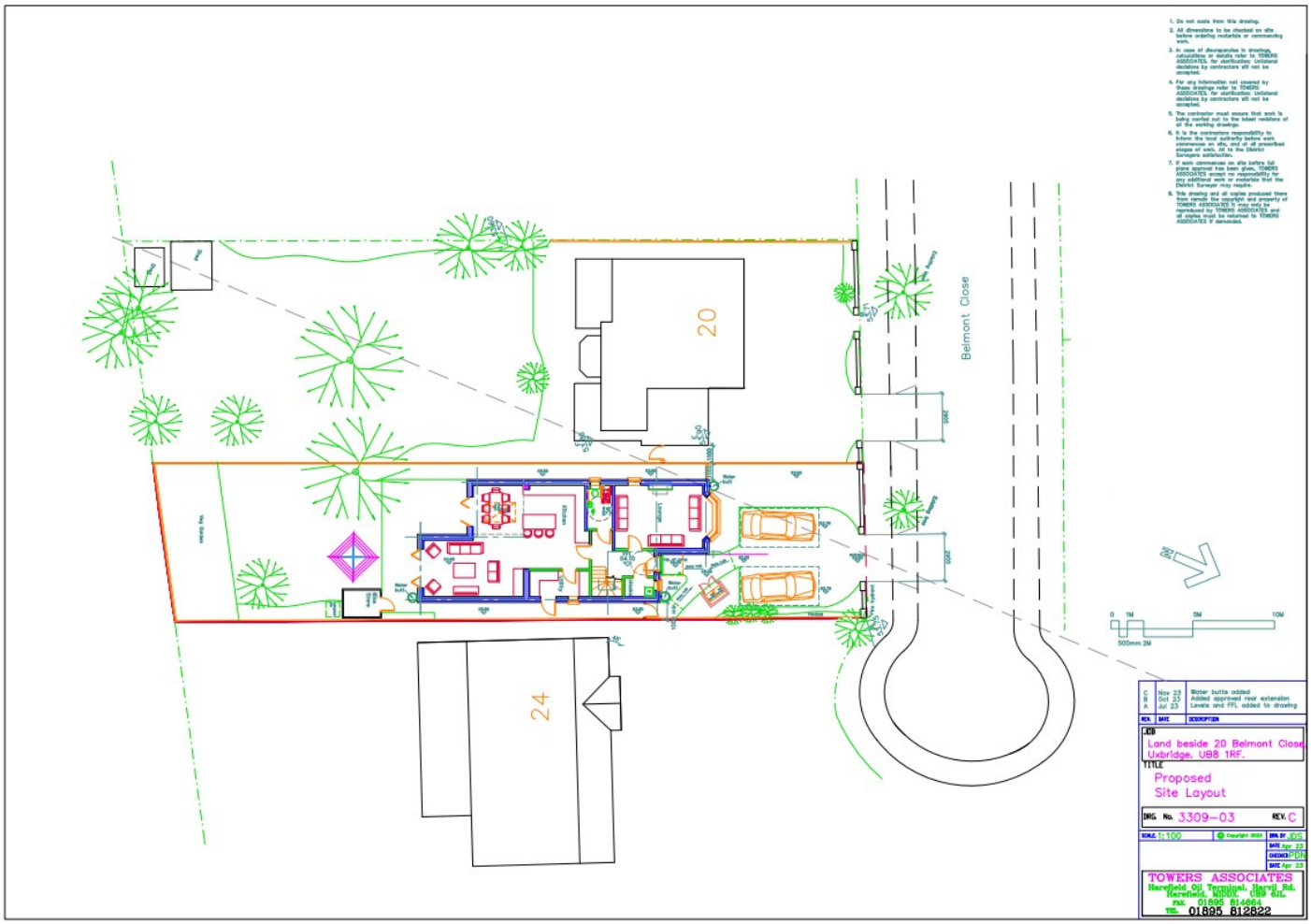


Surface Water Management Plan for a Residential Development at land adjacent to 20 Belmont Close, Uxbridge North, Hillingdon, Uxbridge, UB8 1RF Rev. 2

Contract Ref: FD140

Tower Associates

Contents

Quality Assurance Record

Contributors for Townsend Water Engineering Limited:

Name	Role
Charles Townsend	Director
Alice Osborne	Assistant Flood Risk Analyst

Document Status and Revision History:

Version	Date	Author	Reviewer	Authoriser	Status / Comment
1	11/08/2023	A. Osborne	C. Townsend	C. Townsend	1st Issue
2	15/08/2023	A. Osborne	C. Townsend	C. Townsend	1st Issue

Limitation of Liability and Use

The work described in this report was undertaken for the party or parties stated; for the purpose or purposes stated; to the time and budget constraints stated. No liability is accepted for use by other parties or for other purposes, or unreasonably beyond the terms and parameters of its commission and its delivery to normal professional standards.

1. INTRODUCTION

1.1 Purpose of this Report

Townsend Water Engineering Ltd. has been appointed by Tara Weaver at *Tower Associates* for a Surface Water Mangement Plan (SWMP) for the discharge of condition 4 of the planning permission for the erection of a 4 bedroom house with parking, cycle storage, associated landscaping and access from land adjacent to 20 Belmont Close, Uxbridge North, Hillingdon, Uxbridge, UB8 1RF. Please see below the condition (condition 4):

4 Prior to commencement of the hereby approved development, (excluding demolition and site clearance) a scheme for the provision of sustainable water management shall be submitted to, and approved in writing by the Local Planning Authority. The scheme shall clearly demonstrate how the approved development will incorporate sustainable urban drainage (SuDs) in accordance with the hierarchy set out in Policy 5.13 of the London Plan and will:
i. provide information on all SuDs features including the method employed to delay and control the surface water discharged from the site and:
ii. provide a management and maintenance plan for the lifetime of the development of arrangements to secure the operation of the scheme throughout its lifetime. Including appropriate details of Inspection regimes, appropriate performance specification.
The scheme shall also demonstrate the use of methods to minimise the use of potable water through water collection, reuse and recycling and will:
iii. provide details of water collection facilities to capture excess rainwater; and how water usage will be reduced in the development.
Thereafter the development shall be implemented and retained/maintained in accordance with these details for as long as the development remains in existence.

Figure 1: Condition 4

This report has been prepared in support of the planning permission for the aforementioned development.

The report is based on the available drainage information for the site detailed in Section 1.2 and prepared in accordance with the planning policy requirements set out in Section 1.3. The scope of the Surface water management plan is consistent with the 'Site Specific Flood Risk Assessment Checklist' from the *National Planning Policy Framework* (*NPPF*) and accompanying Planning Practice Guidance (PPG):

https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section

1.2 Sources of Information and Consultation

This Report has been informed by:

- Existing Site Plan drawings and respective topographic plan delivered by *Towers Associates*;
- *BGS* website http://mapapps.bgs.ac.uk/geologyofbritain/home.html;
- *Cranfield University* Soil Mapping http://www.landis.org.uk/soilscapes/;
- Infiltration tests undertaken by *Towers Associates*
- *Environment Agency* flood maps;
- https://flood-map-for-planning.service.gov.uk/; and
- https://flood-warning-information.service.gov.uk/long-term-flood-risk/.

1.3 Policy Context

This report has been prepared in accordance with the relevant national, regional and local planning policy and statutory guidance as follows:

- National policy contained within the *National Planning Policy Framework (NPPF*) dated July 2021, issued by Communities and Local Government with reference to Section 14 'Meeting the challenge of climate change, flooding and coastal change';
- The *NPPF* Planning Practice Guidance (PPG) released in March 2014 ('Flood Risk and Coastal Change' section) and updated in February 2016 to incorporate the *EA* 'Flood Risk Assessments: Climate Change Allowances' guidance'

1.4 Structure of this Report

The Report has been prepared based on the following structure:

- Section 2 refers to spatial planning considerations by reference to the proposed land use, flood zoning and *NPPF* vulnerability;
- Section 3 presents the assessment of surface water management plans at the site;
- Section 4 presents the drainage strategy;
- Section 5 provides a summary of the assessments.

