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James Vogl

12 Eldon Grove

SUSTAINABLE URBAN DRAINAGE REPORT

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Contents

1 Introduction

1.1 This Technical Note has been prepared by Barry Griffin Associates to address the redevelopment of an existing residential building with lower ground floor. This report has been prepared to describe the proposed means of surface water disposal from the proposed development.

1.2 London Borough of Camden (LBC) Local Plan (CC3) and (CPG) requires Sustainable Drainage Systems (SuDS) to be incorporated within proposed developments wherever possible and states that the Council will:

"require sustainable urban drainage (SUDS), or other measures, to reduce both the volume and the speed of water run-off to the drainage system ensuring that surface water run-off is managed as close to its source as possible in line with the hierarchy in the London Plan. In particular, major development must make a significant reduction in the current volume and speed of water run-off to the drainage system".

The above demonstrates that there will be a net decrease in both the volume and rate of run-off leaving the site by incorporating sustainable drainage systems (SuDS) in line with the London Plan drainage hierarchy and National SuDS Standards

Developments on Previously Developed (Brownfield) sites should seek to reduce the volume and rate of run-off leaving the site to the standards set within the London Plan and Camden Planning Guidance 3 (the requirement is normally taken as 50% reduction of a Previously Developed (Brownfield) sites run-off).

To reduce the volume and rate of run-off from heavy rainfall the council will expect developments to utilise sustainable drainage systems (SuDS), such as green and brown roofs, rain gardens, green infrastructure, and attenuation ponds, in line with the London Plan drainage hierarchy and National SuDS Standards.

These statements, policies and supporting guidance above provide a clear message that sustainable drainage must be included within scheme proposals.

1.3 This Report outlines how the development proposals can be satisfactorily accommodated as per guidance provided within London Borough of Camden SuDS Design Requirements, and the National Planning Policy Framework (NPPF).

1.4 The existing site comprises the curtilage of 12 Eldon Grove, Hampstead, London, 0.0which includes an existing garden with a garage.

The site slopes from north-west to south-east to follow the fall of Eldon Grove to the front of the property, and the site area is approximately 0.031Ha (310m²).

1.5 A ground investigation (Geotechnical Appraisal) indicates made ground underlain with Claygate Member.

'The London Clay Formation soil encountered beneath the site are not considered to have sufficient permeability to allow efficient surface water to ground soakaways '.

1.6 The EA Groundwater map shows the site is located outside a Ground Water Protection Zone.

EA Flood Mapping indicates the land and property is in flood zone 1 and has a low probability of flooding and a Flood Risk Assessment is not required.

1.7 A topographical survey has not been undertaken.

1.8 A cursory drainage survey has been carried out and observations indicate that there is no existing surface water discharges or connections to a Thames Water sewer.

No soakaways were identified during the cursory survey.

1.9 There is a sewer in Eldon Grove, which is combined (foul and surface water), which the existing site is connected, the new discharge will also connect to this sewer.

1.10 Equivalent Greenfield runoff rates from the site has been calculated to be 0.15 l/s for the mean annual greenfield runoff (QBAR) event, 0.13 l/s for the 1:1 year event, 0.35 l/s for the 1:30 year event and 0.48 l/s for the 1:100 year event. However, as the site has approximately 34% impermeable area, the existing Previously Developed (Brownfield) rates for the site are likely to be slightly greater than this so will not be used as the basis for surface water retention. it is recommended that the flow from the site to the sewer be controlled by means of a Flow Control Device, limited to 2.0 l/s.

2 Surface Water Drainage Strategy

Infiltration Potential

2.1 Based on the aforementioned geology, and the limited amount of space, infiltration devices would not be suitable as a means of disposal of post development runoff. Therefore, an attenuation-based SuDS scheme is proposed.

Discharge Rates

2.2 It is intended to restrict post development runoff to the mean annual Previously Developed (Brownfield) runoff rate for all storms up to the 1:100 year + 40% climate change event, with the attenuation volume to be stored onsite, to be restricted to 2.0 l/s of the actual runoff in accordance with SuDS Design Requirements, which will also minimise the risk of any flow control blockages (if used).

2.3 Restriction of post development runoff to the Previously Developed (Brownfield) site (50%) will provide a degree of betterment in comparison to the existing site and the most conservative approach to the restriction of post development runoff.

