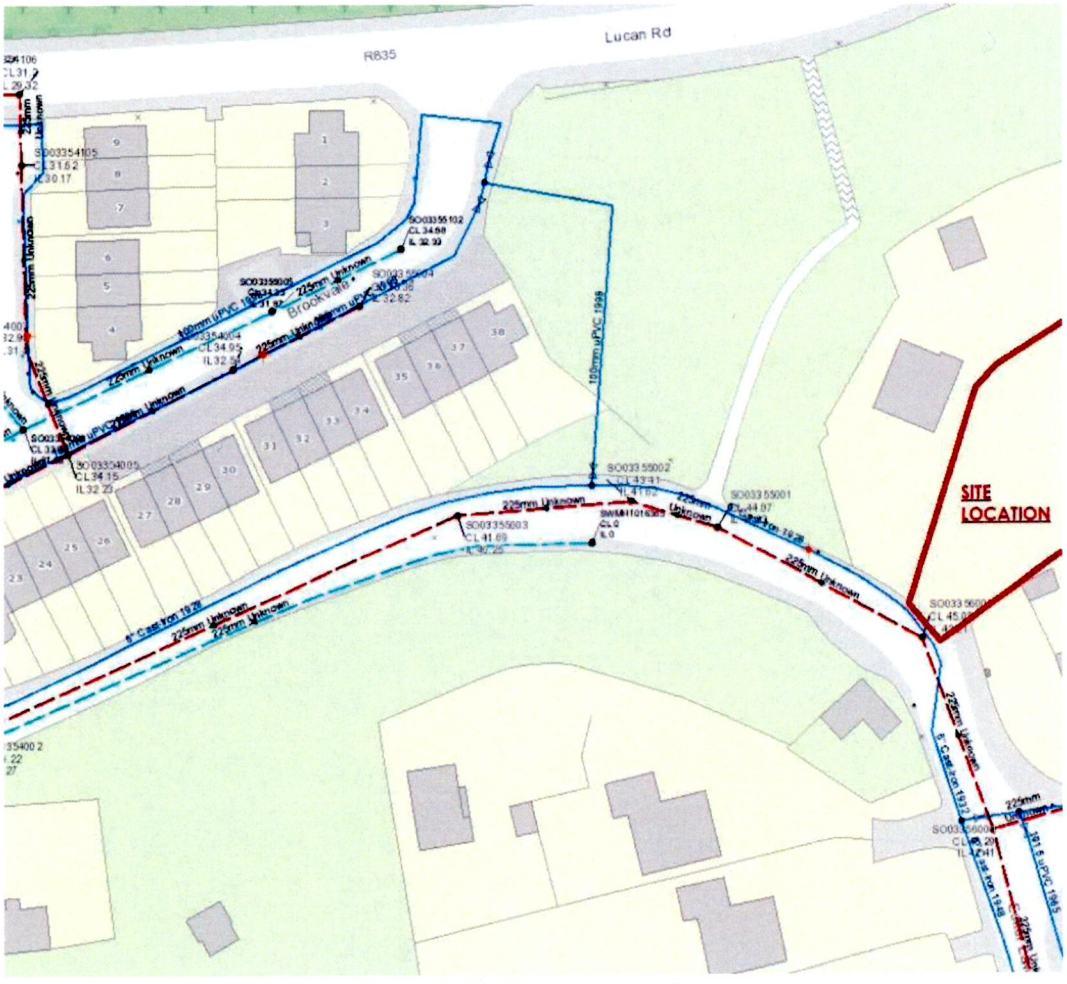


Figure 2- IW Record Mapping

Foul Drainage

An existing 225mm diameter public foul sewer is located along the Lucan Newlands Road. This sewer falls by gravity in a north westerly direction along the Lucan Newlands Road towards Lucan village. There is an existing foul manhole located directly outside the site entrance on the Lucan Newlands Road with a record cover level of 45.030m OD and a record invert level of 42.21m OD.

Surface Water

An existing 225mm diameter surface water sewer is located along the Lucan Newlands Road and is separate from the foul sewer. An existing manhole approximately 50m west of the site appears to be the start of the surface water drainage run. The invert level of this manhole is not identified on the public records provided. However as the topography falls quite significantly along this road the level is expected to be more than adequate for connection purposes. This will be verified prior to commencement of the works. The location of this manhole within Figure 4 below.

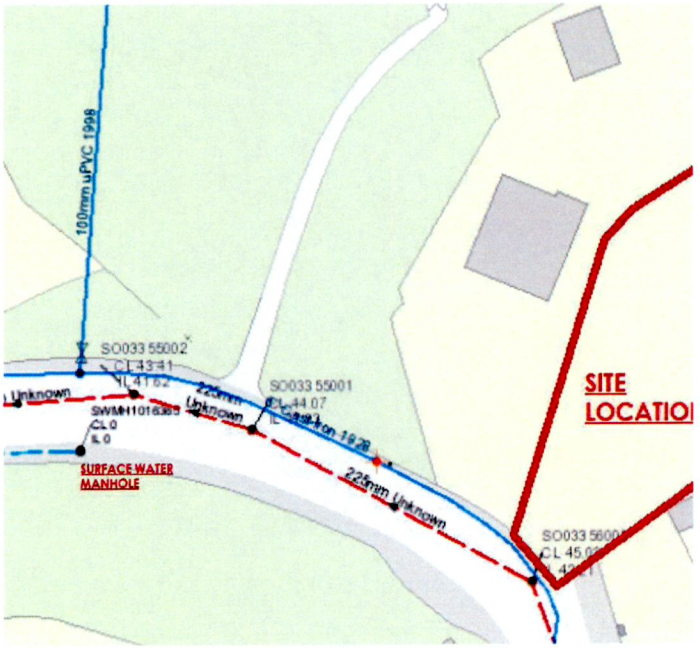


Figure 4- Local Authority Record Map

PROPOSED SERVICES

WATER SUPPLY

The permanent water supply solution is indicated on enclosed Downes Associates drawings.

Water Requirements

Potable Water

Potable water is required for human consumption within the development. An estimate of the water requirement is 225 litres/head/day within each dwelling. Based on an estimate of 6 occupants for each of the 7 No. houses, the water requirement is 9,450 litres per day.

Fire-Fighting

For firefighting purposes, fire hydrants are to be provided within the site to the spacing required by Part B of the Building Regulations including the requirement that hydrants will be provided such that no part of any building elevation shall be 46 metres from a hydrant. 2 No. new hydrants are proposed along the cul-de-sac which shall be supplied from the new 100mm diameter watermain.

Water Supply Source

Connection to Potable Water Supply

A new local 25mm connection will serve the dwelling and will comply with the requirements of Irish Water. A new 100mm diameter MDPE water main will be provided along the new cul de sac access road and will comply with the requirements of Irish Water. A loop will be provided at the end of the cul de sac and will serve a minimum of 4 No. houses as per the requirements of Irish Water. This new watermain will be supplied from the existing 100mm diameter watermain along the Lucan Newlands Road. A new water meter will be provided outside each dwelling as per the requirements of Irish Water.

FOUL DRAINAGE

The permanent foul drainage solution is indicated on enclosed Downes Associates drawings.

Irish Water

Downes Associates has issued a Pre-Connection Enquiry to Irish Water prior to submission of the planning application. Irish Water responded in December 2021 confirming confirmation of feasibility to connect without any upgrade to the public system. A copy of this is included within the Appendices of this report.

Collection and Discharge

Foul water will leave each new dwelling via a new network of underground pipes and fall by gravity via new connection to a new 225mm diameter sewer to be installed along the new access road in accordance with Irish Water requirements. This will ultimately discharge by gravity into the existing 225mm diameter foul sewer along the Lucan Newlands Road. A private side foul inspection chamber shall be provided within 1m of the boundary of each property in accordance with Irish Water Standard Detail IW-STD-WW-01.

The foul water drainage system for the proposed development will be separate to the surface water drainage system.

Pipe Design

The foul water drainage system for the proposed development will be separate to the surface water system. It is proposed to discharge all foul drainage from the buildings by gravity to foul manhole F4 before discharging by gravity to the existing public foul sewer manhole as per enclosed drawing 20047-DOW-00-XX-DR-CE-5001.

Site Usage: Residential – 8 No. 4 bedroom dwellings

Assumptions: It is assumed that a maximum of 6 residents will use each dwelling. A peak flow factor of 6 is adopted for residential developments.

With regard to the calculation of the population equivalent, we have applied the EPA guidelines to the development. The total population equivalent for the development is 48, i.e. 8 No. dwellings x 6 No. maximum residents per dwelling.

Therefore, the total average flow is 48 x 225 litres/head/day = 10,800 litres/day. Using a total peak flow factor of 6 for a residential development the total peak foul discharge to the public sewer is:

(6 x 12,600) / (24 x 60 x 60) = 0.75 litres/second

A roughness coefficient, ks of 1.5mm is used for foul sewers. Foul drains are designed to achieve a minimum self-cleansing velocity of 0.8m/s when flowing half full.

A 225mm diameter pipe is proposed in order to meet the requirements of the Greater Dublin Strategic Drainage Strategy (GDSDS).

Using a 225mm diameter sewer at a gradient of approximately 1:80

Hydriatic performance with ks = 1.5

Full bore condition:

Discharge capacity = 68 l/s (>0.75 l/s)

Velocity = 1.71 m/s (>0.8 m/s)

Refer to Drawing 20047-DOW-00-XX-DR-CE-5001 for details of the proposed foul water layout.

SURFACE WATER DRAINAGE

The permanent surface water drainage solution is indicated on enclosed Downes Associates drawings.

