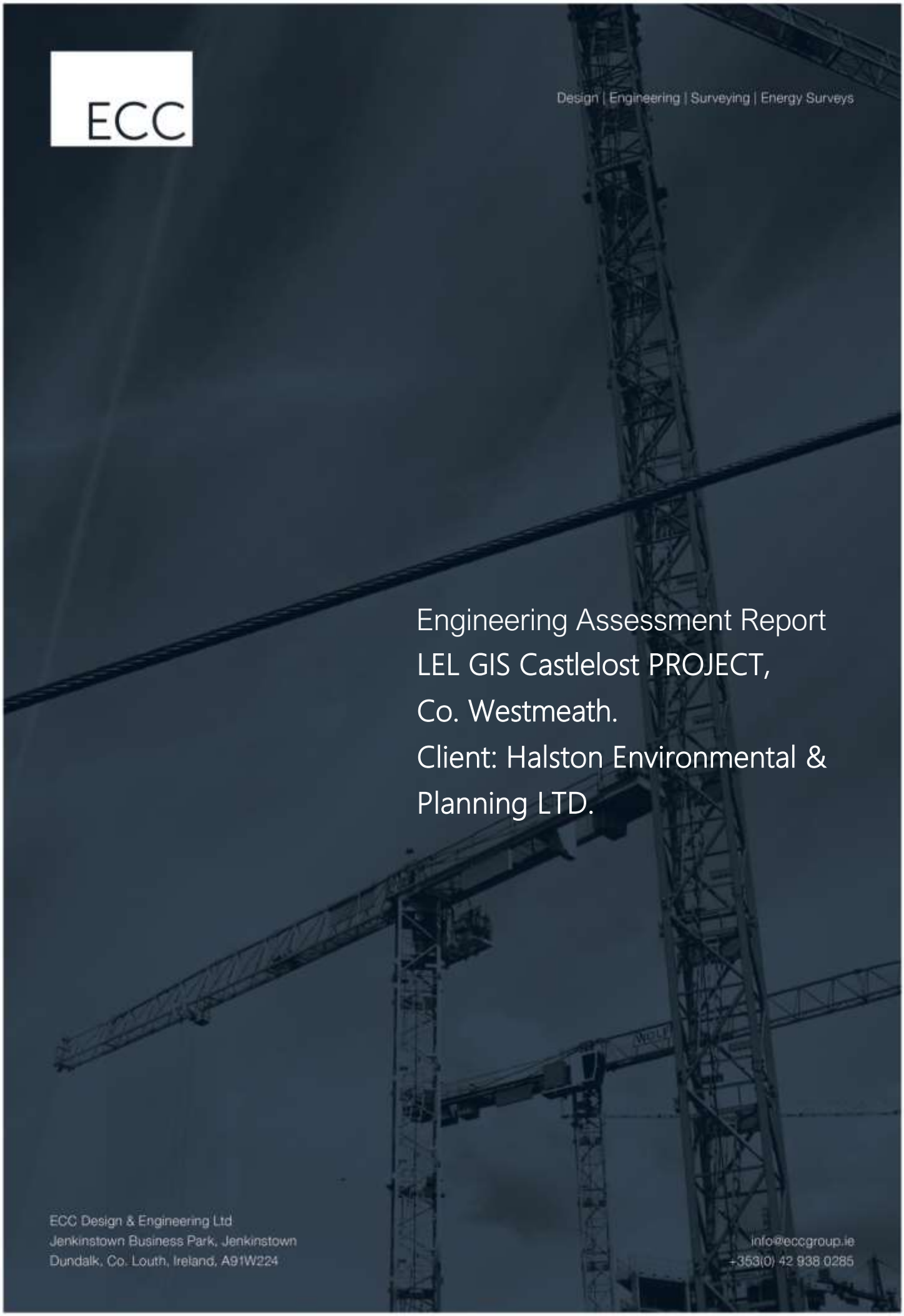

ECC

Design | Engineering | Surveying | Energy Surveys

Engineering Assessment Report
LEL GIS Castlelost PROJECT,
Co. Westmeath.
Client: Halston Environmental & Planning LTD.

ECC Design & Engineering Ltd
Jenkinstown Business Park, Jenkinstown
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REPORT CONTENTS

1.0. INTRODUCTION

1.1. Site Location

The proposed development site is located in the townland of Kiltotan, Collinstown and Oldtown, Rochfortbridge, Co. Westmeath.

1.2. Site Description

The c.20 hectare site is currently agricultural lands (grassland). It is bound to south by the M6 motorway and the north/east/west by agricultural lands. The site topography in general falls north to south from c.103.0m AOD in the south west corner to c.96.0m AOD. A main power supply line traverses the site above ground. This will be rerouted around the lands as part of this development.

1.3. Proposed Development

The proposed development comprises of a 220kV Gas Insulated Switchgear (GIS) Electrical Substation. The project will involve installation of two (2 no.) 220 kV underground circuits forming a connection to the existing Shannonbridge-Maynooth 220 kV overhead line (located within the development boundary) and two (2no.) 220 kV underground circuits and associated low voltage and communication underground cabling connecting the proposed substation with electricity transformers on the adjacent reserve gas-fired generator (Project 1) and ESS (Project 3) sites, and all associated and ancillary site development works. The GIS substation itself includes a two storey, 17m high building (housing electrical switchgear, a battery room, a workshop room, and WC), transformer bay(s), access roadway and all ancillary site development works.

LEL GIS Castlelost Project consists of the following:

- GIS building
- all necessary ancillary development to serve proposed development, including internal roads, water supply, fencing and engineering works for the disposal of foul and surface water, including on-site waste water treatment (WWTP) .

1.4. Background of Report

This report describes the criteria used to design the foul water drainage, surface water drainage and water supply required to serve the proposed development.

2.0. FOUL WATER DRAINAGE

2.1. Existing and Proposed Foul Water Drainage Systems

As the existing site is a green field site there is currently no sewer or treatment plant in place. The proposed foul drainage within the project shall take discharge from the GIS building as part of this application.

It is proposed the GIS building will discharge via gravity to a foul Manhole to the North of the building which then flows North to the proposed Waste water treatment plant. Please refer to appendix B for site characterisation form and plant specification.

The layout of the proposed foul water drainage system and treatment system is included on a drawing accompanying report with this application. Please also refer to appendix A of this report for foul drainage calculations. See drawing No. 0347-PL-2005 Foul Water Drainage Layout

2.2. Foul Water – General

Drains generally will consist of PVC (to IS123) or concrete socket and spigot pipes (to IS 6) and will be laid to comply with the Requirement of the Building Regulations 1997, in accordance with the recommendations contained in the Technical Guidance Documents, Section H and with the Greater Dublin Regional Code of Practice for Drainage Works. Foul water sewers will consist of PVC or concrete socket and spigot pipes (to IS 6) and laid strictly in accordance with Irish Water and Westmeath County Council requirements.

2.3. Foul Water Calculations

Pipe capacities and velocities have been calculated using the Colebrook-White equation with a roughness coefficient (ks) of 1.5mm.

Foul Water Calculations

Average daily dry weather flow = 2 people x 60 l/h/d = 120 l/d = 0.001 l/s

3.0. SURFACE WATER DRAINAGE

3.1. Existing and Proposed Surface Water Drainage System

There is no existing public surface water drainage system in the vicinity of the subject site. However, natural soil infiltration is available on this site and the greater surrounding area. In this regard, all surface water runoff shall drain directly into the soils within the subject site.

A Sustainable Urban Drainage System 'management train' (at source, site/regional) is proposed to cater for the development and shall be managed as set out below.

Please also refer to the accompanying engineering design drawings and appendix C and D of this report. See Drawing No. 0347-PL-2004A & 2004B Surface Water Drainage Layout for details.

- Roof runoff from the building and hardstanding area's as shown on the surface water drainage drawing shall be intercepted at source and shall flow to a stone filled soakaway, the stone media of the soakaway shall provide filtration thus improving the quality of the water.

- All roads where possible shall drain to the filter drains running parallel with the proposed access road and shown on the drainage drawings . This system shall allow runoff to filter down through the stone media providing filtering and delay and storage action. This stone shall be wrapped in a permeable membrane allowing runoff to infiltrate into the surrounding soils thus providing reduction action.

- As all runoff is being intercepted at source and infiltrating directly into the subsoils, typical flow restriction mechanisms such as a hydrobrake or typical attenuation systems such as underground cells shall not be required.

- The GIS roof area filter directly to ground via Infiltration trenches. drains to a full retention separator and then to ground via infiltration trenches. See drawing No. 0347-PL-2004A & 2004B Surface Water Drainage Layout for details.

3.2. Surface Water - General

Strict separation of surface water and wastewater will be imposed on the development. Drains will be laid out to minimise the risk of inadvertent connection of sinks etc to the surface water system. In order to minimise the risk of floating contamination of the surface water system, road gullies will be precast trapped gullies to BS5911: Part 2:1982.

Surface water local drains will consist of PVC (to IS 123) or concrete socket and spigot pipes (to IS 6). These drains will be laid to comply with the Requirement of the Building Regulations 1997, and in accordance with the recommendations contained in the Technical Guidance Documents, Part H and comply with the Greater Dublin Regional Code of Practice for Drainage Works.

Surface water sewers will consist of PVC or concrete socket and spigot pipes (to IS 6) and laid strictly in accordance with Westmeath County Council requirements.

3.3. Surface Water Design Criteria

The Development shall comply with the Greater Dublin Strategic Drainage Study, Volume 2, New Development Policy.

- Criterion 1 - River water quality protection
- Criterion 2 - River regime protection
- Criterion 3 - Level of service (flooding) for the site
- Criterion 4 - River flood protection

<u>Criterion 1 - River water quality protection</u>

- *"Interception storage of at least 5mm and preferably 10mm of rainfall where runoff to the receiving water can be prevented".*

Interception storage volume shall be provided within the stone media beneath the permeable paving and within the filter drains.

In this regard, the total treatment storage shall be provided and shall meet with the requirements of Criterion 1.

Criterion 2 - River regime protection

- *"Discharge rate equal to 1 – year Greenfield site peak runoff rate or 2 l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume".*

- *"Discharge rate equal to 1 in 100 year Greenfield site peak runoff rate or 2 l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume".*

No runoff shall be leaving the site with all runoff being intercepted at source and infiltrating into the ground, therefore the development shall meet with the requirements of Criterion 2.

Criterion 3 - Level of Service (Flooding) for the site

- *"No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical (30 year storm)".*

- *"No internal property flooding. Planned flood routing and temporary flood storage accommodated on site for short high intensity storms. Site critical duration events (100 year storm)".*

- *"No internal flooding. Floor levels at least 500mm above maximum river level and adjacent on-site storage retention (100 year storm)".*

- *"No flooding of adjacent urban areas. Overland flooding managed within the development".*

Each of the above items have been addressed with storage provided within the stone media voids beneath the permeable paving and within the filter drains. Road levels are designed to guide runoff throughout the site with levels set to manage the flood at specific locations. During extreme events, the flood water associated with the 1 in 100-year event shall simply accumulate at the infiltration trench/low point location and temporarily flood at surface level as per the GDSDS until such time as the event subsides and infiltration trench can relieve the area of surface flooding into the ground below. This excess water shall be contained to this local area for the duration of the event.

Floor levels are set to reflect item 3 above. The risk of flooding to downstream properties is minimised due to the proposed management regime.

Criterion 4 - River flood protection (one of the following)

- *"Long term floodwater accommodated on site for development runoff volume which is in excess of the Greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff".*

- *"Infiltration storage provided equal in volume to long term storage. Usually designed to operate for all events. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff".*

- *"Maximum discharge rate of Qbar or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate long term storage cannot be provided".*

With runoff being intercepted at source and infiltrating into the ground and not discharging from the site, the natural infiltration value of the soils shall manage discharge into the ground from hardstanding areas with stone voids volumes being designed to provide sufficient storage thus meeting design criteria no.4.

4.0. WATER SUPPLY

4.1. Existing and Proposed Water Supply

It is proposed to serve the development via a connection to an existing well on site.

The layout of the proposed water supply system to serve the development is included on a drawing accompanying this report. See drawing no. 0347-PL-2006 Watermain Layout for details.

4.2. Water Demand Calculation

An estimate of the water demand for the proposed development is shown below:

Proposed Average demand
2 people x 60 l/h/d = 120 l/d

4.3. Firefighting requirements

Hydrants shall be provided on site at appropriate locations around the proposed GIS building. See drawing no. 0347-PL-2006 Watermain Layout for details.