2.4 In order to mitigate flood risk posed by post development runoff, adequate control measures will be required within the site. The proposed development of impermeable roof surface and hard standings, Refer to [*Proposed Site Layout*] enclosed. The runoff arising from the development will need to be managed in accordance with sustainable drainage principles.

2.5 All post development surface water runoff can be attenuated using the following mitigation methods:

1. Enlarged surface water drainage pipes and manholes will also provide a degree of storage.
2. Below ground storm water tanks with either restricted outflow device or duty and standby pumps, depending the existing sewer connection invert levels.
3. Below ground Cellular Storage with either restricted outflow device or duty and standby pumps, depending on the existing sewer connection invert levels.

2.6 Preliminary calculations initially indicated storage volume is required to attenuate the 1:100 year event to 50% of the existing Previously Developed (Brownfield) site runoff without flooding, due to the proposed impermeable area being larger than the existing site. Furthermore, land drainage may be installed in the front and rear gardens, which will increase the speed of surface water run-off reaching the drainage system for the normal percentage factor 0.40 to 0.70, this increases the storage from 6.00m³ to 6.50m³. This can be achieved using any or a mixture of the three proposals:

Refer to enclosed calculations. Therefore, the attenuation storage will also provide sufficient storage for the 1:100 year critical storm event without flooding. Discharge into the surface water sewer will be controlled using a HydroBrake or similar flow control device or Pumps set at 2.00 l/s as indicated in the HR Wallingford Storage Calculations.

Table 2.1: Summary of Existing & Proposed Surface Water Discharge Rates

Impermeable area (m2)		Discharge Point	Calculation Method	Discharge Rate (l/s)					Attenuation Volume Required (m3) (100 year return period 6 hour storm)
				QBAR	1:1yr	1:30yr	1:100yr	1:100yr +40%	
Greenfield	305	Unknown	QBAR SUDs	0.14 l/s	0.11 l/s	0.31 l/s	0.43 l/s	-	-
Previously Developed Existing	305	Unknown	Based on CIRIA C697 2007: The SUDS Manual	-	-	8.39 l/s	10.68 l/s	-	-
Previously Developed Existing	305	To existing surface water sewer	Based on CIRIA C697 2007: The SUDS Manual, Less 50%	-	-	4.20 l/s	5.34 l/s	7.48 l/s	6.00 m³
Proposed Development	305	To existing surface water sewer	Based on CIRIA C697 2007: The SUDS Manual	-	-	9.86 l/s	12.55 l/s	17.57 l/s	-

2.7 GREENFIELD Site Runoff Rate Estimation Where developments are smaller than 50 ha + regional growth curve factors and peak flow rates for 1-, 30- and 100-year return periods.

$QBAR_{rural} = 0.00108 AREA^{0.89} . SAAR^{1.17} . SOIL^{2.17}$

Where:

QBARrural = Catchment mean annual peak flow (approximately 43% annual probability or 2.3 year return period) (m^3/s)

AREA = Catchment area (Ha)

SAAR = Standard average annual rainfall for the period 1941 to 1970 (mm)

SOIL = Soil index (from Flood Studies or Wallingford Procedure WRAP maps). It is a weighted sum of individual soil class fractions, where:

SOIL (LARGE SITES) = (0.1*A*SOIL1) +(0.3*A* SOIL2) + (0.37*A* SOIL3) + (0.47*A* SOIL4) + (0.53*A*SOIL5)
AREA

SOIL (SMALL SITES) use the SPR for the local soil type, as follows = SOIL: 0.4

SOIL TYPE	1	2	3	4	5
AREA				0.0305Ha	
SPR	0.1	0.3	0.37	0.47	0.53

Existing Catchment Area	ha	0.0305ha
Standard average annual rainfall 1941 – 1970	SAAR	650mm
Sol Index (from small sites)	Soil	0.47
Region Number	-	6

The site area is less than 50ha, since the IoH124 methodology is not calibrated for sites less than 50ha in area, the calculation should be undertaken based on a 50ha site area and proportionately adjusted based on the ratio of the site size to 50ha.

