TWEDDELL & SLATER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Unit 2, Mereside
Greenbank Road
Eden Business Park
Gilwilly, Penrith
Cumbria, CA11 9FB

PROPOSED RESIDENTIAL DWELLINGS, RHEDA PARK, FRIZINGTON, CUMBRIA, DRAINAGE STRATEGY – SEPTEMBER 2021

Introduction

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

This report has been prepared in support of a proposed development of two detached residential properties, located on a site that is currently greenfield. The development site is located at Rheda Park, close to Frizington in Cumbria. Figure 1 shows the location and extent of the site.

Figure 1 – Site Location Shown by Red Boundary

DIRECTORS
R. J. Gibson BEng (Hons) CEng MIStructE
A. K. Poole BEng (Hons) MSc CEng MICE PCert

Tel 01768 865400
Email mail@tsceltd.com
www.tsceltd.com

Existing Surface Water

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 June 2021. The existing site surface water appears to be drained straight to ground.

An analysis of the area's topography has shown that the site is moderately sloped and the flow direction of overland flow in saturated conditions would likely fall to the southwest due to the topography of the area.

Overland flow generated offsite in the surrounding fields will either remain on these fields or be routed southeast in the direction of the River Keekle and will not enter the site. Surface Water generated to the east of the site, within the grounds of the adjacent properties, will be drained prior to the generation of overland flow. Overland flow generated along Rheda Park to the north of the proposed development will be routed to the west and picked up by highway drainage. As there is relatively little impermeable area surrounding the site, it is not anticipated that overland flow from offsite will pose an issue to the development.

The EA flood risk maps and the 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 majority of the site is at a very low risk from surface water flooding (Appendix D). The existing drainage ditch running through the site is currently at a low risk of surface water flooding.

The greenfield runoff rate calculation for each of the proposed residences are shown within Appendix E. The greenfield runoff rates for the overall site are shown below:

QBar (l/s)	2.80
1 in 1 year (l/s)	3.28
1 in 30 year (l/s)	6.41
1 in 100 year (l/s)	7.85
1 in 200 year (l/s)	8.94

Proposed Surface Water

Soil infiltration testing has been undertaken by the client at site on the 30th of June 2021 in accordance with the method prescribed in BRE Digest 365, with percolation testing undertaken in 4x trial pits within the site.

Infiltration testing has demonstrated that the ground has insufficient properties and as such soakaways and permeable paving are not considered to be viable options for the site. All four of the test holes failed to drain within a reasonable time period – with very limited reductions in the depth of water. The location of the percolation test holes is shown within Appendix B.

The closest watercourse to the site is the unnamed watercourse/drainage ditch running through the site. This drainage ditch has a low flow and is located an approximate distance of between 10.5m and 22m north of the southern site boundary. This unnamed watercourse is not classified as a main river by the Environment Agency (EA) and is a tributary of the River Keekle. Discharging directly to this drainage ditch is considered a viable option for the development. As part of the development proposals this drainage ditch is to be diverted further south and closer to the southern site boundary. This diversion will be constructed using a 300mm diameter pipe. Figure 2 shows the direction and approximate distance to the existing location of the drainage ditch.

Figure 2 – Approximate Location of Existing Drainage Ditch

A drainage strategy (Appendix C) has therefore been developed to discharge the roofs and associated hard areas for the proposed dwellings to the existing drainage ditch in accordance with the hierarchy outlined above. It is proposed that the surface water from the development be attenuated on site before discharge to the diverted drainage ditch within the site boundary. It is proposed that each of the dwellings will have their own attenuation and flow control systems. Discharges will be limited to the Q_{BAR} rate for each of the plots.

The position and size of the attenuation systems and associated connections are indicated on drawings 7255-200B and 7255-201B.

A summary of the impermeable areas used to develop the drainage strategy are shown on drawings 7255-100 and 7255-101, included in Appendix C. It is proposed to construct the driveways using permeable slate chippings to prevent water discharging onto the highway and to reduce the impermeable area of the site.

The attenuation systems will be designed such that there will be no surcharge 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 surface water systems will remain private under the maintenance and management of the property owners.

The proposed surface water drainage systems will need to 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 (Hons) MSc CEng MICE PCERT
For Tweddell & Slater Ltd
Tweddell & Slater Ltd Unit 2 Mereside Greenbank Road
Eden Business Park Penrith Cumbria CA11 9FB
September 2021

APPENDIX A -
PROPOSED SITE LAYOUT

PLOT 3
OVERALL SITE AREA 2000M2
BUILDING / DRIVE 380M2
DRIVEWAY
garage
plot 3 subject to separate
planning application
PLOT 4
OVERALL SITE AREA 1750M2
BUILDING / DRIVE 460M2
PLOT 2
2073m2
REFER TO TREESCAPE REPORT FOR
WORKS TO TREES / GROUND CLEARANCE
Dense
Rhododendron
(Trees Not Surveyed)
Public Road
Tarmac Road
Grass
Building
Ridge
Bed
Rhododendron
Fallen Tree
Woodland
Stream
bedroom 4
bedroom
garage
living / kitchen / dining
living
34001

APPENDIX B -
PERCOLATION TEST RESULTS

Percolation Test Results – 30/06/2021

Soakaway test 1 (Hole 1)	Time	Depth
Hole 2m x 0.6 x 1.8m deep	12:15 (hole filled with cube of water)	42 inches
	1:15	42 inches
	2:15	42 inches
	3:00	41 inches
	3:30	Fail

