



HOLDGATE
CONSULTING

Drainage Design
Calculations

REV D

Project:
22 Portway
M22 1UB

Job No.:
23-058

DRAFT

Author: NM

Date: April 23

Checked: RJP

Approved: RJP

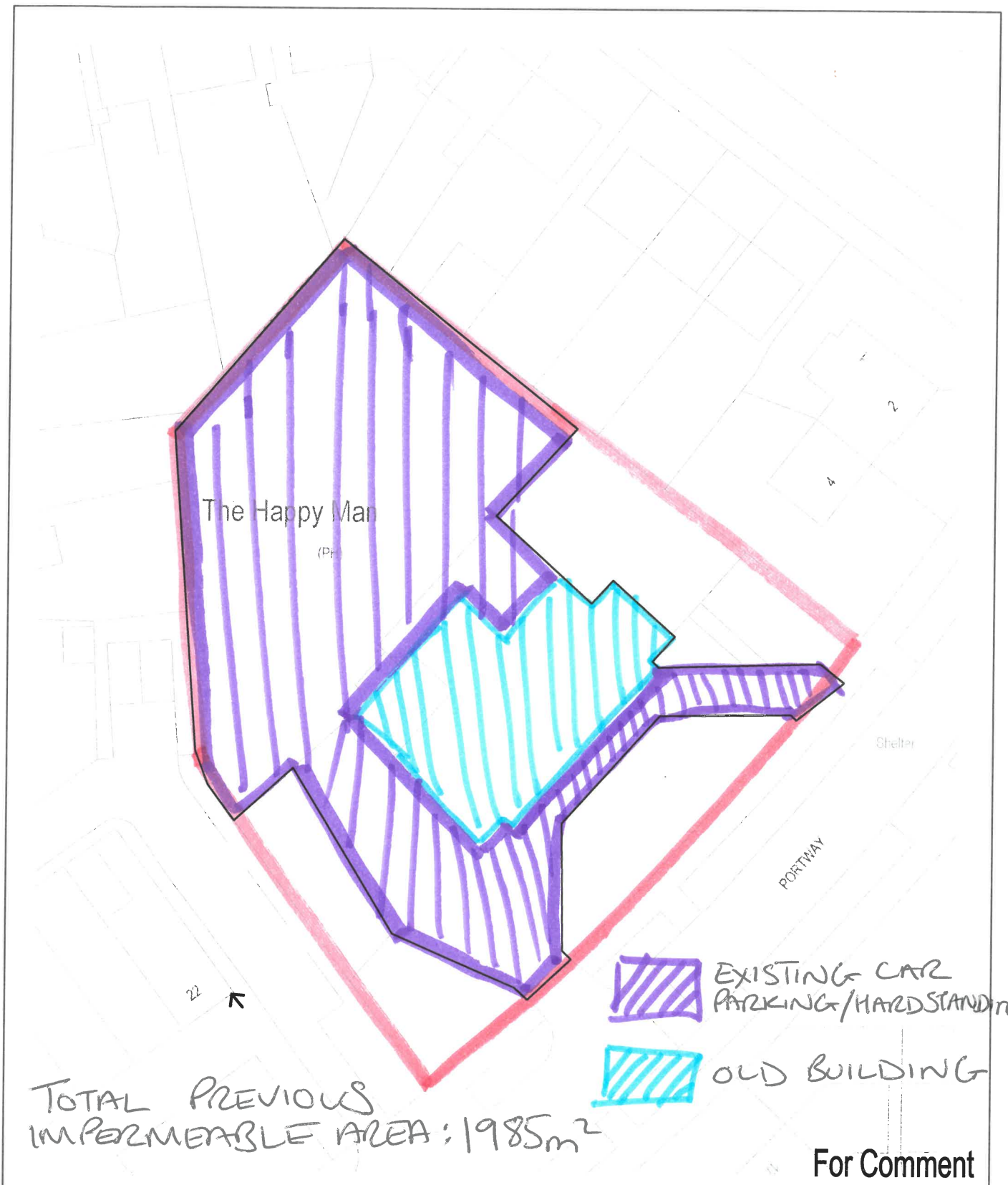
FINAL

Author: NM

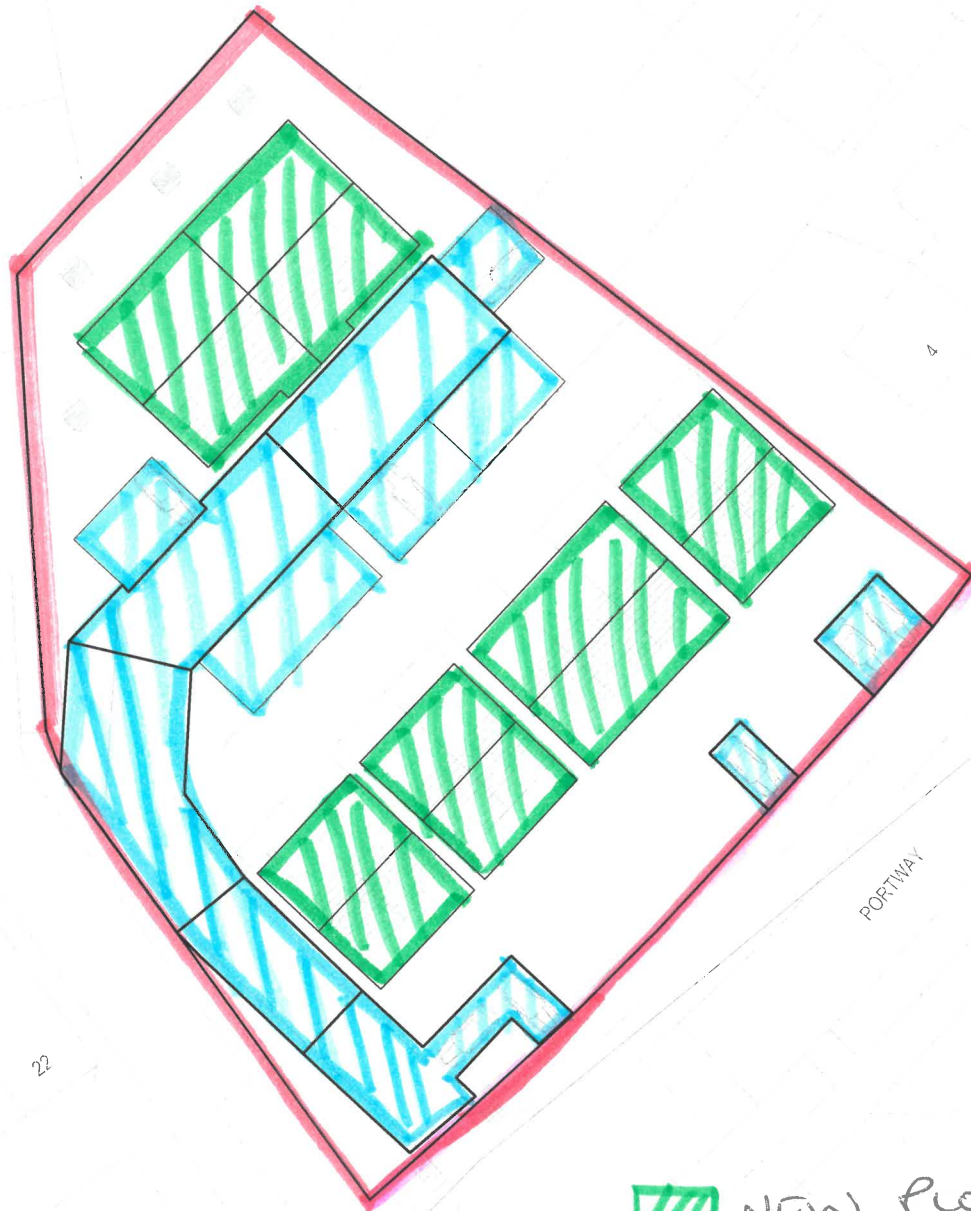
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 HOLDGATE CONSULTING The Old Hall, 23 Park Road, Bingley, West Yorkshire, BD16 4BQ 01274 566696 mail@holdgateconsulting.com	Job Title 22 Port way, M22 1UB	Job No. 23-058 Drawing No. SK-D01 Revision P01
	Drawing Title Existing Site Plan	Date April 23 Drawn By EH Checked NM
Scale as shown @A4		