Additional Appendices are provided that deal with the following:

- Appendix A: Infiltration Tests;
- Appendix B: Proposed Layout; and
- Appendix C: Calculations for the drainage.

2. SPATIAL PLANNING CONSIDERATION

2.1 Location and Background

The location of the proposed development site is shown in Figure 1 and Figure 2, with location details found in Table 1. The site is located at land adjacent to 20 Belmont Close, Uxbridge North, Hillingdon, Uxbridge, UB8 1RF (Grid Ref: 505997, 184673). (Table 1: Site Details)

The development involves the erection of a 4 bed house with associated landscaping, car parking, cycle store and access from land adjacent to 20 Belmont Close, Uxbridge North, Hillingdon, Uxbridge, UB8 1RF. The entire development site is approximately 0.09ha. The existing site is a house in the West portion of the plot (that will remain) and garden.

The site is surrounded by residential housing. To the North of the site is *Belmont Close* (cul-de-sac), to the East is the B483, to the South is *Belmont Road* and to the West of the site is *Belmont Close* (cul-de-sac). Please see Figure 2 & Figure 3, indicating these features.

Table 1: Site Details

Reference	Value
OS X (Eastings)	505997
OS Y (Northings)	184673
Nearest Post Code	UB8 1RF
Grid Reference	TQ059846

Grid reference details taken from the site Grid Reference Finder

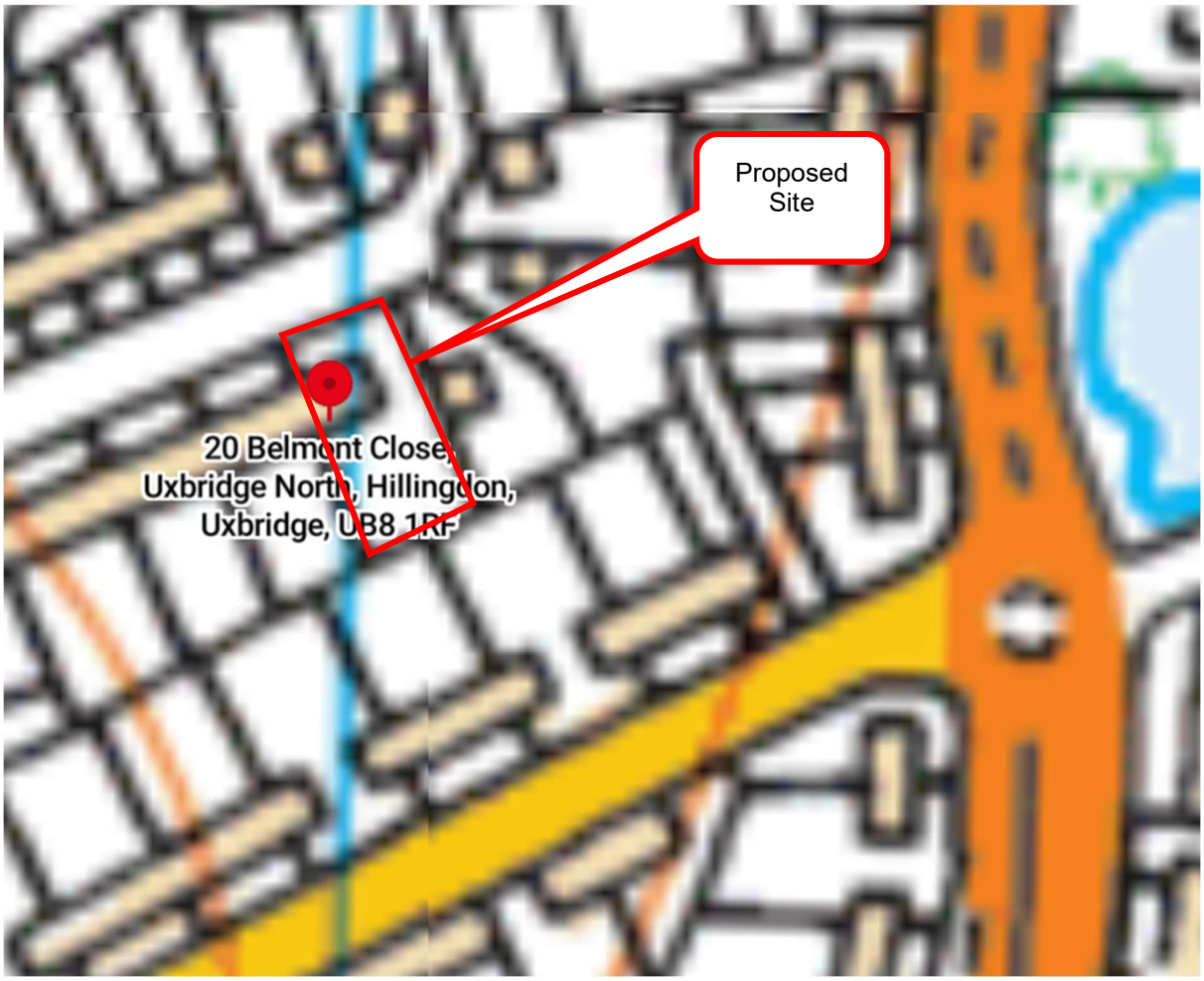


Figure 2: Site Location (Source : Bing Maps)

Figure 3: Aerial View of the site (Source: Grid Reference Finder)

2.2 Topography

The client reports that the site is predominantly flat.

2.3 Geology and Soil

The geology at the site has been obtained from the *British Geological Survey (BGS*) website. The bedrock geology is '*London Clay Formation - Clay, silt and sand. Sedimentary bedrock'*. The superficial deposits are '*Black Park Gravel Member - Sand and gravel'*. Please see Figure 4 below.

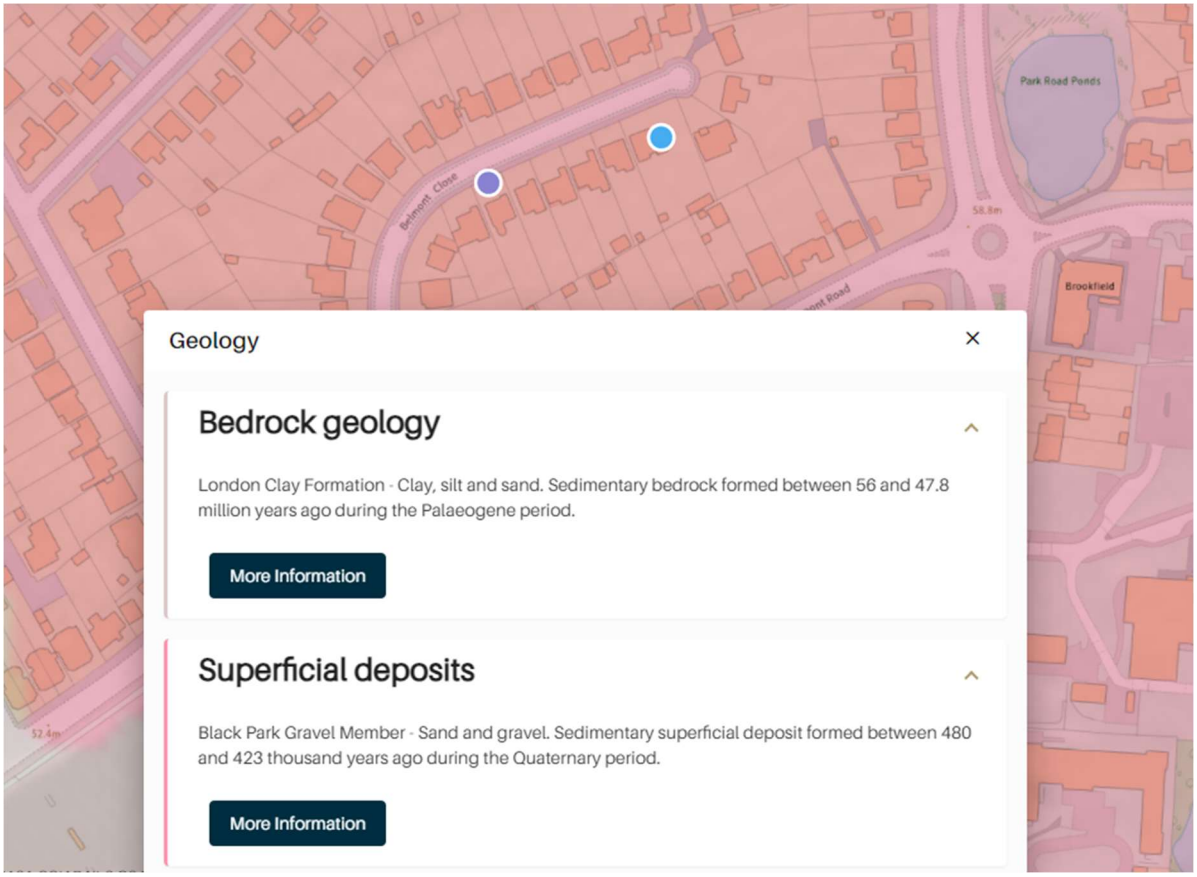


Figure 4:Bedrock Underneath the Site (Source: BGS Bedrock Geology Mapping)

