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## TECHNICAL NOTE

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### PROJECT: Richer Road, Badwell Ash, IP31 3EU

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**Subject:** Discharge of Surface Water Drainage  
Condition

**Our Ref:** 2005-453

**To:** Hartog Hutton

**Date:** 25 October 2023

**Cc:** Hollins

**Author:** Joel Hurst (Ingent CE)

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#### [Brief](#)

Ingent Consulting Engineers have been appointed to prepare a detailed drainage design for the erection of 14 no. Dwellings on the Land off Richer Richer Road, Badwell Ash, Suffolk.

The development has been approved by Mid Suffolk District Council, planning permission reference DC/20/02989. The approval includes a drainage condition, no.9, concurrent with the first reserved matters application that refers to the approved FRA strategy.

The items required to be included within the detailed drainage scheme are as listed below and the points detailed for action are listed and addressed by heading in this note:

## 9. ACTION REQUIRED CONCURRENTLY WITH RESERVED MATTERS - SURFACE WATER DRAINAGE SCHEME

Concurrent with the first reserved matters application(s) a surface water drainage scheme shall be submitted to, and approved in writing by, the local planning authority. The scheme shall be in accordance with the approved FRA and include:

- a. Dimensioned plans and drawings of the surface water drainage scheme;
- b. If the use of infiltration is not possible then modelling shall be submitted to demonstrate that the surface water runoff will be restricted to  $Q_{bar}$  or 2l/s/ha for all events up to the critical 1 in 100 year rainfall events including climate change as specified in the FRA;
- c. Modelling of the surface water drainage scheme to show that the attenuation/infiltration features will contain the 1 in 100 year rainfall event including climate change;
- d. Modelling of the surface water conveyance network in the 1 in 30 year rainfall event to show no above ground flooding, and modelling of the volumes of any above ground flooding from the pipe network in a 1 in 100 year climate change rainfall event, along with topographic plans showing where the water will flow and be stored to ensure no flooding of buildings or offsite flows;
- e. Topographical plans depicting all exceedance flow paths and demonstration that the flows would not flood buildings or flow offsite, and if they are to be directed to the surface water drainage system then the potential additional rates and volumes of surface water must be included within the modelling of the surface water system;
- f. Submit layout plan depicting the footway either in front or behind of the existing watercourse, the existing ditch will need to remain open and not be culverted
- g. Details of the implementation, maintenance and management of the strategy for the disposal of surface water on the site;
- h. Details of a Construction Surface Water Management Plan (CSWMP) detailing how surface water and storm water will be managed on the site during construction (including demolition and site clearance operations) is submitted to and agreed in writing by the local planning authority. The CSWMP shall be implemented and thereafter managed and maintained in accordance with the approved plan for the duration of construction. The approved CSWMP and shall include:
  - Method statements, scaled and dimensioned plans and drawings detailing surface water management proposals to include :- 1. Temporary drainage systems 2. Measures for managing pollution / water quality and protecting controlled waters and watercourses 3. Measures for managing any on or offsite flood risk associated with construction;
- i. Details of the maintenance and management of the surface water drainage scheme shall be submitted to and approved in writing by the local planning authority.

The scheme shall then be fully implemented as approved, in accordance with a timetable as agreed in writing by the Local Planning Authority.

Reason - To prevent flooding by ensuring the satisfactory storage and disposal of surface water from the site for the lifetime of the development. To ensure the development does not cause increased flood risk, or pollution of watercourses or groundwater. To ensure clear arrangements are in place for ongoing operation and maintenance of the disposal of surface water drainage.

## [Actions Required by Heading](#)

### [Items a and e – Drainage Plans](#)

Plans of the proposed surface water drainage scheme, including topographical information, are appended along with exceedance flow route plans.

### [Items b, c and d – Drainage Design Modelling](#)

Detailed modelling of the drainage network in Flow v10.6.232 using FEH rainfall data is appended, demonstrating a restricted outfall of 2l/s/ha for all events up to and including the 1 in 100-year event +45% climate change. Appended report shows attenuation features will contain the 1 in 100-year event +45% climate change and no above ground flooding during the 1 in 30-year event.

### [Item f – Existing watercourse and new footway](#)

Plans of the proposed new footway from the development to Dovedale Close are appended, showing the existing watercourse to be culverted from the site access and joining soffit to soffit with the existing Dovedale Close culvert. There is insufficient space within the available land to provide a footway while also leaving the watercourse open.

### [Items g and i – Implementation, Management and Maintenance of SuDS](#)

The appended SuDS management and maintenance plan provides details of the expected maintenance of SuDS features and details who will be responsible for them.

### [Item h – Construction Surface Water Management Plan](#)

Full details of the CSWMP will be submitted concurrently with the rest of the information regarding surface water drainage as part of the first reserved matters application. The CSWMP layout is appended in support of this technical note.

## Conclusion

The purpose of this report is to provide sufficient detail to discharge condition 9 of the Outline Planning Permission by presenting information to demonstrate compliance with all items of that condition. This has been outlined above and is appended. As such it is considered the detailed design presented in this report meets all the criteria of condition 9.

## Attachments:

Engineering Layouts – 2005-453-070, 2005-453-071

Exceedance Flow Route – 2005-453-080, 2005-453-081

Drainage Calculations Flow v10.6.232

New Footway & Culvert Plans – 2005-453-278

SuDS Maintenance Plan

CSWMP Layout



Unit 10 Brightwell Barns  
Waldringfield Road  
Brightwell Suffolk IP10 OBJ

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## Appendix A – Engineering Layouts

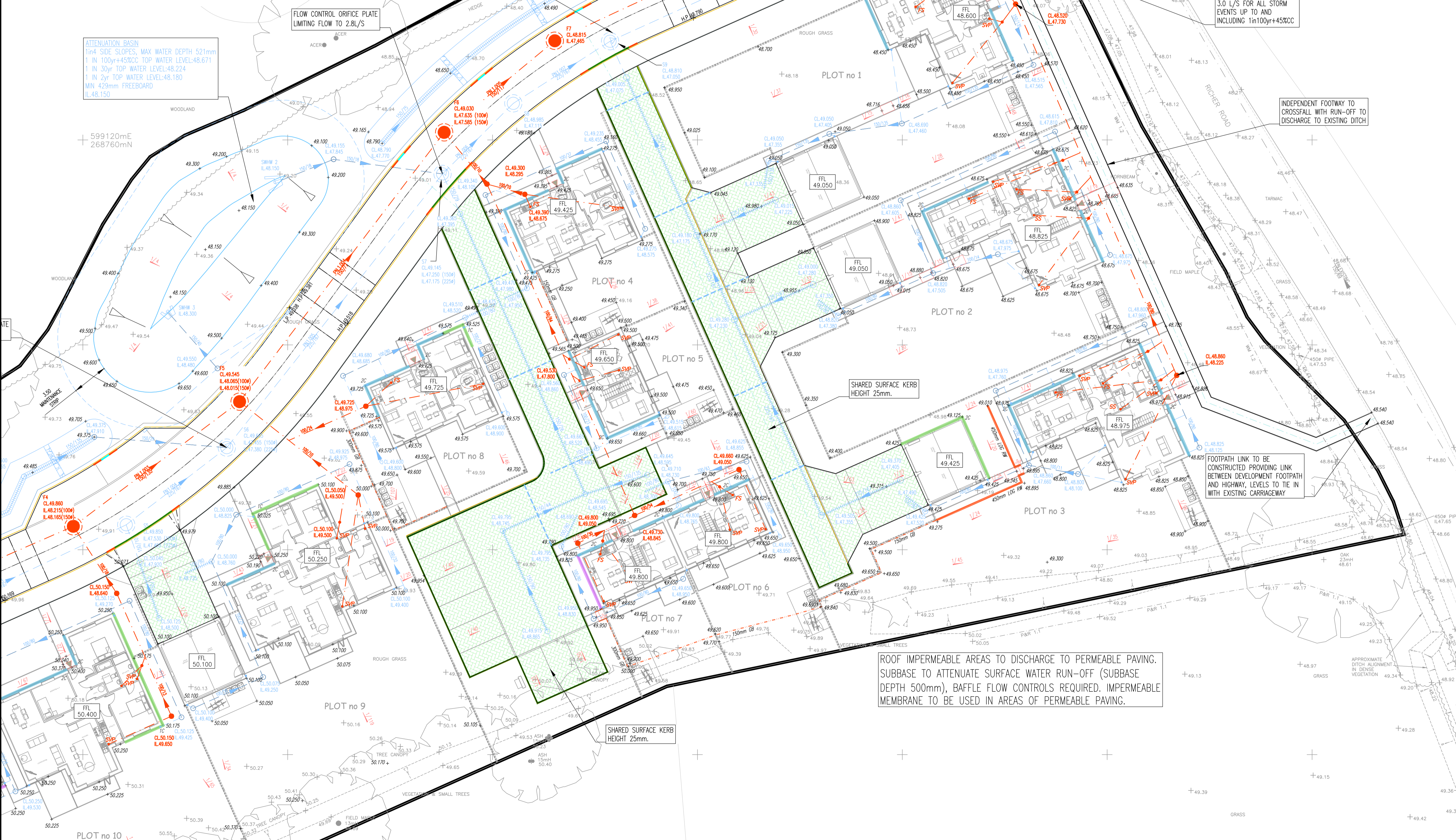


DRAINAGE KEY	
<b>INSPECTION CHAMBERS</b>	<b>INSPECTION CHAMBERS</b>
225mm Ø 0-600mm DEEP	225mm Ø 0-600mm DEEP
480mm Ø >600mm DEEP	480mm Ø >600mm DEEP
600mm Ø (BACKDROP) >1200mm DEEP	600mm Ø (BACKDROP) >1200mm DEEP
<b>MANHOLES</b>	<b>MANHOLES</b>
1200mm Ø (TRAFFICKED) >1200mm DEEP	1200mm Ø (TRAFFICKED) >1200mm DEEP
1200mm Ø (BACKDROP) >1200mm DEEP	1200mm Ø (BACKDROP) >1200mm DEEP
<b>ADOPTABLE SURFACE WATER</b>	<b>ADOPTABLE FOUL WATER</b>
SURFACE WATER MANHOLE TEXT	FOUL WATER MANHOLE TEXT
STORM WATER PIPE-RUN	FOUL WATER PIPE-RUN
INSPECTION CHAMBER DEPTH VARIES	INSPECTION CHAMBER DEPTH VARIES
SURFACING PERMEABLE BLOCK PAVING	

DRAINAGE KEY	
<b>PRIVATE SURFACE WATER</b>	<b>PRIVATE FOUL WATER</b>
SURFACE WATER MANHOLE TEXT	FOUL WATER MANHOLE TEXT
SURFACE PIPE-RUN DIAMETER/GRADIENT	FOUL PIPE-RUN DIAMETER/GRADIENT
PRIVATE ROAD GULLY	PRIVATE FOUL CONNECTION POINTS
PRIVATE YARD GULLY	SOIL & VENT PIPE
RODDING EYE	STUB STACK
RAIN WATER PIPE	WC CONNECTION
PERMEABLE SUBBASE	WASH HAND BASIN
UNDER- DRAINED SWALE	TRAPPED GULLY
	SEALED FLOOR GULLY
	BACK INLET GULLY
	FLOOR SOCKET
	AIR ADMITTANCE VALVE

REGRADE KEY	
RETAINING WALL- LEVEL RETAINED	450mm RW
GRAVEL BOARDS- LEVEL RETAINED	300mm OB
UNDERBUILD WITH NO. OF BRICK COURSES	2C
EXTENT OF RAISED /SECONDARY D.P.C.	2C
TANKING - WITH NO. OF BRICK COURSES	2C
PROPOSED LEVEL	0.00/0.00
EXISTING LEVEL	0.00/0.00
GRADIENT	1:12
STEPS	1:12
BANKING MARKER	
LEVEL THRESHOLD & PART M PLATFORM	FFL 00.00/0.00
FINISHED FLOOR LEVEL	

- GENERAL**
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED. ANY DISCREPANCIES ARE TO BE RECORDED AND REPORTED TO THE ENGINEERS IMMEDIATELY.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERS AND ARCHITECTS DRAWINGS AND THE SPECIFICATION.
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  - ALL WORK ARE TO BE TO THE SATISFACTION OF THE ENGINEER AND LOCAL AUTHORITY BUILDING CONTROL.
  - THE CONTRACTOR IS RESPONSIBLE FOR AND MUST TAKE ALL NECESSARY PRECAUTIONS TO ENSURE THE STABILITY OF THE WORKS AT ALL TIMES DURING CONSTRUCTION.
  - ALL WORKMANSHIP AND MATERIALS ARE TO BE TO CURRENT BRITISH STANDARDS.
  - ALL SERVICES ARE TO BE LOCATED AND PROTECTED AS NECESSARY BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE WORKS.
  - ALL HIGHWAY WORKS ARE TO BE IN ACCORDANCE WITH THE LOCAL AUTHORITIES DESIGN GUIDE AND SPECIFICATION.
  - PRIOR TO THE OCCUPATION OF THE FIRST DWELLING, STREET NAMEPLATES SHALL BE ERECTED IN ACCORDANCE WITH THE HIGHWAY AUTHORITY AND TO THE WORDING AGREED WITH THE PLANNING AUTHORITY.
  - DURING CONSTRUCTION WORKS ON SITE, ALL ROADS AND FOOTPATHS ARE TO BE SWEEP ONLY AND ARE TO BE KEPT CLEAR OF OBSTRUCTIONS, THIS IS TO INCLUDE EXISTING HIGHWAYS AS APPROPRIATE TO ENSURE SAFE PASSAGE OF ALL ROAD USERS.
  - PROVISION SHALL BE MADE FOR THE INSTALLATION OF ALL MAINS SERVICES INCLUDING DUCTING PRIOR TO THE LAYING OF THE ROAD BASE-COURSE.
  - ALL ROAD MARKINGS AND SIGNS ARE TO BE IN ACCORDANCE WITH THE TRAFFIC SIGNS REGULATIONS AND DIRECTIONS' 2016.
  - ALL ADOPTABLE SURFACE WATER SEWERS WITHIN ADOPTABLE HIGHWAYS ARE TO BE A MINIMUM OF 225MM.
  - ALL WATER AUTHORITY SEWER WORKS ARE TO BE IN ACCORDANCE WITH 'SEWERAGE SECTOR GUIDANCE APPENDIX C' DESIGN AND CONSTRUCTION GUIDANCE VERSION 1.0 25TH OCTOBER 2019 AND ANY ADDENDUM THEREAFTER.
  - ALL PRIVATE CONNECTIONS TO ADOPTABLE SEWERS SHALL BE A MINIMUM OF 100mm DIAMETER (FOUL) & 150mm DIAMETER (SURFACE) MADE IN VITRIFIED CLAY CONNECTING SOFFIT TO SOFFIT.
  - NO TREES ARE TO BE PLANTED WITHIN 3M OF ANY ADOPTABLE SEWER AND TREE PITS/ROOT BARRIER ARE TO BE USED WHERE TREES ARE WITHIN 3-6M AS SPECIFIED BY THE WATER AUTHORITY.