 NEW PLOTS
 HARDSTANDING

TOTAL IMPERMEABLE
AREA : 1478m²

For Comment



**HOLDGATE
CONSULTING**

The Old Hall, 23 Park Road,
Bingley, West Yorkshire, BD16 4BQ

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Scale as shown @A4

Job Title

22 Port way, M22 1UB

Drawing Title

Proposed Site Plan

Job No. 23-058

Drawing No. SK-D02

Revision P01

Date April 23

Drawn By EH

Checked NM



HOLDGATE
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Project

HAPPY MAN PH
PORTWAY.

Date

Job No.

23-058

Initials

NM

Sheet No.

03

Calculation for

DRAINAGE

SURFACE WATER

EXISTING SITE DRAINAGE AREA

↳ BUILDING → 395 m^2

HARDSTANDING → 1590 m^2

TOTAL

1985 m^2

(0.1985_{Ha})

BROWNFIELD DISCHARGE RATE

↳ $0.1985 \times 140 = 27.79 \text{ l/sec.}$

(PEAK DISCHARGE)

ALLOW FOR 50% BETTERMENT FROM PEAK

$27.79 \times 0.5 = 13.89 \text{ l/sec}$

MAX DISCHARGE FROM SITE REDUCED
FURTHER TO 13.5 l/sec.

SEE SW CALCULATIONS.



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Inverts
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.000
Ratio-R	0.350	Preferred Cover Depth (m)	0.550
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
IC S1	0.006	5.00	58.200	315	0.650
IC S2	0.006	5.00	58.200	315	0.768
IC S3	0.000		58.200	315	0.908
IC S4	0.006	5.00	58.000	315	0.926
MH S5	0.013	5.00	57.700	1200	1.200
MH S6	0.020	5.00	57.903	1200	1.583
MH S7	0.012	5.00	58.050	1200	1.903
MH S8	0.006	5.00	58.140	1200	2.160
MH S9	0.013	5.00	58.229	1200	2.379
MH S10	0.015	5.00	58.400	1500	2.719
IC S11	0.005	5.00	58.100	315	0.650
IC S12	0.008	5.00	58.000	315	0.650
IC S13	0.008	5.00	58.100	315	0.952
IC S14	0.000		58.100	315	1.127
IC S15	0.010	5.00	58.100	315	1.300
IC S16	0.009	5.00	58.200	315	0.650
IC S17	0.010	5.00	58.200	315	0.808
MH S18	0.000		58.300	600	2.872
MH EX01			58.200	1200	2.820

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	IC S1	IC S2	9.400	0.600	57.550	57.432	0.118	80.0	100	5.18	47.9
1.001	IC S2	IC S3	11.230	0.600	57.432	57.292	0.140	80.0	100	5.40	47.1
1.002	IC S3	IC S4	13.100	0.600	57.292	57.074	0.218	60.0	150	5.57	46.5
1.003	IC S4	MH S6	5.900	0.600	57.074	56.976	0.098	60.0	150	5.64	46.2
1.004	MH S6	MH S7	10.370	0.600	56.320	56.147	0.173	60.0	150	5.78	45.7
1.005	MH S7	MH S8	10.000	0.600	56.147	55.980	0.167	60.0	150	5.90	45.3

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	0.861	6.8	0.8	0.550	0.668	0.006	0.0	23	0.573
1.001	0.861	6.8	1.5	0.668	0.808	0.012	0.0	32	0.696
1.002	1.301	23.0	1.5	0.758	0.776	0.012	0.0	26	0.736
1.003	1.301	23.0	2.3	0.776	0.777	0.018	0.0	32	0.833
1.004	1.301	23.0	6.3	1.433	1.753	0.051	0.0	54	1.111
1.005	1.301	23.0	7.7	1.753	2.010	0.063	0.0	60	1.176