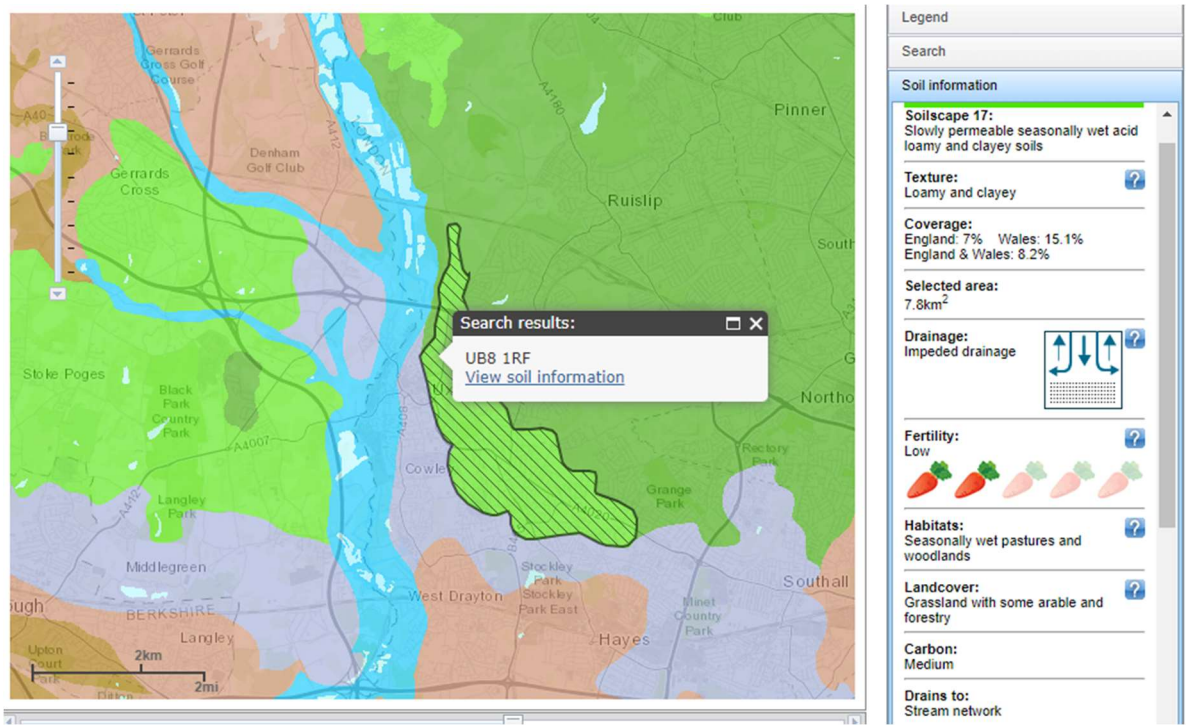


Figure 5: Soilscapes Soil Map of the Site (Source: Cranfield University Soil Mapping)

Soils at the site are described on the *Cranfield University* '*Soilscapes'* website as '*slowly permeable, seasonally wet, acid, loamy and clayey soils.* Please see Figure 5 above.

On the 3rd, 4th and 5th of August 2023, Peter Norman of *Tower Associates* undertook infiltration testing at the site. Please see Figure 6 below for the results, which can also be found in Appendix A.

The soakaway test results indicate that the site is suitable for infiltration. We have used the most conservative infiltration rate, which is 9.78×10^{-06} m/s for designing the soakaways.

Ref:3309 Between 20 and 24 Belmont Close (22 Belmont Close)

Soakaway infiltration test
Hole in proposed rear garden in virgin ground
Ground condition. Top 300mm topsoil, next 300 stoney sand soil. Bottom 600mm clean balast.

Hole excavated the day 1st August 2023. test on 2nd August posponed due to prolonged heavy rain.
Test 1. There was some small amount of cave in botton of hole has approx 20mm topsoil coverage and about 20mm residual water
Test 1 Completed on 3/August/2023 Weather condition ground wet from day before cloudy, no rain, medium wind 13 degree c
Test 2 Completed on 4/August/2023 Weather condition ground wet from day before part cloudy, no rain, medium wind 13 degree c
Test 3 Completed on 5/August/2023 Weather condition ground wet from day before cloudy,showers light rain, very windy 14 degree c

Weather condition 11. Light rain most of day
200 mm top soil and hole filled with water 25mm below top soil
Total hole average size
1.2m deep 1 m 1.05 m 1.05 M2

filled with 1000 ltrs of cold water or 1m3 Total water available from 4 Bins.
Note: filling took 2 minutes, when filled the total water depth 960mm

The proposed invert level of inlet will be 400mm below surface.

test 1		MM	min	drop mm/min
water level fell by	115mm in 60 min	115	60	1.92
test 2				
water level fell by	110mm in 60 min	110	60	1.83
test 3				
water level fell by	102mm in 60min	102	60	1.70

Volume	depth	
1000ltrs	960	
75%	720	
25%	240	
difference	480	mm

Volume out flowing between 75% and 25% = 500Ltrs 0.5 m3

Therefore to drop 50% time taken was

test 1	250.43 Min	60 min in 1 hour
test 2	261.82 Min	
test 3	282.35 Min	

surface area of pit tested

base	1.05	1	1.05 m2	
sides	4.1	0.96 div 50%	1.968 m2	(average depth)
total exposed sides				

The mean surface are through which the flow occurs 3.02 m2

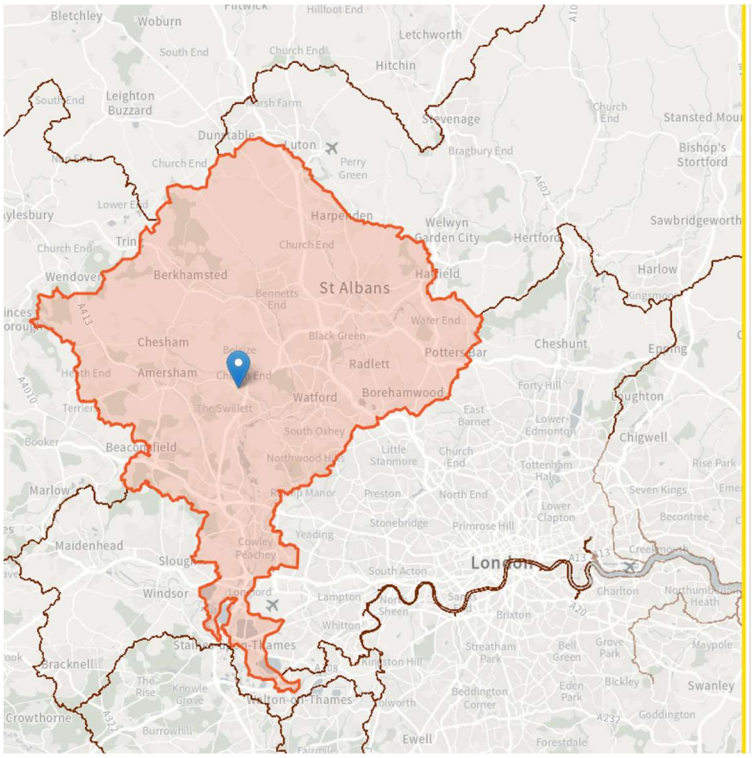
Flow rate

test 1	**1.10E-05**
test 2	**1.05E-05**
test 3	**9.78E-06**

Figure 6: Soakaway Test Results

2.4 Climate Change Allowances for Peak Rainfall Intensity

The *Environment Agency* and *NPPF* require a consideration of the impacts of climate change in Flood Risk Assessments (FRA). In May 2022, the *Environment Agency* updated the climate change allowances required in Flood Risk Assessments (Environment Agency, 2022); this advice updates previous climate change allowances to support the *NPPF* (DCLG, 2021). Table 4: Peak rainfall intensity allowance shows anticipated changes in small catchments, recommending a progressive increase, reaching 40% for the 'Upper End' allowance by 2070. This allowance would be recommended for this proposed development, which is classified as 'More Vulnerable' and has been taken to have a 100-year design life. The 40% climate change allowance is based on the 90th percentile, meaning that there is a 90% chance that rainfall will not increase by more than the 40% increment.



