11 Belbroughton Road

SuDS Assessment

Job Number: 1386

Date	Version	Notes/Amendments
October 2023	1	Issued for Information

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Acronyms	
AOD	Above Ordnance Datum
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency
SFRA	Strategic Flood Risk Assessment
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SuDS	Sustainable Drainage Systems

Introduction

Flume Consulting Engineers have been appointed to undertake a Sustainable Drainage Systems (SuDS) Assessment for the proposed development at 11 Belbroughton Road, Oxford, OX2 6UZ.

This report has been carried out in accordance with advice and guidance from the Environment Agency (EA), the Strategic Flood Risk Assessment (SFRA) produced by Oxford City Council, their Local Plan and related CIRIA documents.

The EA's indicative floodplain map shows that the site is located in Flood Zone 1, however a SuDS Assessment has been carried out to assess the available options for SuDS use for the proposed development.

Site Description and Location

The property is located to the east side of Belbroughton Road close to the junction with Charlbury Road. The house is located to the north of the road, and is approximately 1 mile outside of Oxford city centre.

The site is approximately 1.0km west of the nearest main watercourse; the River Cherwell (Ray to Thames) and Woodeaton Brook.

The site postcode is OX2 6UZ and the OS grid reference is SP 51148 08466.

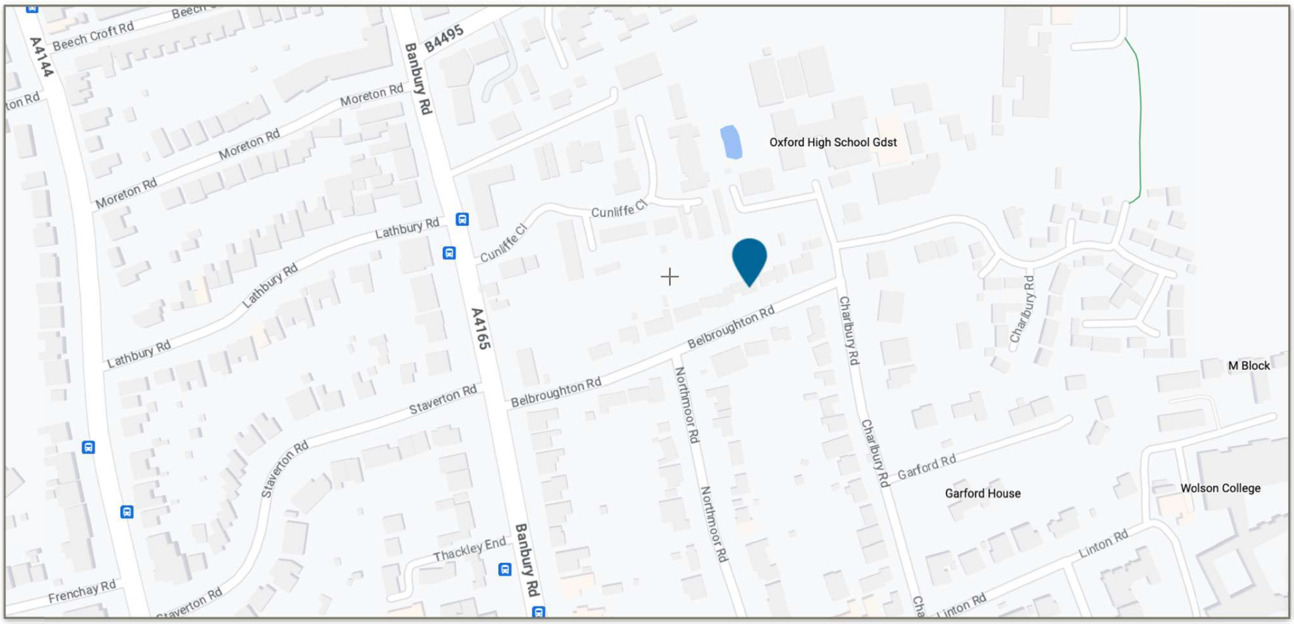

FIGURE 1. SITE LOCATION

Development Proposal

The proposals involve providing rear and roof level extensions to an existing detached Edwardian property located within the North Oxford Conservation Area. It is expected that the ground floor will be finished throughout to the same floor level as existing floor levels.

Vehicular access to the proposed development is via the existing lawful access from Belbroughton Road. Pedestrian street access is also unaffected.

Figure 2 indicates the existing and proposed block plans. The proposed SuDS Sketch is also appended to the report.