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)
1.006	MH S8	MH S9	7.800	0.600	55.980	55.850	0.130	60.0	150	6.00	45.0
1.007	MH S9	MH S10	13.500	0.600	55.850	55.681	0.169	80.0	150	6.20	44.3
1.008	MH S10	MH S18	20.260	0.600	55.681	55.428	0.253	80.0	225	6.43	43.6
1.009	MH S18	MH EX01	3.800	0.600	55.428	55.380	0.048	80.0	225	6.48	43.4
2.000	MH S5	MH S6	18.000	0.600	56.500	56.320	0.180	100.0	150	5.30	47.5
4.000	IC S11	IC S13	10.300	0.600	57.450	57.321	0.129	80.0	100	5.20	47.9
3.000	IC S12	IC S13	12.100	0.600	57.350	57.148	0.202	60.0	100	5.20	47.8
3.001	IC S13	IC S14	14.000	0.600	57.148	56.973	0.175	80.0	100	5.47	46.8
3.002	IC S14	IC S15	10.400	0.600	56.973	56.800	0.173	60.0	100	5.65	46.2
3.003	IC S15	MH S9	12.180	0.600	56.800	56.597	0.203	60.0	100	5.85	45.5
5.000	IC S16	IC S17	9.500	0.600	57.550	57.392	0.158	60.0	100	5.16	48.0
5.001	IC S17	IC S15	12.180	0.600	57.392	57.189	0.203	60.0	100	5.36	47.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.006	1.301	23.0	8.4	2.010	2.229	0.069	0.0	63	1.203
1.007	1.125	19.9	15.8	2.229	2.569	0.132	0.0	102	1.247
1.008	1.463	58.2	17.4	2.494	2.647	0.147	0.0	84	1.280
1.009	1.463	58.2	17.3	2.647	2.595	0.147	0.0	84	1.280
2.000	1.005	17.8	1.7	1.050	1.433	0.013	0.0	31	0.635
4.000	0.861	6.8	0.6	0.550	0.679	0.005	0.0	21	0.537
3.000	0.996	7.8	1.0	0.550	0.852	0.008	0.0	25	0.689
3.001	0.861	6.8	2.7	0.852	1.027	0.021	0.0	43	0.807
3.002	0.996	7.8	2.6	1.027	1.200	0.021	0.0	40	0.901
3.003	0.996	7.8	6.2	1.200	1.532	0.050	0.0	67	1.102
5.000	0.996	7.8	1.2	0.550	0.708	0.009	0.0	26	0.714
5.001	0.996	7.8	2.4	0.708	0.811	0.019	0.0	39	0.884

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
IC S1	58.200	0.650	315		0	1.000	57.550	100
IC S2	58.200	0.768	315		1	1.000	57.432	100
					0	1.001	57.432	100
IC S3	58.200	0.908	315		1	1.001	57.292	100
					0	1.002	57.292	150

**Manhole Schedule**

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
IC S4	58.000	0.926	315	1	1.002	57.074	150
				0	1.003	57.074	150
MH S5	57.700	1.200	1200	0	2.000	56.500	150
MH S6	57.903	1.583	1200	1	2.000	56.320	150
				2	1.003	56.976	150
				0	1.004	56.320	150
MH S7	58.050	1.903	1200	1	1.004	56.147	150
				0	1.005	56.147	150
MH S8	58.140	2.160	1200	1	1.005	55.980	150
				0	1.006	55.980	150
MH S9	58.229	2.379	1200	1	3.003	56.597	100
				2	1.006	55.850	150
				0	1.007	55.850	150
MH S10	58.400	2.719	1500	1	1.007	55.681	150
				0	1.008	55.681	225
IC S11	58.100	0.650	315	0	4.000	57.450	100
IC S12	58.000	0.650	315	0	3.000	57.350	100
IC S13	58.100	0.952	315	1	4.000	57.321	100
				2	3.000	57.148	100
				0	3.001	57.148	100
IC S14	58.100	1.127	315	1	3.001	56.973	100
				0	3.002	56.973	100
IC S15	58.100	1.300	315	1	5.001	57.189	100
				2	3.002	56.800	100
				0	3.003	56.800	100
IC S16	58.200	0.650	315	0	5.000	57.550	100


Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
IC S17	58.200	0.808	315	1	5.000	57.392	100
				0	5.001	57.392	100
MH S18	58.300	2.872	600	1	1.008	55.428	225
				0	1.009	55.428	225
MH EX01	58.200	2.820	1200	1	1.009	55.380	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	90
Analysis Speed	Normal		

Storm Durations

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

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

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.199	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	
CWI		Runoff Volume (m³)	

Node MH S10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	55.681	Product Number	CTL-SHE-0152-1350-2000-1350
Design Depth (m)	2.000	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.5	Min Node Diameter (mm)	1500

Node MH S10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	55.681
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	18



Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	20.0	0.0	1.200	20.0	0.0	1.210	0.0	0.0


Results for 1 year Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC S1	11	57.572	0.022	0.7	0.0057	0.0000	OK
15 minute winter	IC S2	11	57.465	0.033	1.4	0.0076	0.0000	OK
15 minute winter	IC S3	11	57.317	0.025	1.4	0.0020	0.0000	OK
15 minute winter	IC S4	11	57.106	0.032	2.1	0.0067	0.0000	OK
15 minute winter	MH S5	11	56.529	0.029	1.5	0.0397	0.0000	OK
15 minute winter	MH S6	11	56.373	0.053	5.9	0.0735	0.0000	OK
15 minute winter	MH S7	11	56.207	0.060	7.2	0.0758	0.0000	OK
15 minute winter	MH S8	11	56.043	0.063	7.9	0.0750	0.0000	OK
15 minute winter	MH S9	11	55.957	0.107	15.3	0.1329	0.0000	OK
15 minute winter	MH S10	14	55.845	0.164	16.9	3.5850	0.0000	OK
15 minute winter	IC S11	11	57.470	0.020	0.6	0.0047	0.0000	OK
15 minute winter	IC S12	10	57.374	0.024	1.0	0.0077	0.0000	OK
15 minute winter	IC S13	10	57.192	0.044	2.6	0.0108	0.0000	OK
15 minute winter	IC S14	11	57.012	0.039	2.5	0.0030	0.0000	OK
15 minute winter	IC S15	11	56.868	0.068	5.8	0.0158	0.0000	OK
15 minute winter	IC S16	10	57.575	0.025	1.1	0.0089	0.0000	OK
15 minute winter	IC S17	10	57.429	0.037	2.3	0.0121	0.0000	OK
15 minute winter	MH S18	14	55.500	0.072	10.2	0.0203	0.0000	OK
15 minute winter	MH EX01	14	55.443	0.063	10.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC S1	1.000	IC S2	0.7	0.408	0.104	0.0163	
15 minute winter	IC S2	1.001	IC S3	1.4	0.750	0.207	0.0211	
15 minute winter	IC S3	1.002	IC S4	1.4	0.599	0.061	0.0307	
15 minute winter	IC S4	1.003	MH S6	2.1	0.786	0.091	0.0157	
15 minute winter	MH S5	2.000	MH S6	1.5	0.384	0.084	0.0721	
15 minute winter	MH S6	1.004	MH S7	5.8	0.957	0.254	0.0632	
15 minute winter	MH S7	1.005	MH S8	7.2	1.051	0.312	0.0683	
15 minute winter	MH S8	1.006	MH S9	8.0	0.782	0.346	0.0800	
15 minute winter	MH S9	1.007	MH S10	15.2	1.296	0.764	0.2014	
15 minute winter	MH S10	Hydro-Brake®	MH S18	10.2				
15 minute winter	IC S11	4.000	IC S13	0.6	0.528	0.089	0.0117	
15 minute winter	IC S12	3.000	IC S13	1.0	0.417	0.124	0.0285	
15 minute winter	IC S13	3.001	IC S14	2.5	0.824	0.369	0.0427	
15 minute winter	IC S14	3.002	IC S15	2.5	0.589	0.321	0.0442	
15 minute winter	IC S15	3.003	MH S9	5.8	1.060	0.746	0.0670	
15 minute winter	IC S16	5.000	IC S17	1.1	0.516	0.137	0.0199	
15 minute winter	IC S17	5.001	IC S15	2.2	0.842	0.280	0.0317	
15 minute winter	MH S18	1.009	MH EX01	10.2	1.020	0.175	0.0380	8.0



