124 Theobalds Road

Surface Water Drainage – Response to LLFA Comments

1 Introduction

This technical note provides the information requested by the planners in relation to the information submitted at planning stage for the proposed development at 124 Theobalds Road, London WC1X 8RX.

2 Planning Comments

The following response was provided by the Lead Local Flood Authority (LLFA) via the senior planning officer Ewan Campbell (email dated 29/07/2024).

a) Review Summary

This application has sufficiently demonstrated the use of the London Plan's drainage hierarchy and is proposing the following key items:

- *Type of Development: Major refurbishment (11,937sqm) and 598 sqm extension*
- *Flood risk: Low surface water and fluvial flood risk. High risk of flooding from groundwater for property below ground level.*
- *Types of conveyance / attenuation features: Blue roofs and sedum roofing (included in plan drawings).*
- *Greenfield runoff rate: Not provided*
- *Runoff rate restriction (l/s): Details not provided*
- *Runoff attenuation volume (m3): Not provided*
- *Maintenance plan: Not provided*

b) Recommendation and Requests

Further information is required for the following reasons:

1. *The applicant has proposed blue roofing in the Surface Water and Foul Drainage Strategy and sedum roofing in the proposed plan drawing, but not provided any details. In order to comply with the London Plan Policy SI 13 the applicant should explicitly confirm that green infrastructure (in the form of sedum roofing) is proposed alongside rainwater harvesting (blue roofing), to satisfy the requirements of the Drainage Hierarchy. If one or both is not to be included, sufficient justification has not been provided.*
2. *The applicant has not provided any justification for why infiltration has not been proposed.*
3. *The applicant has not provided sufficient detail of which specific flood resilient design features will be in place to mitigate against the high groundwater flood risk, to demonstrate that these will be sufficient.*
4. *The applicant has not provided the greenfield, existing, or proposed runoff rates to demonstrate compliance with Defra Non-statutory Technical Standards S2 and S3 or the London Plan Policy SI 13.*
5. *The applicant has not provided the greenfield, existing, or proposed runoff volumes to demonstrate compliance with Defra Non-statutory Technical Standards S4, S5 and S6.*

6. *The applicant has not provided any evidence to demonstrate there is no flooding predicted on site up to and including the 1 in 100 year event, to satisfy Defra Non-statutory Technical Standards S7 and S8. The applicant has also not provided any details for how exceedance flows would be managed to satisfy Defra Non-statutory Technical Standards S9.*
7. *The applicant has not provided details of the maintenance of the proposed drainage features, including tasks and required maintenance frequency, and maintenance owner.*
8. *Confirmation of sufficient sewer capacity has not been provided.*
9. *Details relating to Health and Safety risks of the SuDS design has not been provided.*

To address the above, please can the applicant submit information which:

1. *Clarifies the drainage features that are proposed, providing details of the blue roofing and sedum roofing that are part of the design (area and depth). If either are to be excluded from the design, the applicant should provide sufficient justification.*
2. *Provides justification for not utilising infiltration within the design.*
3. *Demonstrates that the high groundwater flood risk will be sufficiently mitigated by providing the findings of the further site investigations to be undertaken along with details of the specific flood resilient measures to be employed on site.*
4. *Shows the greenfield, existing, and proposed runoff rates with supporting calculations.*
5. *Shows the greenfield, existing, and proposed runoff volumes with supporting calculations.*
6. *Demonstrates that there is no flooding predicted on site, up to and including the 1 in 100 year rainfall event, with calculations to support.*
7. *Shows the maintenance strategy that will be in place for the surface water drainage strategy, including the maintenance tasks, required frequency and the owner of the maintenance.*
8. *Provides confirmation of sufficient sewer capacity.*
9. *Provides details relating to Health and Safety risks of the SuDS design*

3 Response to LLFA Request for Additional Information

The responses provided below are gathered under the following headings. Supporting information is provided in the Appendices as required.

