

Design Settings

Rainfall Methodology	FEH-21	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	150.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
RWP A	0.015	5.00	40.020	Adoptable	1	471099.473	173299.219	0.870
SWMH 10	0.033	5.00	40.020	Adoptable	600	471102.901	173285.857	1.037
SWMH 11	0.010	5.00	39.845	Adoptable	1200	471127.560	173290.519	0.990
SWMH 20	0.028	5.00	39.845	Adoptable	1200	471125.560	173301.163	0.600
SWMH 21	0.009	5.00	39.750	Adoptable	1200	471137.687	173303.506	0.629
SWMH 30	0.019	5.00	39.900	Adoptable	1200	471140.410	173289.412	1.111
SWMH EX1			39.940	Adoptable	1200	471144.132	173276.367	1.460
SWMH EX2			39.680	Adoptable	1200	471155.858	173268.015	1.420

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	RWP A	SWMH 10	13.795	0.600	39.150	39.058	0.092	150.0	150	5.28	150.0
1.001	SWMH 10	SWMH 11	25.096	0.600	38.983	38.855	0.128	196.0	225	5.73	150.0
1.002	SWMH 11	SWMH 30	12.898	0.600	38.855	38.789	0.066	195.4	225	5.96	150.0
2.000	SWMH 20	SWMH 21	12.351	0.600	39.245	39.121	0.124	100.0	150	5.20	150.0
2.001	SWMH 21	SWMH 30	14.355	0.600	39.121	38.789	0.332	43.2	150	5.36	150.0
1.003	SWMH 30	SWMH EX1	13.566	0.600	38.789	38.480	0.309	43.9	150	6.11	150.0
1.004	SWMH EX1	SWMH EX2	14.396	0.600	38.480	38.260	0.220	65.4	150	6.30	150.0

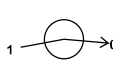
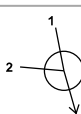
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.818	14.5	8.1	0.720	0.812	0.015	0.0	81	0.842
1.001	0.930	37.0	26.0	0.812	0.765	0.048	0.0	139	1.005
1.002	0.932	37.0	31.4	0.765	0.886	0.058	0.0	160	1.042
2.000	1.005	17.8	15.2	0.450	0.479	0.028	0.0	107	1.126
2.001	1.534	27.1	20.1	0.479	0.961	0.037	0.0	96	1.677
1.003	1.523	26.9	61.8	0.961	1.310	0.114	0.0	150	1.551
1.004	1.245	22.0	61.8	1.310	1.270	0.114	0.0	150	1.268

Pipeline Schedule

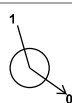
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	13.793	150.0	150	Circular	40.020	39.150	0.720	40.020	39.058	0.812
1.001	25.096	196.0	225	Circular	40.020	38.983	0.812	39.845	38.855	0.765
1.002	12.898	195.4	225	Circular	39.845	38.855	0.765	39.900	38.789	0.886
2.000	12.351	100.0	150	Circular	39.845	39.245	0.450	39.750	39.121	0.479
2.001	14.355	43.2	150	Circular	39.750	39.121	0.479	39.900	38.789	0.961
1.003	13.566	43.9	150	Circular	39.900	38.789	0.961	39.940	38.480	1.310
1.004	14.396	65.4	150	Circular	39.940	38.480	1.310	39.680	38.260	1.270

