

KMBC: Grace Park, Surface Water Drainage - Technical Note

DATE:	19 June 2026	CONFIDENTIALITY:	Confidential
SUBJECT:	Drainage Strategy Addendum		
PROJECT:	UK0029006.8015 KMBC Grace Park LUF	AUTHOR:	Harry Richardson
CHECKED:	Gareth Hardwick	APPROVED:	Andrew Leadbetter

INTRODUCTION

This technical note has been produced to summarise the amendments made to the drainage strategy detailed in WSP document 70119719_WSP_HDG_RP_0002, outlining the changes made and confirming how these still adhere to the overall aims of the drainage strategy.

Following a review of the sustainable drainage systems (SuDS) employed with the above strategy a number of potential betterments were identified which are detailed within this note.

The drainage strategy has been developed for the construction of 2no. multi-use sports pitches and associated buildings and car park. Currently, the drainage strategy consists of 7no. basins with a permanent water base draining 2no. multi-use sports pitches and associated pavilion, children's play area, and a path through the park with hardstanding areas. The 2no. multi-use sports pitches are proposed to be a permeable construction, providing attenuation within the pitch construction layers, the car park is positively drained and proposed to be connected to a class 1 oil separator, prior to discharge into the wider drainage network. The maximum permitted discharge from the site is being restricted to 10l/s at the connection to the existing network. The system also utilises 232m³ of storage provided through 2no. geocellular attenuation systems, located underneath a basin and the car park.

POTENTIAL IMPROVEMENTS IDENTIFIED

REMOVAL OF OIL INTERCEPTOR IN PLACE OF A POROUS ASPHALT SURFACE TO PARKING BAYS

Design rationale;

- The oil separator will require routine filter/coalescer unit changes and/or maintenance to ensure efficient functioning and prevent blockages from occurring. The separator will also require emptying of collected particulates to ensure capacity for future rainfall events. This process would need to be done by a third-party to ensure correct disposal of any waste production. Conversely, porous asphalt acts as a particulate filter to treat the collected rainfall similar to the class 1 oil separator, removing the need for a maintenance-intensive separator unit. Maintenance activities of porous asphalt include:
 - Brushing and vacuuming of the surface to remove any sediment collection.
 - Removal of weeds and herbicide application
- There is a known perched water table on site, which would require specialist installation of the separator unit. The shallower construction depth of a permeable surface will remove the need for a specialist installation and reduce CDM risks throughout the construction, lifespan and demolition of the design.

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REPLACE CAR PARK GEOCELLULAR ATTENUATION CRATES WITH ADDITIONAL STORAGE IN POROUS ASPHALT LAYER

Design Rationale;

- Replacing the geocellular attenuation crates with a porous asphalt surface within the car park removes the need for deep excavations during construction and demolition, as the storage is kept at a shallow depth.
- The maintenance of the porous asphalt is all completed on the surface, with no regular maintenance requiring excavation or entry into a sub-surface system.
- The known perched groundwater within the site would require the geocellular attenuation crates to be designs to counteract hydrostatic uplift pressures, which can lead to increased construction costs. The shallower construction of the porous asphalt reduces this.