APPENDIX A

Foul Drainage Calculations

The Colebrooke-White equation expressed in terms of Velocity:

$$V = -2\sqrt{(2gDi)}Log_{10}\left[\frac{Ks}{3.7D} + \frac{2.51v}{D\sqrt{2gDi}}\right]$$

Where:

V	:	Velocity	m/s
g	:	Gravitional Acceleration	9.81 m/s2
D	:	Internal diameter of Pipe	m
	:	Hydraulic Gradient	m/m
Ks	:	Effective Roughness Value	m
v	:	Kinematic Viscosity	m2/s

Prop. Dep	Prop Flow	Prop Vel
d/D	Qp	Vp
0.0	0.00	0.07
0.1	0.03	0.39
0.2	0.10	0.61
0.3	0.20	0.79
0.4	0.34	0.91
0.5	0.50	1.00
0.6	0.70	1.07
0.7	0.86	1.11
0.8	0.98	1.12
0.9	1.06	1.10
1.0	1.02	1.02

Pipe Dia.
150
225
300
450
600
750
900

INPUT	
OUTPUT	
STANDARD	

Manhole to be designed Backdrop where Pipe Diameter changes

k(s)	m
DUCTILE IRON	0.00003
uPVC	0.00015
STAINLESS STEEL	0.00015
CONCRETE	0.0015

Discharge/person./day	180	l
Person/property	3	No.
Peak Flow	6	DWF
Discharge/prop./day	540	l

Minimum Cover	
Conc. Arch	0.5
Field	0.75
Road	1.2

Pipe Material	CONCRETE	
Roughness, k(s)	0.00150	m
Kinematic Viscocity, v	1.140	10^{-6} m^2/s

LEL GIS CASTLELOST PROJECT - FOUL DRAINAGE DESIGN

MH	G.L.	Length	Pipe Dia	Grad.	HSES.	Ch	I.L. INLET	Cover	CUM HSES.	DWF	Peak Flow	Design Flow (q)	Capacity (Q)	Spare Cap.	Vel.	Prop. Disch.	Prop. Vel.
(No.)	(m OD)	(m)	(mm)	1 : ( )	(No.)	(m)	(m OD)	(m)	(No.)	(l/day)	(l/day)	(l/sec)	(l/sec)	(l/sec)	(m/sec)	(q/Q)	(m/sec)
F3	96.500					0	95.600	0.75									
		22	150	92				-	-	-	-	-	16.13	16.1	0.91	0.00	0.36
F2	96.500					22	95.361	0.99									
		6	150	25.4	-			-	-	-	-	-	30.79	30.8	1.74	0.00	0.68
F1	96.500					28	95.127	1.22									
							95.000										

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APPENDIX B

Waste Water Treatment system Calculations

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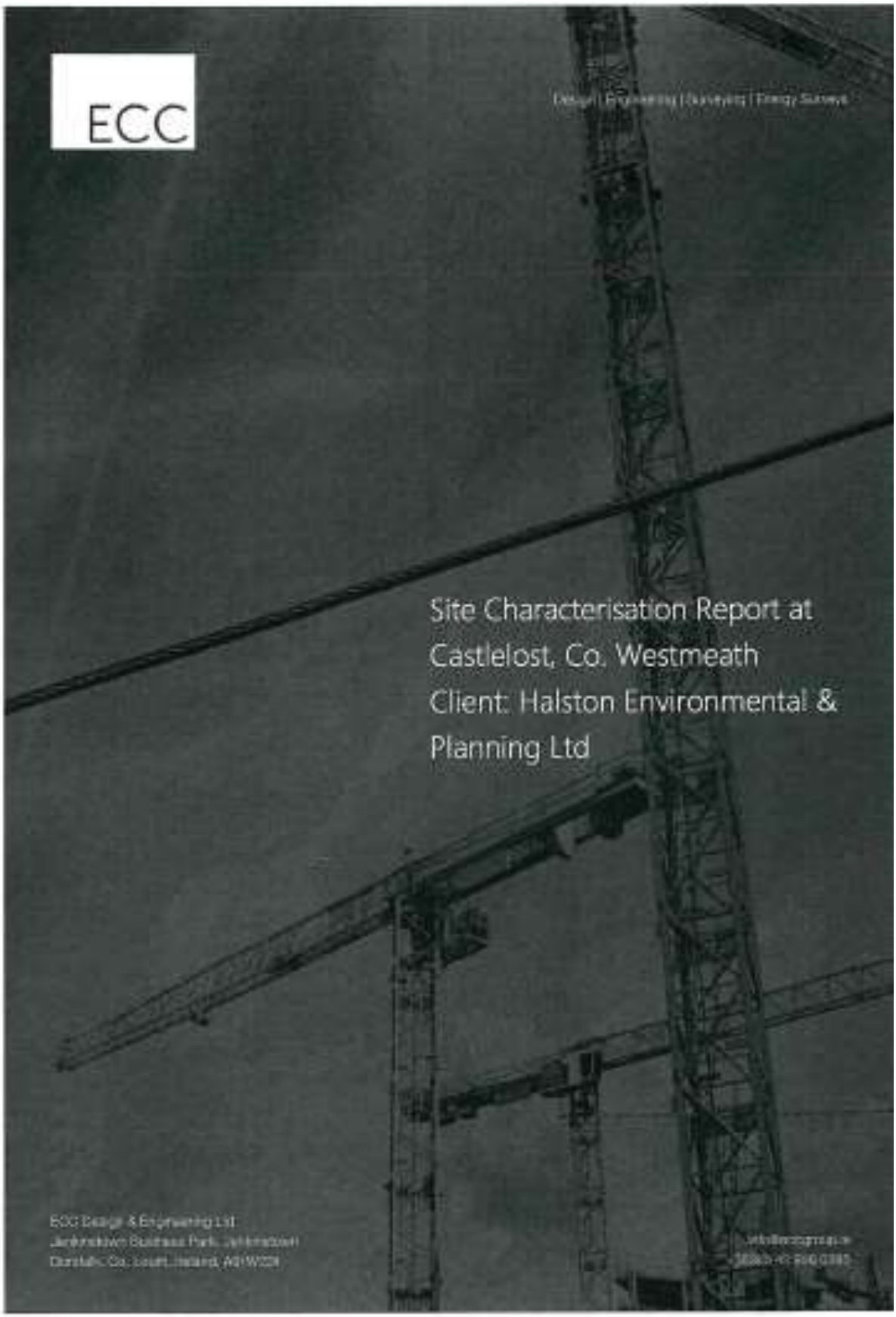


APPENDIX A: SITE CHARACTERISATION FORM

File Reference:

1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Hailtone Environmental & Surname: Planing Ltd

Address: Castlelost, Co. Westmeath

Site Location and Townland: Castlelost, Co. Westmeath

Number of Bedrooms: Maximum Number of Residents: 4

Comments on population equivalent

8 persons on site x 60 l/day (taken from Table 3 - EPA Commercial Manual) = 480 Litres.
Taking 160 l/day/person = 3 Persons.

Proposed Water Supply:

Mains ✓ Private Well/Borehole ☐ Group Well/Borehole ☐

2.0 GENERAL DETAILS (From planning application)

Soil Type, (Specify Type):

Subsoil, (Specify Type): TLs - Till derived from Limestone & Cut over raised peat

Bedrock Type: Waulsortian Limestones

Aquifer Category: Regionally Important | Locally Important LI Poor

Vulnerability: Extreme ☐ High ☐ Moderate ✓ Low ☐

Groundwater Body: Status

Name of Public/Group Scheme Water Supply within 1 km: None

Source Protection Area: ZOC ☐ SI ☐ SO ☐ Groundwater Protection Response: R1

Presence of Significant Sites (Archaeological, Natural & Historical): None

Past experience in the area: None

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

Site seems suitable to ground. Groundwater at risk and will be at risk if the minimum depths required are not met or if the percolation rate is too rapid on site. Wells in the area are likely to be at risk if the minimum separation distances are not adhered to. Surface Water is likely to be a risk as there are gleyed soils in the area.

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position:	Undulating Rolling Landscape		
Slope:	Steep (>1:5) ☐	Shallow (1:5-1:20) ☐	Relatively Flat (<1:20) ☑
Slope Comment			

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses:

6 existing dwellinghouses and 2 farm complexes within 250m of proposed site

Existing Land Use:

Agricultural grazing

Vegetation Indicators:

None Evident within 250m of Site

Groundwater Flow Direction: Southwards

Ground Condition:

Firm under foot

Site Boundaries:

Hedge/tree line, fence/ stone walls and undefined

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment (contd.)

Roads:

M6 to south and County roads to west and east of proposed site

Outcrops (Bedrock And/Or Subsoil):

None Evident within 250m of Site

Surface Water Ponding:

None Evident within 250m of Site

Lakes:

None Evident within 250m of Site

Beaches/Shellfish Areas:

None Evident within 250m of Site

Wetlands:

None Evident within 250m of Site

Karst Features:

None Evident within 250m of Site

Watercourses/Streams:*

None Evident within 250m of Site

*Note and record water level

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment (contd.)

Drainage Ditches:*

None Evident within 250m of Site

Springs:*

None Evident within 250m of Site

Wells:*

None evident, all dwelling served by watermains

Comments:
(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

Based on the above, site is potentially suitable.
Potential Targets – Groundwater

*Note and record water level

3.2 Trial Hole (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas which are at or adjacent tc significant sites, (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

Depth of trial hole (m): 2.65

Depth from ground surface to bedrock (m) (if present):

Depth from ground surface to water table (m) (if present):

Depth of water ingress:

Rock type (if present):

Date and time of excavation: 02-Jul-2021 10:00 Date and time of examination: 13-Jul-2021

Depth of Surface and Subsurface Percolation Tests	Soil/Subsoil Texture & Classification**	Plasticity and dilatancy***	Soil Structure	Density/ Compactness	Colour****	Preferential flowpaths
0.1 m	Top Soil	SILT/CLAY Threads – 4 Ribbons – 90, 90 & 90 Dilatancy – Unsure	Crumb	Compact	Dark Brown Colour	Abundance of Roots and Rootlets
0.2 m						
0.3 m						
0.4 m						
0.5 m			Crumb	Compact/ Firm	Medium Brown Colour	Rare Roots and Rootlets
0.6 m						
0.7 m						
0.8 m		SILT /CLAY Threads – 5 Ribbons – 90, 90 & 100 Dilatancy – Unsure			Abundance of Cobbles and Boulders Present	
0.9 m						
1.0 m						
1.1 m						
1.2 m					No Evidence of Mottling	
1.3 m						
1.4 m						
1.5 m						
1.6 m						
1.7 m						
1.8 m						
1.9 m						
2.0 m						
2.1 m						
2.2 m						
2.3 m						
2.4 m						
2.5 m						
2.6 m						
2.7 m	Base of Trial Hole					Base of Trial Hole
2.8 m						
2.9 m						
3.0 m						
3.1 m						
3.2 m						
3.3 m						
3.4 m						
3.5 m						

Likely Subsurface Percolation Value: 10

Likely Surface Percolation Value:

Note: *Depth of percolation test holes should be indicated on log above. (*Enter Surface or Subsurface at depths as appropriate).
** See Appendix E for BS 5930 classification.
*** 3 samples to be tested for each horizon and results should be entered above for each horizon.
**** All signs of mottling should be recorded.