Colne Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	35%

1% annual exceedance rainfall event

Epoch

	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Figure 7: Peak Climate Change Rainfall Allowances

3. ASSESSMENT OF SURFACE WATER MANGEMENT PLAN FOR PROPOSED DEVELOPMENT

3.1 Development Proposals

The proposed development is for the erection of a 4 bedroom house with car parking and cycle storage (Figure 8). Please see Appendix B for the proposed layout and the impermeable area drawings.

The development area is 0.09ha. The existing impermeable area of the area to be used for the new development is approximately 0.005ha (please see Figure 8 below). The proposed development will have approximately 0.017ha of impermeable area.

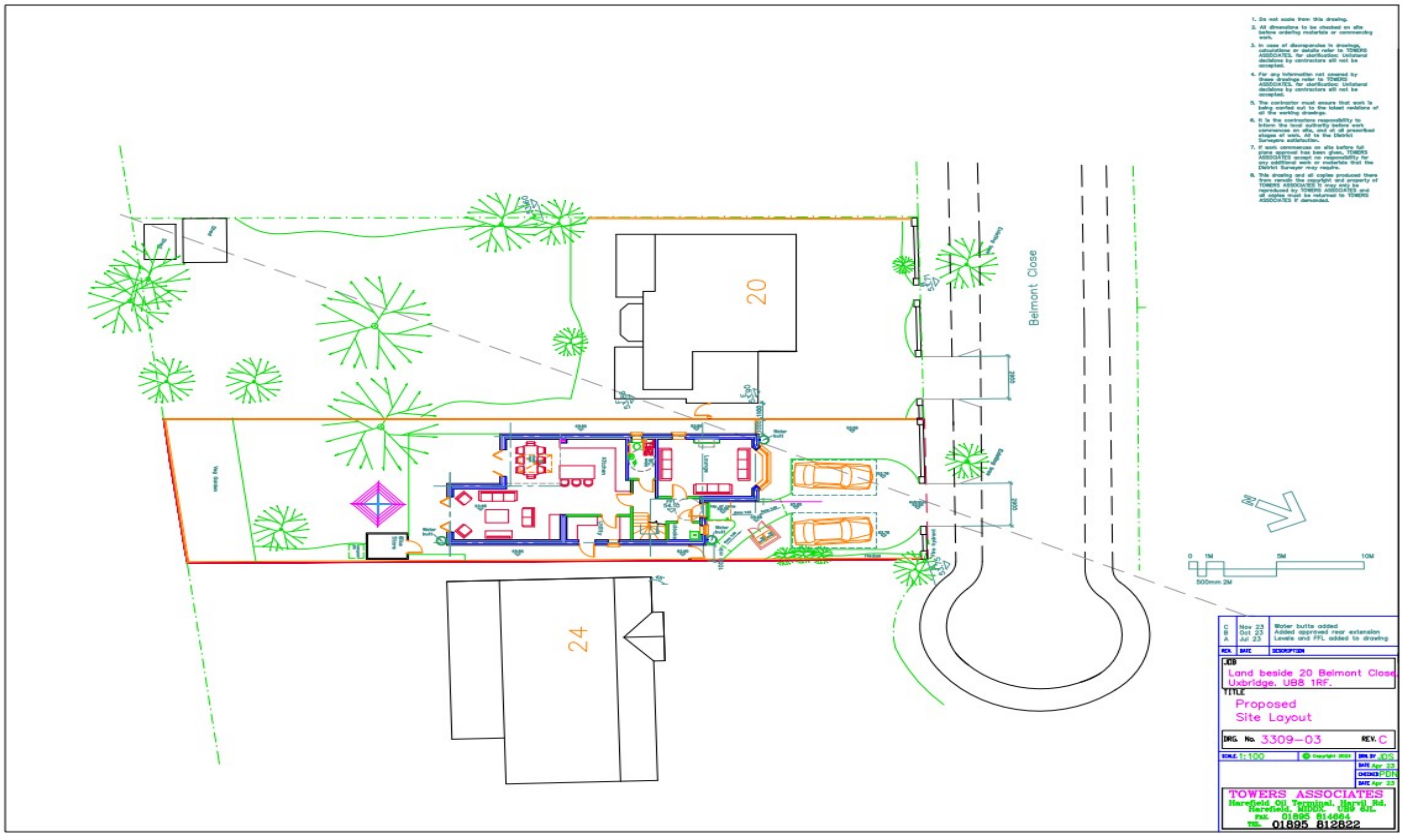


Figure 8: Proposed Site and Impermeable Areas. (Source: Client)

4. DRAINAGE STRATEGY

4.1 Existing Drainage Arrangements

4.1.1 Surface Water

The existing site is a garden. The existing site is a house and garden; a mix of permeable and impermeable. The existing impermeable area is approximately 0.005ha. The existing site drains to the sewer on *Belmont Close*. The proposed site will drain to soakaways and therefore, not be draining to the public sewer, thus decreasing flood risk to the sewers in *Belmont Close*.

4.2 Infiltration Rates

It is considered that infiltration is feasible at the site, per the soakaway test results (Appendix A). Therefore the proposed site will discharge surface water to soakaways. The site infiltration rate will be $9.78E^{-06}$ m/s.

4.3 Surface Water Drainage Strategy

4.3.1 Hierarchy of Discharge

The hierarchy of discharge is that surface water should be drained to soakaways first and if that is not feasible then watercourses, if this is not feasible then public surface water sewer or highway drains. Then finally combined sewers if all else fails.

As detailed in section 2.3, infiltration is feasible at this site. Therefore, we will discharge the surface water from the site to two soakaways; soakaway 1 will be at the bottom of the back garden, by the vegetable patch, 5m away from the main building. Soakaway 2 will be in the North-West corner of the front driveway. Careful consideration will need to be taken when designing soakaway 2 as it is likely within 5m of the house, therefore, it is recommended that soakaway 2 is reinforced. This will be considered at detailed design.

As the proposed site is draining to soakaways the hierarchy of discharge has been followed.

4.3.2 Rain Water Garden SuDS Planter

'A rain garden planter utilises rain water that lands on the roof. Water from the drain pipe is directed into the planter. The soil absorbs and stores the rainwater for the plants to use, known as bioretention. Excess rainwater filters into the gravel layer and drains out the perforated base drainage pipe. Any water that pools on the surface, drains down the overflow upstand. They work in the same way as rain gardens just on a smaller scale'. [1]

Please see Figure 9 below for some examples of rainwater planters.

[1] Rain Garden Planter (eastofedenplants.co.uk)

Figure 9: Examples of SuDS Rain Garden Planters

Rainwater garden planters are an attractive and environmentally friendly solution to surface water disposal. Once surface water has drained through the planter, it would be connected to the public surface water sewer in *Belmont Close* to be drained off site.