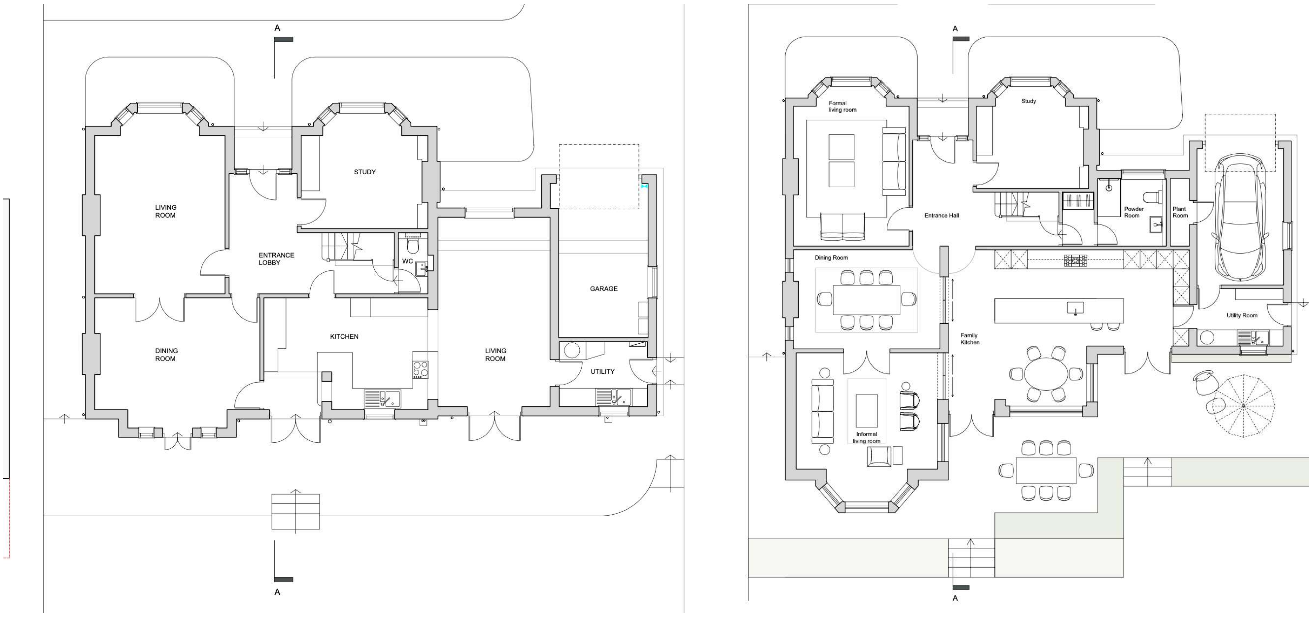

FIGURE 2. EXISTING AND PROPOSED PLANS

Flood Risk Assessment

Flood Risk from Watercourses

The EA's indicative floodplain map, Figure 3, shows that the site is entirely located in Flood Zone 1 (low probability of flooding). Land in this flood zone is assessed as having annual probability of river flooding less than 0.1%. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