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RWP A	1	Manhole	Adoptable	SWMH 10	600	Manhole	Adoptable
1.001	SWMH 10	600	Manhole	Adoptable	SWMH 11	1200	Manhole	Adoptable
1.002	SWMH 11	1200	Manhole	Adoptable	SWMH 30	1200	Manhole	Adoptable
2.000	SWMH 20	1200	Manhole	Adoptable	SWMH 21	1200	Manhole	Adoptable
2.001	SWMH 21	1200	Manhole	Adoptable	SWMH 30	1200	Manhole	Adoptable
1.003	SWMH 30	1200	Manhole	Adoptable	SWMH EX1	1200	Manhole	Adoptable
1.004	SWMH EX1	1200	Manhole	Adoptable	SWMH EX2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
RWP A	471099.473	173299.219	40.020	0.870	1		0	1.000	39.150	150
SWMH 10	471102.901	173285.857	40.020	1.037	600		1	1.000	39.058	150
							0	1.001	38.983	225
SWMH 11	471127.560	173290.519	39.845	0.990	1200		1	1.001	38.855	225
							0	1.002	38.855	225
SWMH 20	471125.560	173301.163	39.845	0.600	1200		0	2.000	39.245	150
SWMH 21	471137.687	173303.506	39.750	0.629	1200		1	2.000	39.121	150
							0	2.001	39.121	150
SWMH 30	471140.410	173289.412	39.900	1.111	1200		1	2.001	38.789	150
							2	1.002	38.789	225
							0	1.003	38.789	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SWMH EX1	471144.132	173276.367	39.940	1.460	1200		1	1.003	38.480	150
							0	1.004	38.480	150
SWMH EX2	471155.858	173268.015	39.680	1.420	1200		1	1.004	38.260	150

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	35	0	0
30	35	0	0
100	40	0	0

Node SWMH 30 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	38.789	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node SWMH 30 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	38.789
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	496

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	84.6	0.0	0.750	84.6	0.0	0.751	0.0	0.0

Node SWMH 30 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	39.470	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	28	Depth (m)	0.300
Safety Factor	2.0	Width (m)	9.000	Inf Depth (m)	
Porosity	0.30	Length (m)	9.500		

Node SWMH 21 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	39.300	Slope (1:X)	104.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	240	Depth (m)	0.300
Safety Factor	2.0	Width (m)	16.800	Inf Depth (m)	
Porosity	0.30	Length (m)	9.600		

Results for 2 year +35% CC Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RWP A	10	39.200	0.050	3.3	0.0000	0.0000	OK
15 minute summer	SWMH 10	10	39.066	0.083	10.4	0.0233	0.0000	OK
360 minute summer	SWMH 11	232	39.013	0.158	3.4	0.1790	0.0000	OK
15 minute summer	SWMH 20	10	39.308	0.063	6.1	0.0715	0.0000	OK
15 minute summer	SWMH 21	10	39.181	0.060	8.0	0.0673	0.0000	OK
360 minute summer	SWMH 30	232	39.013	0.224	6.3	18.2714	0.0000	SURCHARGED
360 minute summer	SWMH EX1	232	38.510	0.030	1.9	0.0344	0.0000	OK
360 minute summer	SWMH EX2	232	38.290	0.030	1.9	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RWP A	1.000	SWMH 10	3.2	0.649	0.222	0.0684	
15 minute summer	SWMH 10	1.001	SWMH 11	10.3	0.722	0.278	0.3582	
360 minute summer	SWMH 11	1.002	SWMH 30	3.1	0.540	0.084	0.4486	
15 minute summer	SWMH 20	2.000	SWMH 21	6.0	0.911	0.340	0.0837	
15 minute summer	SWMH 21	2.001	SWMH 30	8.1	1.567	0.299	0.1164	
360 minute summer	SWMH 30	1.003	SWMH EX1	1.9	0.809	0.071	0.0319	
360 minute summer	SWMH EX1	1.004	SWMH EX2	1.9	0.757	0.086	0.0362	37.3

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.48%

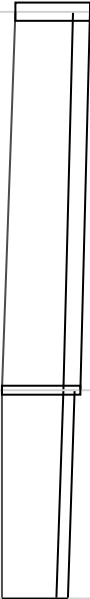
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	RWP A	232	39.406	0.256	1.8	0.0000	0.0000	SURCHARGED
240 minute winter	SWMH 10	232	39.406	0.423	5.7	0.1196	0.0000	SURCHARGED
240 minute winter	SWMH 11	232	39.406	0.551	6.3	0.6229	0.0000	SURCHARGED
240 minute winter	SWMH 20	232	39.406	0.161	3.3	0.1819	0.0000	SURCHARGED
240 minute winter	SWMH 21	232	39.406	0.285	4.4	3.2106	0.0000	SURCHARGED
240 minute winter	SWMH 30	232	39.406	0.617	12.7	50.2614	0.0000	SURCHARGED
15 minute summer	SWMH EX1	41	38.511	0.031	2.0	0.0348	0.0000	OK
15 minute summer	SWMH EX2	41	38.290	0.030	2.0	0.0000	0.0000	OK