Collection and Treatment

Surface water will be collected from the building roofs by gutters, downpipes and underground surface water pipes. Driveway surfaces will generally comprise permeable construction to allow direct infiltration to ground while rear gardens will comprise permeable grass surfacing. The surface water drainage system for the proposed development will be separate to the foul water drainage system.

Permeable Paving is proposed for use in each of the front driveway areas as noted above. The layers of stone and geotextile act as a type of trickle filter. Organic matter, silt and loam is caught by the geotextile and held within the laying course. Heavy metals have an affinity to particulates; adhering to the surface of the organic matter and silt. They are therefore stabilised and retained within the sub-base. Hydrocarbons are digested within the sub-base by a population of naturally occurring

microbes. Research undertaken at Coventry University on microbial growth has shown that the system is capable of degrading at least 70g of oil per m^2 per annum.

Refer to a later sub-section for details of SUDS measures adopted. The collection system is shown on the enclosed drawings.

Sustainable Surface Water Drainage Measures

The proposed surface water drainage system has been designed in accordance with the policy requirements of the Greater Dublin Strategic Drainage Study (GDSDS), incorporating surface water source control measures and Sustainable Drainage Systems (SuDS).

The proposed use of SuDS is based on detailed consideration of the following criteria:

- Technical Guidance Documents for the "Greater Dublin Strategic Drainage Study Regional Drainage Policies" (GDSDS);
- Engineering guidelines contained in CIRIA Document CIRIA C753 – The SuDS Manual
- Restrictions of the development site in terms of location, context, size, ground conditions and topography;
- Management issues relating to the adoption and operation of SuDS;

In general terms, SuDs measures shall comply with the following principles:

- Achieve adequate water quality treatment.
- Minimise runoff volumes and rates.
- Treat appropriately the stormwater effluent prior to discharge to receiving environment.
- Protect groundwater.
- Maximise amenity potential and ecological benefits where possible.

A detailed SuDS evaluation of the site was carried out including use of the design tools available on the website www.irishsuds.com.

Based on the constraints of the site, the SuDs components considered implementable in this instance are as follows:

- Permeable pavements
- Swale
- Attenuation

Source Controls

Maximise permeability within a site to promote attenuation, treatment and infiltration reducing the need for offsite conveyance.

Ref	Measure	Suitable	Comment	Adopted
A.1	Green roofs	No	Not suitable for housing development with pitched roofs	No
A.2	Permeable paving	Yes	Permeable surface within driveway	Yes
A.3	Grass	Yes	It is proposed to maintain the maximum grassed and planted area coverage for the site	Yes
A.4	Reinforced grass	No	Not suitable in domestic.	No
A.5	Gravelled areas	No	Not suitable in housing estate. Permeable paving adopted instead.	No
A.6	Rainwater harvesting	Yes	Infrastructure will be constructed allowing the future adoption of such measures for individual owners gardening (non-potable) purposes only	No
A.7	RainTrap	Yes	Infrastructure will be constructed allowing the future adoption of such measures by owners.	No
A.8	Water Butt	Yes	Water butt indicated for each house	Yes

Swales and conveyance channels

Ref	Measure	Suitable	Comment	Adopted
B.1	Swales	Yes	Swale provided as indicated on attached drawing	Yes
B.2	Canals and rills	No	Not suited to topography	No

Filtration

Ref	Measure	Suitable	Comment	Adopted
C.1	Filter trench	No	No suitable infiltration rate available for this site.	No
C.2	Bioretention areas	Yes	Swale provided which will encourage biodiversity	Yes

Infiltration

Capture surface water runoff and allow it to infiltrate (soak) and filter through to the subsoil layer, before returning it to the water table below.

Ref	Measure	Suitable	Comment	Adopted
D.1	Soakaways	No	No suitable infiltration rate in stiff clays	No
D.2	Infiltration basin	No	No suitable infiltration rate in stiff clays	No
D.3	Rain garden	No	Extent of landscaping available will not permit this	No

Retention and Detention

Designed to either provide storage, through the retention of surface water runoff, or attenuation through the detention of surface water runoff.

Ref	Measure	Suitable	Comment	Adopted
E.1	Detention basins	No	Not considered suitable for a development of this size.	No
E.2	Retention ponds	No	Not considered suitable for a development of this size. Not considered safe within housing development.	No
E.3	Geocellular systems	Yes	Underground Stormwater Attenuation system proposed. Concrete tank adopted given location	Yes

Wetlands

Densely vegetated water bodies that use sedimentation and filtration to provide treatment of surface water runoff.

Ref	Measure	Suitable	Comment	Adopted
F.1	Wetlands	No	Not considered suitable for a development of this size.	No

Proposed Solution

Pipes within the site carrying surface water shall be sized to cater for a rainfall intensity of 50mm per hour applied to all external impermeable areas and roofs. Surface water runoff from impermeable areas is calculated using the Modified Rational Method as follows:

$Q = 2.78C_vC_rIA$ (where Q is in l/s, i is in mm/hr and A is in Ha)

$C_v = 0.75$ and $C_r = 1.3$

$Q = 2.78iA$

A roughness coefficient, k_s of 0.6mm is used for surface water drains. Pipe size and gradient for each run are determined using the Causeway Flow+ Design Software.

Runoff Rate Calculation

The runoff rate for greenfield sites, Q_{bar}, is estimated using the HR Wallingford estimation tool that refers to the Institute of Hydrology Report No. 124 – Flood Estimation for Small Catchments (see below).

The input used in the estimation is as follows:

Total Site Area: 0.3073 Ha

SOIL Type: 2

SPR is a parameter which is used by the Flood Studies Report (FSR). Standard Percentage Runoff is the percentage of rainfall that contributes to the increase of surface runoff based on analysis of data from flood events and adjusted for rainfall and catchment properties.

SPR: 0.3

Standard Average Annual Rainfall (SAAR) for Clonbrone, Lucan: 953mm

$Q_{bar,\,rural}$ = 0.8l/s for 0.3073 Ha (Site Area)

Attenuation Storage Analysis

Analyses of the surface water runoff from the areas contributing to the storage volumes were carried out using the Causeway Flow+ Design Software (see below). The analysis was carried out for the 100-year return period as appropriate to the design criterion. To allow for potential future climate change, 10% increase has been allowed for in calculations. Tree pits are also provided extensively throughout the development. Details of same are included on our attached drawings.

Design Details

The total storage volume required is split between a swale and an underground concrete attenuation tank. The available space on the site does not permit the entire storage volume requirement to be accommodated within the swale. As such, the swale is accompanied by the tank as described above. With regard to limiting outflow from the storage system, a 'Hydrobrake' (or similar approved) flow control device is to be fitted at the outlet manhole. The Hydrobrake is to meet the required flow characteristics for the system restricting the flow to 2.0L/sec as agreed with South Dublin County Council.

Refer to attached drainage layout drawing for details of the proposed surface water drainage layout.

FLOOD RISK MANAGEMENT

Flood Risk Assessment

Primary and Secondary sources of flooding information were gathered and assessed individually in the following chapter as defined in Appendix A of the Planning Systems and Flood Risk Management: Guidelines for Planning Authorities November 2009 report.

Primary Sources for Flood Risk Information

Examination of the Eastern CFRAM Maps available on www.floodinfo.ie reveals the predictive extent of flooding in the vicinity of the site (refer to Figure 3 below). Anticipated flood extents along the River Liffey are far removed from the site as indicated below. This site is also elevated some distance above the River Liffey in any event. The site is therefore considered not susceptible to flooding from exceedance in any direction.

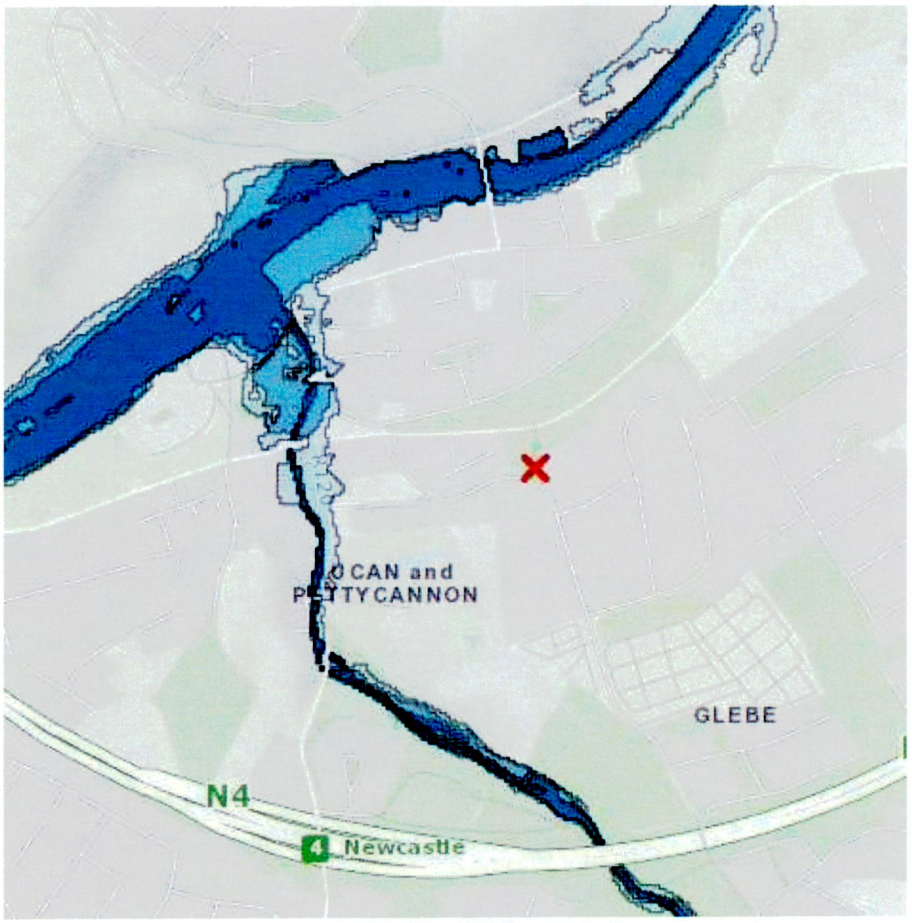


Figure 6 - Extract from CFRAM Maps

Secondary Sources for Flood Risk Information

OPW Flood Record;

An extract from the OPW records found on Floodmaps.ie shown below indicates no recorded flood events in the vicinity of the site. Refer to Figure 4 below. The nearest past flood events again are associated with the river Liffey and are far removed from the site.

