TWEDDELL & SLATER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

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PROPOSED NEW BUNGALOW
LAND ADJACENT TO THORNLEA, CARLETON
DRAINAGE STRATEGY

Introduction

Tweddell and Slater Ltd have been appointed to prepare a surface water and foul drainage statement that is compliant with the National Planning Policy.

This report has been prepared in support of the proposed construction of a residential dormer bungalow at Carleton, near Egremont in Cumbria. The closest postcode to the site is CA22 2NU and the development area is currently greenfield.

The layout of the proposed site is indicated in Figure 1 below.

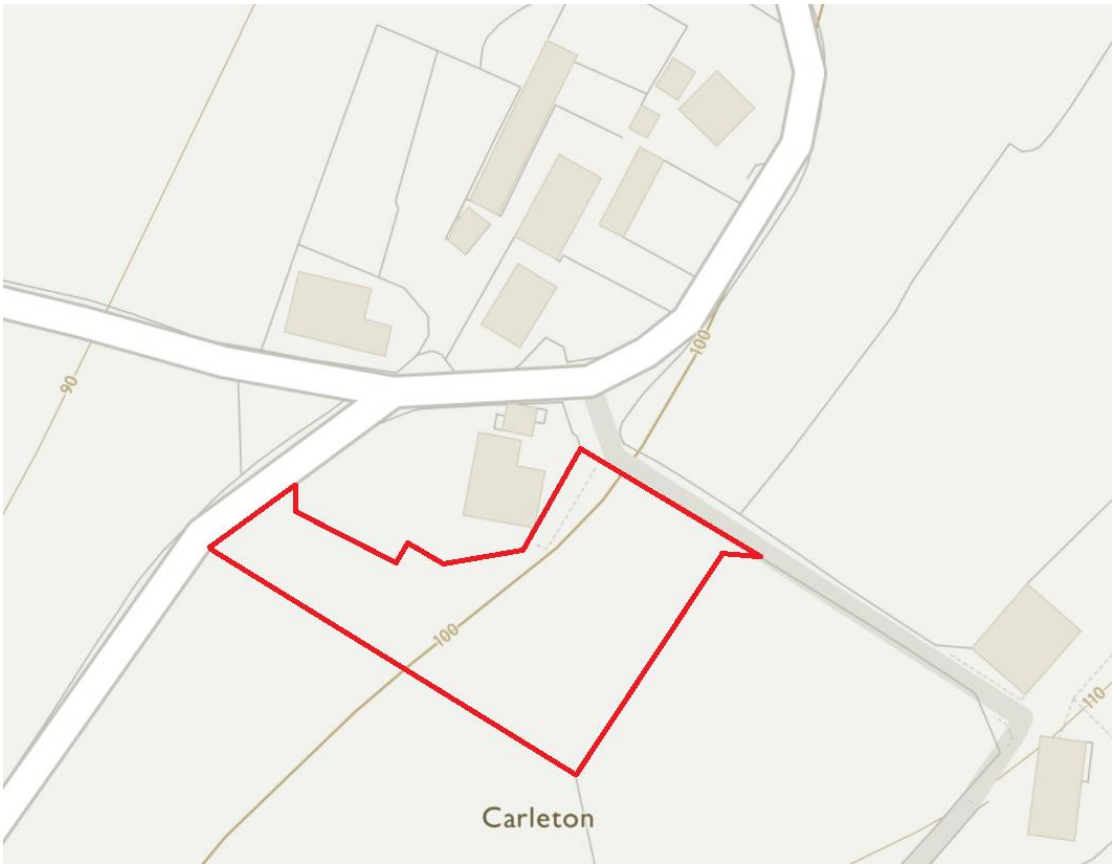

Figure 1 – Proposed Site Location and Boundary

DIRECTORS
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In accordance with the recognised guidance, there is a hierarchy of where surface water should be discharged. This hierarchy where practicable, is as follows:

1) Infiltration
2) Watercourse
3) Public sewer

A site walkover was undertaken in August 2021. The existing site surface water appears to be drained straight to ground. An analysis of the area's topography has shown that the flow direction of overland flow in saturated conditions would generally fall to the west due to the topography on site.

The EA flood risk maps and flood map for planning show that the entirety of the site is not identified as at risk from flooding from rivers and is categorised as Flood Zone 1. Flood Zone 1 is considered to be land having a 1 in 1000 or lesser annual probability of river or sea flooding.

By review of the government long term flood risk information, it has been determined that the site is at a very low risk from surface water flooding (Appendix D).