3.2 Trial Hole (contd.) Evaluation:

3.3(a) Subsurface Percolation Test for Subsoil

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	600	600	650
Depth from ground surface to base of hole (mm) (B)	1,000	1,000	1,050
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	500 x 400	550 x 500	600 x 475

Step 2: Pre-Soaking Test Holes

		1	2	3
Pre-soak start	Date	13-Jul-2021	13-Jul-2021	13-Jul-2021
	Time	10:00	10:00	10:00
2nd pre-soak start	Date	13-Jul-2021	13-Jul-2021	13-Jul-2021
	Time	16:00	16:00	16:00

Each hole should be pre-soaked twice before the test is carried out.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	14-07-2021	14-07-2021	14-07-2021
Time filled to 400 mm	11:40	11:41	11:42
Time water level at 300 mm	11:55	12:07	11:52
Time (min.) to drop 100 mm (T_{100})	15.00	26.00	10.00
Average T_{100}			17.00

If T_{100} > 300 minutes then Subsurface Percolation value >120 – site unsuitable for discharge to ground
If $T_{100} \leq 210$ minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	11:55	12:21	26.00	12:07	12:40	33.00	11:52	12:11	19.00
2	12:22	12:57	35.00	12:41	13:29	48.00	12:12	12:39	27.00
3	12:58	13:45	47.00	13:30	14:24	54.00	12:40	13:15	35.00
Average Δt Value			36.00			45.00			27.00
	Average Δt/4 = [Hole No.1]		9.00 (t_1)	Average Δt/4 = [Hole No.2]		11.25 (t_2)	Average Δt/4 = [Hole No.3]		6.75 (t_3)

Result of Test: Subsurface Percolation Value = 9.00 (min/25 mm)

Comments:

'T' Test Results is in compliance with Trial Hole

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{T_r} = T_f / T_m$	T – Value = 4.45 / K_{T_r}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 1 = (T_1)			0.00

Percolation Test Hole No.	2					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{T_r} = T_f / T_m$	T – Value = 4.45 / K_{T_r}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 2 = (T_2)			0.00

Percolation Test Hole No.	3					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{T_r} = T_f / T_m$	T – Value = 4.45 / K_{T_r}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 3 = (T_3)			0.00

Result of Test: Subsurface Percolation Value =

0.00 (min/25 mm)

Comments:

3.3(b) Surface Percolation Test for Soil

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm)			
Depth from ground surface to base of hole (mm)			
Depth of hole (mm)	0	0	0
Dimensions of hole [length x breadth (mm)]	x	x	x

Step 2: Pre-Soaking Test Holes

Pre-soak start	Date			
	Time			
2nd pre-soak start	Date			
	Time			

Each hole should be pre-soaked twice before the test is carried out.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test			
Time filled to 400 mm			
Time water level at 300 mm			
Time to drop 100 mm (T_{100})	0.00	0.00	0.00
Average T_{100}			0.00

If T_{100} > 300 minutes then Surface Percolation value >90 – site unsuitable for discharge to ground
If $T_{100} \leq 210$ minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)
1			0.00			0.00			0.00
2			0.00			0.00			0.00
3			0.00			0.00			0.00
Average ΔT Value			0.00			0.00			0.00
	Average ΔT/4 = [Hole No.1]		0.00 (T_1)	Average ΔT/4 = [Hole No.2]		0.00 (T_2)	Average ΔT/4 = [Hole No.3]		0.00 (T_3)

Result of Test: Surface Percolation Value = 0.00 (min/25 mm)

Comments:

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{T_f} = T_f / T_m$	T – Value = 4.45 / K_{T_f}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 1 = (T_1)			0.00

Percolation Test Hole No.	2					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{T_f} = T_f / T_m$	T – Value = 4.45 / K_{T_f}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 2 = (T_2)			0.00

Percolation Test Hole No.	3					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{T_f} = T_f / T_m$	T – Value = 4.45 / K_{T_f}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 3 = (T_3)			0.00

Result of Test: Surface Percolation Value = 0.00 (min/25 mm)

Comments:

3.4 The following associated Maps, Drawings and Photographs should be appended to this site characterisation form.

1. Discovery Series 1:50,000 Map indicating overall drainage, groundwater flow direction and housing density in the area.
2. Supporting maps for vulnerability, aquifer classification, soil, subsoil, bedrock.
3. North point should always be included.
4. (a) Scaled sketch of site showing measurements to Trial Hole location and
   (b) Percolation Test Hole locations,
   (c) wells and
   (d) direction of groundwater flow (if known),
   (e) proposed house (incl. distances from boundaries)
   (f) adjacent houses,
   (g) watercourses,
   (h) significant sites
   (i) and other relevant features.
5. Site specific cross sectional drawing of the site and the proposed layout[1] should be submitted.
6. Photographs of the trial hole, test holes and site including landmarks (date and time referenced).
7. Pumped design must be designed by a suitably qualified person.

[1] The calculated percolation area or polishing filter area should be set out accurately on the site layout drawing in accordance with the code of practice's requirements.

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Slope of proposed infiltration / treatment area:	0
Are all minimum separation distances met?	✓
Depth of unsaturated soil and/or subsoil beneath invert of gravel (or drip tubing in the case of drip dispersal system)	1.20

Percolation test result: Surface: Sub-surface: 9.00

Not Suitable for Development ☐ **Suitable for Development** ✓

Identify all suitable options		**Discharge Route**[1]
1. Septic tank system (septic tank and percolation area) **(Chapter 7)**	Yes	Discharge to Ground Water
2. Secondary Treatment System **(Chapters 8 and 9)** and soil polishing filter **(Section 10.1)**	Yes	
3. Tertiary Treatment System and Infiltration / treatment area **(Section 10.2)**	Yes	

5.0 SELECTED DWWTS

Propose to install: Secondary Treatment System and soil polishing filter

and discharge to: Ground Water

Invert level of the trench/bed gravel or drip tubing (m) 0.60

Site Specific Conditions (e.g. special works, site improvement works testing etc.

We propose to install a Klargester Treatment Plant and Percolation Area due to results gained from Site Testing and location of proposed site.

We have sized the percolation area as follows: Taking a maximum of 8 persons on site x 60 l/day (taken from Table 3 - EPA Commercial Manual) = 480 Litres. Taking 180 l/day/person = 3 Persons.

Therefore, to allow for future expansion we propose to size the system to cater for 6 persons.

Invert of Proposed Percolation Pipes to be 0.4m below Existing Ground Level thus ensuring that a minimum separation distance of 1.2m from Invert Level of percolation pipes and level of mottling. 36m of Percolation piping to be installed (4 lenghts of 9m long).

[1] A discharge of sewage effluent to "waters" (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to Section 2.4.

6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank Systems (Chapter 7)

Tank Capacity (m^3)		Percolation Area		Mounded Percolation Area	
		No. of Trenches		No. of Trenches	
		Length of Trenches (m)		Length of Trenches (m)	
		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System (Chapters 8 and 9) and polishing filter (Section 10.1)

Secondary Treatment Systems receiving septic tank effluent (Chapter 8)

Media Type	Area (m^2)*	Depth of Filter	Invert Level
Sand/Soil			
Soil			
Constructed Wetland			
Other			

Packaged Secondary Treatment Systems receiving raw wastewater (Chapter 9)

Type: Klargester Bioficient

Capacity PE: 6

Sizing of Primary Compartment: 2.20 m^3

Polishing Filter*: (Section 10.1)

Surface Area (m^2)*: 45.00

Option 1 - Direct Discharge Surface area (m^2):

Option 2 - Pumped Discharge Surface area (m^2):

Option 3 - Gravity Discharge Trench length (m): 36.00

Option 4 - Low Pressure Pipe Distribution Trench length (m):

Option 5 - Drip Dispersal Surface area (m^2):

SYSTEM TYPE: Tertiary Treatment System and infiltration / treatment area (Section 10.2)

Identify purpose of tertiary treatment	Provide performance information demonstrating system will provide required treatment levels	Provide design information

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate * ($l/m^2.d$)		Surface area (m^2)	
Surface Water **		Discharge Rate (m^3/hr)			

* Hydraulic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

6.0 TREATMENT SYSTEM DETAILS

QUALITY ASSURANCE:

Installation & Commissioning

To be installed by competent contractor and supervised by the undersigned who will certify that system has been installed and is in compliance with EPA code of Practice and planning authorities conditions

On-going Maintenance

To be regulary emptied and inspected by competant person as per maintenance agreement to be entered into with Klargester and the client.

7.0 SITE ASSESSOR DETAILS

Company: ECC Design & Engineering Ltd

Prefix: Mr First Name: Colm Surname: Holmes

Address: Jenkinstown Business Park, Jenkinstown, Dundalk, Co. Louth

Qualifications/Experience: Arch. Tech., MCIAT, FETAC Level 6 - Site Suitability On-Site Wastewater Treatment

Date of Report: 16-Aug-2021

Phone: 042 9380285 E-mail colm.holmes@eccgroup.ie

Indemnity Insurance Number: AP10003833

Signature: Colm Holmes Digitally signed by Colm Holmes Date: 2021.08.16 13:11:33 +01'00'

Kingspan Klargester

OVER 60 YEARS OF EXPERTISE

SITE SUITABILITY REPORT

Date: 16TH August 2021

Mr. Colm Staunton,

Halstone & Environmental Planning Ltd.

Site: Castlelost, Co. Westmeath.

Site suitability report. Ref : 160821 **Engineer:** ECC Design & Engineering Ltd.
Mr. Colm Holmes.

The above engineer has carried out and submitted a site assessment on the above site. In summary this report states the following.

Percolation values:	P: 0.00 (min/25mm)			T: 9.00 (min/25mm)		
Water Table: below ground level	None Found					
Bedrock:	Waulsortian Limestones					
Proposed number of bedrooms:	6 PE					
Percolation area recommended:	Soil polishing filter ☒			Constructed Sand filter ☐		
	Raised soil Filter ☐			Pressurised filter system ☐		
Aquifer Category:	Regionally important ☐		Locally important ☒		Poor ☐	
Vulnerability:	Extreme ☐	High ☐	Moderate ☒	Low ☐	High to Low ☐	Unknown ☐
Ground Water Protection scheme:	Yes ☐			No ☒		

All percolation area must be designed and constructed in accordance with EPA COP 2009:

Kingspan Klargester

OVER 60 YEARS OF EXPERTISE

KINGSPAN KLARGESTER
PROPOSED SYSTEM

For this site we would propose the installation of a Klargester BioFicient+1 Gravity ® Sewage Treatment Plant.

The proposed Klargester BioFicient+® system is **IS EN 12566-3** Certified by PIA (cert attached) and operates by using the well aerated media technology.
This gives a high effluent quality 20mg/lt. BOD, 30mgs/lt. SS and 10mgs/lt. ammonia.

How the Kingspan Klargester BioFicient+® works.

Wastewater and sewage flows into the Primary settlement zone where solids are settled out and retained. This accumulated sludge should be drawn out annually.
Solids are broken down by air agitated media in the Biozone, Media and liquid circulation in the Biozone is achieved through the use of a compressor and diffuser, which introduces fresh air into each compartment. The liquor is constantly re-circulated and contacts the moving media and as it does so it is purified by the micro-organisms growing on the surface of the media.

The final settlement tank is where fine solids form sludge. At pre-set intervals, portions of the sludge and liquor are returned to the primary tank for additional treatment.

Benefits of the Klargester BioFicient+®

- Suitable for shallow dig.
- Robust and lightweight polyethylene.
- Low profile.
- Invert options to suit site.
- Control panel with power failure alarms. (Options can be added.)
- Designed in compliance with the EPA Code of Practice 2009:
- IS EN 12566-3 and CE – Marked.

Installation and aftercare.

It is important that any wastewater treatment system is installed and maintained and Kingspan Klargester is keen to promote this.

The BioFicient+ includes a full set of detailed installation instructions and these can be follow by any competent engineer following which the unit can be checked and commissioned by Kingspan service who will issue a Commissioning Certificate and offer ongoing annual service.

Alternatively. Kingspan Klargester promote a nationwide team of accredited installers who are trained to either offer a full install or oversee a project and then offer a fully commissioned system and localized ongoing service.

Please contact **klargesterinfo@kingspan.com**

Kingspan Klargester technical advice.

Kingspan Klargester are pleased to offer a free site visit to discuss any issues prior to delivery.

Please contact **KPCNewrySales@kingspan.com**

I hope this helps and if I can be of any further assistance please do not hesitate to contact me.

Regards
Ronan Freeman
0879930558
Ronan.freeman@kingspan.com

Area/Specification Manager
Kingspan/Klargester Ireland.