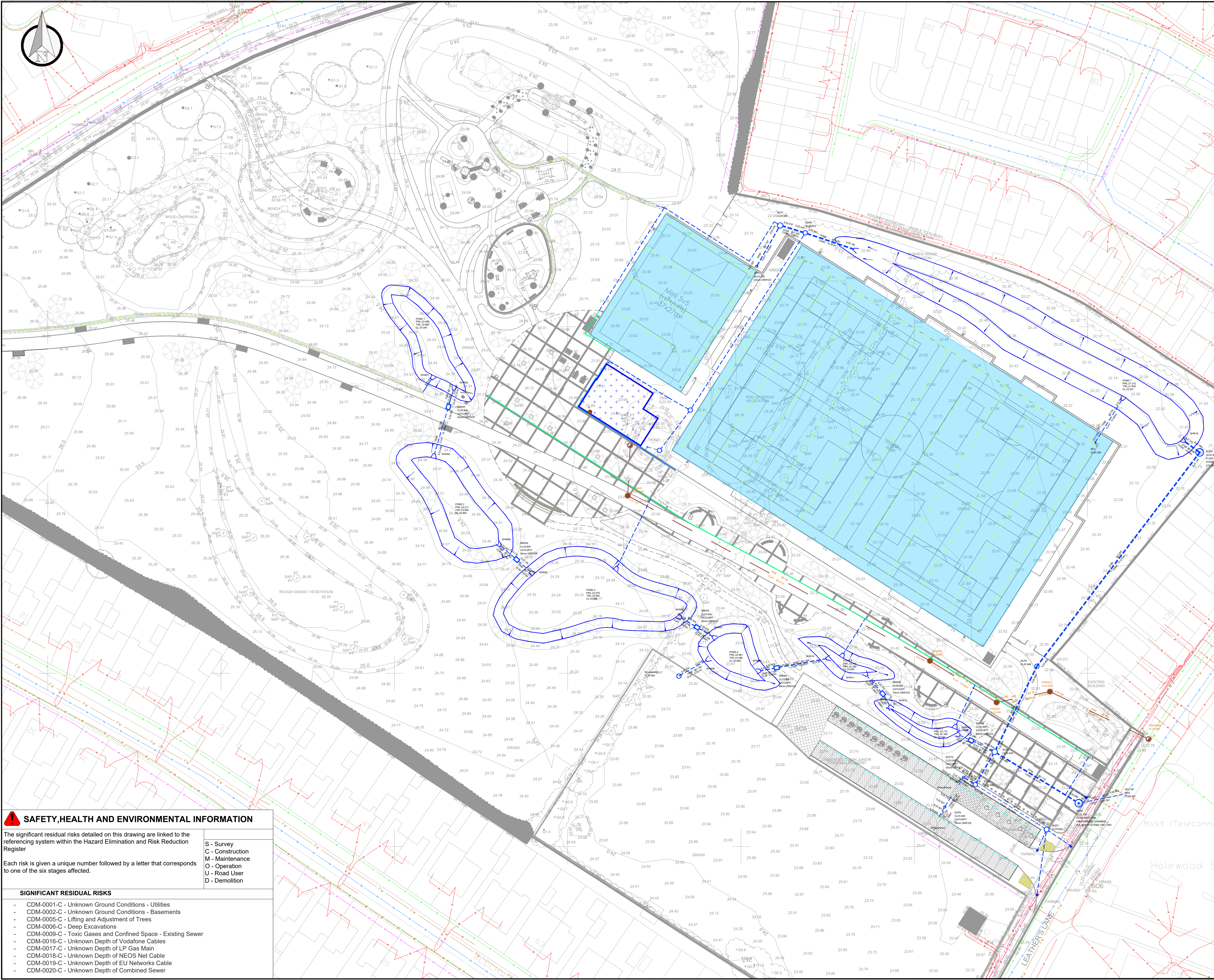
REMOVE GEOCELLULAR TANK UNDER BASIN

- With an increase in the flow restrictions across the 6no. basins in tandem, the collected rainfall will be retained for longer throughout the basins. The increase in upstream storage usage, in tandem with the porous asphalt storage capacity, allows for the removal of the geocellular attenuation crates located underneath the basin.
- Removal of the crates reduces the construction risks, alongside any potential maintenance or repair requirements throughout usage. If remedial works were required to the geocellular attenuation crates, there could be negative ecological impacts associated with the works, as the basin above would likely be damaged.

SUMMARY

This revised strategy provides a more sustainable system of treatment and conveyance of collected rainfall, at the same time as remaining in line with the SuDS Manual Chapter 26 and the precedents set within the original strategy. The discharge rate has remained at 10l/s as previous, with minimal updates to the physical form. The inherent risk of the design from construction, through maintenance, to demolition has been reduced, whilst also reducing the maintenance requirements throughout the lifespan.

APPENDIX A – DRAINAGE STRATEGY GENERAL ARRANGEMENT



KEY

PROPOSED POROUS ASPHALT SURFACING

PROPOSED PERMEABLE SPORTS PITCH

PROPOSED FOUL MANHOLE

PROPOSED ATTENUATION POND/DETENTION BASIN

PROPOSED HEADWALL

PROPOSED SQUARE BRICK MANHOLE

PROPOSED STORM MANHOLE

PROPOSED INSPECTION CHAMBER

PROPOSED LINEAR DRAINAGE CHANNEL

PROPOSED SLOTDRAIN

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

The significant residual risks detailed on this drawing are linked to the referencing system within the Hazard Elimination and Risk Reduction Register

Each risk is given a unique number followed by a letter that corresponds to one of the six stages affected.

S - Survey

C - Construction

M - Maintenance

O - Operation

U - Road User

D - Demolition

SIGNIFICANT RESIDUAL RISKS

- CDM-0001-C - Unknown Ground Conditions - Utilities

- CDM-0002-C - Unknown Ground Conditions - Basements

- CDM-0005-C - Lifting and Adjustment of Trees

- CDM-0008-C - Deep Excavations

- CDM-0009-C - Toxic Gases and Confined Space - Existing Sewer

- CDM-0016-C - Unknown Depth of Vodafone Cables

- CDM-0017-C - Unknown Depth of LP Gas Main

- CDM-0018-C - Unknown Depth of NEOS Net Cable

- CDM-0019-C - Unknown Depth of EU Networks Cable

- CDM-0020-C - Unknown Depth of Combined Sewer

P02

19/06/2026

HR

ATTENUATION TANKS AND OIL SEPARATORS REMOVED FOR POROUS ASPHALT CONSTRUCTION

GH

AL

P01

01/07/2025

RS

INITIAL DESIGN FOR CLIENT DISCUSSION

PS

GH

REV

DATE

BY

DESCRIPTION

CHK

APP

DRAWING STATUS: INITIAL DESIGN

70 Chancery Lane, London, WC2A 1AF
www.fmconway.co.uk www.wsp.com

CLIENT:

KNOWSLEY METROPOLITAN BOROUGH COUNCIL

SITE/PROJECT:

KMBC GRACE PARK LUF
RIBA 3

TITLE:

PROPOSED DRAINAGE
GENERAL ARRANGMENT

SCALE @ A1:

1:500

CHECKED:

SA

APPROVED:

GH

PROJECT NO:

0029006.8015

DESIGNED:

TB

DRAWN:

TB

DATE:

01/04/2026

DRAWING NO:

0029006.8015-WSP-HDG-GR-DP-0002

REV:

P02

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APPENDIX B – CAUSEWAY FLOW RESULTS