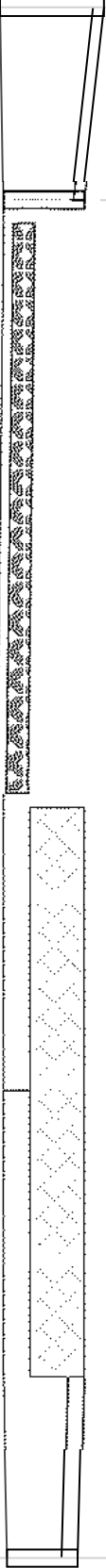
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	RWP A	1.000	SWMH 10	1.8	0.543	0.124	0.2429	
240 minute winter	SWMH 10	1.001	SWMH 11	5.1	0.472	0.139	0.9981	
240 minute winter	SWMH 11	1.002	SWMH 30	6.1	0.646	0.164	0.5130	
240 minute winter	SWMH 20	2.000	SWMH 21	3.3	0.788	0.186	0.2174	
240 minute winter	SWMH 21	2.001	SWMH 30	4.4	0.904	0.162	0.2527	
240 minute winter	SWMH 30	1.003	SWMH EX1	2.0	0.816	0.073	0.0325	
15 minute summer	SWMH EX1	1.004	SWMH EX2	2.0	0.763	0.089	0.0369	33.2

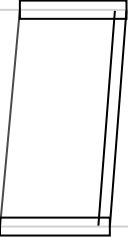
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	RWP A	236	39.587	0.437	2.3	0.0000	0.0000	SURCHARGED
240 minute winter	SWMH 10	236	39.587	0.604	7.1	0.1709	0.0000	SURCHARGED
240 minute winter	SWMH 11	236	39.587	0.732	8.5	0.8280	0.0000	FLOOD RISK
15 minute summer	SWMH 20	11	39.654	0.408	25.5	0.4620	0.0000	FLOOD RISK
240 minute winter	SWMH 21	236	39.587	0.466	5.7	12.1820	0.0000	FLOOD RISK
240 minute winter	SWMH 30	236	39.587	0.798	16.5	63.0092	0.0000	SURCHARGED
15 minute summer	SWMH EX1	143	38.511	0.031	2.0	0.0348	0.0000	OK
15 minute summer	SWMH EX2	143	38.290	0.030	2.0	0.0000	0.0000	OK

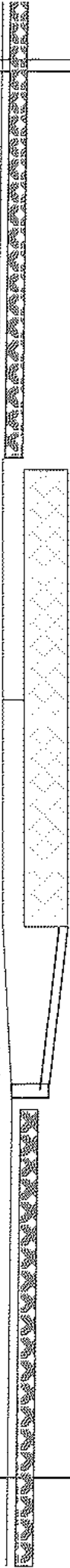
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	RWP A	1.000	SWMH 10	2.2	0.552	0.152	0.2429	
240 minute winter	SWMH 10	1.001	SWMH 11	7.0	0.463	0.188	0.9981	
240 minute winter	SWMH 11	1.002	SWMH 30	8.3	0.669	0.223	0.5130	
15 minute summer	SWMH 20	2.000	SWMH 21	24.3	1.383	1.371	0.2174	
240 minute winter	SWMH 21	2.001	SWMH 30	5.4	0.923	0.199	0.2527	
240 minute winter	SWMH 30	1.003	SWMH EX1	2.0	0.816	0.073	0.0325	
15 minute summer	SWMH EX1	1.004	SWMH EX2	2.0	0.763	0.089	0.0369	45.0