Results for 30 year Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC S1	10	57.584	0.034	1.7	0.0089	0.0000	OK
15 minute winter	IC S2	10	57.485	0.053	3.4	0.0124	0.0000	OK
15 minute winter	IC S3	11	57.330	0.038	3.3	0.0030	0.0000	OK
15 minute winter	IC S4	11	57.125	0.051	4.9	0.0106	0.0000	OK
15 minute winter	MH S5	13	56.552	0.052	3.8	0.0700	0.0000	OK
15 minute winter	MH S6	13	56.545	0.225	14.4	0.3110	0.0000	SURCHARGED
15 minute winter	MH S7	13	56.504	0.357	16.6	0.4491	0.0000	SURCHARGED
15 minute winter	MH S8	13	56.447	0.467	17.0	0.5537	0.0000	SURCHARGED
15 minute winter	MH S9	13	56.390	0.540	27.3	0.6700	0.0000	SURCHARGED
30 minute winter	MH S10	26	56.165	0.484	26.7	10.5828	0.0000	SURCHARGED
15 minute winter	IC S11	10	57.482	0.032	1.5	0.0075	0.0000	OK
15 minute winter	IC S12	10	57.387	0.037	2.3	0.0120	0.0000	OK
15 minute winter	IC S13	12	57.332	0.184	6.0	0.0453	0.0000	SURCHARGED
15 minute winter	IC S14	12	57.238	0.265	5.2	0.0207	0.0000	SURCHARGED
15 minute winter	IC S15	12	57.174	0.374	11.8	0.0869	0.0000	SURCHARGED
15 minute winter	IC S16	10	57.590	0.040	2.6	0.0141	0.0000	OK
15 minute winter	IC S17	10	57.456	0.064	5.5	0.0209	0.0000	OK
30 minute winter	MH S18	26	55.512	0.084	13.4	0.0237	0.0000	OK
30 minute winter	MH EX01	26	55.453	0.073	13.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC S1	1.000	IC S2	1.7	0.514	0.248	0.0307	
15 minute winter	IC S2	1.001	IC S3	3.3	0.953	0.489	0.0390	
15 minute winter	IC S3	1.002	IC S4	3.3	0.755	0.144	0.0578	
15 minute winter	IC S4	1.003	MH S6	5.0	0.990	0.216	0.0295	
15 minute winter	MH S5	2.000	MH S6	3.7	0.474	0.211	0.2072	
15 minute winter	MH S6	1.004	MH S7	13.1	1.115	0.571	0.1826	
15 minute winter	MH S7	1.005	MH S8	15.4	1.171	0.672	0.1760	
15 minute winter	MH S8	1.006	MH S9	13.1	0.820	0.572	0.1373	
15 minute winter	MH S9	1.007	MH S10	26.3	1.496	1.325	0.2377	
30 minute winter	MH S10	Hydro-Brake®	MH S18	13.4				
15 minute winter	IC S11	4.000	IC S13	1.5	0.676	0.215	0.0222	
15 minute winter	IC S12	3.000	IC S13	2.3	0.502	0.291	0.0629	
15 minute winter	IC S13	3.001	IC S14	5.2	0.933	0.771	0.1095	
15 minute winter	IC S14	3.002	IC S15	5.5	0.706	0.706	0.0814	
15 minute winter	IC S15	3.003	MH S9	11.2	1.433	1.433	0.0943	
15 minute winter	IC S16	5.000	IC S17	2.6	0.631	0.330	0.0389	
15 minute winter	IC S17	5.001	IC S15	5.4	1.043	0.684	0.0626	
30 minute winter	MH S18	1.009	MH EX01	13.4	1.093	0.230	0.0467	25.7


Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC S1	10	57.598	0.048	3.2	0.0126	0.0000	OK
15 minute winter	IC S2	10	57.515	0.083	6.4	0.0193	0.0000	OK
15 minute winter	IC S3	11	57.345	0.053	6.2	0.0042	0.0000	OK
15 minute winter	IC S4	13	57.274	0.200	9.3	0.0415	0.0000	SURCHARGED
15 minute winter	MH S5	13	57.275	0.775	8.5	1.0443	0.0000	SURCHARGED
15 minute winter	MH S6	13	57.265	0.945	21.0	1.3073	0.0000	SURCHARGED
15 minute winter	MH S7	14	57.170	1.023	21.7	1.2863	0.0000	SURCHARGED
30 minute winter	MH S8	23	57.054	1.074	18.7	1.2751	0.0000	SURCHARGED
30 minute winter	MH S9	24	56.966	1.116	34.5	1.3839	0.0000	SURCHARGED
30 minute winter	MH S10	33	56.731	1.050	38.4	22.9666	0.0000	SURCHARGED
15 minute winter	IC S11	14	57.811	0.361	3.6	0.0838	0.0000	FLOOD RISK
15 minute winter	IC S12	14	57.821	0.471	4.2	0.1525	0.0000	FLOOD RISK
15 minute winter	IC S13	14	57.807	0.659	8.3	0.1620	0.0000	FLOOD RISK
15 minute winter	IC S14	14	57.698	0.725	5.4	0.0566	0.0000	SURCHARGED
15 minute winter	IC S15	13	57.614	0.814	15.4	0.1890	0.0000	SURCHARGED
15 minute winter	IC S16	13	57.788	0.237	4.7	0.0843	0.0000	SURCHARGED
15 minute winter	IC S17	13	57.761	0.369	9.4	0.1198	0.0000	SURCHARGED
60 minute winter	MH S18	74	55.512	0.084	13.5	0.0238	0.0000	OK
120 minute summer	MH EX01	68	55.453	0.073	13.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC S1	1.000	IC S2	3.2	0.583	0.467	0.0500	
15 minute winter	IC S2	1.001	IC S3	6.2	1.097	0.915	0.0625	
15 minute winter	IC S3	1.002	IC S4	6.2	0.873	0.271	0.1474	
15 minute winter	IC S4	1.003	MH S6	9.3	1.148	0.403	0.1039	
15 minute winter	MH S5	2.000	MH S6	4.9	0.477	0.278	0.3169	
15 minute winter	MH S6	1.004	MH S7	15.8	1.101	0.688	0.1826	
15 minute winter	MH S7	1.005	MH S8	18.0	1.128	0.783	0.1760	
30 minute winter	MH S8	1.006	MH S9	17.3	0.980	0.751	0.1373	
30 minute winter	MH S9	1.007	MH S10	33.0	1.875	1.660	0.2377	
30 minute winter	MH S10	Hydro-Brake®	MH S18	13.5				
15 minute winter	IC S11	4.000	IC S13	2.4	0.720	0.359	0.0806	
15 minute winter	IC S12	3.000	IC S13	3.1	0.518	0.398	0.0947	
15 minute winter	IC S13	3.001	IC S14	5.4	0.974	0.798	0.1095	
15 minute winter	IC S14	3.002	IC S15	7.5	0.952	0.953	0.0814	
15 minute winter	IC S15	3.003	MH S9	13.8	1.758	1.759	0.0953	
15 minute winter	IC S16	5.000	IC S17	4.4	0.680	0.557	0.0743	
15 minute winter	IC S17	5.001	IC S15	7.3	1.076	0.934	0.0953	
60 minute winter	MH S18	1.009	MH EX01	13.5	1.095	0.232	0.0469	59.3