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)	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)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
PermPave1	0.040	5.00		23.450			344757.087	385158.513	0.600	22.850
PermPave2	0.121	5.00		23.400			344762.872	385167.872	0.634	22.766
EX GP MH3				23.000	1500		344810.044	385165.017	2.500	20.500
CP5	0.068	5.00		23.400	1500		344773.200	385177.318	2.540	20.860
CP6				23.150	2100		344797.478	385162.511	2.470	20.680
CP4				22.946	1500		344785.382	385202.021	1.996	20.950
HW01	0.110			24.420			344611.003	385285.316	0.964	23.456
HW02		5.00		24.340			344617.498	385283.311	0.934	23.406
dummy	0.106	5.00		24.420	1200		344599.215	385311.434	0.891	23.529
HW03	0.107			24.600			344611.580	385263.328	1.333	23.267
HW04		5.00		24.800			344630.314	385237.139	1.583	23.217
HW05	0.298			24.800			344640.235	385228.472	1.674	23.126
HW06		5.00		24.000			344681.265	385216.849	0.921	23.079
HW07	0.054			24.000			344691.094	385211.032	0.992	23.008
HW09		5.00		23.850			344707.282	385201.042	0.889	22.961
HW10	0.060			23.650			344723.217	385203.964	0.789	22.861
HW11		5.00		23.653			344737.233	385198.304	0.839	22.814
HW12	0.062			23.611			344742.537	385192.195	0.854	22.757
HW13		5.00		23.532			344764.906	385181.297	0.822	22.710
HW14	0.216			22.940			344732.527	385322.385	1.700	21.240
HW16		5.00		22.541			344828.443	385266.567	1.329	21.212
Compound		5.00	2.0	24.000	1350		344682.108	385199.200	0.856	23.144
P1	0.750	5.00		22.250	600		344722.580	385317.757	0.700	21.550
P2	0.129	5.00		23.300	600		344704.561	385317.446	0.800	22.500
CP1	0.089	5.00		22.960	1500		344711.305	385329.216	0.544	22.416
CP12				23.850	1200		344685.378	385275.944	1.445	22.405
MH01				24.450	1240	900	344615.595	385276.886	1.088	23.362
MH02				24.800	1240	900	344635.264	385232.815	1.630	23.170
MH03				24.000	1240	900	344687.311	385213.271	0.966	23.034
MH04				23.800	1240	900	344710.297	385201.595	0.861	22.939
MH05				23.600	1240	900	344740.892	385194.089	0.826	22.774
MH06				23.400	1240	900	344766.381	385180.634	0.705	22.695
CP2	0.175	5.00		22.970	1200		344718.539	385327.100	1.196	21.774
CP3				22.946	2100		344832.361	385263.749	1.752	21.194
CP11	0.028	5.00		23.850	1200		344677.023	385264.469	1.350	22.500
CP7	0.022	5.00		23.550	1350		344788.181	385154.932	1.300	22.250
CP8				23.450	1200		344767.602	385167.865	1.950	21.500
CP9				23.450	600		344758.806	385161.442	0.623	22.827
CP10				23.500	600		344764.227	385170.015	0.751	22.749