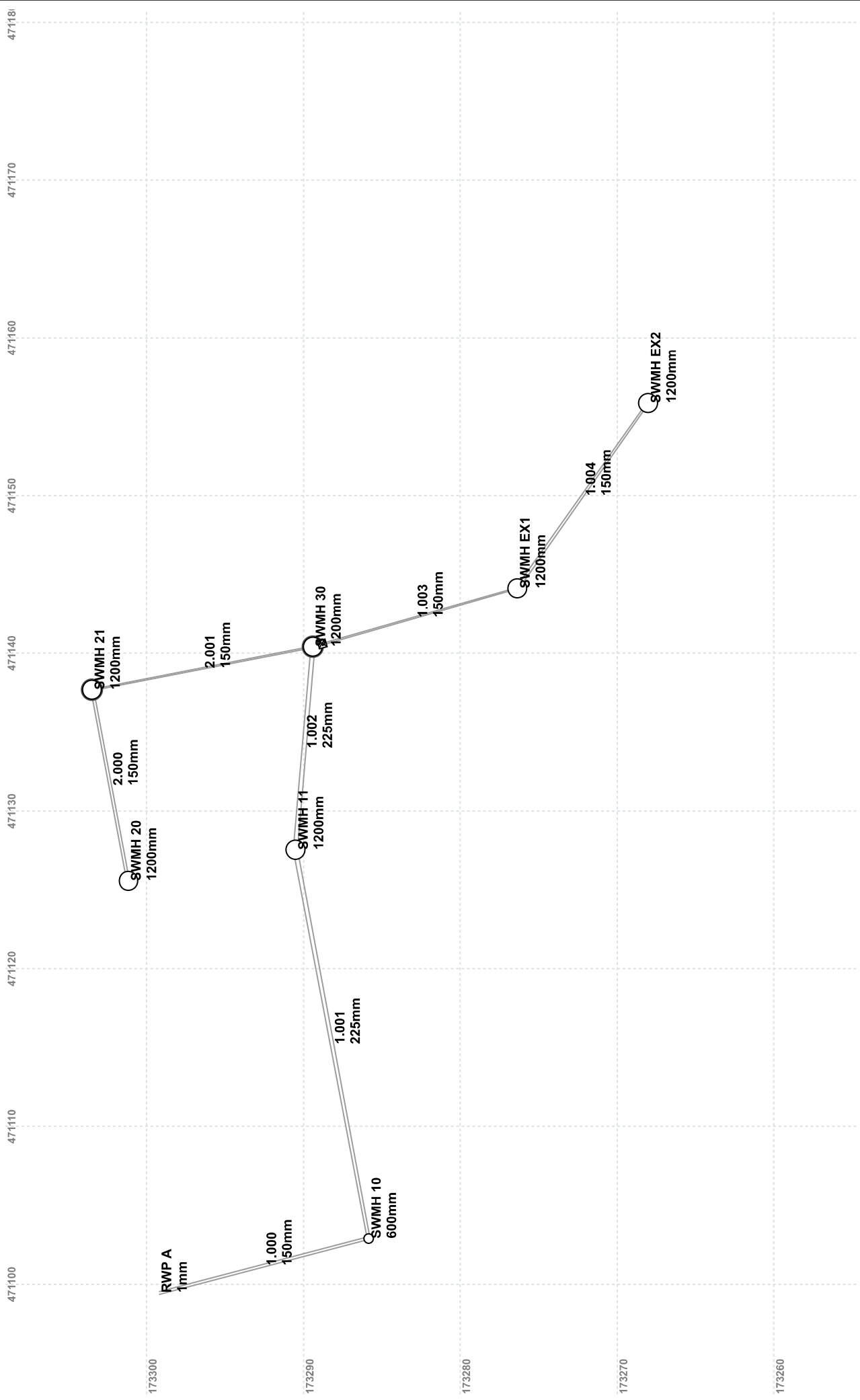
Node Name		RWP A	SWMH 10	SWMH 11
A4 drawing Hor Scale 500 Ver Scale 100 Datum (m) 33.000			38.983	38.855
Link Name		1.000	1.001	
Section Type		150mm	225mm	
Slope (1:X)		150.0	196.0	
Cover Level (m)		40.020	40.020	39.845
Invert Level (m)		39.150	39.058	38.855
Length (m)		13.795	25.096	

