SURFACE WATER DRAINAGE SCHEME

for

RIBBLE VALLEY VIEW LODGE PARK

PROPOSED HOLIDAY LODGES

at

RIBBLE VALLEY VIEW LODGE PARK

OLD LANGHO ROAD, LANGHO, BB6 8AW

MAY 2022

CONTENTS

1. INTRODUCTION

1.1 This surface water drainage scheme has been produced on behalf of Ribble Valley View Lodge Park to discharge Condition 13 of the planning approval from Ribble Valley Borough Council (Reference 3/2021/0335) for the extension of the existing holiday lodge park to provide the siting of 19 additional holiday lodges at Ribble Valley View Lodge Park, Old Langho Road, Langho, BB6 8AW. A location plan is included within Appendix A.

1.2 Condition 13 states the following:

No development shall commence until a final, detailed surface water sustainable drainage scheme for the site has been submitted to, and approved in writing by, the local planning authority.

The detailed sustainable drainage scheme shall be based upon the site-specific flood risk assessment submitted and the sustainable drainage principles set out in the National Planning Policy Framework, Planning Practice Guidance and Defra Technical Standards for Sustainable Drainage Systems. No surface water shall be allowed to discharge into the public foul sewer(s), either directly or indirectly. The detailed sustainable drainage scheme shall include, as a minimum:

a) Final sustainable drainage plans, appropriately labelled to include:
   i) A final surface water drainage layout plan showing all pipe and structure references, dimensions and design levels;
   ii) A plan identifying the areas contributing to the surface water drainage network, including surface water flows from outside the curtilage as necessary;
   iii) Details of all sustainable drainage components, including landscape drawings showing topography and slope gradient as appropriate;
   iv) Flood water exceedance routes in accordance with Defra Technical Standards for Sustainable Drainage Systems;
   v) Finished Floor Levels (FFL) in AOD with adjacent ground levels for all sides of each building; development boundary; and

vi) *Measures taken to manage the quality of the surface water runoff to prevent pollution, protect groundwater and surface waters, and deliver suitably clean water to sustainable drainage components.*

b) *A full set of sustainable drainage flow calculations for the surface water drainage network. The calculations must show the full network design criteria, pipeline schedules and simulation outputs for the 1 in 1 year, 1 in 30 year and 1 in 1000 year return period, plus an additional 40% allowance for climate change and an additional 10% allowance for urban creep. Surface water run-off must not exceed the existing pre-development surface water runoff rates and volumes for the corresponding rainfall intensity.*

The scheme shall be implemented in accordance with the approved details prior to first occupation of any of the approved dwellings.

1.3 This surface water drainage scheme is to discharge Condition 13 of the planning approval. It describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed scheme for the provision of new surface water drainage to serve the proposed development.

2. BASE INFORMATION

Existing site

2.1 The proposal relates to land (approx. total area 1.9 hectares) at Ribble Valley View Holiday Lodge Park that lies off Old Langho Road, Langho, BB6 8AW.

2.2 The site is located on the west side of Brockhall Village, separated by an area of woodland. At the front of the site to the south is the Black Bull, a public house and restaurant that lies on Old Langho Road. To the north and west of the site there are open fields. The River Ribble lies approx. 1.3 km to the north.

2.3 The site itself is an established holiday lodge site that has 30 lodges already on it. The site has access to the side of the Black Bull to the front. The lodges are arranged around a central spine road and have individual parking allocated to them. The lodges are all of the 'timber' log style and have external balcony areas.

2.4 The Dinckley Brook lies approx. 70m to the northwest of the site and flows to the north to discharge into the River Ribble.

2.5 The existing site comprises grassland.

2.6 The site has a general fall towards the northern boundary of the site and beyond to the Dinckley Brook.

Site geology

2.7 The online Soilscapes viewer has identified that the geology encountered will be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage. This has been confirmed when carrying out work within the established site, the nature of the soils found comprising clays.

2.8 Based upon the ground conditions identified, infiltration is unlikely to provide a viable drainage solution for surface water runoff generated by the site. Infiltration tests have therefore not been carried out.

Understanding of existing drainage local to the site

2.9 There are no public sewers within the development site. The nearest public sewer is located at Old Langho Road.

2.10 The Dinckley Brook lies approx. 70m to the northwest of the site and flows to the north to discharge into the River Ribble.

2.11 A private drainage system collects surface water from the existing roofs and hardstanding areas within the established site. The surface water from each lodge is attenuated within a gravel area positioned under each individual lodge and a pipe overflow takes surface water through a reed bed in an adjacent area of land prior to a discharge being made into the Dinckley Brook.

2.12 Foul water from the existing site is collected by a piped system into an existing pumping station that pumps foul water to a manhole that lies at the highest point of the existing site. The foul water then drains by gravity to the public sewer that lies at Old Langho Road.

Proposed development

2.13 It is proposed that the development will comprise 19 additional holiday lodges. The site layout plan is shown on the approved drawing RS1108-901 P04.