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_1	HW16	CP3	5.325	0.600	21.212	21.194	0.018	295.8	375	5.08	50.0
1.002_2	CP5	CP6	31.414	0.600	20.860	20.680	0.180	174.5	375	7.19	47.4
1.002_1	CP4	CP5	27.436	0.600	20.950	20.860	0.090	304.8	375	6.81	50.0
2.000	HW13	MH06	2.178	0.600	22.710	22.695	0.015	145.2	150	5.04	50.0
2.001	CP6	EX GP MH3	10.920	0.600	20.680	20.500	0.180	60.7	150	7.33	50.0
3.000_2	PermPave1	CP9	3.396	0.600	22.850	22.827	0.023	150.0	150	5.07	50.0
3.002	PermPave2	CP10	2.535	0.600	22.766	22.749	0.017	150.0	225	5.26	50.0
2.001_1	CP8	CP5	10.986	0.600	21.500	20.935	0.565	19.4	300	5.40	50.0
3.000_1	HW02	MH01	6.556	0.600	23.406	23.362	0.044	149.0	150	5.13	50.0
4.000	HW04	MH02	7.036	0.600	23.217	23.170	0.047	149.7	150	5.14	50.0
5.000_1	HW09	MH04	3.657	0.600	22.961	22.939	0.022	166.2	225	5.06	50.0
5.000	HW06	MH03	7.548	0.600	23.079	23.034	0.045	167.7	225	5.12	50.0
7.000	HW11	MH05	5.994	0.600	22.814	22.774	0.040	149.9	150	5.12	50.0
8.000	P2	CP1	14.040	0.600	22.500	22.416	0.084	167.1	225	5.23	50.0
3.000	dummy	HW01	4.131	0.600	23.529	23.504	0.025	165.2	225	5.07	50.0
7.001	Compound	HW07	19.888	0.600	23.144	23.011	0.133	149.5	150	5.40	50.0
9.000	P1	HW14	12.363	0.600	21.550	21.240	0.310	39.9	150	5.13	50.0
11.001	CP1	CP2	7.537	0.600	22.416	22.341	0.075	100.5	375	5.30	50.0
8.000_1	CP11	CP12	14.194	0.600	22.500	22.405	0.095	150.0	150	5.29	50.0
5.001	MH01	HW03	14.140	0.600	23.362	23.268	0.094	150.0	150	5.42	50.0
7.001_1	MH02	HW05	6.601	0.600	23.170	23.126	0.044	150.0	150	5.28	50.0
12.001	MH03	HW07	4.396	0.600	23.034	23.008	0.026	168.0	225	5.20	50.0
6.001	MH04	HW10	13.135	0.600	22.939	22.861	0.078	168.0	225	5.28	50.0
13.001	MH05	HW12	2.509	0.600	22.774	22.757	0.017	150.0	150	5.17	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000_1	1.048	115.7	0.0	0.954	1.377	0.000	0.0	0	0.000
1.002_2	1.368	151.1	42.9	2.165	2.095	0.251	0.0	137	1.185
1.002_1	1.032	114.0	0.0	1.621	2.165	0.000	0.0	0	0.000
2.000	0.832	14.7	0.0	0.672	0.555	0.000	0.0	0	0.000
2.001	1.293	22.9	45.3	2.320	2.350	0.251	0.0	150	1.318
3.000_2	0.818	14.5	7.2	0.450	0.473	0.040	0.0	75	0.819
3.002	1.065	42.3	29.1	0.409	0.526	0.161	0.0	138	1.146
2.001_1	3.581	253.1	33.1	1.650	2.165	0.183	0.0	73	2.505
3.000_1	0.821	14.5	0.0	0.784	0.938	0.000	0.0	0	0.000
4.000	0.819	14.5	0.0	1.433	1.480	0.000	0.0	0	0.000
5.000_1	1.011	40.2	0.0	0.664	0.636	0.000	0.0	0	0.000
5.000	1.006	40.0	0.0	0.696	0.741	0.000	0.0	0	0.000
7.000	0.818	14.5	0.0	0.689	0.676	0.000	0.0	0	0.000
8.000	1.008	40.1	23.3	0.575	0.319	0.129	0.0	123	1.046
3.000	1.014	40.3	19.2	0.666	0.691	0.106	0.0	109	1.002
7.001	0.819	14.5	2.0	0.706	0.839	0.000	2.0	38	0.577
9.000	1.598	28.2	135.5	0.550	1.550	0.750	0.0	150	1.628
11.001	1.807	199.6	39.5	0.169	0.254	0.218	0.0	112	1.418
8.000_1	0.818	14.5	5.1	1.200	1.295	0.028	0.0	61	0.746
5.001	0.818	14.5	0.0	0.938	1.182	0.000	0.0	0	0.000
7.001_1	0.818	14.5	0.0	1.480	1.524	0.000	0.0	0	0.000
12.001	1.006	40.0	0.0	0.741	0.767	0.000	0.0	0	0.000
6.001	1.006	40.0	0.0	0.636	0.564	0.000	0.0	0	0.000
13.001	0.818	14.5	0.0	0.676	0.704	0.000	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.001	MH06	CP5	7.583	0.600	22.695	22.644	0.051	150.0	150	5.20	50.0
8.002	CP2	HW14	14.761	0.600	21.774	21.626	0.148	100.0	375	6.67	46.2
1.001	CP3	CP4	77.572	0.600	21.194	20.952	0.242	320.0	375	6.37	47.3
3.001	CP9	PermPave2	7.608	0.600	22.827	22.776	0.051	150.0	150	5.22	50.0
3.003	CP10	CP8	4.002	0.600	22.749	22.725	0.024	166.7	225	5.33	50.0
2.000_1	CP7	CP8	24.306	0.600	22.250	21.700	0.550	44.2	100	5.35	50.0
8.001	CP12	CP2	60.964	0.600	22.405	21.999	0.406	150.0	150	6.53	46.7

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)
4.001	0.818	14.5	0.0	0.555	0.606	0.000	0.0	0	0.000
8.002	1.812	200.1	70.3	0.821	0.939	0.421	0.0	153	1.660
1.001	1.007	111.2	0.0	1.377	1.619	0.000	0.0	0	0.000
3.001	0.818	14.5	7.2	0.473	0.474	0.040	0.0	75	0.819
3.003	1.010	40.1	29.1	0.526	0.500	0.161	0.0	142	1.097
2.000_1	1.163	9.1	4.0	1.200	1.650	0.022	0.0	46	1.126
8.001	0.818	14.5	4.7	1.295	0.821	0.028	0.0	59	0.732

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_1	5.325	295.8	375	1 STANDARD	22.541	21.212	0.954	22.946	21.194	1.377
1.002_2	31.414	174.5	375	1 STANDARD	23.400	20.860	2.165	23.150	20.680	2.095
1.002_1	27.436	304.8	375	1 STANDARD	22.946	20.950	1.621	23.400	20.860	2.165
2.000	2.178	145.2	150	1 STANDARD	23.532	22.710	0.672	23.400	22.695	0.555
2.001	10.920	60.7	150	1 STANDARD	23.150	20.680	2.320	23.000	20.500	2.350
3.000_2	3.396	150.0	150	Circular	23.450	22.850	0.450	23.450	22.827	0.473
3.002	2.535	150.0	225	Circular	23.400	22.766	0.409	23.500	22.749	0.526
2.001_1	10.986	19.4	300	Circular	23.450	21.500	1.650	23.400	20.935	2.165
3.000_1	6.556	149.0	150	1 STANDARD	24.340	23.406	0.784	24.450	23.362	0.938
4.000	7.036	149.7	150	1 STANDARD	24.800	23.217	1.433	24.800	23.170	1.480
5.000_1	3.657	166.2	225	1 STANDARD	23.850	22.961	0.664	23.800	22.939	0.636
5.000	7.548	167.7	225	1 STANDARD	24.000	23.079	0.696	24.000	23.034	0.741
7.000	5.994	149.9	150	1 STANDARD	23.653	22.814	0.689	23.600	22.774	0.676