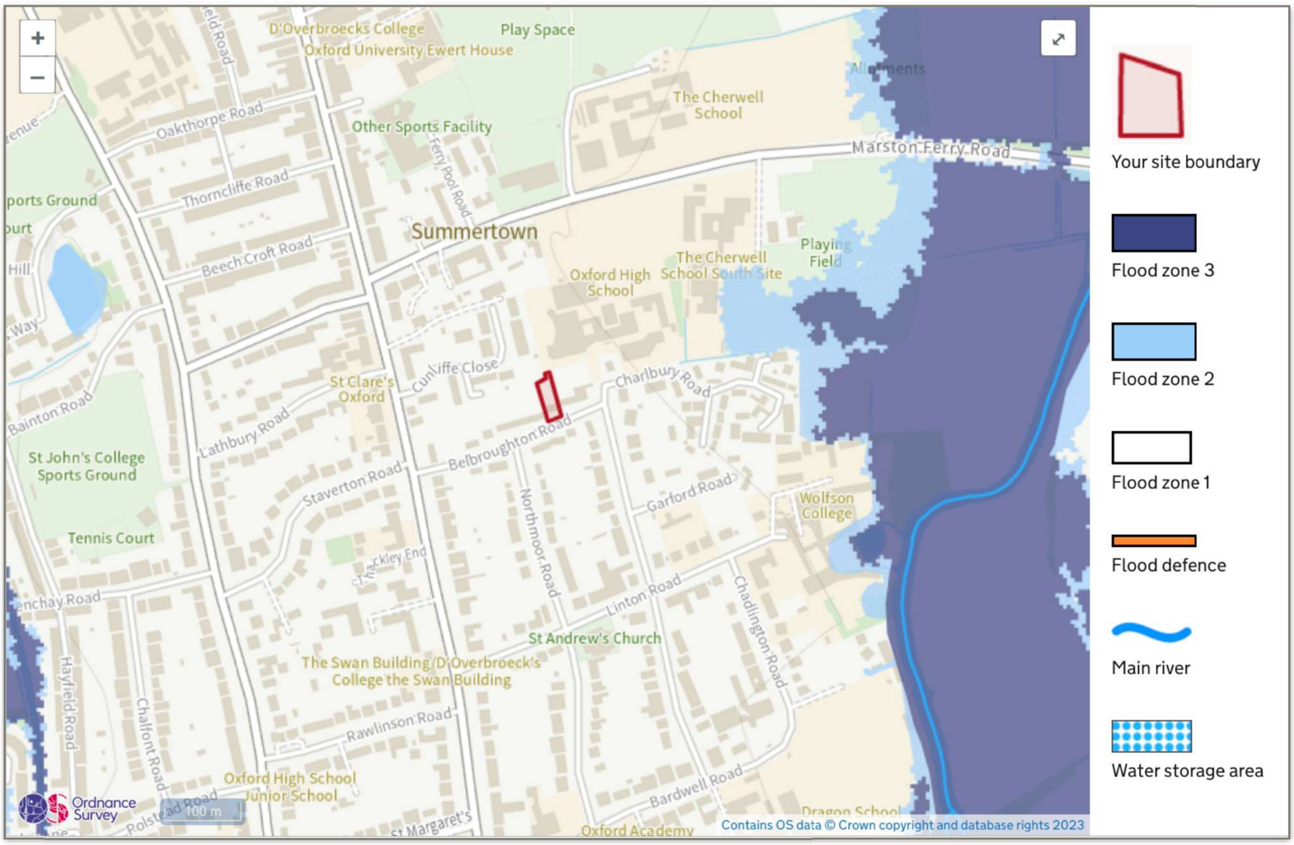

FIGURE 3. ENVIRONMENT AGENCY FLOOD RISK FOR PLANNING MAP (GOV.UK, 2023)

Surface Water Run-off Assessment

Existing Run-off

The total site area which includes the existing building and associated external landscaping, is approximately 1250m^2/0.125ha, comprising of approximately 470m^2 of which is impermeable hardstanding areas.

The existing peak run-off rate for the design storm event (1 in 1, 1 in 30 and 1 in 100 year) was calculated using the Modified Rational Method | Wallingford Procedure as shown below:
as shown below:
Q = 2.78 x i x A

Where 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr as estimated using the relevant maps presented in the Flood Studies Report.

Q_{1ex} = 2.78 x 33 x 0.047 = <u>4.31 l/s</u>
Q_{30ex} = 2.78 x 83 x 0.047 = <u>10.84 l/s</u>
Q_{100ex} = 2.78 x 106 x 0.047 = <u>13.85 l/s</u>

Proposed Run-off (Unmitigated without SuDS Measures)

According to Planning Practice Guidance (PPG), *"generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable: 1. Into the ground (infiltration) 2. To a surface water body; 3. To a surface water sewer, highway drain or another drainage system; 4. To a combined sewer",* whilst ensuring that surface water run-off is managed as close to its source as possible.

The proposed development does not introduce any additional hardstanding areas compared with the existing case, and will therefore not generate any additional surface water run-off. An allowance for a future increase in rainfall intensity is provided below:

$Q_{100+40cc}$ = 2.78 x 148 x 0.47 = <u>19.39 l/s</u>

The following chapters aims to outline the possibility of incorporating SuDS features in the design. Figure 4 outlines the possibility of incorporating SuDS into the scheme to reduce the surface water run-off and volumes further.

SuDS Assessment

To minimise the impact of urbanisation on watercourse flows and safeguard water quality, it is highly recommended to introduce Sustainable Drainage Systems (SuDS) that closely mimic natural drainage pathways from the source. This approach aligns with various guidelines and standards, including the Environmental Agency's recommendations, DEFRA's Non-Statutory Technical Standards for Sustainable Drainage Systems (NSTS), Building Regulations, and advice from Water Authorities.

To effectively manage surface water run-off, it is crucial to implement SuDS as close to its source as possible, as per the guidance provided. By adopting this approach, the proposed SuDS will work towards achieving the desired rates for reducing surface water run-off whenever feasible and practical. This initiative is in line with national and local policies which reinforce the importance of sustainable drainage practices.

The NSTS states stormwater flows off site should achieve the greenfield runoff rate as best practicably possible, or are at least a 50% betterment of the existing flow rates for all periods.

CIRIA SuDS Manual (C753) states that a development should utilise SuDS unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

I. Use infiltration techniques, such as porous surfaces in non-clay areas,
II. attenuate rainwater in ponds or open water features for gradual release,
III. attenuate rainwater by storing in tanks or sealed water features for gradual release,
IV. discharge rainwater direct to a watercourse,
V. discharge rainwater to a surface water sewer / drain,
VI. discharge rainwater to the combined sewer.

In assessing the feasibility of implementing SuDS at the site, a hierarchical approach was employed, considering preferred surface water management methods. The following paragraphs will discuss these methods in order of priority, evaluating the suitability of each approach for the site. To determine the suitability of different SuDS elements for this particular development, Figure 4 presents the SuDS site suitability table.

By employing this systematic approach, the potential of various SuDS techniques can be evaluated and the most suitable options for the site can be determined. The SuDS site suitability table guides the decision-making process, ensuring that the chosen SuDS elements align with the specific characteristics and requirements of the development.

SuDS Component	Site Suitability	Comments
Green Roofs & Rainwater Reuse	✗/✓	No Green Roofs have been incorporated into the scheme as no flat roofs to support them are proposed. However, Watering Butts will be introduced to reduce both the surface water run-off for smaller storm events and reduce water demand.
Soakaways	✓	A Cellular Soakaway will be incorporated in the scheme. These should be constructed more than 5m from any structure and 2.5m away from the boundary edge.
Filter Strips	✗	Other SuDS features are preferred in this instance.
Infiltration Trenches	✗	Other SuDS features are preferred in this instance.
Swales	✗	Not suitable due to site layout and size of the development.
Bioretention	✗	Not suitable due to site layout and size of the development.
Porous Pavements	✓	Permeable Paving will be introduced to the proposed hard landscaped areas. Although it is expected the surface water to infiltrate into the ground, an overflow should be incorporated due to the proximity of the permeable paving to the structure of the building.
Geocellular Systems	✗	Other SuDS features are preferred in this instance.
Infiltration basins	✗	Not suitable due to site layout and size of the development.
Detention basins	✗	Not suitable due to site layout and size of the development.
Ponds	✗	Not suitable due to site layout and size of the development.
Stormwater wetlands	✗	Not suitable due to site layout and size of the development.

FIGURE 4. SUDS SITE SUITABILITY

Living Roofs & Rainwater Re-use

Green Roofs have not been incorporated as part of the proposed scheme. The SuDS Manual C753 states *"Green roofs can provide benefits in terms of reducing peak flow rates to the site drainage system – principally for small and medium-sized events.".* However, the SuDS Manual also goes further to say that they behave like traditional roofs during storm events or return periods greater than this, limiting their effectiveness for these types of occurrences.

Infiltration

The preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration system. The BGS maps confirm that infiltration in the area may be feasible due to the presence of Summerton-Radley Sand and Gravel Member - Sand and Gravel (Figure 5). Furthermore, the surrounding borehole logs appear to support this map indicating Sand and Gravels to depths of 2.50m+.

At this time, it is impractical to carry out infiltration testing now in its current form, and would be more practical to proceed with the necessary tests at build stage once excavations and building work has commenced.

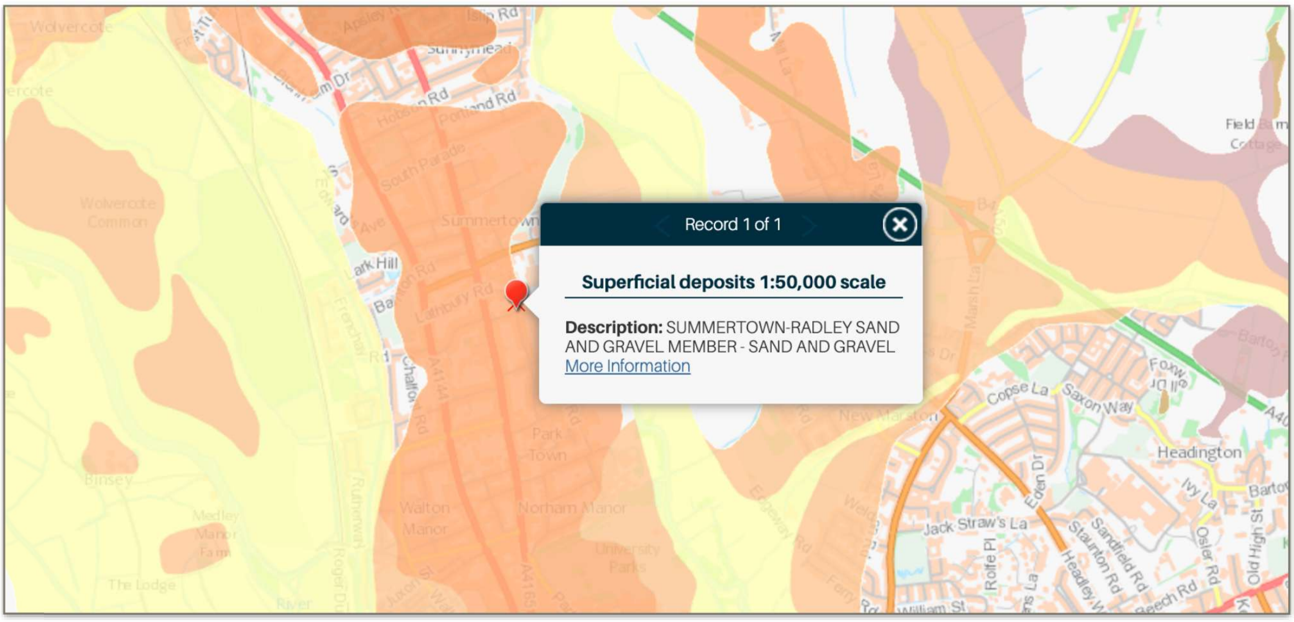

FIGURE 5. BGS GEOLOGICAL MAPS

For the purposes of this report, the soil texture classification system has been used to assign an approximate infiltration rate to the underlying ground. As a conservative approach, the lower infiltration figure has been used to design the infiltration based systems.

The soil texture classification system shown in the CIRIA SuDS Manual (C753) is not the same as the standard used in site investigation reports, though it does include a note of the equivalents, see below.

Soil Texture	ISO 14688-1	Lower (m/s)	Upper (m/s)
Gravel	Sandy GRAVEL	$3x10^{-4}$	$3x10^{-2}$
Sand	Slightly silty slightly clayey SAND	$1x10^{-5}$	$5x10^{-5}$
Loamy Sand	Silty slightly clayey SAND	$1x10^{-4}$	$3x10^{-5}$
Sandy Loam	Silty clayey SAND	$1x10^{-7}$	$1x10^{-5}$
Loam	Very silty clayey SAND	$1x10^{-7}$	$5x10^{-6}$
Silt Loam	Very sandy clayey SILT	$1x10^{-7}$	$1x10^{-5}$
Sandy Clay Loam	Very clayey silty SAND	$3x10^{-10}$	$3x10^{-7}$
Silty Clay Loam	-	$1x10^{-8}$	$1x10^{-6}$
Clay	-	0	$3x10^{-8}$
Till	-	$3x10^{-9}$	$3x10^{-5}$

The lower infiltration rate ($1.0x10^{-5}$ m/s) was used to design the preliminary cellular soakaway, and a more conservative infiltration rate, $1.0x10^{-7}$ m/s, was considered as part of the design of the permeable paving thicknesses - refer to Figure 6 for the design considerations from Interpave's Guidance.

Therefore, the design will incorporate shallow 2D infiltration systems, such as permeable pavements to drain all hardstanding areas, an overflow to the surface water drainage can be used to ensure the site has a failsafe option for draining this layer (Type B Permeable Paving System). Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. It is proposed to utilise permeable paving for the external hardstanding areas, infiltrating to ground and reducing the run-off by approximately **200m^2**.

Cellular Soakaway

A preliminary assessment based on geological maps suggests that Infiltration is likely to allow surface water run-off from the hardstanding areas to penetrate into the ground. To ensure a cautious approach, a more conservative infiltration rate of $1.0x10^{-5}$ m/s was adopted and considered in the design process.

Considering the ability of infiltration to drain the surface water run-off from the new roof, a Cellular Soakaway has been proposed. A storage requirement of 19m^3 is required to accommodate the 1 in 100 year return period and a 40% allowance for climate change. Detailed calculations supporting these design choices can be found in Appendix A of the report.

Permeable Pavements

Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. An overflow will also be incorporated as a failsafe due to the inherent variability of the infiltration properties of the underlaying ground, which will be connected to the surface water drainage. Infiltration through Permeable Pavements (2D plane only) can also be utilised closer to structures. Permeable Pavements serving themselves behave in a similar way to soft landscaping and can be placed directly against the edge of structures. Should it be proposed to discharge additional surface water run-off from the building, a minimum 2m easement should apply.

Capacity of the Permeable Pavement

The surface water run-off from the permeable paving will self-attenuate and infiltrate into the ground. A conservative infiltration rate of $1x10^{-7}$ m/s was used to define the paving thicknesses.

Infiltration rate = 1×10^{-7}m/s

		1 in 10	1 in 30	1 in 100	1 in 100 + 20%	1 in 100 + 30%
M5-60	**r**	**10**	**3.33**	**1**	**0.5**	**0.25**
20	0.4	90	120	160	210	225
	0.3	100	140	190	240	270
	0.2	135	180	250	310	370
17	0.4	70	100	140	180	190
	0.3	80	110	160	210	225
	0.2	105	150	210	270	305
14	0.4					
	0.3	60	90	130	170	180
	0.2	75	110	160	220	245

FIGURE 6. PERMEABLE PAVEMENT AND ASSOCIATED PAVING THICKNESSES REQUIRED (INTERPAVE, 2018)

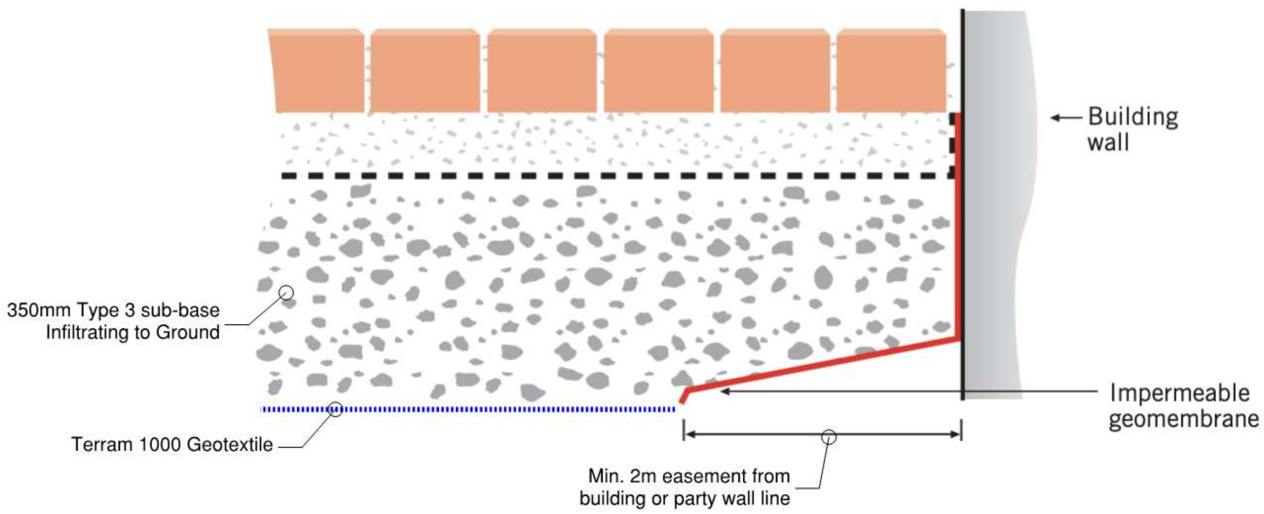

FIGURE 7. PERMEABLE PAVEMENT USED FOR THE HARDSTANDING AREA

Attenuation

The inclusion of Permeable Paving and Soakaways in this instance would be considered more appropriate and preferred compared to alternatives.

SuDS Run-off Summary

Return Period	Greenfield (l/s) (interpolated - minimum site area calculation = 0.1ha)	Existing (l/s)	Proposed (l/s) (without SuDS Measures)	Proposed (l/s) (with SuDS Measures)
1 in 1 Year	0.17	4.31	4.31	0.00
1 in 30 Year	0.46	10.84	10.84	0.00
1 in 100 Year	0.64	13.85	13.85	0.00
1 in 100 Year + 40%cc	-	-	19.39	0.00

In conclusion, the incorporation of Permeable Paving (‘2d’ Infiltration) and a Cellular Soakaway (‘3d’ Infiltration) will reduce the development’s surface water run-off rates compared with the existing development. These SuDS systems provide an overall reduction in surface water run-off rates for all storm events up to the 1 in 100 year plus climate change compared to the unmitigated scenario by 100%. Furthermore, a form of Rainwater Harvesting (Watering Butts) will be utilised primarily to reduce water demand.

Surface Water Maintenance Strategy

The drainage design will be designed to be fully maintainable in accordance with building regulations and the recommendations of CIRIA C753 – SuDS Manual, outlined below. The applicant or their appointed management team will be responsible for the management and maintenance of the respective SuDS systems in perpetuity.

Cellular Storage Tank / Soakaway

Maintenance Schedule	Required Action	Typical Frequency
Monitoring / Inspections	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are working as they should	Annually or after severe storms
Regular Maintenance	Inspect and identify any elements that are not operating correctly.	Monthly for three months, then Half yearly or as required.
	Remove sediments / debris from catch pits / gullies and control structures	Annually, after severe storms or as required
Remedial Actions	Repair inlets, outlets, vents, overflows and control structures.	As required

Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Monitoring/Inspections	Initial Inspection.	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required take remedial action.	Annually (and after severe storms)
Regular Maintenance	Rubbish and litter removal	As required
	Brushing and vacuuming - standard cosmetic sweep across surface	Once a year after Autumn leaf fall
Remedial Actions	Remedial work to any depressions or rutting considered detrimental to the structural performance.	As required
	Rehabilitation of surface with remedial sweeping	Every 10-15 years or as required.

The involvement of the principal contractor is essential for the safe and sustainable construction of SuDS components. It's important to note that the Construction (Design and Management) Regulations (CDM Regulations) impose specific health and safety duties on individuals involved in commissioning, planning, and executing construction works. If you're uncertain about the implications of these regulations, seek guidance from professionals such as architects, builders, or other competent experts who can provide appropriate advice. While Flume doesn't offer health and safety advisory services, we are obligated to inform you about your general responsibilities under the CDM Regulations.

Conclusions

- The site resides in Flood Zone 1 where there is less than 1 in 1000 annual probability of river or sea flooding (<0.1%). Developments in this flood zone have no restrictions other than ensuring surface water drainage proposals do not increase the flood risk on site and the surrounding areas.

- There will be no increase in the impermeable area of the site and the resulting discharge rates and volumes of surface water run-off from the development. However, Infiltration will be prioritised on site where feasible, with the use of permeable paving serving the external hardstanding areas infiltrating to ground.

- The incorporation of a 19m^3 Cellular Soakaway, along with Permeable Paving to drain all hardstanding areas will reduce the proposed surface water run-off from the development, providing an overall reduction in run-off rates for all storm events up to the 1 in 100 year plus allowance for climate change compared to the existing development by up to 100%.

- Permeable Pavements and Soakaways are also placed highly in the SuDS Hierarchy, and will ensure that water quality, water quantity, amenity and biodiversity are all promoted in the SuDS design.

- A SuDS Maintenance Plan will also be in place to ensure efficient operation and prevent failure of the system.

Note:

	Prepared By	Checked By	Approved for issue
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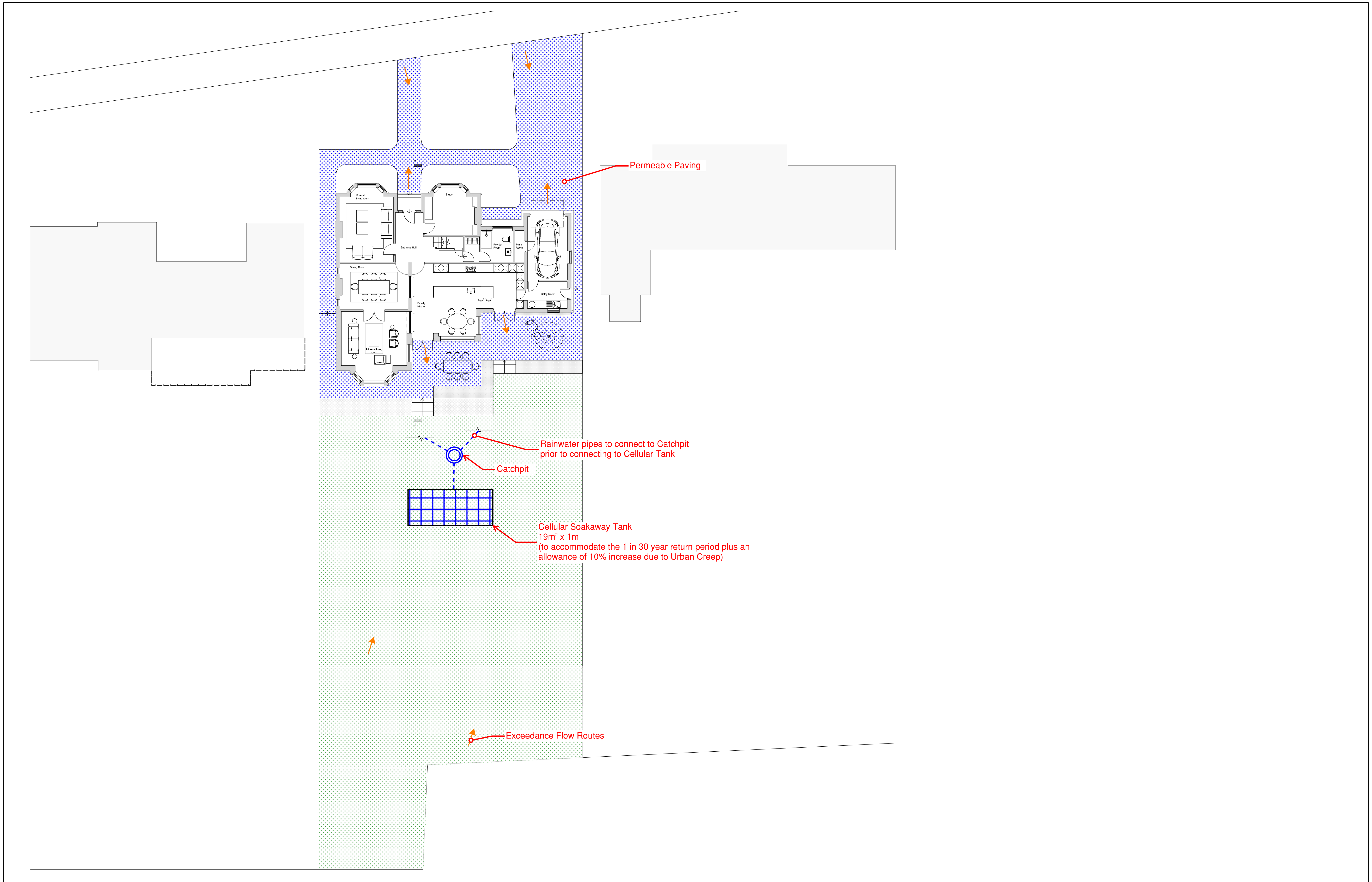
Signature	TQ	MST	TQ
Date	16 October 2023	17 October 2023	17 October 2023

Appendix A - SuDS Strategy and Hydraulic Calculations

Job No.	1386	Page	SK 001	Rev	1
Date	16/10/2023	Eng	TQ	Chd	
Job	11 Belbroughton Road - SuDS Strategy				



Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Tom Quigg
Site name:	Belbroughton Road
Site location:	Oxford

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:	51.77254° N
Longitude:	1.26014° W
Reference:	2787064081
Date:	

Runoff estimation approach: IH124

Site characteristics

Total site area (ha): 0.1

Methodology

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

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	630	630
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):	0.43	0.43
1 in 1 year (l/s):	0.36	0.36
1 in 30 years (l/s):	0.98	0.98
1 in 100 year (l/s):	1.36	1.36
1 in 200 years (l/s):	1.6	1.6

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Soakaway	0.027	5.00	2.000	450	2.000
Outfall	0.000		2.000	450	2.000

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)
1.000	Soakaway	Outfall	3.000	0.600	0.000	0.000	0.000	0.0	100	5.05	54.5

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	1.000	7.9	4.0	1.900	1.900	0.027	0.0	0	∞

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	3.000	0.0	100	Circular	2.000	0.000	1.900	2.000	0.000	1.900

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Soakaway	450	Manhole	Adoptable	Outfall	450	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Soakaway	2.000	2.000	450	0	1.000	0.000	100
Outfall	2.000	2.000	450	1	1.000	0.000	100

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	1440
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	0.0
M5-60 (mm)	20.000	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.400	Skip Steady State	x	Check Discharge Volume	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 %)
10	0	10	0	30	0	30	0

Node Soakaway Online Depth/Flow Control

Flap Valve	x	Invert Level (m)	0.000	Design Flow (l/s)	0.2
Replaces Downstream Link	✓	Design Depth (m)	1.000		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.000	1.000	0.000

