Cowan Consultancy
STRUCTURAL, CIVIL AND BUILDING CONSULTANTS

LONG ACRE
THE STREET
WALBERTON
ARUNDEL
WEST SUSSEX
BN18 0PY

DRAINAGE STRATEGY REPORT

For:

MAXWELL HOMES LTD

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TB/466543/eg
16 December 2024

INDEX

1.0 INTRODUCTION

1.1 This report has been prepared by Cowan Consultancy Limited (CCL) for Maxwell Homes Ltd.

1.2 This drainage strategy report is required to supplement the drainage strategy for the subject site and forms part of the planning application relating to the drainage.

2.0 GEOLOGY OF THE AREA

2.1.1 The site lies on OS grid reference (Eastings) 496725 (Northings) 106175 and Site GPS Coordinates 50.847068, -0.62739869.

2.1.2 By reference to the British Geological Maps, the site would be expected to lie within a bedrock of London Clay Formation. Overlain by superficial deposits of River Terrace Deposits – Sand, silt and clay.

2.1.3 On site trial pits, used for infiltration testing, showed that clay soils were present from approximately 400mm below ground level.

2.1.4 The infiltration testing at 3 locations on site showed that infiltration rates of between 4.561 E-05 and 2.362 E-06 m/s were achieved.

2.1.5 Winter ground water monitoring data was also collected for the site between December 2023 and January 2024. It showed that ground water reached a peak winter level of 0.149m bgl in January 2024

3.0 SITE DESCRIPTION

3.1.1 The site for the proposed development consists of approximately 0.4450 ha and is part of the gardens attached to the existing bungalow Long Acre.

3.1.2 The site consists of mainly grass with some trees / hedges, but towards the south is an existing access into the site

3.1.3 The site is adjoined to the north by fields which are to be developed in the near future by Barratt Developments. The west the site is existing residential

properties and to the east of the site is the access to Field Close. The south of the site is The Street.

3.1.4 The site is relatively flat but with a gradual slope from south east to north west.

3.1.5 The proposed access to the site is via the existing access off The Street.

3.1.6 The proposed site development consists of six houses, together with detached single garages, associated landscaping, amenity space and parking.

4.0 SURFACE WATER DRAINAGE STRATEGY

4.1 Pre-Development

4.2 The site is currently mainly undeveloped land and its previous use was as gardens for Long Acre. The current surface water drainage for Long Acre is currently unknown but it is likely to discharge into the piped watercourse along the southern boundary.

4.3 The site slopes generally from north to south. Any rainfall which does not naturally permeate into the ground will ultimately discharge off site into the road on the south boundary which then drains into the highways drains via road gulleys..

4.4 Southern Water sewer record plans indicate that there are no public surface water or combined sewers in the vicinity of the site.

4.5 Post-Development

4.6 The site is currently undeveloped and therefore any proposed development will increase the impermeable area, thus increasing surface water runoff rates and volumes of water.

4.7 Referencing the site investigation data, it would suggest that disposing of the surface water via infiltration on site is not feasible due to the high groundwater encountered. Even though the infiltration testing on site showed that the soils were permeable, albeit at a relatively slow rate, groundwater was recorded at 0.149m bgl, this meant that a 1.0m freeboard of unsaturated ground beneath infiltration base level is unachievable on site.

4.8 The Arun Watercourse map for the area shows that there is a piped watercourse that runs adjacent to the southern boundary of the site. This pipe

runs from east to west and discharges into a pond located to the south west of the site.

4.9 Groundwater was recorded at 0.149m bgl would compromise the attenuation storage features if the underside and sides are permeable, therefore these have been designed as impermeable lined.

4.10 An adjacent large Barratt Developments site has its surface water discharging at a controlled rate into the piped watercourse at Field Close, which is upstream of Long Acre.

4.11 The drainage strategy utilises a shallow attenuation system for the surface water drainage, which conveys the surface water flows to the southern boundary of the site, where it discharges into the piped watercourse. Via the piped watercourse, the surface water enters the pond to the south west

4.12 HR Wallingford Greenfield Run-off calculations (see Appendix C) show that a pre-development greenfield run-off rate (QBAR) for the site is 2.44 l/s, equating to 5.48 l/s/ha. The proposed total impermeable area of the site is 0.1355 ha and therefore the discharge into the piped watercourse should be limited to 0.74 l/s Due to the risk of blockages at the discharge location in the ditch, then a minimum discharge rate of 1 l/s has applied to the design.

4.13 It is common for discharge rates to be set at 2 l/s to minimise the risk of blockages to orifices < 50mm, but, with the inclusion of Contraflow control chambers, trash screens and permeable paving, the risk of blockages is somewhat reduced and, therefore, the run-off rate can be limited to 1 l/s. A comprehensive management & maintenance regime shall be implemented to ensure that the risk of blockages is minimised.

4.14 Attenuation of the storm water will be provided by the access road granular sub-base and the sub-base attenuation. Network calculations within Appendix B shows that there is sufficient storage within the system to prevent flooding in the 1 in 100 year storm event plus a 45% increase allowance for climate change.

4.15 A 300mm depth of a combined Type 3 sub-base and shallow sub-base replacement attenuation crates, have been proposed underneath the permeable paved driveways. Varying depths of Type 3 sub-base have been proposed under the permeable tarmac access road areas. The sub-bases have been designed to attenuate and convey the surface water. Water from roofs is drained to the permeable sub-base via Aco Multi-Drain channels & pipework through diffuser units, with a silt trap proceeding each connection into the sub-base. The permeable access road sub-bases are piped into the piped

watercourse via hyro-brake flow control chamber, limiting the discharge to a rate of 1 l/s.

4.16 The scheme has allowed for a climate change allowance of 45%. 10% urban creep has been applied to all impermeable areas except the access roads.

4.17 The proposed Drainage Strategy can be seen in Appendix A

5.0 SUSTAINABLE URBAN DRAINAGE SYSTEMS

5.1 SuDS have been incorporated into the design to intercept rainfall and convey the water to the ditch outfall to the north-east of the site.

5.2 As well as providing storm water storage, the SuDS features are within the design to ensure the water quality entering the surface water body is acceptable.

5.3 In accordance with section 26.3 of CIRIA C753 recommends the use of simple index approach for assessing the minimum water quality management requirements and this method has been used to assess the suitability of above proposals as follows:

(i) From table 26.2, residential roads runoff is considered low pollution hazard

(ii) From table 26.2 the following hazard indices are applicable;
Total suspended solids – 0.5
Metals – 0.4
Hydrocarbons – 0.4

(iii) From table 26.3, the indicative SuDS mitigation indices for permeable paving is as follows;
Total suspended solids – 0.7
Metals – 0.6
Hydrocarbons – 0.7

5.4 From the above it can be seen that the provision of permeable paving exceeds the pollution mitigation requirements.

6.0 FOUL DRAINAGE STRATEGY

6.1 Pre-Development

6.2 The site is currently being used as gardens for the existing property. The Topo survey indicates some manholes within the site, which appear to be flowing towards The Street.

6.3 Southern Water sewer record plans indicate that there is an existing 150mm diameter public foul sewer in The Street.

6.4 Post-Development

6.5 The proposed site consists of 6 residential dwellings. Using the recommendations within Sewers for Adoption 7th Edition for an allowance of 4000 litres per unit per day, this will result in a peak flow of 0.27 l/s from the proposed development.

6.6 The proposals are to create a new connection to the existing foul sewer in The Street.

6.7 As part of this planning application, a pre-planning capacity check with Southern Water is concurrently and expecting to receive feedback in due course.

7.0 LIDSEY TREATMENT CATCHMENT AREA

7.1 The Arun DC interactive maps show the site to be located within the Lidsey Treatment Catchment Area.

7.2 The impact on the foul drainage network shall be reduced by ensuring there is suitable capacity within the Southern Water foul sewer network, see section **6.7.**

7.3 The implementation of greywater harvesting shall be considered to help reduce the pressure on the existing mains sewerage system. Also careful selection of wastewater producing products will help reduce the foul flows further.

7.4 The planning validation requirements interactive map shows the site to be located within the Lidsey Local Risk Zone LFRZ_003

7.5 Referring to the WSCC Surface Water Management Plan, LFRZ_003 has a medium pluvial flood risk and high risk of fluvial, groundwater and public sewer flood risk.

7.6 Sections **5.2** – **5.4** within this report shows that the proposed surface water drainage system for the site will maintain the appropriate water quality of the surface water.