PIA Prüfinstitut für Abwassertechnik GmbH

TREATMENT PERFORMANCE RESULTS

Kingspan Environmental Ltd.
College Rd North, Aston Clinton, Aylesbury, Bucks, GB

EN 12566-3
Results corresponding to EN 12566-3 and S.R. 66

PIA-SR66-1609-1114

BioFicient+
Aerated moving-bed-biofilm reactor

Nominal organic daily load	0.29 kg/d		
Nominal hydraulic daily load	0.9 m³/d		
Material	Polyethylene		
Watertightness	Pass		
Structural behaviour (Pit Test)	Pass (also wet conditions)		
Durability	Pass		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	91.2 %	64 mg/l
	BOD_5	95.0 %	15 mg/l
	NH_4-N	84.7 %	5.1 mg/l
	SS	96.0 %	16 mg/l
Number of desludging	Not more than once		
Electrical consumption	0.92 kWh/d		

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

Notified Body No.: 1739

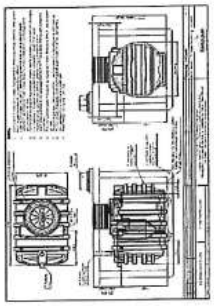
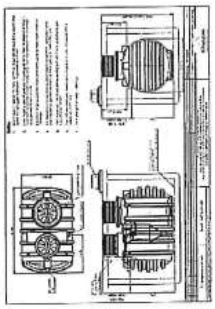
Certified according to ISO 9001:2008

DAkkS Deutsche Akkreditierungsstelle D-PL-17712-01-00

Prüfinstitut für Abwassertechnik GmbH
geprüft - tested - testé

Elmar Lancé October 2016

BioFicient+ range and its referring test reports:

Population Equation (PE)	Drawing of model of the range	Watertightness (EN 12566-3 Annex A)	Treatment Efficiency (EN 12566-3 Annex B)	Structural Behaviour (EN 12566-3 Annex C)	Durability
Initial type test (ITT) 6		Pass PIA2015-WD-1508-1044.01	Pass PIA2015-218B44.01	Pass For wet ground conditions also, Installation depth 1.50 m from inlet invert	Pass PIA2015-DH-1503-1018.01
10		Pass PIA2015-WD-1508-1044.01	Pass Range conformity according to S.R. 66:2015	Pass PIA2015-ST-PIT-1508-1044.01 For wet ground conditions also, Installation depth 1.50 m from inlet invert	Pass PIA2015-DH-1503-1018.01

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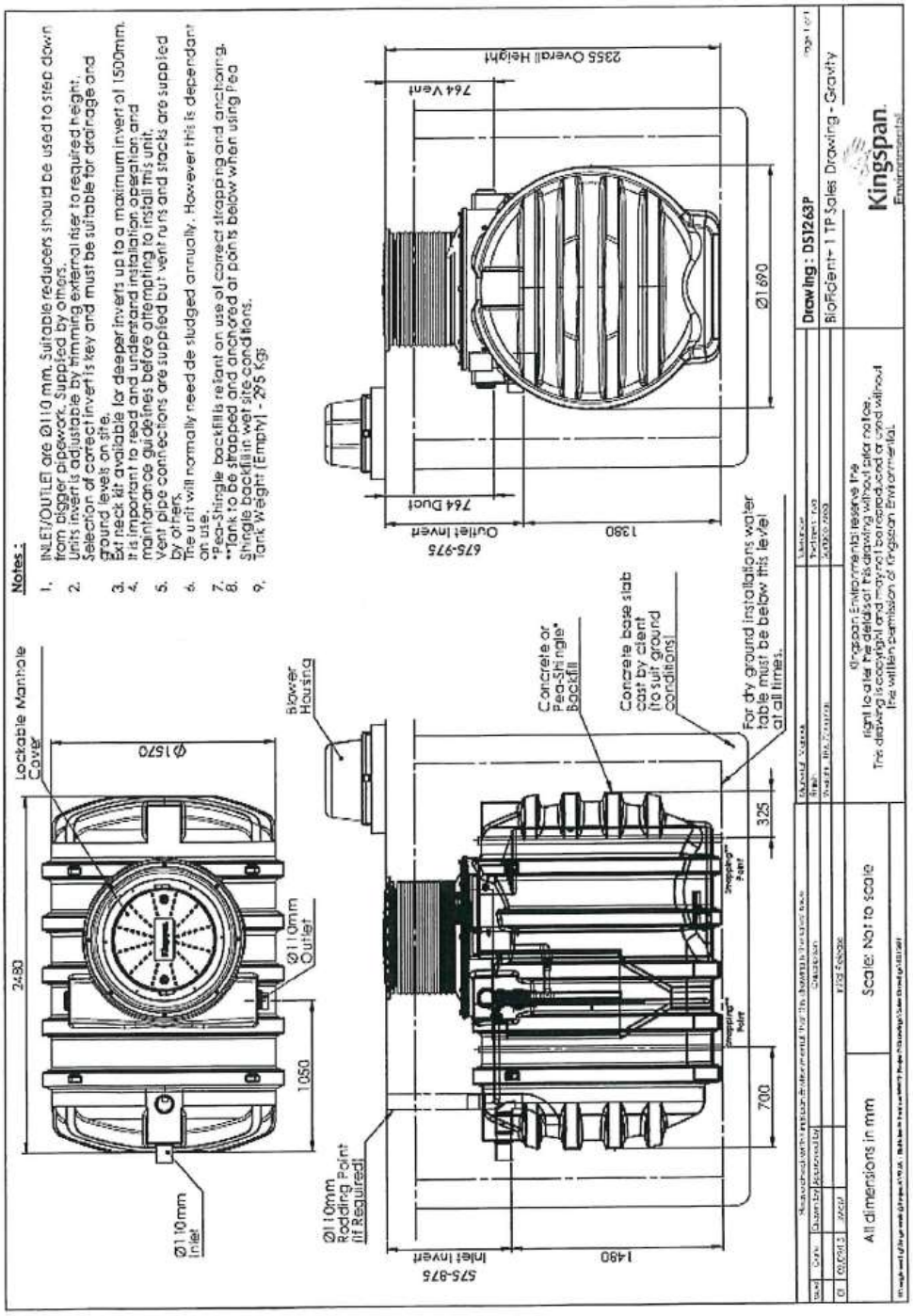

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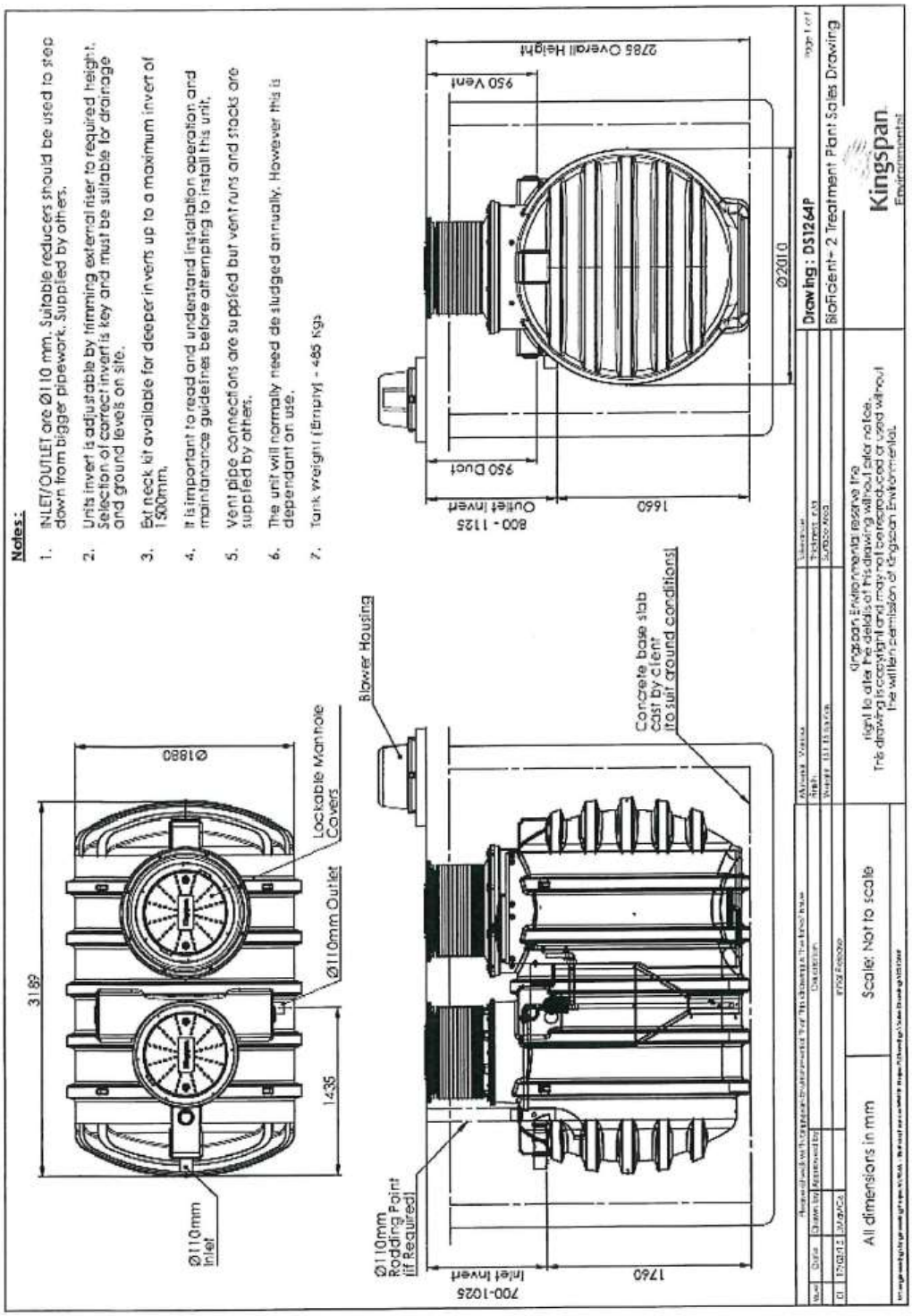
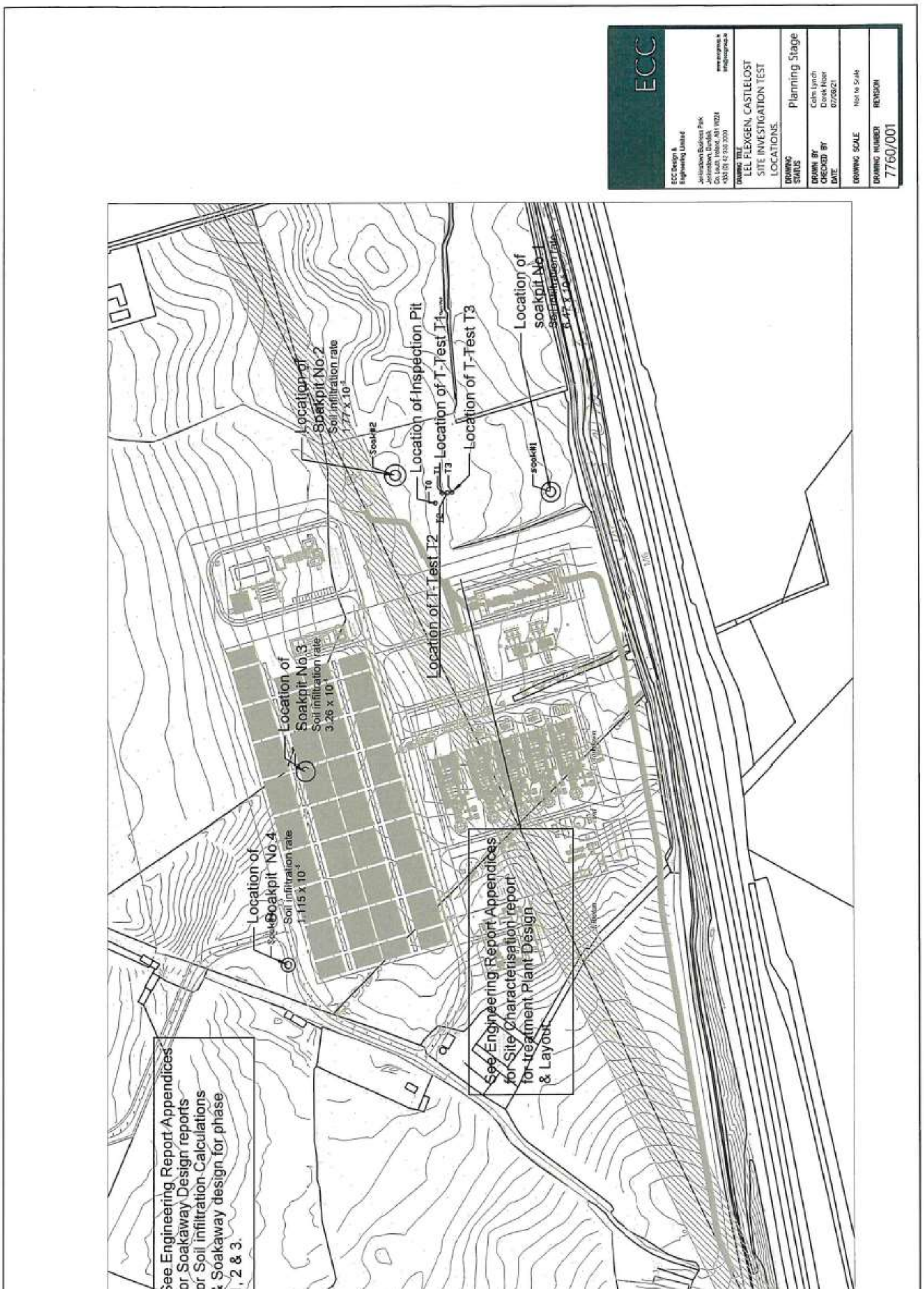

Notes:
1. INLET/OUTLET are Ø110 mm. Suitable reducers should be used to step down from bigger pipework. Supplied by others.
2. Units invert is adjustable by trimming external riser to required height. Selection of correct invert is key and must be suitable for drainage and ground levels on site.
3. Bet neck kit available for deeper inverts up to a maximum invert of 1500mm.
4. It is important to read and understand installation operation and maintenance guidelines before attempting to install this unit.
5. Vent pipe connections are supplied but vent runs and stacks are supplied by others.
6. The unit will normally need de sludged annually. However this is dependant on use.
7. Tank weight (Empty) - 485 Kgs
Ø1880
3189
1435
Lockable Manhole Covers
Ø110mm Outlet
Ø110mm Inlet
Blower Housing
Concrete base slab cast by client into suit ground conditions
Ø110mm Rodding Point (if Required)
700-1025
Inlet Invert
1760
800 - 1125
Outlet Invert
950 Duct
1660
2785 Overall Height
950 Vent
Ø2010
Drawing : DS1264P
Biofident - 2 Treatment Plant Sales Drawing
Kingspan
Environmental
All dimensions in mm
Scale: Not to scale
Kingspan Environmental reserve the right to alter the details of this drawing without prior notice. This drawing is copyright and may not be reproduced or used without the written permission of Kingspan Environmental.