Existing Site Runoff

The greenfield runoff rate calculation for the site is shown within Appendix B. The greenfield runoff rates for the site are shown below:

Event	Greenfield Runoff Rate
1 in 1 year	0.73 l/s
Q Bar	0.84 l/s
1 in 30 years	1.42 l/s
1 in 100 years	1.74 l/s

Soil infiltration testing has been undertaken at the site by GEO Environmental Engineering in August 2021 in accordance with the method prescribed in BRE Digest 365, with percolation testing undertaken in 2x trial pits within the site.

Infiltration testing has demonstrated that the ground has insufficient infiltration properties therefore, soakaways and permeable paving are not considered viable options for the site. Further information of the percolation testing is contained within Appendix C.

The closest watercourse to the site is an unnamed watercourse leading to "Beggar Gill". This watercourse is located approximately 270m north of the proposed development and within the boundary of an agricultural field. This watercourse is not classified as a main river by the Environment Agency (EA). The closest main river to the site is the River Ehen which lies approximately 600m to the northwest. Due to the significant distance to these watercourses and the land ownership issues involved, discharging to either of these watercourses is not considered to be a viable option for the development.

Surface Water Proposals

Sewer records obtained from United Utilities (UU) show that there is a 150mm diameter combined sewer located to the north of the site and beneath the unnamed road running through Carleton. There are no surface water or foul sewers located within close proximity to the site.

A surface water drainage strategy (Appendix A) has therefore been developed to discharge the runoff generated by the roof and driveway area of the proposed residence to the combined sewer north of the development. This is in line with the drainage hierarchy as outlined above.

To achieve a discharge rate in line with the site's Q_{BAR} value it is proposed to attenuate surface water within an attenuation tank on site and then have a controlled outflow to the existing combined sewer via a flow control device.

These proposals have been presented to UU and have been agreed as per application reference SC5677.

The attenuation tank and surface water system will be designed such that it will not be surcharged in events up to 30 years recurrence and that there will be no flooding in events up to 100 years with an allowance for climate change of 40%.

The proposed surface water drainage system will be designed to building regulations to ensure the structural integrity under anticipated loading conditions over the design life, this includes the cover to pipes that have been designed in accordance with the manufacturer's requirements and specification.

Foul System Proposal

It is anticipated that foul discharge from the development will connect to the existing combined sewer located to the north of the site. The proposal is to collect all foul drainage from the new property, and then connect to an existing manhole located in the unnamed road approximately 20m northwest of the site.

As per the surface water proposals, the foul proposals have been presented to UU and have been agreed as per application reference SC5677.

The use of a foul drainage field is not viable due to the ground conditions.

The proposed foul water drainage system will be designed to building regulations to ensure the structural integrity under anticipated loading conditions over the design life this includes the cover to pipes that have been designed in accordance with the manufacturer's requirements and specification.

Andy Poole BEng CEng MICE PCERT
For Tweddell & Slater Ltd
March 2022

APPENDIX A -
DRAINAGE STRATEGY DRAWING

Revision Notes
A 29/03/22 Included flow control details

PRELIMINARY

Suitability
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Project
PROPOSED BUNGALOW
CARLETON

Client
L ZARRINI

Drawing
OUTLINE DRAINAGE STRATEGY

Project no	Drawing no	Date	Drawn by	Rev	Scale	Sheet
7513	200	FEB 22	SJ	A	1:150	A1

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APPENDIX B -
GREENFIELD RUNOFF CALCULATIONS

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Simon Johnston
Site name:	Land Adjacent to Thornlea
Site location:	Carleton

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	54.46899° N
Longitude:	3.51819° W
Reference:	3230204333
Date:	Feb 23 2022 12:23

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.09667

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1154	1154
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