QBAR = (0.583 x SAAR1.17 x SPR2.17) x (.001 x (AREA/0.05)

Where:

The AREA in Ha is 0.0342

The SAAR is 650mm

The SPR is 0.47

The SOIL type is 4

QBAR = (0.583 x SAAR1.17 x SPR2.17) x (.001 x (AREA/0.05)	
QBAR site	0.14 l/s

ICP SUDs Mean Annual Flood	
Return Period (years)	100
Area (Ha)	0.0305
SAAR (mm)	650
Soil	0.47
Region Number	6
Urban	0.00

RESULTS			
YEAR	QBAR SITE	GROWTH RATE	FLOW RATE
Q1	0.14 l/s	0.85	0.11 l/s
Q10	0.14 l/s	1.62	0.22 l/s
Q30	0.14 l/s	2.30	0.31 l/s
Q100	0.14 l/s	3.19	0.43 l/s

2.8 EXISTING SITE PREVIOUSLY DEVELOPED (BROWNFIELD):

Catchment Area	0.0305Ha
Approximate Longest Drainage Path	20m
Difference in Ground Levels	The site slopes from north-west to south-east approximately 1.5m
Impermeable Area = 200.7sqm, Provided by the Architects	66% x Rational Method runoff coefficient = 0.95
Permeable Area = 104.7sqm, Provided by the Architects	34% x Rational Method runoff coefficient = 0.40

Result: Existing Previously Developed (Brownfield) Site Discharge Rate:

Rational Method/Lloyd-Davies equation to determine peak pipe flows (Q = 2.78CiA) Where: Q = Discharge Rate (l/s) C = Weighed Runoff Coefficient (0.40 – 0.95) I = Rainwater Intensity (mm/hour) A = Area (Ha)		
Q5	2.78 x 0.75 x (M5-D = 7.47mm/5 min x 12) x 0.0305Ha	5.70 l/s
Q10	2.78 x 0.75 x (M10-D = 9.0 mm/5 min x 12) x 0.0305Ha	6.86 l/s
Q30	2.78 x 0.75 x (M30-D = 11.0 mm/5 min x 12) x 0.0305Ha	8.39 l/s
Q100	2.78 x 0.75 x (M100-D = 14.0mm/5 min x 12) x 0.0305Ha	10.68 l/s
Q100 x 50%	2.78 x 0.75 x (M100-D = 14.0mm/5 min x 12) x 0.0305Ha / 2	5.34 l/s

2.9 POST DEVELOPMENT SITE:

Catchment Area	0.0342Ha
Approximate Longest Drainage Path	20m
Difference in Ground Levels	The site slopes from north-west to south-east approximately 1.5m
Impermeable Area = 229.50sqm, Provided by the Architects	75% x Rational Method runoff coefficient = 0.95
Permeable Area 75.9sqm Provided by the Architects	25% x Rational Method runoff coefficient = 0.40

Result: Proposed Developed Site Discharge Rate:

Rational Method/Lloyd-Davies equation to determine peak pipe flows (Q = 2.78CiA) Where: Q = Discharge Rate (l/s) C = Weighed Runoff Coefficient (0.40 – 0.95) I = Rainwater Intensity (mm/hour) A = Area (Ha)		
Q5	2.78 x 0.88 x (M5-D = 7.47mm/5 min x 12) x 0.0305Ha	6.68 l/s
Q10	2.78 x 0.88 x (M10-D = 9.0 mm/5 min x 12) x 0.0305Ha	8.07 l/s
Q30	2.78 x 0.88 x (M30-D = 11.0 mm/5 min x 12) x 0.0305Ha	9.86 l/s
Q100	2.78 x 0.88 x (M100-D = 14.0mm/5 min x 12) x 0.0305Ha	12.55 l/s

Design Exceedance

2.9 Should the onsite drainage system fail under extreme rainfall events or blockage; flooding may occur within the site. Any resultant floodwater from the preferred storm water storage systems will be routed away from the proposed development to the last surface water manhole on the site. There will also be a degree of emergency storage via the enlarged surface water drainage pipes and manholes.

Water Quality

2.10 It is not envisaged that the water runoff quality will be detrimental as it will be straight from the roof into the main sewer.

Maintenance

2.11 All onsite drainage features and below ground drainage will be maintained by a private management company. A draft Maintenance Schedule is presented within this report. Maintenance tasks are based upon guidance from CIRIA's C753 The SuDS Manual. It is recommended that all drainage elements are inspected following the first storm event and monthly for the first 3 months following commissioning.

2.12 A draft Maintenance Schedule is outlined in Table 2.2 below.

Storage

2.13 It is not envisaged that silt build up within the storage systems will require a rigorous maintenance regime so long as silt is removed on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection and silt removal (as necessary). Inspection should be undertaken using CCTV. Camera access can be gained via inspection chambers and inlet pipework located at each end of the storage tank.