- Surface water discharge options
- Existing situation – contributing areas, greenfield and brownfield rates
- SuDS proposals
- Flood risk reduction and flood resilient design
- Adoption & maintenance
- H&S – drainage during construction

3.1 Surface water discharge options

The potential for surface water to discharge to ground has been assessed through a review of the likely ground conditions and possible infiltration structures. As the area is underlain by London Clay, infiltration is not considered as a suitable option.

It is proposed that the surface water is discharged via the existing Thames Water combined sewer network in the area via the existing connections.

3.2 Existing Situation

The existing site area, based on the survey of the basement area is 2205 m^2 (≈ 0.22 ha). The site is currently 100 % impermeable and this is not expected to be altered as a result of the development.

The Greenfield and Brownfield rates for the full site area are presented in the tables below for the full site area of 0.22 ha.

Table 3.1 – Greenfield runoff rates

Rainfall event	Greenfield rate (l/s)
Qbar	0.34
1 in 1 year	0.29
1 in 30 year	0.79
1 in 100 year	1.09

Table 3.2 – Modified Rational Method pre-development surface water runoff for full site

Return period	Rainfall intensity (mm/hr)	Peak flow (l/s)
1 in 1 year	22.55	17.1
1 in 30 year	61.57	46.6
1 in 100 year	85.81	65.0

3.3 SuDS Proposals

The LLFA comments acknowledges that the application has sufficiently demonstrated the use of the London Plan's drainage hierarchy. As requested, details of the proposed SuDS elements for the scheme are presented in sections 3.3.1 and 3.3.2.

3.3.1 Blue Roof

The options to include blue roofs have been assessed at the planning stage and based on the structural restrictions and the access requirements, it was identified that up to 130 mm depth of blue roofs can be accommodated on three of the existing terrace areas. Blue roofs are proposed for three terrace areas as shown in Figure 3.1.