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
1.000_1	HW16			Junction		CP3	2100		Manhole	1 STANDARD
1.002_2	CP5	1500		Manhole	1 STANDARD	CP6	2100		Manhole	Adoptable
1.002_1	CP4	1500		Manhole	1 STANDARD	CP5	1500		Manhole	1 STANDARD
2.000	HW13			Junction		MH06	1240	900	Manhole	1 STANDARD
2.001	CP6	2100		Manhole	Adoptable	EX GP MH3	1500		Manhole	1 STANDARD
3.000_2	PermPave1			Junction		CP9	600		Manhole	Adoptable
3.002	PermPave2			Junction		CP10	600		Manhole	Adoptable
2.001_1	CP8	1200		Manhole	Adoptable	CP5	1500		Manhole	1 STANDARD
3.000_1	HW02			Junction		MH01	1240	900	Manhole	1 STANDARD
4.000	HW04			Junction		MH02	1240	900	Manhole	1 STANDARD
5.000_1	HW09			Junction		MH04	1240	900	Manhole	1 STANDARD
5.000	HW06			Junction		MH03	1240	900	Manhole	1 STANDARD
7.000	HW11			Junction		MH05	1240	900	Manhole	1 STANDARD

Pipeline Schedule

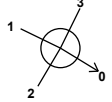
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
8.000	14.040	167.1	225	Circular	23.300	22.500	0.575	22.960	22.416	0.319
3.000	4.131	165.2	225	1 STANDARD	24.420	23.529	0.666	24.420	23.504	0.691
7.001	19.888	149.5	150	Circular	24.000	23.144	0.706	24.000	23.011	0.839
9.000	12.363	39.9	150	Circular	22.250	21.550	0.550	22.940	21.240	1.550
11.001	7.537	100.5	375	Circular	22.960	22.416	0.169	22.970	22.341	0.254
8.000_1	14.194	150.0	150	Circular	23.850	22.500	1.200	23.850	22.405	1.295
5.001	14.140	150.0	150	1 STANDARD	24.450	23.362	0.938	24.600	23.268	1.182
7.001_1	6.601	150.0	150	1 STANDARD	24.800	23.170	1.480	24.800	23.126	1.524
12.001	4.396	168.0	225	1 STANDARD	24.000	23.034	0.741	24.000	23.008	0.767
6.001	13.135	168.0	225	1 STANDARD	23.800	22.939	0.636	23.650	22.861	0.564
13.001	2.509	150.0	150	1 STANDARD	23.600	22.774	0.676	23.611	22.757	0.704
4.001	7.583	150.0	150	1 STANDARD	23.400	22.695	0.555	23.400	22.644	0.606
8.002	14.761	100.0	375	Circular	22.970	21.774	0.821	22.940	21.626	0.939
1.001	77.572	320.0	375	1 STANDARD	22.946	21.194	1.377	22.946	20.952	1.619
3.001	7.608	150.0	150	Circular	23.450	22.827	0.473	23.400	22.776	0.474
3.003	4.002	166.7	225	Circular	23.500	22.749	0.526	23.450	22.725	0.500
2.000_1	24.306	44.2	100	Circular	23.550	22.250	1.200	23.450	21.700	1.650
8.001	60.964	150.0	150	Circular	23.850	22.405	1.295	22.970	21.999	0.821

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
8.000	P2	600		Manhole	Adoptable	CP1	1500		Manhole	Adoptable
3.000	dummy	1200		Manhole	1 STANDARD	HW01			Junction	
7.001	Compound	1350		Manhole	Adoptable	HW07			Junction	
9.000	P1	600		Manhole	Adoptable	HW14			Junction	
11.001	CP1	1500		Manhole	Adoptable	CP2	1200		Manhole	Adoptable
8.000_1	CP11	1200		Manhole	Adoptable	CP12	1200		Manhole	Adoptable
5.001	MH01	1240	900	Manhole	1 STANDARD	HW03			Junction	
7.001_1	MH02	1240	900	Manhole	1 STANDARD	HW05			Junction	
12.001	MH03	1240	900	Manhole	1 STANDARD	HW07			Junction	
6.001	MH04	1240	900	Manhole	1 STANDARD	HW10			Junction	
13.001	MH05	1240	900	Manhole	1 STANDARD	HW12			Junction	
4.001	MH06	1240	900	Manhole	1 STANDARD	CP5	1500		Manhole	1 STANDARD
8.002	CP2	1200		Manhole	Adoptable	HW14			Junction	
1.001	CP3	2100		Manhole	1 STANDARD	CP4	1500		Manhole	1 STANDARD
3.001	CP9	600		Manhole	Adoptable	PermPave2			Junction	
3.003	CP10	600		Manhole	Adoptable	CP8	1200		Manhole	Adoptable
2.000_1	CP7	1350		Manhole	Adoptable	CP8	1200		Manhole	Adoptable
8.001	CP12	1200		Manhole	Adoptable	CP2	1200		Manhole	Adoptable

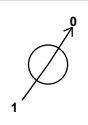
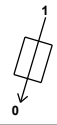
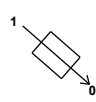
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
PermPave1	344757.087	385158.513	23.450	0.600						
							0	3.000_2	22.850	150
PermPave2	344762.872	385167.872	23.400	0.634						
							1	3.001	22.776	150
							0	3.002	22.766	225