KERB LAYOUT KEY	
EDGING KERB (EF)	—
HALF-BATTERED KERB 100mm UPSTAND	—
BULL NOSE KERB (BN2) 25mm UPSTAND	—
BULL NOSE KERB (BN2) 0mm UPSTAND	—
DROPPER KERB	—
DISH CHANNEL KERB	—
SPEED TABLE/ SHARED SURFACE RAMP	—
TACTILE PAVING	—

Rev	Revision Notes	Drawn	Appr'd	Date

**INGENT**  
CONSULTING ENGINEERS  
Unit 10 Brightwell Barns, Waldringfield Road, Brightwell, Suffolk, IP10 0BJ.  
Tel: 01473 598038 — www.ingent.co.uk — email: info@ingent.co.uk

**PRELIMINARY**

Project: RICHER ROAD, BADWELL ASH  
SUFFOLK

Drawing Title: ENGINEERING LAYOUT  
SHEET 1 OF 2

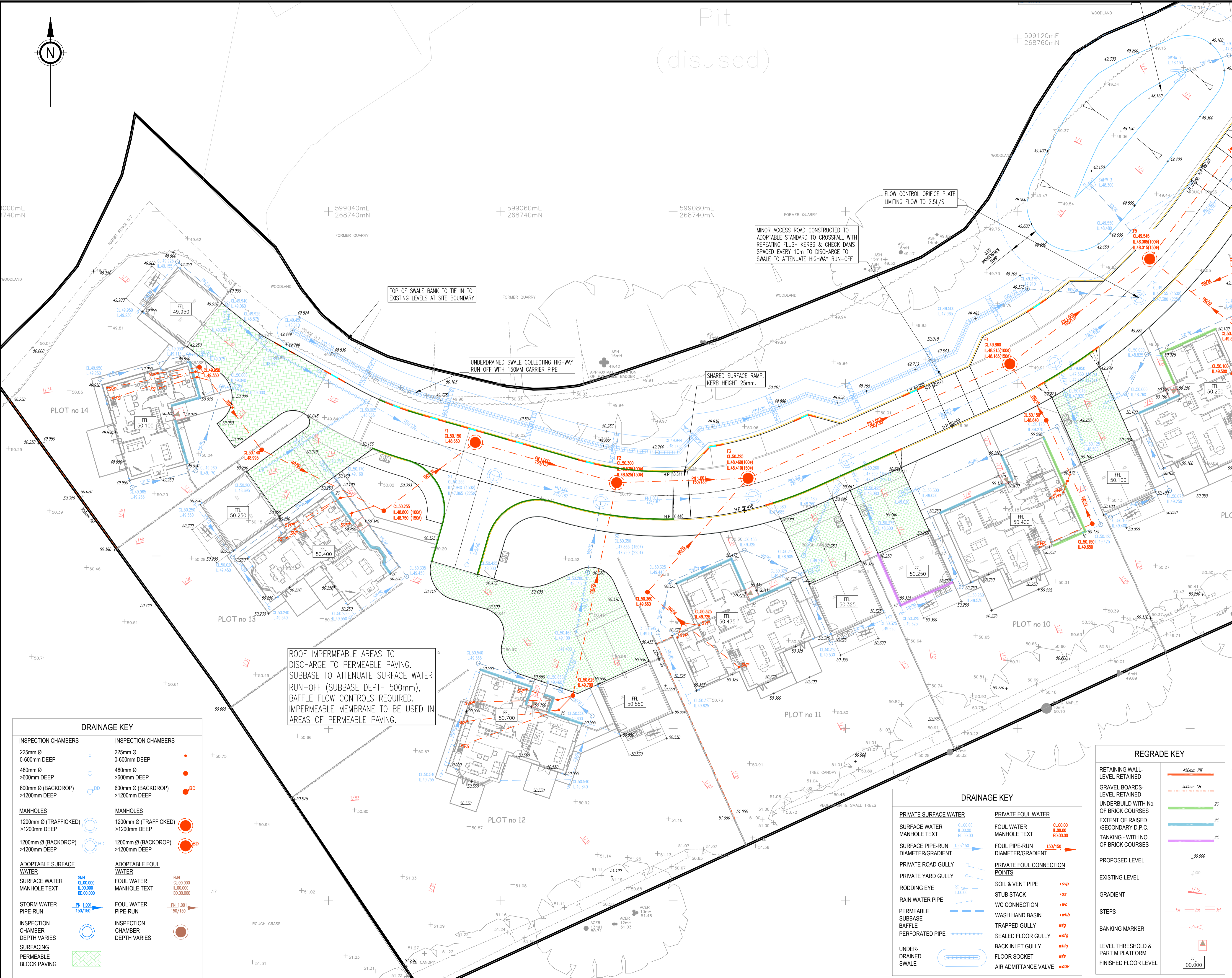
Client: BG & JM SUTTON	Date: SEPT 2023
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Drawn: JH	Designed: DCH	Checked: RGW	Approved: RGW
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  - ALL ADAPTABLE SURFACE WATER SEWERS WITHIN ADAPTABLE HIGHWAYS ARE TO BE A MINIMUM OF 225MM.
  - ALL WATER AUTHORITY SEWER WORKS ARE TO BE IN ACCORDANCE WITH 'SEWERAGE SECTOR GUIDANCE APPENDIX C' DESIGN AND CONSTRUCTION GUIDANCE VERSION 1.0 25TH OCTOBER 2019 AND ANY ADDENDUM THEREAFTER.
  - ALL PRIVATE CONNECTIONS TO ADAPTABLE SEWERS SHOULD BE A MINIMUM OF 100mm DIAMETER (FOUL) & 150mm DIAMETER (SURFACE) MADE IN VITRIFIED CLAY CONNECTING SOFFIT TO SOFFIT.
  - NO TREES ARE TO BE PLANTED WITHIN 3M OF ANY ADAPTABLE SEWER AND TREE PITS/ROOT BARRIER ARE TO BE USED WHERE TREES ARE WITHIN 3-6M AS SPECIFIED BY THE WATER AUTHORITY.

**KERB LAYOUT KEY**

EDGING KERB (EF)	
HALF-BATTERED KERB 100mm UPSTAND	
BULL NOSE KERB (BN2) 25mm UPSTAND	
BULL NOSE KERB (BN2) 0mm UPSTAND	
DROPPER KERB	
DISH CHANNEL KERB	
SPEED TABLE/ SHARED SURFACE RAMP	
TACTILE PAVING	

ROOF IMPERMEABLE AREAS TO DISCHARGE TO PERMEABLE PAVING. SUBBASE TO ATTENUATE SURFACE WATER RUN-OFF (SUBBASE DEPTH 500mm), BAFFLE FLOW CONTROLS REQUIRED. IMPERMEABLE MEMBRANE TO BE USED IN AREAS OF PERMEABLE PAVING.

**DRAINAGE KEY**

INSPECTION CHAMBERS	
225mm Ø 0-600mm DEEP	
480mm Ø >600mm DEEP	
600mm Ø (BACKDROP) >1200mm DEEP	
MANHOLES	
1200mm Ø (TRAFFICKED) >1200mm DEEP	
1200mm Ø (BACKDROP) >1200mm DEEP	
ADOPTABLE SURFACE WATER	
SURFACE WATER MANHOLE TEXT	
STORM WATER PIPE-RUN	
INSPECTION CHAMBER DEPTH VARIES	
SURFACING PERMEABLE BLOCK PAVING	
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225mm Ø 0-600mm DEEP	
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ADOPTABLE FOUL WATER	
FOUL WATER MANHOLE TEXT	
FOUL WATER PIPE-RUN	
INSPECTION CHAMBER DEPTH VARIES	

**DRAINAGE KEY**

PRIVATE SURFACE WATER		PRIVATE FOUL WATER	
SURFACE WATER MANHOLE TEXT		FOUL WATER MANHOLE TEXT	
SURFACE PIPE-RUN DIAMETER/GRADIENT		FOUL PIPE-RUN DIAMETER/GRADIENT	
PRIVATE ROAD GULLY		PRIVATE FOUL CONNECTION POINTS	
PRIVATE YARD GULLY		SOIL & VENT PIPE	
RODDING EYE		STUB STACK	
RAIN WATER PIPE		WC CONNECTION	
PERMEABLE SUBBASE		WASH HAND BASIN	
BAFFLE		TRAPPED GULLY	
PERFORATED PIPE		SEALED FLOOR GULLY	
UNDER- DRAINED SWALE		BACK INLET GULLY	
		FLOOR SOCKET	
		AIR ADMITTANCE VALVE	

**REGRADE KEY**

RETAINING WALL- LEVEL RETAINED	
GRAVEL BOARDS- LEVEL RETAINED	
UNDERBUILD WITH No. OF BRICK COURSES	
EXTENT OF RAISED /SECONDARY D.P.C.	
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PROPOSED LEVEL	
EXISTING LEVEL	
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Revision Notes

Rev	Revision Notes	Drawn	Appd	Date

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**PRELIMINARY**

Project:  
**RICHER ROAD, BADWELL ASH  
SUFFOLK**

Drawing Title:  
**ENGINEERING LAYOUT  
SHEET 2 OF 2**

Client: <b>BG &amp; JM SUTTON</b>	Date: <b>SEPT 2023</b>
Drawn: <b>JH</b>	Designed: <b>JH</b>
Checked: <b>DCH</b>	Approved: <b>RGW</b>

Scale:  
1:200

Project No:  
2005-453

Drawing No & Revision:  
071

Size:  
A1



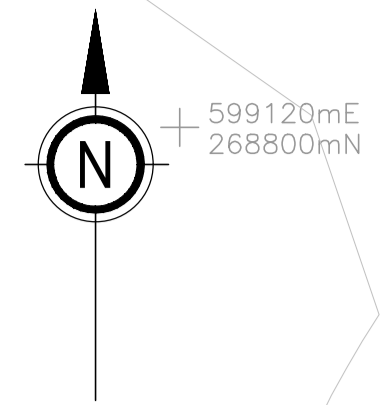
Unit 10 Brightwell Barns  
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## Appendix B – Exceedance Flow Routes





599120mE  
268800mN

599120mE  
268780mN

599120mE  
268760mN

599120mE  
268760mN

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  - ALL ADOPTABLE SURFACE WATER SEWERS WITHIN ADOPTABLE HIGHWAYS ARE TO BE A MINIMUM OF 225MM.
  - ALL WATER AUTHORITY SEWER WORKS ARE TO BE IN ACCORDANCE WITH 'SEWERAGE SECTOR GUIDANCE APPENDIX C' DESIGN AND CONSTRUCTION GUIDANCE VERSION 1.0 25TH OCTOBER 2019 AND ANY ADDENDUM THEREAFTER.
  - ALL PRIVATE CONNECTIONS TO ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 100mm DIAMETER (FOUL) & 150mm DIAMETER (SURFACE) MADE IN VITRIFIED CLAY CONNECTING SOFFIT TO SOFFIT.
  - NO TREES ARE TO BE PLANTED WITHIN 3M OF ANY ADOPTABLE SEWER AND TREE PITS/ROOT BARRIER ARE TO BE USED WHERE TREES ARE WITHIN 3-6M AS SPECIFIED BY THE WATER AUTHORITY.

**KERB LAYOUT KEY**

EDGING KERB (EF)	—
HALF-BATTERED KERB 100mm UPSTAND	—
BULL NOSE KERB (BN2) 25mm UPSTAND	—
BULL NOSE KERB (BN2) 0mm UPSTAND	—
DROPPER KERB	—
DISH CHANNEL KERB	—
SPEED TABLE/ SHARED SURFACE RAMP	—
TACTILE PAVING	—

**DRAWING KEY**

SITE BOUNDARY	—
EXCEEDANCE FLOW ROUTE	→

Rev	Revision Notes	Drawn	App'd	Date

**INGENT**  
CONSULTING ENGINEERS

Unit 10 Brightwell Barns, Waldringfield Road, Brightwell, Suffolk, IP10 0BJ.  
Tel: 01473 598038 — www.ingent.co.uk — email: info@ingent.co.uk

**PRELIMINARY**

Project:  
**RICHER ROAD, BADWELL ASH  
SUFFOLK**

Drawing Title:  
**EXCEEDANCE FLOW ROUTE  
SHEET 1 OF 2**

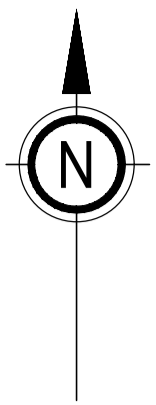
Client: <b>BG &amp; JM SUTTON</b>	Date: <b>SEPT 2023</b>
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Drawn: <b>JH</b>	Designed: <b>JH</b>	Checked: <b>DCH</b>	Approved: <b>RGW</b>
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Scale: 1:200

Project No: <b>2005-453</b>	Drawing No & Revision: <b>080</b>	Size: <b>A1</b>
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**KERB LAYOUT KEY**

EDGING KERB (EF)	—
HALF-BATTERED KERB 100mm UPSTAND	—
BULL NOSE KERB (BN2) 25mm UPSTAND	—
BULL NOSE KERB (BN2) 0mm UPSTAND	—
DROPPER KERB	—
DISH CHANNEL KERB	—
SPEED TABLE/ SHARED SURFACE RAMP	—
TACTILE PAVING	—

**DRAWING KEY**

SITE BOUNDARY	—
EXCEEDANCE FLOW ROUTE	→

Rev	Revision Notes	Drawn	App'd	Date

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**PRELIMINARY**

Project:  
**RICHER ROAD, BADWELL ASH  
SUFFOLK**

Drawing Title:  
**EXCEEDANCE FLOW ROUTE  
SHEET 2 OF 2**

Client: <b>BG &amp; JM SUTTON</b>	Date: <b>SEPT 2023</b>
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Drawn: <b>JH</b>	Designed: <b>JH</b>	Checked: <b>DCH</b>	Approved: <b>RGW</b>
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Scale:

Project No: <b>2005-453</b>	Drawing No & Revision: <b>081</b>	Size: <b>A1</b>
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Unit 10 Brightwell Barns  
Waldringfield Road  
Brightwell Suffolk IP10 OBJ

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## Appendix C – Drainage Calculations Flow v10.6.232