2.14 Silt removal can be achieved by sludge gulper tanker liquid disposal units. Jetting may also be required and should be undertaken in accordance with current jetting guidelines, in particular the Code of Practice for Sewer Jetting published by The Water Research Centre. Jetting at 150bar at 300l/min should be more than adequate in removing any build-up of material within the storage tank.

2.15 A standard jet head with rear facing nozzles should be used. The head should be fed to the far end of the storage tank via the nearest inspection chamber, activated and retracted. As the nozzle is removed, debris will be swept back into the inspection chamber where it can then be removed with the use of a standard sludge gulper. This method will ensure the effective removal of gross solids (carrier bags, cans, leaf litter etc.) from the system. Whilst 100% removal cannot be guaranteed, it has been shown that this jetting method will also remove an element of finer material which would otherwise be 'lost' within the system.

Table 2.2: Maintenance Regime for Elements of the Drainage Infrastructure

Drainage Element	Maintenance Requirement	Frequency
Catch pits	Inspect and remove silt	To be inspected every 3 months and silt removed as necessary.
Enlarged Pipework	Inspect and remove debris	To be inspected every 6 months and silt/ debris removed as necessary.
Storage Tanks	Inspect and remove debris	To be inspected every 6 months and silt/ debris removed as necessary.
Cellular Storage	Inspect and remove debris	CCTCV inspection following first storm event. Monthly CCTV inspections for first 3 months. 6 monthly CCTV inspections thereafter. Jetting to remove silt as necessary.
Inspection chambers, Hydro Brake flow control & Pumps	Inspect and remove silt/ debris	To be inspected every 3 months and silt/ debris removed as necessary. Flow control to be checked for blockages.

Note: In addition to the above maintenance requirements, it is recommended that all drainage elements are

Inspected:

- following the first storm event
- monthly for the first 3 months following commissioning

3 Conclusion

3.1 This *Technical Note* outlines a sustainable surface water drainage strategy for the proposed development at 12 Eldon Grove in accordance with the requirements of the NPPF. The scheme incorporates surface water management techniques to attenuate and convey post development runoff generated by the impermeable areas of the development.

3.2 The surface water drainage scheme will be designed to accommodate and dispose of runoff from storms up to the 1:100 year + 40% climate change event. Based upon review of available geological records, post development runoff will be discharged via the use of attenuation SuDS in the form of storm water storage retention. The use of attenuation SuDS will ensure that surface water runoff is dealt with at source and flood risk is not increased elsewhere. Runoff will be discharged at 2.00 l/s maximum, thereby affording significant betterment over the existing un-attenuated discharge situation of 7.48 l/s for the previously developed site and 17.57 l/s for the proposed site.

3.3. Flow Control Device to control the outflow from the site to the public sewer on Eldon Grove.

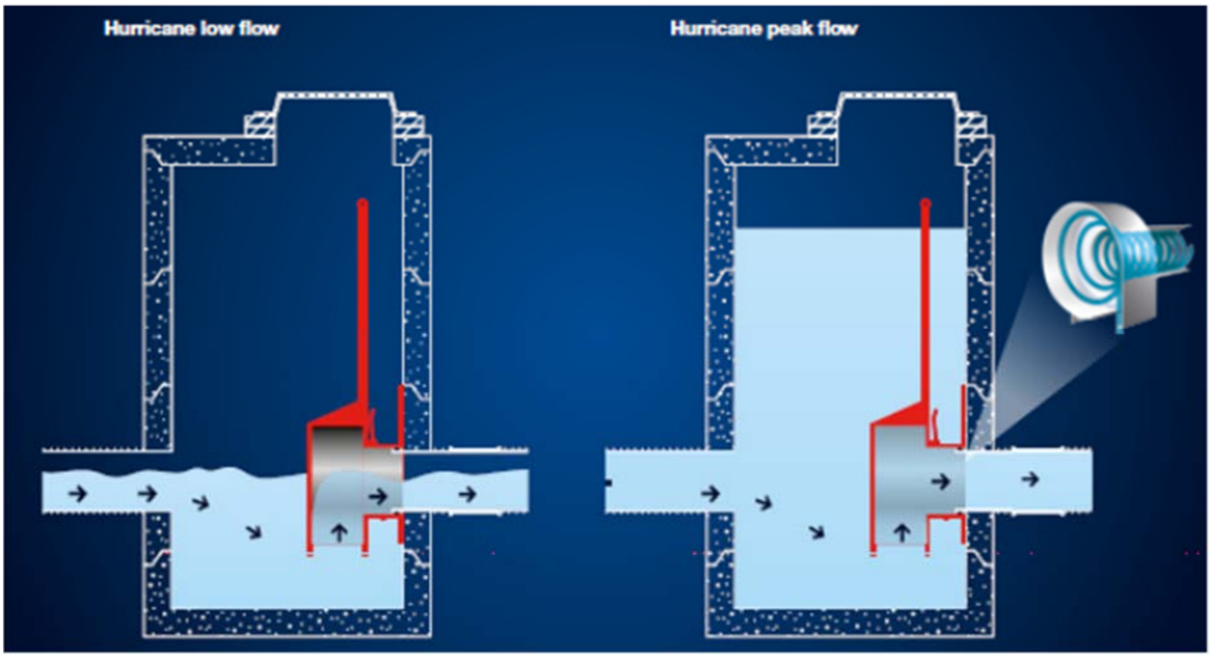
The Flow Control Device to be specified is a Wavin and Mosbaek Vortex valve, of the Hurricane range. The Hurricane series offers an emergency drain-down facility by simply removing the valve from its location plate from ground level.