ECC
LEL FLEXGEN, CASTLELOST
SITE INVESTIGATION TEST
LOCATIONS.
Planning Stage
Not to Scale
7760/001
Location of soakpit No.1
Location of Soakpit No.2
Location of Soakpit No.3
Location of Soakpit No.4
Location of Inspection Pit
Location of T-Test T1
Location of T-Test T2
Location of T-Test T3
See Engineering Report Appendices for Soakaway Design reports for Soil infiltration Calculations & Soakaway design for phase 1, 2 & 3.
See Engineering Report Appendices for Site Characterisation report for treatment Plant Design & Layout

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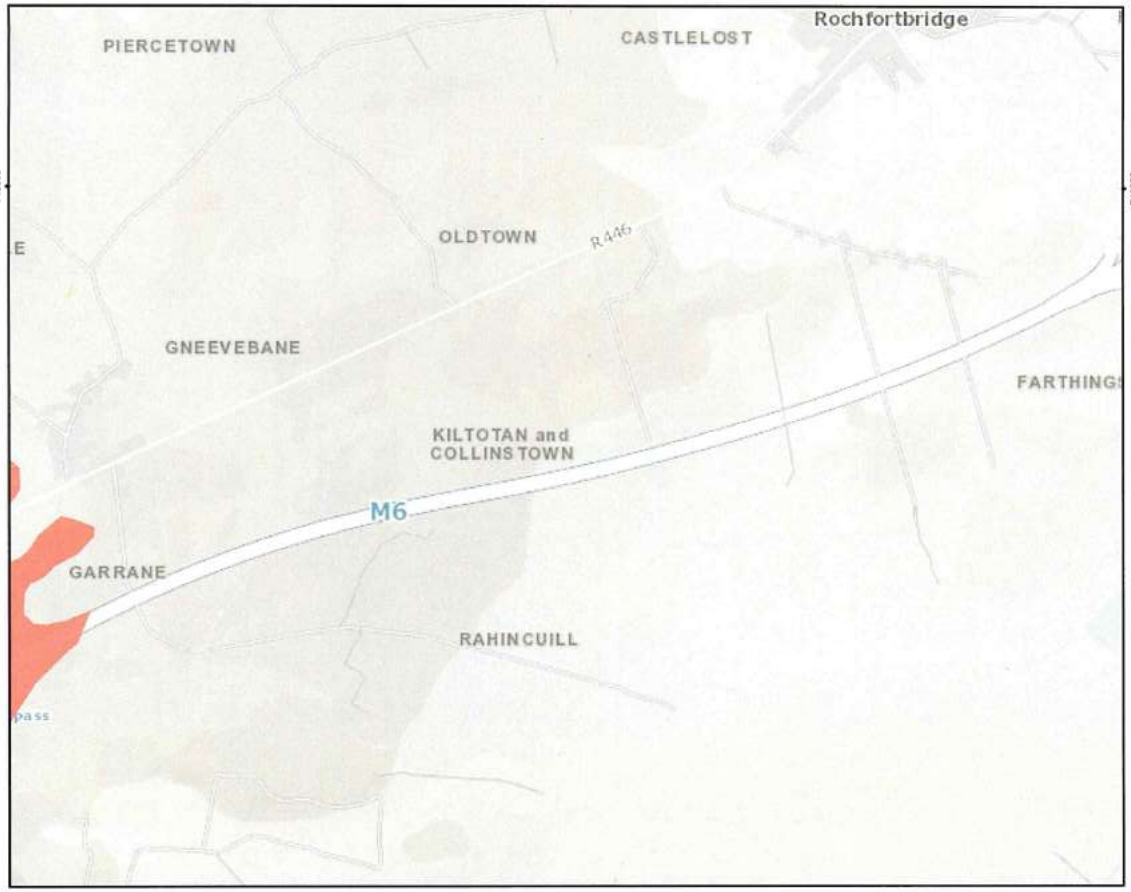
Aquifer



Legend

Gravel Aquifer

- Locally important gravel aquifer
- Bedrock Aquifer Faults

Bedrock Aquifer

- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Scale: 1:25,000

Geological Survey Ireland

0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 645,157 738,869
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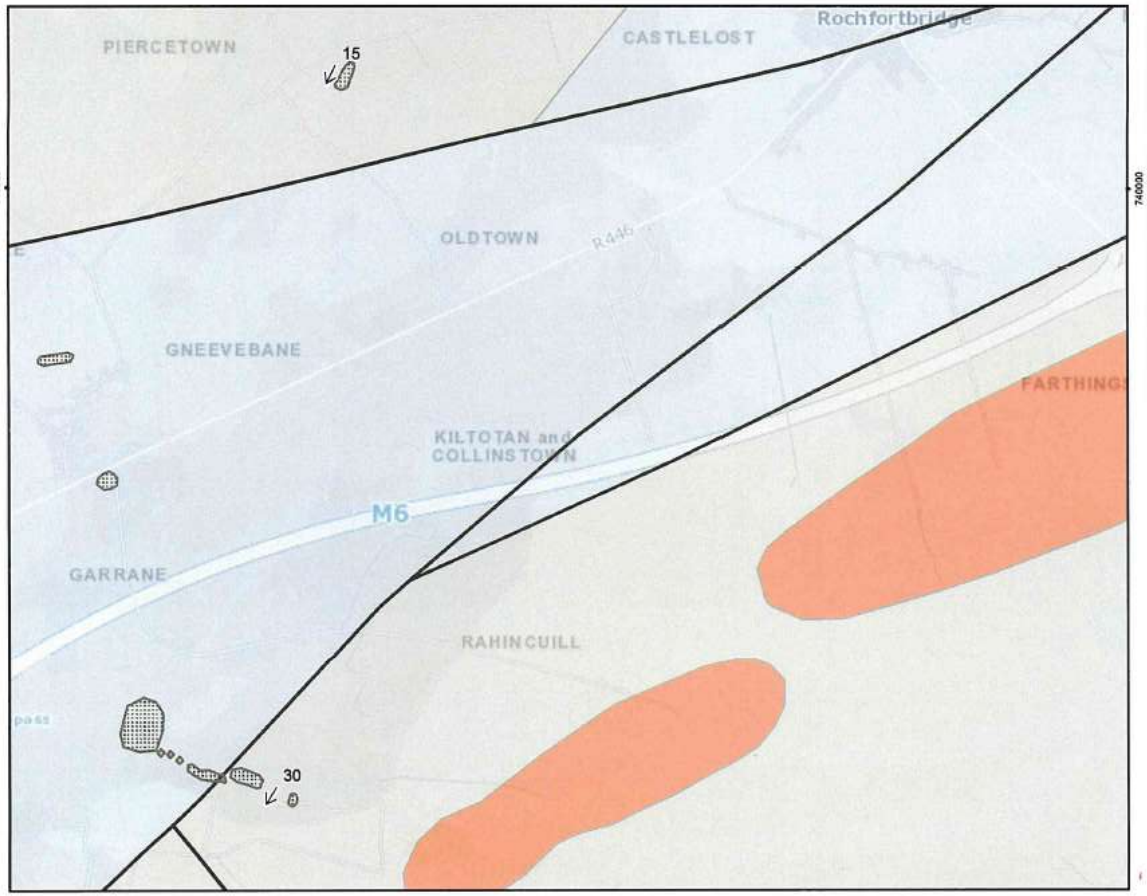
Ireland | Éireann

Bedrock



Legend

Structural Symbols 100K ITM 2018

- Dip of bedding or main foliation, old GSI data
- Bedrock Outcrops 100 ITM 2018

Bedrock Linework 100k ITM 2018

- Fault

Bedrock Polygons 100k ITM 2018

- Lucan Formation
- Waulsortian Limestones
- Agglomerate

Scale: 1:25,000

Geological Survey Ireland

N W E S

0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km

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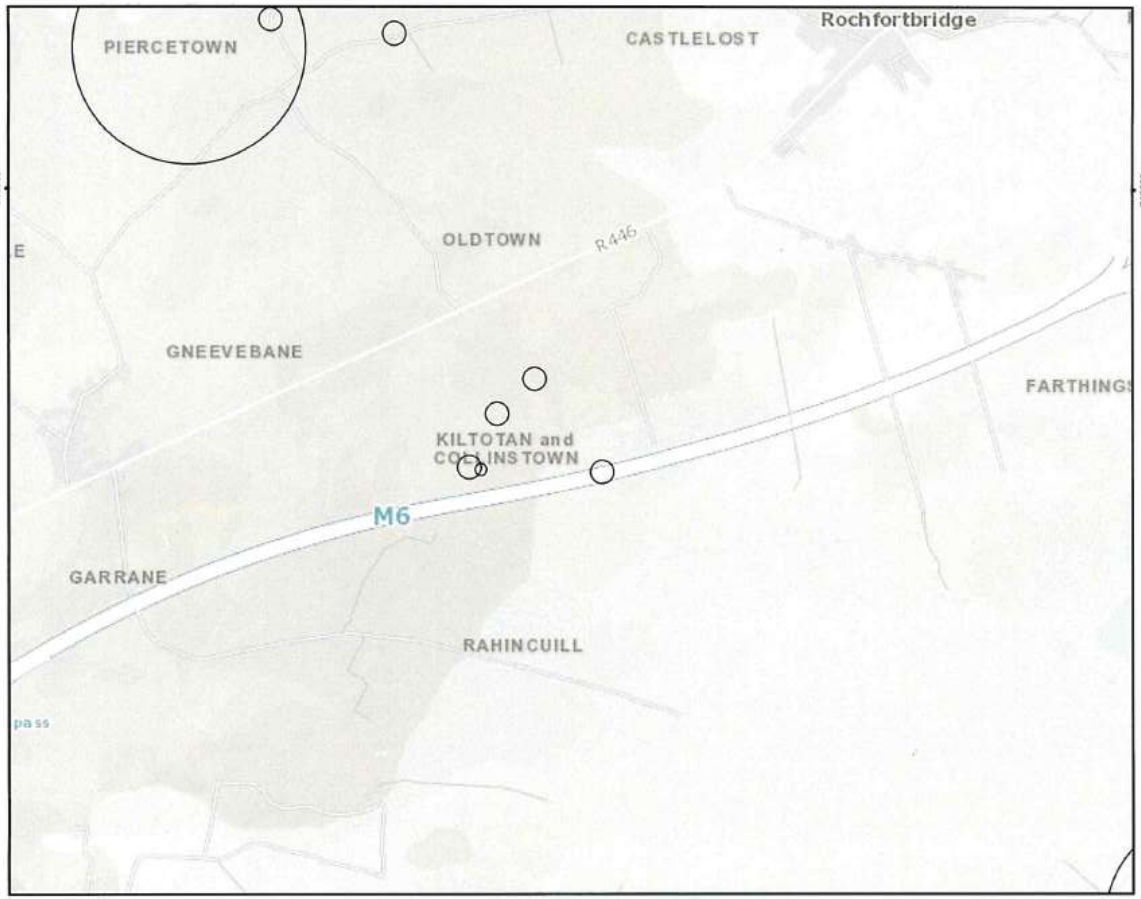
Groundwater