**Design Settings**

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	9.999
CV	0.750	Preferred Cover Depth (m)	0.350
Time of Entry (mins)	5.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWHW 1			47.820		599214.465	268778.470	1.400
S11			47.985	1350	599213.269	268777.895	1.525
S10	0.007	5.00	48.065		599205.980	268785.310	1.260
S9			48.810	1200	599171.474	268769.643	1.760
S8			48.985	1200	599162.028	268763.581	1.870
S7			49.145	1200	599155.120	268756.688	1.970
S6	0.000	5.00	49.665	1200	599134.057	268729.974	2.285
S5	0.000	5.00	49.850	1200	599124.241	268722.440	2.395
S4	0.000	5.00	50.260	1200	599100.163	268711.104	2.645
S3			50.380	1200	599089.283	268706.909	2.695
S2			50.350	1200	599071.613	268706.307	2.560
S1	0.004	5.00	50.255	1200	599059.265	268709.314	2.390
P14/13			50.005	480	599044.377	268717.909	1.940
P12	0.038	5.00	50.280	480	599070.069	268698.100	1.735
P11	0.000	5.00	50.390	480	599095.133	268700.050	1.495
P10	0.000	5.00	50.275	480	599103.587	268702.688	1.685
P9	0.000	5.00	50.125	480	599127.455	268713.298	1.625
R3.1	0.014	5.00	49.915	480	599165.364	268712.028	1.050
R3.2 (BAFFLE)	0.026	5.00	49.795	480	599160.989	268721.847	1.050
R3.3			49.695	480	599169.045	268725.437	1.150
R4.1 (BAFFLE)	0.024	5.00	49.505	480	599192.103	268723.348	2.150
R4.2	0.024	5.00	49.280	480	599183.590	268742.452	2.050
R4.3 (BAFFLE)	0.023	5.00	49.180	480	599179.924	268750.690	2.005
SW1.1			47.675	480	599203.479	268791.131	0.750
SW1.2			48.067		599190.139	268785.101	0.946
SW1.3			48.335	480	599174.568	268778.163	0.985
SW1.4			48.445		599167.721	268774.863	0.994
SW1.5			48.614		599157.837	268768.179	1.005
SW1.6		5.00	48.790	480	599149.222	268759.658	1.020
SW2.1		5.00	49.425	480	599035.797	268726.197	0.815
SW2.2			49.548		599041.404	268723.042	0.986
SW2.3			49.688		599048.270	268719.592	1.183
SW2.4			49.748		599055.141	268717.460	1.296
SW2.5			49.808		599062.368	268715.407	1.412
SW2.6			49.870		599070.439	268713.111	1.536
SW2.7			49.944	480	599078.122	268712.043	1.669
SW2.8			49.940		599083.513	268714.835	1.712

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW2.9			49.879		599093.914	268718.063	1.732
SW2.10			49.700		599108.223	268721.702	1.667
SW2.11			49.485	480	599115.103	268727.545	1.525
SW2.12			49.375	480	599121.110	268731.006	1.465
SWHW 2		5.00	48.750		599139.378	268756.067	0.600
SWHW 2.1			49.155	480	599144.481	268758.117	1.310
BAFFLE R3.1	0.014	5.00	49.457	1050	599160.262	268745.147	1.742
BAFFLE R3.2	0.014	5.00	49.562	1050	599164.129	268736.469	1.482
BAFFLE R3.3	0.010	5.00	49.673	1050	599168.199	268727.335	1.208
BAFFLE R4.1			49.058		599175.275	268761.114	1.952
R4.2.1			49.296		599184.194	268741.098	2.059
BAFFLE R4.3			49.410		599188.468	268731.507	2.110
P14	0.000	5.00	49.850	480	599033.033	268723.904	1.190
P13	0.000	5.00	50.020	480	599032.234	268710.004	1.325
SWHW 3			48.750		599128.223	268743.356	0.600
SWHW 3.1	0.025	5.00	49.550	480	599133.145	268737.701	1.070

**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	12.709	0.600	47.865	47.790	0.075	169.5	225	5.55	50.0
1.001	S2	S3	17.680	0.600	47.790	47.685	0.105	168.4	225	5.84	50.0
1.002	S3	S4	11.661	0.600	47.685	47.615	0.070	166.6	225	6.04	50.0
1.003	S4	S5	26.613	0.600	47.615	47.455	0.160	166.3	225	6.48	50.0
1.004	S5	S6	12.374	0.600	47.455	47.380	0.075	165.0	225	6.68	50.0
1.005	S6	S7	34.019	0.600	47.380	47.175	0.205	165.9	225	7.45	48.2
1.006	S7	S8	9.759	0.600	47.175	47.115	0.060	162.6	225	7.61	47.7
1.007	S8	S9	11.224	0.600	47.115	47.050	0.065	172.7	225	7.79	47.0
1.008	S9	S10	37.896	0.600	47.050	46.805	0.245	154.7	225	8.40	45.2
1.009	S10	S11	10.398	0.600	46.805	46.460	0.345	30.1	225	8.47	45.0
1.010	S11	SWHW 1	1.327	0.600	46.460	46.420	0.040	33.2	225	8.48	44.9

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	1.001	39.8	7.7	2.165	2.335	0.057	0.0	67	0.780
1.001	1.004	39.9	12.9	2.335	2.470	0.095	0.0	87	0.896
1.002	1.010	40.2	12.9	2.470	2.420	0.095	0.0	87	0.901
1.003	1.011	40.2	20.2	2.420	2.170	0.149	0.0	113	1.012
1.004	1.015	40.4	23.9	2.170	2.060	0.176	0.0	124	1.055
1.005	1.012	40.2	33.9	2.060	1.745	0.259	0.0	159	1.130
1.006	1.022	40.6	43.6	1.745	1.645	0.337	0.0	210	1.129
1.007	0.992	39.4	43.0	1.645	1.535	0.337	0.0	225	1.010
1.008	1.049	41.7	52.5	1.535	1.035	0.429	0.0	225	1.068
1.009	2.392	95.1	59.5	1.035	1.300	0.488	0.0	129	2.517
1.010	2.279	90.6	59.4	1.300	1.175	0.488	0.0	133	2.426

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)
SW1.000P	SW1.6	SW1.5	12.117	0.600	47.770	47.609	0.161	75.3	150	5.17	50.0
SW1.001P	SW1.5	SW1.4	11.932	0.600	47.609	47.451	0.158	75.5	150	5.35	50.0
SW1.002P	SW1.4	SW1.3	7.601	0.600	47.451	47.350	0.101	75.3	150	5.46	50.0
SW1.003P	SW1.3	SW1.2	17.047	0.600	47.350	47.121	0.229	74.4	150	5.70	50.0
SW1.004P	SW1.2	SW1.1	14.640	0.600	47.121	46.925	0.196	74.7	150	5.91	50.0
SW2.000P	SW2.1	SW2.2	6.434	0.600	48.610	48.562	0.048	134.0	150	5.12	50.0
SW2.001P	SW2.2	SW2.3	7.684	0.600	48.562	48.505	0.057	134.8	150	5.27	50.0
SW2.002P	SW2.3	SW2.4	7.194	0.600	48.505	48.452	0.053	135.7	150	5.41	50.0
SW2.003P	SW2.4	SW2.5	7.513	0.600	48.452	48.396	0.056	134.2	150	5.56	50.0
SW2.004P	SW2.5	SW2.6	8.391	0.600	48.396	48.334	0.062	135.3	150	5.72	50.0
SW2.005P	SW2.6	SW2.7	7.757	0.600	48.334	48.275	0.059	131.5	150	5.87	50.0
SW2.006P	SW2.7	SW2.8	6.071	0.600	48.275	48.228	0.047	129.2	150	5.98	50.0
SW2.007P	SW2.8	SW2.9	10.890	0.600	48.228	48.147	0.081	134.4	150	6.19	50.0
SW2.008P	SW2.9	SW2.10	14.764	0.600	48.147	48.033	0.114	129.5	150	6.47	50.0
SW2.009P	SW2.10	SW2.11	9.026	0.600	48.033	47.960	0.073	123.6	150	6.64	50.0
SW2.010P	SW2.11	SW2.12	6.933	0.600	47.960	47.910	0.050	138.7	150	6.77	50.0
SW2.100	SW2.12	S6	12.988	0.600	47.910	47.455	0.455	28.5	150	6.89	50.0
2.000	SWHW 2	SWHW 2.1	5.499	0.600	48.150	47.845	0.305	18.0	150	5.04	50.0
2.001	SWHW 2.1	S7	10.735	0.600	47.845	47.250	0.595	18.0	150	5.11	50.0
3.000	P14/13	S1	17.191	0.600	48.065	47.940	0.125	137.5	150	5.34	50.0
4.000	P12	S2	8.351	0.600	48.545	47.865	0.680	12.3	150	5.04	50.0
5.000	P11	S4	12.145	0.600	48.895	47.690	1.205	10.1	150	5.06	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)
SW1.000P	1.160	20.5	2.6	0.870	0.855	0.019	0.0	36	0.797
SW1.001P	1.158	20.5	3.7	0.855	0.844	0.027	0.0	43	0.880
SW1.002P	1.160	20.5	4.7	0.844	0.835	0.035	0.0	49	0.945
SW1.003P	1.166	20.6	6.1	0.835	0.796	0.045	0.0	56	1.018
SW1.004P	1.164	20.6	7.0	0.796	0.600	0.052	0.0	61	1.058
SW2.000P	0.866	15.3	0.8	0.665	0.836	0.006	0.0	24	0.461
SW2.001P	0.864	15.3	1.5	0.836	1.033	0.011	0.0	32	0.551
SW2.002P	0.861	15.2	3.1	1.033	1.146	0.023	0.0	46	0.677
SW2.003P	0.866	15.3	3.9	1.146	1.262	0.029	0.0	52	0.726
SW2.004P	0.862	15.2	4.9	1.262	1.386	0.036	0.0	58	0.768
SW2.005P	0.875	15.5	5.8	1.386	1.519	0.043	0.0	64	0.812
SW2.006P	0.882	15.6	5.8	1.519	1.562	0.043	0.0	64	0.820
SW2.007P	0.865	15.3	6.8	1.562	1.582	0.050	0.0	70	0.840
SW2.008P	0.881	15.6	9.9	1.582	1.517	0.073	0.0	87	0.933
SW2.009P	0.902	15.9	9.9	1.517	1.375	0.073	0.0	86	0.951
SW2.010P	0.851	15.0	11.2	1.375	1.315	0.083	0.0	97	0.933
SW2.100	1.891	33.4	11.2	1.315	2.060	0.083	0.0	60	1.711
2.000	2.383	42.1	0.0	0.450	1.160	0.000	0.0	0	0.000
2.001	2.382	42.1	0.0	1.160	1.745	0.000	0.0	0	0.000
3.000	0.855	15.1	7.2	1.790	2.165	0.053	0.0	73	0.845
4.000	2.890	51.1	5.1	1.585	2.335	0.038	0.0	32	1.856
5.000	3.192	56.4	3.7	1.345	2.420	0.027	0.0	26	1.815

**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)
6.000	P10	S4	9.086	0.600	48.590	47.690	0.900	10.1	150	5.05	50.0
7.000	P9	S5	9.691	0.600	48.500	47.530	0.970	10.0	150	5.05	50.0
8.000	R3.1	R3.2 (BAFFLE)	10.750	0.600	48.865	48.745	0.120	89.6	150	5.17	50.0
8.001	R3.2 (BAFFLE)	R3.3	8.820	0.600	48.745	48.545	0.200	44.1	150	5.27	50.0
8.002	R3.3	BAFFLE R3.3	2.078	0.600	48.545	48.465	0.080	26.0	150	5.28	50.0
8.003	BAFFLE R3.3	BAFFLE R3.2	10.000	0.600	48.465	48.080	0.385	26.0	150	5.37	50.0
8.004	BAFFLE R3.2	BAFFLE R3.1	9.501	0.600	48.080	47.715	0.365	26.0	150	5.45	50.0
8.005	BAFFLE R3.1	S7	12.635	0.600	47.715	47.250	0.465	27.2	150	5.56	50.0
9.000	R4.1 (BAFFLE)	BAFFLE R4.3	8.932	0.600	47.355	47.300	0.055	162.4	225	5.15	50.0
9.001	BAFFLE R4.3	R4.2.1	10.500	0.600	47.300	47.237	0.063	166.7	225	5.32	50.0
9.002	R4.2.1	R4.2	1.483	0.600	47.237	47.230	0.007	211.8	225	5.35	50.0
9.003	R4.2	R4.3 (BAFFLE)	9.017	0.600	47.230	47.175	0.055	163.9	225	5.49	50.0
9.004	R4.3 (BAFFLE)	BAFFLE R4.1	11.414	0.600	47.175	47.106	0.069	165.4	225	5.68	50.0
9.005	BAFFLE R4.1	S9	9.338	0.600	47.106	47.050	0.056	166.7	225	5.84	50.0
10.000	SW1.1	S10	6.336	0.600	46.925	46.880	0.045	140.8	150	6.03	50.0
3.001	P14	P14/13	12.831	0.600	48.660	48.065	0.595	21.6	150	5.10	50.0
3.002	P13	P14/13	14.489	0.600	48.695	48.065	0.630	23.0	150	5.11	50.0
11.000	SWHW 3.1	SWHW 3	7.497	0.600	48.480	48.150	0.330	22.7	150	5.06	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)
6.000	3.189	56.4	3.7	1.535	2.420	0.027	0.0	26	1.813
7.000	3.206	56.7	3.7	1.475	2.170	0.027	0.0	25	1.798
8.000	1.062	18.8	1.9	0.900	0.900	0.014	0.0	32	0.679
8.001	1.519	26.8	5.4	0.900	1.000	0.040	0.0	45	1.189
8.002	1.983	35.0	5.4	1.000	1.058	0.040	0.0	40	1.439
8.003	1.983	35.0	6.8	1.058	1.332	0.050	0.0	45	1.543
8.004	1.981	35.0	8.7	1.332	1.592	0.064	0.0	51	1.645
8.005	1.939	34.3	10.6	1.592	1.745	0.078	0.0	57	1.711
9.000	1.023	40.7	3.9	1.925	1.885	0.029	0.0	47	0.651
9.001	1.010	40.1	4.5	1.885	1.834	0.033	0.0	51	0.670
9.002	0.894	35.6	4.6	1.834	1.825	0.034	0.0	55	0.622
9.003	1.018	40.5	8.3	1.825	1.780	0.061	0.0	69	0.804
9.004	1.014	40.3	12.1	1.780	1.727	0.089	0.0	84	0.886
9.005	1.009	40.1	12.5	1.727	1.535	0.092	0.0	86	0.892
10.000	0.845	14.9	7.0	0.600	1.035	0.052	0.0	72	0.832
3.001	2.178	38.5	3.9	1.040	1.790	0.029	0.0	33	1.412
3.002	2.109	37.3	3.3	1.175	1.790	0.024	0.0	30	1.293
11.000	2.122	37.5	3.4	0.920	0.450	0.025	0.0	30	1.316

**Simulation Settings**

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Additional Storage (m <sup>3</sup> /ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