Soakaway test 2 (Hole 2)	Time	Depth
Hole 2.1 x 0.5 x 1.7.4m deep	12:30 (hole filled with cube of water)	44 inches
	1:30	44 inches
	2:30	42 inches
	3:30	41 inches
	4:00	41 inches

APPENDIX C -
DRAINAGE STRATEGY DRAWINGS

Areas	
Total Site Area:	0.2000 Ha
Impermeable	
Dwelling Area:	0.0153 Ha
Garage Area:	0.0041 Ha
Permeable	
Drive Area:	0.0183 Ha
Totals	
Impermeable Area:	0.0194 Ha
Permeable Area:	0.1806 Ha

PRELIMINARY

Suitability --

Project
PLOT 3
RHEDA PARK, FRIZINGTON

Client

Drawing
SITE AREAS

Project No.	Drawing No.	Date	Drawn By	Rev	Scale	Sheet
7255	100	JUL 21	SJ	-	1:200	A1

TWEDDELL & SLATER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Tweddell & Slater Ltd
Unit 2, Mereside
Eden Business Park
Penrith, Cumbria, CA11 9FB
Tel 01768 865400

Tweddell & Slater North East Ltd
20 Market Place
Richmond
North Yorkshire, DL10 4QG
Tel 01748 563182

Email mail@tsceltd.com
Web www.tsceltd.com

PLOT 4

PLOT 3

DRIVEWAY

driveway

garage

Tarmac Road

Ridge
129.31

Bed

Grass

Dense
Rhododendron
(Trees Not Surveyed)

Pubic Road

TP

Grass

Woodland

Stream

Rhododendron

Derelict Fence

Fallen Tree

Post

Field

existing ditch
removed

4000 litre
crate attenuation
with soakaway

garden

plot 3 subject to separate
planning application

Areas

Total Site Area:	0.1736 Ha
Impermeable Roof Area:	0.0260 Ha
Permeable Drive Area:	0.0194 Ha
Totals	
Impermeable Area:	0.0260 Ha
Permeable Area:	0.1476 Ha

PRELIMINARY

Suitability
--

Project
PLOT 4
RHEDA PARK, FRIZINGTON

Client

Drawing
PLOT 4
SITE AREAS

Project no.	Drawing no.	Date	Drawn by	Rev	Scale	Sheet
7255	101	JUL 21	GJ	-	1:200	A1

TWEDDELL & SLATER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Tweddell & Slater Ltd
Unit 2, Mereside
Eden Business Park
Penrith, Cumbria, CA11 9FB
Tel 01768 865400
Email mail@tsceltd.com
Web www.tsceltd.com

Tweddell & Slater North East Ltd
20 Market Place
Richmond
North Yorkshire, DL10 4QG
Tel 01748 503162

Revision Notes
B 09.09.21 Adjusted drainage to suit updated site layout

PRELIMINARY

Suitability --

Project
PLOT 3
RHEDA PARK, FRIZINGTON

Client

Drawing
DRAINAGE STRATEGY

Project no	Drawing no	Date	Drawn by	Rev	Scale	Sheet
7255	200	JUL 21	SJ	B	1:150	A1

TWEDDELL & SLATER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Tweddell & Slater Ltd
Unit 2, Mereside
Eden Business Park
Penrith, Cumbria, CA11 9FB
Tel 01768 865400

Tweddell & Slater North East Ltd
20 Market Place
Richmond
North Yorkshire, DL10 4QG
Tel 01748 503162

Email mail@tsceltd.com
Web www.tsceltd.com

Key

- Extent of Proposed Facility
- Proposed Surface Water
- Proposed Foul Water
- Proposed Stream Diversion
- Proposed Surface Water Manhole
- Proposed SW Inspection Chamber
- Proposed FW Inspection Chamber

Public Road

Tarmac Road

Grass

Building

Ridge 129.31

Ridge 129.30

Bed

TP 121.86

TP 120.71

Pump Chamber

119.700

Permeable Driveway

FFL 120.800m

Stream

Existing Stream to be Diverted

Existing Stream to be Diverted

Existing Stream to be Diverted

Existing Stream to be Diverted

Rhododendron

Fallen Tree

Woodland

garden

Hydrobrake by Hydro International Ref. CTL-SHE-0072-1800-0400-1800 Design Depth 0.400m Design Flow 1.8 l/s

