Sustainable Urban Drainage System (SuDS)

Garage Site, Malmesbury Close, Pinner HA5 2NG-Proposed New Dwelling

Rev A - 30 Sept 2021-Additional SuDs measures included see Item 7

This SuDS assessment complies with the principles presented in the National Standards for Sustainable Drainage Systems (DEFRA, 2011) and the national planning policy guidance (NPPF, 2012, revised 2018). A surface water drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report has used baseline data on flood risk from the Environment Agency (EA), rainfall data from the Flood Estimation Handbook (FEH), and Hydrogeological information from the British Geological Survey (BGS) and the Site Soil Investigation report.

Drainage on the Site has been assessed by considering the following key constraints:

- Topography of the Site
- Underlying geology, soil types and permeability
- Layout and geometry of the proposed development
- Modelled surface water run-off generated during 1 in 100 year plus climate change critical storm events.

There are a range of SUDS options available to provide effective surface water management that intercept and store excess run-off. When considering these options the destination of the run off should be considered using the order of preference outlined DEFRA's National Standards for SUDS (2011)

1. Proposed Development

Garage Site, Malmesbury Close, Pinner HA5 2NG

The development is one new detached residential, with 2 floors, 2 double bedrooms

The approximate site area of the development is 225 sqm and all the existing is impervious as the site was used for parking garages with hardstanding.

Currently there is a gulley on the southeast site of the site which is connected to the Thames Water surface water sewer outside No 10.

The Site is not located within a Groundwater Source Protection Zone, as defined by the Environment Agency.

The ground conditions from Soil Investigation report have shown to be firm impervious London Clay so soakaways are not appropriate.

2. Peak Flow Rates and Attenuation Volumes

An estimation of run-off is required to permit effective site water management and prevent any increase in flood risk to off-site receptors. The run-off from the site has been calculated in accordance with The SUDS Manual (C753, 2015).

3. Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the National Planning Policy Framework (NPPF) recommends that the effects of climate change are incorporated into Flood Risk Assessments. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the NPPF technical guidance note (NPPF, 2012).

A figure of 40% has been used in these calculations for future climate change rainfall.

4. Surface Water Run-Off from the Site

The potential surface water run-off generated from the site during 1 in 1, 1 in 10, 1 in 30, and 1 in 100-year return period rainfall events have been calculated for a storm duration of 6 hours. The method used for calculating the runoff complies with the NPPF (2012) and assumes that the excess runoff associated with the proposed development (plus an allowance for future climate change) will need to be managed by the proposed SUDS scheme even though the development will reduce the site covered in impermeable area by approximately 50%.

The QBAR method has been used to estimate the runoff from the permeable areas of the Site for the existing and proposed development. The QBAR method is typically used for estimating runoff from small catchments and this is defined in Table 4.2 of the SUDS Manual. The formula is:

QBAR = 0.00108 x AREA0.89 x SAAR1.17 x SPR2.17

Where:

- QBAR = Catchment mean annual peak flow (approximately 43% annual probability or 2.3-year return period) (m3/s)
- AREA = Catchment Area (km2)
- SAAR = Standard annual rainfall for the period 1941 to 1970 (mm)
- SPR = Standard Percentage Runoff coefficient for the SOIL category
- SOIL = Soil index (from Flood Studies or Wallingford Procedure WRAP maps). It is a weighted sum of individual soil class fractions

For the impermeable surfaces, it has been assumed that 100% runoff will occur from these in the existing and proposed development. Future climate change has been accounted for in the proposed development calculations with an influence of 40% for both impermeable and permeable surfaces, in accordance with the NPPF (2012).

The formula for determining the peak greenfield runoff rate should theoretically not be applied to areas less than 50 hectares. As many developments are smaller than this size this constraint is avoided by calculating QBAR for 50 hectares and linearly interpolating flow rates for smaller areas.:

The AREA in m2 is 225 sqm

Impermeable Area is 129sqm

The SAAR is 660mm

The SPR is 0.47

The SOIL type is 4

The above figures are used to calculate QBAR, which in this case equates to 0.1 l/s

The following table shows the site discharge rates, calculated for 1, 10, 30, and 100-year rainfall events. These are calculated using the Growth Curve Factors, which have been derived for each of the 10 hydrological regions of the UK. This is based on the work carried out by the Flood Studies research.