2.14 Vehicle access into the developed site will be from the existing site access from Old Langho Road.

3. PROPOSED SURFACE WATER DRAINAGE SCHEME

3.1 In accordance with the National Standards for Sustainable Drainage, the surface water drainage scheme should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):

(i) a controlled discharge to a local waterbody or watercourse, or

(ii) a controlled discharge into the public sewer network (depending on availability and capacity).

3.2 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.

3.3 The online Soilscapes viewer has identified that the geology encountered will be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage. This has been confirmed when carrying out work within the established site, the nature of the soils found comprising clays. As such, based upon the ground conditions identified, infiltration of surface water back into the ground is not a viable drainage solution for surface water runoff generated by the site.

3.4 The Dinckley Brook lies approx. 70m to the northwest of the site and flows to the north to discharge into the River Ribble.

3.5 A private drainage system collects surface water from the existing roofs and hardstanding areas within the established site. The surface water from each lodge is attenuated within a gravel area positioned under each individual lodge and a pipe overflow takes surface water through a reed bed in an adjacent area of land prior to a discharge being made into the Dinckley Brook. Essentially there is a Greenfield runoff into the brook.

3.6 It is intended that surface water runoff from the proposed lodges will be dealt with in the same way as the existing established site and a discharge also made into the Dinckley Brook to the north of the development site.

3.7 An attenuation storage area comprising an area of gravel will be provided under each lodge to store 12m^3 surface water runoff that is sized to accommodate surface water runoff from each lodge and associated car parking area generated by the 100 year plus 40% added for climate change event. An overflow from each attenuation storage area will be provided to discharge into a drainage run laid alongside.

3.8 Surface water runoff from the internal access routes will be collected by French drains laid alongside. The French drains will provide attenuation storage for surface water runoff generated by the 100 year plus 40% added for climate change event.

3.9 Due to the size of the area of the site being used for development (approx. one hectare), surface water runoff will be restricted to 5 l/s, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 40% on stored volumes to be attenuated prior to discharge into the Dinckley Brook that lies to the north of the development site. The additional 40% is to allow for climate change and has been included in the surface water volume.

3.10 A surface water drainage design has been carried out for the proposed development for all rainfall events up to the 100 year critical rain storm plus 40% included for climate change on stored volumes. The surface water drainage design is included within Appendix B. Water quality control will be provided by the area of gravel under each lodge and the French drains laid alongside the internal access routes.

3.11 The exceedance route is to the north into the Dinckley Brook.

3.12 Surface water within any non-drained areas of the site such as public open spaces, soft landscaping, etc. will be allowed to infiltrate into the upper strata and be stored and will be either taken up by plants or evaporated. There will, potentially, be periods where the upper strata may become saturated and surface ponding may occur but this will be shallow in depth and will disappear over a short period of time.

4. SUMMARY AND CONCLUSIONS

4.1 This surface water drainage scheme has been produced on behalf of Ribble Valley View Lodge Park to discharge Condition 13 of the planning approval from Ribble Valley Borough Council (Reference 3/2021/0335) for the extension of the existing holiday lodge park to provide the siting of 19 additional holiday lodges at Ribble Valley View Lodge Park, Old Langho Road, Langho, BB6 8AW.

4.2 Based upon the ground conditions identified within the site, infiltration of surface water back into the ground is not a viable drainage solution for surface water runoff generated by the site.

4.3 Surface water runoff will be restricted to 5 l/s, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 40% on stored volumes to be attenuated prior to discharge into the Dinckley Brook that lies to the north of the development site.

4.4 Attenuation storage will be provided by the area of gravel under each lodge and the French drains laid alongside the internal access routes.