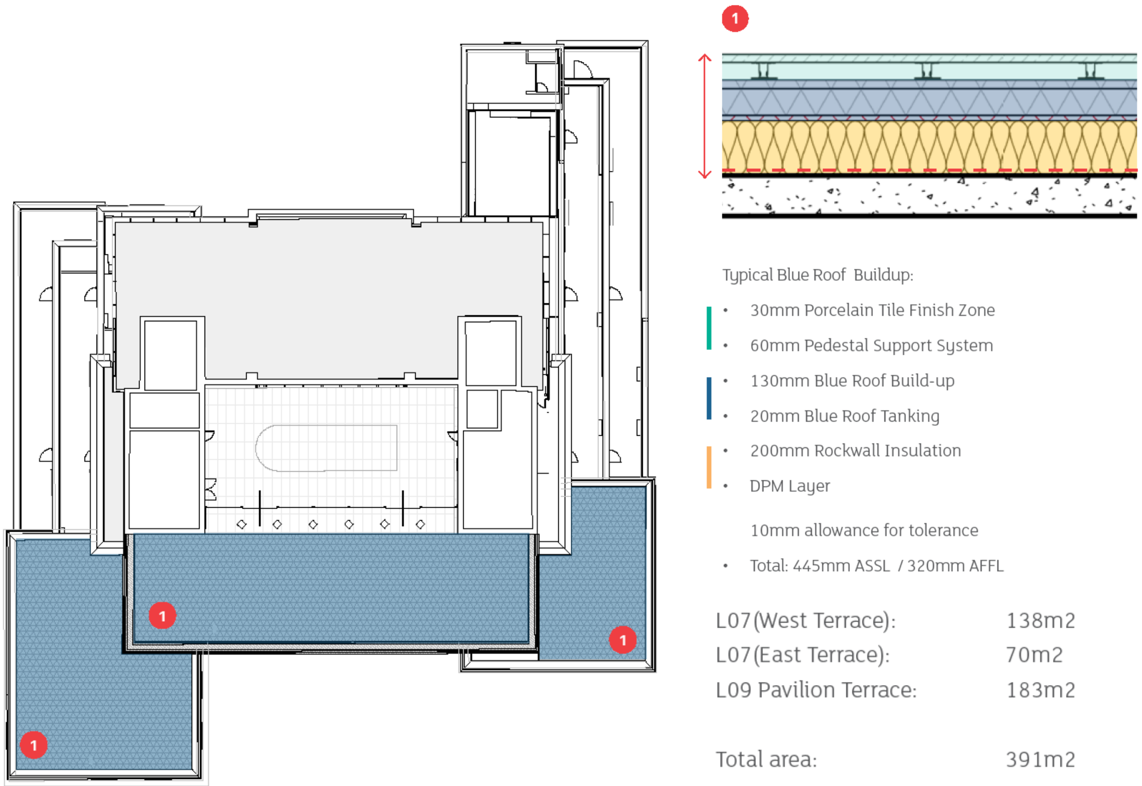


Figure 3.1 – Blue roof areas

The current design is based on the following assumptions.

- Each area to have maximum 1 l/s discharge restriction with minimum 2No. outfall points. Therefore, the blue roof areas will be restricted to 3 l/s
- Catchment of the blue roofs is equal to the terrace areas including the parapets

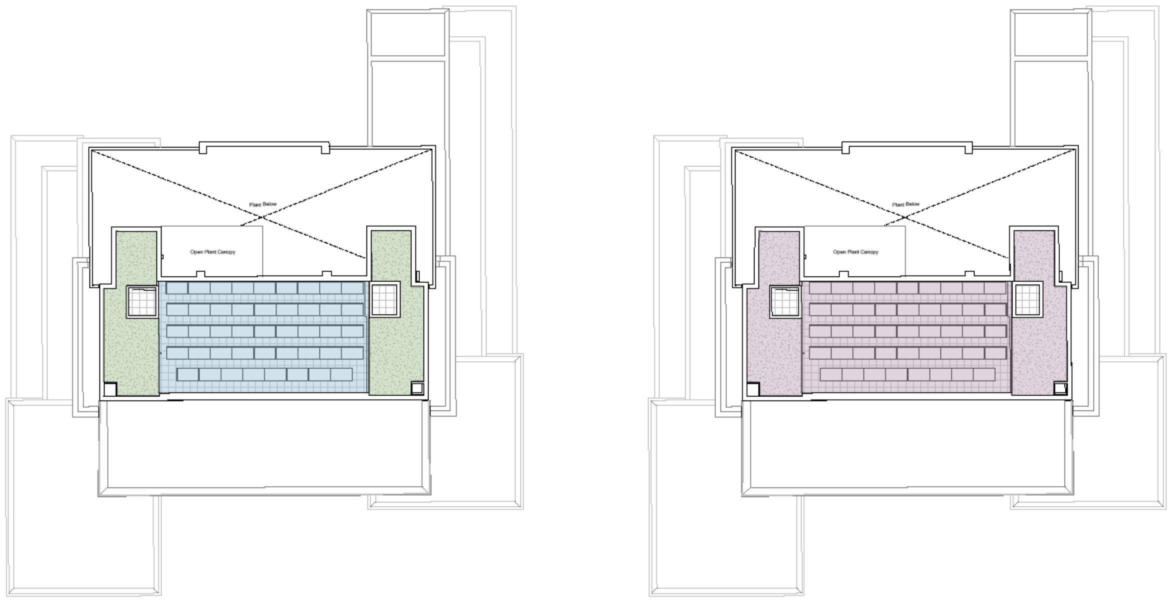
Table 3.3 – Modified Rational Method post-development surface water runoff for full site with blue roofs

Rainfall event	Blue roof area (l/s)	Remaining areas (l/s)	Total proposed discharge rate (l/s)
1 in 1 year	3.0	14.1	17.1
1 in 30 year	3.0	38.2	41.0
1 in 100 year	3.0	53.3	56.3

The inclusion of the blue roofs offers 12-13% betterment for the 1 in 30 and 1 in 100 year rainfall events.