**Storm Durations**

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	45	0	0

**Node S11 Online Hydro-Brake® Control**

Flap Valve	x	Objective (HE)	Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	46.460	Product Number	CTL-SHE-0075-3000-1525-3000
Design Depth (m)	1.525	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.0	Min Node Diameter (mm)	1200

**Node BAFFLE R4.1 Online Depth/Flow Control**

Flap Valve	x	Replaces Downstream Link	✓	Invert Level (m)	47.106
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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.612	0.000	1.613	50.000

**Node R4.2 Online Depth/Flow Control**

Flap Valve	x	Replaces Downstream Link	✓	Invert Level (m)	47.230
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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.710	0.000	1.711	50.000

**Node BAFFLE R4.3 Online Depth/Flow Control**

Flap Valve	x	Replaces Downstream Link	✓	Invert Level (m)	47.300
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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.770	0.000	1.771	50.000

**Node R4.3 (BAFFLE) Online Depth/Flow Control**

Flap Valve	x	Replaces Downstream Link	✓	Invert Level (m)	47.175
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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.665	0.000	1.666	50.000

**Node R4.1 (BAFFLE) Online Depth/Flow Control**

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 47.355

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.810	0.000	1.811	50.000

**Node BAFFLE R3.1 Online Depth/Flow Control**

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 47.715

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.402	0.000	1.403	50.000

**Node BAFFLE R3.2 Online Depth/Flow Control**

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 48.080

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.142	0.000	1.143	50.000

**Node BAFFLE R3.3 Online Depth/Flow Control**

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 48.465

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	0.868	0.000	0.869	50.000

**Node R3.2 (BAFFLE) Online Depth/Flow Control**

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 48.745

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	0.710	0.000	0.711	50.000

**Node S6 Online Orifice Control**

Flap Valve	x	Design Depth (m)	2.285	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	2.5		
Invert Level (m)	47.380	Diameter (m)	0.028		

**Node S9 Online Orifice Control**

Flap Valve	x	Design Depth (m)	1.760	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	3.0		
Invert Level (m)	47.050	Diameter (m)	0.033		

**Node S7 Online Orifice Control**

Flap Valve	x	Design Depth (m)	1.970	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.8		
Invert Level (m)	47.175	Diameter (m)	0.030		

**Node SWHW 2 Flow through Pond Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	19.900
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.150	Main Channel Slope (1:X)	99999.0
Safety Factor	5.0	Time to half empty (mins)		Main Channel n	0.030

**Inlets**  
SWHW 3

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	36.3	0.0	0.600	146.0	0.0

**Node BAFFLE R3.1 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.742	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	4.500	Inf Depth (m)	
Porosity	0.30	Length (m)	9.500		

**Node BAFFLE R3.2 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.847	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	4.500	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

**Node BAFFLE R3.3 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.958	Slope (1:X)	88.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	4.500	Inf Depth (m)	
Porosity	0.30	Length (m)	7.634		

**Node R3.3 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.980	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	6.500	Inf Depth (m)	
Porosity	0.30	Length (m)	17.570		

**Node R3.2 (BAFFLE) Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	49.080	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	12.500	Inf Depth (m)	
Porosity	0.30	Length (m)	8.508		

**Node BAFFLE R4.1 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.343	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	4.500	Inf Depth (m)	
Porosity	0.30	Length (m)	11.414		



**Node R4.3 (BAFFLE) Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.465	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	3.500	Inf Depth (m)	
Porosity	0.30	Length (m)	9.013		

**Node R4.2 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.565	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	3.500	Inf Depth (m)	
Porosity	0.30	Length (m)	11.987		

**Node BAFFLE R4.3 Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.695	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	3.500	Inf Depth (m)	
Porosity	0.30	Length (m)	8.932		

**Node R4.1 (BAFFLE) Carpark Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.790	Slope (1:X)	90.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	3.0	Width (m)	3.500	Inf Depth (m)	
Porosity	0.30	Length (m)	6.257		

**Node SW2.2 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.000P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.562	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	665

**Node SW2.3 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.001P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.505	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	836

**Node SW2.4 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.002P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.452	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1033

**Node SW2.5 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.003P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.396	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1146

**Node SW2.6 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.004P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.334	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1262

**Node SW2.7 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.005P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.275	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1386

**Node SW2.8 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.006P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.228	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1519

**Node SW2.9 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.007P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.147	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1582

**Node SW2.10 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.008P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	48.033	Surround Shape	Trench
Safety Factor	3.0	Time to half empty (mins)		Diameter (mm)	1517

**Node SW2.11 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.009P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	47.960	Surround Shape	Trench
Safety Factor	3.0	Time to half empty (mins)		Diameter (mm)	1375

**Node SW2.12 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW2.010P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	47.910	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	1315

**Node SW1.1 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW1.004P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	46.925	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	600

**Node SW1.2 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW1.003P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	47.121	Surround Shape	Trench
Safety Factor	3.0	Time to half empty (mins)	200	Diameter (mm)	796

**Node SW1.3 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW1.002P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	47.350	Surround Shape	Trench
Safety Factor	3.0	Time to half empty (mins)	92	Diameter (mm)	835

**Node SW1.4 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW1.001P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	47.451	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)	4	Diameter (mm)	844

**Node SW1.5 Link Surround Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	SW1.000P
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	47.609	Surround Shape	Trench
Safety Factor	2.0	Time to half empty (mins)	4	Diameter (mm)	855

**Node SW1.1 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	46.925
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	5.5	0.0	0.375	38.6	0.0	0.376	0.0	0.0

**Node SW1.2 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	47.121
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	256

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	8.5	0.0	0.375	59.7	0.0	0.376	0.0	0.0

**Node SW1.3 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	47.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	76

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.8	0.0	0.375	26.6	0.0	0.376	0.0	0.0

**Node SW1.4 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	47.451
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	4

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	6.0	0.0	0.375	41.8	0.0	0.376	0.0	0.0

**Node SW1.5 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	47.609
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	5

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	6.1	0.0	0.375	42.5	0.0	0.376	0.0	0.0

**Node SW2.12 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	47.910
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.5	0.0	0.375	24.3	0.0	0.376	0.0	0.0

**Node SW2.11 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	47.960
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	4.8	0.0	0.375	33.7	0.0	0.376	0.0	0.0

**Node SW2.10 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	48.033
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	7.7	0.0	0.375	54.1	0.0	0.376	0.0	0.0

**Node SW2.9 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.147
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	5.5	0.0	0.375	38.3	0.0	0.376	0.0	0.0

**Node SW2.8 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.228
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.3	0.0	0.375	23.0	0.0	0.376	0.0	0.0

**Node SW2.7 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.275
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.9	0.0	0.375	27.2	0.0	0.376	0.0	0.0

**Node SW2.6 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.334
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	4.2	0.0	0.375	29.4	0.0	0.376	0.0	0.0

**Node SW2.5 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.396
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.8	0.0	0.375	26.3	0.0	0.376	0.0	0.0

**Node SW2.4 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.452
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.6	0.0	0.375	25.2	0.0	0.376	0.0	0.0

**Node SW2.3 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.505
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.8	0.0	0.375	26.9	0.0	0.376	0.0	0.0

**Node SW2.2 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.562
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	3.2	0.0	0.375	22.5	0.0	0.376	0.0	0.0

**Results for 2 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWHW 1	1	46.420	0.000	2.6	0.0000	0.0000	OK
30 minute winter	S11	33	46.998	0.538	5.4	0.7701	0.0000	SURCHARGED
30 minute winter	S10	29	47.001	0.196	5.4	0.0217	0.0000	OK
240 minute winter	S9	184	47.415	0.365	1.4	0.4132	0.0000	SURCHARGED
240 minute winter	S8	184	47.415	0.300	1.4	0.3398	0.0000	SURCHARGED
240 minute winter	S7	172	47.935	0.760	1.6	0.8591	0.0000	SURCHARGED
240 minute winter	S6	224	48.298	0.918	4.3	1.0380	0.0000	SURCHARGED
240 minute winter	S5	224	48.298	0.843	4.4	0.9533	0.0000	SURCHARGED
240 minute winter	S4	224	48.298	0.683	4.0	0.7724	0.0000	SURCHARGED
240 minute winter	S3	224	48.298	0.613	2.5	0.6933	0.0000	SURCHARGED
240 minute winter	S2	224	48.298	0.508	2.6	0.5745	0.0000	SURCHARGED
240 minute winter	S1	224	48.298	0.433	1.6	0.5040	0.0000	SURCHARGED
240 minute winter	P14/13	224	48.298	0.233	1.7	0.0422	0.0000	SURCHARGED
15 minute winter	P12	10	48.580	0.035	5.5	0.0214	0.0000	OK
15 minute summer	P11	1	48.895	0.000	0.0	0.0000	0.0000	OK
15 minute winter	5.000:50%	10	48.319	0.027	3.9	0.0081	0.0000	OK
15 minute summer	P10	1	48.590	0.000	0.0	0.0000	0.0000	OK
240 minute winter	6.000:50%	224	48.298	0.158	0.9	0.2931	0.0000	SURCHARGED
15 minute summer	P9	1	48.500	0.000	0.0	0.0000	0.0000	OK
240 minute winter	7.000:50%	224	48.298	0.283	0.9	1.0137	0.0000	SURCHARGED
720 minute winter	R3.1	855	49.376	0.511	0.2	0.2289	0.0000	SURCHARGED
720 minute winter	R3.2 (BAFFLE)	840	49.376	0.631	0.5	8.3479	0.0000	SURCHARGED
1440 minute winter	R3.3	1500	49.055	0.510	0.1	0.5964	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S11	Hydro-Brake®	SWHW 1	2.6				17.4
240 minute winter	S10	1.009	S11	6.1	0.321	0.064	0.2493	
240 minute winter	S9	Orifice	S10	1.3				
180 minute winter	S8	1.007	S9	1.4	0.284	0.034	0.4464	
120 minute winter	S7	Orifice	S8	1.4				
15 minute winter	S6	1.005	S7	1.6	0.428	0.041	1.3530	
15 minute winter	S5	1.004	S6	12.2	0.481	0.303	0.4921	
15 minute winter	S4	1.003	S5	14.6	0.641	0.363	1.0584	
15 minute winter	S3	1.002	S4	9.9	0.616	0.246	0.4638	
15 minute summer	S2	1.001	S3	13.0	0.810	0.325	0.7032	
15 minute summer	S1	1.000	S2	8.3	0.614	0.207	0.5055	
15 minute winter	P14/13	3.000	S1	7.7	0.832	0.513	0.2418	
15 minute winter	P12	4.000	S2	5.5	1.837	0.107	0.0852	
15 minute summer	P11	5.000	5.000:50%	0.0	0.000	0.000	0.0062	
15 minute winter	P11	5.000	S4	3.9	1.670	0.069	0.0599	
15 minute summer	P10	6.000	6.000:50%	0.0	0.000	0.000	0.0047	
15 minute winter	P10	6.000	S4	3.9	1.664	0.069	0.0448	
15 minute summer	P9	7.000	7.000:50%	0.0	0.000	0.000	0.0291	
15 minute winter	P9	7.000	S5	3.9	1.371	0.069	0.0797	
15 minute summer	R3.1	8.000	R3.2 (BAFFLE)	2.4	0.134	0.125	0.1893	
15 minute summer	R3.2 (BAFFLE)	Depth/Flow	R3.3	0.0				
15 minute winter	R3.3	8.002	BAFFLE R3.3	-0.8	-0.096	-0.022	0.0366	

**Results for 2 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
360 minute winter	R4.1 (BAFFLE)	360	49.165	1.810	0.6	2.9686	0.0000	SURCHARGED
720 minute winter	9.000:50%	690	48.724	1.396	1.2	0.0000	0.0000	SURCHARGED
600 minute winter	R4.2	840	47.867	0.637	0.4	0.2645	0.0000	SURCHARGED
720 minute winter	9.003:50%	960	47.844	0.641	0.3	5.0712	0.0000	SURCHARGED
720 minute winter	R4.3 (BAFFLE)	765	47.845	0.670	0.3	0.2745	0.0000	SURCHARGED
600 minute winter	9.004:50%	735	47.328	0.187	0.1	0.4431	0.0000	OK
30 minute winter	SW1.1	31	46.998	0.073	4.6	0.6707	0.0000	OK
15 minute winter	SW1.2	14	47.169	0.048	5.0	0.5760	0.0000	OK
15 minute winter	SW1.004P:50%	13	47.075	0.052	5.0	0.0118	0.0000	OK
15 minute winter	SW1.3	13	47.396	0.046	4.2	0.2581	0.0000	OK
15 minute winter	SW1.003P:50%	12	47.286	0.051	5.0	0.0116	0.0000	OK
15 minute winter	SW1.4	12	47.492	0.041	3.6	0.3376	0.0000	OK
15 minute winter	SW1.002P:50%	12	47.449	0.048	4.2	0.0102	0.0000	OK
15 minute winter	SW1.5	11	47.644	0.035	2.8	0.2826	0.0000	OK
15 minute winter	SW1.001P:50%	11	47.573	0.043	3.6	0.0083	0.0000	OK
15 minute summer	SW1.6	1	47.770	0.000	0.0	0.0000	0.0000	OK
15 minute winter	SW1.000P:50%	10	47.727	0.037	2.8	0.0066	0.0000	OK
15 minute winter	SW2.1	11	48.610	0.000	0.0	0.0001	0.0000	OK
15 minute winter	SW2.000P:50%	10	48.610	0.024	0.9	0.0050	0.0000	OK
15 minute winter	SW2.2	12	48.585	0.023	0.9	0.0918	0.0000	OK
15 minute winter	SW2.001P:50%	11	48.565	0.031	1.5	0.0081	0.0000	OK
15 minute winter	SW2.3	12	48.535	0.030	1.5	0.1491	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
480 minute winter	R4.1 (BAFFLE)	Depth/Flow	9.000:50%	2.0				
15 minute winter	R4.1 (BAFFLE)	9.000	BAFFLE R4.3	1.1	0.308	0.027	0.0981	
15 minute summer	R4.2	Depth/Flow	9.003:50%	0.0				
15 minute winter	R4.2	9.003	R4.3 (BAFFLE)	-2.6	-0.113	-0.063	0.1793	
15 minute summer	R4.3 (BAFFLE)	Depth/Flow	9.004:50%	0.0				
15 minute winter	R4.3 (BAFFLE)	9.004	BAFFLE R4.1	0.9	0.299	0.022	0.1041	
15 minute winter	SW1.1	10.000	S10	4.7	0.736	0.313	0.0533	
15 minute winter	SW1.2	SW1.004P	SW1.004P:50%	4.6	0.897	0.223	0.0374	
15 minute winter	SW1.2	SW1.004P	SW1.1	5.0	0.921	0.244	0.0427	
15 minute winter	SW1.3	SW1.003P	SW1.003P:50%	4.1	0.840	0.198	0.0415	
15 minute winter	SW1.3	SW1.003P	SW1.2	5.0	1.089	0.244	0.0420	
15 minute winter	SW1.4	SW1.002P	SW1.002P:50%	3.3	0.762	0.162	0.0168	
15 minute winter	SW1.4	SW1.002P	SW1.3	4.2	0.920	0.206	0.0179	
15 minute winter	SW1.5	SW1.001P	SW1.001P:50%	2.5	0.698	0.122	0.0217	
15 minute winter	SW1.5	SW1.001P	SW1.4	3.6	0.952	0.176	0.0236	
15 minute summer	SW1.6	SW1.000P	SW1.000P:50%	0.0	0.000	0.000	0.0099	
15 minute winter	SW1.6	SW1.000P	SW1.5	2.8	0.887	0.135	0.0195	
15 minute winter	SW2.1	SW2.000P	SW2.000P:50%	0.0	-0.004	0.000	0.0030	
15 minute winter	SW2.1	SW2.000P	SW2.2	0.9	0.539	0.057	0.0056	
15 minute winter	SW2.2	SW2.001P	SW2.001P:50%	0.8	0.366	0.051	0.0083	
15 minute winter	SW2.2	SW2.001P	SW2.3	1.5	0.627	0.095	0.0097	
15 minute winter	SW2.3	SW2.002P	SW2.002P:50%	1.3	0.419	0.087	0.0119	