Node Name		SWMH 11	SWMH 30	SWMH EX1
A4 drawing Hor Scale 500 Ver Scale 100 Datum (m) 33.000				
		Link Name	1.002	1.003
		Section Type	225mm	150mm
		Slope (1:X)	195.4	43.9
		Cover Level (m)	39.845	39.900
Invert Level (m)		38.855	38.789	38.480
Length (m)		12.898	13.566	

Node Name	SWMH EX1	SWMH EX2
A4 drawing Hor Scale 500 Ver Scale 100		
Datum (m) 33.000		
Link Name	1.004	
Section Type	150mm	
Slope (1:X)	65.4	
Cover Level (m)	39.940	39.680
Invert Level (m)	38.480	38.260
Length (m)		14.396

Node Name	SWMH 20	SWMH 21
A4 drawing		
Hor Scale 500		
Ver Scale 100		
Datum (m) 33.000		
Link Name	2.000	
Section Type	150mm	
Slope (1:X)	100.0	
Cover Level (m)	39.845	39.750
Invert Level (m)	39.245	39.121
Length (m)		12.351

Node Name		SWMH 21	SWMH 30
A4 drawing Hor Scale 500 Ver Scale 100			
Datum (m) 33.000			
Link Name		2.001	
Section Type		150mm	
Slope (1:X)		43.2	
Cover Level (m)		39.750	39.900
Invert Level (m)		39.121	38.789
Length (m)		14.355	



		Project: Hexbox, Hexagon Theatre, Reading				Project No: 5544	
		Surface Water Western side				Made by: TJG Date: Dec 2023	
		Planning stage Pre and Post Development runoff volumes 1:100 year 6 hour event				Revision 00	
						Page 1 of 1	
Development runoff volumes in 1:100 year 6 hour event							
Using the Wallingford method and calculating the M100-360 rainfall depth from the M5-60 rainfall							
depth gives a rainfall depth of		62.4mm		in the 1:100 Year 6 hour storm			
Total existing building and hard paved areas draining to west to sewer =						510m2	
Total volume of rain falling onto the existing areas =						31.8m3	
Assuming 95% runoff during long return period event gives discharge of						30.2m3	
Total existing volume in 1:100yr 6 hour storm =						30.2m3	
Using the Wallingford method and calculating the M100-360 rainfall depth including 40% climate							
change allowance gives a rainfall depth of				82.9mm		in the 1:100 year 6 hour storm	
including 40% climate change allowance							
Discharge from site		= Area x urban creep x rainfall/1000 x discharge coefficient					
Proposed hard roof areas							
		0m2		0% urban creep, 95% discharge		0.0m3	
Proposed impermeable paving							
		271m2		0% urban creep, 95% discharge		16.1m3	
Proposed porous pavements. Ciria SUDS manual advises that a minimum of 5mm depth is retained							
therefore discharge based on M100-360 rainfall - 5mm =				57.4mm			
		0m2		0% urban creep, 95% discharge		0.0m3	
Total proposed volume discharged from 1:100 year event without climate change						17.7m3	
Total proposed volume discharged from the 1:100 year event + 40% climate change						21.3m3	
The increase in overall paved areas leads to an increase in the discharge volume in the present							
day 1:100 year 6 hour storm without climate change.				Increase =		-12.6m3	
When climate change is taken into account the discharge volume increases by						-8.9m3	
It is not practical to reduce the discharge to the greenfield volume.							
The proposed discharge below the present day discharge from the previously developed site							
to the sewer to the west (the proposed roof drains to the east and to soakaway)							
This satisfies non statutory technical standard S5							