3.3.2 Green Roof

The green roof is proposed at the 9th floor roof level. The footprint of the green roof has been extended post planning to address the comments from the planners as shown on Figure 3.2.



Roof Strategy at Planning

- PV Area = 83m2 (44 PV panels at 15 degree angle)
- 97sqm of sedum green roof
- 160 sqm of paving

Roof Strategy as requested by L.B Camden

- PV Area = 83m2 (44 PV panels at 10 degree angle)
- 257 sqm of intensive wildflower roof

Figure 3.2 – Proposed green roof (area extended post planning)

The inclusion of the intensive wildflower roof will have an increased biodiversity value compared to the original proposal.

3.4 Flood Risk Reduction and Flood Resilient Design

3.4.1 Flood risk reduction

It is proposed to discharge the surface water from the development via the existing connection to the Thames Water sewer. Compared to the existing situation, there would be a reduction to the flow rate of surface water discharge from the site due to the inclusion of blue roofs.

The area is not subject to overland flow routes and surface water flooding as detailed in the drainage report provided at planning stage. The SuDS elements for the proposed development have been designed to cater for the 1 in 100 year + 40 % climate change storm. i.e. in such a storm event, surface water would be collected in the blue roofs and slowly released. Thus, the overland flow route would only be required in the event of a drainage network failure, or if a storm in excess of the 1 in 100 year + 40 % climate change storm caused flows from offsite to flow through the site. Surface water from a rainfall event in excess of the deign-rainfall would follow the existing topography.

3.4.2 Flood Resilient Design

As the site is located in an area with a potential groundwater flood risk, it is necessary to incorporate flood resilient design measures to mitigate against this risk. The following options and other relevant best practice guidance should be considered when developing the detailed design for the scheme.

- Use of materials with good drying and cleaning properties or sacrificial materials that can easily be replaced post-flood
- Locating electrical services, appliances, utility meters and ventilation entry points as high as practicable
- Retain the existing stairs between basement and upper floors

3.5 Adoption and Maintenance

3.5.1 Thames Water Engagement

It is assumed that all the drainage within the site boundary will remain private. The existing CCTV survey does not fully confirm the final outfall points to the Thames Water sewer due to survey access restrictions. There are no changes proposed to the existing drainage outfall arrangements for the building and new proposals will look to utilise these connections for surface and foul water discharge. Hence, no pre-development enquiry has been submitted to Thames Water as there is no change to the existing outfall arrangements or impermeable area.

Engagement with Thames Water will commence at the detailed design stage, as required, when the MEP design is further developed and further information from additional CCTV survey works become available.

3.5.2 Maintenance

The owner/operator of the building will be responsible for the long-term maintenance of the SuDS features and the drainage infrastructure within the site boundary.

Maintenance of SuDS features should be undertaken in line with maintenance schedules outlined in the SuDS Manual. Full maintenance schedules should be confirmed at the detailed design stage in consultation with appropriate product suppliers. An example maintenance schedule is provided below for the SuDS elements.

Table 3.4 – Maintenance Schedule for Green/Blue Roofs

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms

Maintenance schedule	Required action	Typical frequency
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e., year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5 % of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting as required - clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Table 3.5 – Maintenance Schedule for ***other drainage items***

Product Type	Period	Responsibility	Maintenance Methods
Standard Manholes/ Inspection Chambers	As necessary	Owner/ Maintenance Company	Remove and clean any soil and vegetation that covers the manhole cover to prevent blockage of the drainage system at the manhole.

Product Type	Period	Responsibility	Maintenance Methods
			Renew/replace any damaged/missing bolts and damaged/missing manhole covers
Drainage pipes	Six monthly intervals	Owner/ Maintenance Company	Inspect underground drainage pipes to ensure that the distribution pipework arrangement is operational and free from blockages. If required, take remedial action
Flow control	Annually	Maintenance Company for communal areas	Renew any missing/broken items Cleaning out Check outlet spigot

3.6 Drainage During Construction

Drainage is typically an early activity in the construction stage of a development, taking form during the earthworks phase. However, final construction i.e. piped drainage system connections to the SuDS devices, should not take place until the end of site development work, unless a robust strategy for silt-removal is implemented prior to occupation of the site. A plan for the management of construction (including phasing of works, details of any offsite works etc.) cannot be provided at this early stage, as construction work plans are not yet known.

Runoff control measures will need to be implemented in order not to overwhelm the temporary system and cause flooding issues. Runoff rates from the site will be managed so they are no greater than pre-development or in keeping with the best practice guidance to minimise risk of blockage. Any additional conveyance measures are to be installed as needed during grading. All drainage infrastructure should be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers, and storing construction materials away from the drainage infrastructure.

Appendix A – Drainage Calculations

- Greenfield rates
- Attenuation estimates for blue roofs (subject the further design by manufacturer)

hr wallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Cham Ariyaratne
Site name:	124 Theobald Road
Site location:	WC1X 8RX

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:	51.52000° N
Longitude:	0.11998° W
Reference:	2068796619
Date:	Dec 05 2023 19:09

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.2205

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	611	611
Hydrological region:	6	6
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):	0.34	0.34
1 in 1 year (l/s):	0.29	0.29
1 in 30 years (l/s):	0.79	0.79
1 in 100 year (l/s):	1.09	1.09
1 in 200 years (l/s):	1.28	1.28

Design Settings

Rainfall Methodology	FEH-22	Time of Entry (mins)	5.00	Connection Type	Level Soffits	Enforce best practice design rules	x
Return Period (years)	100	Maximum Time of Concentration (mins)	30.00	Minimum Backdrop Height (m)	0.200		
Additional Flow (%)	0	Maximum Rainfall (mm/hr)	50.0	Preferred Cover Depth (m)	1.200		
CV	0.950	Minimum Velocity (m/s)	1.00	Include Intermediate Ground	✓		

Nodes

Name	Area (ha)	Cover Level (m)	Node Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
L9 Blue Roof	0.020	56.223	Junction	1200	530536.536	181788.412	0.220
L7 Blue Roof (West)	0.015	49.075	Junction	1200	530526.180	181773.178	0.220
L7 Blue Roof (East)	0.008	49.075	Junction	1200	530554.232	181792.497	0.220

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.840	Skip Steady State	x	Additional Storage (m³/ha)	0.0	Check Discharge Volume	x
Summer CV	0.950	Analysis Speed	Normal	Drain Down Time (mins)	240	Check Discharge Rate(s)	x		

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	0	0	0	100	0	0	0
30	0	0	0	100	40	0	0

Node L9 Blue Roof Online Orifice Control

Flap Valve	x	Invert Level (m)	56.003	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.130	Diameter (m)	0.037		

Node L7 Blue Roof (West) Online Orifice Control

Flap Valve	x	Invert Level (m)	48.855	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Depth (m)	0.130	Diameter (m)	0.037		

Node L7 Blue Roof (East) Online Orifice Control

Flap Valve	x	Invert Level (m)	48.855	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Depth (m)	0.130	Diameter (m)	0.037		

Node L9 Blue Roof Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Side Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Porosity	0.95	Invert Level (m)	56.003	Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	183.0	0.0	0.130	183.0	0.0	0.131	0.0	0.0

Node L7 Blue Roof (West) Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Side Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Porosity	0.95	Invert Level (m)	48.855	Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	138.0	0.0	0.130	138.0	0.0	0.131	0.0	0.0

Node L7 Blue Roof (East) Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Side Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Porosity	0.95	Invert Level (m)	48.855	Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	70.0	0.0	0.130	70.0	0.0	0.131	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Exit Loss (manhole)	0.250	Entry Loss (junction)	0.000	Exit Loss (junction)	0.000	Apply Recommended Losses	x	Flood Risk (m)	0.300