7.7 Referring to the Preferred Interventions Table 10.5 – LFRZ_003 OPTIONS, the options of intervention which shall be implemented to Long Acre are;

- Option Ref. 7 – *Rainwater harvesting*. The installation of water butts to all properties and garages shall be proposed

- Option Ref. 12 – *Sealing of manhole covers and protecting gullies*. Where appropriate, new manholes across the site can be sealed.

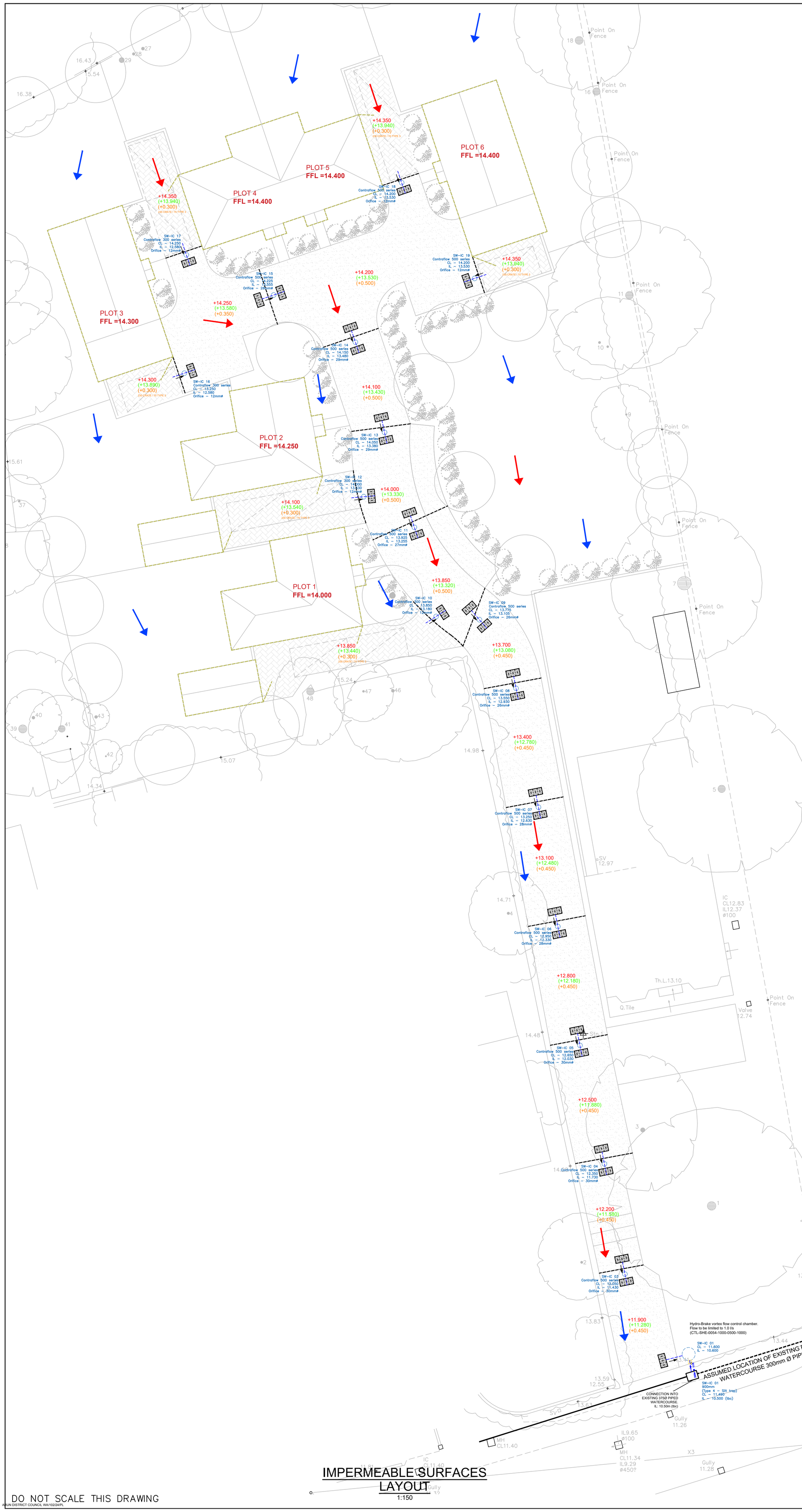
- Option Ref. 26 – *Raising doorway / access threshold*. The proposed FFL's of the plots has been set a minimum 150mm above existing ground levels installation of water butts to all properties and garages shall be proposed

7.8 Implementing options mentioned above and the full surface water drainage system will minimise any further risk to flooding from the development.

Signature……..
TIM BUTTON
For and on behalf of Cowan Consultancy Limited

APPENDIX A

DRAINAGE STRATEGY DRAWING



IMPERMEABLE SURFACES LAYOUT

1:150

DO NOT SCALE THIS DRAWING

ARUN DISTRICT COUNCIL WA/102/24/PL

! CDM 2015 - RESIDUAL RISKS !

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NOTES

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8. The Contractor is responsible for specifying product and codes and ordering of drainage materials.

9. Contractor to ensure that new sewers are laid and installed in like for like basis.

10. New adoptable pipework to be vitrified clay type and to be constructed to the following specifications. Systems that are resistant to a jetting pressure of 4000psi. Systems that minimise the number of joints in the system, by using 3metre pipe length. Systems that do not have lip seal joints, hence preventing root ingress.

11. All non-uPVC (adoptable) pipe connection to manholes shall be provided with a 'rocker pipe' of 600mm effective length in accordance with Cl E6.6 of 'Sewers for Adoption'.

12.Precast concrete manhole units shall comply with the relevant provisions of BS EN 1917 and BS 5911-3.

13. The diameter of the pipes to be diverted are 300mm for storm and 150mm for foul. The new pipes are to of 300mm and 150mm for foul diameter respectively.
Any abandoned pipes or manholes are to be grubbed out or sealed up.

14. Cover grades are in accordance with BS497 Pt 1
Cover Grades : D400 - carriageways.
B125 - carriageways for slow traffic.
A15 - inaccessible to vehicles

15. All drainage pipes within development site to be 100mm dia unless shown otherwise.

16. All uPVC drainage to be installed to BS5955 Pt6 and in strict accordance with the manufacturers instructions.

17. All uPVC drainage products to conform to BS EN1401 & Kite mark certified in accordance with specification.

18. All adoptable drainage and associated works to comply with the latest Part E - Civil Engineering Specification of 'Sewer for Adoption'.

19. DO NOT SCALE. If discrepancy or query arises on dimensions consult Engineer.

20. Any works with tree RPA's are to be to the approval and under the supervision of the arborist.

KEY

- Permeable tarmac Access Road & Parking areas with Type 3 Sub-base. Impermeable lined (SEE DETAIL 1)
- Pemeable paved driveway areas with a combination of Type 3 Sub-base and Polypipe Permavoid attenuation crates. Impermeable lined (SEE DETAIL 2)
- ACO Multi-Drain M100D 10.0 constant depth (or similar approved) drainage channel laid with no fall (or to follow ground levels adjacent to the building) and incorporating a sump unit with silt bucket at each outlet
- Surface water drainage pipes
- Surface Water Inspection Chamber
- Concrete Baffle (See Detail)
- +14.100 (+13.500) (0.400) — Cover level / (formation level) / Type 3 Sub-base thickness (and / or attenuation crate)
- Diffuser Unit
- Existing overland flow routes
- Exceedance flow routes

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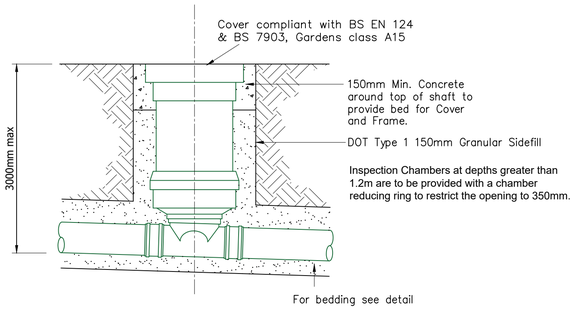
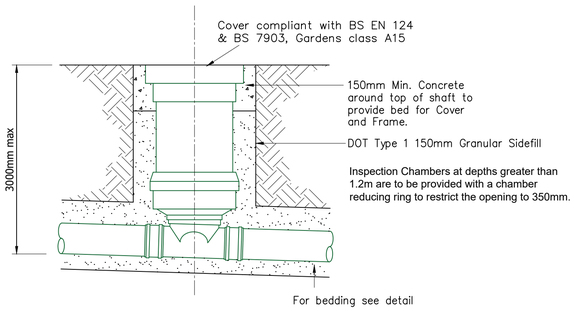
Title: SURFACE WATER DRAINAGE LAYOUT