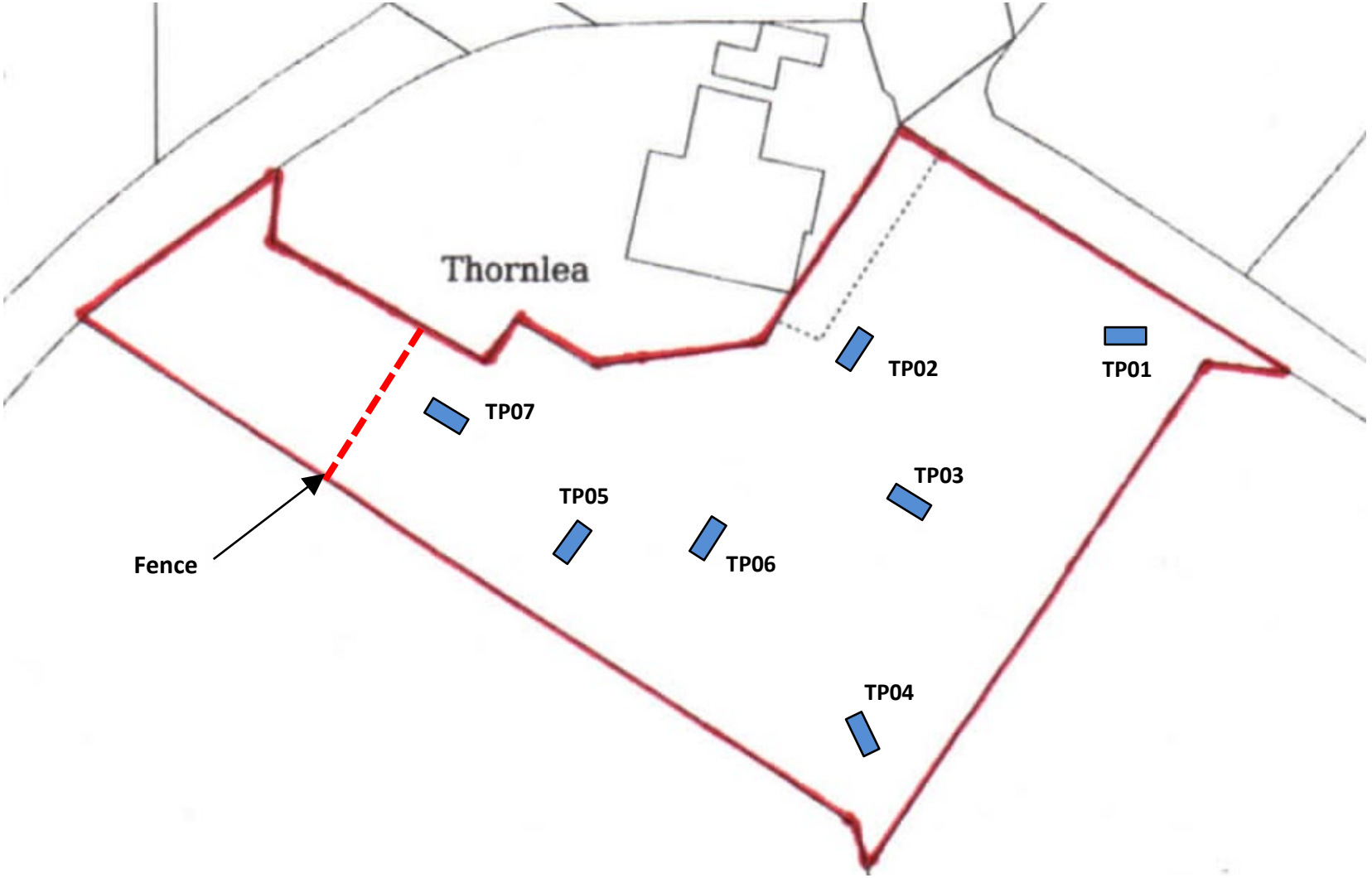
(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.84	0.84
1 in 1 year (l/s):	0.73	0.73
1 in 30 years (l/s):	1.42	1.42
1 in 100 year (l/s):	1.74	1.74
1 in 200 years (l/s):	1.99	1.99

APPENDIX C -
PERCOLATION TEST RESULTS

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – Exploratory Hole Location Plan



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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP01

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.18	TOPSOIL: Dark grey brown sandy gravelly LOAM with occasional clinker.		0.10 - J
0.18	0.87	Brown slightly silty very sandy fine to coarse sub-rounded GRAVEL with many cobbles.		
0.87	1.50	Brown slightly silty gravelly medium SAND.		
1.50	2.00	Brown slightly silty very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Occasional boulders.		
		End of trial hole at 2.00m due to complete collapse. Groundwater ingress at 1.50m bgl. Standing groundwater at 1.50m bgl on completion. Complete collapse of trial pit at 2.00m bgl. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP02

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.24	MADE GROUND: Dark brown silty sandy fine to coarse angular to sub-rounded GRAVEL of mixed aggregate with occasional brick, clinker and asphalt.		0.10 - J
0.24	0.90	Brown slightly silty very sandy fine to coarse sub-rounded GRAVEL with many cobbles.		
0.90	1.20	Brown slightly silty gravelly medium SAND.		
1.20	1.50	Brown slightly silty very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Occasional boulders.		
		End of trial hole at 1.50m – Soil Infiltration Test Completed. Groundwater ingress at 1.50m bgl. Standing groundwater at 1.50m bgl on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator
Dimensions: 2.10m x 0.90m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP03

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.38	MADE GROUND: Grey brown silty very sandy fine to coarse sub-rounded GRAVEL of mixed lithology with occasionally concrete/slag.		0.20 - J
0.38	2.00	Brown slightly silty very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Occasional boulders.		1.00 - J
		End of trial hole at 2.00m. Groundwater ingress at 1.40m bgl. Standing groundwater at 1.40m bgl on completion. Trial pit collapsing during excavation. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP04

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.22	MADE GROUND: Brown silty sandy gravelly LOAM with occasional clinker.		0.10 - J
0.22	0.41	MADE GROUND: Blue grey fused SLAG. Strong sulphurous odour. Difficult to excavate.		
0.41	1.80	Brown slightly silty, very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Occasional boulders. Occasional pockets of very gravelly sand.		1.00 - J
		End of trial hole at 1.80m. Trial Pit dry and stable on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP05

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.50	MADE GROUND: Grey brown sandy fine to coarse angular GRAVEL of mixed aggregate, slag and concrete. Plastic pipe at surface.		0.10 - J
0.50	1.10	Grey brown very silty gravelly SAND.		
1.10	1.70	Brown slightly silty, very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Ceramic field drain at 1.10m bgl.		
		End of trial hole at 1.70m. Trial Pit dry and stable on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP06

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	MADE GROUND: Grey brown sandy fine to coarse angular GRAVEL of mixed aggregate, slag and concrete.		0.10 - J
0.40	1.80	Brown slightly silty, very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Occasional boulders.		
		End of trial hole at 1.80m – Soil Infiltration Test Completed. Groundwater ingress at 1.45m bgl. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator
Dimenions: 2.00m x 1.00m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2021-4903: Land Adjacent to Thornlea, Carleton, Egremont, Cumbria – TP07

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.20	MADE GROUND: Grey brown loamy soil with occasional ash (former bonfire).		0.10 - J
0.20	1.30	Brown slightly silty, very sandy fine to coarse sub-rounded GRAVEL and COBBLES of mixed lithology. Occasional boulders.		
1.30	2.10	Brown silty gravelly medium SAND		
		End of trial hole at 2.10m. Trial Pit dry and stable on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 17/08/2021
Plant: Tracked 360 Excavator

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

Website: www.geoenvironmentalengineering.com
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GEO2021-4903: Carleton, Egremont, Cumbria – Soil Infiltration Test Results

TP02 – Test 1

Duration (mins)	Water Level (m bgl)
0	0.66
11	0.66
36	0.65
72	0.65
128	0.64
199	0.63

TP06 – Test 1

Duration (mins)	Water Level (m bgl)
0	0.83
13	0.88
58	0.98
130	1.07

TP06 – Test 2

Duration (mins)	Water Level (m bgl)
0	0.73
137	0.98

GEO Environmental Engineerin

SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Thornlea, Carleton, Egremont**
JOB NO:	**2021-4903**
TRIAL PIT:	**TP06**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**1000**	mm
Length	**2000**	mm
Depth of hole	**1800**	mm
Change Water Level	**240**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	830
0	13	0	780	880
0	58	0	3480	980
0	130	0	7800	1070

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.24** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **2.72** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **3900** secs

Soil Infiltration rate:

f = **2.3E-05** m/s

GEO Environmental Engineerin

SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Thornlea, Carleton, Egremont**
JOB NO:	**2021-4903**
TRIAL PIT:	**TP06**
TEST NO.:	**2**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**1000**	mm
Length	**2000**	mm
Depth of hole	**1800**	mm
Change Water Level	**250**	mm

MONITORING RESULTS:

Recorded Time			Total Time (secs)	Depth of water (mm)
Hours	Minutes	Seconds		
0	0	0	0	730
0	137	0	8220	980

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **2**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.25** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **2.75** m^2

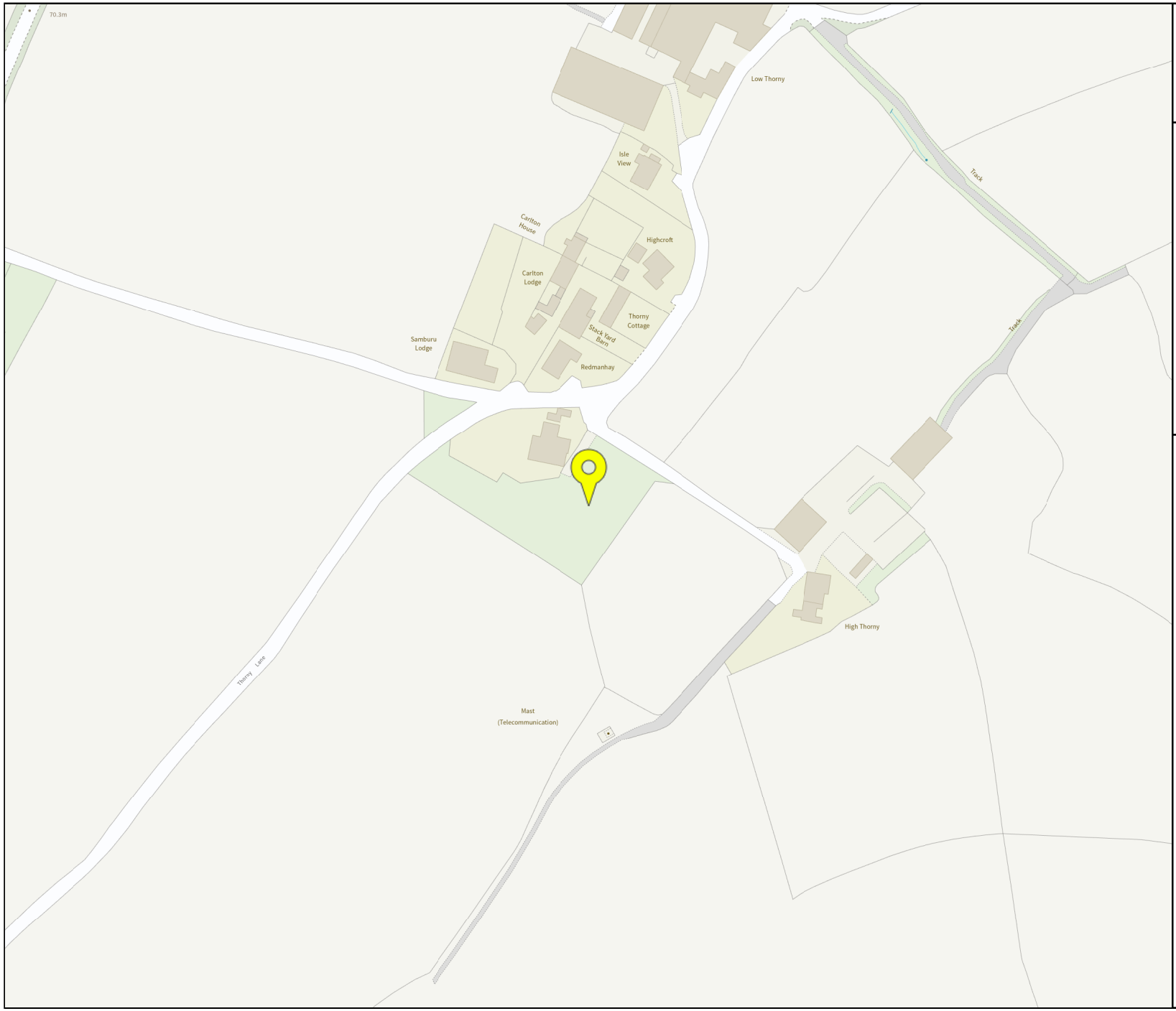
Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **4110** secs

Soil Infiltration rate:

f = **2.2E-05** m/s

APPENDIX D -
EA FLOOD MAP FOR PLANNING AND LONG-TERM FLOOD RISK



Environment Agency

Flood map for planning

Your reference
Carleton

Location (easting/northing)
301702/509230

Scale
1:2500

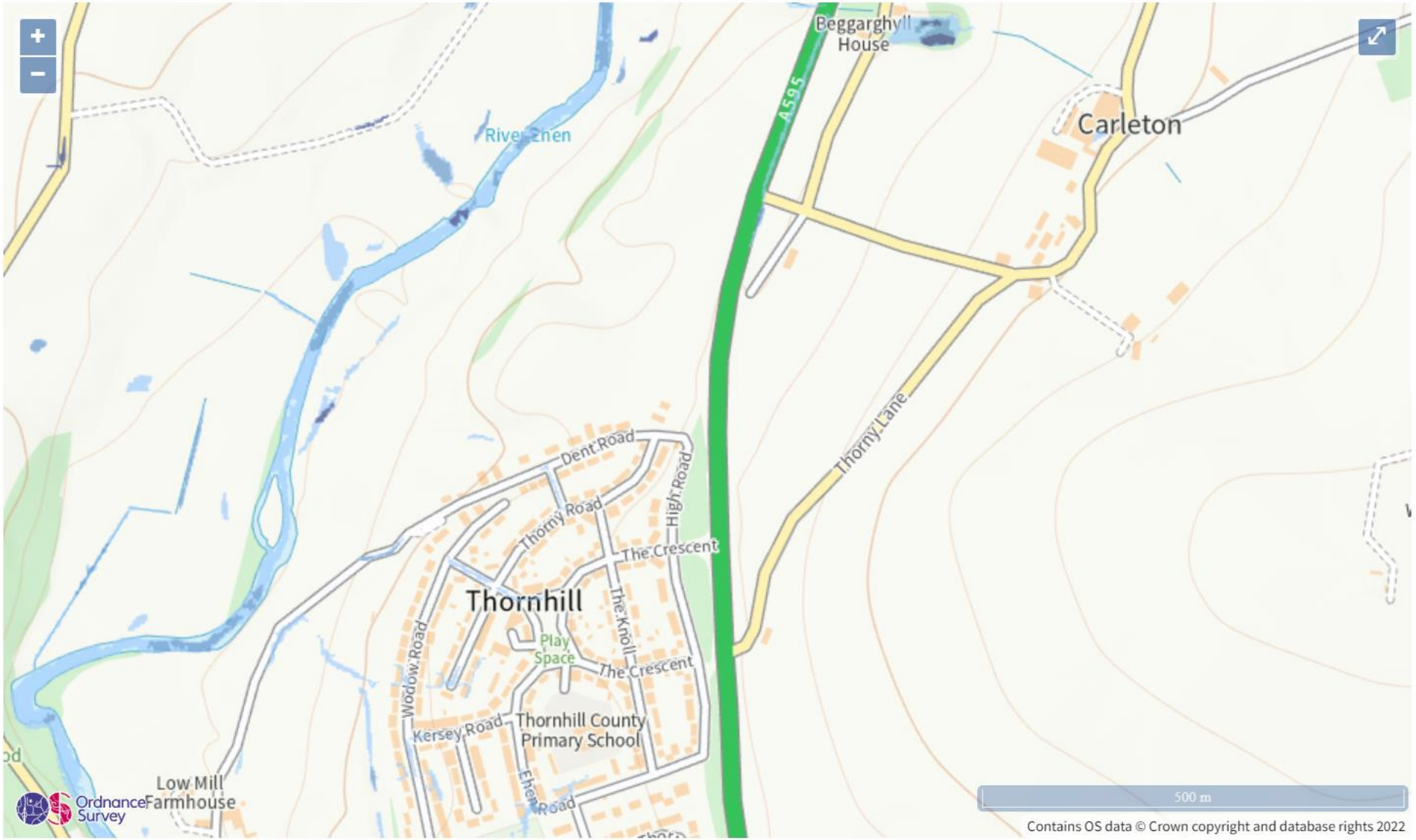
Created
23 Feb 2022 16:17

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected



Extent of flooding from surface water

High Medium Low Very low Location you selected

APPENDIX E -
ATTENUATION TANK SIZE CALCULATION

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	2.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
S1	0.006	2.00	101.850	1200	0.700
S2	0.005	2.00	101.850	1200	0.742
S3	0.005	2.00	101.850	1200	0.830
S4	0.005	2.00	101.850	1200	0.859
S5	0.005	2.00	101.850	1200	1.088
S6	0.005	2.00	101.850	1200	2.095
S7	0.005	2.00	101.850	1200	2.140
S8	0.005	2.00	101.850	1200	2.573
Tank Inlet			101.500		2.373
Tank Outlet			100.800		1.733
S9			100.750	1200	1.698
COM1			100.600	1200	1.600

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	4.250	0.600	101.150	101.108	0.042	100.0	150	2.07	50.0
1.001	S2	S3	8.760	0.600	101.108	101.020	0.088	100.0	150	2.22	50.0
1.002	S3	S4	2.903	0.600	101.020	100.991	0.029	100.0	150	2.26	50.0
1.003	S4	S5	22.859	0.600	100.991	100.762	0.229	100.0	150	2.64	50.0
1.004	S5	S6	10.250	0.600	100.762	99.755	1.007	10.2	150	2.70	50.0
1.005	S6	S8	4.775	0.600	99.755	99.277	0.478	10.0	150	2.72	50.0
2.000	S7	S8	4.325	0.600	99.710	99.277	0.433	10.0	150	2.02	50.0
1.006	S8	Tank Inlet	1.500	0.600	99.277	99.127	0.150	10.0	150	2.73	50.0
1.007	Tank Inlet	Tank Outlet	12.000	0.600	99.127	99.067	0.060	200.0	400	2.83	50.0
1.008	Tank Outlet	S9	1.500	0.600	99.067	99.052	0.015	100.0	150	2.86	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	1.5	0.550	0.592	0.006	0.0	30	0.613
1.001	1.005	17.8	2.8	0.592	0.680	0.011	0.0	40	0.734
1.002	1.005	17.8	4.0	0.680	0.709	0.016	0.0	49	0.818
1.003	1.005	17.8	5.3	0.709	0.938	0.021	0.0	56	0.877
1.004	3.176	56.1	6.6	0.938	1.945	0.026	0.0	34	2.126
1.005	3.206	56.7	7.8	1.945	2.423	0.031	0.0	38	2.270
2.000	3.206	56.7	1.3	1.990	2.423	0.005	0.0	16	1.314
1.006	3.204	56.6	10.4	2.423	2.223	0.041	0.0	44	2.458
1.007	1.975	4739.6	10.4	1.973	1.333	0.041	0.0	7	0.232
1.008	1.005	17.8	10.4	1.583	1.548	0.041	0.0	82	1.042