**Results for 2 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW2.002P:50%	11	48.521	0.043	2.8	0.0131	0.0000	OK
15 minute winter	SW2.4	12	48.495	0.043	2.7	0.2229	0.0000	OK
15 minute winter	SW2.003P:50%	12	48.471	0.047	3.3	0.0154	0.0000	OK
15 minute winter	SW2.5	13	48.444	0.048	3.3	0.2639	0.0000	OK
15 minute winter	SW2.004P:50%	13	48.416	0.051	3.8	0.0182	0.0000	OK
15 minute winter	SW2.6	14	48.385	0.051	3.8	0.3210	0.0000	OK
15 minute winter	SW2.005P:50%	13	48.360	0.055	4.2	0.0189	0.0000	OK
15 minute winter	SW2.7	14	48.328	0.053	4.2	0.3242	0.0000	OK
240 minute winter	SW2.8	228	48.298	0.070	1.4	0.3930	0.0000	OK
240 minute winter	SW2.007P:50%	224	48.299	0.111	2.2	0.0567	0.0000	OK
240 minute winter	SW2.9	220	48.298	0.151	2.8	1.9051	0.0000	SURCHARGED
240 minute winter	SW2.008P:50%	220	48.298	0.208	2.3	0.1595	0.0000	SURCHARGED
240 minute winter	SW2.10	224	48.298	0.265	2.6	6.5967	0.0000	SURCHARGED
240 minute winter	SW2.11	224	48.298	0.338	2.0	6.4371	0.0000	SURCHARGED
240 minute winter	SW2.010P:50%	224	48.298	0.363	2.0	0.1637	0.0000	SURCHARGED
240 minute winter	SW2.12	224	48.298	0.388	3.1	5.4715	0.0000	SURCHARGED
15 minute winter	SHW 2	14	48.174	0.024	3.0	0.0000	0.0000	OK
240 minute winter	SHW 2.1	172	47.935	0.090	0.8	0.0162	0.0000	OK
360 minute winter	BAFFLE R3.1	344	48.933	1.218	0.3	3.0240	0.0000	SURCHARGED
360 minute winter	BAFFLE R3.2	344	49.050	0.970	0.3	3.0240	0.0000	SURCHARGED
1440 minute winter	BAFFLE R3.3	1020	49.055	0.590	0.1	1.1678	0.0000	SURCHARGED
600 minute winter	BAFFLE R4.1	750	47.328	0.222	0.1	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 winter	SW2.3	SW2.002P	SW2.4	2.7	0.693	0.181	0.0150	
15 minute winter	SW2.4	SW2.003P	SW2.003P:50%	2.6	0.600	0.173	0.0169	
15 minute winter	SW2.4	SW2.003P	SW2.5	3.3	0.733	0.218	0.0177	
15 minute winter	SW2.5	SW2.004P	SW2.004P:50%	3.2	0.638	0.211	0.0212	
15 minute winter	SW2.5	SW2.004P	SW2.6	3.8	0.763	0.252	0.0222	
15 minute winter	SW2.6	SW2.005P	SW2.005P:50%	3.7	0.661	0.239	0.0217	
15 minute winter	SW2.6	SW2.005P	SW2.7	4.2	0.754	0.270	0.0223	
15 minute winter	SW2.7	SW2.006P	SW2.8	4.0	0.745	0.257	0.0335	
15 minute winter	SW2.8	SW2.007P	SW2.007P:50%	3.9	0.712	0.256	0.0301	
15 minute winter	SW2.8	SW2.007P	SW2.9	4.2	0.803	0.275	0.0298	
30 minute winter	SW2.9	SW2.008P	SW2.008P:50%	4.0	0.688	0.258	0.0552	
30 minute winter	SW2.9	SW2.008P	SW2.10	5.1	0.837	0.330	0.1081	
30 minute winter	SW2.10	SW2.009P	SW2.11	4.6	0.726	0.286	0.1589	
30 minute winter	SW2.11	SW2.010P	SW2.010P:50%	-5.4	0.448	-0.356	0.0610	
30 minute winter	SW2.11	SW2.010P	SW2.12	-5.1	0.799	-0.336	0.0610	
15 minute winter	SW2.12	SW2.100	S6	-10.4	-0.590	-0.311	0.2287	
15 minute winter	SHW 2	2.000	SHW 2.1	2.2	1.247	0.053	0.0098	
15 minute winter	SHW 2.1	2.001	S7	2.2	1.113	0.053	0.1022	
15 minute summer	BAFFLE R3.1	Depth/Flow	S7	0.0				
15 minute summer	BAFFLE R3.2	Depth/Flow	BAFFLE R3.1	0.0				
15 minute summer	BAFFLE R3.3	Depth/Flow	BAFFLE R3.2	0.0				
15 minute summer	BAFFLE R4.1	Depth/Flow	9.005:50%	0.0				

**Results for 2 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
240 minute winter	9.005:50%	184	47.415	0.337	0.1	0.0000	0.0000	SURCHARGED
600 minute winter	R4.2.1	840	47.867	0.630	0.3	0.0000	0.0000	SURCHARGED
600 minute winter	9.002:50%	840	47.867	0.633	0.4	0.0000	0.0000	SURCHARGED
600 minute winter	BAFFLE R4.3	585	48.724	1.424	0.3	0.0425	0.0000	SURCHARGED
600 minute winter	9.001:50%	780	47.867	0.598	0.4	4.2913	0.0000	SURCHARGED
15 minute summer	P14	1	48.660	0.000	0.0	0.0000	0.0000	OK
15 minute winter	3.001:50%	10	48.396	0.033	4.2	0.0355	0.0000	OK
15 minute summer	P13	1	48.695	0.000	0.0	0.0000	0.0000	OK
15 minute winter	3.002:50%	10	48.411	0.031	3.5	0.0000	0.0000	OK
15 minute winter	SWHW 3	12	48.180	0.030	3.6	0.0000	0.0000	OK
15 minute winter	SWHW 3.1	10	48.513	0.033	3.6	0.0213	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	BAFFLE R4.1	9.005	S9	0.4	0.300	0.010	0.1809	
15 minute winter	R4.2.1	9.002	9.002:50%	-2.4	-0.353	-0.068	0.0295	
15 minute winter	R4.2.1	9.002	R4.2	-2.9	-0.327	-0.081	0.0295	
15 minute summer	BAFFLE R4.3	Depth/Flow	9.001:50%	0.0				
15 minute winter	BAFFLE R4.3	9.001	R4.2.1	-1.7	0.140	-0.043	0.2088	
15 minute summer	P14	3.001	3.001:50%	0.0	0.000	0.000	0.0090	
15 minute winter	P14	3.001	P14/13	4.2	0.755	0.108	0.0390	
15 minute summer	P13	3.002	3.002:50%	0.0	0.000	0.000	0.0091	
15 minute winter	P13	3.002	P14/13	3.5	0.615	0.093	0.0434	
15 minute winter	SWHW 3	Flow through pond	SWHW 2	3.0	0.066	0.031	1.0276	
15 minute winter	SWHW 3.1	11.000	SWHW 3	3.6	1.533	0.096	0.0192	

**Results for 30 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	SWHW 1	1	46.420	0.000	2.6	0.0000	0.0000	OK
120 minute winter	S11	118	47.269	0.809	4.1	1.1579	0.0000	SURCHARGED
120 minute winter	S10	118	47.269	0.464	5.1	0.0515	0.0000	SURCHARGED
180 minute winter	S9	152	47.668	0.618	1.5	0.6989	0.0000	SURCHARGED
180 minute winter	S8	152	47.668	0.553	1.6	0.6255	0.0000	SURCHARGED
240 minute winter	S7	240	48.224	1.049	1.9	1.1866	0.0000	SURCHARGED
360 minute winter	S6	352	48.673	1.293	6.2	1.4623	0.0000	SURCHARGED
360 minute winter	S5	352	48.673	1.218	6.3	1.3775	0.0000	SURCHARGED
360 minute winter	S4	352	48.673	1.058	5.9	1.1966	0.0000	SURCHARGED
360 minute winter	S3	352	48.673	0.988	4.2	1.1174	0.0000	SURCHARGED
360 minute winter	S2	352	48.673	0.883	4.3	0.9986	0.0000	SURCHARGED
360 minute winter	S1	352	48.673	0.808	2.6	0.9405	0.0000	SURCHARGED
360 minute winter	P14/13	352	48.673	0.608	2.6	0.1101	0.0000	SURCHARGED
360 minute winter	P12	352	48.673	0.128	1.9	0.0792	0.0000	OK
15 minute summer	P11	1	48.895	0.000	0.0	0.0000	0.0000	OK
360 minute winter	5.000:50%	352	48.672	0.380	1.4	1.7669	0.0000	SURCHARGED
360 minute winter	P10	352	48.673	0.083	0.0	0.0150	0.0000	OK
360 minute winter	6.000:50%	352	48.673	0.533	1.4	3.3370	0.0000	SURCHARGED
360 minute winter	P9	352	48.673	0.173	0.1	0.0313	0.0000	SURCHARGED
360 minute winter	7.000:50%	352	48.673	0.658	1.4	5.4851	0.0000	SURCHARGED
180 minute winter	R3.1	120	49.455	0.590	1.2	0.2645	0.0000	SURCHARGED
180 minute winter	R3.2 (BAFFLE)	120	49.455	0.710	3.4	10.9349	0.0000	SURCHARGED
1440 minute winter	R3.3	1380	49.333	0.788	0.6	8.8992	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	S11	Hydro-Brake®	SWHW 1	2.6				28.5
15 minute winter	S10	1.009	S11	9.6	0.628	0.101	0.4135	
600 minute winter	S9	Orifice	S10	1.6				
15 minute winter	S8	1.007	S9	1.7	0.090	0.043	0.4464	
30 minute winter	S7	Orifice	S8	1.8				
15 minute winter	S6	1.005	S7	-6.1	0.458	-0.152	1.3530	
15 minute winter	S5	1.004	S6	22.9	0.576	0.567	0.4921	
15 minute summer	S4	1.003	S5	25.5	0.711	0.635	1.0584	
15 minute winter	S3	1.002	S4	19.3	0.651	0.481	0.4638	
15 minute winter	S2	1.001	S3	21.1	0.829	0.527	0.7032	
15 minute winter	S1	1.000	S2	14.8	0.630	0.373	0.5055	
15 minute winter	P14/13	3.000	S1	12.5	0.877	0.824	0.3026	
15 minute winter	P12	4.000	S2	14.7	2.054	0.288	0.1110	
15 minute summer	P11	5.000	5.000:50%	0.0	0.000	0.000	0.0535	
15 minute winter	P11	5.000	S4	10.0	1.834	0.177	0.1069	
60 minute winter	P10	6.000	6.000:50%	-0.2	-0.020	-0.004	0.0433	
15 minute winter	P10	6.000	S4	8.3	1.825	0.147	0.0800	
30 minute winter	P9	7.000	7.000:50%	-0.7	-0.062	-0.012	0.0660	
15 minute summer	P9	7.000	S5	7.8	1.530	0.138	0.0853	
15 minute winter	R3.1	8.000	R3.2 (BAFFLE)	5.0	0.285	0.267	0.1893	
180 minute winter	R3.2 (BAFFLE)	Depth/Flow	R3.3	2.0				
15 minute winter	R3.3	8.002	BAFFLE R3.3	-2.0	-0.126	-0.056	0.0366	