Node Soakaway Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00360	Safety Factor	5.0	Invert Level (m)	0.000
Side Inf Coefficient (m/hr)	0.00360	Porosity	0.95	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	19.0	19.0	1.000	19.0	19.0	1.001	0.0	19.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
10 year +10% A 15 minute summer	211.819	59.937	10 year +10% A 600 minute summer	15.690	4.291	30 year +30% A 180 minute summer	53.298	13.715
10 year +10% A 15 minute winter	148.645	59.937	10 year +10% A 600 minute winter	10.720	4.291	30 year +30% A 180 minute winter	34.645	13.715
10 year +10% A 30 minute summer	136.831	38.718	10 year +10% A 720 minute summer	13.925	3.732	30 year +30% A 240 minute summer	41.604	10.995
10 year +10% A 30 minute winter	96.022	38.718	10 year +10% A 720 minute winter	9.358	3.732	30 year +30% A 240 minute winter	27.641	10.995
10 year +10% A 60 minute summer	90.826	24.003	10 year +10% A 960 minute summer	11.365	2.993	30 year +30% A 360 minute summer	31.221	8.034
10 year +10% A 60 minute winter	60.342	24.003	10 year +10% A 960 minute winter	7.528	2.993	30 year +30% A 360 minute winter	20.295	8.034
10 year +10% A 120 minute summer	54.899	14.508	10 year +10% A 1440 minute summer	8.174	2.191	30 year +30% A 480 minute summer	24.324	6.428
10 year +10% A 120 minute winter	36.474	14.508	10 year +10% A 1440 minute winter	5.493	2.191	30 year +30% A 480 minute winter	16.160	6.428
10 year +10% A 180 minute summer	41.666	10.722	30 year +30% A 15 minute summer	268.706	76.035	30 year +30% A 600 minute summer	19.756	5.404
10 year +10% A 180 minute winter	27.084	10.722	30 year +30% A 15 minute winter	188.566	76.035	30 year +30% A 600 minute winter	13.498	5.404
10 year +10% A 240 minute summer	32.645	8.627	30 year +30% A 30 minute summer	174.929	49.499	30 year +30% A 720 minute summer	17.490	4.687
10 year +10% A 240 minute winter	21.689	8.627	30 year +30% A 30 minute winter	122.757	49.499	30 year +30% A 720 minute winter	11.754	4.687
10 year +10% A 360 minute summer	24.632	6.339	30 year +30% A 60 minute summer	116.589	30.811	30 year +30% A 960 minute summer	14.215	3.743
10 year +10% A 360 minute winter	16.012	6.339	30 year +30% A 60 minute winter	77.459	30.811	30 year +30% A 960 minute winter	9.416	3.743
10 year +10% A 480 minute summer	19.260	5.090	30 year +30% A 120 minute summer	70.438	18.615	30 year +30% A 1440 minute summer	10.161	2.723
10 year +10% A 480 minute winter	12.796	5.090	30 year +30% A 120 minute winter	46.797	18.615	30 year +30% A 1440 minute winter	6.829	2.723

Results for 10 year +10% A Critical Storm Duration. Lowest mass balance: 97.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Soakaway	1410	0.754	0.754	0.4	13.7379	0.0000	SURCHARGED
15 minute summer	Outfall	1	0.000	0.000	0.0	0.0000	0.0000	OK

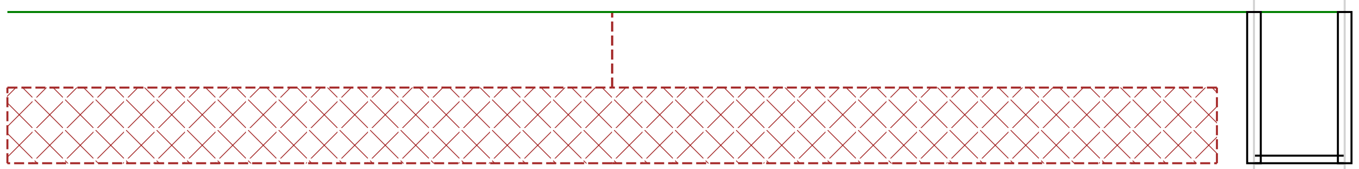
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Soakaway	Depth/Flow	Outfall	0.0	0.0
1440 minute winter	Soakaway	Infiltration		0.0	

Results for 30 year +30% A Critical Storm Duration. Lowest mass balance: 97.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Soakaway	1440	1.906	1.906	0.6	18.3621	0.0000	SURCHARGED
15 minute summer	Outfall	1	0.000	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Soakaway	Depth/Flow	Outfall	0.0	0.0
1440 minute winter	Soakaway	Infiltration		0.0	

Node Name	Soakaway	Outfall



A3 drawing

Hor Scale 250
Ver Scale 100

Datum (m) -9.000

Link Name	1.000	
Section Type	100mm	
Slope (1:X)	0.0	
Cover Level (m)	2.000	2.000
Invert Level (m)	0.000	0.000
Length (m)	3.000	