The Hurricane-valve consists of two elements: The first part is a location plate which is fixed to the inside of the chamber as appropriate and which houses a male location device.

The second part is the valve head, featuring a customised and pre-fitted lifting rod and handle, designed to terminate some 300mm below the level of the chamber cover.

The back of the valve incorporates a female location device. Using the handle to lift the valve head from the surface, the locating devices are disengaged, activating the drain-down facility, and enabling maintenance to either the valve head or chamber. To re-engage, simply lower the valve head back into position.

The Hurricane valve is particularly suitable for use within non-man entry chambers as the valve head can be fully detached from ground level using the lift rod and handle.



3.4 Storage construction:

Can either be a below ground concrete box construction with access for maintenance or a Brett Martin StormCrate storage cate system with separate concrete construction to house the Hurricane Vortex valve.

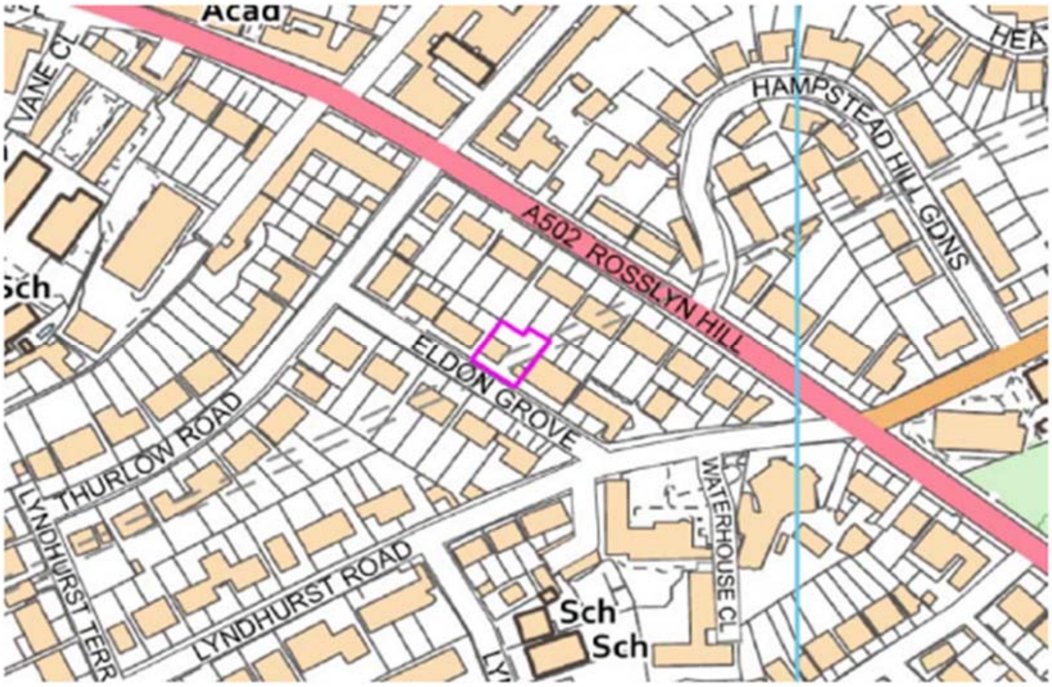
A suggested position for this attenuation (concrete box construction) is shown on the drainage sketch in Section 4.3

3.5 A draft Maintenance Schedule is presented within this report. Maintenance tasks are based upon guidance from CIRIA's *C753 The SuDS Manual.* It is recommended that all drainage elements are inspected following the first storm event and monthly for the first 3 months following commissioning.

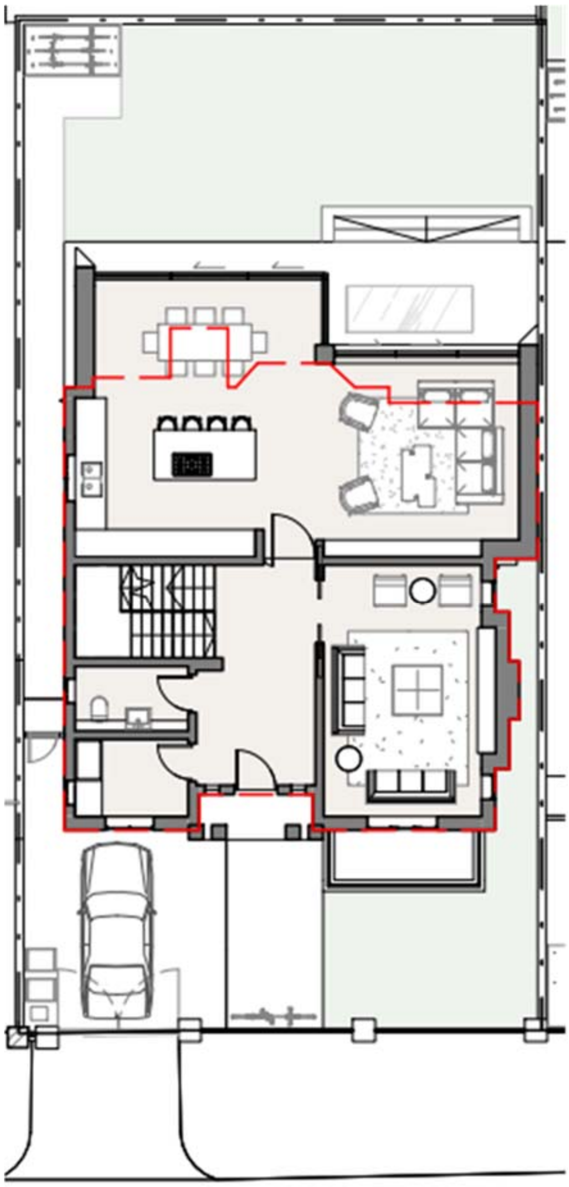
4 Enclosures

1. Local Area Map National Grid Reference TQ 26857 85443.
2. Proposed Site Layout
3. Proposed Location of SUDs Surface Water Attenuation Tank
4. HR Wallingford Calculations