Legend

- Groundwater Wells and Springs

Scale: 1:25,000

Geological Survey Ireland

N W E S

0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km

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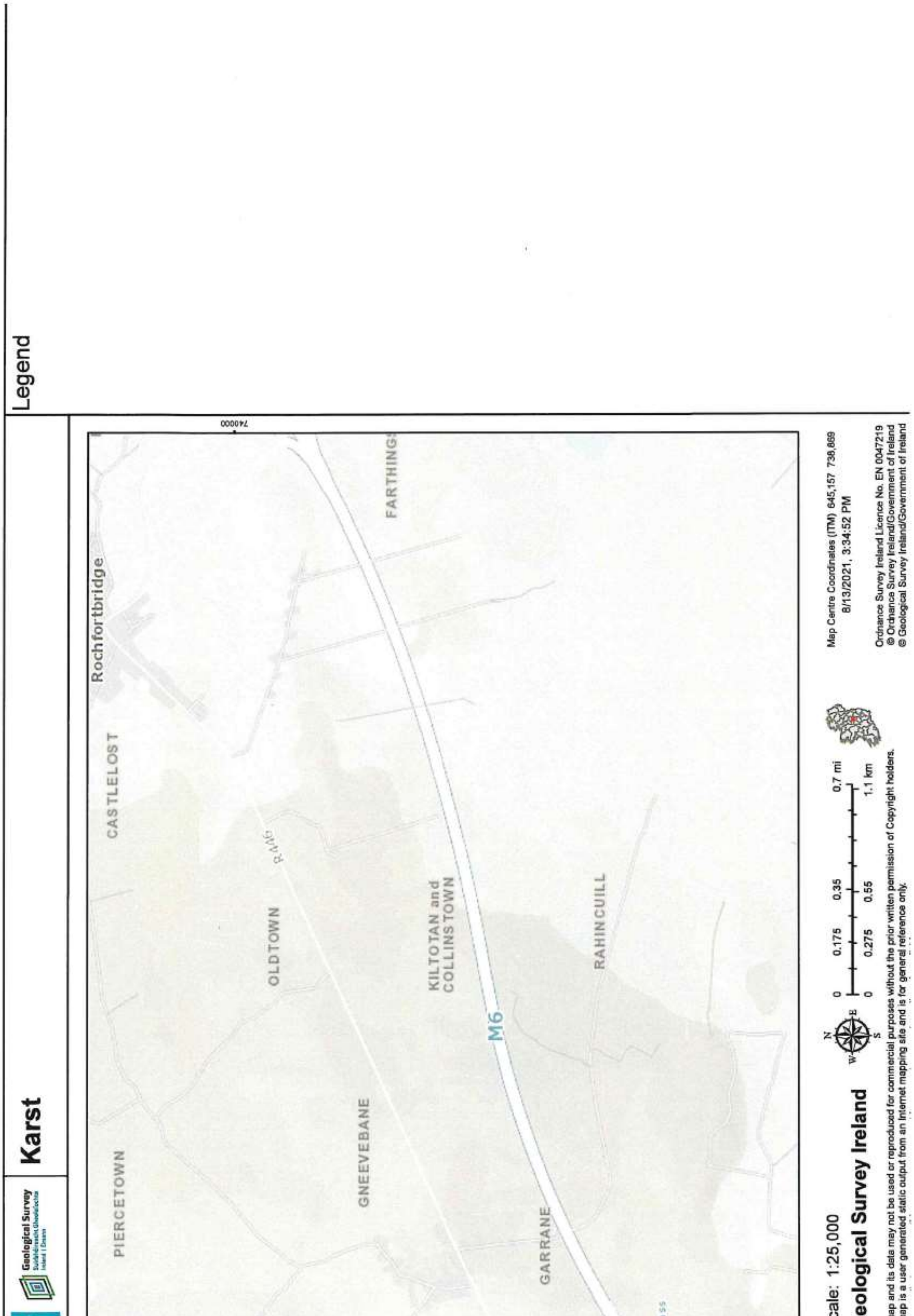
Karst
Legend
Geological Survey Ireland
PIERCETOWN
GNEEVEBANE
GARRANE
OLDTOWN
CASTLELOST
Rochfortbridge
KILTOTAN and COLLINSTOWN
M6
RAHINCUILL
FARTHING
R446
Scale: 1:25,000
Geological Survey Ireland
0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km
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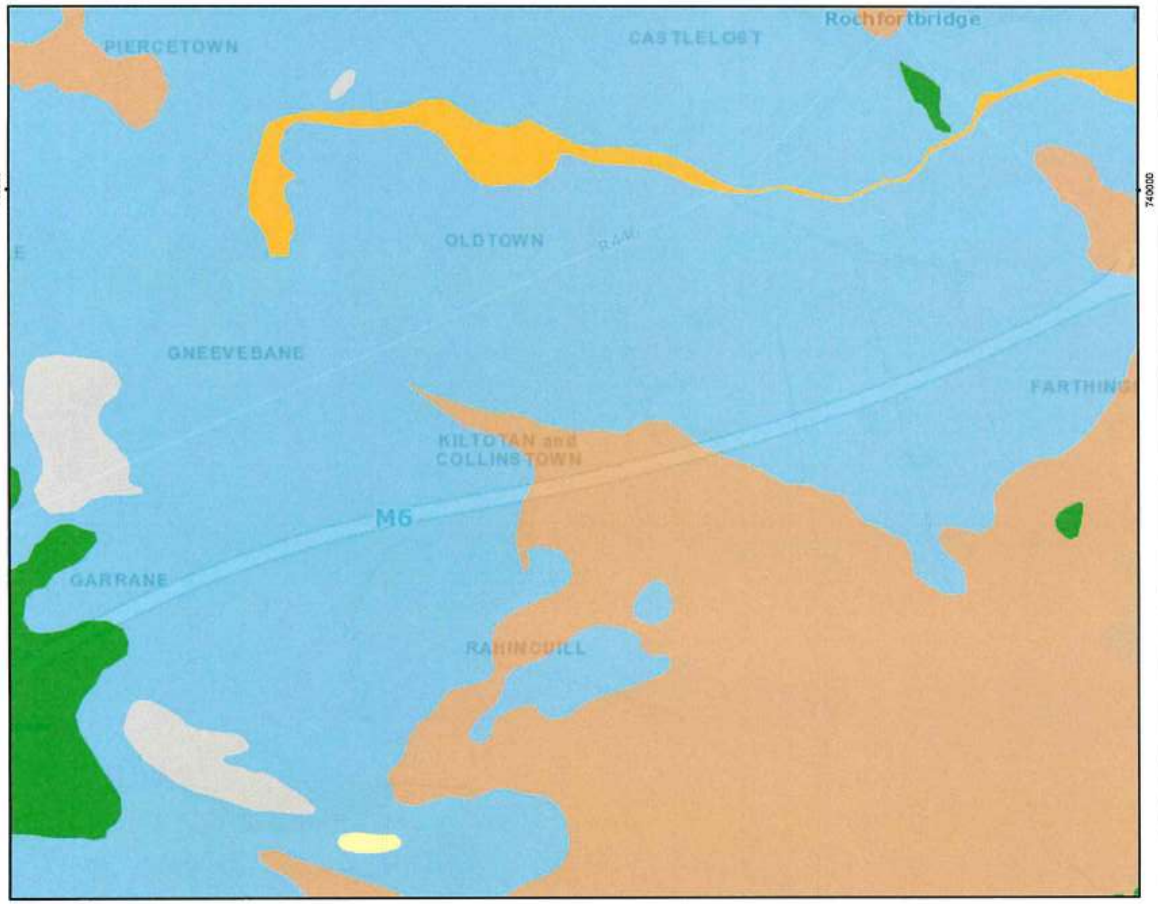
Subsoil



Legend

Quaternary Sediments 1:50,000
Ireland ITM

- A, Alluvium
- Cut, Cut over raised peat
- GLs, Gravels derived from Limestones
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- TLs, Till derived from limestones

Scale: 1:25,000

Geological Survey Ireland

N W E S

0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 645,157 738,869
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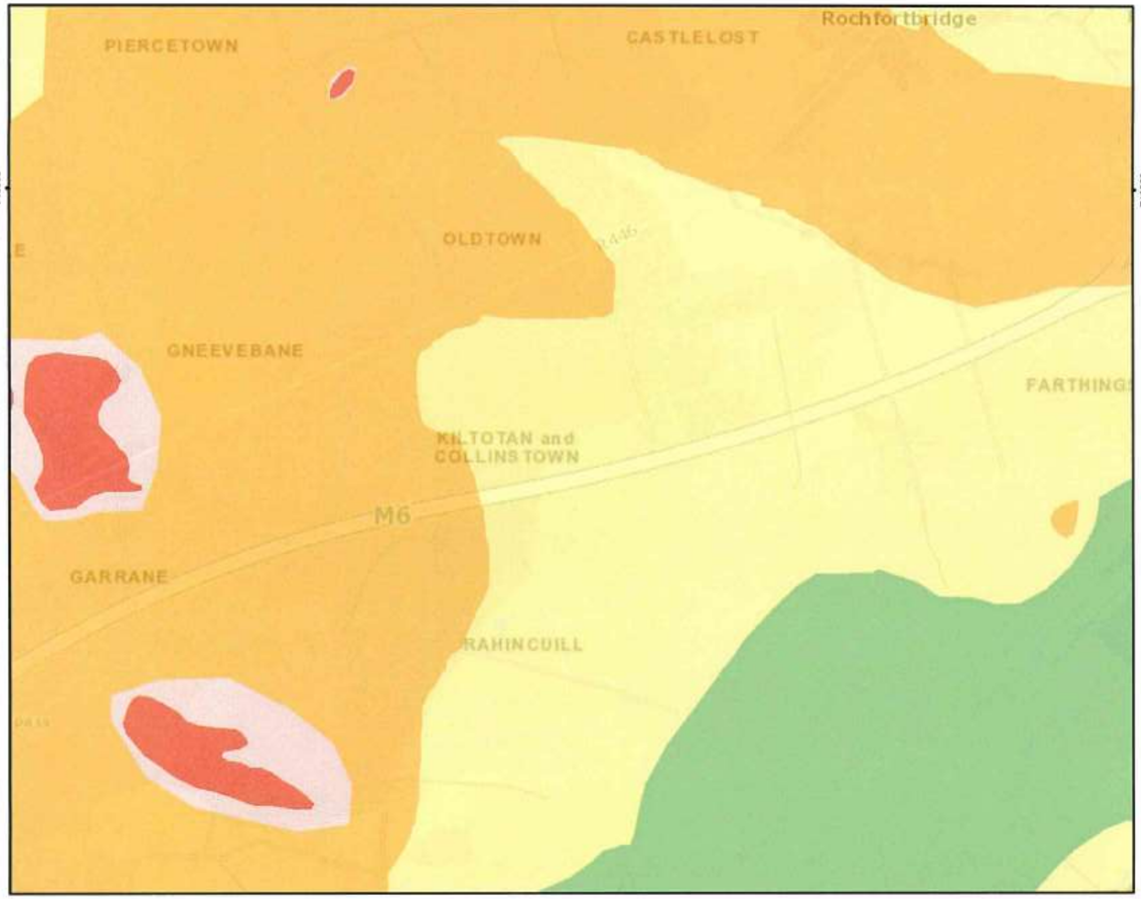
Geological Survey Suirbhéireacht Gheolaíochta Éireann

Vulnerability



Legend

National Groundwater Vulnerability Ireland

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low

Scale: 1:25,000

Geological Survey Ireland

0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 645,157 738,869
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Photo of Test Holes

Photo showing Excavated Material from Trial Hole

Photo showing Trial Hole

Photo showing Wall of Trial Hole

Photo showing Depth of Trial Hole

Photo of 'T' test hole 1

Photo of 'T' test hole 2

Photo of 'T' test hole 3

Photo from test holes looking southwards

Photo from test holes looking westwards

Photo from test holes looking northwards

Photo from test holes looking eastwards

APPENDIX C

Storm drainage Calculations

The Colebrooke-White equation expressed in terms of Velocity:

$$V = -2\sqrt{(2gDi)}Log_{10}\left[\frac{Ks}{3.7D} + \frac{2.51v}{D\sqrt{2gDi}}\right]$$

Where:

V	:	Velocity	m/s
g	:	Gravitional Acceleration	9.81 m/s2
D	:	Internal diameter of Pipe	m
	:	Hydraulic Gradient	m/m
Ks	:	Effective Roughness Value	m
v	:	Kinematic Viscosity	m2/s