Figure 7 Extract from 'Past Flood Events' obtained from Floodinfo.ie

Conclusions from Flood Risk Assessment

A flood risk to the site has been identified using available Preliminary Flood Risk Assessments. It is noted that the site is not at risk from Flood Zone A or Flood Zone B events. The proposed site can be considered as being within **Flood Zone C.**

Sequential Approach to Planning

In accordance with "The Planning Systems and Flood Risk Management: Guidelines for Planning Authorities November 2009" a sequential approach has been undertaken during the layout and design stage of the proposed development to ensure that the flooding risks to the proposed development are managed. The diagram below sets out the broad philosophy of the sequential approach which has been adopted within the design and layout of the proposed development.

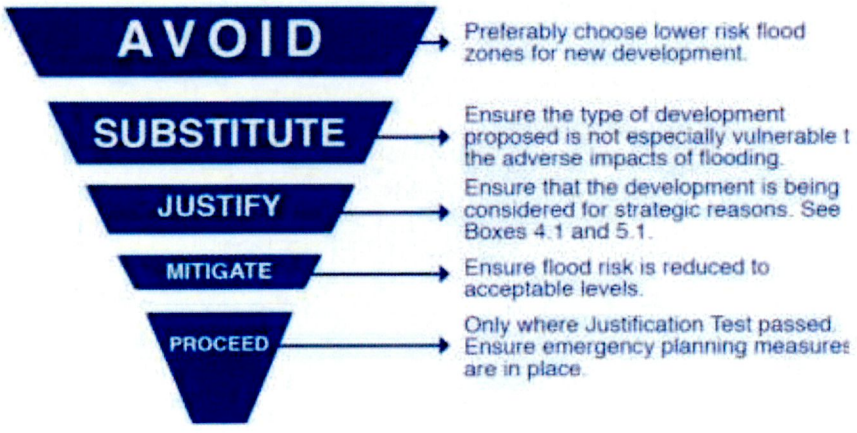


Figure 8 - Sequential Approach

Vulnerability Class of Proposed Development

The vulnerability class of the development is dependent on the land use and type of development proposed. The "Planning Systems and Flood Risk Management: Guidelines for Planning Authorities" presents a matrix of vulnerability versus flood zone to illustrate appropriate development and the requirement of justification tests. The proposed residential development is classified as a highly vulnerable development. Highly vulnerable developments, such as the proposed development, at risk of Zone A and Zone B flooding require a Justification Test. Therefore, a Justification test is not required for the proposed development as based on the evidence outlined above, the development is considered to be located in Zone C, i.e. an area subject to a low probability of flooding.

TRAFFIC AND TRANSPORT

A full swept path analysis has been undertaken to demonstrate that the area can adequately be serviced by emergency and refuse vehicles. These drawings are included with the application.

The development comprises 7 No. houses which is not expected to generate any significant volume of traffic. Traffic has been monitored at peak times during the school term and no issues are identified.

A road safety audit has been undertaken by Roadplan Consulting Engineers. The Road Safety Audit report is included within the Appendices of this report.

SCHEDULE OF DRAWINGS

The following drawings should be read in conjunction with this report:

- 20047-DOW-00-XX-DR-CE-4000-S0-P03-Manhole Details Sheet 1 of 2 - 20.07.22
- 20047-DOW-00-XX-DR-CE-4001-S0-P03-Manhole Details Sheet 2 of 2 - 20.07.22
- 20047-DOW-00-XX-DR-CE-4002-S0-P03-Gully Details - 20.07.22
- 20047-DOW-00-XX-DR-CE-4003-S0-P03-Pipe Bedding Details - 20.07.22
- 20047-DOW-00-XX-DR-CE-4004-S0-P03-Road Surface Details - 20.07.22
- 20047-DOW-00-XX-DR-CE-4005-S0-P03-Paving Details - 20.07.22
- 20047-DOW-00-XX-DR-CE-4006-S0-P03-Watermain Details - 20.07.22
- 20047-DOW-00-XX-DR-CE-5000-S0-P03 - Existing Site Layout & Water Services - 20.07.22
- 20047-DOW-00-XX-DR-CE-5001-S0-P03 - Proposed Site Layout & Water Services - 20.07.22
- 20047-DOW-00-XX-DR-CE-5002-S0-P03 - Proposed Longitudinal Drainage Sections - 20.07.22
- 20047-DOW-00-XX-DR-CE-5003-S0-P02 - Proposed Longitudinal Road Section - 20.07.22
- 20047-DOW-00-XX-DR-CE-5004-S0-P01 - Proposed Swept Path Analysis - Refuse Vehicle - 20.07.22
- 20047-DOW-00-XX-DR-CE-5005-S0-P01 - Proposed Swept Path Analysis - Fire Tender - 20.07.22
- 20047-DOW-00-XX-DR-CE-5006-S0-P01 - Proposed Sightlines & Entrance Works - 20.07.22
- 20047-DOW-00-XX-DR-CE-5007-S0-P01 - Proposed Signage & Road Markings - 20.07.22

APPENDIX A

DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	0.80
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.360	Preferred Cover Depth (m)	0.000
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Node S6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.005	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0057-2000-2000-2000
Invert Level (m)	43.630	Min Outlet Diameter (m)	0.075
Design Depth (m)	2.000	Min Node Diameter (mm)	1200
Design Flow (l/s)	2.0		

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	43.676
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	232

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	5.0	0.0	1.400	30.0	0.0

Node Depth/Area 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	43.676
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	30.0	0.0	1.000	30.0	0.0	1.010	0.0	0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S10	12	44.733	0.295	7.8	0.4393	0.0000	SURCHARGED
15 minute summer	S2	12	44.735	0.344	10.8	0.5178	0.0000	SURCHARGED
15 minute summer	4	12	44.732	0.381	31.7	0.6399	0.0000	SURCHARGED
240 minute summer	S3	240	44.716	0.481	12.7	0.7442	0.0000	SURCHARGED
240 minute summer	S4	240	44.716	0.634	14.6	0.9036	0.0000	SURCHARGED
240 minute summer	S5	240	44.716	0.962	17.8	1.5221	0.0000	SURCHARGED
240 minute summer	Depth/Area 1	240	44.715	1.039	5.3	14.8377	0.0000	SURCHARGED
240 minute summer	S6	240	44.715	1.085	17.3	1.2273	0.0000	SURCHARGED
240 minute summer	S7	244	43.583	0.031	1.5	0.0353	0.0000	OK
240 minute summer	S8	244	43.474	0.032	1.5	0.0357	0.0000	OK
240 minute summer	S11	244	43.413	0.031	1.5	0.0000	0.0000	OK
240 minute summer	Depth/Area 2	240	44.715	1.039	10.4	30.1500	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S10	1.000	4	6.5	0.474	0.178	0.3723	
15 minute summer	S2	2.000	4	9.5	0.428	1.519	0.2464	
15 minute summer	4	1.001	S3	29.2	0.842	0.798	0.9239	
15 minute summer	S3	1.002	S4	36.7	1.073	1.000	0.6730	
15 minute summer	S4	1.003	S5	42.1	1.094	1.150	0.7235	
15 minute summer	S5	1.004	S6	54.8	1.378	1.498	0.9875	
15 minute summer	Depth/Area 1	3.000	S6	-13.7	-0.397	-0.375	0.3657	
240 minute summer	S6	1.005	S7	1.5	0.449	0.041	0.0522	
240 minute summer	S7	1.006	S8	1.5	0.447	0.041	0.0738	
240 minute summer	S8	1.007	S11	1.5	0.451	0.041	0.0400	37.0
15 minute summer	Depth/Area 2	3.000_1	S6	-41.9	-1.064	-1.185	0.3917	