Site Discharge Rates		
	% of QBAR	Flow l/s
QBAR	1	0.1
1 in 1 Year	0.8	0.08
1 in 30 Year	2.3	0.23
1 in 100 Year	3.2	0.32

The system will require a flow control device, to limit the flow to 0.32 l/s. However, this is not practical and there can be issues with a flow control device with such a small orifice, with the potential for blocking. It is recommended larger flow rate of 2.0 l/s should be used for the flow control device.

5. Existing Versus Proposed Site Run-Off

The existing site is of the same area so run-off rates will be similar to the proposed development.

The existing site does not contain any SuDS features, there is no attenuation chamber. The site drains to the public surface water sewer in front of No 10.

With the inclusion of the attenuation tank and flow control, the new system will not allow uncontrolled discharges to the public sewer, reducing any risk of flooding and sewer overload considerably.

6. Attenuation Volume

An attenuation chamber is considered to store rainfall at the development to ensure that the outfall during a peak rain event does not exceed the current outfall from the previous development.

The Rainfall in a 1 in 100-year event for 6 hours is 63mm per m^2, as calculated through the UK SUDS storage estimation tool (a copy of which is included in the appendix). This figure allows for climate change and an urban creep allowance factor.

From the SUDS storage estimation tool, it has been calculated that a total storage of 1.0m^3 will be required for this site.

Using the WAVIN AquaCell Eco Attenuation designed in accordance with CIRIA C697 a total of 6 crates would allow 1.14m^3 of attenuation storage, slightly below the required 1.0m^3. The proposed position for this attenuation store is shown on the drainage drawing.

Crates are laid 3x1, 2 deep with a minimum cover of 0.3m and a depth of 1.2m.

7. Provision of additional SuDS

Rainwater harvesting

Rainwater harvesting will be used for surface water run-from the roof and will help manage rainwater close to where it will fall. In this instance rainwater harvesting will be used only for the reduction of potable water demand, and the dwelling will be fitted with a slim line water butt via a iverter and filter such as shown below.

The slimline rainwater harvesting/water butts for external use will provide additional, "off line" SuDS, and is a suitable SuDS component for small plots. The collection and re-use of water will reduce run off volumes arising from roofs. The collected water, via diverters will be used for external uses with manual control. Any useful volume is not accounted for in storage calculations

Rainwater butts can, in part, accommodate the 5mm event dependent on manual drawdown and evaporation.

Permeable Hard Standing

The proposed permeable paving offers sufficient storage volume to accommodate the 5mm event.

The areas of permeable paving are disconnected from the proposed SW network, i.e. they are not primarily designed to drain to the network. Surface water will be retained in the graded sub-base matrix and will be lost through evaporation and infiltration, at shallow depths, into the surrounding naturally sub-soils. In doing so it is like the natural hydrological process of water falling onto the ground and finding natural flow paths for dispersion.

Any exceedance flows over the storm event will be conveyed via ACO channels to the existing SW network

Note-in calculation the attenuation volume storage and dispersion in the permeable paving zone is not included.

8. Recommendations

The soil report shows the site relatively low permeability, consisting of impermeable clay, and infiltration techniques are not considered viable for this Site. The existing site discharges to a surface water sewer and the new development will use this sewer with controlled discharge at 2.0 l/s. Thames Water consent for connecting to this sewer has been granted consent reference DS4105526.

Attenuation of 1.14m^3 total shall be allowed for and so as not to increase the run-off rates during a 6 hour 100 year storm event, with a controlled discharge flow rate using a Flow Control Device restricted to 2.0 litres per second.

Additional SuDs measures to be included are Rainwater Harvesting and permeable paving.