Tank Inlet CL: 120.500 IL: 119.293

1.007 Attenuation Tank 6 x 4 x 0.4m @ 1:200

Tank Outlet CL: 120.500 IL: 119.263

Dutfall - Estimated CL: 120.500 IL: 119.218

Existing Stream to be Piped through Site - 200ø ST assumed gradient of 1:100

SW1 CL: 120.650 IL: 119.762

SW2 CL: 120.650 IL: 119.703

SW3 CL: 120.650 IL: 119.652

SW4 CL: 120.650 IL: 119.533

SW5 CL: 120.650 IL: 119.435

SW6 CL: 120.650 IL: 119.329

SW7 CL: 120.650 IL: 119.735

SW8 CL: 120.650 IL: 119.659

SW9 CL: 120.650 IL: 119.487

SW10 CL: 120.650 IL: 119.415

SW11 CL: 120.650 IL: 119.766

SW12 CL: 120.650 IL: 119.360

SW13 CL: 120.500 IL: 119.238

F1 CL: 120.800 IL: 120.250

F2 CL: 121.150 IL: 120.000

F3 CL: 120.650 IL: 119.900

1.000, 5.877m 100ø @ 1:100

1.001, 5.100m 100ø @ 1:100

1.002, 11.925m 100ø @ 1:100

1.003, 1.650m 100ø @ 1:100

1.004, 8.128m 100ø @ 1:100

1.005, 7.500m 100ø @ 1:100

1.006, 6.737m 100ø @ 1:100

1.008, 2.500m 100ø @ 1:100

1.009, 2.000m 100ø @ 1:100

2.000, 7.600m 100ø @ 1:100

2.001, 17.158m 100ø @ 1:100

2.002, 7.200m 100ø @ 1:100

2.003, 3.463m 100ø @ 1:100

3.000, 8.128m 100ø @ 1:120

bedroom 4

bedroom

garage

hallway

store

utility

living

living / kitchen / dining

living / kitchen /

PLOT 3

PLOT 4

LOT 3

Revision Notes

B 08.09.21 Adjusted drainage to suit updated site layout

PRELIMINARY

Suitability --

Project

PLOT 4

RHEDA PARK, FRIZINGTON

Client

Drawing

DRAINAGE STRATEGY

Project	Drawing	Date	Drawn by	Rev	Scale	Sheet
7255	201	JUL 21	SJ	B	1:150	A1

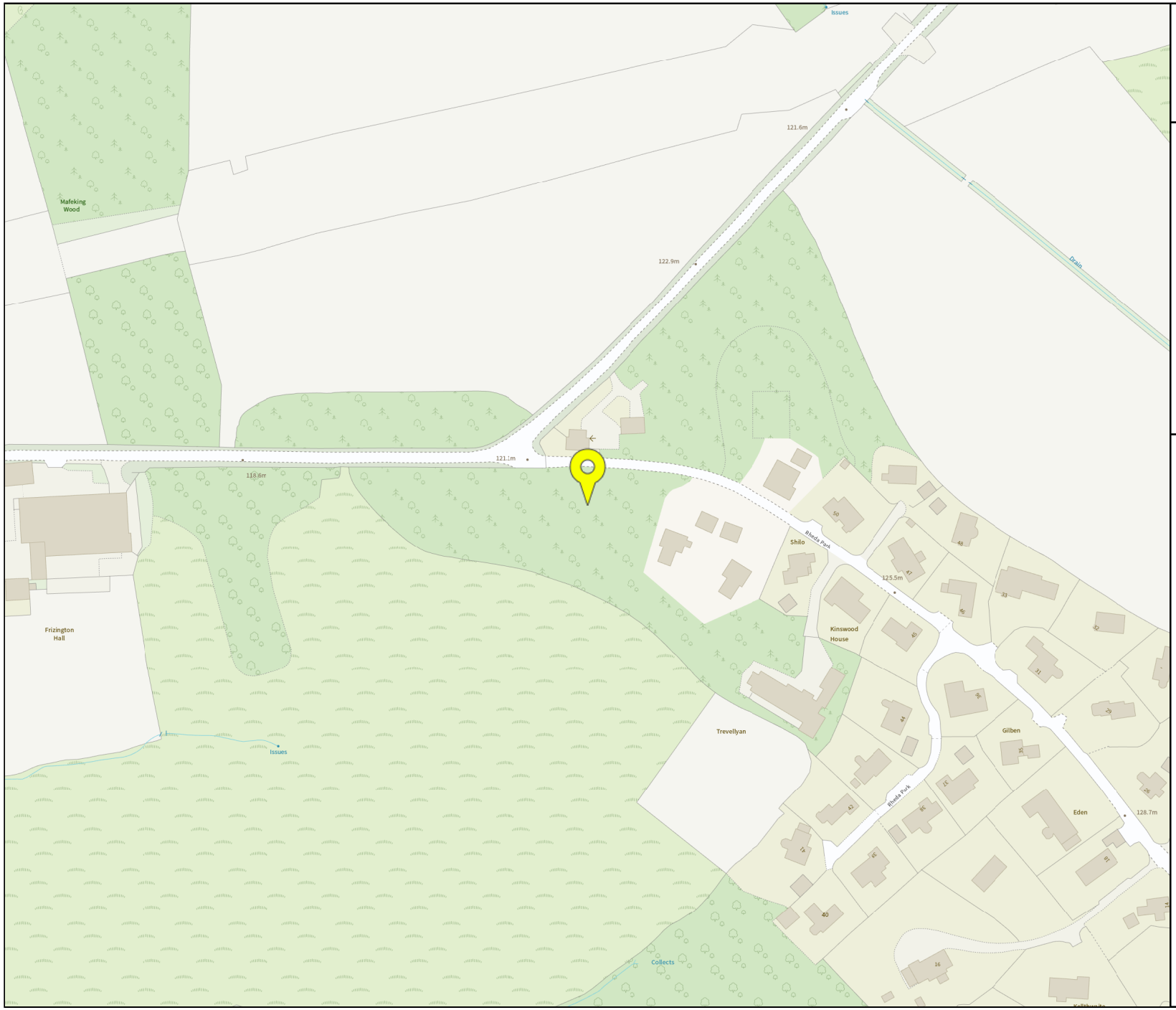
TWEDDELL & SLATER CONSULTING CIVIL & STRUCTURAL ENGINEERS