Date	SEP 2024	Scale	As Shown @ A1	Drg. No.
Drawn	TB	Chk'd EG	QA'D EG	466543–201P



450mmø INSPECTION CHAMBER GRADE 'A' NON-LOAD BEARING INSTALLATION

1:10



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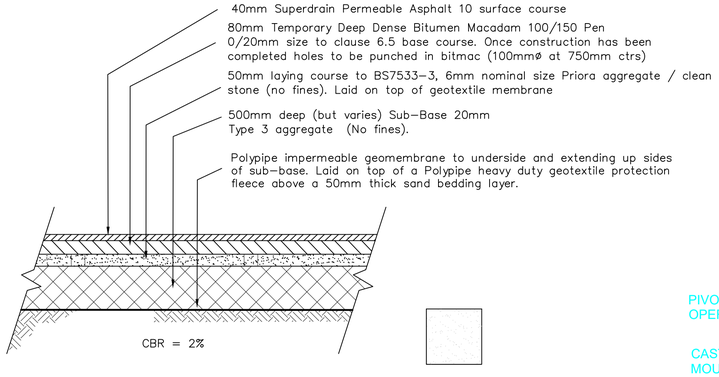
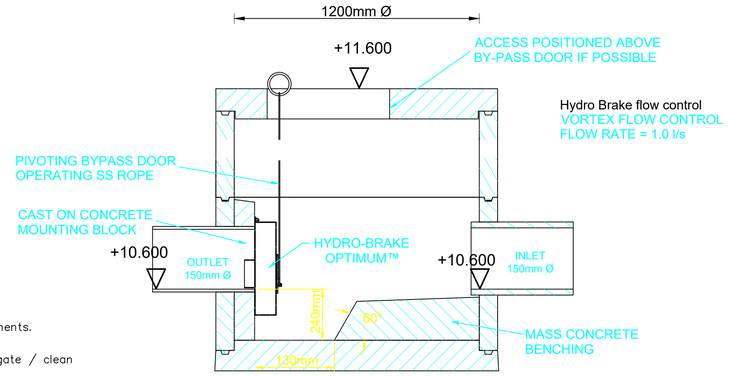


DETAIL 1 - NEW ACCESS ROAD - TYPICAL SECTION

SCALE 1: 20



FLOW CONTROL CHAMBER DETAIL

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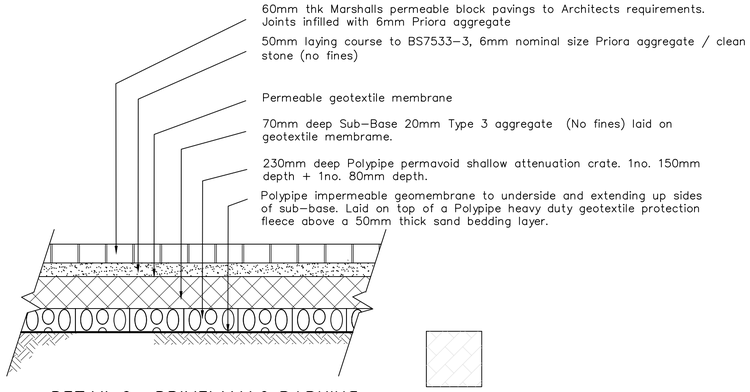

DETAIL 2 - DRIVEWAY & PARKING CONSTRUCTION - TYPICAL SECTION

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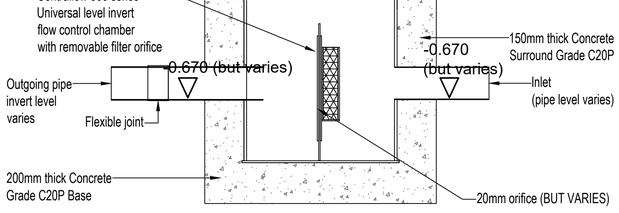

CONTROFLOW FLOW CONTROL CHAMBER DETAIL

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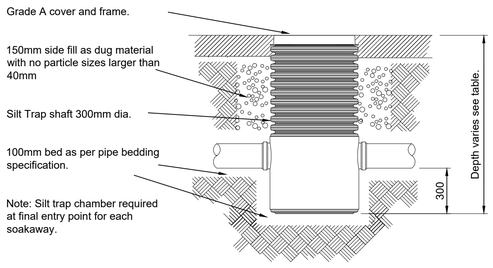
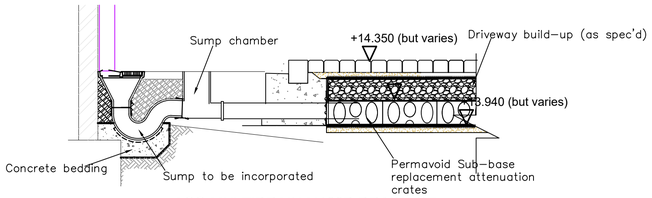


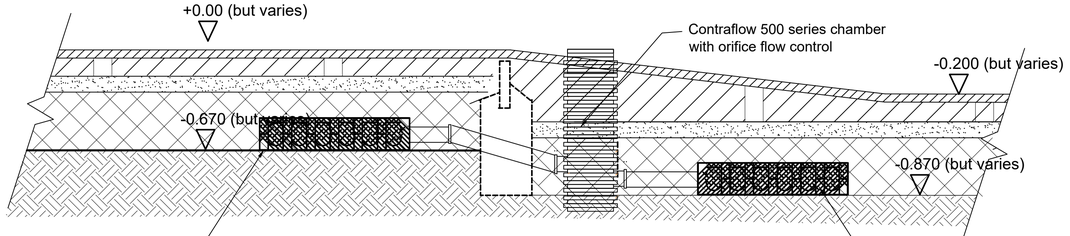
TYPICAL DETAIL FOR SILT TRAP NON-LOAD BEARING AREAS

1:20



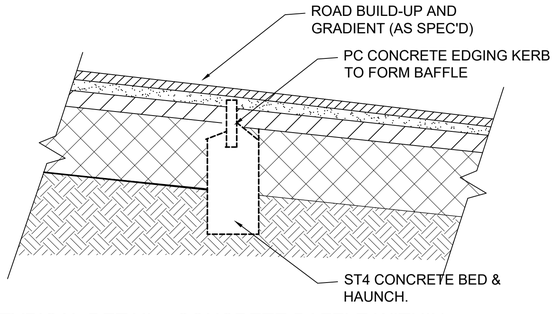
ACO MULTIDRAIN M100D DRAINAGE INTO TYPE PERMAVOID ATTENUATION TYPICAL DETAIL

SCALE 1:20



TYPICAL SECTION THROUGH STEP WITHIN PERVIOUS PAVEMENT INCORPORATING CONCRETE EDGING BAFFLE

SCALE 1: 15



TYPICAL DETAIL - CONCRETE BAFFLE WITHIN PERMEABLE PAVED BUILD-UP

SCALE 1:15

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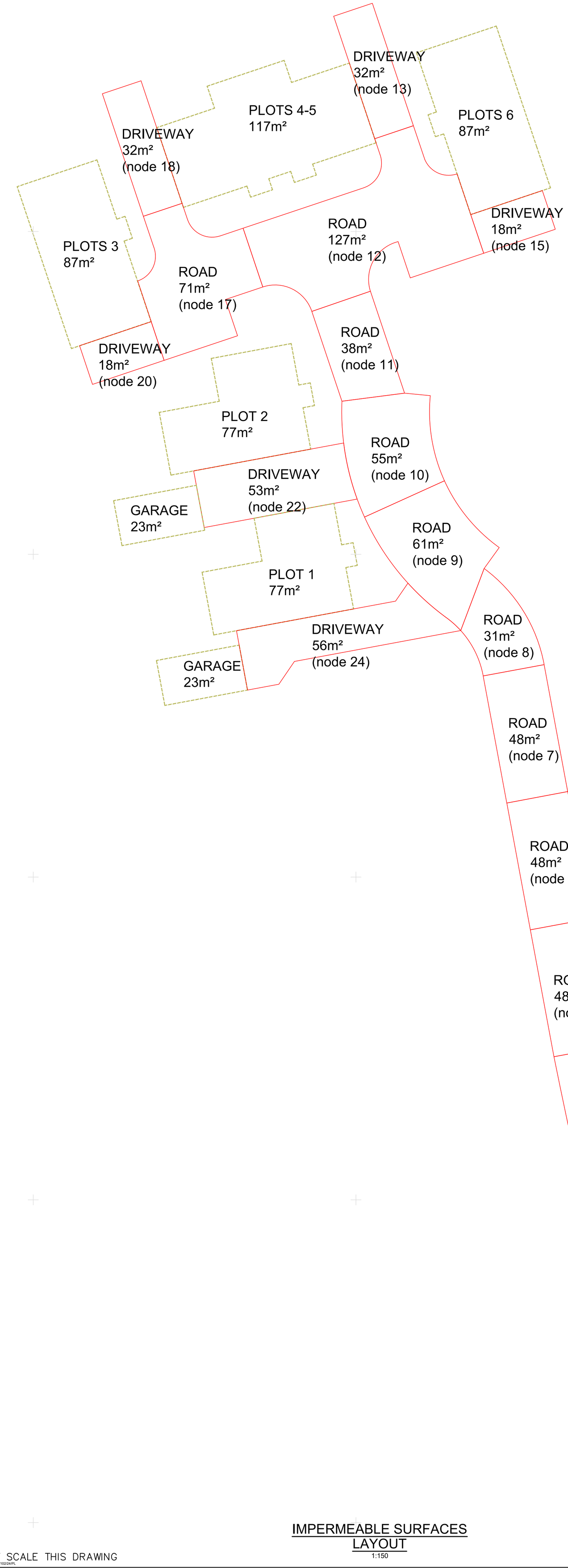
APPENDIX B