Approval Settings

Node Size	✓
Node Losses	✓
Link Size	✓
Minimum Diameter (mm)	150
Link Length	✓
Maximum Length (m)	100.000
Coordinates	✓
Accuracy (m)	1.000
Crossings	✓
Cover Depth	✓
Minimum Cover Depth (m)	
Maximum Cover Depth (m)	3.000
Backdrops	✓
Minimum Backdrop Height (m)	
Maximum Backdrop Height (m)	1.500
Full Bore Velocity	✓
Minimum Full Bore Velocity (m/s)	
Maximum Full Bore Velocity (m/s)	3.000
Proportional Velocity	✓
Return Period (years)	
Minimum Proportional Velocity (m/s)	0.750
Maximum Proportional Velocity (m/s)	3.000
Surcharged Depth	✓
Return Period (years)	
Maximum Surcharged Depth (m)	0.100
Flooding	✓
Return Period (years)	30
Time to Half Empty	x
Discharge Rates	✓
Discharge Volume	✓
100 year 360 minute (m³)	

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	108.112	30.592
2 year 15 minute winter	75.868	30.592
2 year 30 minute summer	67.853	19.200
2 year 30 minute winter	47.616	19.200
2 year 60 minute summer	44.076	11.648
2 year 60 minute winter	29.283	11.648
2 year 120 minute summer	32.948	8.707
2 year 120 minute winter	21.890	8.707
2 year 180 minute summer	26.958	6.937
2 year 180 minute winter	17.523	6.937
2 year 240 minute summer	21.866	5.779
2 year 240 minute winter	14.527	5.779
2 year 360 minute summer	16.868	4.341
2 year 360 minute winter	10.965	4.341
2 year 480 minute summer	13.198	3.488
2 year 480 minute winter	8.769	3.488
2 year 600 minute summer	10.703	2.927
2 year 600 minute winter	7.313	2.927
2 year 720 minute summer	9.441	2.530
2 year 720 minute winter	6.345	2.530
2 year 960 minute summer	7.609	2.004
2 year 960 minute winter	5.040	2.004
2 year 1440 minute summer	5.384	1.443
2 year 1440 minute winter	3.618	1.443

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 15 minute summer	330.301	93.464
30 year 15 minute winter	231.790	93.464
30 year 30 minute summer	210.841	59.661
30 year 30 minute winter	147.958	59.661
30 year 60 minute summer	137.433	36.320
30 year 60 minute winter	91.307	36.320
30 year 120 minute summer	87.806	23.204
30 year 120 minute winter	58.336	23.204
30 year 180 minute summer	67.469	17.362
30 year 180 minute winter	43.857	17.362
30 year 240 minute summer	52.836	13.963
30 year 240 minute winter	35.103	13.963
30 year 360 minute summer	39.236	10.097
30 year 360 minute winter	25.504	10.097
30 year 480 minute summer	30.053	7.942
30 year 480 minute winter	19.966	7.942
30 year 600 minute summer	24.011	6.568
30 year 600 minute winter	16.406	6.568
30 year 720 minute summer	20.940	5.612
30 year 720 minute winter	14.073	5.612
30 year 960 minute summer	16.583	4.367
30 year 960 minute winter	10.985	4.367
30 year 1440 minute summer	11.450	3.069
30 year 1440 minute winter	7.695	3.069

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 15 minute summer	432.709	122.442
100 year 15 minute winter	303.656	122.442
100 year 30 minute summer	277.692	78.577
100 year 30 minute winter	194.871	78.577
100 year 60 minute summer	181.770	48.037
100 year 60 minute winter	120.764	48.037
100 year 120 minute summer	115.602	30.550
100 year 120 minute winter	76.803	30.550
100 year 180 minute summer	89.460	23.021
100 year 180 minute winter	58.151	23.021
100 year 240 minute summer	70.579	18.652
100 year 240 minute winter	46.891	18.652
100 year 360 minute summer	53.034	13.648
100 year 360 minute winter	34.474	13.648
100 year 480 minute summer	40.942	10.820
100 year 480 minute winter	27.201	10.820
100 year 600 minute summer	32.857	8.987
100 year 600 minute winter	22.450	8.987
100 year 720 minute summer	28.725	7.699
100 year 720 minute winter	19.305	7.699
100 year 960 minute summer	22.769	5.996
100 year 960 minute winter	15.083	5.996
100 year 1440 minute summer	15.655	4.196
100 year 1440 minute winter	10.521	4.196