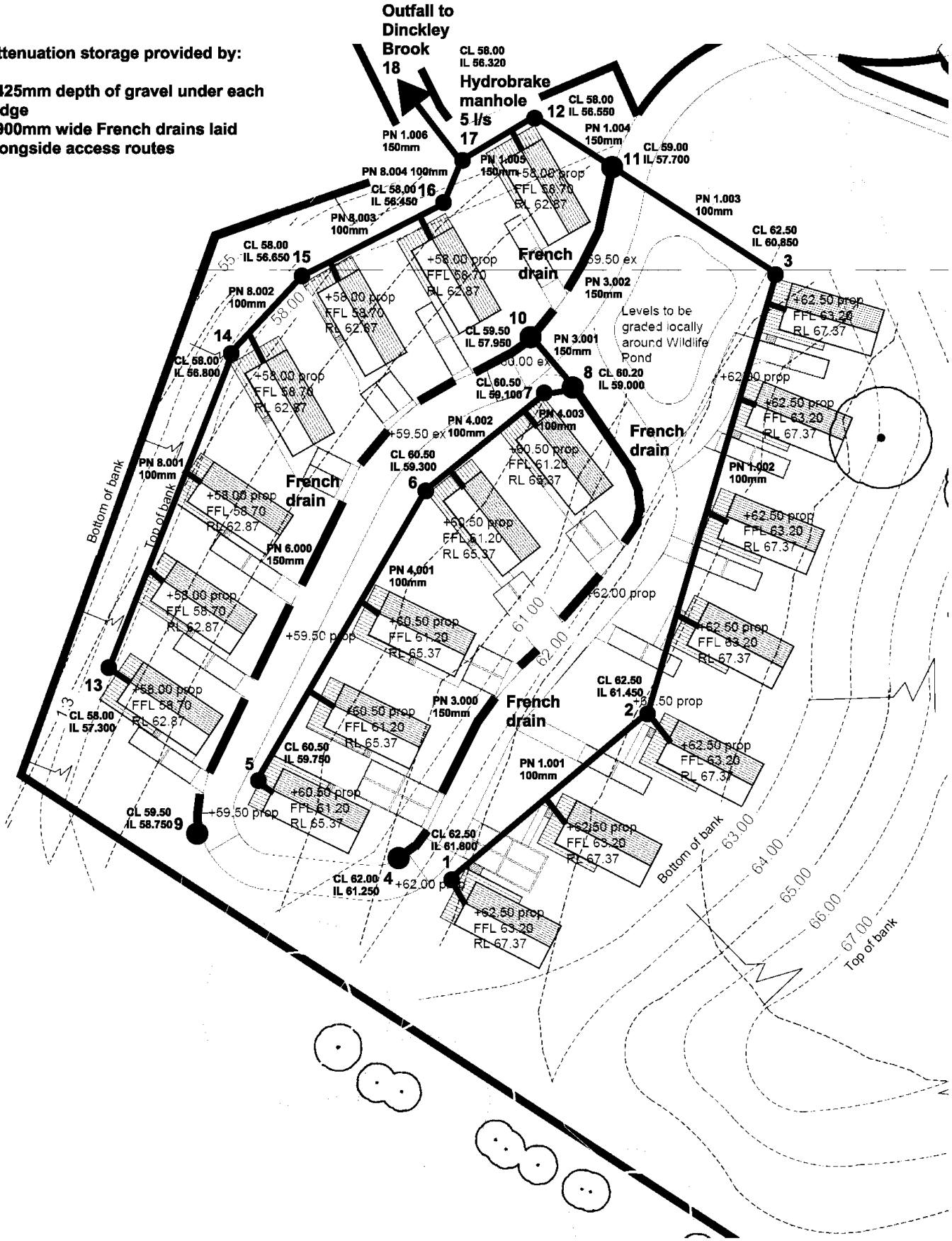
APPENDIX A

LOCATION PLAN

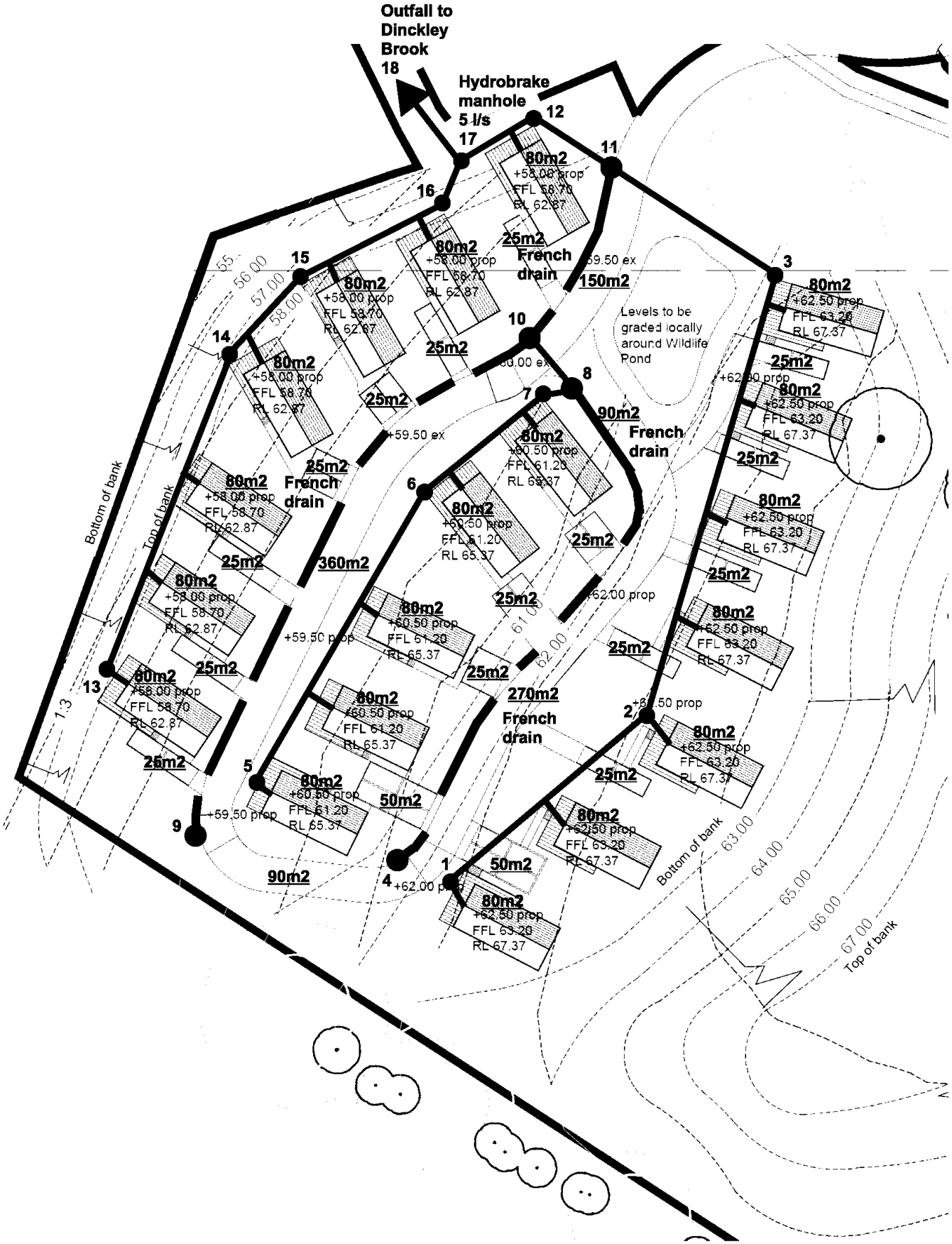
APPENDIX B

Attenuation storage provided by:

- 425mm depth of gravel under each lodge
- 900mm wide French drains laid alongside access routes



PROPOSED SURFACE WATER DRAINAGE LAYOUT



SURFACE WATER DRAINAGE AREAS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.900	Minimum Backdrop Height (m)	2.000
Ratio-R	0.300	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1a	0.021	5.00	62.500	50	0.100
1			62.500	450	0.700
2a	0.053	5.00	62.500	50	0.100
2			62.500	450	1.050
3			62.500	450	1.650
4	0.027	5.00	62.000	1200	0.750
5a	0.032	5.00	60.500	50	0.100
5			60.500	450	0.750
6a	0.021	5.00	60.500	50	0.100
6			60.500	450	1.200
7			60.500	450	1.400
8	0.009	5.00	60.200	1200	1.200
9	0.045	5.00	59.500	1200	0.750
10	0.015	5.00	59.500	1200	1.550
11			59.000	1200	1.300
12a	0.011	5.00	58.000	50	0.100
12			58.000	450	1.450
13a	0.032	5.00	58.000	50	0.100
13			58.000	450	0.700
14a	0.011	5.00	58.000	50	0.100
14			58.000	450	1.200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
15a	0.021	5.00	58.000	50	0.100