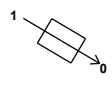
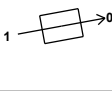
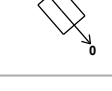
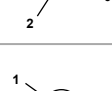
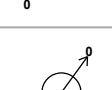
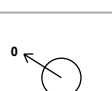
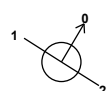
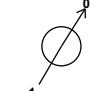
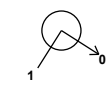
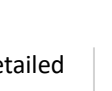
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
EX GP MH3	344810.044	385165.017	23.000	2.500	1500		 1	2.001	20.500	150
CP5	344773.200	385177.318	23.400	2.540	1500		 1 2 3 0	4.001 2.001_1 1.002_1 1.002_2	22.644 20.935 20.860 20.860	150 300 375 375
CP6	344797.478	385162.511	23.150	2.470	2100		 1	1.002_2	20.680	375
CP4	344785.382	385202.021	22.946	1.996	1500		 1 0	2.001 1.001	20.680 20.952	150 375
HW01	344611.003	385285.316	24.420	0.964			 1	1.002_1 3.000	20.950 23.504	375 225
HW02	344617.498	385283.311	24.340	0.934			 0	3.000_1	23.406	150
dummy	344599.215	385311.434	24.420	0.891	1200		 0	3.000	23.529	225
HW03	344611.580	385263.328	24.600	1.333			 1	5.001	23.268	150
HW04	344630.314	385237.139	24.800	1.583			 0	4.000	23.217	150
HW05	344640.235	385228.472	24.800	1.674			 1	7.001_1	23.126	150
HW06	344681.265	385216.849	24.000	0.921			 0	5.000	23.079	225
HW07	344691.094	385211.032	24.000	0.992			 1 2	12.001 7.001	23.008 23.011	225 150
HW09	344707.282	385201.042	23.850	0.889			 0	5.000_1	22.961	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
HW10	344723.217	385203.964	23.650	0.789			 1	6.001	22.861	225
HW11	344737.233	385198.304	23.653	0.839			 0	7.000	22.814	150
HW12	344742.537	385192.195	23.611	0.854			 1	13.001	22.757	150
HW13	344764.906	385181.297	23.532	0.822			 0	2.000	22.710	150
HW14	344732.527	385322.385	22.940	1.700			 1 2	9.000 8.002	21.240 21.626	150 375
HW16	344828.443	385266.567	22.541	1.329			 0	1.000_1	21.212	375
Compound	344682.108	385199.200	24.000	0.856	1350		 0	7.001	23.144	150
P1	344722.580	385317.757	22.250	0.700	600		 0	9.000	21.550	150
P2	344704.561	385317.446	23.300	0.800	600		 0	8.000	22.500	225
CP1	344711.305	385329.216	22.960	0.544	1500		 1 0	8.000 11.001	22.416 22.416	225 375
CP12	344685.378	385275.944	23.850	1.445	1200		 1 0	8.000_1 8.001	22.405 22.405	150 150
MH01	344615.595	385276.886	24.450	1.088	1240	900	 1	3.000_1	23.362	150
MH02	344635.264	385232.815	24.800	1.630	1240	900	 1 0	5.001 4.000	23.362 23.170	150 150
							 0	7.001_1	23.170	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
MH03	344687.311	385213.271	24.000	0.966	1240	900		1 5.000	23.034	225
							0	12.001	23.034	225
MH04	344710.297	385201.595	23.800	0.861	1240	900		1 5.000_1	22.939	225
							0	6.001	22.939	225
MH05	344740.892	385194.089	23.600	0.826	1240	900		1 7.000	22.774	150
							0	13.001	22.774	150
MH06	344766.381	385180.634	23.400	0.705	1240	900		1 2.000	22.695	150
							0	4.001	22.695	150
CP2	344718.539	385327.100	22.970	1.196	1200			1 11.001	22.341	375
							2	8.001	21.999	150
							0	8.002	21.774	375
CP3	344832.361	385263.749	22.946	1.752	2100			1 1.000_1	21.194	375
							0	1.001	21.194	375
CP11	344677.023	385264.469	23.850	1.350	1200					
							0	8.000_1	22.500	150
CP7	344788.181	385154.932	23.550	1.300	1350					
							0	2.000_1	22.250	100
CP8	344767.602	385167.865	23.450	1.950	1200			1 3.003	22.725	225
							2	2.000_1	21.700	100
							0	2.001_1	21.500	300
CP9	344758.806	385161.442	23.450	0.623	600			1 3.000_2	22.827	150
							0	3.001	22.827	150
CP10	344764.227	385170.015	23.500	0.751	600			1 3.002	22.749	225
							0	3.003	22.749	225

Simulation Settings

Rainfall Methodology FEH-22
Rainfall Events Singular
Summer CV 1.000
Winter CV 1.000

Analysis Speed Detailed
Skip Steady State x
Drain Down Time (mins) 240
Additional Storage (m³/ha) 0.0

Starting Level (m)
Check Discharge Rate(s) x
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 %)
100	45	0	0

Node CP6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	20.680	Product Number	CTL-SHE-0137-1000-1561-1000
Design Depth (m)	1.561	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	10.0	Min Node Diameter (mm)	1500

Node P2 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.035
Downstream Link	8.000	Invert Level (m)	22.500	Discharge Coefficient	0.600