9. FLOW CONTROL DEVICE

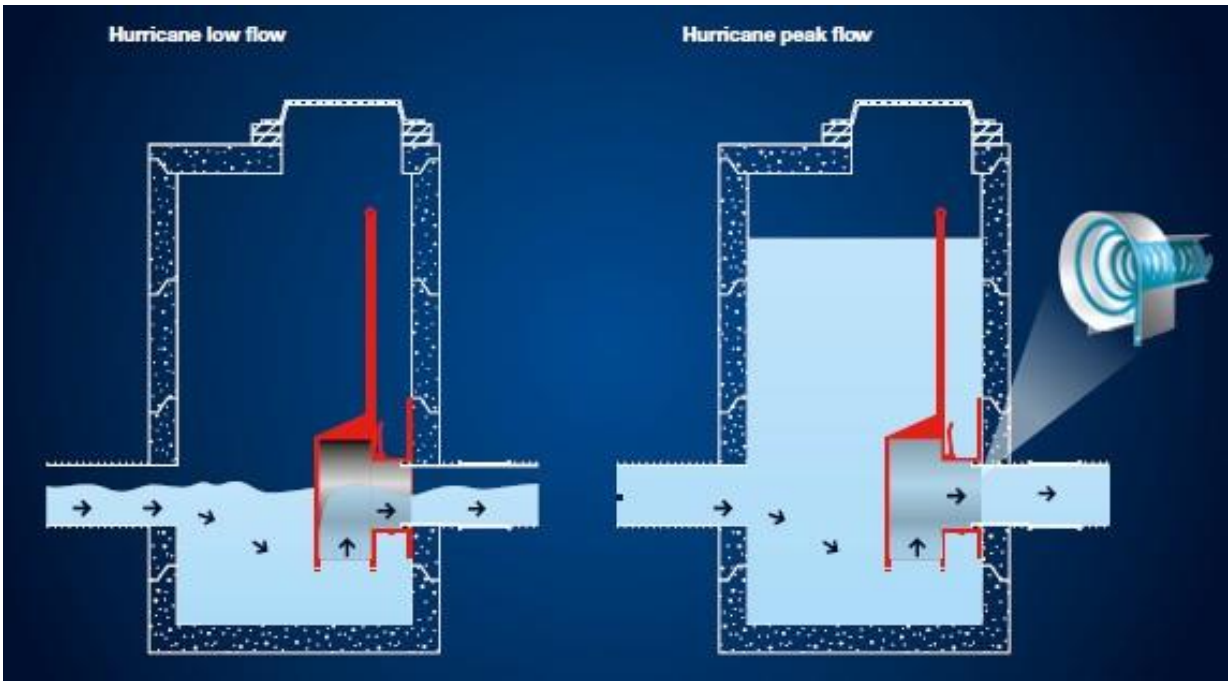
Technical Information

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.


Hurricane low flow
Hurricane peak flow

10. Drainage Maintenance

The actual maintenance regime, plans, and method statements will be the responsibility of the Management Company of the development. Included within this section is guidance on how the maintenance should be carried out, along with an example Method Statement.

Maintenance Plan

Litter Management – Frequency: Monthly. All litter should be picked up from the externalsite

Gullies and Channels – Frequency: Monthly. Remove silt and debris from all surface watercollection points

Impermeable Surfaces – Frequency: Once annually out of Autumn, Monthly during Autumn.Sweep all impermeable surfaces, with extra attention during Autumn and periods with heavyleaf fall

Access Chambers – Frequency: Annual. Check chamber is not blocked and free flowing

Method Statement

Below is a typical method statement, and something similar should be adopted by the ManagementCompany.

All operatives must wear suitable PPE including high visibility clothing

Traffic management to be installed in accordance with the Safety at Street Works and RoadWorks Code of Practice

Using hand tools only, remove any debris from gully gratings and/or drainage channels

Use hand tools to reform channel if necessary to facilitate flow of surface water

Remove traffic management

Do not attempt to lift any ironwork

Do not attempt to use any mechanical equipment on this drainage maintenance activity

APPENDIX

STORAGE ESTIMATION CALCULATION

GREENFIELD RUNOFF CALCULATION

SITE DRAINAGE PLAN

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Khalid Awan
Site name:	Garage site
Site location:	Malmesbury Close Pinner

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 Details

Latitude:	51.59240° N
Longitude:	0.41228° W
Reference:	2294829956
Date:	Sep 16 2021 13:36

Site characteristics

Total site area (ha):	0.022
Significant public open space (ha):	0
Area positively drained (ha):	0.022
Impermeable area (ha):	0.011
Percentage of drained area that is impermeable (%):	50
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):	0.02
Net impermable area for storage volume design (ha):	0.01
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.