'The SuDS Manual states that typically the surface area of a bioretention feature would be 2-4% of the overall site area being drained, to prevent rapid clogging of the bioretention surface. Based on this guidance, the surface area of any planter (or combination of planters) should not be less than 2-4% of the roof area it is draining. Where possible, the size of the planter should reflect this recommendation.'[2].

It is proposed to use these around soakaway 2 at the front of the house. These have not been used in the calculations but will improve the water quality from the development.

4.3.3 Water Butts

Water butts can perform as SuDS devices by providing temporary storage and reducing runoff volumes conveyed to sewer systems during a storm event. Water running off a roof in a storm event can be diverted into the water butt and used to water your garden at a later event. Recycling surface water in this manner can have a positive environmental impact, as well as reducing the impact on the sewer system. Water butts could not only be connected to the homes drainage system, but also to the proposed cycle storage unit's system and any potential sheds or greenhouses. Please see below for examples of water butts and water harvesting devices.

[2] Rain Garden Planter (eastofedenplants.co.uk)

Figure 10: Examples of Water Butts & Rainwater Harvesting Devices

4.3.4 Sizing of SUDS Features

As discussed in section 4.1 of this report, the proposed impermeable surface area of the dwelling and associated features is 0.017ha. As discussed in section 4.2, soakaways are feasible.

The proposed development will have two soakaways. The first soakaway will drain the driveways and parking spaces and drains an area of 0.004ha. The soakaway is circular and has a diameter of a 1.2m circular soakaway.

The second soakaway (named soakaway 1) has the dimensions of 4m wide by 4m long and 1.2m deep. It is draining an area of 0.013ha.

Modelling of the surface water runoff to the design parameters was carried out using *Infodrainage*, an industry leading software which allows design and analysis of SuDS features. The model results are displayed in Appendix D: concept drainage design. The following conservative assumptions and design parameters have been set within the Hydraulic model:

- Dwellings, walkways, parking spaces and access roads area equals a total of 0.017ha. Soakaway;
- Rainfall intensity was obtained using the Flood Studies Report methodology and increased by 40% for climate change over the 100 years design life of the proposed residential development;

- No runoff loss has been assumed in the modelling, therefore, all the design rainfall landing on the impermeable surfaces is expected to reach the soakaway; and
- As per the conclusions in Section 4.4.2, the soil has been modelled with an infiltration rate of $9.78E^{-06}$m/s.
- The half time for both soakaways is under 24hrs.

The calculations indicate the system will hold the 1 in 100 year event plus climate change (40%). Please see Appendix D for the calculations. Below is the summary of the results and the concept drainage design.

FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Summer

Stormwater Control	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Soakaway (1)	1.418	1.418	0.218	0.218	8.0	0.000	0.0	0.000	341	27	OK
Soakaway	0.677	0.677	0.677	0.677	2.7	0.000	0.0	0.000	526	44	OK

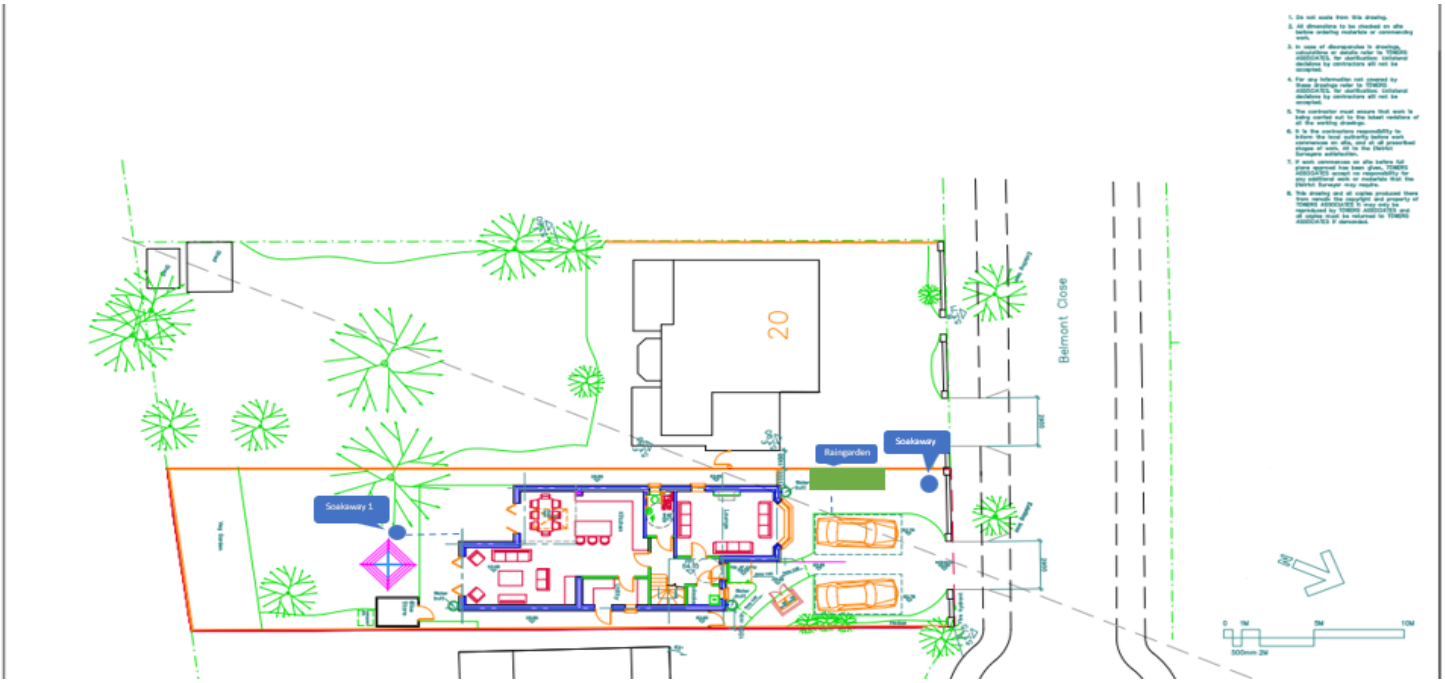


Figure 11: Drainage Design

4.3.5 Maintenance Plan

Structures which manage surface water runoff require little maintenance, however, a regular maintenance schedule e.g. after heavy rainfall, should be established by the site owners to reduce the risk of blockage within the drainage system and ensure the design remains in good working order. It is proposed for this to be maintained by the owners:

Table 3: Operation and Maintenance Requirements for Soakaways

TABLE 13.1 Operation and maintenance requirements for soakaways

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

5. SUMMARY & CONCLUSIONS

A summary of the main conclusions for the Sustainable Drainage Assessment is presented below:

- The proposed development is at land adjacent to 20 Belmont Close, Uxbridge North, Hillingdon, Uxbridge, UB8 1RF;
- The proposed development is for the construction of 1 4-bed dwellings with parking & cycle storage;
- The development site is approximately 0.09ha. The existing impermeable area is 0.005ha. The new impermeable area is 0.017ha;
- The site is suitable for infiltration, two soakaways will be used to drain surface water from the site, the infiltration rate will be $9.78E^{-06}$m/s;
- One soakaway will be located at the bottom of the back garden, 5m away from the main building. The second soakaway will be in the North-West corner of the front driveway, this will need to be investigated at detailed design and will need reinforcing if it is unable to be placed 5m away from the main building;
- The proposed development will have storage up to and including the 1 in 100 year event plus climate change of 40%
- The proposed site will increase the risk of surface water flooding to Belmont Close as the existing site discharge to the surface water pipe in Belmont Close. The proposed development .;

Please see below the answers to the condition 4:

Prior to commencement of the hereby approved development (excluding demolition and site clearance) a scheme for the provision of sustainable water management shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall clearly demonstrate how the approved development will incorporate sustainable urban drainage (SuDS) in accordance with the hierarchy set out in Policy 5.13 of the London Plan and will:

The proposed site will use infiltration which is the optimal way of discharging water under the hierarchy of discharge. Please see chapter 4 to answer this part of the condition.

i. *Provide information on all SuDS features including the method employed to delay and control the surface water discharged from the site and:*
This will be through Water Butts, the rainwater garden and the soakaways; please see chapter 4 for further explanation.

ii. *Provide a management and maintenance plan for the lifetime of the development of arrangements to secure the operation of the scheme throughout its lifetime. Including appropriate details of Inspection regimes, appropriate performance specification.*
Please see section 4.3.5. The maintenance will be undertaken by the homeowners, and they will follow Ciria guidance to maintain the SuDS systems.

iii. *Provide details of water collection facilities to capture excess rainwater; and how water usage will be reduced in the development*
Water Butts will be used to recycle water and slow down discharge, the rain garden will slow the water down further. Finally the soakaways will infiltrate the water into the ground which is the slowest way of discharging water from the site.