NETWORK CALCULATIONS



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NOTES

IMPERMEABLE SURFACE AREAS

TOTAL SITE AREA = 4,450m²
ROOFS & GARAGES = 491m²
DRIVEWAYS = 209m²
ROAD = 655m²

CATCHMENT AREAS

NODE 2 - ROAD = 44m²
NODE 3 - ROAD = 36m²
NODE 4 - ROAD = 48m²
NODE 5 - ROAD = 48m²
NODE 6 - ROAD = 48m²
NODE 7 - ROAD = 48m²
NODE 8 - ROAD = 31m²
NODE 9 - ROAD = 61m²
NODE 10 - ROAD = 55m²
NODE 11 - ROAD = 38m²
NODE 12 - ROAD = 127m²
NODE 13 - DRIVEWAY = 44m² + PLOT 5 = 59m² (TOTAL INC 10 % URBAN CREEP = 113m²)
NODE 15 - DRIVEWAY = 18m² + PLOT 6 = 87m² (TOTAL INC 10 % URBAN CREEP = 106m²)
NODE 17 - ROAD = 71m²
NODE 18 - DRIVEWAY = 32m² + PLOT 4 = 59m² (TOTAL INC 10 % URBAN CREEP = 100m²)
NODE 20 - DRIVEWAY = 13m² + PLOT 3 = 87m² (TOTAL INC 10 % URBAN CREEP = 110m²)
NODE 22 - DRIVEWAY = 53m² + PLOT 2 = 77m² + GARAGE = 23m² (TOTAL INC 10 % URBAN CREEP = 168m²)
NODE 24 - DRIVEWAY = 56m² + PLOT 1 = 77m² + GARAGE = 23m² (TOTAL INC 10 % URBAN CREEP = 172m²)

IMPERMEABLE SURFACES LAYOUT
1:150

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Drawn	TB	Chk'd EG	QA'D EG	466543-200P

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	0.310
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
24	0.015	5.00	13.850		496724.700	106169.454	0.410
22	0.014	5.00	14.100		496718.645	106180.517	0.410
20	0.011	5.00	14.300		496706.863	106190.732	0.410
18	0.009	5.00	14.350		496708.442	106206.704	0.410
17	0.007	5.00	14.250		496711.876	106196.549	0.580
15	0.010	5.00	14.350		496737.167	106200.742	0.410
13	0.009	5.00	14.350		496726.299	106212.599	0.410
12	0.016	5.00	14.200		496722.141	106199.878	0.570
11	0.004	5.00	14.100		496725.023	106191.095	0.570
10	0.006	5.00	14.000		496727.542	106183.363	0.570
9	0.006	5.00	13.850		496731.132	106175.913	0.720
8	0.003	5.00	13.700		496735.667	106168.774	0.720
7	0.005	5.00	13.400		496738.130	106161.150	0.720
6	0.005	5.00	13.100		496739.957	106151.265	0.720
5	0.005	5.00	12.800		496741.784	106141.436	0.720
4	0.005	5.00	12.500		496743.715	106131.695	0.720
3	0.004	5.00	12.200		496745.752	106121.517	0.720
2	0.004	5.00	11.900		496747.513	106112.905	0.720
1			11.600	1200	496748.698	106108.729	0.600

Links (Results)

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)
2	2.059	36.4	24.7	0.570	0.450	0.137	0.0	91	2.208
3	1.867	33.0	23.9	0.570	0.570	0.132	0.0	95	2.030
4	1.717	30.3	23.3	0.570	0.570	0.129	0.0	99	1.889
5	1.755	31.0	22.4	0.570	0.570	0.124	0.0	95	1.909
6	1.749	30.9	21.5	0.570	0.570	0.119	0.0	92	1.888
7	1.745	30.8	20.7	0.570	0.570	0.114	0.0	90	1.867
8	1.956	34.6	19.8	0.570	0.570	0.110	0.0	81	2.018
9	1.342	23.7	16.5	0.570	0.570	0.091	0.0	92	1.448
10	1.925	34.0	15.4	0.420	0.570	0.085	0.0	71	1.876
22	1.291	10.1	2.5	0.310	0.470	0.014	0.0	34	1.071
11	1.115	19.7	11.9	0.420	0.420	0.066	0.0	84	1.166
12	1.045	18.5	11.2	0.420	0.420	0.062	0.0	85	1.096
17	0.607	10.7	4.9	0.430	0.420	0.027	0.0	71	0.593
15	1.109	8.7	1.8	0.310	0.470	0.010	0.0	31	0.873
13	1.176	9.2	1.6	0.310	0.470	0.009	0.0	29	0.887
20	1.310	10.3	2.0	0.310	0.480	0.011	0.0	30	1.018
18	1.227	9.6	1.6	0.310	0.480	0.009	0.0	28	0.911
6.000	1.586	12.5	2.7	0.310	0.620	0.015	0.0	32	1.267

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	✓	2 year (l/s)	0.3	500 year (l/s)	1.8
Summer CV	1.000	Drain Down Time (mins)	240	10 year (l/s)	0.6	Check Discharge Volume	✓
Winter CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	1.0	100 year 360 minute (m³)	35
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	100 year (l/s)	1.3		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	10	0	0	100	45	0	0
10	40	0	0	500	45	0	0
30	40	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.37	Growth Factor 100 year	3.19	Q 10 year (l/s)	0.6
Greenfield Method	IH124	Region	7	Growth Factor 500 year	4.49	Q 30 year (l/s)	1.0
Positively Drained Area (ha)	0.133	Growth Factor 2 year	0.88	Betterment (%)	0	Q 100 year (l/s)	1.3
SAAR (mm)	722	Growth Factor 10 year	1.62	QBar	0.4	Q 500 year (l/s)	1.8
Soil Index	3	Growth Factor 30 year	2.40	Q 2 year (l/s)	0.3		

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	3	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.37	Climate Change (%)	0	PR	0.376
Positively Drained Area (ha)	0.133	CWI	108.444	Storm Duration (mins)	360	Runoff Volume (m^3)	35

Node 1 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	11.000	Product Number	CTL-SHE-0054-1000-0500-1000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node 2 Online Orifice Control

Flap Valve	x	Invert Level (m)	11.180	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.030		

Node 3 Online Orifice Control

Flap Valve	x	Invert Level (m)	11.480	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.030		

Node 4 Online Orifice Control

Flap Valve	x	Invert Level (m)	11.780	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.030		

Node 5 Online Orifice Control

Flap Valve	x	Invert Level (m)	12.080	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.030		

Node 6 Online Orifice Control

Flap Valve	x	Invert Level (m)	12.380	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.028		

Node 7 Online Orifice Control

Flap Valve	x	Invert Level (m)	12.680	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.028		

Node 8 Online Orifice Control

Flap Valve	x	Invert Level (m)	12.980	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.026		

Node 9 Online Orifice Control

Flap Valve	x	Invert Level (m)	13.130	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.026		

Node 10 Online Orifice Control

Flap Valve	x	Invert Level (m)	13.430	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.027		

Node 11 Online Orifice Control

Flap Valve	x	Invert Level (m)	13.530	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.029		

Node 12 Online Orifice Control

Flap Valve	x	Invert Level (m)	13.630	Design Flow (l/s)	0.6	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Depth (m)	0.300	Diameter (m)	0.029		

Node 13 Offline Orifice Control

Flap Valve	x	Loop to Node	12	Invert Level (m)	13.940	Diameter (m)	0.012	Discharge Coefficient	0.600

Node 15 Offline Orifice Control

Flap Valve	x	Loop to Node	12	Invert Level (m)	13.940	Diameter (m)	0.012	Discharge Coefficient	0.600

Node 17 Online Orifice Control

Flap Valve	x	Invert Level (m)	13.670	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.026		

Node 18 Offline Orifice Control

Flap Valve	x	Invert Level (m)	13.940	Design Flow (l/s)	0.5	Discharge Coefficient	0.600
Loop to Node	17	Design Depth (m)	0.300	Diameter (m)	0.012		

Node 20 Offline Orifice Control

Flap Valve	x	Loop to Node	17	Invert Level (m)	13.890	Diameter (m)	0.012	Discharge Coefficient	0.600

Node 22 Offline Orifice Control

Flap Valve	x	Invert Level (m)	13.690	Design Flow (l/s)	0.5	Discharge Coefficient	0.600
Loop to Node	10	Design Depth (m)	0.300	Diameter (m)	0.012		

Node 24 Offline Orifice Control

Flap Valve	x	Loop to Node	8	Invert Level (m)	13.440	Diameter (m)	0.012	Discharge Coefficient	0.600

Node 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.850	Depth (m)	0.450
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	11.180	Length (m)	9.450	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	30.0		

Node 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	3.900	Depth (m)	0.450
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	11.480	Length (m)	9.200	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	30.0		

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.800	Depth (m)	0.450
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	11.780	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	30.0		

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.800	Depth (m)	0.450
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.080	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	30.0		

Node 6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.800	Depth (m)	0.450
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.380	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	30.0		

Node 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.800	Depth (m)	0.450
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.680	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	30.0		

Node 8 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.800	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.980	Length (m)	6.458	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	132	Slope (1:X)	30.0		

Node 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	6.100	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.130	Length (m)	8.971	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	312	Slope (1:X)	40.0		

Node 10 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	8.089	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.430	Length (m)	6.800	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	304	Slope (1:X)	60.0		

Node 11 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	7.917	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.530	Length (m)	4.800	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	224	Slope (1:X)	60.0		

Node 12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	16.323	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.630	Length (m)	7.780	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	136	Slope (1:X)	100.0		

Node 13 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.81	Width (m)	3.200	Depth (m)	0.300
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.940	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node 15 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.81	Width (m)	3.160	Depth (m)	0.300
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.940	Length (m)	5.850	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node 17 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	9.149	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.670	Length (m)	7.760	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	148	Slope (1:X)	100.0		

Node 18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.81	Width (m)	3.200	Depth (m)	0.300
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.940	Length (m)	10.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node 20 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.81	Width (m)	5.850	Depth (m)	0.300
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.890	Length (m)	3.160	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node 22 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.81	Width (m)	4.460	Depth (m)	0.300
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.690	Length (m)	11.880	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node 24 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.81	Width (m)	3.730	Depth (m)	0.300
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.440	Length (m)	15.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Approval Settings

Node Size	✓	Minimum Backdrop Height (m)	0.200	Return Period (years)	100
Node Losses	✓	Maximum Backdrop Height (m)	1.500	Time to Half Empty	✓
Link Size	✓	Full Bore Velocity	✓	Return Period (years)	2
Minimum Diameter (mm)	100	Minimum Full Bore Velocity (m/s)	1.000	Discharge Rates	✓
Link Length	✓	Maximum Full Bore Velocity (m/s)	3.000	2 year (l/s)	0.3
Maximum Length (m)	100.000	Proportional Velocity	✓	10 year (l/s)	0.6
Coordinates	✓	Return Period (years)	2	30 year (l/s)	1.0
Accuracy (m)	1.000	Minimum Proportional Velocity (m/s)	0.750	100 year (l/s)	1.3
Crossings	✓	Maximum Proportional Velocity (m/s)	3.000	500 year (l/s)	1.8
Cover Depth	✓	Surcharged Depth	✓	Discharge Volume	✓
Minimum Cover Depth (m)	0.310	Return Period (years)	2	100 year 360 minute (m^3)	35
Maximum Cover Depth (m)	3.000	Maximum Surcharged Depth (m)	0.100		
Backdrops	✓	Flooding	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +10% CC 15 minute summer	127.183	35.988	2 year +10% CC 240 minute summer	25.561	6.755
2 year +10% CC 15 minute winter	89.251	35.988	2 year +10% CC 240 minute winter	16.982	6.755
2 year +10% CC 30 minute summer	83.190	23.540	2 year +10% CC 360 minute summer	19.671	5.062
2 year +10% CC 30 minute winter	58.379	23.540	2 year +10% CC 360 minute winter	12.787	5.062
2 year +10% CC 60 minute summer	56.522	14.937	2 year +10% CC 480 minute summer	15.456	4.084
2 year +10% CC 60 minute winter	37.552	14.937	2 year +10% CC 480 minute winter	10.268	4.084
2 year +10% CC 120 minute summer	39.472	10.431	2 year +10% CC 600 minute summer	12.599	3.446
2 year +10% CC 120 minute winter	26.224	10.431	2 year +10% CC 600 minute winter	8.608	3.446
2 year +10% CC 180 minute summer	31.717	8.162	2 year +10% CC 720 minute summer	11.172	2.994
2 year +10% CC 180 minute winter	20.617	8.162	2 year +10% CC 720 minute winter	7.508	2.994

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +10% CC 960 minute summer	9.089	2.393	30 year +40% CC 60 minute summer	185.815	49.105
2 year +10% CC 960 minute winter	6.021	2.393	30 year +40% CC 60 minute winter	123.451	49.105
2 year +10% CC 1440 minute summer	6.546	1.754	30 year +40% CC 120 minute summer	114.024	30.133
2 year +10% CC 1440 minute winter	4.399	1.754	30 year +40% CC 120 minute winter	75.755	30.133
10 year +40% CC 15 minute summer	314.380	88.959	30 year +40% CC 180 minute summer	86.685	22.307
10 year +40% CC 15 minute winter	220.618	88.959	30 year +40% CC 180 minute winter	56.348	22.307
10 year +40% CC 30 minute summer	207.983	58.852	30 year +40% CC 240 minute summer	67.740	17.902
10 year +40% CC 30 minute winter	145.953	58.852	30 year +40% CC 240 minute winter	45.005	17.902
10 year +40% CC 60 minute summer	141.079	37.283	30 year +40% CC 360 minute summer	50.524	13.002
10 year +40% CC 60 minute winter	93.730	37.283	30 year +40% CC 360 minute winter	32.842	13.002
10 year +40% CC 120 minute summer	89.256	23.588	30 year +40% CC 480 minute summer	38.965	10.297
10 year +40% CC 120 minute winter	59.300	23.588	30 year +40% CC 480 minute winter	25.888	10.297
10 year +40% CC 180 minute summer	68.726	17.685	30 year +40% CC 600 minute summer	31.344	8.573
10 year +40% CC 180 minute winter	44.673	17.685	30 year +40% CC 600 minute winter	21.416	8.573
10 year +40% CC 240 minute summer	54.072	14.290	30 year +40% CC 720 minute summer	27.508	7.373
10 year +40% CC 240 minute winter	35.924	14.290	30 year +40% CC 720 minute winter	18.487	7.373
10 year +40% CC 360 minute summer	40.586	10.444	30 year +40% CC 960 minute summer	22.031	5.801
10 year +40% CC 360 minute winter	26.382	10.444	30 year +40% CC 960 minute winter	14.594	5.801
10 year +40% CC 480 minute summer	31.412	8.301	30 year +40% CC 1440 minute summer	15.490	4.151
10 year +40% CC 480 minute winter	20.870	8.301	30 year +40% CC 1440 minute winter	10.410	4.151
10 year +40% CC 600 minute summer	25.332	6.929	100 year +45% CC 15 minute summer	530.847	150.211
10 year +40% CC 600 minute winter	17.308	6.929	100 year +45% CC 15 minute winter	372.524	150.211
10 year +40% CC 720 minute summer	22.276	5.970	100 year +45% CC 30 minute summer	356.289	100.817
10 year +40% CC 720 minute winter	14.971	5.970	100 year +45% CC 30 minute winter	250.027	100.817
10 year +40% CC 960 minute summer	17.896	4.713	100 year +45% CC 60 minute summer	245.314	64.829
10 year +40% CC 960 minute winter	11.855	4.713	100 year +45% CC 60 minute winter	162.981	64.829
10 year +40% CC 1440 minute summer	12.647	3.390	100 year +45% CC 120 minute summer	147.403	38.954
10 year +40% CC 1440 minute winter	8.500	3.390	100 year +45% CC 120 minute winter	97.931	38.954
30 year +40% CC 15 minute summer	409.133	115.770	100 year +45% CC 180 minute summer	111.428	28.674
30 year +40% CC 15 minute winter	287.111	115.770	100 year +45% CC 180 minute winter	72.431	28.674
30 year +40% CC 30 minute summer	272.802	77.193	100 year +45% CC 240 minute summer	86.912	22.968
30 year +40% CC 30 minute winter	191.440	77.193	100 year +45% CC 240 minute winter	57.742	22.968

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 360 minute summer	64.791	16.673	500 year +45% CC 120 minute summer	193.137	51.040
100 year +45% CC 360 minute winter	42.116	16.673	500 year +45% CC 120 minute winter	128.316	51.040
100 year +45% CC 480 minute summer	50.058	13.229	500 year +45% CC 180 minute summer	146.480	37.694
100 year +45% CC 480 minute winter	33.258	13.229	500 year +45% CC 180 minute winter	95.216	37.694
100 year +45% CC 600 minute summer	40.329	11.031	500 year +45% CC 240 minute summer	114.869	30.357
100 year +45% CC 600 minute winter	27.555	11.031	500 year +45% CC 240 minute winter	76.316	30.357
100 year +45% CC 720 minute summer	35.432	9.496	500 year +45% CC 360 minute summer	86.607	22.287
100 year +45% CC 720 minute winter	23.813	9.496	500 year +45% CC 360 minute winter	56.297	22.287
100 year +45% CC 960 minute summer	28.389	7.475	500 year +45% CC 480 minute summer	67.433	17.821
100 year +45% CC 960 minute winter	18.805	7.475	500 year +45% CC 480 minute winter	44.801	17.821
100 year +45% CC 1440 minute summer	19.928	5.341	500 year +45% CC 600 minute summer	54.606	14.936
100 year +45% CC 1440 minute winter	13.393	5.341	500 year +45% CC 600 minute winter	37.310	14.936
500 year +45% CC 15 minute summer	683.949	193.534	500 year +45% CC 720 minute summer	48.142	12.903
500 year +45% CC 15 minute winter	479.964	193.534	500 year +45% CC 720 minute winter	32.354	12.903
500 year +45% CC 30 minute summer	466.638	132.043	500 year +45% CC 960 minute summer	38.717	10.195
500 year +45% CC 30 minute winter	327.466	132.043	500 year +45% CC 960 minute winter	25.647	10.195
500 year +45% CC 60 minute summer	323.800	85.571	500 year +45% CC 1440 minute summer	27.174	7.283
500 year +45% CC 60 minute winter	215.125	85.571	500 year +45% CC 1440 minute winter	18.262	7.283

Results for 2 year +10% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	24	12	13.467	0.027	3.1	0.5455	0.0000	OK
30 minute summer	22	21	13.717	0.027	2.6	0.6274	0.0000	OK
15 minute summer	20	12	13.918	0.028	2.3	0.3620	0.0000	OK
15 minute summer	18	13	13.963	0.023	1.9	0.3462	0.0000	OK
240 minute summer	17	176	13.891	0.221	1.8	3.8820	0.0000	SURCHARGED
15 minute summer	15	12	13.968	0.028	2.1	0.3338	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	24	6.000	8	1.9	0.433	0.156	0.0523	
15 minute summer	24	Orifice	8	0.0				0.0
30 minute summer	22	22	10	1.6	0.284	0.154	0.0443	
30 minute summer	22	Orifice	10	0.0				0.1
15 minute summer	20	20	17	1.8	0.432	0.175	0.0358	
15 minute summer	20	Orifice	17	0.0				0.0
15 minute summer	18	18	17	1.1	0.283	0.119	0.0490	
15 minute summer	18	Orifice	17	0.0				0.0
240 minute summer	17	17	12	0.3	0.096	0.032	0.1900	
15 minute summer	15	15	12	1.5	0.378	0.174	0.0672	
15 minute summer	15	Orifice	12	0.0				0.0

Results for 2 year +10% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	13	13.964	0.024	1.9	0.3532	0.0000	OK
240 minute summer	12	240	13.837	0.207	2.6	6.4215	0.0000	SURCHARGED
360 minute winter	11	336	13.744	0.214	0.8	1.9835	0.0000	SURCHARGED
360 minute winter	10	272	13.667	0.237	1.2	2.9691	0.0000	SURCHARGED
480 minute winter	9	488	13.468	0.338	2.3	3.7111	0.0000	SURCHARGED
240 minute summer	8	160	13.305	0.325	1.5	2.0278	0.0000	SURCHARGED
360 minute winter	7	272	12.928	0.248	0.9	1.3444	0.0000	SURCHARGED
720 minute winter	6	495	12.631	0.251	0.9	1.3758	0.0000	SURCHARGED
720 minute winter	5	495	12.289	0.209	0.9	0.9620	0.0000	SURCHARGED
960 minute winter	4	615	12.004	0.224	0.9	1.1030	0.0000	SURCHARGED
720 minute winter	3	465	11.702	0.222	0.9	0.8818	0.0000	SURCHARGED
960 minute winter	2	600	11.414	0.234	0.9	1.2057	0.0000	SURCHARGED
960 minute winter	1	600	11.070	0.070	0.9	0.0797	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	13	13	12	1.1	0.289	0.121	0.0593	
15 minute summer	13	Orifice	12	0.0				0.0
240 minute summer	12	12	11	0.7	0.280	0.041	0.1453	
360 minute winter	11	11	10	0.6	0.120	0.031	0.1400	
360 minute winter	10	10	9	2.1	0.233	0.062	0.0886	
480 minute winter	9	9	8	0.7	0.091	0.028	0.1489	
240 minute summer	8	8	7	0.8	0.294	0.023	0.0744	
360 minute winter	7	7	6	0.8	0.197	0.026	0.0938	
720 minute winter	6	6	5	0.8	0.222	0.026	0.0933	
720 minute winter	5	5	4	0.8	0.173	0.027	0.0928	
960 minute winter	4	4	3	0.9	0.396	0.028	0.0972	
720 minute winter	3	3	2	0.9	0.259	0.026	0.0821	
960 minute winter	2	2	1	0.9	0.237	0.024	0.0198	
960 minute winter	1	Hydro-Brake®		0.9				42.3

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	24	20	13.485	0.045	7.0	1.3403	0.0000	OK
480 minute winter	22	472	13.805	0.115	0.8	4.4391	0.0000	FLOOD RISK
240 minute winter	20	236	14.043	0.153	1.1	2.1675	0.0000	FLOOD RISK
240 minute winter	18	236	14.043	0.103	1.4	2.4234	0.0000	SURCHARGED
240 minute winter	17	236	14.043	0.373	2.5	7.1267	0.0000	FLOOD RISK
240 minute winter	15	236	14.010	0.070	1.0	0.9647	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)
30 minute summer	24	6.000	8	5.1	0.781	0.407	0.0615	
30 minute summer	24	Orifice	8	0.1				0.1
480 minute winter	22	22	10	0.7	0.314	0.074	0.0731	
480 minute winter	22	Orifice	10	0.0				0.2
240 minute winter	20	20	17	1.0	0.177	0.093	0.0601	
240 minute winter	20	Orifice	17	0.0				0.2
240 minute winter	18	18	17	0.9	0.159	0.089	0.0839	
240 minute winter	18	Orifice	17	0.0				0.2
240 minute winter	17	17	12	0.3	0.101	0.029	0.1900	
240 minute winter	15	15	12	1.0	0.175	0.110	0.1032	
240 minute winter	15	Orifice	12	0.0				0.2

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	13	236	14.010	0.070	0.9	1.5642	0.0000	OK
240 minute winter	12	236	14.010	0.380	3.8	13.0082	0.0000	FLOOD RISK
480 minute winter	11	488	13.904	0.374	1.0	3.8064	0.0000	FLOOD RISK
480 minute winter	10	480	13.805	0.375	1.6	5.2568	0.0000	FLOOD RISK
480 minute winter	9	456	13.673	0.543	1.2	6.3842	0.0000	FLOOD RISK
360 minute summer	8	240	13.480	0.500	2.0	3.6561	0.0000	FLOOD RISK
360 minute summer	7	336	13.067	0.387	1.9	3.1899	0.0000	SURCHARGED
360 minute summer	6	336	12.747	0.367	1.4	2.8951	0.0000	SURCHARGED
360 minute summer	5	328	12.405	0.325	1.6	2.2946	0.0000	SURCHARGED
360 minute summer	4	328	12.124	0.344	2.5	2.5757	0.0000	SURCHARGED
720 minute winter	3	960	11.847	0.367	2.3	2.3145	0.0000	SURCHARGED
720 minute winter	2	960	11.609	0.428	3.3	3.7420	0.0000	FLOOD RISK
720 minute winter	1	960	11.383	0.383	4.0	0.4332	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	13	13	12	0.9	0.159	0.093	0.0917	
240 minute winter	13	Orifice	12	0.0				0.2
240 minute winter	12	12	11	0.7	0.284	0.039	0.1627	
480 minute winter	11	11	10	1.2	0.108	0.060	0.1432	
480 minute winter	10	10	9	0.8	0.233	0.023	0.1456	
480 minute winter	9	9	8	0.7	0.108	0.031	0.1489	
360 minute summer	8	8	7	1.8	0.425	0.052	0.1130	
360 minute summer	7	7	6	1.1	0.221	0.037	0.1265	
360 minute summer	6	6	5	1.6	0.413	0.052	0.0985	
360 minute summer	5	5	4	2.5	0.218	0.081	0.1122	
360 minute summer	4	4	3	2.3	0.402	0.076	0.1264	
720 minute winter	3	3	2	3.2	0.243	0.096	0.1481	
720 minute winter	2	2	1	4.0	0.471	0.110	0.0764	
720 minute winter	1	Hydro-Brake®		1.0				42.0

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	24	288	13.526	0.086	2.1	3.2354	0.0000	OK
600 minute winter	22	585	13.870	0.180	0.8	7.2180	0.0000	FLOOD RISK
360 minute winter	20	352	14.104	0.214	1.2	3.0585	0.0000	FLOOD RISK
360 minute winter	18	352	14.104	0.164	0.9	3.9963	0.0000	FLOOD RISK
360 minute winter	17	352	14.104	0.434	1.9	8.4197	0.0000	FLOOD RISK
360 minute winter	15	352	14.071	0.131	0.9	1.8784	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	24	6.000	8	1.6	0.284	0.127	0.0825	
360 minute summer	24	Orifice	8	0.0				0.3
600 minute winter	22	22	10	0.7	0.210	0.065	0.0731	
600 minute winter	22	Orifice	10	0.0				0.3
360 minute winter	20	20	17	0.7	0.138	0.071	0.0601	
360 minute winter	20	Orifice	17	0.0				0.2
360 minute winter	18	18	17	0.7	0.133	0.073	0.0839	
360 minute winter	18	Orifice	17	0.0				0.2
360 minute winter	17	17	12	0.3	0.101	0.029	0.1900	
360 minute winter	15	15	12	0.9	0.158	0.099	0.1178	
360 minute winter	15	Orifice	12	0.0				0.3

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	13	352	14.071	0.131	1.2	3.1478	0.0000	FLOOD RISK
360 minute winter	12	352	14.071	0.441	3.4	15.3327	0.0000	FLOOD RISK
360 minute winter	11	344	13.966	0.436	1.1	4.5179	0.0000	FLOOD RISK
600 minute winter	10	585	13.870	0.440	1.7	6.3244	0.0000	FLOOD RISK
480 minute summer	9	480	13.732	0.602	1.5	6.3842	0.0000	FLOOD RISK
360 minute summer	8	288	13.526	0.546	2.1	3.6627	0.0000	FLOOD RISK
600 minute winter	7	555	13.119	0.439	2.3	3.9430	0.0000	FLOOD RISK
600 minute winter	6	555	12.798	0.418	1.3	3.6377	0.0000	SURCHARGED
600 minute winter	5	555	12.454	0.374	1.6	3.0079	0.0000	SURCHARGED
600 minute winter	4	840	12.177	0.397	1.4	3.3345	0.0000	SURCHARGED
600 minute winter	3	840	11.923	0.443	1.3	3.1308	0.0000	FLOOD RISK
600 minute winter	2	840	11.675	0.495	3.0	4.0445	0.0000	FLOOD RISK
600 minute winter	1	840	11.427	0.427	1.7	0.4831	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)
360 minute winter	13	13	12	0.8	0.142	0.082	0.1047	
360 minute winter	13	Orifice	12	0.0				0.2
360 minute winter	12	12	11	0.8	0.247	0.041	0.1627	
360 minute winter	11	11	10	0.6	0.103	0.030	0.1432	
600 minute winter	10	10	9	0.8	0.136	0.022	0.1456	
480 minute summer	9	9	8	0.7	0.149	0.029	0.1489	
360 minute summer	8	8	7	2.0	0.146	0.057	0.1372	
600 minute winter	7	7	6	1.0	0.190	0.034	0.1634	
600 minute winter	6	6	5	1.5	0.244	0.048	0.1316	
600 minute winter	5	5	4	1.2	0.175	0.038	0.1474	
600 minute winter	4	4	3	1.1	0.181	0.035	0.1813	
600 minute winter	3	3	2	2.8	0.224	0.085	0.1547	
600 minute winter	2	2	1	-3.0	0.375	-0.083	0.0764	
600 minute winter	1	Hydro-Brake®		1.0				39.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	24	464	13.618	0.178	1.4	7.3674	0.0000	FLOOD RISK
720 minute winter	22	705	13.988	0.298	1.0	12.2587	0.0000	FLOOD RISK
360 minute winter	20	352	14.226	0.336	1.3	4.3421	0.0000	FLOOD RISK
360 minute winter	18	352	14.226	0.286	1.2	7.1655	0.0000	FLOOD RISK
360 minute winter	17	352	14.226	0.556	2.0	9.8334	0.0000	FLOOD RISK
480 minute winter	15	472	14.192	0.252	0.9	3.6850	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	24	6.000	8	1.1	0.343	0.090	0.0860	
480 minute winter	24	Orifice	8	0.0				0.4
720 minute winter	22	22	10	0.6	0.210	0.062	0.0731	
720 minute winter	22	Orifice	10	0.0				0.3
360 minute winter	20	20	17	0.8	0.150	0.078	0.0601	
360 minute winter	20	Orifice	17	0.0				0.2
360 minute winter	18	18	17	0.7	0.143	0.073	0.0839	
360 minute winter	18	Orifice	17	0.0				0.2
360 minute winter	17	17	12	0.3	0.089	0.029	0.1900	
480 minute winter	15	15	12	0.8	0.153	0.095	0.1178	
480 minute winter	15	Orifice	12	0.0				0.3

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	13	472	14.192	0.252	0.9	6.2752	0.0000	FLOOD RISK
480 minute winter	12	472	14.192	0.562	3.2	17.5861	0.0000	FLOOD RISK
480 minute winter	11	456	14.095	0.565	1.1	5.2537	0.0000	FLOOD RISK
720 minute winter	10	705	13.988	0.558	1.3	7.3203	0.0000	FLOOD RISK
720 minute winter	9	690	13.841	0.711	1.0	6.3842	0.0000	FLOOD RISK
480 minute winter	8	464	13.617	0.637	1.7	3.6627	0.0000	FLOOD RISK
720 minute winter	7	675	13.319	0.639	2.8	4.1031	0.0000	FLOOD RISK
720 minute winter	6	675	13.055	0.674	1.2	4.1031	0.0000	FLOOD RISK
720 minute winter	5	675	12.743	0.663	1.3	4.1031	0.0000	FLOOD RISK
720 minute winter	4	675	12.471	0.691	1.5	4.1031	0.0000	FLOOD RISK
720 minute winter	3	690	12.160	0.680	1.2	3.2123	0.0000	FLOOD RISK
720 minute winter	2	645	11.857	0.677	1.9	4.0445	0.0000	FLOOD RISK
720 minute winter	1	660	11.546	0.546	3.4	0.6179	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)
480 minute winter	13	13	12	0.7	0.150	0.077	0.1047	
480 minute winter	13	Orifice	12	0.0				0.3
480 minute winter	12	12	11	0.9	0.205	0.047	0.1627	
480 minute winter	11	11	10	1.0	0.105	0.053	0.1432	
720 minute winter	10	10	9	0.7	0.136	0.021	0.1456	
720 minute winter	9	9	8	0.9	0.118	0.038	0.1489	
480 minute winter	8	8	7	1.4	0.132	0.041	0.1410	
720 minute winter	7	7	6	1.0	0.190	0.032	0.1770	
720 minute winter	6	6	5	1.0	0.244	0.033	0.1760	
720 minute winter	5	5	4	1.2	0.145	0.038	0.1748	
720 minute winter	4	4	3	1.0	0.189	0.034	0.1827	
720 minute winter	3	3	2	1.6	0.206	0.048	0.1547	
720 minute winter	2	2	1	3.4	0.296	0.092	0.0764	
720 minute winter	1	Hydro-Brake®		1.0				48.4

Results for 500 year +45% CC Critical Storm Duration. Lowest mass balance: 96.17%

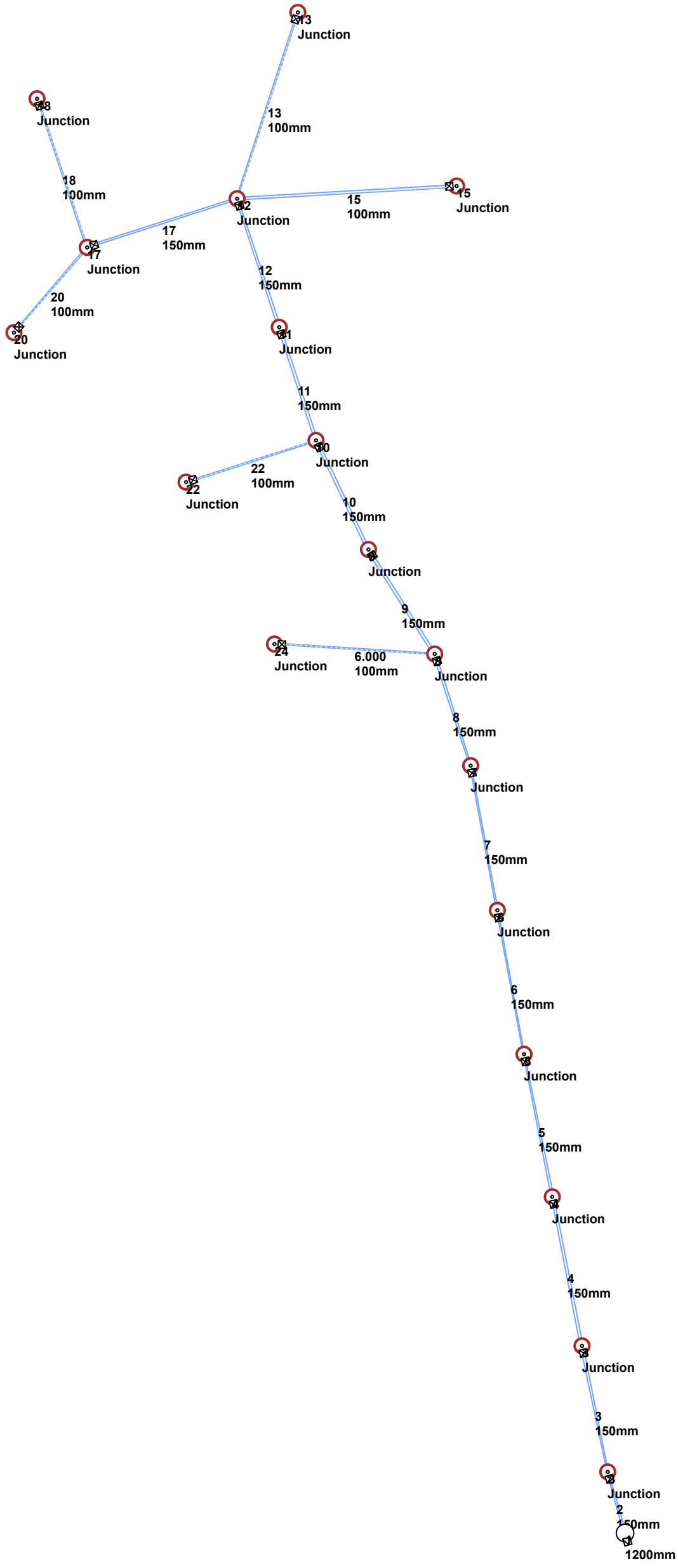
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	24	264	13.702	0.262	2.4	11.2072	0.0000	FLOOD RISK
480 minute summer	22	304	14.002	0.312	2.7	12.3830	0.0000	FLOOD RISK
240 minute summer	20	144	14.256	0.366	3.5	4.3421	0.0000	FLOOD RISK
240 minute winter	18	152	14.274	0.334	3.7	7.5308	0.0000	FLOOD RISK
480 minute summer	17	272	14.250	0.580	3.4	9.8334	8.9873	FLOOD
240 minute summer	15	148	14.209	0.269	3.2	3.9330	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	24	6.000	8	1.4	0.261	0.116	0.0860	
360 minute winter	24	Orifice	8	0.0				0.4
480 minute summer	22	22	10	0.9	0.161	0.086	0.0731	
480 minute summer	22	Orifice	10	0.0				0.3
240 minute summer	20	20	17	2.0	0.250	0.190	0.0601	
240 minute summer	20	Orifice	17	0.0				0.2
240 minute winter	18	18	17	2.4	0.312	0.254	0.0839	
240 minute winter	18	Orifice	17	0.0				0.2
480 minute summer	17	17	12	0.4	0.092	0.033	0.1900	
240 minute summer	15	15	12	1.9	0.320	0.219	0.1178	
240 minute summer	15	Orifice	12	0.0				0.3

Results for 500 year +45% CC Critical Storm Duration. Lowest mass balance: 96.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	13	148	14.205	0.265	3.6	6.6210	0.0000	FLOOD RISK
600 minute summer	12	345	14.200	0.570	3.8	17.5861	21.0900	FLOOD
600 minute summer	11	345	14.100	0.570	1.2	5.2537	2.0379	FLOOD
960 minute winter	10	585	14.000	0.570	1.6	7.3203	8.8916	FLOOD
720 minute summer	9	375	13.850	0.720	1.3	6.3842	4.6165	FLOOD
480 minute summer	8	304	13.700	0.720	1.9	3.6627	5.3358	FLOOD
600 minute summer	7	345	13.400	0.720	2.4	4.1031	0.8261	FLOOD
960 minute summer	6	540	13.100	0.720	1.4	4.1031	2.7384	FLOOD
720 minute winter	5	450	12.800	0.720	1.5	4.1031	0.5078	FLOOD
960 minute summer	4	555	12.500	0.720	1.5	4.1031	2.5865	FLOOD
720 minute winter	3	450	12.200	0.720	1.3	3.2123	1.7637	FLOOD
960 minute winter	2	585	11.900	0.720	1.7	4.0445	1.4738	FLOOD
1440 minute winter	1	1110	11.578	0.578	4.9	0.6535	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 summer	13	13	12	-1.9	0.286	-0.200	0.1047	
240 minute summer	13	Orifice	12	0.0				0.2
600 minute summer	12	12	11	0.9	0.146	0.048	0.1627	
600 minute summer	11	11	10	1.3	0.101	0.068	0.1432	
960 minute winter	10	10	9	0.8	0.116	0.024	0.1456	
720 minute summer	9	9	8	0.7	0.089	0.030	0.1489	
480 minute summer	8	8	7	1.7	0.157	0.049	0.1410	
600 minute summer	7	7	6	0.9	0.130	0.030	0.1770	
960 minute summer	6	6	5	1.0	0.453	0.032	0.1760	
720 minute winter	5	5	4	1.0	0.164	0.033	0.1748	
960 minute summer	4	4	3	1.0	0.194	0.034	0.1827	
720 minute winter	3	3	2	1.8	0.152	0.055	0.1547	
960 minute winter	2	2	1	2.6	0.409	0.072	0.0764	
1440 minute winter	1	Hydro-Brake®		1.1				83.3



APPENDIX C

HR WALLINGFORD GREENFIELD RUN-OFF RATE CALCUALTIONS

hr wallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Hedwilena Silva
Site name:	Long Acre
Site location:	The Street, Walberton

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.84690° N
Longitude:	0.62721° W
Reference:	276655399
Date:	Aug 27 2024 15:22

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.445

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	780	780
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.08	2.44
1 in 1 year (l/s):	0.07	2.07
1 in 30 years (l/s):	0.2	5.61
1 in 100 year (l/s):	0.27	7.78
1 in 200 years (l/s):	0.32	9.12