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:	--	63
Rainfall 100 yrs 12 hrs:	--	89.32
FEH / FSR conversion factor:	1.16	1.16
SAAR (mm):	660	660
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological 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):	0.1	0.1
Q_{BAR} for net site area (l/s):	0.1	0.1

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

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):	1	1
Long term storage 1/100 years (m³):	0	0
Total storage 1/100 years (m³):	1	1

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Khalid Awan
Site name:	Garage site
Site location:	Malmesbury Close Pinner

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:	51.59248° N
Longitude:	0.41223° W
Reference:	591357114
Date:	Sep 16 2021 13:15

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 0.022

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):	660	660
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):	0.1	0.1
1 in 1 year (l/s):	0.08	0.08
1 in 30 years (l/s):	0.23	0.23
1 in 100 year (l/s):	0.32	0.32
1 in 200 years (l/s):	0.37	0.37

MALMESBURY CLOSE

Existing crossover adjusted to match existing finish

Impermeable Areas
House= 75sqm
Parking=25sqm
Paving=20sqm
Total=120 sqm

BED'C'

Aco Drain

Brick piers with pre-cast coping

'Elledge' or similar timber slatted double wheelie bin enclosure, with hinged doors and lid, to be sited on 2x standard 1200x900 concrete paving slabs set at 10mm above ground level

1.8m high close boarded timber fence with lockable gate

SW MH2

1.2m high railings

1.8m high close boarded timber fence

RWP with BIG

SW MH2

Silt Trap Chamber

TREE '1'

Water Butt

Attenuation Tank

Flow Control Chamber

BED'A'

BED'B'

1.8m high close boarded timber fence

Existing public surface water manhole 0.7m deep 100mm dia

Shed/ cycle storage

1.8m high close boarded timber fence

0 5

Scale in Metres

PLANTING SCHEDULE

TREES						
Species Name	Girth	Height	Specification			
Prunus 'Amanogawa'	12-14cm	200cm	½ standard in 25l pot	TREE '1'		
Photinia x Fraseri	10-12cm	140cm	Crown Lifted Shrub	TREE '2' 'Red Robin'		
SHRUBS				BED 'A'	BED'B'	BED'C'
Species Name	Pot Size	Height	Planting density			
Cotoneaster lacteus	3 litre	30-50cm	3-4 per sq. metre	7		6
Pyraccantha Mohave	2 litre	30-40cm	3-4 per sq. metre	5	9	
Genista lydia	2 litre	30-40cm	3-4 per sq. metre	9		9
Berberis Darwinii	2 litre	30-40cm	3-4 per sq. metre	5	9	
Cornus Alba	3 litre	30-50cm	3-4 per sq. metre	9	9	
Viburnum Tinus	3 litre	30-50cm	3-4 per sq. metre	5		
Mahonia Aquifolum	3 litre	30-50cm	3-4 per sq. metre	3	9	
			Totals	43	36	15

LEGEND

PLANTED AREAS INCLUDING APPROPRIATE NEW SHRUBS:
See planting schedule for details.

Beds to be mulched with 75mm bark chippings to provide weed suppression and moisture retention.

All planting preparation, planting, handling and maintenance should be in accordance with CPSE Code for handling and establishing plants. All trees and shrubs to comply with BS 3936 Part 1:1992, planted to BS 4043:1989 & BS 4428:1989.

LAWN AREA:
good quality amenity grass turves laid in line with good horticultural practices

PERMEABLE PAVING:
80mm Grey Concrete Block with 6mm open joints on 50mm laying course of 6mm open graded crushed rock on 250mm sub-base of 20mm coarse graded aggregate

PAVING:
22mm Non slip Limestone paving laid to manufacturers recommendations

90% POROUS PATH PAVING:
ACO groundguard or similar to be laid in line with manufacturers recommendations - cells filled with 8mm silver grey granite chippings

Solar PIR security and amenity lighting to be provided, downward projecting to minimise light pollution

REV	DESCRIPTION	DATE
A	- Acco drain added	19/06/21

EXTERNAL WORKS HARD & SOFT LANDSCAPING

Proposed Dwelling
Adj 9 And 10 Fairacre
Malmesbury Close
Pinner
HA5 2NG

Floor levels *External*

Plan No. 1 of 1 | Scale 1:100 @A3

KA/2105/01A | Sheet 001 | 26/05/21