Min. Cover	
Conc. Arch	0.5
Field	0.75
Road	1.2

Pipe Dia
225
300
450
600
750
900
1050

Manhole to be designed Backdrop where Pipe Diameter changes	

INPUT	
OUTPUT	
STANDARD	

RATIONALE METHOD Q = 2.78 Ai

2.78	Conversion factor, Hectare*Rainfall Intensity to Flow Rate, Ha*mm/hr to l/s
50	Rainfall Intensity for a 5 year return period, 40 standard, 45/50 conservative

LEL GIS CASTLELOST PROJECT- STORM WATER DESIGN

MH	Existing GL	Proposed G.L.	Length	Pipe Dia	Grad.	Area Blds	Area Roads	CH.	I.L. INLET	Cover	Fill	Imperv. Area	Cum. Area	Run Off	Cum. Run Off	CAP	Spar Cap.	Vel.	Vol. In Pipe
	(m OD)	(m OD)	(m)	(mm)	1 : ( )	(m^2)	(m^2)	(m)	(m OD)	(m)	(m)	(Ha)	(Ha)	(l/s)	(l/s)	(l/s)	(l/s)	(m/s)	(m^3)
SMH6	96.40	97.50						0	95.54	1.73	1.10								
			71.0	225	100	-	-			-		-	-	-	-	51.9	52	1.31	2.82
SMH5	95.10	96.40						71	94.830	1.34	1.30								
			22.8	225	100	-	-			-		-	-	-	-	51.9	52	1.31	0.91
SMH1	95.60	96.40						93.824	94.602	1.57	0.80								
									94.48										3.73

LEL GIS CASTLELOST PROJECT - STORM WATER DESIGN

MH	Existing GL	Proposed G.L.	Length	Pipe Dia	Grad.	Area Blds	Area Roads	CH.	I.L. INLET	Cover	Fill	Imperv. Area	Cum. Area	Run Off	Cum. Run Off	CAP	Spar Cap.	Vel.	Vol. In Pipe
	(m OD)	(m OD)	(m)	(mm)	1 : ( )	(m^2)	(m^2)	(m)	(m OD)	(m)	(m)	(Ha)	(Ha)	(l/s)	(l/s)	(l/s)	(l/s)	(m/s)	(m^3)
SMH4	97.80	97.33						0	95.90	1.20	- 0.47								
			60.0	225	150	-	-			-		-	-	-	-	42.3	42	1.06	2.39
SMH3	96.80	96.51						60	95.500	0.79	- 0.29								
			28.0	225	100	-	-			-		-	-	-	-	51.9	52	1.31	1.11
SMH2	96.40	96.50						87.992	95.220	1.05	0.10								
			44.2	225	60	-	-			-		-	-	-	-	67.2	67	1.69	1.76
SMH1	95.40	96.40						132.18	94.484	1.69	1.00								
			5.0	225	60	-	-			-		-	-	-	-	67.2	67	1.69	0.20
SMHB	95.60	96.40						137.18	94.400	1.77	0.80								
									94.40										5.45

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APPENDIX D

Soakaway Calculations

Soakaway Design

The design procedure is based on 'BRE Digest 365 – Soakaway Design'. This standard requires the soakaways and soakage trenches provided to be capable of catering for rainfall storms with a 10 year and 30-year return period. The GDSDS states that one can provide storage below ground for the 1 in 30-year storm while allowing for temporary flooding above ground during the 1 in 100-year storm.

In this case we have designed for the 1 in 30-year storm and have catered for inclusive of 20% for climate change to ensure flooding does not occur onsite.

The design procedure is based on 'BRE Digest The fundamental design formula used in BRE 365 is

$S = I - O$

where

S = Storage required in soakage trench

I = Inflow from impermeable area draining into soakage trench during storm duration

0 = Outflow infiltration from soakage trench into soil during storm duration

Outflow infiltration (O) = $a_{s50} \times f \times D$

where

a_{s50} = internal surface area of soakage trench to 50% effective depth (excluding base)

f = Soil infiltration rate

D = Storm Duration

Dimensions of trial pit

The dimensions of the trial pit are as follows:
1.9 m long x 1.1 m wide x 1.7 m deep

1.0 FILLED SOAKAWAY GIS BUILDING & CATCHMENT AREA

With a new impermeable area of 1129 m^2 and 409 m^2 and with a soil infiltration rate of $6.47x10^{-5}$ m/sec (found from infiltration test carried out on Soak pit No. 4, shown on drawing No. 7760-001 attached with this report). The stone filled soakaway's will be 1.4 m wide x 45 m long x effective depth 1.2m. (effective depth is from the invert of the inlet pipe to the base of the soakaway) (See Table 1 overleaf).

The effective storage volume available within the stone filled soakaway's is:

1.4 m x 45.0m x 1.2m (effective depth*) x 0.33 (void ratio) = 24.95 m^3

** effective depth is measure from the base of the inlet pipe to the bottom of the soakaway.*

Internal surface area of soakage (a_{s50}) of each Soakaway

The internal surface area of soakage (a_{s50}) of the Soakaway to 50% effective depth (excluding base) as follows:

[(1.2 x 1.4) + (45 x 1.4)] 2 sides x 50% = 45.7 m^2

Calculate the Inflow and the outflow for a different duration, take the outflow away from the inflow to calculate the storage required.

Time of Emptying of soakaway from full to half volume within 24 hours (t_{50})

The half empty (t_{50}) of the soakaway is calculated as follows:

(45 x 0.5) / ($6.47x10^{-5}$ x 45.7) = 7609.6 seconds

7609 seconds / (60 x 60) = 2.11 hours

Therefore, the soakaway is half empty in 2.11 hours which is less than 24 hours and in compliance with BRE

Inflow Rainfall in metres x impermeable area
Outflow Infiltration x soakage area x duration x 60 secs

Provide storage for the 1 in 30 year storm filled soakaway in garden with 33% voids

duration	rainfall	Imp Area	Infiltrate	Eff Soak	Inflow	Outflow	Required	Available	
mins	mm	sqm	m/sec	sqm	cu.m	cu.m	cu.m	cu.m	
5	11.9	1373.5	6.47E-05	109.8	16.3447	2.1318768	14.212773	24.948	
10	16.5	1373.5	6.47E-05	109.8	22.6628	4.2637536	18.398996	24.948	
15	19.5	1373.5	6.47E-05	109.8	26.7833	6.3956304	20.38762	24.948	Critical
30	23.2	1373.5	6.47E-05	109.8	31.8652	12.791261	19.073939	24.948	
60	27.6	1373.5	6.47E-05	109.8	37.9086	25.582522	12.326078	24.948	
120	32.9	1373.5	6.47E-05	109.8	45.1882	51.165043	-5.9768932	24.948	
180	43.4	1373.5	6.47E-05	109.8	59.6099	76.747565	-17.137665	24.948	
240	48.1	1373.5	6.47E-05	109.8	66.0654	102.33009	-36.264736	24.948	
360	51.7	1373.5	6.47E-05	109.8	71.01	153.49513	-82.48518	24.948	
540	57.3	1373.5	6.47E-05	109.8	78.7016	230.24269	-151.54114	24.948	
720	61.6	1373.5	6.47E-05	109.8	84.6076	306.99026	-222.38266	24.948	
1080	70.4	1373.5	6.47E-05	109.8	96.6944	460.48539	-363.79099	24.948	
1440	78.5	1373.5	6.47E-05	109.8	107.82	613.98052	-506.16077	24.948	
2880	85.9	1373.5	6.47E-05	109.8	117.984	1227.961	-1109.9774	24.948	
4320	99.4	1373.5	6.47E-05	109.8	136.526	1841.9416	-1705.4157	24.948	
5760	111.7	1373.5	6.47E-05	109.8	153.42	2455.9221	-2302.5021	24.948	

Soakaway Dimensions	W	L	D	Vol	Vol 33% for stone
Storage available in 1 no soakaway	1.4	45	1.2	75.6	24.948

Critical storage required for a 30 min storm	20.3876	m3
Critical storage required allowing for 20% climate change	24.4651	m3 Storage required for 1124.5m2 area (1 No. Soakaway)

24.95 m3 storage provided > 24.47 m3 storage required therfore ok

1 in 30 year Design for soakaway.

Trench cross sectional area is 1.4m width x 45m long x 1.2 m deep

Inflow Rainfall in metres x impermeable area
Outflow Infiltration x soakage area x duration x 60 secs

Provide storage for the 1 in 30 year storm filled soakaway on site with 33% voids

duration	rainfall	Imp Area	Infiltrate	Eff Soak	Inflow	Outflow	Required	Available	
mins	mm	sqm	m/sec	sqm	cu.m	cu.m	cu.m	cu.m	
5	11.9	350	1.12E-05	120	4.165	0.4014	3.7636	5.94	
10	16.5	350	1.12E-05	120	5.775	0.8028	4.9722	5.94	
15	19.5	350	1.12E-05	120	6.825	1.2042	5.6208	5.94	
30	23.2	350	1.12E-05	120	8.12	2.4084	5.7116	5.94	
60	27.6	350	1.12E-05	120	9.66	4.8168	4.8432	5.94	Critical
120	32.9	350	1.12E-05	120	11.515	9.6336	1.8814	5.94	
180	36.4	350	1.12E-05	120	12.74	14.4504	-1.7104	5.94	
240	39.2	350	1.12E-05	120	13.72	19.2672	-5.5472	5.94	
360	43.4	350	1.12E-05	120	15.19	28.9008	-13.7108	5.94	
540	48.1	350	1.12E-05	120	16.835	43.3512	-26.5162	5.94	
720	51.7	350	1.12E-05	120	18.095	57.8016	-39.7066	5.94	
1080	57.3	350	1.12E-05	120	20.055	86.7024	-66.6474	5.94	
1440	61.6	350	1.12E-05	120	21.56	115.6032	-94.0432	5.94	
2880	70.4	350	1.12E-05	120	24.64	231.2064	-206.5664	5.94	
4320	78.5	350	1.12E-05	120	27.475	346.8096	-319.3346	5.94	
5760	85.9	350	1.12E-05	120	30.065	462.4128	-432.3478	5.94	

Soakaway Dimensions	W	L	D	Vol	Vol 33% for stone
Storage available in 1 no soakaway	0.3	100	0.6	18	5.94

Critical storage required for a 360 min storm	4.8432	m3
Critical storage required allowing for 20% climate change	5.81184	m3 Storage required for 500 m2 area (1 No. Soakaway)

5.8 m3 storage required < 5.94 m3 storage provided therfore ok

Design for 100 metres of 7m wide road with normal Chamber
The design above caters for half of the road width, there will be a infiltration trench located on both sides of the road.

Inflow Rainfall in metres x impermeable area
Outflow Infiltration x soakage area x duration x 60 secs

Provide storage for the 1 in 30 year storm filled soakaway on site with 33% voids

duration	rainfall	Imp Area	Infiltrate	Eff Soak	Inflow	Outflow	Required	Available	
mins	mm	sqm	m/sec	sqm	cu.m	cu.m	cu.m	cu.m	
5	11.9	350	1.12E-05	120	4.165	0.4014	3.7636	5.94	
10	16.5	350	1.12E-05	120	5.775	0.8028	4.9722	5.94	
15	19.5	350	1.12E-05	120	6.825	1.2042	5.6208	5.94	
30	23.2	350	1.12E-05	120	8.12	2.4084	5.7116	5.94	
60	27.6	350	1.12E-05	120	9.66	4.8168	4.8432	5.94	Critical
120	32.9	350	1.12E-05	120	11.515	9.6336	1.8814	5.94	
180	36.4	350	1.12E-05	120	12.74	14.4504	-1.7104	5.94	
240	39.2	350	1.12E-05	120	13.72	19.2672	-5.5472	5.94	
360	43.4	350	1.12E-05	120	15.19	28.9008	-13.7108	5.94	
540	48.1	350	1.12E-05	120	16.835	43.3512	-26.5162	5.94	
720	51.7	350	1.12E-05	120	18.095	57.8016	-39.7066	5.94	
1080	57.3	350	1.12E-05	120	20.055	86.7024	-66.6474	5.94	
1440	61.6	350	1.12E-05	120	21.56	115.6032	-94.0432	5.94	
2880	70.4	350	1.12E-05	120	24.64	231.2064	-206.5664	5.94	
4320	78.5	350	1.12E-05	120	27.475	346.8096	-319.3346	5.94	
5760	85.9	350	1.12E-05	120	30.065	462.4128	-432.3478	5.94	

Soakaway Dimensions	W	L	D	Vol	Vol 33% for stone
Storage available in 1 no soakaway	0.3	100	0.6	18	5.94