We trust that the above information will enable you to remove the condition.

6. REFERENCES

Author	Date	Title/Description
Department for Communities and Local Government	Mar 2012	Technical Guidance to the National Planning Policy Framework
Ministry of Housing, Communities and Local Government.	Feb 2019	National Planning Policy Framework

Appendix A: Infiltration Tests

Ref:3309 Between 20 and 24 Belmont Close (22 Belmont Close)

Soakaway infiltration test
Hole in proposed rear garden in virgin ground
Ground condition. Top 300mm topsoil, next 300 stoney sand soil. Bottom 600mm clean balast.

Hole excavated the day 1st August 2023. test on 2nd August posponed due to prolonged heavy rain.
Test 1. There was some small amount of cave in botton of hole has approx 20mm topsoil coverage and about 20mm residual water
Test 1 Completed on 3/August/2023 Weather condition ground wet from day before cloudy, no rain, medium wind 13 degree c
Test 2 Completed on 4/August/2023 Weather condition ground wet from day before part cloudy, no rain, medium wind 13 degree c
Test 3 Completed on 5/August/2023 Weather condition ground wet from day before cloudy,showers light rain, very windy 14 degree c

Weather condition 11. Light rain most of day
200 mm top soil and hole filled with water 25mm below top soil
Total hole average size
1.2m deep 1 m 1.05 m 1.05 M2

filled with 1000 ltrs of cold water or 1m3 Total water available from 4 Bins.
Note: filling took 2 minutes, when filled the total water depth 960mm

The proposed invert level of inlet will be 400mm below surface.

		MM	min	drop mm/min
test 1				
water level fell by	115mm in 60 min	115	60	1.92
test 2				
water level fell by	110mm in 60 min	110	60	1.83
test 3				
water level fell by	102mm in 60min	102	60	1.70

Volume	depth	
1000ltrs	960	
75%	720	
25%	240	
difference	480	mm

Volume out flowing between 75% and 25% = 500Ltrs 0.5 m3

Therefore to drop 50% time taken was

test 1	250.43	Min	60 min in 1 hour
test 2	261.82	Min	
test 3	282.35	Min	

surface area of pit tested

base	1.05	1		1.05	m2
sides	4.1	0.96	div 50%	1.968	m2 (average depth) .
total exposed sides					

The mean surface are through which the flow occurs 3.02 m2

Flow rate

test 1	**1.10E-05**
test 2	**1.05E-05**
test 3	**9.78E-06**

Appendix B:Proposed Layout

Appendix C: Drainage Calculations

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Inflows Storm Phase: Phase	Company Address:		

Catchment Area (2)

Type : Catchment Area

Area (ha)	0.013

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Catchment Area (3)

Type : Catchment Area

Area (ha)	0.004

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Soakaway (1)

Type : Soakaway

Dimensions

Exceedance Level (m)	1.500
Depth (m)	0.300
Base Level (m)	1.200
Freeboard (mm)	0
Soakaway Shape	Rectangular
Diameter / Width (m)	4.000
Length (m)	4.000
Porosity (%)	100
Ineffective Storage Depth (m)	0.000
Number of Soakaways	1
Base Infiltration Rate (m/hr)	0.03521
Side Infiltration Rate (m/hr)	0.03521
Safety Factor	2.0
Total Volume (m³)	4.800

Inlets

Inlet

Incoming Item(s)	Catchment Area (2)
Bypass Destination	(None)
Capacity Type	No Restriction

Soakaway

Type : Soakaway

Dimensions

Exceedance Level (m)	1.200
Depth (m)	1.200
Base Level (m)	0.000
Freeboard (mm)	0
Soakaway Shape	Circular
Diameter / Width (m)	1.500
Porosity (%)	100
Ineffective Storage Depth (m)	0.000
Number of Soakaways	1
Base Infiltration Rate (m/hr)	0.03521
Side Infiltration Rate (m/hr)	0.03521
Safety Factor	2.0
Total Volume (m³)	2.121

Inlets

Inlet

Incoming Item(s)	Catchment Area (3)
Bypass Destination	(None)
Capacity Type	No Restriction

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

Summary Results for Catchment Area (2): Rank By: Max. Inflow

Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
FSR: 100 years: +40 %: 15 mins: Summer	0.01	8.0	3.589
FSR: 100 years: +40 %: 15 mins: Winter	0.01	8.4	4.015
FSR: 100 years: +40 %: 30 mins: Summer	0.01	5.4	4.651
FSR: 100 years: +40 %: 30 mins: Winter	0.01	5.7	5.215
FSR: 100 years: +40 %: 60 mins: Summer	0.01	4.6	5.742
FSR: 100 years: +40 %: 60 mins: Winter	0.01	4.1	6.432
FSR: 100 years: +40 %: 120 mins: Summer	0.01	3.3	6.834
FSR: 100 years: +40 %: 120 mins: Winter	0.01	2.6	7.668
FSR: 100 years: +40 %: 180 mins: Summer	0.01	2.5	7.482
FSR: 100 years: +40 %: 180 mins: Winter	0.01	1.9	8.382
FSR: 100 years: +40 %: 240 mins: Summer	0.01	2.0	7.932
FSR: 100 years: +40 %: 240 mins: Winter	0.01	1.6	8.868
FSR: 100 years: +40 %: 360 mins: Summer	0.01	1.5	8.604
FSR: 100 years: +40 %: 360 mins: Winter	0.01	1.1	9.624

FSR: 100 years: +40 %: 480 mins: Summer	0.01	1.2	9.060
FSR: 100 years: +40 %: 480 mins: Winter	0.01	0.9	10.194
FSR: 100 years: +40 %: 600 mins: Summer	0.01	1.0	9.510
FSR: 100 years: +40 %: 600 mins: Winter	0.01	0.8	10.626

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

Summary Results for Catchment Area (3): Rank By: Max. Inflow

Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
FSR: 100 years: +40 %: 15 mins: Summer	0.00	2.7	1.215
FSR: 100 years: +40 %: 15 mins: Winter	0.00	2.9	1.368
FSR: 100 years: +40 %: 30 mins: Summer	0.00	1.8	1.578
FSR: 100 years: +40 %: 30 mins: Winter	0.00	1.9	1.770
FSR: 100 years: +40 %: 60 mins: Summer	0.00	1.6	1.944
FSR: 100 years: +40 %: 60 mins: Winter	0.00	1.4	2.190
FSR: 100 years: +40 %: 120 mins: Summer	0.00	1.1	2.322
FSR: 100 years: +40 %: 120 mins: Winter	0.00	0.9	2.616
FSR: 100 years: +40 %: 180 mins: Summer	0.00	0.9	2.550
FSR: 100 years: +40 %: 180 mins: Winter	0.00	0.7	2.862
FSR: 100 years: +40 %: 240 mins: Summer	0.00	0.7	2.694
FSR: 100 years: +40 %: 240 mins: Winter	0.00	0.5	3.018
FSR: 100 years: +40 %: 360 mins: Summer	0.00	0.5	2.928
FSR: 100 years: +40 %: 360 mins: Winter	0.00	0.4	3.276

FSR: 100 years: +40 %: 480 mins: Summer	0.00	0.4	3.096
FSR: 100 years: +40 %: 480 mins: Winter	0.00	0.3	3.444
FSR: 100 years: +40 %: 600 mins: Summer	0.00	0.3	3.216
FSR: 100 years: +40 %: 600 mins: Winter	0.00	0.3	3.600