Node CP3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	21.194	Product Number	CTL-SHE-0114-6000-1050-6000
Design Depth (m)	1.050	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node MH01 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.400	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	35.0		
Invert Level (m)	23.362	Diameter (m)	0.050		

Node MH02 Online Orifice Control

Flap Valve	x	Invert Level (m)	23.170	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.050		

Node MH03 Online Orifice Control

Flap Valve	x	Invert Level (m)	23.034	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.050		

Node MH04 Online Orifice Control

Flap Valve	x	Invert Level (m)	22.939	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.060		

Node MH05 Online Orifice Control

Flap Valve	x	Invert Level (m)	22.774	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.070		

Node MH06 Online Orifice Control

Flap Valve	x	Invert Level (m)	22.695	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.060		

Node G1 Online Orifice Control

Flap Valve	x	Invert Level (m)	0.000	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.040		

Node CP9 Online Orifice Control

Flap Valve	x	Invert Level (m)	22.827	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.010		

Node CP10 Online Orifice Control

Flap Valve	x	Invert Level (m)	22.749	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.025		

Node HW02 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	35.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.406	Main Channel Slope (1:X)	700.0
Safety Factor	2.0	Time to half empty (mins)	192	Main Channel n	0.070

Inlets

HW01

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	189.3	0.0	0.934	424.2	0.0

Node HW04 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	27.679
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.217	Main Channel Slope (1:X)	553.6
Safety Factor	2.0	Time to half empty (mins)	0	Main Channel n	0.070

Inlets

HW03

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	272.7	0.0	1.383	656.4	0.0

Node HW06 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	42.268
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.079	Main Channel Slope (1:X)	845.4
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.070

Inlets

HW05

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	711.8	0.0	0.921	1073.3	0.0

Node HW09 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	18.396
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.961	Main Channel Slope (1:X)	365.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.070

Inlets HW07

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	112.6	0.0	0.889	265.0	0.0

Node HW11 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	21.121
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.814	Main Channel Slope (1:X)	422.4
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.070

Inlets HW10

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	36.1	0.0	0.836	169.4	0.0

Node HW13 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	23.574
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.710	Main Channel Slope (1:X)	471.5
Safety Factor	2.0	Time to half empty (mins)	495	Main Channel n	0.070

Inlets HW12

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	33.3	33.3	0.822	171.2	173.9

Node HW16 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	119.607
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	21.212	Main Channel Slope (1:X)	2392.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.070

Inlets HW14

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	526.5	0.0	1.350	1483.5	0.0

Node P1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	21.550	Slope (1:X)	300.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.400
Safety Factor	2.0	Width (m)	106.000	Inf Depth (m)	
Porosity	0.30	Length (m)	70.000		

Node P2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.500	Slope (1:X)	300.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	31.000	Inf Depth (m)	
Porosity	0.30	Length (m)	41.000		

Node PermPave1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.850	Slope (1:X)	400.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	62.800	Inf Depth (m)	
Porosity	1.00	Length (m)	6.000		

Node PermPave2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	22.766	Slope (1:X)	400.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	67.600	Inf Depth (m)	
Porosity	1.00	Length (m)	5.000		