Critical storage required for a 360 min storm	4.8432	m3
Critical storage required allowing for 20% climate change	5.81184	m3 Storage required for 500 m2 area (1 No. Soakaway)

5.8 m3 storage provided > 5.94 m3 storage required therfore ok

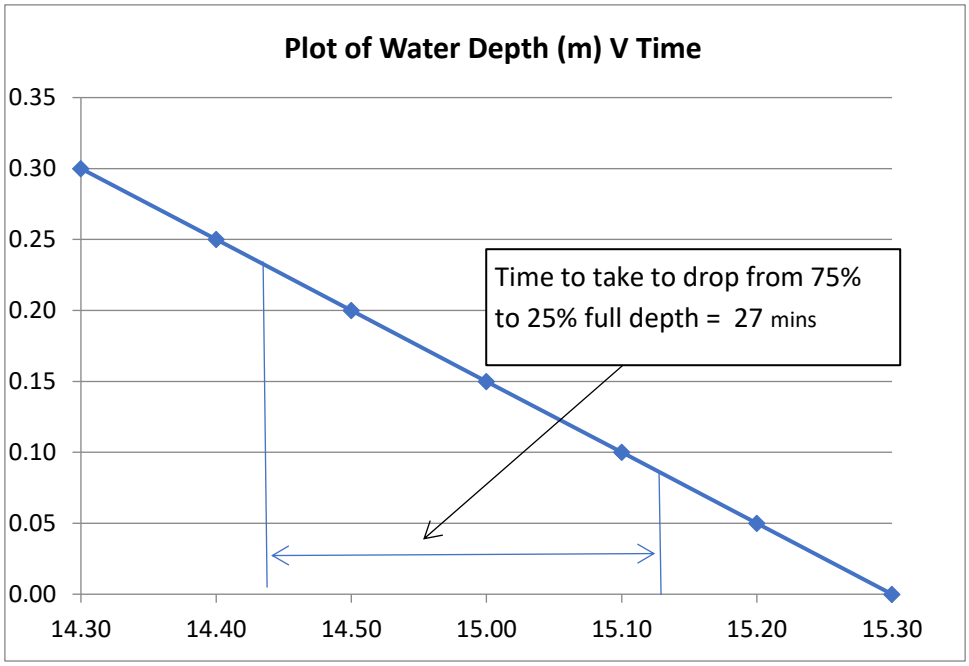
Design for 100 metres of 7m wide road with normal Chamber
The design above caters for half of the road width, there will be a infiltration trench located on both sides of the road.

Road section

Road section 100m long for a 1 in 30-year storm

Cross sectional area of trench= 0.3 wide x 0.6 deep

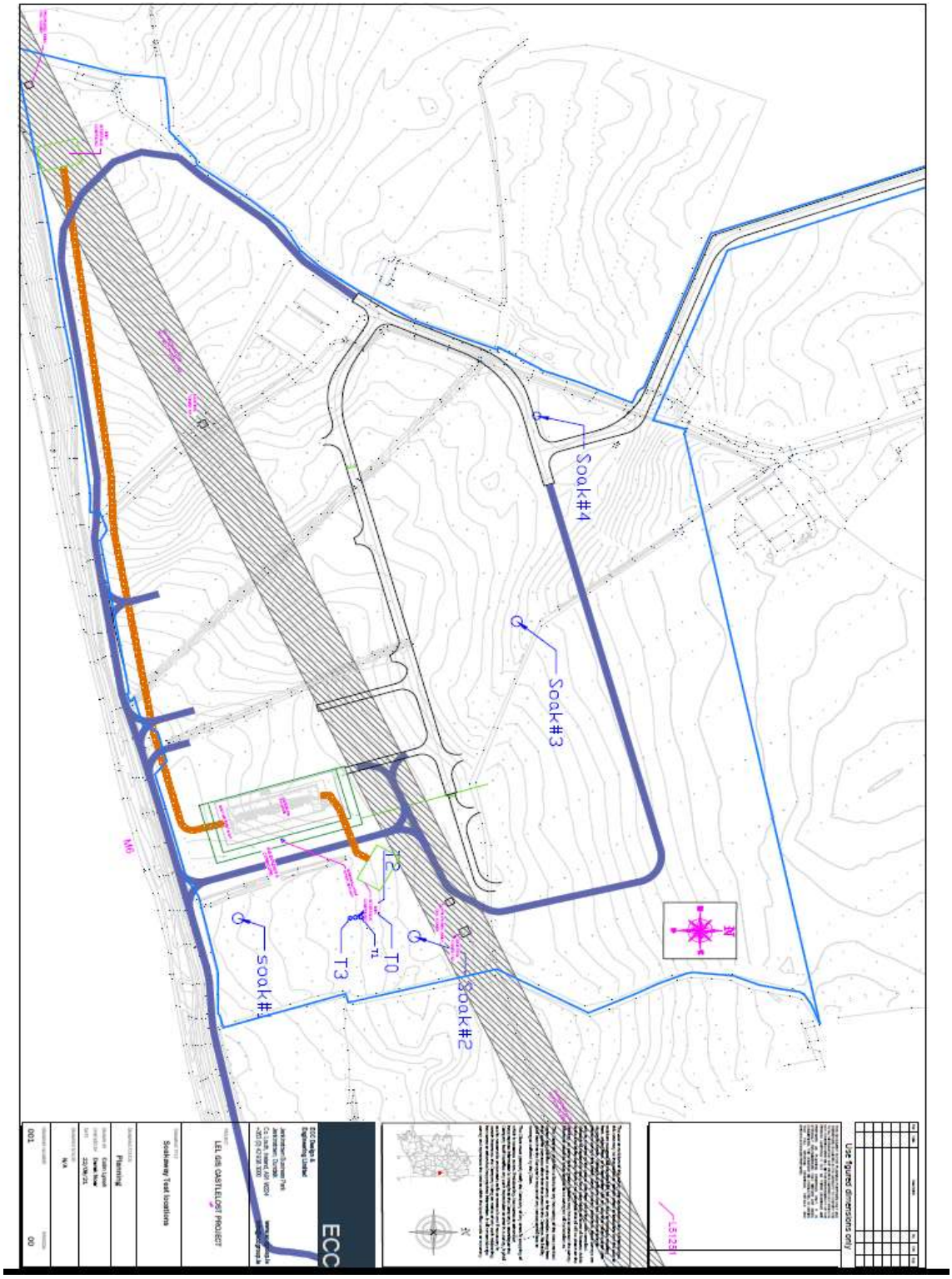
Digest 365.



Graph – Depth of Water vs Time

Conclusion

Therefore, the critical storm for the contributing impermeable area of 1124.5 m^2 (GIS building & Transformers) is the 30-minute storm for a return period of 1 in 30 years, with more storage provided than required as can be seen on the table above for both cases. (20% additional storage for climate change is included see summary of details above). There will be 2 No. separate Stone filled soakaways required, 1.4 m x 45 m x 1.2m effective depth for the Transformers & GIS Building (with 33% voids) inclusive of 20% allowance for climate change. The soakaway is 50% empty in 2.11 hours (for the worst-case scenario) which is less than 24 hours and therefore in compliance with BRE Digest 365 recommendations.


Soak#4
Soak#3
Soak#2
soak#1
T2
T1
T0
T3
M6
N
ECC
LEL GIS CASTLELOST PROJECT
Soakaway Test locations
Planning
N/A
001
00
Use figured dimensions only

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 245310, Northing: 238894,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.8,	4.0,	4.7,	5.7,	6.4,	6.9,	8.6,	10.6,	11.9,	13.7,	15.3,	16.6,	18.6,	20.1,	21.4,	N/A ,
10 mins	4.0,	5.6,	6.6,	7.9,	8.9,	9.6,	12.0,	14.7,	16.5,	19.1,	21.4,	23.2,	25.9,	28.1,	29.9,	N/A ,
15 mins	4.7,	6.6,	7.7,	9.3,	10.4,	11.3,	14.1,	17.3,	19.5,	22.5,	25.2,	27.3,	30.5,	33.0,	35.1,	N/A ,
30 mins	6.0,	8.4,	9.7,	11.6,	12.9,	13.9,	17.1,	20.8,	23.2,	26.5,	29.5,	31.8,	35.4,	38.2,	40.4,	N/A ,
1 hours	7.8,	10.7,	12.2,	14.4,	15.9,	17.1,	20.8,	24.9,	27.6,	31.4,	34.7,	37.2,	41.1,	44.1,	46.5,	N/A ,
2 hours	10.1,	13.5,	15.3,	17.9,	19.7,	21.0,	25.2,	29.9,	32.9,	37.0,	40.7,	43.5,	47.7,	50.9,	53.6,	N/A ,
3 hours	11.7,	15.5,	17.5,	20.4,	22.2,	23.7,	28.2,	33.2,	36.4,	40.8,	44.7,	47.6,	52.0,	55.4,	58.2,	N/A ,
4 hours	13.1,	17.2,	19.2,	22.3,	24.3,	25.8,	30.6,	35.8,	39.2,	43.8,	47.7,	50.8,	55.3,	58.8,	61.7,	N/A ,
6 hours	15.2,	19.7,	22.0,	25.3,	27.5,	29.1,	34.3,	39.9,	43.4,	48.2,	52.4,	55.6,	60.4,	64.0,	67.0,	N/A ,
9 hours	17.7,	22.7,	25.2,	28.7,	31.1,	32.8,	38.4,	44.3,	48.1,	53.2,	57.6,	60.9,	65.9,	69.6,	72.7,	N/A ,
12 hours	19.7,	25.0,	27.7,	31.5,	33.9,	35.8,	41.6,	47.8,	51.7,	57.0,	61.5,	65.0,	70.1,	73.9,	77.1,	N/A ,
18 hours	22.9,	28.7,	31.6,	35.7,	38.4,	40.4,	46.6,	53.2,	57.3,	62.8,	67.6,	71.1,	76.5,	80.5,	83.7,	N/A ,
24 hours	25.5,	31.7,	34.8,	39.1,	41.9,	44.0,	50.5,	57.3,	61.6,	67.3,	72.2,	75.9,	81.3,	85.4,	88.7,	99.9,
2 days	31.8,	38.7,	42.1,	46.8,	49.8,	52.0,	58.9,	66.0,	70.4,	76.3,	81.3,	85.0,	90.5,	94.6,	97.9,	108.9,
3 days	37.2,	44.8,	48.4,	53.5,	56.7,	59.1,	66.4,	73.9,	78.5,	84.6,	89.8,	93.6,	99.3,	103.5,	106.9,	118.1,
4 days	42.2,	50.4,	54.2,	59.6,	63.0,	65.5,	73.2,	81.1,	85.9,	92.3,	97.6,	101.6,	107.4,	111.8,	115.2,	126.7,
6 days	51.4,	60.5,	64.9,	70.8,	74.5,	77.3,	85.7,	94.2,	99.4,	106.2,	111.9,	116.2,	122.3,	126.9,	130.6,	142.6,
8 days	59.9,	69.9,	74.6,	81.1,	85.1,	88.1,	97.1,	106.2,	111.7,	119.0,	125.0,	129.4,	135.9,	140.8,	144.6,	157.2,
10 days	67.9,	78.7,	83.8,	90.7,	95.0,	98.2,	107.8,	117.4,	123.3,	130.9,	137.2,	141.9,	148.7,	153.7,	157.7,	170.8,
12 days	75.7,	87.2,	92.6,	100.0,	104.5,	107.9,	118.0,	128.1,	134.2,	142.2,	148.8,	153.7,	160.7,	165.9,	170.1,	183.6,
16 days	90.5,	103.4,	109.4,	117.5,	122.6,	126.3,	137.3,	148.3,	154.9,	163.5,	170.7,	175.9,	183.4,	189.0,	193.4,	207.8,
20 days	104.9,	118.9,	125.5,	134.3,	139.7,	143.7,	155.6,	167.4,	174.5,	183.7,	191.2,	196.8,	204.8,	210.7,	215.4,	230.5,
25 days	122.2,	137.7,	144.8,	154.4,	160.3,	164.7,	177.5,	190.2,	197.8,	207.7,	215.7,	221.6,	230.2,	236.4,	241.4,	257.4,

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

Rainfall Return period table at Castlelost, Co. Westmeath

Jenkinstown Business Park,Jenkinstown
Dundalk, Co. Louth, Ireland, A91W224

78 Clontarf Road, Clontarf Dublin 3
Ireland, D03 DE62

15 Longmeade, Gravesend, Kent
United Kingdom, DA12 2NX