4.1 Local Area Map National Grid Reference TQ 26857 85443.



4.2 Proposed Site Layout (Ground Floor)



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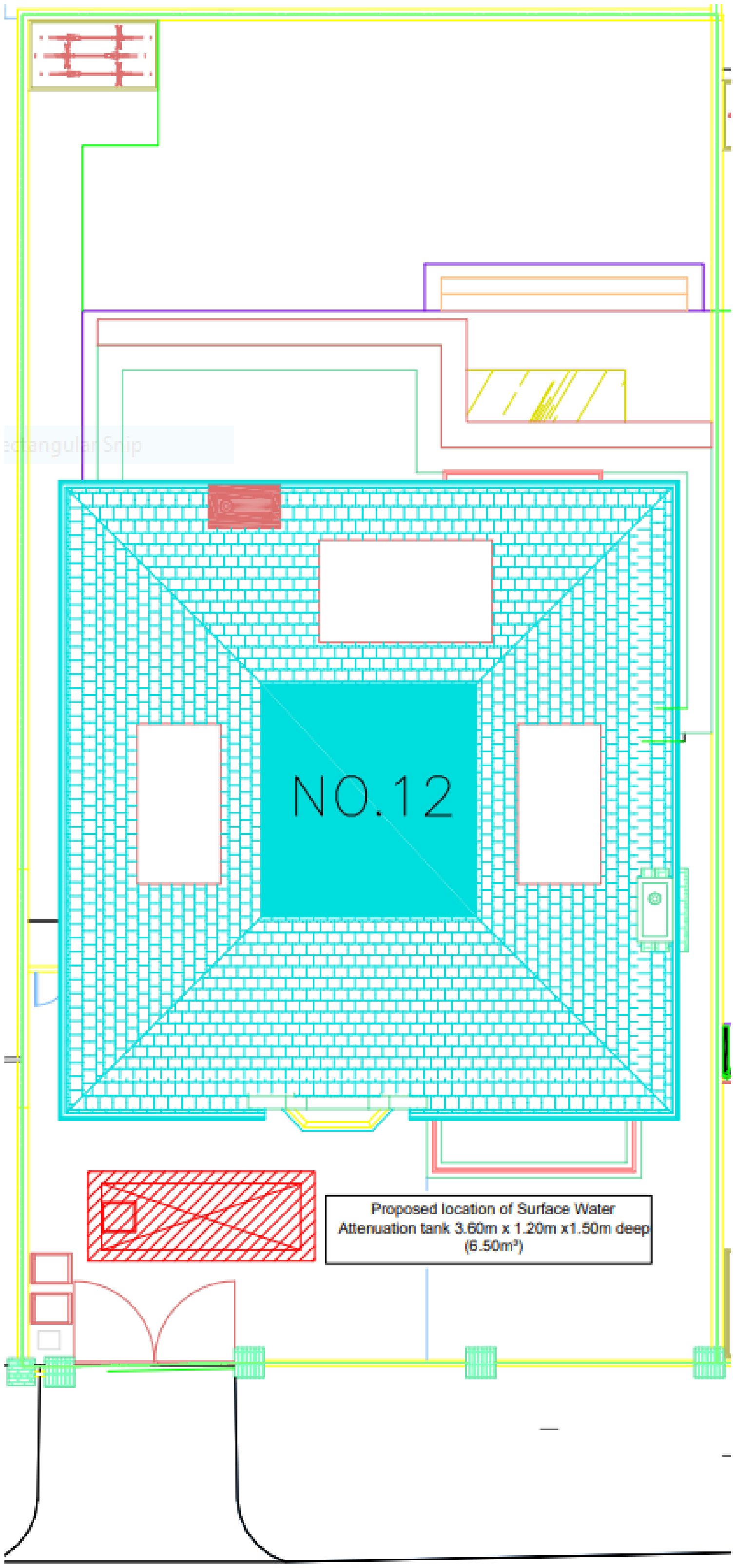
4.3 Proposed Location of SUDs Surface Water Attenuation Tank



4.4 HR Wallingford Calculations

HR WALLINGFORD SURFACE WATER STORAGE REQUIREMENTS FOR SITES

12/22/2020 Surface water storage volume estimation - member's only area

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Barry Griffin
Site name:	12 Eldon Grove
Site location:	Hampstead

Site Details

Latitude:	51.55360° N
Longitude:	0.17167° W
Reference:	935960985
Date:	Dec 22 2020 12:25

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics

Total site area (ha):	.0305
Significant public open space (ha):	0
Area positively drained (ha):	0.0305
Impermeable area (ha):	0.02295
Percentage of drained area that is impermeable (%):	75
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.03
Net impermable area for storage volume design (ha):	0.02
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	86
Rainfall 100 yrs 12 hrs:	--	102.41
FEH / FSR conversion factor:	1.33	1.33
SAAR (mm):	650	650
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.14	0.14
Q_{BAR} for net site area (l/s):	0.14	0.14

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m³):	6	6
Long term storage 1/100 years (m³):	0	0
Total storage 1/100 years (m³):	6	6

https://www.uksuds.com/drainage-tools-members/surface-water-storage-tool.html 1/1

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HR WALLINGFORD GREENFIELD RUNOFF RATE ESTIMATION FOR SITES

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Barry Griffin
Site name:	12 Eldon Grove
Site location:	Hampstead

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:	51.55360° N
Longitude:	0.17167° W
Reference:	3450199186
Date:	Dec 22 2020 12:44

Runoff estimation approach IH124

Site characteristics

Total site area (ha): .0305

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):	650	650
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):	0.14	0.14
1 in 1 year (l/s):	0.11	0.11
1 in 30 years (l/s):	0.31	0.31
1 in 100 year (l/s):	0.43	0.43
1 in 200 years (l/s):	0.5	0.5