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.009	S9	COM1	5.156	0.600	99.052	99.000	0.052	100.0	150	2.94	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.009	1.005	17.8	10.4	1.548	1.450	0.041	0.0	82	1.042

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.300	1 year (l/s)	0.4
Summer CV	1.000	30 year (l/s)	0.9
Winter CV	1.000	100 year (l/s)	1.0
Analysis Speed	Detailed	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	52

Storm Durations

15	30	60	120	180	240	360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	40	10	0
30	40	10	0
100	40	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.097	Betterment (%)	0
SAAR (mm)	1154	QBar	0.8
Soil Index	4	Q 1 year (l/s)	
SPR	0.47	Q 30 year (l/s)	
Region	10	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	40
Positively Drained Area (ha)	0.097	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.548
CWI	125.385	Runoff Volume (m³)	52

Node S9 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	99.052	Product Number	CTL-SHE-0050-8000-0400-8000
Design Depth (m)	0.400	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.8	Min Node Diameter (mm)	1200

Approval Settings

Node Size	x	Backdrops	x	Return Period (years)	100
Node Losses	x	Full Bore Velocity	x	Discharge Rates	✓
Link Size	x	Proportional Velocity	x	1 year (l/s)	0.8
Link Length	x	Surcharged Depth	x	30 year (l/s)	0.8
Coordinates	x	Flooding	✓	100 year (l/s)	0.8
Crossings	x	Return Period (years)	100	Discharge Volume	✓
Cover Depth	x	Time to Half Empty	✓	100 year +40% 360 minute (m³)	52

Approval Results

The network has been designed for a 1 in 100 year storm using FSR rainfall
It contains 12 nodes (1 outfall) and 11 links
The total impermeable area is 0.041 ha
1 online control has been defined
No additional storage is present
Simulations have been completed using FSR summer and winter storms from 15 to 1440 minute duration

The node size test has not been completed

The node losses test has not been completed

The link size test has not been completed

The link length test has not been completed

The coordinates test has not been completed

The crossings test has not been completed

The cover depth test has not been completed

The backdrops test has not been completed

The full bore velocity test has not been completed

The proportional velocity test has not been completed

The surcharged depth test has not been completed

No nodes flood during the 100 year return period

No infiltrating structures failed to half empty in 1440 minutes during the 100 year return period

No outfalls have a discharge rate greater than 0.8l/s during the 1 year return period

No outfalls have a discharge rate greater than 0.8l/s during the 30 year return period

No outfalls have a discharge rate greater than 0.8l/s during the 100 year return period

No outfalls have a discharge volume greater than 52m³ during the 100 year 360 minute storm

Results for 1 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	9	101.187	0.037	2.1	0.0493	0.0000	OK
15 minute summer	S2	9	101.157	0.049	3.9	0.0622	0.0000	OK
15 minute summer	S3	9	101.090	0.070	5.7	0.0883	0.0000	OK
15 minute summer	S4	9	101.064	0.073	7.4	0.0915	0.0000	OK
15 minute summer	S5	9	100.803	0.041	9.0	0.0506	0.0000	OK
15 minute summer	S6	9	99.800	0.045	10.6	0.0530	0.0000	OK
15 minute summer	S7	9	99.728	0.018	1.8	0.0218	0.0000	OK
15 minute summer	S8	9	99.339	0.062	14.1	0.0733	0.0000	OK
180 minute summer	Tank Inlet	164	99.197	0.070	4.2	0.0000	0.0000	OK
180 minute summer	Tank Outlet	144	99.196	0.129	4.0	0.0000	0.0000	OK
180 minute summer	S9	144	99.197	0.145	2.4	0.1635	0.0000	OK
15 minute summer	COM1	1	99.000	0.000	0.8	0.0000	0.0000	OK

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	S1	1.000	S2	2.1	0.504	0.118	0.0177	
15 minute summer	S2	1.001	S3	3.9	0.607	0.221	0.0568	
15 minute summer	S3	1.002	S4	5.6	0.681	0.316	0.0239	
15 minute summer	S4	1.003	S5	7.2	1.173	0.404	0.1413	
15 minute summer	S5	1.004	S6	8.8	2.117	0.157	0.0426	
15 minute summer	S6	1.005	S8	10.5	1.850	0.185	0.0271	
15 minute summer	S7	2.000	S8	1.8	0.527	0.032	0.0177	
15 minute summer	S8	1.006	Tank Inlet	13.9	4.392	0.246	0.0055	
15 minute summer	Tank Inlet	1.007	Tank Outlet	13.3	0.105	0.003	3.6110	
30 minute summer	Tank Outlet	1.008	S9	3.0	0.365	0.170	0.0197	
30 minute summer	S9	Hydro-Brake®	COM1	0.8				6.0

Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	9	101.214	0.064	5.1	0.0841	0.0000	OK
15 minute summer	S2	9	101.190	0.082	9.4	0.1051	0.0000	OK
15 minute summer	S3	9	101.156	0.136	13.7	0.1716	0.0000	OK
15 minute summer	S4	9	101.124	0.133	17.7	0.1679	0.0000	OK
15 minute summer	S5	9	100.828	0.066	21.4	0.0816	0.0000	OK
15 minute summer	S6	9	99.833	0.078	25.6	0.0919	0.0000	OK
15 minute summer	S7	9	99.738	0.028	4.3	0.0331	0.0000	OK
360 minute summer	S8	360	99.381	0.104	7.1	0.1217	0.0000	OK
360 minute summer	Tank Inlet	360	99.379	0.252	7.3	0.0000	0.0000	OK
360 minute summer	Tank Outlet	360	99.379	0.312	8.1	0.0000	0.0000	SURCHARGED
360 minute summer	S9	352	99.379	0.327	2.0	0.3698	0.0000	SURCHARGED
15 minute summer	COM1	1	99.000	0.000	0.8	0.0000	0.0000	OK

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	S1	1.000	S2	5.1	0.600	0.287	0.0361	
15 minute summer	S2	1.001	S3	9.4	0.702	0.529	0.1167	
15 minute summer	S3	1.002	S4	13.4	0.802	0.753	0.0484	
15 minute summer	S4	1.003	S5	17.1	1.417	0.965	0.2748	
15 minute summer	S5	1.004	S6	21.3	2.547	0.379	0.0856	
15 minute summer	S6	1.005	S8	25.4	2.289	0.448	0.0529	
15 minute summer	S7	2.000	S8	4.3	0.637	0.076	0.0329	
15 minute summer	S8	1.006	Tank Inlet	33.8	5.031	0.598	0.0125	
15 minute summer	Tank Inlet	1.007	Tank Outlet	32.7	0.138	0.007	9.5663	
15 minute summer	Tank Outlet	1.008	S9	2.8	0.511	0.156	0.0264	
15 minute summer	S9	Hydro-Brake®	COM1	0.8				10.4

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 98.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	101.251	0.101	6.7	0.1332	0.0000	OK
15 minute summer	S2	10	101.247	0.139	11.6	0.1777	0.0000	OK
15 minute summer	S3	9	101.217	0.197	15.9	0.2494	0.0000	SURCHARGED
15 minute summer	S4	9	101.183	0.192	19.4	0.2413	0.0000	SURCHARGED
15 minute summer	S5	9	100.832	0.070	23.6	0.0862	0.0000	OK
15 minute summer	S6	9	99.840	0.085	29.0	0.1003	0.0000	OK
15 minute summer	S7	9	99.742	0.032	5.5	0.0374	0.0000	OK
720 minute summer	S8	495	99.487	0.210	4.9	0.2466	0.0000	SURCHARGED
720 minute summer	Tank Inlet	495	99.487	0.360	4.9	0.0000	0.0000	OK
720 minute summer	Tank Outlet	495	99.487	0.420	3.0	0.0000	0.0000	SURCHARGED
720 minute summer	S9	495	99.487	0.435	2.0	0.4919	0.0000	SURCHARGED
15 minute summer	COM1	1	99.000	0.000	0.8	0.0000	0.0000	OK

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	S1	1.000	S2	6.1	0.619	0.343	0.0630	
15 minute summer	S2	1.001	S3	10.4	0.719	0.586	0.1517	
15 minute summer	S3	1.002	S4	13.9	0.827	0.780	0.0511	
15 minute summer	S4	1.003	S5	18.1	1.391	1.022	0.2932	
15 minute summer	S5	1.004	S6	23.5	2.590	0.419	0.0939	
15 minute summer	S6	1.005	S8	28.9	2.314	0.510	0.0595	
15 minute summer	S7	2.000	S8	5.5	0.667	0.097	0.0375	
15 minute summer	S8	1.006	Tank Inlet	39.8	4.989	0.702	0.0181	
15 minute winter	Tank Inlet	1.007	Tank Outlet	40.6	0.146	0.009	12.5961	
15 minute winter	Tank Outlet	1.008	S9	3.7	0.566	0.209	0.0264	
720 minute summer	S9	Hydro-Brake®	COM1	0.8				60.0