**Results for 30 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
120 minute winter	R4.1 (BAFFLE)	70	49.165	1.810	2.9	2.9701	0.0000	SURCHARGED
720 minute winter	9.000:50%	450	49.072	1.744	2.0	0.0000	0.0000	SURCHARGED
1440 minute winter	R4.2	1650	48.476	1.246	0.4	0.5172	0.0000	SURCHARGED
1440 minute winter	9.003:50%	1500	48.193	0.991	0.4	12.1017	0.0000	SURCHARGED
1440 minute winter	R4.3 (BAFFLE)	1560	48.194	1.019	0.4	0.4178	0.0000	SURCHARGED
1440 minute winter	9.004:50%	1380	47.489	0.348	0.1	1.5303	0.0000	SURCHARGED
120 minute winter	SW1.1	120	47.270	0.345	5.9	7.4838	0.0000	SURCHARGED
120 minute winter	SW1.2	120	47.270	0.149	5.4	2.8818	0.0000	OK
120 minute winter	SW1.004P:50%	120	47.270	0.247	6.2	0.1786	0.0000	SURCHARGED
15 minute winter	SW1.3	12	47.436	0.086	12.0	0.5903	0.0000	OK
15 minute winter	SW1.003P:50%	12	47.329	0.093	14.8	0.0369	0.0000	OK
15 minute winter	SW1.4	12	47.527	0.076	10.0	0.7624	0.0000	OK
15 minute winter	SW1.002P:50%	12	47.490	0.090	12.0	0.0281	0.0000	OK
15 minute winter	SW1.5	11	47.670	0.061	7.4	0.5730	0.0000	OK
15 minute winter	SW1.001P:50%	11	47.604	0.074	10.0	0.0237	0.0000	OK
15 minute summer	SW1.6	1	47.770	0.000	0.0	0.0000	0.0000	OK
15 minute winter	SW1.000P:50%	10	47.752	0.062	7.5	0.0171	0.0000	OK
360 minute winter	SW2.1	352	48.674	0.064	0.0	0.0115	0.0000	OK
360 minute winter	SW2.000P:50%	352	48.674	0.088	0.3	0.0278	0.0000	OK
360 minute winter	SW2.2	352	48.673	0.111	0.5	0.7127	0.0000	OK
360 minute winter	SW2.001P:50%	352	48.673	0.140	0.6	0.0542	0.0000	OK
360 minute winter	SW2.3	352	48.674	0.169	1.0	1.5837	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
30 minute winter	R4.1 (BAFFLE)	Depth/Flow	9.000:50%	20.4				
60 minute winter	R4.1 (BAFFLE)	9.000	BAFFLE R4.3	4.2	0.308	0.103	0.1776	
15 minute summer	R4.2	Depth/Flow	9.003:50%	0.0				
15 minute winter	R4.2	9.003	R4.3 (BAFFLE)	-8.1	-0.204	-0.200	0.1793	
15 minute summer	R4.3 (BAFFLE)	Depth/Flow	9.004:50%	0.0				
15 minute winter	R4.3 (BAFFLE)	9.004	BAFFLE R4.1	-1.7	0.354	-0.043	0.2129	
15 minute winter	SW1.1	10.000	S10	9.1	0.862	0.607	0.1115	
15 minute winter	SW1.2	SW1.004P	SW1.004P:50%	13.5	1.099	0.654	0.1034	
15 minute winter	SW1.2	SW1.004P	SW1.1	14.8	1.167	0.720	0.1289	
15 minute winter	SW1.3	SW1.003P	SW1.003P:50%	11.7	1.088	0.567	0.0934	
15 minute winter	SW1.3	SW1.003P	SW1.2	14.8	1.388	0.716	0.0950	
15 minute winter	SW1.4	SW1.002P	SW1.002P:50%	9.5	0.963	0.464	0.0381	
15 minute winter	SW1.4	SW1.002P	SW1.3	12.0	1.154	0.587	0.0407	
15 minute winter	SW1.5	SW1.001P	SW1.001P:50%	7.0	0.919	0.343	0.0460	
15 minute winter	SW1.5	SW1.001P	SW1.4	10.0	1.190	0.489	0.0517	
15 minute summer	SW1.6	SW1.000P	SW1.000P:50%	0.0	0.000	0.000	0.0203	
15 minute winter	SW1.6	SW1.000P	SW1.5	7.4	1.138	0.363	0.0408	
15 minute summer	SW2.1	SW2.000P	SW2.000P:50%	-0.1	-0.090	-0.009	0.0072	
15 minute winter	SW2.1	SW2.000P	SW2.2	2.3	0.658	0.152	0.0117	
15 minute winter	SW2.2	SW2.001P	SW2.001P:50%	2.2	0.482	0.143	0.0177	
15 minute winter	SW2.2	SW2.001P	SW2.3	4.1	0.771	0.266	0.0219	
15 minute winter	SW2.3	SW2.002P	SW2.002P:50%	3.8	0.530	0.253	0.0270	

**Results for 30 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
360 minute winter	SW2.002P:50%	352	48.673	0.195	1.2	0.0789	0.0000	SURCHARGED
360 minute winter	SW2.4	352	48.674	0.222	1.3	2.3038	0.0000	SURCHARGED
360 minute winter	SW2.003P:50%	352	48.673	0.249	1.9	0.1127	0.0000	SURCHARGED
360 minute winter	SW2.5	352	48.673	0.277	1.5	3.4921	0.0000	SURCHARGED
360 minute winter	SW2.004P:50%	352	48.673	0.308	1.8	0.1622	0.0000	SURCHARGED
360 minute winter	SW2.6	352	48.673	0.339	2.1	5.4783	0.0000	SURCHARGED
360 minute winter	SW2.005P:50%	352	48.673	0.368	2.0	0.1853	0.0000	SURCHARGED
360 minute winter	SW2.7	352	48.673	0.398	2.8	6.1195	0.0000	SURCHARGED
360 minute winter	SW2.8	352	48.673	0.445	4.2	5.2947	0.0000	SURCHARGED
360 minute winter	SW2.007P:50%	352	48.673	0.485	4.4	0.3514	0.0000	SURCHARGED
360 minute winter	SW2.9	352	48.673	0.526	5.2	8.6160	0.0000	SURCHARGED
360 minute winter	SW2.008P:50%	352	48.673	0.583	5.3	0.5752	0.0000	SURCHARGED
360 minute winter	SW2.10	352	48.673	0.640	5.3	12.2527	0.0000	SURCHARGED
360 minute winter	SW2.11	352	48.673	0.713	5.5	8.2325	0.0000	SURCHARGED
360 minute winter	SW2.010P:50%	352	48.673	0.738	5.6	0.3589	0.0000	SURCHARGED
360 minute winter	SW2.12	352	48.673	0.763	5.2	5.7346	0.0000	SURCHARGED
240 minute winter	SWHW 2	240	48.224	0.074	1.7	0.0000	0.0000	OK
240 minute winter	SWHW 2.1	236	48.224	0.379	1.7	0.0686	0.0000	SURCHARGED
480 minute winter	BAFFLE R3.1	352	49.117	1.402	0.7	5.5750	0.0000	SURCHARGED
960 minute winter	BAFFLE R3.2	645	49.222	1.142	0.3	5.5205	0.0000	SURCHARGED
1440 minute winter	BAFFLE R3.3	1440	49.333	0.868	0.4	4.3157	0.0000	SURCHARGED
1440 minute winter	BAFFLE R4.1	1470	47.489	0.383	0.1	0.0000	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	SW2.3	SW2.002P	SW2.4	8.0	0.892	0.529	0.0333	
15 minute winter	SW2.4	SW2.003P	SW2.003P:50%	7.7	0.768	0.506	0.0378	
15 minute winter	SW2.4	SW2.003P	SW2.5	9.6	0.935	0.630	0.0404	
15 minute winter	SW2.5	SW2.004P	SW2.004P:50%	9.3	0.816	0.610	0.0480	
15 minute winter	SW2.5	SW2.004P	SW2.6	11.4	0.972	0.751	0.0511	
15 minute winter	SW2.6	SW2.005P	SW2.005P:50%	10.8	0.831	0.701	0.0506	
15 minute winter	SW2.6	SW2.005P	SW2.7	12.4	0.995	0.803	0.0512	
15 minute winter	SW2.7	SW2.006P	SW2.8	11.8	0.953	0.758	0.0951	
15 minute winter	SW2.8	SW2.007P	SW2.007P:50%	11.4	0.893	0.748	0.0959	
15 minute winter	SW2.8	SW2.007P	SW2.9	12.4	1.040	0.809	0.0959	
60 minute winter	SW2.9	SW2.008P	SW2.008P:50%	-10.9	-0.617	-0.698	0.1300	
15 minute winter	SW2.9	SW2.008P	SW2.10	14.9	1.129	0.956	0.1300	
30 minute winter	SW2.10	SW2.009P	SW2.11	-13.3	0.769	-0.836	0.1589	
30 minute winter	SW2.11	SW2.010P	SW2.010P:50%	-17.7	-1.004	-1.175	0.0610	
30 minute winter	SW2.11	SW2.010P	SW2.12	-16.3	-0.926	-1.083	0.0610	
15 minute winter	SW2.12	SW2.100	S6	-20.6	-1.172	-0.617	0.2287	
15 minute winter	SWHW 2	2.000	SWHW 2.1	7.7	1.767	0.183	0.0547	
15 minute winter	SWHW 2.1	2.001	S7	7.7	1.223	0.182	0.1890	
720 minute winter	BAFFLE R3.1	Depth/Flow	S7	1.7				
600 minute winter	BAFFLE R3.2	Depth/Flow	BAFFLE R3.1	0.6				
1440 minute winter	BAFFLE R3.3	Depth/Flow	BAFFLE R3.2	0.1				
15 minute summer	BAFFLE R4.1	Depth/Flow	9.005:50%	0.0				

**Results for 30 year Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
180 minute winter	9.005:50%	152	47.668	0.590	0.3	0.0000	0.0000	SURCHARGED
1440 minute winter	R4.2.1	1650	48.476	1.239	0.4	0.0000	0.0000	SURCHARGED
1440 minute winter	9.002:50%	1650	48.476	1.242	0.4	0.0000	0.0000	SURCHARGED
480 minute summer	BAFFLE R4.3	496	49.070	1.770	1.2	3.0526	0.0000	SURCHARGED
1440 minute winter	9.001:50%	1680	48.476	1.207	1.3	17.4686	0.0000	SURCHARGED
360 minute winter	P14	352	48.673	0.013	0.0	0.0024	0.0000	OK
360 minute winter	3.001:50%	352	48.673	0.310	1.5	3.0685	0.0000	SURCHARGED
15 minute summer	P13	1	48.695	0.000	0.0	0.0000	0.0000	OK
360 minute winter	3.002:50%	352	48.673	0.293	1.2	0.0000	0.0000	SURCHARGED
240 minute winter	SWHW 3	240	48.224	0.074	1.8	0.0000	0.0000	OK
15 minute winter	SWHW 3.1	10	48.535	0.055	9.9	0.0357	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	BAFFLE R4.1	9.005	S9	1.3	0.342	0.033	0.1857	
15 minute winter	R4.2.1	9.002	9.002:50%	-7.8	-0.406	-0.218	0.0295	
15 minute winter	R4.2.1	9.002	R4.2	-8.4	-0.427	-0.237	0.0295	
600 minute winter	BAFFLE R4.3	Depth/Flow	9.001:50%	5.8				
15 minute winter	BAFFLE R4.3	9.001	R4.2.1	-6.7	-0.169	-0.168	0.2088	
360 minute winter	P14	3.001	3.001:50%	0.0	0.002	0.000	0.0589	
15 minute summer	P14	3.001	P14/13	10.1	0.894	0.261	0.1129	
15 minute summer	P13	3.002	3.002:50%	0.0	0.000	0.000	0.0638	
15 minute summer	P13	3.002	P14/13	8.5	0.767	0.227	0.1275	
15 minute winter	SWHW 3	Flow through pond	SWHW 2	8.5	0.097	0.090	2.0039	
15 minute winter	SWHW 3.1	11.000	SWHW 3	9.9	1.854	0.263	0.0410	



**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	SWHW 1	1	46.420	0.000	2.5	0.0000	0.0000	OK
240 minute winter	S11	232	47.538	1.078	3.3	1.5423	0.0000	SURCHARGED
240 minute winter	S10	232	47.538	0.733	4.1	0.0814	0.0000	SURCHARGED
240 minute winter	S9	232	47.975	0.925	1.6	1.0462	0.0000	SURCHARGED
240 minute winter	S8	232	47.975	0.860	1.6	0.9729	0.0000	SURCHARGED
960 minute winter	S7	945	48.670	1.495	7.7	1.6910	0.0000	SURCHARGED
720 minute winter	S6	705	49.310	1.930	4.6	2.1825	0.0000	SURCHARGED
720 minute winter	S5	705	49.310	1.855	4.6	2.0977	0.0000	SURCHARGED
720 minute winter	S4	705	49.310	1.695	4.5	1.9169	0.0000	SURCHARGED
720 minute winter	S3	705	49.310	1.625	3.2	1.8377	0.0000	SURCHARGED
720 minute winter	S2	705	49.310	1.520	3.3	1.7191	0.0000	SURCHARGED
720 minute winter	S1	705	49.310	1.445	1.8	1.6819	0.0000	SURCHARGED
720 minute winter	P14/13	705	49.310	1.245	1.7	0.2253	0.0000	SURCHARGED
720 minute winter	P12	705	49.310	0.765	2.1	0.4735	0.0000	SURCHARGED
720 minute winter	P11	705	49.310	0.415	0.1	0.0751	0.0000	SURCHARGED
720 minute winter	5.000:50%	705	49.309	1.017	1.5	12.6966	0.0000	SURCHARGED
720 minute winter	P10	705	49.310	0.720	0.1	0.1303	0.0000	SURCHARGED
720 minute winter	6.000:50%	705	49.310	1.170	1.5	16.0783	0.0000	SURCHARGED
720 minute winter	P9	705	49.310	0.810	0.1	0.1466	0.0000	SURCHARGED
720 minute winter	7.000:50%	705	49.310	1.295	1.8	21.2418	0.0000	SURCHARGED
30 minute winter	R3.1	20	49.472	0.607	7.8	0.2719	0.0000	SURCHARGED
30 minute winter	R3.2 (BAFFLE)	21	49.455	0.710	21.6	10.9443	0.0000	SURCHARGED
120 minute winter	R3.3	82	49.336	0.791	8.8	9.0079	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
60 minute winter	S11	Hydro-Brake®	SWHW 1	2.6				41.3
15 minute summer	S10	1.009	S11	12.4	0.739	0.131	0.4135	
1440 minute winter	S9	Orifice	S10	1.8				
15 minute summer	S8	1.007	S9	1.8	0.068	0.045	0.4464	
15 minute summer	S7	Orifice	S8	1.9				
15 minute summer	S6	1.005	S7	-9.8	0.471	-0.242	1.3530	
15 minute winter	S5	1.004	S6	27.3	0.687	0.677	0.4921	
15 minute winter	S4	1.003	S5	29.7	0.776	0.738	1.0584	
15 minute winter	S3	1.002	S4	25.0	0.679	0.622	0.4638	
15 minute winter	S2	1.001	S3	26.6	0.867	0.666	0.7032	
15 minute summer	S1	1.000	S2	-14.2	0.625	-0.356	0.5055	
15 minute summer	P14/13	3.000	S1	14.6	0.869	0.969	0.3026	
15 minute winter	P12	4.000	S2	25.5	2.158	0.500	0.1470	
60 minute winter	P11	5.000	5.000:50%	-0.7	-0.064	-0.012	0.0953	
15 minute summer	P11	5.000	S4	11.6	1.824	0.206	0.1069	
15 minute winter	P10	6.000	6.000:50%	-2.6	-0.229	-0.046	0.0800	
15 minute summer	P10	6.000	S4	8.9	1.815	0.158	0.0800	
30 minute summer	P9	7.000	7.000:50%	-2.1	-0.189	-0.038	0.0853	
15 minute summer	P9	7.000	S5	8.8	1.653	0.155	0.0853	
15 minute winter	R3.1	8.000	R3.2 (BAFFLE)	9.3	0.531	0.498	0.1893	
30 minute winter	R3.2 (BAFFLE)	Depth/Flow	R3.3	16.8				
120 minute winter	R3.3	8.002	BAFFLE R3.3	4.7	0.269	0.135	0.0366	