Tweddell & Slater Ltd
Unit 2, Mereside
Eden Business Park
Penrith, Cumbria, CA11 9FB
Tel 01768 865400

Email mail@tsceltd.com
Web www.tsceltd.com

Tweddell & Slater North East Ltd
20 Market Place
Richmond
North Yorkshire, DL10 4QG
Tel 01748 503162

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



Environment Agency

Flood map for planning

Your reference
Rheda Park

Location (easting/northing)
302117/517067

Scale
1:2500

Created
2 Jul 2021 11:39

- 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

Surface Water Flood Risk

Extent of flooding from surface water

High Medium Low Very low Location you selected

Fluvial Flood Risk

Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

APPENDIX E -
GREENFIELD RUNOFF RATES

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Simon Johnston
Site name:	Plot 3
Site location:	Rheda Park

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:	54.53930° N
Longitude:	3.51429° W
Reference:	1094578524
Date:	Jul 01 2021 12:40

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.2

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):	1315	1315
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):	2.02	2.02
1 in 1 year (l/s):	1.76	1.76
1 in 30 years (l/s):	3.43	3.43
1 in 100 year (l/s):	4.2	4.2
1 in 200 years (l/s):	4.79	4.79

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Simon Johnston
Site name:	Plot 4
Site location:	Rheda Park

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:	54.53932° N
Longitude:	3.51479° W
Reference:	1342948630
Date:	Jul 01 2021 16:48

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.1736

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):	1315	1315
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):	1.75	1.75
1 in 1 year (l/s):	1.52	1.52
1 in 30 years (l/s):	2.98	2.98
1 in 100 year (l/s):	3.65	3.65
1 in 200 years (l/s):	4.15	4.15

APPENDIX F -
ATTENUATION TANK SIZE CALCULATIONS

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)
SW1	0.004	2.00	122.350	1200	0.905
SW2	0.004	2.00	122.350	1200	1.029
SW3	0.003	2.00	122.350	1200	1.164
SW4	0.003	2.00	122.350	1200	1.201
SW5	0.003	2.00	122.350	1200	1.276
SW6			122.350	1200	1.302
SW7	0.003	2.00	122.350	1200	1.297
SW8			122.350	1200	1.349
Tank Inlet			121.900		0.931
Tank Outlet			121.700		0.749
SW9			121.695	1200	0.769
Outfall			121.600	1200	0.703

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	SW1	SW2	12.380	0.600	121.445	121.321	0.124	99.8	150	2.21	50.0
1.001	SW2	SW3	13.500	0.600	121.321	121.186	0.135	100.0	150	2.43	50.0
1.002	SW3	SW5	11.180	0.600	121.186	121.074	0.112	99.8	150	2.61	50.0
2.000	SW4	SW5	7.452	0.600	121.149	121.074	0.075	100.0	150	2.12	50.0
1.003	SW5	SW6	2.579	0.600	121.074	121.048	0.026	99.2	150	2.66	50.0
1.004	SW6	SW8	4.697	0.600	121.048	121.001	0.047	99.9	150	2.74	50.0
3.000	SW7	SW8	5.225	0.600	121.053	121.001	0.052	100.0	150	2.09	50.0
1.005	SW8	Tank Inlet	3.190	0.600	121.001	120.969	0.032	100.0	150	2.79	50.0
1.006	Tank Inlet	Tank Outlet	3.500	0.600	120.969	120.951	0.018	200.0	400	2.82	50.0
1.007	Tank Outlet	SW9	2.500	0.600	120.951	120.926	0.025	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	1.0	0.755	0.879	0.004	0.0	24	0.544
1.001	1.005	17.8	2.0	0.879	1.014	0.008	0.0	34	0.670
1.002	1.006	17.8	2.8	1.014	1.126	0.011	0.0	40	0.734
2.000	1.005	17.8	0.8	1.051	1.126	0.003	0.0	21	0.501
1.003	1.009	17.8	4.3	1.126	1.152	0.017	0.0	50	0.832
1.004	1.005	17.8	4.3	1.152	1.199	0.017	0.0	50	0.828
3.000	1.005	17.8	0.8	1.147	1.199	0.003	0.0	21	0.501
1.005	1.005	17.8	5.1	1.199	0.781	0.020	0.0	55	0.868
1.006	1.902	2282.0	5.1	0.531	0.349	0.020	0.0	7	0.231
1.007	1.005	17.8	5.1	0.599	0.619	0.020	0.0	55	0.868

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)
1.008	SW9	Outfall	2.927	0.600	120.926	120.897	0.029	100.0	150	2.91	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)
1.008	1.005	17.8	5.1	0.619	0.553	0.020	0.0	55	0.868

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)	1.8
Summer CV	1.000	30 year (l/s)	3.4
Winter CV	1.000	100 year (l/s)	4.2
Analysis Speed	Detailed	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	107

Storm Durations

15	30	60	120	180	240	360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	40	0	0
30	40	0	0
100	40	0	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)	0.200	Betterment (%)	0
SAAR (mm)	1315	QBar	2.0
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)	0.200	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.549
CWI	125.788	Runoff Volume (m³)	107