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute summer	PermPave1	7080	23.018	0.168	0.6	60.4245	0.0000	SURCHARGED
1440 minute winter	PermPave2	1170	23.041	0.275	3.7	88.9228	0.0000	SURCHARGED
480 minute summer	EX GP MH3	208	20.569	0.069	10.0	0.0000	0.0000	OK
120 minute summer	CP5	76	22.121	1.261	30.5	2.2286	0.0000	SURCHARGED
120 minute summer	CP6	76	22.119	1.439	15.6	4.9859	0.0000	SURCHARGED
120 minute summer	CP4	76	22.122	1.172	13.9	2.0701	0.0000	SURCHARGED
240 minute winter	HW01	232	23.885	0.429	25.3	0.0000	0.0000	OK
240 minute winter	HW02	232	23.885	0.479	14.2	0.0000	0.0000	SURCHARGED
240 minute winter	dummy	232	23.885	0.356	12.5	0.4023	0.0000	SURCHARGED
2880 minute summer	HW03	2400	23.663	0.396	5.2	0.0000	0.0000	OK
2880 minute summer	HW04	2400	23.663	0.446	3.4	0.0000	0.0000	SURCHARGED
8640 minute summer	HW05	6060	23.605	0.479	5.2	0.0000	0.0000	OK
8640 minute summer	HW06	6060	23.605	0.526	3.2	0.0000	0.0000	SURCHARGED
10080 minute summer	HW07	6600	23.500	0.492	3.9	0.0000	0.0000	OK
10080 minute summer	HW09	6600	23.500	0.539	3.9	0.0000	0.0000	SURCHARGED
1440 minute summer	HW10	930	23.285	0.424	5.1	0.0000	0.0000	OK
1440 minute summer	HW11	930	23.285	0.471	4.2	0.0000	0.0000	SURCHARGED
720 minute summer	HW12	465	23.168	0.411	7.7	0.0000	0.0000	OK
720 minute summer	HW13	465	23.168	0.458	6.1	0.0000	0.0000	SURCHARGED
2880 minute winter	HW14	2820	21.946	0.706	17.3	0.0000	0.0000	OK
2880 minute winter	HW16	2820	21.946	0.734	11.7	0.0000	0.0000	SURCHARGED
10080 minute summer	Compound	6600	23.503	0.359	2.0	0.5135	0.0000	SURCHARGED
2880 minute winter	P1	2820	21.947	0.397	15.1	624.1415	0.0000	SURCHARGED
480 minute winter	P2	456	22.771	0.271	8.9	77.1725	0.0000	SURCHARGED
15 minute summer	CP1	10	22.582	0.166	63.3	0.2938	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)
7200 minute summer	PermPave1	3.000_2	CP9	0.1	0.065	0.008	0.0598	
1440 minute winter	PermPave2	3.002	CP10	0.8	0.196	0.019	0.1008	
120 minute summer	CP5	1.002_2	CP6	15.6	0.528	0.103	3.4649	
120 minute summer	CP6	2.001	EX GP MH3	10.0	1.204	0.437	0.0906	166.3
120 minute summer	CP4	1.002_1	CP5	-13.9	0.264	-0.122	3.0261	
240 minute winter	HW01	Flow through Pond	HW02	14.2	0.042	0.006	111.8064	
240 minute winter	HW02	3.000_1	MH01	3.3	0.290	0.226	0.1154	
240 minute winter	dummy	3.000	HW01	12.4	0.780	0.307	0.1643	
2880 minute summer	HW03	Flow through Pond	HW04	3.4	0.011	0.000	139.4027	
2880 minute summer	HW04	4.000	MH02	3.1	0.309	0.213	0.1239	
8640 minute summer	HW05	Flow through Pond	HW06	3.2	0.007	0.000	406.0261	
8640 minute summer	HW06	5.000	MH03	1.7	0.142	0.043	0.3002	
10080 minute summer	HW07	Flow through Pond	HW09	3.9	0.010	0.001	80.6273	
10080 minute summer	HW09	5.000_1	MH04	3.9	0.264	0.097	0.1454	
1440 minute summer	HW10	Flow through Pond	HW11	4.2	0.038	0.004	32.0052	
1440 minute summer	HW11	7.000	MH05	3.9	0.366	0.272	0.1055	
720 minute summer	HW12	Flow through Pond	HW13	6.1	0.041	0.005	30.2517	
720 minute summer	HW13	2.000	MH06	4.8	0.300	0.326	0.0383	
2880 minute winter	HW14	Flow through Pond	HW16	11.7	0.026	0.003	552.0609	
2880 minute winter	HW16	1.000_1	CP3	6.0	0.107	0.052	0.5873	
10080 minute summer	Compound	7.001	HW07	2.0	0.577	0.138	0.3501	
2880 minute winter	P1	9.000	HW14	9.5	0.672	0.338	0.2176	
480 minute winter	P2	8.000	CP1	1.3	0.522	0.031	0.0642	
15 minute summer	CP1	11.001	CP2	63.0	1.474	0.316	0.3225	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	CP12	12	22.624	0.219	18.6	0.2474	0.0000	SURCHARGED
240 minute winter	MH01	232	23.882	0.520	3.3	0.5803	0.0000	SURCHARGED
2880 minute summer	MH02	2400	23.662	0.492	3.1	0.5493	0.0000	SURCHARGED
8640 minute summer	MH03	6060	23.605	0.571	1.7	0.6369	0.0000	SURCHARGED
10080 minute summer	MH04	6600	23.500	0.561	3.9	0.6257	0.0000	SURCHARGED
1440 minute summer	MH05	930	23.282	0.508	3.9	0.5665	0.0000	SURCHARGED
720 minute summer	MH06	465	23.165	0.470	4.8	0.5250	0.0000	FLOOD RISK
15 minute summer	CP2	10	22.107	0.333	201.3	0.3762	0.0000	OK
2880 minute winter	CP3	2820	21.946	0.752	6.0	2.6051	0.0000	SURCHARGED
15 minute summer	CP11	11	22.789	0.289	19.8	0.3270	0.0000	SURCHARGED
15 minute summer	CP7	12	22.905	0.655	15.5	0.9367	0.0000	SURCHARGED
120 minute summer	CP8	76	22.121	0.621	6.8	0.7023	0.0000	SURCHARGED
7200 minute summer	CP9	7080	23.018	0.191	0.1	0.0540	0.0000	SURCHARGED
1440 minute winter	CP10	1170	23.041	0.292	0.8	0.0826	0.0000	SURCHARGED

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	CP12	8.001	CP2	16.5	0.962	1.139	0.9926	
240 minute winter	MH01	5.001	HW03	3.2	0.578	0.224	0.2489	
2880 minute summer	MH02	7.001_1	HW05	1.6	0.747	0.111	0.1162	
8640 minute summer	MH03	12.001	HW07	1.7	0.076	0.043	0.1748	
10080 minute summer	MH04	6.001	HW10	3.9	0.651	0.097	0.5224	
1440 minute summer	MH05	13.001	HW12	3.9	0.655	0.273	0.0442	
720 minute summer	MH06	4.001	CP5	4.8	0.714	0.332	0.0510	
15 minute summer	CP2	8.002	HW14	198.3	2.010	0.991	1.4795	
2880 minute winter	CP3	1.001	CP4	6.0	0.543	0.054	8.5560	
15 minute summer	CP11	8.000_1	CP12	18.6	1.054	1.284	0.2499	
15 minute summer	CP7	2.000_1	CP8	12.4	1.585	1.358	0.1883	
120 minute summer	CP8	2.001_1	CP5	6.8	1.030	0.027	0.7736	
7200 minute summer	CP9	3.001	PermPave2	0.1	0.201	0.005	0.1339	
1440 minute winter	CP10	3.003	CP8	0.7	0.375	0.017	0.0072	