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 15 minute summer	605.793	171.418
100 year +40% CC 15 minute winter	425.118	171.418
100 year +40% CC 30 minute summer	388.768	110.008
100 year +40% CC 30 minute winter	272.820	110.008
100 year +40% CC 60 minute summer	254.478	67.251
100 year +40% CC 60 minute winter	169.069	67.251
100 year +40% CC 120 minute summer	161.842	42.770
100 year +40% CC 120 minute winter	107.524	42.770
100 year +40% CC 180 minute summer	125.244	32.229
100 year +40% CC 180 minute winter	81.412	32.229
100 year +40% CC 240 minute summer	98.811	26.113
100 year +40% CC 240 minute winter	65.647	26.113
100 year +40% CC 360 minute summer	74.248	19.107
100 year +40% CC 360 minute winter	48.263	19.107
100 year +40% CC 480 minute summer	57.319	15.148
100 year +40% CC 480 minute winter	38.081	15.148
100 year +40% CC 600 minute summer	46.000	12.582
100 year +40% CC 600 minute winter	31.430	12.582
100 year +40% CC 720 minute summer	40.215	10.778
100 year +40% CC 720 minute winter	27.027	10.778
100 year +40% CC 960 minute summer	31.877	8.394
100 year +40% CC 960 minute winter	21.116	8.394
100 year +40% CC 1440 minute summer	21.917	5.874
100 year +40% CC 1440 minute winter	14.730	5.874

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute summer	L9 Blue Roof	390	56.025	0.022	0.6	3.8585	0.0000	OK
360 minute summer	L7 Blue Roof (West)	240	48.875	0.020	0.7	2.6279	0.0000	OK
360 minute summer	L7 Blue Roof (East)	224	48.872	0.017	0.4	1.1241	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
600 minute summer	L9 Blue Roof	Orifice	0.2	4.5
360 minute summer	L7 Blue Roof (West)	Orifice	0.2	2.9
360 minute summer	L7 Blue Roof (East)	Orifice	0.1	1.5

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	L9 Blue Roof	240	56.048	0.045	2.1	7.7800	0.0000	OK
240 minute summer	L7 Blue Roof (West)	168	48.897	0.042	2.1	5.4720	0.0000	OK
180 minute summer	L7 Blue Roof (East)	120	48.892	0.037	1.3	2.4638	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute summer	L9 Blue Roof	Orifice	0.5	8.5
240 minute summer	L7 Blue Roof (West)	Orifice	0.4	6.0
180 minute summer	L7 Blue Roof (East)	Orifice	0.4	3.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	L9 Blue Roof	248	56.063	0.060	2.8	10.3446	0.0000	OK
240 minute summer	L7 Blue Roof (West)	168	48.910	0.055	2.8	7.2405	0.0000	OK
180 minute summer	L7 Blue Roof (East)	120	48.904	0.049	1.8	3.2783	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute summer	L9 Blue Roof	Orifice	0.6	11.6
240 minute summer	L7 Blue Roof (West)	Orifice	0.5	8.2
180 minute summer	L7 Blue Roof (East)	Orifice	0.5	4.8

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	L9 Blue Roof	256	56.087	0.084	3.9	14.5585	0.0000	OK
240 minute summer	L7 Blue Roof (West)	172	48.934	0.079	3.9	10.3316	0.0000	OK
180 minute summer	L7 Blue Roof (East)	124	48.924	0.069	2.5	4.6053	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute summer	L9 Blue Roof	Orifice	0.7	16.0
240 minute summer	L7 Blue Roof (West)	Orifice	0.7	11.7
180 minute summer	L7 Blue Roof (East)	Orifice	0.6	6.7