**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
60 minute summer	R4.1 (BAFFLE)	34	49.166	1.811	10.9	2.9768	0.0000	SURCHARGED
120 minute winter	9.000:50%	100	49.075	1.747	12.5	0.0000	0.0000	SURCHARGED
1440 minute winter	R4.2	1290	48.940	1.710	0.7	4.5953	0.0000	SURCHARGED
1440 minute winter	9.003:50%	1680	48.688	1.485	0.8	27.1880	0.0000	SURCHARGED
1440 minute winter	R4.3 (BAFFLE)	1620	48.688	1.513	0.7	2.2615	0.0000	SURCHARGED
600 minute winter	9.004:50%	735	47.704	0.564	0.3	4.0147	0.0000	SURCHARGED
240 minute winter	SW1.1	232	47.538	0.613	4.6	8.9799	0.0000	FLOOD RISK
240 minute winter	SW1.2	232	47.539	0.418	5.8	13.2329	0.0000	SURCHARGED
240 minute winter	SW1.004P:50%	232	47.539	0.516	4.9	0.4735	0.0000	SURCHARGED
240 minute winter	SW1.3	232	47.539	0.189	5.9	1.9139	0.0000	SURCHARGED
240 minute winter	SW1.003P:50%	232	47.538	0.303	5.8	0.2696	0.0000	SURCHARGED
15 minute winter	SW1.4	13	47.573	0.122	18.2	1.5015	0.0000	OK
15 minute winter	SW1.002P:50%	13	47.557	0.156	21.0	0.0565	0.0000	SURCHARGED
15 minute winter	SW1.5	11	47.700	0.091	13.7	0.9870	0.0000	OK
15 minute winter	SW1.001P:50%	11	47.641	0.111	18.3	0.0488	0.0000	OK
15 minute winter	SW1.6	10	47.780	0.010	0.2	0.0017	0.0000	OK
15 minute winter	SW1.000P:50%	10	47.779	0.089	13.9	0.0345	0.0000	OK
720 minute winter	SW2.1	705	49.310	0.700	0.1	0.1266	0.0000	FLOOD RISK
720 minute winter	SW2.000P:50%	705	49.310	0.724	0.3	0.3263	0.0000	SURCHARGED
720 minute winter	SW2.2	705	49.310	0.748	1.5	5.1678	0.0000	FLOOD RISK
720 minute winter	SW2.001P:50%	705	49.309	0.776	1.4	0.4186	0.0000	SURCHARGED
720 minute winter	SW2.3	705	49.310	0.805	3.3	6.2050	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
30 minute winter	R4.1 (BAFFLE)	Depth/Flow	9.000:50%	40.9				
15 minute winter	R4.1 (BAFFLE)	9.000	BAFFLE R4.3	14.1	0.398	0.347	0.1776	
960 minute winter	R4.2	Depth/Flow	9.003:50%	1.4				
15 minute winter	R4.2	9.003	R4.3 (BAFFLE)	-15.5	-0.391	-0.384	0.1793	
15 minute summer	R4.3 (BAFFLE)	Depth/Flow	9.004:50%	0.0				
15 minute winter	R4.3 (BAFFLE)	9.004	BAFFLE R4.1	2.8	0.383	0.070	0.2270	
15 minute winter	SW1.1	10.000	S10	9.1	0.859	0.609	0.1115	
15 minute summer	SW1.2	SW1.004P	SW1.004P:50%	15.9	1.028	0.774	0.1289	
15 minute winter	SW1.2	SW1.004P	SW1.1	18.9	1.280	0.919	0.1289	
15 minute winter	SW1.3	SW1.003P	SW1.003P:50%	18.1	1.056	0.876	0.1500	
15 minute summer	SW1.3	SW1.003P	SW1.2	23.7	1.532	1.151	0.1500	
15 minute summer	SW1.4	SW1.002P	SW1.002P:50%	15.8	1.009	0.771	0.0597	
15 minute winter	SW1.4	SW1.002P	SW1.3	20.7	1.286	1.009	0.0669	
15 minute winter	SW1.5	SW1.001P	SW1.001P:50%	12.8	1.019	0.624	0.0747	
15 minute winter	SW1.5	SW1.001P	SW1.4	18.2	1.340	0.889	0.0860	
15 minute winter	SW1.6	SW1.000P	SW1.000P:50%	-0.2	-0.038	-0.008	0.0346	
15 minute winter	SW1.6	SW1.000P	SW1.5	13.7	1.305	0.669	0.0661	
480 minute summer	SW2.1	SW2.000P	SW2.000P:50%	-1.0	-0.059	-0.068	0.0566	
15 minute winter	SW2.1	SW2.000P	SW2.2	4.3	0.764	0.280	0.0192	
180 minute winter	SW2.2	SW2.001P	SW2.001P:50%	-6.4	0.393	-0.421	0.0676	
15 minute winter	SW2.2	SW2.001P	SW2.3	7.4	0.803	0.487	0.0500	
180 minute winter	SW2.3	SW2.002P	SW2.002P:50%	-8.4	-0.475	-0.550	0.0633	

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
720 minute winter	SW2.002P:50%	705	49.309	0.831	3.3	0.4221	0.0000	SURCHARGED
720 minute winter	SW2.4	705	49.310	0.858	4.1	5.8492	0.0000	SURCHARGED
720 minute winter	SW2.003P:50%	705	49.310	0.886	4.2	0.4713	0.0000	SURCHARGED
720 minute winter	SW2.5	705	49.310	0.914	4.7	6.1440	0.0000	SURCHARGED
720 minute winter	SW2.004P:50%	705	49.310	0.945	4.8	0.5627	0.0000	SURCHARGED
720 minute winter	SW2.6	705	49.310	0.976	4.8	6.8968	0.0000	SURCHARGED
720 minute winter	SW2.005P:50%	705	49.309	1.005	4.9	0.5557	0.0000	SURCHARGED
720 minute winter	SW2.7	705	49.310	1.035	4.7	6.6051	0.0000	SURCHARGED
720 minute winter	SW2.8	705	49.310	1.082	4.8	5.8742	0.0000	SURCHARGED
720 minute winter	SW2.007P:50%	705	49.309	1.122	4.9	0.8710	0.0000	SURCHARGED
720 minute winter	SW2.9	705	49.310	1.163	4.6	9.1356	0.0000	SURCHARGED
720 minute winter	SW2.008P:50%	705	49.310	1.220	4.6	1.2801	0.0000	SURCHARGED
720 minute winter	SW2.10	705	49.310	1.277	3.8	12.9576	0.0000	SURCHARGED
720 minute winter	SW2.11	705	49.310	1.350	3.9	9.2097	0.0000	FLOOD RISK
720 minute winter	SW2.010P:50%	705	49.310	1.375	4.0	0.6901	0.0000	SURCHARGED
720 minute winter	SW2.12	705	49.310	1.400	3.6	6.1810	0.0000	FLOOD RISK
960 minute winter	SWHW 2	945	48.671	0.521	3.3	0.0000	0.0000	FLOOD RISK
960 minute winter	SWHW 2.1	930	48.672	0.827	2.9	0.1496	0.0000	SURCHARGED
240 minute summer	BAFFLE R3.1	152	49.118	1.403	20.5	5.5819	0.0000	SURCHARGED
60 minute winter	BAFFLE R3.2	56	49.223	1.143	6.5	5.5316	0.0000	SURCHARGED
60 minute winter	BAFFLE R3.3	55	49.333	0.868	5.5	4.3161	0.0000	SURCHARGED
600 minute winter	BAFFLE R4.1	630	47.705	0.599	0.1	0.0000	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	SW2.3	SW2.002P	SW2.4	14.6	1.020	0.963	0.0630	
15 minute summer	SW2.4	SW2.003P	SW2.003P:50%	12.9	0.831	0.842	0.0624	
15 minute winter	SW2.4	SW2.003P	SW2.5	16.7	1.080	1.089	0.0661	
15 minute summer	SW2.5	SW2.004P	SW2.004P:50%	13.6	0.826	0.892	0.0739	
15 minute winter	SW2.5	SW2.004P	SW2.6	17.8	1.105	1.168	0.0739	
15 minute summer	SW2.6	SW2.005P	SW2.005P:50%	14.4	0.816	0.929	0.0683	
15 minute winter	SW2.6	SW2.005P	SW2.7	17.6	1.122	1.138	0.0683	
15 minute summer	SW2.7	SW2.006P	SW2.8	15.0	1.021	0.959	0.1069	
60 minute winter	SW2.8	SW2.007P	SW2.007P:50%	-16.8	-0.952	-1.097	0.0959	
60 minute winter	SW2.8	SW2.007P	SW2.9	-15.4	0.888	-1.010	0.0959	
60 minute winter	SW2.9	SW2.008P	SW2.008P:50%	-19.4	-1.104	-1.248	0.1300	
15 minute winter	SW2.9	SW2.008P	SW2.10	19.8	1.306	1.273	0.1300	
30 minute winter	SW2.10	SW2.009P	SW2.11	-19.3	-1.095	-1.209	0.1589	
15 minute winter	SW2.11	SW2.010P	SW2.010P:50%	-24.5	-1.389	-1.625	0.0610	
15 minute winter	SW2.11	SW2.010P	SW2.12	-21.2	-1.207	-1.412	0.0610	
15 minute summer	SW2.12	SW2.100	S6	-24.5	-1.394	-0.734	0.2287	
15 minute winter	SWHW 2	2.000	SWHW 2.1	16.7	2.079	0.397	0.0775	
15 minute winter	SWHW 2.1	2.001	S7	14.3	1.436	0.340	0.1890	
180 minute winter	BAFFLE R3.1	Depth/Flow	S7	27.8				
120 minute winter	BAFFLE R3.2	Depth/Flow	BAFFLE R3.1	28.8				
360 minute winter	BAFFLE R3.3	Depth/Flow	BAFFLE R3.2	16.3				
15 minute summer	BAFFLE R4.1	Depth/Flow	9.005:50%	0.0				

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 90.39%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
240 minute winter	9.005:50%	232	47.975	0.897	0.4	0.0000	0.0000	SURCHARGED
960 minute winter	R4.2.1	855	48.940	1.703	0.9	0.0000	0.0000	SURCHARGED
1440 minute winter	9.002:50%	1140	48.940	1.706	0.7	0.0000	0.0000	SURCHARGED
120 minute winter	BAFFLE R4.3	72	49.070	1.770	6.7	3.0534	0.0000	SURCHARGED
960 minute winter	9.001:50%	855	48.940	1.671	6.4	33.4852	0.0000	SURCHARGED
720 minute winter	P14	705	49.310	0.650	0.1	0.1176	0.0000	SURCHARGED
720 minute winter	3.001:50%	705	49.310	0.947	2.8	28.6382	0.0000	SURCHARGED
720 minute winter	P13	705	49.310	0.615	0.1	0.1113	0.0000	SURCHARGED
720 minute winter	3.002:50%	705	49.310	0.930	1.3	0.0000	0.0000	SURCHARGED
960 minute winter	SWHW 3	930	48.670	0.520	4.9	0.0000	0.0000	OK
960 minute winter	SWHW 3.1	945	48.671	0.191	1.1	0.1236	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	BAFFLE R4.1	9.005	S9	2.2	0.356	0.056	0.1857	
15 minute winter	R4.2.1	9.002	9.002:50%	-15.4	-0.388	-0.434	0.0295	
15 minute winter	R4.2.1	9.002	R4.2	-16.2	-0.420	-0.455	0.0295	
60 minute winter	BAFFLE R4.3	Depth/Flow	9.001:50%	32.6				
15 minute winter	BAFFLE R4.3	9.001	R4.2.1	-14.0	-0.352	-0.349	0.2088	
15 minute winter	P14	3.001	3.001:50%	-2.6	-0.224	-0.067	0.1129	
15 minute winter	P14	3.001	P14/13	-11.7	1.007	-0.304	0.1129	
15 minute winter	P13	3.002	3.002:50%	-2.8	-0.189	-0.075	0.1275	
15 minute winter	P13	3.002	P14/13	14.0	0.857	0.376	0.1275	
15 minute winter	SWHW 3	Flow through pond	SWHW 2	16.2	0.116	0.172	3.8998	
15 minute winter	SWHW 3.1	11.000	SWHW 3	18.2	2.148	0.486	0.0653	

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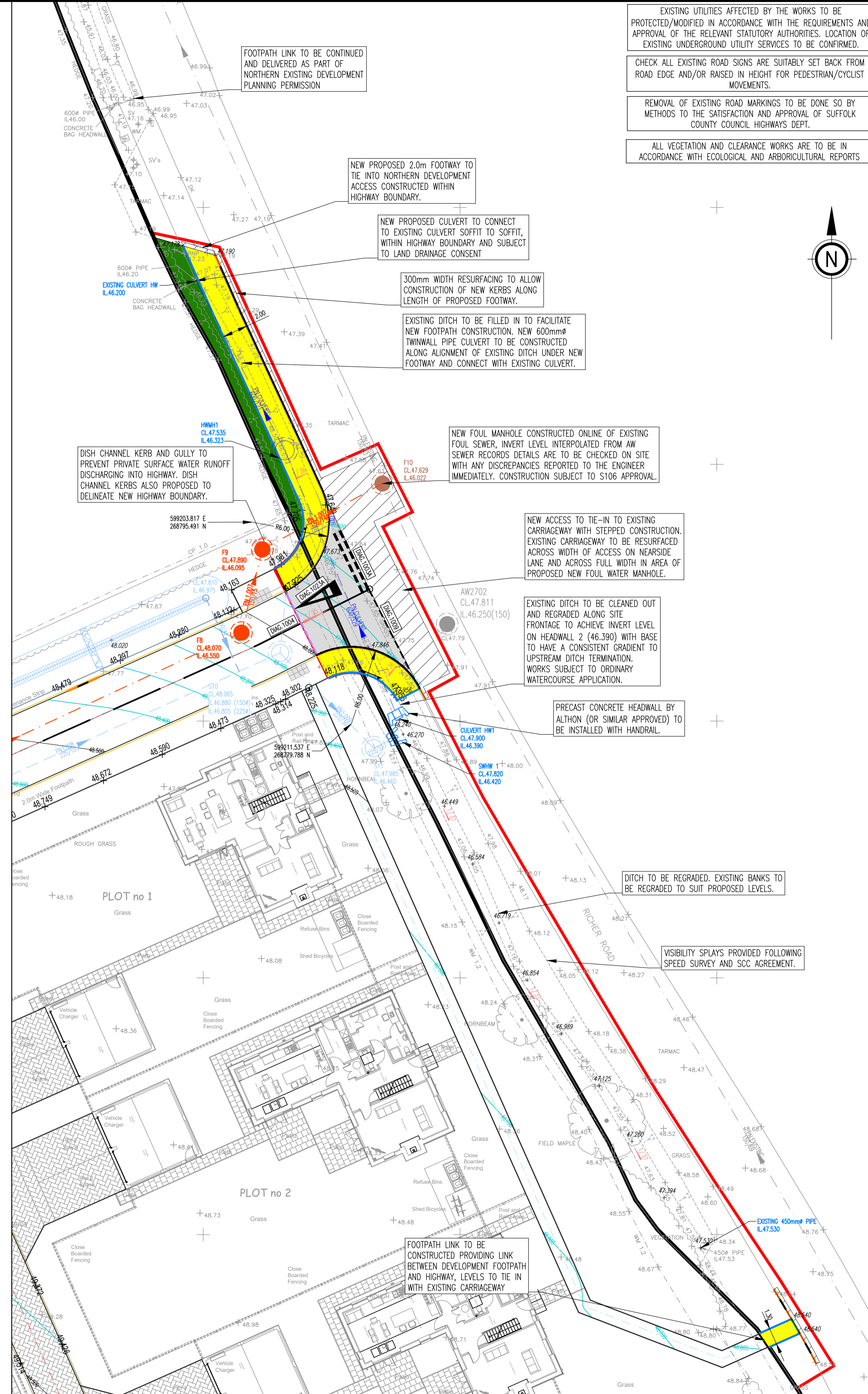