Node SW9 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	120.926	Product Number	CTL-SHE-0076-2000-0350-2000
Design Depth (m)	0.350	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	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)	2.0
Link Length	x	Surcharged Depth	x	30 year (l/s)	2.0
Coordinates	x	Flooding	✓	100 year (l/s)	2.0
Crossings	x	Return Period (years)	30	Discharge Volume	✓
Cover Depth	x	Time to Half Empty	✓	100 year +40% 360 minute (m^3)	107

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 0.020 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 30 year return period

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

No outfalls have a discharge rate greater than 2.0l/s during the 1 year return period

No outfalls have a discharge rate greater than 2.0l/s during the 30 year return period

No outfalls have a discharge rate greater than 2.0l/s during the 100 year return period

No outfalls have a discharge volume greater than 107m³ during the 100 year 360 minute storm

Results for 1 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	9	121.472	0.027	1.3	0.0333	0.0000	OK
15 minute summer	SW2	9	121.360	0.039	2.6	0.0468	0.0000	OK
15 minute summer	SW3	9	121.231	0.045	3.5	0.0531	0.0000	OK
15 minute summer	SW4	9	121.173	0.024	1.0	0.0284	0.0000	OK
15 minute summer	SW5	9	121.138	0.064	5.4	0.0750	0.0000	OK
15 minute summer	SW6	10	121.108	0.060	5.1	0.0675	0.0000	OK
15 minute summer	SW7	9	121.077	0.024	1.0	0.0284	0.0000	OK
15 minute summer	SW8	10	121.060	0.059	5.9	0.0672	0.0000	OK
30 minute summer	Tank Inlet	21	121.037	0.068	4.9	0.0000	0.0000	OK
30 minute summer	Tank Outlet	21	121.037	0.086	4.0	0.0000	0.0000	OK
15 minute summer	SW9	13	121.045	0.119	4.8	0.1346	0.0000	OK
15 minute summer	Outfall	1	120.897	0.000	2.0	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	SW1	1.000	SW2	1.3	0.450	0.073	0.0358	
15 minute summer	SW2	1.001	SW3	2.5	0.636	0.143	0.0541	
15 minute summer	SW3	1.002	SW5	3.4	0.599	0.194	0.0645	
15 minute summer	SW4	2.000	SW5	1.0	0.256	0.056	0.0333	
15 minute summer	SW5	1.003	SW6	5.1	0.751	0.287	0.0176	
15 minute summer	SW6	1.004	SW8	5.0	0.771	0.282	0.0306	
15 minute summer	SW7	3.000	SW8	1.0	0.365	0.056	0.0211	
15 minute summer	SW8	1.005	Tank Inlet	5.9	1.558	0.334	0.0183	
15 minute winter	Tank Inlet	1.006	Tank Outlet	4.3	0.084	0.002	0.6863	
60 minute summer	Tank Outlet	1.007	SW9	5.0	0.472	0.284	0.0282	
15 minute summer	SW9	Hydro-Brake®	Outfall	2.0				2.1

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	9	121.487	0.042	3.1	0.0516	0.0000	OK
15 minute summer	SW2	9	121.384	0.063	6.2	0.0763	0.0000	OK
15 minute summer	SW3	9	121.259	0.073	8.5	0.0866	0.0000	OK
60 minute summer	SW4	42	121.194	0.045	1.4	0.0531	0.0000	OK
60 minute summer	SW5	42	121.194	0.120	7.6	0.1413	0.0000	OK
60 minute summer	SW6	42	121.194	0.146	7.5	0.1647	0.0000	OK
60 minute summer	SW7	43	121.193	0.140	1.4	0.1650	0.0000	OK
60 minute summer	SW8	43	121.193	0.192	8.2	0.2174	0.0000	SURCHARGED
60 minute summer	Tank Inlet	43	121.193	0.224	7.7	0.0000	0.0000	OK
60 minute summer	Tank Outlet	43	121.193	0.242	5.1	0.0000	0.0000	SURCHARGED
60 minute summer	SW9	43	121.193	0.267	3.6	0.3015	0.0000	SURCHARGED
15 minute summer	Outfall	1	120.897	0.000	2.0	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	SW1	1.000	SW2	3.1	0.561	0.174	0.0688	
15 minute summer	SW2	1.001	SW3	6.2	0.792	0.347	0.1051	
15 minute summer	SW3	1.002	SW5	8.4	0.721	0.475	0.1295	
15 minute summer	SW4	2.000	SW5	2.1	0.296	0.117	0.0672	
15 minute summer	SW5	1.003	SW6	12.4	0.888	0.695	0.0360	
15 minute summer	SW6	1.004	SW8	12.1	0.953	0.682	0.0728	
15 minute summer	SW7	3.000	SW8	2.1	0.444	0.118	0.0789	
15 minute summer	SW8	1.005	Tank Inlet	12.9	1.492	0.729	0.0562	
15 minute summer	Tank Inlet	1.006	Tank Outlet	10.7	0.070	0.005	2.0327	
180 minute summer	Tank Outlet	1.007	SW9	5.4	0.432	0.304	0.0440	
30 minute winter	SW9	Hydro-Brake®	Outfall	2.0				6.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	9	121.493	0.048	4.0	0.0588	0.0000	OK
15 minute summer	SW2	9	121.395	0.074	8.0	0.0893	0.0000	OK
60 minute summer	SW3	45	121.278	0.092	6.4	0.1086	0.0000	OK
60 minute summer	SW4	45	121.278	0.128	1.8	0.1517	0.0000	OK
60 minute summer	SW5	45	121.277	0.203	9.8	0.2397	0.0000	SURCHARGED
60 minute summer	SW6	45	121.277	0.229	9.3	0.2589	0.0000	SURCHARGED
60 minute summer	SW7	44	121.276	0.223	1.8	0.2628	0.0000	SURCHARGED
60 minute summer	SW8	45	121.276	0.275	9.5	0.3113	0.0000	SURCHARGED
60 minute summer	Tank Inlet	46	121.276	0.307	8.5	0.0000	0.0000	OK
60 minute summer	Tank Outlet	46	121.276	0.325	6.1	0.0000	0.0000	SURCHARGED
60 minute summer	SW9	46	121.275	0.349	3.8	0.3949	0.0000	SURCHARGED
15 minute summer	Outfall	1	120.897	0.000	2.0	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	SW1	1.000	SW2	4.0	0.596	0.225	0.0837	
15 minute summer	SW2	1.001	SW3	8.0	0.826	0.449	0.1303	
15 minute summer	SW3	1.002	SW5	10.9	0.750	0.616	0.1567	
15 minute summer	SW4	2.000	SW5	2.9	0.305	0.161	0.0965	
15 minute summer	SW5	1.003	SW6	15.2	0.910	0.855	0.0454	
15 minute summer	SW6	1.004	SW8	14.3	0.915	0.803	0.0827	
15 minute summer	SW7	3.000	SW8	2.8	0.494	0.156	0.0920	
15 minute summer	SW8	1.005	Tank Inlet	15.6	1.600	0.879	0.0562	
30 minute summer	Tank Inlet	1.006	Tank Outlet	10.3	0.075	0.005	3.1114	
120 minute winter	Tank Outlet	1.007	SW9	5.7	0.458	0.322	0.0440	
60 minute summer	SW9	Hydro-Brake®	Outfall	2.0				11.4

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)
SW1	0.003	2.00	121.350	1200	0.700
SW2	0.002	2.00	121.350	1200	0.759
SW3	0.002	2.00	121.350	1200	0.810
SW4	0.002	2.00	121.350	1200	0.929
SW5	0.002	2.00	121.350	1200	0.945
SW6	0.002	2.00	121.350	1200	1.026
SW7	0.003	2.00	121.350	1200	1.039
SW8	0.002	2.00	121.350	1200	1.115
SW9	0.002	2.00	121.350	1200	1.286
SW10	0.002	2.00	121.350	1200	1.359
SW11	0.002	2.00	121.350	1200	1.182
SW12	0.002	2.00	121.350	1200	1.907
Tank Inlet			121.350		2.032
Tank Outlet			121.350		2.062
SW13			120.500	1200	1.337
Outfall			120.500	1200	1.500

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	SW1	SW2	5.877	0.600	120.650	120.591	0.059	99.6	150	2.10	50.0
1.001	SW2	SW3	5.100	0.600	120.591	120.540	0.051	100.0	150	2.18	50.0
1.002	SW3	SW4	11.925	0.600	120.540	120.421	0.119	100.2	150	2.38	50.0
1.003	SW4	SW5	1.650	0.600	120.421	120.405	0.016	103.1	150	2.41	50.0
1.004	SW5	SW6	8.128	0.600	120.405	120.324	0.081	100.3	150	2.54	50.0
1.005	SW6	SW12	7.500	0.600	120.324	119.443	0.881	8.5	150	2.58	50.0
2.000	SW7	SW8	7.600	0.600	120.311	120.235	0.076	100.0	150	2.13	50.0
2.001	SW8	SW9	17.158	0.600	120.235	120.064	0.171	100.3	150	2.41	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	1.007	17.8	0.8	0.550	0.609	0.003	0.0	21	0.502
1.001	1.005	17.8	1.3	0.609	0.660	0.005	0.0	27	0.583
1.002	1.004	17.7	1.8	0.660	0.779	0.007	0.0	32	0.642
1.003	0.989	17.5	2.3	0.779	0.795	0.009	0.0	37	0.685
1.004	1.003	17.7	2.8	0.795	0.876	0.011	0.0	40	0.732
1.005	3.474	61.4	3.3	0.876	1.757	0.013	0.0	24	1.865
2.000	1.005	17.8	0.8	0.889	0.965	0.003	0.0	21	0.501
2.001	1.003	17.7	1.3	0.965	1.136	0.005	0.0	27	0.582

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)
2.002	SW9	SW10	7.200	0.600	120.064	119.991	0.073	98.6	150	2.53	50.0
2.003	SW10	SW12	5.483	0.600	119.991	119.443	0.548	10.0	150	2.56	50.0
3.000	SW11	SW12	8.128	0.600	120.168	119.443	0.725	11.2	150	2.04	50.0
1.006	SW12	Tank Inlet	1.250	0.600	119.443	119.318	0.125	10.0	150	2.59	50.0
1.007	Tank Inlet	Tank Outlet	6.000	0.600	119.318	119.288	0.030	200.0	400	2.64	50.0
1.008	Tank Outlet	SW13	1.250	0.600	119.288	119.163	0.125	10.0	150	2.64	50.0
1.009	SW13	Outfall	1.630	0.600	119.163	119.000	0.163	10.0	150	2.65	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)
2.002	1.012	17.9	1.8	1.136	1.209	0.007	0.0	32	0.647
2.003	3.203	56.6	2.3	1.209	1.757	0.009	0.0	20	1.555
3.000	3.026	53.5	0.5	1.032	1.757	0.002	0.0	10	0.939
1.006	3.204	56.6	6.6	1.757	1.882	0.026	0.0	34	2.145
1.007	1.937	3099.8	6.6	1.632	1.662	0.026	0.0	7	0.232
1.008	3.204	56.6	6.6	1.912	1.187	0.026	0.0	34	2.145
1.009	3.204	56.6	6.6	1.187	1.350	0.026	0.0	34	2.145

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)	1.8
Summer CV	1.000	30 year (l/s)	3.4
Winter CV	1.000	100 year (l/s)	4.2
Analysis Speed	Detailed	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	107

Storm Durations

15	30	60	120	180	240	360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	40	0	0
30	40	0	0
100	40	0	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)	0.200	Betterment (%)	0
SAAR (mm)	1315	QBar	2.0
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)	0.200	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.549
CWI	125.788	Runoff Volume (m^3)	107

Node SW13 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	119.163	Product Number	CTL-SHE-0072-1800-0450-1800
Design Depth (m)	0.450	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	1.8	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)	1.8
Link Length	x	Surcharged Depth	x	30 year (l/s)	1.8
Coordinates	x	Flooding	✓	100 year (l/s)	1.8
Crossings	x	Return Period (years)	100	Discharge Volume	✓
Cover Depth	x	Time to Half Empty	✓	100 year +40% 360 minute (m^3)	93

Approval Results

The network has been designed for a 1 in 100 year storm using FSR rainfall
It contains 16 nodes (1 outfall) and 15 links
The total impermeable area is 0.026 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 structures failed to half empty in 1440 minutes during the 100 year return period

No outfalls have a discharge rate greater than 1.8l/s during the 1 year return period

No outfalls have a discharge rate greater than 1.8l/s during the 30 year return period

No outfalls have a discharge rate greater than 1.8l/s during the 100 year return period

No outfalls have a discharge volume greater than 93m³ during the 100 year 360 minute storm

Results for 1 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	9	120.675	0.024	1.0	0.0298	0.0000	OK
15 minute summer	SW2	9	120.623	0.032	1.6	0.0374	0.0000	OK
15 minute summer	SW3	9	120.575	0.035	2.2	0.0412	0.0000	OK
15 minute summer	SW4	9	120.467	0.046	2.7	0.0539	0.0000	OK
15 minute summer	SW5	9	120.451	0.046	3.1	0.0535	0.0000	OK
15 minute summer	SW6	10	120.348	0.024	3.6	0.0284	0.0000	OK
15 minute summer	SW7	9	120.335	0.024	1.0	0.0288	0.0000	OK
15 minute summer	SW8	9	120.265	0.030	1.6	0.0348	0.0000	OK
15 minute summer	SW9	9	120.101	0.037	2.1	0.0427	0.0000	OK
15 minute summer	SW10	9	120.013	0.022	2.6	0.0252	0.0000	OK
15 minute summer	SW11	9	120.179	0.011	0.6	0.0131	0.0000	OK
15 minute summer	SW12	9	119.487	0.043	7.2	0.0501	0.0000	OK
60 minute summer	Tank Inlet	39	119.360	0.042	6.9	0.0000	0.0000	OK
30 minute summer	Tank Outlet	22	119.358	0.070	14.3	0.0000	0.0000	OK
60 minute summer	SW13	41	119.394	0.231	10.8	0.2607	0.0000	SURCHARGED
15 minute summer	Outfall	1	119.000	0.000	1.8	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	SW1	1.000	SW2	1.0	0.440	0.056	0.0134	
15 minute summer	SW2	1.001	SW3	1.6	0.544	0.089	0.0148	
15 minute summer	SW3	1.002	SW4	2.1	0.553	0.119	0.0457	
15 minute summer	SW4	1.003	SW5	2.5	0.557	0.145	0.0075	
15 minute summer	SW5	1.004	SW6	3.0	0.971	0.170	0.0259	
15 minute summer	SW6	1.005	SW12	3.5	1.215	0.057	0.0228	
15 minute summer	SW7	2.000	SW8	1.0	0.464	0.056	0.0164	
15 minute summer	SW8	2.001	SW9	1.5	0.530	0.087	0.0499	
15 minute summer	SW9	2.002	SW10	2.0	0.831	0.112	0.0177	
15 minute summer	SW10	2.003	SW12	2.5	0.902	0.045	0.0159	
15 minute summer	SW11	3.000	SW12	0.6	0.310	0.011	0.0196	
15 minute summer	SW12	1.006	Tank Inlet	7.0	3.589	0.124	0.0032	
15 minute summer	Tank Inlet	1.007	Tank Outlet	9.6	0.091	0.003	1.1516	
30 minute winter	Tank Outlet	1.008	SW13	10.8	0.836	0.191	0.0159	
60 minute summer	SW13	Hydro-Brake®	Outfall	1.8				4.5

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	9	120.688	0.038	2.3	0.0457	0.0000	OK
15 minute summer	SW2	9	120.643	0.052	3.9	0.0620	0.0000	OK
15 minute summer	SW3	9	120.598	0.058	5.5	0.0681	0.0000	OK
15 minute summer	SW4	9	120.505	0.084	7.1	0.0984	0.0000	OK
15 minute summer	SW5	9	120.484	0.079	8.5	0.0931	0.0000	OK
15 minute summer	SW6	9	120.365	0.041	9.9	0.0475	0.0000	OK
15 minute summer	SW7	9	120.349	0.038	2.3	0.0447	0.0000	OK
15 minute summer	SW8	9	120.283	0.048	3.9	0.0556	0.0000	OK
15 minute summer	SW9	9	120.125	0.061	5.5	0.0713	0.0000	OK
15 minute summer	SW10	9	120.027	0.035	7.0	0.0411	0.0000	OK
15 minute summer	SW11	9	120.186	0.018	1.6	0.0209	0.0000	OK
60 minute winter	SW12	48	119.532	0.089	7.8	0.1023	0.0000	OK
60 minute winter	Tank Inlet	51	119.524	0.206	11.5	0.0000	0.0000	OK
60 minute winter	Tank Outlet	51	119.525	0.237	11.8	0.0000	0.0000	SURCHARGED
60 minute winter	SW13	50	119.525	0.362	11.0	0.4098	0.0000	SURCHARGED
15 minute summer	Outfall	1	119.000	0.000	1.8	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	SW1	1.000	SW2	2.3	0.521	0.130	0.0262	
15 minute summer	SW2	1.001	SW3	3.9	0.667	0.220	0.0299	
15 minute summer	SW3	1.002	SW4	5.5	0.675	0.311	0.0976	
15 minute summer	SW4	1.003	SW5	6.9	0.704	0.395	0.0162	
15 minute summer	SW5	1.004	SW6	8.3	1.265	0.469	0.0540	
15 minute summer	SW6	1.005	SW12	9.8	1.593	0.160	0.0467	
15 minute summer	SW7	2.000	SW8	2.3	0.560	0.130	0.0313	
15 minute summer	SW8	2.001	SW9	3.9	0.673	0.219	0.0993	
15 minute summer	SW9	2.002	SW10	5.4	1.093	0.300	0.0358	
15 minute summer	SW10	2.003	SW12	6.9	1.195	0.122	0.0323	
15 minute summer	SW11	3.000	SW12	1.6	0.405	0.030	0.0398	
15 minute summer	SW12	1.006	Tank Inlet	19.6	3.656	0.346	0.0134	
15 minute winter	Tank Inlet	1.007	Tank Outlet	20.6	0.089	0.007	4.2022	
60 minute winter	Tank Outlet	1.008	SW13	11.0	0.826	0.195	0.0220	
15 minute winter	SW13	Hydro-Brake®	Outfall	1.8				6.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW1	9	120.694	0.044	3.0	0.0530	0.0000	OK
15 minute summer	SW2	9	120.652	0.061	5.0	0.0719	0.0000	OK
15 minute summer	SW3	9	120.606	0.066	7.0	0.0780	0.0000	OK
15 minute summer	SW4	9	120.520	0.099	9.0	0.1157	0.0000	OK
15 minute summer	SW5	9	120.497	0.092	10.8	0.1076	0.0000	OK
15 minute summer	SW6	9	120.370	0.046	12.6	0.0538	0.0000	OK
15 minute summer	SW7	9	120.355	0.044	3.0	0.0518	0.0000	OK
15 minute summer	SW8	9	120.290	0.055	5.0	0.0639	0.0000	OK
15 minute summer	SW9	9	120.134	0.070	7.0	0.0818	0.0000	OK
15 minute summer	SW10	9	120.031	0.040	8.9	0.0465	0.0000	OK
15 minute summer	SW11	9	120.188	0.020	2.0	0.0232	0.0000	OK
120 minute summer	SW12	84	119.633	0.190	10.2	0.2189	0.0000	SURCHARGED
120 minute summer	Tank Inlet	84	119.633	0.315	10.4	0.0000	0.0000	OK
120 minute summer	Tank Outlet	84	119.633	0.345	15.8	0.0000	0.0000	SURCHARGED
120 minute summer	SW13	84	119.633	0.470	5.5	0.5310	0.0000	SURCHARGED
15 minute summer	Outfall	1	119.000	0.000	1.8	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	SW1	1.000	SW2	3.0	0.553	0.169	0.0321	
15 minute summer	SW2	1.001	SW3	5.0	0.708	0.282	0.0361	
15 minute summer	SW3	1.002	SW4	7.0	0.711	0.397	0.1177	
15 minute summer	SW4	1.003	SW5	8.8	0.748	0.504	0.0194	
15 minute summer	SW5	1.004	SW6	10.6	1.347	0.600	0.0645	
15 minute summer	SW6	1.005	SW12	12.5	1.653	0.204	0.0571	
15 minute summer	SW7	2.000	SW8	3.0	0.598	0.169	0.0382	
15 minute summer	SW8	2.001	SW9	5.0	0.719	0.282	0.1195	
15 minute summer	SW9	2.002	SW10	6.9	1.171	0.385	0.0428	
15 minute summer	SW10	2.003	SW12	8.8	1.238	0.156	0.0396	
15 minute summer	SW11	3.000	SW12	2.0	0.418	0.037	0.0490	
15 minute summer	SW12	1.006	Tank Inlet	24.7	3.837	0.436	0.0173	
30 minute summer	Tank Inlet	1.007	Tank Outlet	19.7	0.081	0.006	6.9671	
15 minute summer	Tank Outlet	1.008	SW13	12.0	1.040	0.212	0.0220	
120 minute summer	SW13	Hydro-Brake®	Outfall	1.8				19.5