15			58.000	450	1.350
16			58.000	450	1.550
17			58.000	1200	1.680
18			55.000	1200	1.000

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	1a	1	2.000	0.600	62.400	62.375	0.025	80.0	50	5.06	57.0
1.001	1	2	35.000	0.600	61.800	61.450	0.350	100.0	100	5.82	53.9
2.000	2a	2	2.000	0.600	62.400	62.375	0.025	80.0	50	5.06	57.0
1.002	2	3	60.000	0.600	61.450	60.850	0.600	100.0	100	7.12	49.5
1.003	3	11	25.000	0.600	60.850	57.750	3.100	8.1	100	7.27	49.1
3.000	4	8	80.000	0.600	61.250	59.000	2.250	35.6	150	5.79	54.1
4.000	5a	5	2.000	0.600	60.400	60.375	0.025	80.0	50	5.06	57.0
4.001	5	6	45.000	0.600	59.750	59.300	0.450	100.0	100	6.04	53.1
5.000	6a	6	2.000	0.600	60.400	60.375	0.025	80.0	50	5.06	57.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.539	1.1	3.2	0.050	0.075	0.021	0.0
1.001	0.769	6.0	3.1	0.600	0.950	0.021	0.0
2.000	0.539	1.1	8.2	0.050	0.075	0.053	0.0
1.002	0.769	6.0	9.9	0.950	1.550	0.074	0.0
1.003	2.739	21.5	9.8	1.550	1.150	0.074	0.0
3.000	1.693	29.9	4.0	0.600	1.050	0.027	0.0
4.000	0.539	1.1	4.9	0.050	0.075	0.032	0.0
4.001	0.769	6.0	4.6	0.650	1.100	0.032	0.0
5.000	0.539	1.1	3.2	0.050	0.075	0.021	0.0

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)
4.002	6	7	20.000	0.600	59.300	59.100	0.200	100.0	100	6.47	51.6
4.003	7	8	5.000	0.600	59.100	59.050	0.050	100.0	100	6.58	51.2
3.001	8	10	8.000	0.600	59.000	57.950	1.050	7.6	150	6.62	51.1
6.000	9	10	80.000	0.600	58.750	57.950	0.800	100.0	150	6.33	52.1
3.002	10	11	25.000	0.600	57.950	57.700	0.250	100.0	150	7.03	49.8
1.004	11	12	10.000	0.600	57.700	56.550	1.150	8.7	150	7.32	48.9
7.000	12a	12	2.000	0.600	57.900	57.875	0.025	80.0	50	5.06	57.0
1.005	12	17	8.000	0.600	56.550	56.320	0.230	34.8	150	7.40	48.7
8.000	13a	13	2.000	0.600	57.900	57.875	0.025	80.0	50	5.06	57.0
8.001	13	14	50.000	0.600	57.300	56.800	0.500	100.0	100	6.15	52.7
9.000	14a	14	2.000	0.600	57.900	57.875	0.025	80.0	50	5.06	57.0
8.002	14	15	15.000	0.600	56.800	56.650	0.150	100.0	100	6.47	51.6
10.000	15a	15	2.000	0.600	57.900	57.875	0.025	80.0	50	5.06	57.0
8.003	15	16	20.000	0.600	56.650	56.450	0.200	100.0	100	6.90	50.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
4.002	0.769	6.0	7.4	1.100	1.300	0.053	0.0
4.003	0.769	6.0	7.4	1.300	1.050	0.053	0.0
3.001	3.673	64.9	12.3	1.050	1.400	0.089	0.0
6.000	1.005	17.8	6.4	0.600	1.400	0.045	0.0
3.002	1.005	17.8	20.1	1.400	1.150	0.149	0.0
1.004	3.437	60.7	29.6	1.150	1.300	0.223	0.0
7.000	0.539	1.1	1.7	0.050	0.075	0.011	0.0
1.005	1.712	30.3	30.9	1.300	1.530	0.234	0.0
8.000	0.539	1.1	4.9	0.050	0.075	0.032	0.0
8.001	0.769	6.0	4.6	0.600	1.100	0.032	0.0
9.000	0.539	1.1	1.7	0.050	0.075	0.011	0.0
8.002	0.769	6.0	6.0	1.100	1.250	0.043	0.0
10.000	0.539	1.1	3.2	0.050	0.075	0.021	0.0
8.003	0.769	6.0	8.7	1.250	1.450	0.064	0.0

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)
8.004	16	17	8.000	0.600	56.450	56.370	0.080	100.0	100	7.08	49.7
1.006	17	18	50.000	0.600	56.320	54.000	2.320	21.6	150	7.78	47.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
8.004	0.769	6.0	8.6	1.450	1.530	0.064	0.0
1.006	2.179	38.5	38.4	1.530	0.850	0.298	0.0

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	18.900	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.300	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15 30 60 120 180 240 360 480 600 720 960 1440

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

Node 11 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	57.700	Product Number	CTL-SHE-0101-5000-1300-5000
Design Depth (m)	1.300	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 8 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	3.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	59.000	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	0	Diameter (mm)	900

Node 10 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	6.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	57.950	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	93	Diameter (mm)	900

Node 11 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Link	3.002
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	57.700	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	110	Diameter (mm)	900

Node 1a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	61.975
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	160.0	0.0

Node 2a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	61.975
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	400.0	0.0

Node 5a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	59.975
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	240.0	0.0

Node 6a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	59.975
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	160.0	0.0

Node 12a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	57.475
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	80.0	0.0

Node 13a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	57.475
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	240.0	0.0

Node 14a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	57.475
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	80.0	0.0

Node 15a Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00001	Safety Factor	2.0	Invert Level (m)	57.475
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.35	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)
0.000	160.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1a	1110	62.084	-0.316	0.2	6.1200	0.0000	OK
15 minute summer	1	1	61.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	2a	1410	62.101	-0.299	0.5	17.6399	0.0000	OK
15 minute summer	2	1	61.450	0.000	0.0	0.0000	0.0000	OK
15 minute summer	3	1	60.850	0.000	0.0	0.0000	0.0000	OK
15 minute winter	4	11	61.285	0.035	3.3	0.0643	0.0000	OK
1440 minute winter	5a	1350	60.112	-0.288	0.3	11.5199	0.0000	OK
15 minute summer	5	1	59.750	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	6a	1110	60.084	-0.316	0.2	6.1200	0.0000	OK
15 minute summer	6	1	59.300	0.000	0.0	0.0000	0.0000	OK
15 minute summer	7	1	59.100	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	1a	1.000	1	0.0	0.000	0.000	0.0000	
1440 minute winter	1a	Infiltration		0.0				
15 minute summer	1	1.001	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	2.000	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	Infiltration		0.0				
15 minute summer	2	1.002	3	0.0	0.000	0.000	0.0000	
15 minute summer	3	1.003	11	0.0	0.000	0.000	0.0978	
15 minute winter	4	3.000	8	3.2	1.249	0.106	0.2046	
1440 minute winter	5a	4.000	5	0.0	0.000	0.000	0.0000	
1440 minute winter	5a	Infiltration		0.0				
15 minute summer	5	4.001	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	5.000	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	Infiltration		0.0				
15 minute summer	6	4.002	7	0.0	0.000	0.000	0.0000	
15 minute summer	7	4.003	8	0.0	0.000	0.000	0.0000	

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	8	11	59.026	0.026	4.2	0.0367	0.0000	OK
15 minute winter	9	11	58.805	0.055	5.4	0.1288	0.0000	OK
15 minute winter	10	12	58.033	0.083	11.1	0.2030	0.0000	OK
30 minute winter	11	24	58.002	0.302	9.1	1.6357	0.0000	SURCHARGED
1440 minute winter	12a	990	57.578	-0.322	0.1	2.8800	0.0000	OK
30 minute winter	12	24	56.594	0.044	4.9	0.0070	0.0000	OK
1440 minute winter	13a	1350	57.612	-0.288	0.3	11.5199	0.0000	OK
15 minute summer	13	1	57.300	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	14a	990	57.578	-0.322	0.1	2.8800	0.0000	OK
15 minute summer	14	1	56.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	15a	1110	57.584	-0.316	0.2	6.1200	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	8	3.001	10	4.2	0.769	0.065	0.0479	
15 minute winter	9	6.000	10	5.2	0.677	0.291	0.6331	
15 minute winter	10	3.002	11	10.5	0.677	0.593	0.3446	
30 minute winter	11	1.004	12	4.9	1.494	0.081	0.0332	
1440 minute winter	12a	7.000	12	0.0	0.000	0.000	0.0000	
1440 minute winter	12a	Infiltration		0.0				
30 minute winter	12	1.005	17	4.9	1.297	0.162	0.0303	
1440 minute winter	13a	8.000	13	0.0	0.000	0.000	0.0000	
1440 minute winter	13a	Infiltration		0.0				
15 minute summer	13	8.001	14	0.0	0.000	0.000	0.0000	
1440 minute winter	14a	9.000	14	0.0	0.000	0.000	0.0000	
1440 minute winter	14a	Infiltration		0.0				
15 minute summer	14	8.002	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	10.000	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	Infiltration		0.0				

Results for 1 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	15	1	56.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	16	1	56.450	0.000	0.0	0.0000	0.0000	OK
30 minute winter	17	25	56.356	0.036	4.9	0.0413	0.0000	OK
30 minute winter	18	25	54.036	0.036	4.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	15	8.003	16	0.0	0.000	0.000	0.0000	
15 minute summer	16	8.004	17	0.0	0.000	0.000	0.0000	
30 minute winter	17	1.006	18	4.9	1.491	0.127	0.1644	7.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1a	1410	62.232	-0.168	0.4	14.3999	0.0000	OK
15 minute summer	1	1	61.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	2a	1440	62.219	-0.181	1.0	34.1998	0.0000	OK
15 minute summer	2	1	61.450	0.000	0.0	0.0000	0.0000	OK
15 minute summer	3	1	60.850	0.000	0.0	0.0000	0.0000	OK
15 minute winter	4	10	61.305	0.055	8.0	0.1022	0.0000	OK
1440 minute winter	5a	1440	60.219	-0.181	0.6	20.5199	0.0000	OK
15 minute summer	5	1	59.750	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	6a	1410	60.232	-0.168	0.4	14.3999	0.0000	OK
15 minute summer	6	1	59.300	0.000	0.0	0.0000	0.0000	OK
15 minute summer	7	1	59.100	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	1a	1.000	1	0.0	0.000	0.000	0.0000	
1440 minute winter	1a	Infiltration		0.0				
15 minute summer	1	1.001	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	2.000	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	Infiltration		0.0				
15 minute summer	2	1.002	3	0.0	0.000	0.000	0.0000	
15 minute summer	3	1.003	11	0.0	0.000	0.000	0.0978	
15 minute winter	4	3.000	8	7.7	1.604	0.258	0.3872	
1440 minute winter	5a	4.000	5	0.0	0.000	0.000	0.0000	
1440 minute winter	5a	Infiltration		0.0				
15 minute summer	5	4.001	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	5.000	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	Infiltration		0.0				
15 minute summer	6	4.002	7	0.0	0.000	0.000	0.0000	
15 minute summer	7	4.003	8	0.0	0.000	0.000	0.0000	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	8	11	59.040	0.040	10.4	0.0600	0.0000	OK
15 minute winter	9	11	58.844	0.094	13.3	0.2187	0.0000	OK
60 minute winter	10	47	58.395	0.445	16.0	3.5757	0.0000	SURCHARGED
60 minute winter	11	48	58.374	0.674	9.7	4.9263	0.0000	SURCHARGED
1440 minute winter	12a	1110	57.694	-0.206	0.2	6.1200	0.0000	OK
15 minute winter	12	12	56.594	0.044	5.0	0.0070	0.0000	OK
1440 minute winter	13a	1440	57.719	-0.181	0.6	20.5199	0.0000	OK
15 minute summer	13	1	57.300	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	14a	1110	57.694	-0.206	0.2	6.1200	0.0000	OK
15 minute summer	14	1	56.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	15a	1410	57.732	-0.168	0.4	14.3999	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	8	3.001	10	10.3	0.905	0.159	0.0857	
15 minute winter	9	6.000	10	12.8	0.809	0.720	1.1677	
60 minute winter	10	3.002	11	9.7	0.630	0.548	0.4401	
60 minute winter	11	1.004	12	5.0	1.502	0.082	0.0337	
1440 minute winter	12a	7.000	12	0.0	0.000	0.000	0.0000	
1440 minute winter	12a	Infiltration		0.0				
15 minute winter	12	1.005	17	5.0	1.304	0.165	0.0307	
1440 minute winter	13a	8.000	13	0.0	0.000	0.000	0.0000	
1440 minute winter	13a	Infiltration		0.0				
15 minute summer	13	8.001	14	0.0	0.000	0.000	0.0000	
1440 minute winter	14a	9.000	14	0.0	0.000	0.000	0.0000	
1440 minute winter	14a	Infiltration		0.0				
15 minute summer	14	8.002	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	10.000	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	Infiltration		0.0				

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	15	1	56.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	16	1	56.450	0.000	0.0	0.0000	0.0000	OK
240 minute summer	17	152	56.357	0.037	5.0	0.0417	0.0000	OK
240 minute summer	18	152	54.037	0.037	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	15	8.003	16	0.0	0.000	0.000	0.0000	
15 minute summer	16	8.004	17	0.0	0.000	0.000	0.0000	
240 minute summer	17	1.006	18	5.0	1.500	0.130	0.1668	32.9

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1a	1410	62.284	-0.116	0.5	17.2799	0.0000	OK
15 minute summer	1	1	61.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	2a	1440	62.271	-0.129	1.2	41.3998	0.0000	OK
15 minute summer	2	1	61.450	0.000	0.0	0.0000	0.0000	OK
15 minute summer	3	1	60.850	0.000	0.0	0.0000	0.0000	OK
15 minute winter	4	10	61.314	0.064	10.3	0.1177	0.0000	OK
1440 minute winter	5a	1440	60.271	-0.129	0.7	24.8399	0.0000	OK
15 minute summer	5	1	59.750	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	6a	1410	60.284	-0.116	0.5	17.2799	0.0000	OK
15 minute summer	6	1	59.300	0.000	0.0	0.0000	0.0000	OK
15 minute summer	7	1	59.100	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	1a	1.000	1	0.0	0.000	0.000	0.0000	
1440 minute winter	1a	Infiltration		0.0				
15 minute summer	1	1.001	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	2.000	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	Infiltration		0.0				
15 minute summer	2	1.002	3	0.0	0.000	0.000	0.0000	
15 minute summer	3	1.003	11	0.0	0.000	0.000	0.0978	
15 minute winter	4	3.000	8	10.0	1.720	0.334	0.4664	
1440 minute winter	5a	4.000	5	0.0	0.000	0.000	0.0000	
1440 minute winter	5a	Infiltration		0.0				
15 minute summer	5	4.001	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	5.000	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	Infiltration		0.0				
15 minute summer	6	4.002	7	0.0	0.000	0.000	0.0000	
15 minute summer	7	4.003	8	0.0	0.000	0.000	0.0000	

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	8	11	59.046	0.046	13.4	0.0695	0.0000	OK
15 minute winter	9	11	58.872	0.122	17.2	0.2834	0.0000	OK
60 minute winter	10	51	58.602	0.652	21.0	7.3599	0.0000	SURCHARGED
60 minute winter	11	53	58.586	0.886	11.0	6.8415	0.0000	SURCHARGED
960 minute winter	12a	945	57.777	-0.123	0.3	8.4599	0.0000	OK
30 minute summer	12	18	56.594	0.044	5.0	0.0070	0.0000	OK
1440 minute winter	13a	1440	57.771	-0.129	0.7	24.8399	0.0000	OK
15 minute summer	13	1	57.300	0.000	0.0	0.0000	0.0000	OK
960 minute winter	14a	945	57.777	-0.123	0.3	8.4599	0.0000	OK
15 minute summer	14	1	56.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	15a	1410	57.784	-0.116	0.5	17.2799	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	8	3.001	10	13.3	1.002	0.204	0.0887	
15 minute winter	9	6.000	10	16.2	0.948	0.910	1.3159	
60 minute winter	10	3.002	11	11.0	0.642	0.621	0.4401	
60 minute winter	11	1.004	12	5.0	1.502	0.082	0.0337	
960 minute winter	12a	7.000	12	0.0	0.000	0.000	0.0000	
960 minute winter	12a	Infiltration		0.0				
30 minute summer	12	1.005	17	5.0	1.304	0.165	0.0307	
1440 minute winter	13a	8.000	13	0.0	0.000	0.000	0.0000	
1440 minute winter	13a	Infiltration		0.0				
15 minute summer	13	8.001	14	0.0	0.000	0.000	0.0000	
960 minute winter	14a	9.000	14	0.0	0.000	0.000	0.0000	
960 minute winter	14a	Infiltration		0.0				
15 minute summer	14	8.002	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	10.000	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	Infiltration		0.0				

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	15	1	56.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	16	1	56.450	0.000	0.0	0.0000	0.0000	OK
240 minute winter	17	124	56.357	0.037	5.0	0.0417	0.0000	OK
240 minute winter	18	124	54.037	0.037	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	15	8.003	16	0.0	0.000	0.000	0.0000	
15 minute summer	16	8.004	17	0.0	0.000	0.000	0.0000	
240 minute winter	17	1.006	18	5.0	1.500	0.130	0.1668	47.9

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1a	1440	62.399	-0.001	0.7	23.7599	0.0000	OK
15 minute summer	1	1	61.800	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	2a	1470	62.401	0.001	1.7	59.6699	0.0000	OK
15 minute summer	2	1	61.450	0.000	0.0	0.0000	0.0000	OK
15 minute summer	3	1	60.850	0.000	0.0	0.0000	0.0000	OK
15 minute winter	4	10	61.327	0.077	14.4	0.1431	0.0000	OK
1440 minute winter	5a	1440	60.399	-0.001	1.0	35.6398	0.0000	OK
15 minute summer	5	1	59.750	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	6a	1440	60.399	-0.001	0.7	23.7599	0.0000	OK
15 minute summer	6	1	59.300	0.000	0.0	0.0000	0.0000	OK
15 minute summer	7	1	59.100	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	1a	1.000	1	0.0	0.000	0.000	0.0000	
1440 minute winter	1a	Infiltration		0.0				
15 minute summer	1	1.001	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	2.000	2	0.0	0.000	0.000	0.0000	
1440 minute winter	2a	Infiltration		0.0				
15 minute summer	2	1.002	3	0.0	0.000	0.000	0.0000	
15 minute summer	3	1.003	11	0.0	0.000	0.000	0.0978	
15 minute winter	4	3.000	8	14.0	1.876	0.469	0.6006	
1440 minute winter	5a	4.000	5	0.0	0.000	0.000	0.0000	
1440 minute winter	5a	Infiltration		0.0				
15 minute summer	5	4.001	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	5.000	6	0.0	0.000	0.000	0.0000	
1440 minute winter	6a	Infiltration		0.0				
15 minute summer	6	4.002	7	0.0	0.000	0.000	0.0000	
15 minute summer	7	4.003	8	0.0	0.000	0.000	0.0002	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	8	11	59.056	0.056	18.8	0.0872	0.0000	OK
15 minute winter	9	12	59.393	0.643	24.0	1.4992	0.0000	FLOOD RISK
60 minute winter	10	58	58.903	0.953	28.1	14.7041	0.0000	SURCHARGED
60 minute winter	11	59	58.882	1.182	12.4	9.5044	0.0000	FLOOD RISK
1440 minute winter	12a	1380	57.911	0.011	0.4	12.2237	0.0000	OK
15 minute winter	12	10	56.594	0.044	5.0	0.0070	0.0000	OK
1440 minute winter	13a	1440	57.899	-0.001	1.0	35.6398	0.0000	OK
15 minute summer	13	1	57.300	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	14a	1380	57.911	0.011	0.4	12.2237	0.0000	OK
1440 minute winter	14	1380	56.809	0.009	0.1	0.0014	0.0000	OK
1440 minute winter	15a	1440	57.899	-0.001	0.7	23.7599	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	8	3.001	10	18.5	1.339	0.285	0.0944	
15 minute winter	9	6.000	10	17.2	0.978	0.970	1.4084	
60 minute winter	10	3.002	11	12.4	0.702	0.696	0.4401	
60 minute winter	11	1.004	12	5.0	1.502	0.082	0.0337	
1440 minute winter	12a	7.000	12	0.1	0.334	0.094	0.0006	
1440 minute winter	12a	Infiltration		0.0				
15 minute winter	12	1.005	17	5.0	1.304	0.165	0.0307	
1440 minute winter	13a	8.000	13	0.0	0.000	0.000	0.0000	
1440 minute winter	13a	Infiltration		0.0				
15 minute summer	13	8.001	14	0.0	0.000	0.000	0.0000	
1440 minute winter	14a	9.000	14	0.1	0.334	0.094	0.0006	
1440 minute winter	14a	Infiltration		0.0				
1440 minute winter	14	8.002	15	0.1	0.288	0.017	0.0052	
1440 minute winter	15a	10.000	15	0.0	0.000	0.000	0.0000	
1440 minute winter	15a	Infiltration		0.0				

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.69%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	15	1380	56.659	0.009	0.1	0.0014	0.0000	OK
1440 minute winter	16	1380	56.459	0.009	0.1	0.0014	0.0000	OK
720 minute summer	17	375	56.357	0.037	5.0	0.0417	0.0000	OK
720 minute summer	18	375	54.037	0.037	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	15	8.003	16	0.1	0.287	0.017	0.0070	
1440 minute winter	16	8.004	17	0.1	0.287	0.017	0.0028	
720 minute summer	17	1.006	18	5.0	1.500	0.130	0.1668	82.0