## Appendix D – New Footway & Culvert Plans





VISIBILITY SPLAYS  
SCALE 1:500



GENERAL ARRANGEMENT  
SCALE 1:200

- EXISTING UTILITIES AFFECTED BY THE WORKS TO BE PROTECTED/MODIFIED IN ACCORDANCE WITH THE REQUIREMENTS AND APPROVAL OF THE RELEVANT STATUTORY AUTHORITIES. LOCATION OF EXISTING UNDERGROUND UTILITY SERVICES TO BE CONFIRMED.
- CHECK ALL EXISTING ROAD SIGNS ARE SUITABLY SET BACK FROM ROAD EDGE AND/OR RAISED IN HEIGHT FOR PEDESTRIAN/CYCLIST MOVEMENTS.
- REMOVAL OF EXISTING ROAD MARKINGS TO BE DONE SO BY METHODS TO THE SATISFACTION AND APPROVAL OF SUFFOLK COUNTY COUNCIL HIGHWAYS DEPT.
- ALL VEGETATION AND CLEARANCE WORKS ARE TO BE IN ACCORDANCE WITH ECOLOGICAL AND ARBORICULTURAL REPORTS

- GENERAL
- DO NOT SCALE THIS DRAWING. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED. ANY DISCREPANCIES ARE TO BE RECORDED AND REPORTED TO THE ENGINEERS IMMEDIATELY.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEERS AND ARCHITECTS DRAWINGS AND THE SPECIFICATION.
  - ANY EXISTING DETAILS WHICH ARE SHOWN ON THIS DRAWING ARE FOR GUIDANCE ONLY AND ARE TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY VARIATIONS ARE TO BE RECORDED AND REPORTED TO THE ENGINEER IMMEDIATELY.
  - ALL WORK ARE TO BE TO THE SATISFACTION OF THE ENGINEER AND LOCAL AUTHORITY BUILDING CONTROL.
  - THE CONTRACTOR IS RESPONSIBLE FOR AND MUST TAKE ALL NECESSARY PRECAUTIONS TO ENSURE THE STABILITY OF THE WORKS AT ALL TIMES DURING CONSTRUCTION.
  - ALL WORKMANSHIP AND MATERIALS ARE TO BE TO CURRENT BRITISH STANDARDS.
  - ALL SERVICES ARE TO BE LOCATED AND PROTECTED AS NECESSARY BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE WORKS.
  - ALL HIGHWAY WORKS ARE TO BE IN ACCORDANCE WITH THE LOCAL AUTHORITIES DESIGN GUIDE AND SPECIFICATION.
  - PRIOR TO THE OCCUPATION OF THE FIRST DWELLING, STREET NAMEPLATES SHALL BE ERECTED IN ACCORDANCE WITH THE HIGHWAY AUTHORITY AND TO THE WORDING AGREED WITH THE PLANNING AUTHORITY.
  - DURING CONSTRUCTION WORKS ON SITE, ALL ROADS AND FOOTPATHS ARE TO BE SWEEP AND KEPT CLEAR OF OBSTRUCTIONS, THIS IS TO INCLUDE EXISTING HIGHWAYS AS APPROPRIATE TO ENSURE SAFE PASSAGE OF ALL ROAD USERS.
  - PROVISION SHALL BE MADE FOR THE INSTALLATION OF ALL MAINS SERVICES INCLUDING DUCTING PRIOR TO THE LAYING OF THE ROAD BASE-COURSE.
  - ALL ROAD MARKINGS AND SIGNS ARE TO BE IN ACCORDANCE WITH 'THE TRAFFIC SIGNS REGULATIONS AND DIRECTIONS' 2016.

SECTION 278 AGREEMENT KEY

HIGHWAY BOUNDARY (BOUNDARY TBC BY SCC)	—
S278 LIMIT OF WORKS - RED	—
S278 NEW FLEXIBLE CARRIAGEWAY	—
S278 NEW FLEXIBLE (BLACK TOP) FOOTWAYS =77m²	—
S278 GRASS VERGE - GREEN =33m²	—
BREAK OUT AND REPLACE / EXISTING SURFACING TIE IN =68m²	—
JUNCTION VISIBILITY SPLAY	—
DROPPER (DK) =6m	—
BULLNOSED (BN) =2m	—
HALF BATTERED (HB2) =40m	—
EDGING (EF) =42m	—
DISH CHANNEL KERB =6m	—
HIGHWAYS DRAINAGE	—
STREET NAMEPLATE SIGN	—
PROPOSED LEVELS/REGRADE	—

QUANTITIES ARE APPROXIMATE AND REFLECTIVE OF WORKS TAKING PLACE WITHIN THE EXISTING OR PROPOSED HIGHWAY BOUNDARY.

Rev	Revision Notes	Drawn	Appr'd	Date

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**PRELIMINARY**

Project:  
RICHER ROAD, BADWELL ASH  
SUFFOLK

Drawing Title:  
S278  
GENERAL ARRANGEMENT

Client: BG & JM SUTTON	Date: SEPT 2023
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Drawn: JH	Designed: JH	Checked: DCH	Approved: RGW
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Scale:  
1:200

Project No: 2005-453	Drawing No & Revision: 278	Size: A1
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## Appendix E – SuDS Maintenance Plan

# **Richer Road, Badwell Ash, Suffolk. SuDS Maintenance Plan**

*Date: **October 2023***

*Author: **Joel Hurst***

*Ingent Project Code & Reference: **2005-453***

*Revision: -*

## **Contents**

1	INTRODUCTION .....	2
2	THE SUDS FEATURES AT BADWELL ASH .....	2
3.	MAINTENANCE OF SUDS .....	4



## 1 INTRODUCTION

- 1.1 The use of SuDS is proposed within the surface water drainage strategy for the development of 14 dwellings off Richer Road, Badwell Ash in order to serve several functions:
- Control of runoff water rates and volumes, thereby reducing downstream flood risk
  - Reducing pollutant concentrations and act as a buffer for accidental spills to improve runoff water quality
  - To enhance the amenity value of the site and promote biodiversity
- 1.2 The range of SuDS will be described in this document and recommended maintenance regimes to be applied to each and who it is envisaged will be responsible for implementing the maintenance.

## 2 THE SUDS FEATURES AT BADWELL ASH

- 2.1 The SuDS features proposed on the Badwell Ash development consists of:
- **Permeable Pavements** – in this case permeable block paving, allowing rain to percolate through the surface into underlying drainage layers. It should be protected from silt, sand, compost, mulch etc. Maintenance of the permeable paving will be carried out by individual owners for driveways and site maintenance company for the shared access ways.
  - **Attenuation Basins** – are landscaped depressions that are normally dry except during and immediately following storm events. These can be off-line components where surface run-off from regular events is not routed through the basin and only in more severe events, when the flows rise, the basin fills and provides storage of run-off and flow attenuation. Seeding with a native wildflower/grass seed mix will enhance water treatment. Maintenance of the attenuation basin will be by the site management company.
  - **Roadside Swales** – are shallow, flat bottomed, vegetated open channels designed to convey, treat, and attenuate surface water runoff. Surface water runoff from the road during all events will be collected and treated by the swales. The swales are under-drained with a perforated pipe collecting runoff after it has percolated through open graded aggregate situated above. This aggregate should be kept free of silt, sand and debris in order to allow optimum treatment and storage in severe events. The flush kerbs allowing runoff to enter the swale channel should also remain unobstructed. Check dams constructed of coarse aggregate are to be situated approximately every 10m along the length of the swales.

2.2 Within individual dwelling curtilages surface water drainage will consist of rainwater guttering, downpipes, yard gullies and below ground plastic pipework, all designed and installed in compliance with Building Regulations.

The responsibility for maintaining this drainage will lie with the individual householders and consist of routine clearance of guttering, gullies and inspection chambers and occasional jetting of obstructions if they occur.

Outside of dwelling curtilages surface water pipework will connect to main drains consisting of larger pipes laid within the development access roads. These pipes will have been designed and installed in accordance with Sewers for Adoption where below adoptable standard roads.

The responsibility for maintaining these pipes and chambers will therefore rest with Anglian Water where adopted under Section 104, or the site Management Company elsewhere.

Surface water runoff from the main access roads will be collected through a combination of roadside swales and road gullies which are connected to the main pipework described above. Maintenance of these features will be the responsibility of the Site Management Company where the access road is not adopted but lies outside the boundaries of individual dwellings.

The site outfall is a restricted discharge to an existing watercourse. Maintenance of the existing watercourse at point of outfall, the headwall and the flow restriction device will all be required and will be the responsibility of the Site Management Company.

Watercourse maintenance is expected to consist of litter picking and clearance, and annual cutting back of hedges and vegetation and clearance of silt in the invert of the ditch if obstructing clear flow from the outfall.

Hydrobrake maintenance is expected to consist of annual clearance of silt from the sump and the inlet and flushing through, as well as checks to confirm effective operation of the bypass plate.

### 3. MAINTENANCE OF SUDS

3.1 **Permeable Pavement** - will require regular maintenance to ensure continuing operation to design performance standards.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

**3.2 Attenuation Basin** - The attenuation basin will require ongoing regular maintenance to ensure continuing operation to design performance standards. Maintenance of attenuation basins is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a SuDS attenuation basin over and above what is necessary for standard public open space.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
	Occasional maintenance	Reseed areas of poor vegetation growth
Prune and trim any trees and remove cuttings		Every 2 years, or as required
Remove sediment from inlets, outlets, forebay and main basin when required		Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

**3.3 Roadside Swales** – Swales will require regular maintenance to ensure continuing operation to design performance standards. The treatment performance of swales is dependent on maintenance. Maintenance of swales is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a swale over and above what is necessary for standard public open space.

<b>Operation and maintenance requirements for swales</b>		
<b>Maintenance schedule</b>	<b>Required action</b>	<b>Typical frequency</b>
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeded	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

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## Appendix F – CSWMP Layout





- NOTES**
1. NO MATERIALS ARE TO BE STORED WITHIN 8m OF ANY WATERCOURSE.
  2. IN THE EVENT OF A POLLUTION SPILLAGE, IMMEDIATELY BUNG OFFFALL PIPE AND THEN FOLLOW GUIDANCE OF PPG22 TO CONTAIN, CLEAN AND REPORT SPILLAGE.

TEMPORARY DETENTION BASIN TO BE CREATED WHEN FIRST ON SITE. DEPTH AROUND 300mm.

PERMANENT SITE BOUNDARY

225mm PIPE BUNGS TO BE KEPT ON SITE AVAILABLE FOR USE TO IMMEDIATELY BLOCK OFFFALL IN THE EVENT OF A POLLUTION INCIDENT.

ENSURE TEMPORARY AND PERMANENT PIPES OFFFALLS DO NOT PROTRUDE INTO CROSS SECTION OF EXISTING DITCH.

225mm OFFFALL PIPE TO BE CONSTRUCTED INTO BUND AT LOW POINT OF SITE. STRAW BALES TO BE PLACED INFRONT OF OFFFALL PIPE SO SURFACE WATER CAN SEEP THROUGH.

OFFFALL WATERCOURSE TO BE CHECKED AT LEAST WEEKLY FOR ANY EVIDENCE OF CONTAMINATION BY SEDIMENT OR POLLUTION FROM THE SITE. IF ANY EVIDENCE IS FOUND THEN DISCHARGE FROM BASIN TOO BE STOPPERED AND SOURCE INVESTIGATED AND REMEDIATED.

BUND TO BE FORMED ALONG NORTH EASTERN SITE BOUNDARY WITH TOPSOIL AND ARISINGS. MIN 450mm HIGH AND 1:2 SIDE SLOPES

NATURAL FLOW PATH TO NORTH EAST WHERE WATER WILL DISCHARGE THROUGH OFFFALL PIPE TO EXISTING WATERCOURSE.

AREA FOR SITE COMPOUND AND OFFICES. SITE COMPOUND TO INCLUDE FULLY BUNDED FUEL STORE.

TEMPORARY CAR PARKING SPACE

**MAINTENANCE SCHEDULE FOR CONSTRUCTION SURFACE WATER DRAINAGE.**

1. INSPECT TEMPORARY BASINS ON WEEKLY BASIS AND REMOVE ALL LARGE DEBRIS AND CHECK FOR SIGNS OF POLLUTION AND LEVEL OF SILT.
2. IF BASIN FILLS WITH SILT ARRANGE FOR CLEANING TO RESTORE CAPACITY AS SOON AS POSSIBLE.
3. INSPECT STRAW BALES ON WEEKLY BASIS AND CHECK FOR SIGNS OF BREAKDOWN THAT WOULD ALLOW UNFILTERED SURFACE WATER TO LEAVE SITE.
4. AT SAME TIME CHECK DITCH DOWNSTREAM OF BALES FOR ANY SIGN OF SILT OR POLLUTION LEAVING SITE.
5. IN THE EVENT OF ANY SIGNS OF POLLUTION SPILLAGE, IMMEDIATELY STOPPER THE 225mm OFFFALL PIPE AND IMPLEMENT CONTAINMENT, CLEARING AND REPORTING IN ACCORDANCE WITH REQUIREMENTS OF .GOV WEBSITE AND GUIDANCE OF APPENDED PPG22.

**GENERAL**

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3. ANY EXISTING DETAILS WHICH ARE SHOWN ON THIS DRAWING ARE FOR GUIDANCE ONLY AND ARE TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY VARIATIONS ARE TO BE RECORDED AND REPORTED TO THE ENGINEER IMMEDIATELY.

**CSWMP KEY**

- DEVELOPERS OWNERSHIP BOUNDARY
- SITE COMPOUND AND OFFICES
- TEMPORARY PARKING SPACES

Rev	Revision Notes	Drawn (Appr)	Date

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**PRELIMINARY**

Project:  
**RICHER ROAD, BADWELL ASH SUFFOLK**

Drawing Title:  
**CONSTRUCTION SURFACE WATER MANAGEMENT PLAN**

Client:  
**BG & JM SUTTON** Date:  
**SEPT 2023**

Drawn: <b>JH</b>	Designed: <b>JH</b>	Checked: <b>DCH</b>	Approved: <b>RGW</b>
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Scale:   
1:500

Project No: <b>2005-453</b>	Drawing No & Revision: <b>160</b>	Size: <b>A1</b>
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