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

Summary Results for Soakaway (1): Rank By: Max. Outflow

Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
FSR: 100 years: +40 %: 15 mins: Summer	1.418	1.418	0.218	0.218	8.0	0.000	0.0	0.000	27.392	OK
FSR: 100 years: +40 %: 15 mins: Winter	1.444	1.444	0.244	0.244	8.4	0.000	0.0	0.000	18.552	OK
FSR: 100 years: +40 %: 30 mins: Summer	1.479	1.479	0.279	0.279	5.4	0.000	0.0	0.000	6.971	OK
FSR: 100 years: +40 %: 30 mins: Winter	1.514	1.514	0.314	0.314	5.6	0.220	0.0	0.000	-4.590	Flood
FSR: 100 years: +40 %: 60 mins: Summer	1.536	1.536	0.336	0.336	4.6	0.584	0.0	0.000	-12.174	Flood
FSR: 100 years: +40 %: 60 mins: Winter	1.580	1.580	0.380	0.380	4.1	1.279	0.0	0.000	-26.649	Flood
FSR: 100 years: +40 %: 120 mins: Summer	1.584	1.584	0.384	0.384	3.3	1.350	0.0	0.000	-28.139	Flood
FSR: 100 years: +40 %: 120 mins: Winter	1.636	1.636	0.436	0.436	2.6	2.184	0.0	0.000	-45.519	Flood
FSR: 100 years: +40 %: 180 mins: Summer	1.604	1.604	0.404	0.404	2.5	1.664	0.0	0.000	-34.678	Flood
FSR: 100 years: +40 %: 180 mins: Winter	1.661	1.661	0.461	0.461	1.9	2.584	0.0	0.000	-53.844	Flood
FSR: 100 years: +40 %: 240 mins: Summer	1.612	1.612	0.412	0.412	2.0	1.785	0.0	0.000	-37.204	Flood
FSR: 100 years: +40 %: 240 mins: Winter	1.671	1.671	0.471	0.471	1.6	2.745	0.0	0.000	-57.198	Flood
FSR: 100 years: +40 %: 360 mins: Summer	1.613	1.613	0.413	0.413	1.5	1.807	0.0	0.000	-37.661	Flood
FSR: 100 years: +40 %: 360 mins: Winter	1.679	1.679	0.479	0.479	1.1	2.860	0.0	0.000	-59.600	Flood

FSR: 100 years: +40 %: 480 mins: Summer	1.601	1.601	0.401	0.401	1.2	1.620	0.0	0.000	-33.752	Flood
FSR: 100 years: +40 %: 480 mins: Winter	1.676	1.676	0.476	0.476	0.9	2.808	0.0	0.000	-58.518	Flood
FSR: 100 years: +40 %: 600 mins: Summer	1.591	1.591	0.391	0.391	1.0	1.461	0.0	0.000	-30.459	Flood
FSR: 100 years: +40 %: 600 mins: Winter	1.664	1.664	0.464	0.464	0.8	2.631	0.0	0.000	-54.828	Flood

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

Summary Results for Soakaway: Rank By: Max. Outflow

Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
FSR: 100 years: +40 %: 15 mins: Summer	0.677	0.677	0.677	0.677	2.7	0.000	0.0	0.000	43.626	OK
FSR: 100 years: +40 %: 15 mins: Winter	0.763	0.763	0.763	0.763	2.9	0.000	0.0	0.000	36.471	OK
FSR: 100 years: +40 %: 30 mins: Summer	0.871	0.871	0.871	0.871	1.8	0.000	0.0	0.000	27.414	OK
FSR: 100 years: +40 %: 30 mins: Winter	0.979	0.979	0.979	0.979	1.9	0.000	0.0	0.000	18.481	OK
FSR: 100 years: +40 %: 60 mins: Summer	1.055	1.055	1.055	1.055	1.6	0.000	0.0	0.000	12.135	OK
FSR: 100 years: +40 %: 60 mins: Winter	1.190	1.190	1.190	1.190	1.4	0.000	0.0	0.000	0.820	OK
FSR: 100 years: +40 %: 120 mins: Summer	1.217	1.217	1.217	1.217	1.1	0.031	0.0	0.000	-1.409	Flood
FSR: 100 years: +40 %: 120 mins: Winter	1.380	1.380	1.380	1.380	0.9	0.318	0.0	0.000	-14.950	Flood
FSR: 100 years: +40 %: 180 mins: Summer	1.295	1.295	1.295	1.295	0.9	0.168	0.0	0.000	-7.891	Flood
FSR: 100 years: +40 %: 180 mins: Winter	1.471	1.471	1.471	1.471	0.7	0.478	0.0	0.000	-22.515	Flood
FSR: 100 years: +40 %: 240 mins: Summer	1.327	1.327	1.327	1.327	0.7	0.224	0.0	0.000	-10.503	Flood
FSR: 100 years: +40 %: 240 mins: Winter	1.509	1.509	1.509	1.509	0.5	0.546	0.0	0.000	-25.690	Flood
FSR: 100 years: +40 %: 360 mins: Summer	1.360	1.360	1.360	1.360	0.5	0.283	0.0	0.000	-13.312	Flood
FSR: 100 years: +40 %: 360 mins: Winter	1.555	1.555	1.555	1.555	0.4	0.627	0.0	0.000	-29.535	Flood

FSR: 100 years: +40 %: 480 mins: Summer	1.356	1.356	1.356	1.356	0.4	0.276	0.0	0.000	-12.964	Flood
FSR: 100 years: +40 %: 480 mins: Winter	1.555	1.555	1.555	1.555	0.3	0.626	0.0	0.000	-29.490	Flood
FSR: 100 years: +40 %: 600 mins: Summer	1.341	1.341	1.341	1.341	0.3	0.249	0.0	0.000	-11.717	Flood
FSR: 100 years: +40 %: 600 mins: Winter	1.547	1.547	1.547	1.547	0.3	0.613	0.0	0.000	-28.865	Flood

Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Phase Management Storm Phase: Phase	Company Address:		

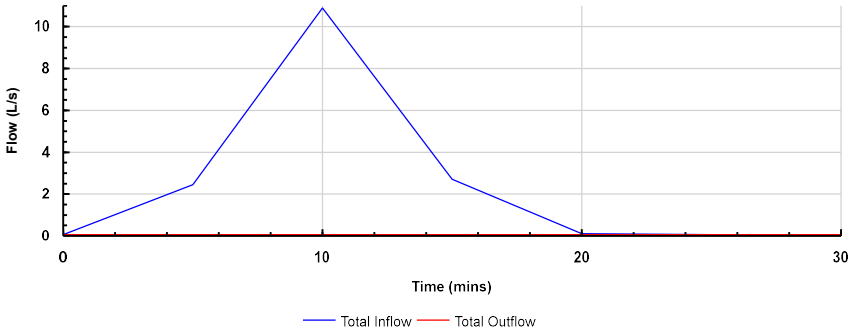
Phase
FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Summer

Tables

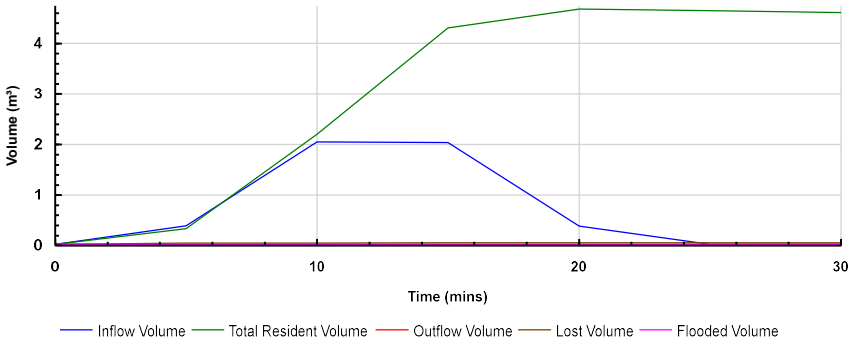
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
TOTAL	10.9	4.804	0.0	0.000

Graphs

Flow Graph



Volume Graph



Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Inflow Results Storm Phase: Phase	Company Address:		