Results for 100 year +20% CC 15 minute summer. 255 minute analysis at 1 minute timestep. Mass balance: 99.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S10	12	44.733	0.295	7.8	0.4393	0.0000	SURCHARGED
15 minute summer	S2	12	44.735	0.344	10.8	0.5178	0.0000	SURCHARGED
15 minute summer	4	12	44.732	0.381	31.7	0.6399	0.0000	SURCHARGED
15 minute summer	S3	12	44.658	0.423	41.1	0.6555	0.0000	SURCHARGED
15 minute summer	S4	12	44.555	0.473	45.3	0.6746	0.0000	SURCHARGED
15 minute summer	S5	12	44.402	0.648	57.1	1.0261	0.0000	SURCHARGED
15 minute summer	Depth/Area 1	20	44.294	0.618	13.7	6.5048	0.0000	SURCHARGED
15 minute summer	S6	20	44.294	0.664	54.8	0.7509	0.0000	SURCHARGED
15 minute summer	S7	10	43.581	0.029	1.3	0.0332	0.0000	OK
15 minute summer	S8	255	43.472	0.030	1.3	0.0336	0.0000	OK
15 minute summer	S11	255	43.411	0.029	1.3	0.0000	0.0000	OK
15 minute summer	Depth/Area 2	20	44.295	0.619	41.9	18.5607	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S10	1.000	4	6.5	0.474	0.178	0.3723	
15 minute summer	S2	2.000	4	9.5	0.428	1.519	0.2464	
15 minute summer	4	1.001	S3	29.2	0.842	0.798	0.9239	
15 minute summer	S3	1.002	S4	36.7	1.073	1.000	0.6730	
15 minute summer	S4	1.003	S5	42.1	1.094	1.150	0.7235	
15 minute summer	S5	1.004	S6	54.8	1.378	1.498	0.9875	
15 minute summer	Depth/Area 1	3.000	S6	-13.7	-0.397	-0.375	0.3657	
15 minute summer	S6	1.005	S7	1.3	0.497	0.036	0.0478	
15 minute summer	S7	1.006	S8	1.3	0.487	0.036	0.0674	
15 minute summer	S8	1.007	S11	1.3	0.435	0.036	0.0365	17.7
15 minute summer	Depth/Area 2	3.000_1	S6	-41.9	-1.064	-1.185	0.3917	

Results for 100 year +20% CC 30 minute summer. 270 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S10	20	44.711	0.273	7.0	0.4063	0.0000	SURCHARGED
30 minute summer	S2	20	44.712	0.321	9.7	0.4827	0.0000	SURCHARGED
30 minute summer	4	20	44.710	0.359	30.7	0.6023	0.0000	SURCHARGED
30 minute summer	S3	20	44.650	0.415	40.4	0.6429	0.0000	SURCHARGED
30 minute summer	S4	20	44.568	0.486	39.5	0.6929	0.0000	SURCHARGED
30 minute summer	S5	21	44.447	0.693	52.2	1.0976	0.0000	SURCHARGED
30 minute summer	Depth/Area 1	34	44.443	0.767	13.6	9.0805	0.0000	SURCHARGED
30 minute summer	S6	34	44.442	0.812	49.7	0.9188	0.0000	SURCHARGED
30 minute summer	S7	17	43.581	0.029	1.3	0.0332	0.0000	OK
30 minute summer	S8	17	43.472	0.030	1.3	0.0336	0.0000	OK
30 minute summer	S11	17	43.411	0.029	1.3	0.0000	0.0000	OK
30 minute summer	Depth/Area 2	34	44.443	0.767	34.2	23.0037	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	S10	1.000	4	6.3	0.476	0.173	0.3723	
30 minute summer	S2	2.000	4	9.2	0.432	1.470	0.2464	
30 minute summer	4	1.001	S3	29.1	0.831	0.796	0.9239	
30 minute summer	S3	1.002	S4	32.1	1.035	0.876	0.6730	
30 minute summer	S4	1.003	S5	38.2	1.055	1.044	0.7235	
30 minute summer	S5	1.004	S6	49.7	1.250	1.358	0.9875	
30 minute summer	Depth/Area 1	3.000	S6	-13.6	-0.342	-0.372	0.3657	
30 minute summer	S6	1.005	S7	1.3	0.467	0.036	0.0477	
30 minute summer	S7	1.006	S8	1.3	0.468	0.036	0.0674	
30 minute summer	S8	1.007	S11	1.3	0.435	0.036	0.0365	18.9
30 minute summer	Depth/Area 2	3.000_1	S6	-34.2	-0.859	-0.966	0.3917	

Results for 100 year +20% CC 60 minute summer. 300 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	S10	36	44.561	0.123	5.2	0.1825	0.0000	OK
60 minute summer	S2	61	44.560	0.169	7.2	0.2536	0.0000	OK
60 minute summer	4	61	44.560	0.209	23.5	0.3503	0.0000	OK
60 minute summer	S3	62	44.560	0.325	31.2	0.5025	0.0000	SURCHARGED
60 minute summer	S4	62	44.560	0.478	34.6	0.6813	0.0000	SURCHARGED
60 minute summer	S5	63	44.560	0.806	41.5	1.2763	0.0000	SURCHARGED
60 minute summer	Depth/Area 1	63	44.561	0.885	11.4	11.4233	0.0000	SURCHARGED
60 minute summer	S6	63	44.561	0.931	39.6	1.0530	0.0000	SURCHARGED
60 minute summer	S7	64	43.582	0.030	1.4	0.0341	0.0000	OK
60 minute summer	S8	65	43.473	0.031	1.4	0.0345	0.0000	OK
60 minute summer	S11	65	43.412	0.030	1.4	0.0000	0.0000	OK
60 minute summer	Depth/Area 2	63	44.561	0.885	26.0	26.5610	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	S10	1.000	4	5.3	0.473	0.143	0.2519	
60 minute summer	S2	2.000	4	7.1	0.432	1.134	0.1984	
60 minute summer	4	1.001	S3	22.9	0.798	0.625	0.9085	
60 minute summer	S3	1.002	S4	28.6	0.995	0.781	0.6730	
60 minute summer	S4	1.003	S5	31.1	0.963	0.850	0.7235	
60 minute summer	S5	1.004	S6	39.6	0.996	1.082	0.9875	
60 minute summer	Depth/Area 1	3.000	S6	-11.4	-0.288	-0.313	0.3657	
60 minute summer	S6	1.005	S7	1.4	0.440	0.038	0.0496	
60 minute summer	S7	1.006	S8	1.4	0.443	0.038	0.0701	
60 minute summer	S8	1.007	S11	1.4	0.441	0.038	0.0381	22.4
60 minute summer	Depth/Area 2	3.000_1	S6	-26.0	-0.654	-0.736	0.3917	

Results for 100 year +20% CC 120 minute summer. 360 minute analysis at 2 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	S10	124	44.656	0.218	3.3	0.3246	0.0000	OK
120 minute summer	S2	124	44.656	0.265	4.6	0.3988	0.0000	SURCHARGED
120 minute summer	4	124	44.656	0.305	15.1	0.5124	0.0000	SURCHARGED
120 minute summer	S3	124	44.656	0.421	20.6	0.6520	0.0000	SURCHARGED
120 minute summer	S4	124	44.656	0.574	23.6	0.8188	0.0000	SURCHARGED
120 minute summer	S5	124	44.656	0.902	27.7	1.4282	0.0000	SURCHARGED
120 minute summer	Depth/Area 1	122	44.657	0.981	8.2	13.4874	0.0000	SURCHARGED
120 minute summer	S6	122	44.656	1.026	26.9	1.1609	0.0000	SURCHARGED
120 minute summer	S7	124	43.583	0.031	1.5	0.0348	0.0000	OK
120 minute summer	S8	124	43.473	0.031	1.5	0.0353	0.0000	OK
120 minute summer	S11	124	43.413	0.031	1.5	0.0000	0.0000	OK
120 minute summer	Depth/Area 2	122	44.657	0.981	16.9	29.4187	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute summer	S10	1.000	4	3.3	0.477	0.090	0.3705	
120 minute summer	S2	2.000	4	4.6	0.437	0.743	0.2464	
120 minute summer	4	1.001	S3	15.2	0.739	0.416	0.9239	
120 minute summer	S3	1.002	S4	19.7	0.886	0.536	0.6730	
120 minute summer	S4	1.003	S5	21.0	0.857	0.575	0.7235	
120 minute summer	S5	1.004	S6	26.9	0.678	0.737	0.9875	
120 minute summer	Depth/Area 1	3.000	S6	-8.2	-0.207	-0.225	0.3657	
120 minute summer	S6	1.005	S7	1.5	0.446	0.040	0.0512	
120 minute summer	S7	1.006	S8	1.5	0.444	0.040	0.0725	
120 minute summer	S8	1.007	S11	1.5	0.447	0.040	0.0393	27.8
120 minute summer	Depth/Area 2	3.000_1	S6	-16.9	-0.426	-0.479	0.3917	

Results for 100 year +20% CC 180 minute summer. 420 minute analysis at 4 minute timestep. Mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	S10	184	44.706	0.268	2.5	0.3989	0.0000	SURCHARGED
180 minute summer	S2	184	44.706	0.315	3.4	0.4739	0.0000	SURCHARGED
180 minute summer	4	184	44.706	0.355	11.3	0.5962	0.0000	SURCHARGED
180 minute summer	S3	184	44.706	0.471	15.3	0.7292	0.0000	SURCHARGED
180 minute summer	S4	184	44.706	0.624	17.6	0.8899	0.0000	SURCHARGED
180 minute summer	S5	184	44.706	0.952	20.3	1.5071	0.0000	SURCHARGED
180 minute summer	Depth/Area 1	184	44.706	1.030	6.2	14.6240	0.0000	SURCHARGED
180 minute summer	S6	184	44.706	1.076	19.5	1.2170	0.0000	SURCHARGED
180 minute summer	S7	184	43.583	0.031	1.5	0.0352	0.0000	OK
180 minute summer	S8	184	43.474	0.032	1.5	0.0357	0.0000	OK
180 minute summer	S11	184	43.413	0.031	1.5	0.0000	0.0000	OK
180 minute summer	Depth/Area 2	184	44.706	1.030	12.1	30.1500	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute summer	S10	1.000	4	2.5	0.481	0.068	0.3723	
180 minute summer	S2	2.000	4	3.4	0.432	0.544	0.2464	
180 minute summer	4	1.001	S3	11.3	0.695	0.309	0.9239	
180 minute summer	S3	1.002	S4	14.7	0.815	0.401	0.6730	
180 minute summer	S4	1.003	S5	15.4	0.806	0.420	0.7235	
180 minute summer	S5	1.004	S6	19.5	0.491	0.534	0.9875	
180 minute summer	Depth/Area 1	3.000	S6	-6.2	-0.156	-0.170	0.3657	
180 minute summer	S6	1.005	S7	1.5	0.449	0.041	0.0520	
180 minute summer	S7	1.006	S8	1.5	0.447	0.041	0.0736	
180 minute summer	S8	1.007	S11	1.5	0.450	0.041	0.0399	32.5
180 minute summer	Depth/Area 2	3.000_1	S6	-12.1	-0.305	-0.343	0.3917	

Results for 100 year +20% CC 240 minute summer. 480 minute analysis at 4 minute timestep. Mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	S10	240	44.716	0.278	2.1	0.4134	0.0000	SURCHARGED
240 minute summer	S2	240	44.716	0.325	2.9	0.4886	0.0000	SURCHARGED
240 minute summer	4	240	44.716	0.365	9.5	0.6126	0.0000	SURCHARGED
240 minute summer	S3	240	44.716	0.481	12.7	0.7442	0.0000	SURCHARGED
240 minute summer	S4	240	44.716	0.634	14.6	0.9036	0.0000	SURCHARGED
240 minute summer	S5	240	44.716	0.962	17.8	1.5221	0.0000	SURCHARGED
240 minute summer	Depth/Area 1	240	44.715	1.039	5.3	14.8377	0.0000	SURCHARGED
240 minute summer	S6	240	44.715	1.085	17.3	1.2273	0.0000	SURCHARGED
240 minute summer	S7	244	43.583	0.031	1.5	0.0353	0.0000	OK
240 minute summer	S8	244	43.474	0.032	1.5	0.0357	0.0000	OK
240 minute summer	S11	244	43.413	0.031	1.5	0.0000	0.0000	OK
240 minute summer	Depth/Area 2	240	44.715	1.039	10.4	30.1500	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	S10	1.000	4	2.1	0.482	0.057	0.3723	
240 minute summer	S2	2.000	4	2.9	0.409	0.461	0.2464	
240 minute summer	4	1.001	S3	9.4	0.686	0.257	0.9239	
240 minute summer	S3	1.002	S4	12.2	0.801	0.333	0.6730	
240 minute summer	S4	1.003	S5	13.6	0.773	0.372	0.7235	
240 minute summer	S5	1.004	S6	17.3	0.435	0.473	0.9875	
240 minute summer	Depth/Area 1	3.000	S6	-5.3	-0.134	-0.146	0.3657	
240 minute summer	S6	1.005	S7	1.5	0.449	0.041	0.0522	
240 minute summer	S7	1.006	S8	1.5	0.447	0.041	0.0738	
240 minute summer	S8	1.007	S11	1.5	0.451	0.041	0.0400	37.0
240 minute summer	Depth/Area 2	3.000_1	S6	-10.4	-0.261	-0.294	0.3917	

Results for 100 year +20% CC 360 minute summer. 600 minute analysis at 8 minute timestep. Mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	S10	312	44.701	0.263	1.6	0.3910	0.0000	SURCHARGED
360 minute summer	S2	312	44.701	0.310	2.2	0.4659	0.0000	SURCHARGED
360 minute summer	4	312	44.701	0.350	7.2	0.5873	0.0000	SURCHARGED
360 minute summer	S3	312	44.701	0.466	9.6	0.7210	0.0000	SURCHARGED
360 minute summer	S4	312	44.701	0.619	11.3	0.8822	0.0000	SURCHARGED
360 minute summer	S5	312	44.701	0.947	13.5	1.4984	0.0000	SURCHARGED
360 minute summer	Depth/Area 1	312	44.700	1.024	4.0	14.4895	0.0000	SURCHARGED
360 minute summer	S6	312	44.700	1.070	13.0	1.2105	0.0000	SURCHARGED
360 minute summer	S7	312	43.583	0.031	1.5	0.0352	0.0000	OK
360 minute summer	S8	312	43.474	0.032	1.5	0.0356	0.0000	OK
360 minute summer	S11	312	43.413	0.031	1.5	0.0000	0.0000	OK
360 minute summer	Depth/Area 2	312	44.700	1.024	7.6	30.1500	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	S10	1.000	4	1.6	0.457	0.043	0.3723	
360 minute summer	S2	2.000	4	2.2	0.372	0.349	0.2464	
360 minute summer	4	1.001	S3	7.1	0.643	0.195	0.9239	
360 minute summer	S3	1.002	S4	9.5	0.732	0.260	0.6730	
360 minute summer	S4	1.003	S5	10.4	0.689	0.283	0.7235	
360 minute summer	S5	1.004	S6	13.0	0.328	0.357	0.9875	
360 minute summer	Depth/Area 1	3.000	S6	-4.0	-0.101	-0.110	0.3657	
360 minute summer	S6	1.005	S7	1.5	0.448	0.041	0.0519	
360 minute summer	S7	1.006	S8	1.5	0.446	0.041	0.0735	
360 minute summer	S8	1.007	S11	1.5	0.450	0.041	0.0399	45.4
360 minute summer	Depth/Area 2	3.000_1	S6	-7.6	-0.190	-0.214	0.3917	

Results for 100 year +20% CC 480 minute summer. 720 minute analysis at 8 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	S10	376	44.685	0.247	1.2	0.3678	0.0000	SURCHARGED
480 minute summer	S2	376	44.685	0.294	1.7	0.4424	0.0000	SURCHARGED
480 minute summer	4	376	44.685	0.334	5.6	0.5610	0.0000	SURCHARGED
480 minute summer	S3	376	44.685	0.450	7.6	0.6968	0.0000	SURCHARGED
480 minute summer	S4	376	44.685	0.603	9.0	0.8599	0.0000	SURCHARGED
480 minute summer	S5	376	44.685	0.931	10.6	1.4736	0.0000	SURCHARGED
480 minute summer	Depth/Area 1	376	44.685	1.009	3.0	14.1276	0.0000	SURCHARGED
480 minute summer	S6	376	44.685	1.055	10.2	1.1928	0.0000	SURCHARGED
480 minute summer	S7	376	43.583	0.031	1.5	0.0351	0.0000	OK
480 minute summer	S8	376	43.473	0.031	1.5	0.0355	0.0000	OK
480 minute summer	S11	376	43.413	0.031	1.5	0.0000	0.0000	OK
480 minute summer	Depth/Area 2	376	44.685	1.009	5.8	30.1474	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute summer	S10	1.000	4	1.2	0.425	0.033	0.3723	
480 minute summer	S2	2.000	4	1.7	0.342	0.272	0.2464	
480 minute summer	4	1.001	S3	5.6	0.598	0.153	0.9239	
480 minute summer	S3	1.002	S4	7.6	0.688	0.206	0.6730	
480 minute summer	S4	1.003	S5	8.1	0.662	0.221	0.7235	
480 minute summer	S5	1.004	S6	10.2	0.256	0.278	0.9875	
480 minute summer	Depth/Area 1	3.000	S6	-3.0	-0.074	-0.081	0.3657	
480 minute summer	S6	1.005	S7	1.5	0.448	0.040	0.0517	
480 minute summer	S7	1.006	S8	1.5	0.446	0.040	0.0731	
480 minute summer	S8	1.007	S11	1.5	0.449	0.040	0.0397	53.5
480 minute summer	Depth/Area 2	3.000_1	S6	-5.8	-0.147	-0.165	0.3917	

Results for 100 year +20% CC 600 minute summer. 840 minute analysis at 15 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute summer	S10	450	44.652	0.214	1.0	0.3186	0.0000	OK
600 minute summer	S2	450	44.652	0.261	1.4	0.3927	0.0000	SURCHARGED
600 minute summer	4	450	44.652	0.301	4.6	0.5056	0.0000	SURCHARGED
600 minute summer	S3	450	44.652	0.417	6.2	0.6456	0.0000	SURCHARGED
600 minute summer	S4	450	44.652	0.570	7.3	0.8129	0.0000	SURCHARGED
600 minute summer	S5	450	44.652	0.898	8.8	1.4214	0.0000	SURCHARGED
600 minute summer	Depth/Area 1	450	44.652	0.976	2.3	13.3788	0.0000	SURCHARGED
600 minute summer	S6	450	44.652	1.022	8.3	1.1556	0.0000	SURCHARGED
600 minute summer	S7	450	43.583	0.031	1.5	0.0348	0.0000	OK
600 minute summer	S8	450	43.473	0.031	1.5	0.0353	0.0000	OK
600 minute summer	S11	450	43.412	0.030	1.5	0.0000	0.0000	OK
600 minute summer	Depth/Area 2	450	44.652	0.976	4.7	29.2716	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute summer	S10	1.000	4	1.0	0.407	0.027	0.3688	
600 minute summer	S2	2.000	4	1.4	0.318	0.224	0.2464	
600 minute summer	4	1.001	S3	4.6	0.557	0.126	0.9239	
600 minute summer	S3	1.002	S4	6.1	0.677	0.166	0.6730	
600 minute summer	S4	1.003	S5	6.8	0.622	0.184	0.7235	
600 minute summer	S5	1.004	S6	8.3	0.208	0.226	0.9875	
600 minute summer	Depth/Area 1	3.000	S6	-2.3	-0.058	-0.063	0.3657	
600 minute summer	S6	1.005	S7	1.5	0.446	0.040	0.0511	
600 minute summer	S7	1.006	S8	1.5	0.444	0.040	0.0723	
600 minute summer	S8	1.007	S11	1.5	0.447	0.040	0.0393	60.2
600 minute summer	Depth/Area 2	3.000_1	S6	-4.7	-0.119	-0.134	0.3917	

Results for 100 year +20% CC 720 minute summer. 960 minute analysis at 15 minute timestep. Mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	S10	510	44.639	0.201	0.9	0.2995	0.0000	OK
720 minute summer	S2	510	44.639	0.248	1.2	0.3734	0.0000	SURCHARGED
720 minute summer	4	510	44.639	0.288	4.0	0.4840	0.0000	SURCHARGED
720 minute summer	S3	510	44.639	0.404	5.4	0.6258	0.0000	SURCHARGED
720 minute summer	S4	510	44.639	0.557	6.3	0.7945	0.0000	SURCHARGED
720 minute summer	S5	510	44.639	0.885	7.7	1.4010	0.0000	SURCHARGED
720 minute summer	Depth/Area 1	510	44.639	0.963	2.0	13.0912	0.0000	SURCHARGED
720 minute summer	S6	510	44.639	1.009	7.2	1.1410	0.0000	SURCHARGED
720 minute summer	S7	510	43.583	0.031	1.4	0.0347	0.0000	OK
720 minute summer	S8	510	43.473	0.031	1.4	0.0352	0.0000	OK
720 minute summer	S11	510	43.412	0.030	1.4	0.0000	0.0000	OK
720 minute summer	Depth/Area 2	510	44.639	0.963	4.1	28.8849	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute summer	S10	1.000	4	0.9	0.395	0.025	0.3616	
720 minute summer	S2	2.000	4	1.2	0.304	0.192	0.2464	
720 minute summer	4	1.001	S3	4.0	0.535	0.109	0.9239	
720 minute summer	S3	1.002	S4	5.3	0.652	0.145	0.6730	
720 minute summer	S4	1.003	S5	5.9	0.615	0.160	0.7235	
720 minute summer	S5	1.004	S6	7.2	0.184	0.198	0.9875	
720 minute summer	Depth/Area 1	3.000	S6	-2.0	-0.049	-0.053	0.3657	
720 minute summer	S6	1.005	S7	1.4	0.445	0.040	0.0509	
720 minute summer	S7	1.006	S8	1.4	0.443	0.040	0.0721	
720 minute summer	S8	1.007	S11	1.4	0.446	0.040	0.0391	67.3
720 minute summer	Depth/Area 2	3.000_1	S6	-4.1	-0.102	-0.115	0.3917	

Results for 100 year +20% CC 960 minute summer. 1200 minute analysis at 15 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	S10	660	44.613	0.175	0.7	0.2603	0.0000	OK
960 minute summer	S2	660	44.613	0.222	1.0	0.3338	0.0000	OK
960 minute summer	4	660	44.613	0.262	3.3	0.4398	0.0000	SURCHARGED
960 minute summer	S3	660	44.613	0.378	4.5	0.5850	0.0000	SURCHARGED
960 minute summer	S4	660	44.613	0.531	5.2	0.7570	0.0000	SURCHARGED
960 minute summer	S5	660	44.613	0.859	6.4	1.3595	0.0000	SURCHARGED
960 minute summer	Depth/Area 1	660	44.613	0.937	1.5	12.5157	0.0000	SURCHARGED
960 minute summer	S6	660	44.613	0.983	6.0	1.1113	0.0000	SURCHARGED
960 minute summer	S7	660	43.583	0.031	1.4	0.0345	0.0000	OK
960 minute summer	S8	660	43.473	0.031	1.4	0.0350	0.0000	OK
960 minute summer	S11	660	43.412	0.030	1.4	0.0000	0.0000	OK
960 minute summer	Depth/Area 2	660	44.613	0.937	3.3	28.0986	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	S10	1.000	4	0.7	0.366	0.019	0.3406	
960 minute summer	S2	2.000	4	1.0	0.286	0.160	0.2458	
960 minute summer	4	1.001	S3	3.3	0.506	0.090	0.9239	
960 minute summer	S3	1.002	S4	4.5	0.620	0.121	0.6730	
960 minute summer	S4	1.003	S5	4.9	0.603	0.133	0.7235	
960 minute summer	S5	1.004	S6	6.0	0.158	0.165	0.9875	
960 minute summer	Depth/Area 1	3.000	S6	-1.5	-0.042	-0.042	0.3657	
960 minute summer	S6	1.005	S7	1.4	0.443	0.039	0.0505	
960 minute summer	S7	1.006	S8	1.4	0.442	0.039	0.0714	
960 minute summer	S8	1.007	S11	1.4	0.444	0.039	0.0388	80.4
960 minute summer	Depth/Area 2	3.000_1	S6	-3.3	-0.082	-0.092	0.3917	

Results for 100 year +20% CC 1440 minute summer. 1680 minute analysis at 30 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	S10	930	44.512	0.074	0.5	0.1105	0.0000	OK
1440 minute summer	S2	930	44.512	0.121	0.7	0.1824	0.0000	OK
1440 minute summer	4	930	44.512	0.161	2.3	0.2708	0.0000	OK
1440 minute summer	S3	930	44.512	0.277	3.1	0.4292	0.0000	SURCHARGED
1440 minute summer	S4	930	44.512	0.430	3.7	0.6134	0.0000	SURCHARGED
1440 minute summer	S5	930	44.512	0.758	4.7	1.2000	0.0000	SURCHARGED
1440 minute summer	Depth/Area 1	930	44.512	0.836	1.0	10.4176	0.0000	SURCHARGED
1440 minute summer	S6	930	44.512	0.882	4.4	0.9974	0.0000	SURCHARGED
1440 minute summer	S7	930	43.582	0.030	1.4	0.0337	0.0000	OK
1440 minute summer	S8	930	43.472	0.030	1.4	0.0341	0.0000	OK
1440 minute summer	S11	930	43.412	0.030	1.4	0.0000	0.0000	OK
1440 minute summer	Depth/Area 2	930	44.512	0.836	2.2	25.0762	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	S10	1.000	4	0.5	0.337	0.014	0.1555	
1440 minute summer	S2	2.000	4	0.7	0.249	0.112	0.1358	
1440 minute summer	4	1.001	S3	2.3	0.468	0.063	0.8157	
1440 minute summer	S3	1.002	S4	3.1	0.559	0.084	0.6730	
1440 minute summer	S4	1.003	S5	3.7	0.559	0.100	0.7235	
1440 minute summer	S5	1.004	S6	4.4	0.146	0.120	0.9875	
1440 minute summer	Depth/Area 1	3.000	S6	-1.0	-0.025	-0.027	0.3657	
1440 minute summer	S6	1.005	S7	1.4	0.437	0.037	0.0487	
1440 minute summer	S7	1.006	S8	1.4	0.435	0.037	0.0689	
1440 minute summer	S8	1.007	S11	1.4	0.438	0.037	0.0374	104.3
1440 minute summer	Depth/Area 2	3.000_1	S6	-2.2	-0.055	-0.062	0.3917	

APPENDIX B

IRISH WATER CONFIRMATION OF FEASIBILITY

Ian Connolly

Cashel Business Centre
Cashel Road
Kimmage, Dublin 12
Co. Dublin
D12ET25

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

1 December 2021

Re: CDS21008497 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 8 unit(s) at Clonbrone, Lucan-Newlands Road, Dublin

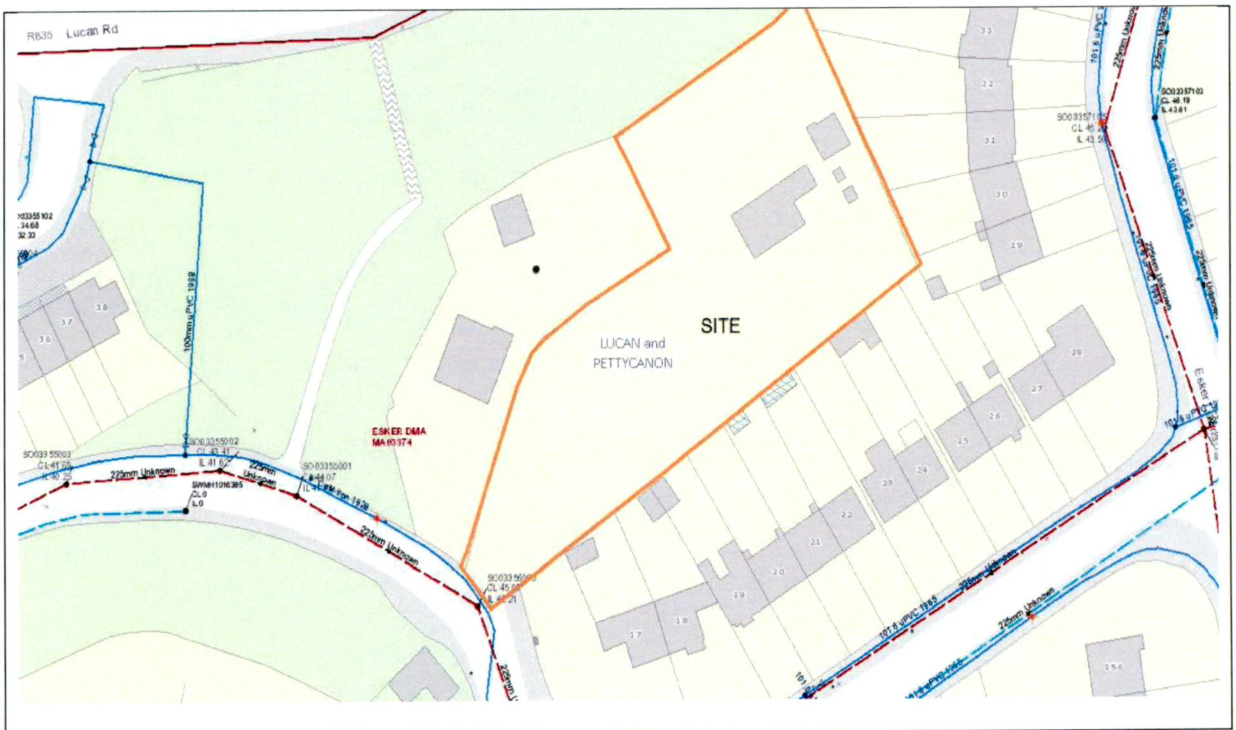
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Clonbrone, Lucan-Newlands Road, Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	OUTCOME OF PRE-CONNECTION ENQUIRY THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement. • There are Irish Water assets near the site boundaries. Records of the assets on the map below, are indicative and must be verified on site. Any trial investigations should be carried out with the agreement and in the presence of the Local Authority Water Services Inspector. • Structural integrity and access for maintenance of the assets must be secured at any time during and after the proposed works.

	• Separation distances between the existing Irish Water assets and proposed structures have to be in accordance with the Irish Water Codes of Practice and Standard Details (drawing no.STD-W-11) • For design submissions and queries related to separation distances and/or diversion, please contact IW Diversion Team via email address diversions@water.ie For further information. This Confirmation of Feasibility to connect to the Irish Water infrastructure also does not extend to your fire flow requirements. Please note that Irish Water can not guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development In order to determine the potential flow that could be delivered during normal operational conditions, an on site assessment of the existing network is required.
Wastewater Connection	Connection is feasible
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.	

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Kevin McManmon from the design team at kmcmanmon@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

APPENDIX C

ROAD SAFETY AUDIT REPORT

22030-01-001

Proposed Development at Clonbrone, Lucan, Co. Dublin

ROAD SAFETY AUDIT STAGE 1

September 2022

ROADPLAN CONSULTING

7, Ormonde Road
Kilkenny
R95 N4FE

Tel: 056 7795800
info@roadplan.ie

1. INTRODUCTION

1.1 This report describes a Stage 1 Road Safety Audit carried out at Clonbrone, Lucan, Co Dublin on behalf of Downes Associates. The audit was carried out on 17th June 2022 in the offices of Roadplan Consulting, Kilkenny.

1.2 The audit team members were as follows:

- Harry Cullen, BE CEng MIEI
  Auditor Number HC1333178

- Richard Frisby, BSc AEng MIEI.
  Auditor Number RF13337391

1.3 Both audit team members visited the site on the 10th June 2022. The audit comprised an examination of the drawings relating to the scheme supplied by Downes Association and an examination of the site.

1.4 The development consists of 8 detached houses at Clonbrone, with associated road and footpaths, off the Lucan-Newlands road near Lucan. There appears to be two car parking spaces available for each house. See Site Location Map Fig .1 and Site Map Figure 2. below.

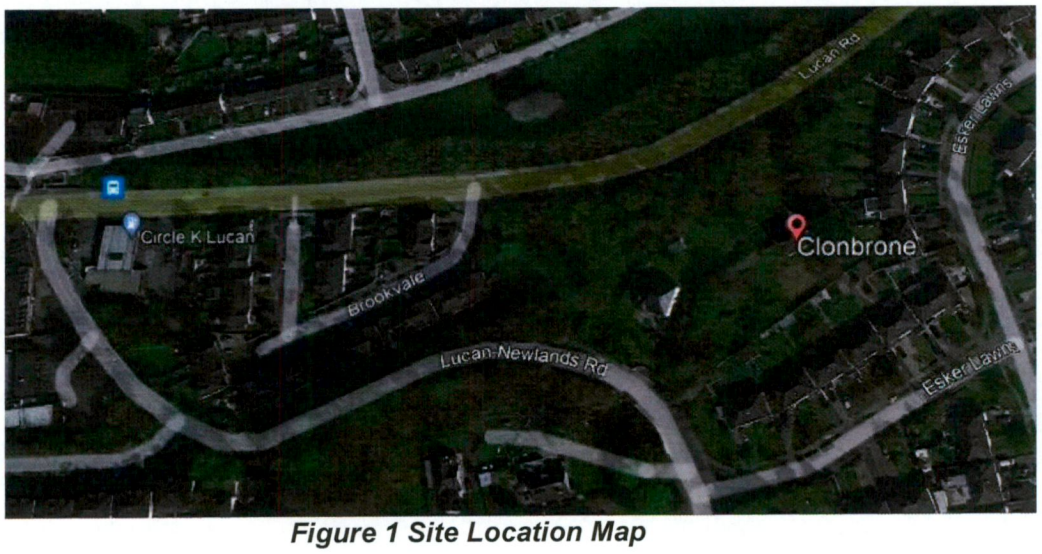


Figure 1 Site Location Map

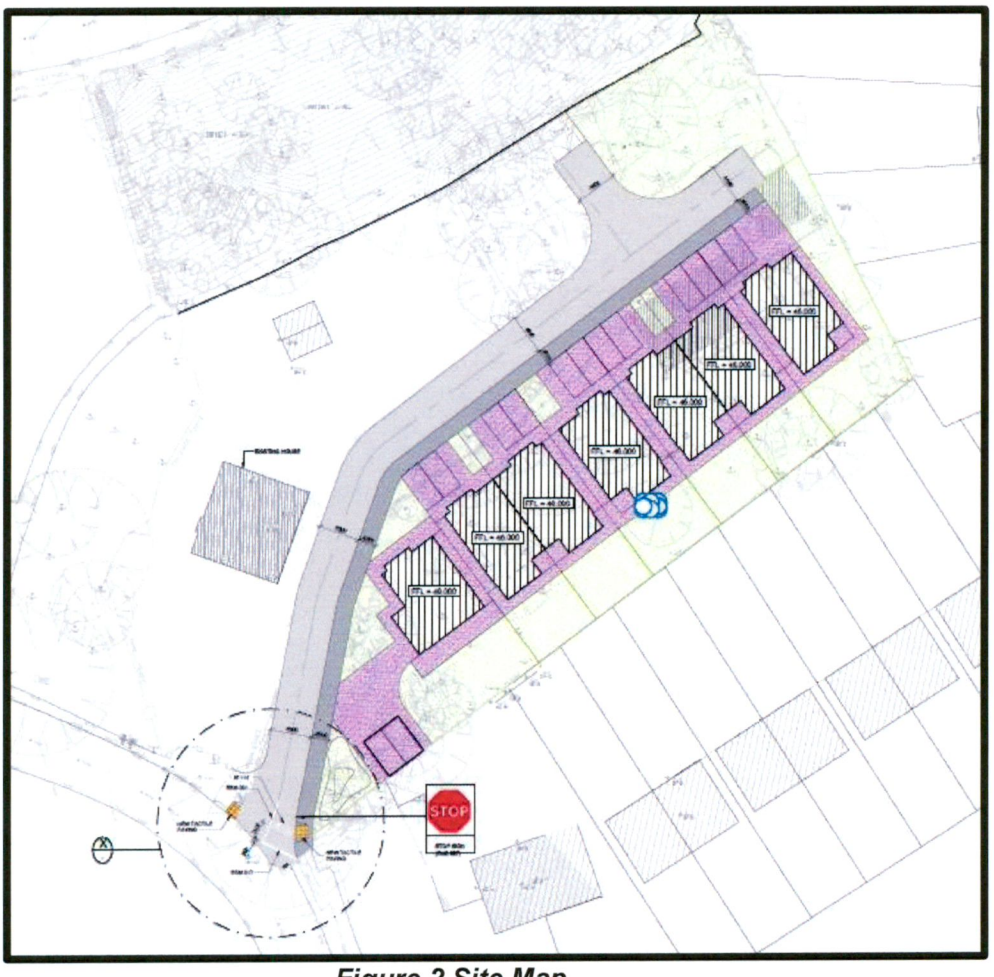


Figure 2 Site Map

1.5 The site entrance is adjacent to another entrance to the property on the left hand (Lucan) side. See Figure 3 below.

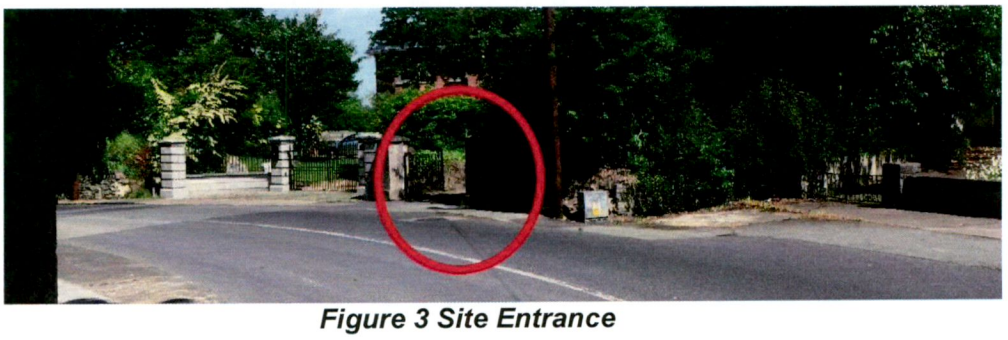


Figure 3 Site Entrance

1.6 The site is located about 300m from the centre of Lucan village, where there are a number of bus routes available, including Routes C3,C4,C5,C7 and

L54. The road down to Lucan village is quite narrow - approx. 7m wide with poor alignment. See Figure 4 and 5 below.

Figure 4 Lucan – Newlands Road at Site Entrance

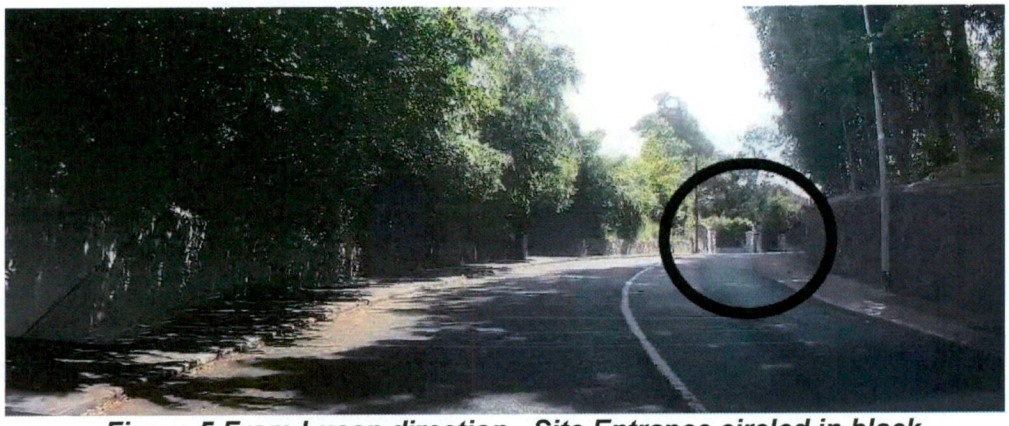


Figure 5 From Lucan direction - Site Entrance circled in black

1.7 There does not appear to be any cycle lanes in the vicinity of the site, and there do not appear to be any proposed for the development.

1.8 The speed limit of road at the site entrance is 50 km/h.

1.9 This Stage 1 Audit has been carried out in accordance with the relevant sections of TII GE-STY-01024. The team has examined only those issues within the design relating to the road safety implications of the scheme and has therefore not examined or verified the compliance of the design to any other criteria.

1.10 All problems described in this report are considered by the audit team to require action in order to improve the safety of the scheme and minimise accident occurrence.

1.11 Appendix A describes the audited drawings.

2. STAGE 1 AUDIT

2.1 Problem

There is an existing footpath just south of the site entrance – see Figure 7 below circled in red in first photo, with both footpaths highlighted in second photo.

Figure 6 Footpaths at entrance

This footpath starts approx. 2m back from the line of the footpath at the site entrance. No details have been provided to show the connection detail for these footpaths.

The location of the footpath will impact on the location of the Stop line and Stop sign at the exit, which in turn may impact the sight distance available at the junction and could comprise the safety of vehicles leaving the development.

Recommendation

Please confirm that the connection detail for the footpaths will not impact the sight distance at the entrance.

2.2 **Problem**

No details are available on the drawing regarding road signage for this development.

Adequate warning signage for the junction ahead, for the speed limit and the development in general are required to ensure collisions on the development are minimised.

Recommendation

Please confirm that all road signage (including speed limit signage) for the development will be provided, and that the requirement for a warning sign for traffic turning right at the exit will be evaluated.

2.3 **Problem**

Tactile paving is provided at the proposed pedestrian crossing at the access to the development. However, the tactile paving on either side of the crossing do not align with one another which may lead to difficulties for visually impaired pedestrians crossing at this location.

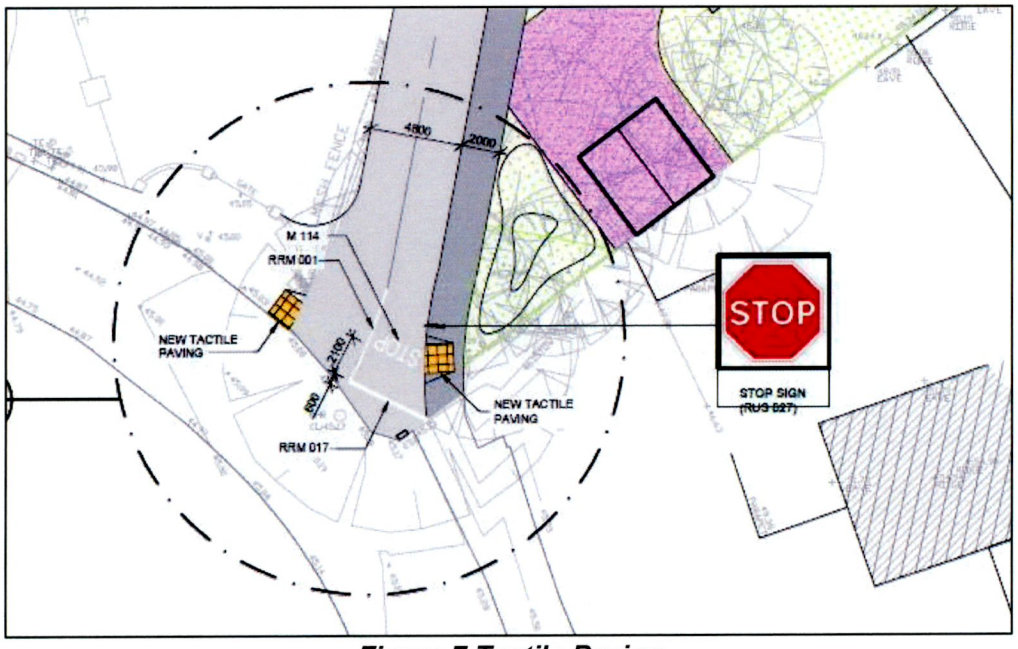


Figure 7 Tactile Paving

Recommendation

Revise the alignment of the tactile paving at the pedestrian crossing to ensure that the desired line for pedestrians is catered for.

2.4 Problem

There appears to be congestion outside the development on the main road down into Lucan at morning and evening peak times, see Figure 9 below.

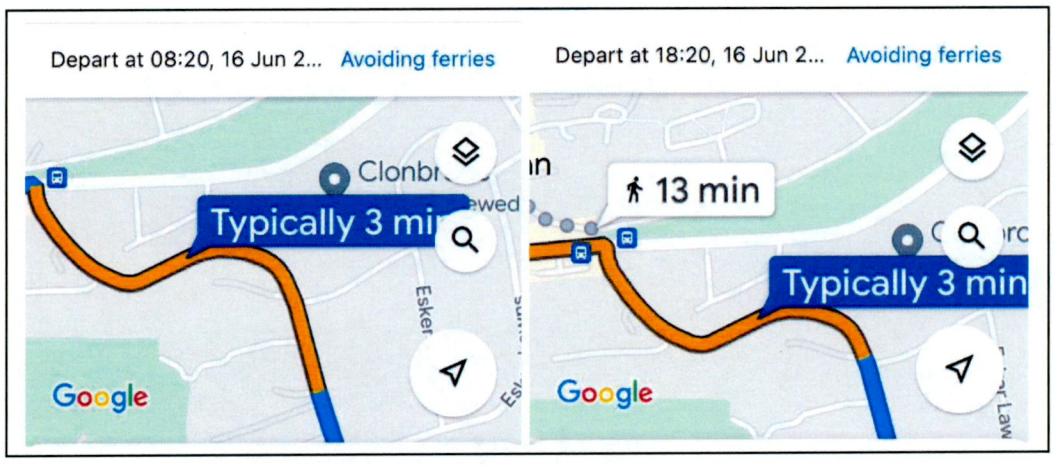


Figure 8 Congestion am and pm

This could lead to risk taking by residents wishing to leave the development at this time, leading to collisions.

Recommendation

Review the morning and evening peak traffic flows and evaluate if additional measures are required at the site entrance to allow traffic to exit at peak times.

3. AUDIT TEAM STATEMENT

3.1 We certify that we have examined the drawings listed in Appendix A and have inspected the site. This examination has been carried out with the sole purpose of identifying any features of the design that could be removed or modified to improve the safety of the scheme.

Signed..... ..... Harry Cullen

Date ..... 17th June 2022.....

Signed..... ..... Richard Frisby

Date ..... 17th June 2022.....

APPENDIX A

List of Drawings Examined

The following drawings have been provided electronically in PDF format by Downes Associates:

Drawing number	Drawing title
20047-DOW-00-XX-DR-CE-5004-S0-P01	Proposed Swept Path Analysis – Refuse Vehicle
20047-DOW-00-XX-DR-CE-5005-S0-P01	Proposed Swept Path Analysis – Fire Tender
20047-DOW-00-XX-DR-CE-5006-S0-P01	Proposed Sightlines & Entrance Works
20047-DOW-00-XX-DR-CE-5007-S0-P01	Proposed Signage & Road Markings

SAFETY AUDIT FEEDBACK FORM

Scheme: Proposed Residential Development at Clonbrone, Co. Lucan

Document Number: 22030-01-001

Audit Stage: Stage 1 RSA

Date Audit Completed: 17 June 2022

Paragraph No. in Safety Audit Report	To Be Completed By Designer			To Be Completed by Audit Team Leader
	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)
2.1	Yes	Yes	----------	----------
2.2	Yes	Yes	----------	----------
2.3	Yes	Yes	----------	----------
2.4	No	No	We have monitored traffic at peak times, during school term, and are not of the opinion that traffic congestion is an issue in this area. The addition of 6 No. houses is minimal in the overall context and is not expected to contribute significantly to traffic within the area.	Yes

Safety Audit Signed off ..... **Design Team Leader**

Print Name IAN CONNOLLY **Date** 15/9/22

Safety Audit Signed off Linda Gilsenan **Employer**

Print Name LINDA GILSENAN **Date** 17/09/2022

Safety Audit Signed off ..... **Audit Team Leader**

Print Name Harry Cullen **Date** 20/9/22

Please complete and return to:

Roadplan Consulting Ltd.
7, Ormonde Road
Kilkenny
E-mail: info@roadplan.ie

APPENDIX D

DRAWINGS