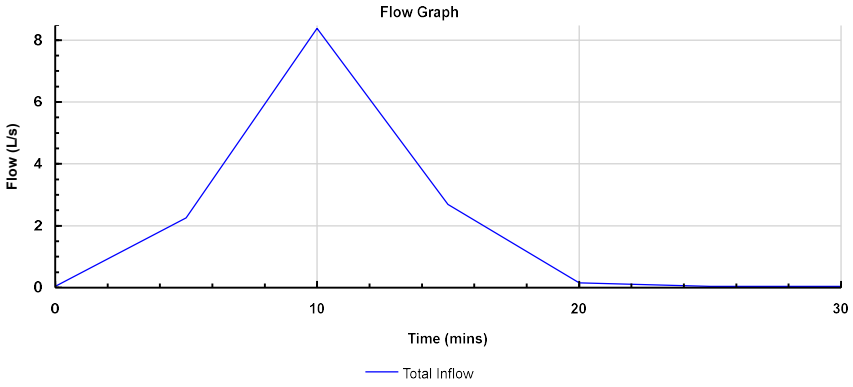
Catchment Area (2)
Critical Storm: FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Winter

Type : Catchment Area

Inflow

Max. Inflow (L/s)	8.4
Total Inflow Volume (m^3)	4.015

Graphs



Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Inflow Results Storm Phase: Phase	Company Address:		

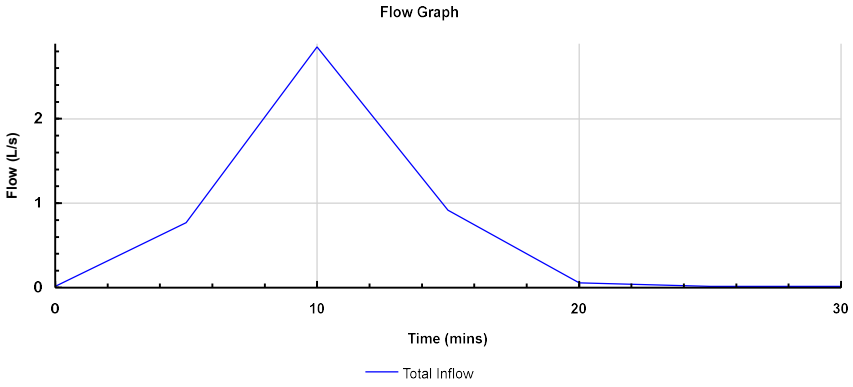
Catchment Area (3)
Critical Storm: FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Winter

Type : Catchment Area

Inflow

Max. Inflow (L/s)	2.9
Total Inflow Volume (m^3)	1.368

Graphs

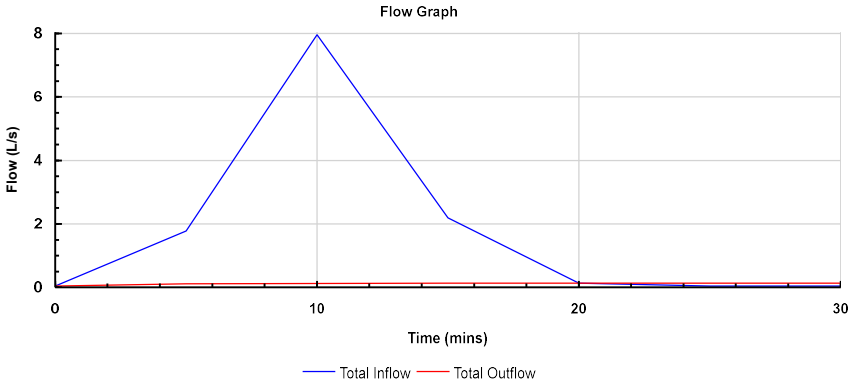


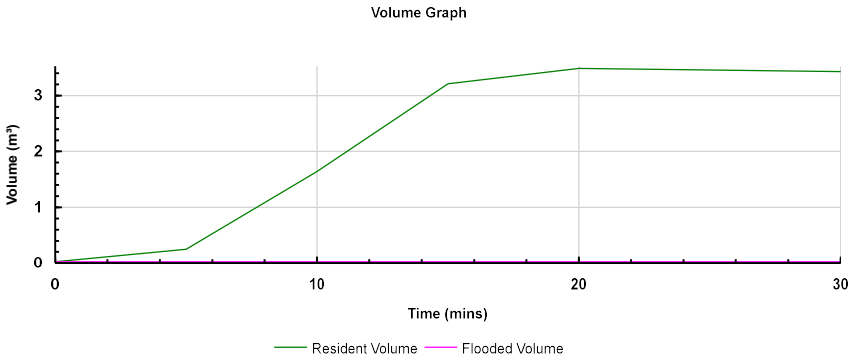
Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		

Soakaway (1)
Critical Storm: FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Summer

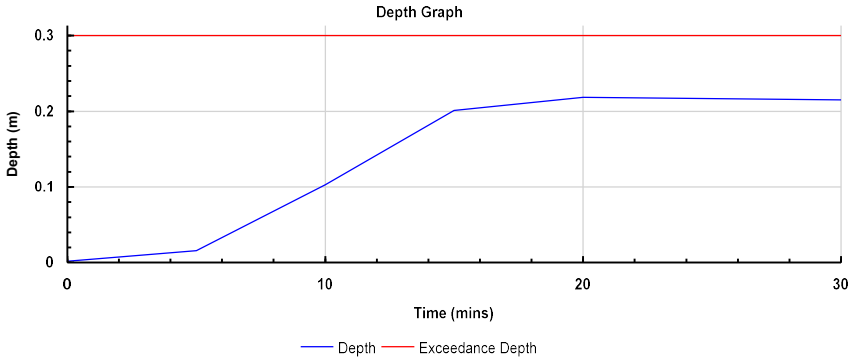
Type : Soakaway

Graphs





Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		

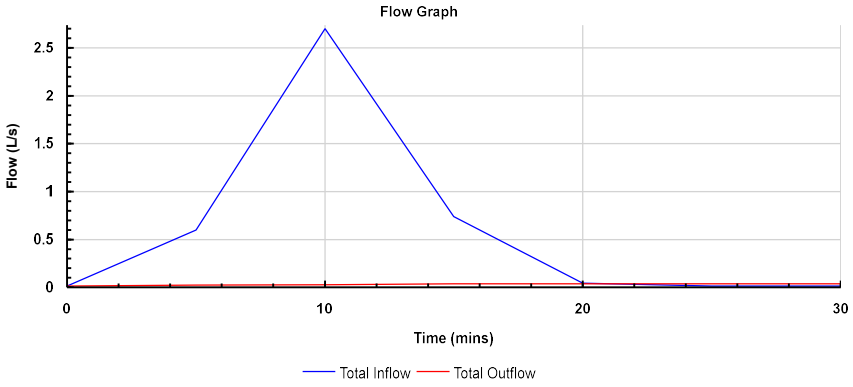


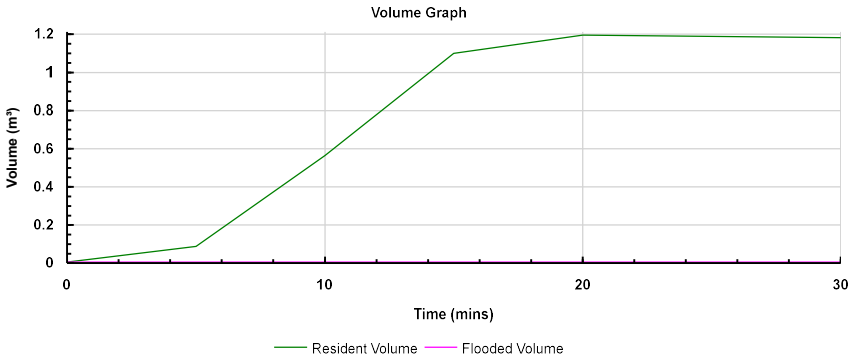
Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:		

Soakaway
Critical Storm: FSR: 100 years: Increase Rainfall (%): +40: 15 mins: Summer

Type : Soakaway

Graphs





Project:	Date: 10/08/2023		
	Designed by: towns	Checked by:	Approved By:
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address: