SuDS/67.ROR/0424

SURFACE WATER DRAINAGE DESIGN: SUSTAINABLE URBAN DRAINAGE SYSTEM PLAN

67 Royal Oak Road

Bexleyheath

KENT DA6 7HQ

April 2024 | JRM

LANGLEYS CHARTERED SURVEYORS RICS

SuDS/67.ROR/0424
Sustainable Urban Drainage System Plan

Site Address

No./Name	67
Street	Royal Oak Road
Ward	Bexleyheath
Borough/City	Bexley
Region	KENT
Postcode	DA6 7HQ
Easting	548873
Northing	174977
LPA Ref	**BEX**

Submission Details

Report Dated	15th April 2024
Site Visit Made	10th April 2024
Report by	J R Mustafa BSc (Hons) Langleys Chartered Surveyors

Application Details

Project Reference	**67.ROR/0424**
Proposal Description	PART-RETROSPECTIVE Erection of a 4 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping (enlargement of the implemented 3 bedroom dwellinghouse permitted under planning application 21/02245/FUL)
Application Type	Approval of details pursuant to conditions
Submission Method	Electronically via the Planning Portal
Planning Portal Reference	PP – 12 98 06 44
LPA Reference Number	*Pending*
On behalf of the Applicants	Mr. K. Mustafa
Site Owner (if Different)	N/A

RICS
LCS SURVEYORS LTD - Registered Company No. 08994867
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Contents

1.0 Introduction

1.1 Overview

1.1.1 Langleys Chartered Surveyors has been appointed to undertake a Surface Water Drainage Design for the proposed development at 67 Royal Oak Road, Bexleyheath, DA6 7HQ: 'PART-RETROSPECTIVE Erection of a 4 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping (enlargement of the implemented 3 bedroom dwellinghouse permitted under planning application 21/02245/FUL)', described herein as "the development".

1.1.2 It is an adapted copy of the Surface Water Drainage Design **SuDS/67.ROR/0721** (dated 18/07/2023) referred to herein as "the original SuDS Design". This was provided in response to Condition 3 of the original planning consent 'Erection of a 3 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping' (ref. 21/02245/FUL) and was **approved** under permission 21/02245/FUL01 (dated 18/09/2023; see **Supporting Document 01**). A copy of the original planning permission with Condition 3 highlighted has been provided in **APX 1**. A copy of the approved Drain Connection and SuDS Management Plan Drawing has been provided in **APX 2**.

1.1.3 This document should be read in conjunction with **Drawing 009** (Proposed Drain Connections and SuDS Management Plan - 1:100 @ A1). Together, these documents provide full details regarding our SuDS and Drainage proposals for 67 and 67a Royal Oak Road and, if approved, should remove the need for any pre-commencement or pre-occupation conditions relating to such matters

1.1.4 This statement demonstrates that the proposed development can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at risk of flooding, as per National guidance provided within the National Planning Policy Framework (NPPF) 2021, the National Planning Practice Guidance (NPPG), DEFRA's National Standards for Sustainable Drainage, and Local guidance provided in the draft London Plan SI13 Sustainable Drainage and London Borough of Bexley SuDS policies.

1.2 Flood risk

1.2.1 The Environment Agency (EA) provides a detailed written and mapped summary of flood risk for locations within the UK that considers the level of flood risk from groundwater, rivers, surface water and reservoirs. The Flood Risk Indicator for the Site obtained via the Environment Agency (EA) demonstrates that:

I. The entire application site is located within Flood Zone 1 (see **APX 3**).

II. Risk of Flooding from Rivers or Seas: The closest river to the site is the River Shuttle which is approximately 0.48miles (0.77km) south of the land (see **APX 4**). The River Cray is also just under a mile away from the site at its' nearest point (1.14km). These present the greatest risk of fluvial flooding to the site and are shown in **Drawing 009**.

Notwithstanding their proximity, there is a no identified risk of fluvial flooding to the site and as such no targeted defence or alleviation techniques are necessary (see **APX 5**).

III. Risk of Surface Water Flooding: there is a low to medium risk of surface water flooding (see **APX 6**). While limited, there is therefore some risk that flood water could encroach the site and some level of management is therefore necessary. By their nature, pluvial flood events are usually short in duration and dissipate within a matter of hours, however, if significant floodwater enters the site it would need to be quickly redirected away from the dwellinghouse and neighbouring properties.

IV. Risk of Flooding from Reservoirs: flooding from reservoirs is unlikely in this area and as such no targeted defence or alleviation techniques are necessary (see **APX 7**).

1.3 Vulnerability classification

1.3.1 Table 2 of the PPG technical notes for the NPPF1 sets out the vulnerability classification of each 'type' of land or building use projected for development.

1.3.2 The matrix presented in Table 3 of the same PPG sets out which vulnerability classifications are appropriate within each flood zone (1, 2, 3a, 3b).

1.3.3 With reference to the vulnerability table, the compatibility matrix and the Environment Agency Flood Map for Planning (Appendix A), the following can be statements can be made:

- The approved development, a dwellinghouse, is classified as 'more vulnerable' to the impact of flooding.
- More vulnerable development types are compatible within Flood Zone 1.

1.3.4 As the vulnerability classification of the approved development is compatible with the Flood Zone an extensive Flood Risk Assessment and Drainage Strategy is not required, however, adequate thought must be given to drainage onsite and appropriate SuDS techniques integrated into the water management plan to reasonably reduce surface water runoff per Condition 3 of 21/02245/FUL.

2.0 Existing Drainage Conditions and Installations

2.1 Pre-existing drainage infrastructure

2.1.1 All pre-existing manholes onsite are shown in **Drawing 009**. These are to be retained in situ.

2.1.2 The closest storm drains are approximately 3.8m and 9.3 northwest of the front boundary of the land fronting Royal Oak Road and 9.8m & 15.9m from the closest point of the front of the proposed building.

2.1.3 Both a public foul sewer and public surface water sewer run along Royal Oak Road at the front of the site. Foul and surface water directed to the existing site drains at 67 Royal Oak Road drain to these sewers. Foul water produced by the new dwelling will be connected to the existing foul run onsite. Surface water runoff from the roof of the new house will be directed to a soakaway within the rear garden and a water butt rather than into the surface water sewer.

2.2 Existing Surface Water Runoff Conditions

2.2.1 HR Wallingford's full Greenfield Runoff Estimation has been provided in **APX 8**. Surface water runoff rates at the site for the typical assessment return periods are as set out in Table 1, below.

2.2.2 Referring to the SuDS Manual (CIRIA, 2015) 'SuDS should be designed so that runoff is completely contained within the designated drainage system for all events up to the specified standard of service for the critical duration event for the system. This level of service will normally be 1 in 30 years as a minimum unless otherwise specified or agreed with the planning approval or SuDS approving body'. It is therefore this return period that has been used to assess the attenuation volume requirement for the development.

Table 1 HR Wallingford Surface Water Runoff Estimates

Surface water runoff conditions	
Qbar (l/s)	0.1
1 in 1 year (l/s)	0.09
1 in 30 years (l/s)	0.23
1 in 100 years (l/s)	0.32
1 in 200 years (l/s)	0.38

2.3 Soil classification and composition

2.3.1 The British Geological Survey's Geology Viewer has identified that the site is underlain with Harwich Formation Sand (sand and gravel). This typically varies from a high to medium level of permeability dependant on the degree of clay content found in it.

2.3.2 The HR Wallingford Greenfield Runoff Estimation tool has identified that the site has a soil classification level of 1. Soil type 1 has the highest potential rainwater 'storage' volume capacity and overall permeability and lowest winter run-off potential of all FEH Soil Types.

2.3.3 The site is at medium risk of surface water flooding but is not known to be prone to groundwater flooding which is likely a result of the characteristics of the soil.

2.4 Percolation test

Date

2.4.1 A percolation test was carried out at 10:00am on Friday 23rd June 2023.

Method

2.4.2 In accordance with the BRE365 Method:

1. From the site, a cubic section of soil measuring 1mx1mx1m was dug out with an excavator, with care being taken to keep sides vertical so that the volume and pit internal surface area may be accurately deduced. The location of the trial pit can be viewed in **Drawing 009** (red hatched box).

2. This was then filled with 1m^3 of water instantaneously (1000 litres).

3. The time taken for the water to soak away was observed.

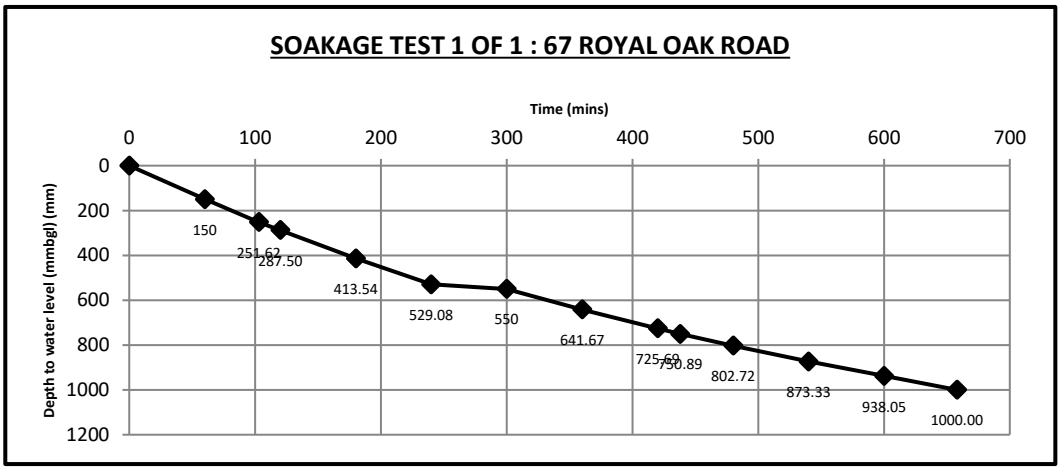
Results

2.4.3 The results are summarised in the table and chart on the following page and provided in full in **APX 9**. The test revealed a soil infiltration rate of 0.1477 l/s (0.0001 m^3/s).

2.4.4 The test was complete (water fully percolated) within 10.97 hours (658 minutes). As this duration is longer than the return period 6 hour critical duration it is with confidence that we can deliver an assessment of the likely actual fill volume of the attenuation features at any one time during a return period event, as has been provided in **APX 11** (Calculation B).

Table 2 Percolation Test results: soil infiltration rate and results table

Soil Infiltration Rate (f) =			
0.0089	m^3/m	8.8632	l/m
0.0001	m^3/s	0.1477	l/s



2.5 Soil compliant SuDS techniques that may be used

2.5.1 These soil conditions support the use of permeable paving systems, soakaways and other such SuDS methods that work via permeation.

2.5.2 As such, new areas of hard standing, such as the new driveway, footpath between the houses and rear patios and all existing areas of hardstanding will either be surfaced or re-surfaced with a new permeable paving system.

2.5.3 Runoff from the rear facing gutters of the new house will be directed to a soakaway positioned within the garden to control the rate of release into the soil.

2.5.4 A domestic water butt will also connect to the downpipes of 67a, offering further attenuation usable to residents.

3.0 SuDS Techniques

3.1 Policy

3.1.1 Planning authorities have been responsible for the approval of sustainable drainage designs since 2015. The National Planning Policy Framework (2019) encourages the use of sustainable drainage techniques for new developments. It is seen as a means by which development can avoid increasing the risk of flooding elsewhere.

3.1.2 London Plan Policy SI 13 Sustainable Drainage states a general preference toward using green rather than grey drainage features and sets out the Mayor of London's preference for particular SuDS techniques in new development. It states as follows:

Figure 1 London Plan Policy SI 13

Policy SI13 Sustainable drainage

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)

2) rainwater infiltration to ground at or close to source

3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)

4) rainwater discharge direct to a watercourse (unless not appropriate)

7) controlled rainwater discharge to a surface water sewer or drain

8) controlled rainwater discharge to a combined sewer.

C Development proposals for impermeable surfacing should be refused unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improve water quality, and enhance biodiversity, urban greening, amenity and recreation.

3.1.3 Table 8 of the London Sustainable Drainage Action Plan (2016) recommends 6 potential sustainable drainage options for residential developments as shown in

Figure 2. While a number of these methods are practical to incorporate into small scale residential developments, this table focuses on large residential schemes, hence, some of the options would be inappropriate for the site.

3.1.4 Table 26 of the same document sets out options recommended for 'single/small blocks of individually occupied residential homes' which are more suitable for smaller developments, set out in Figure 3.

Figure 2 Table 8 of the London Sustainable Drainage Action Plan (2016)

Table 8: Housing sector options and opportunities

Likely sustainable drainage options	Likely opportunities to implement sustainable drainage
Green/brown/blue roofs	Major roof repairs for residential buildings. Small scale repairs to garages, sheds and other structures
Raingardens, flow through planters, stormwater tree pits/diversion of downpipes	Landscaping enhancements
Rainwater harvesting	Major refurbishment programmes for larger buildings/estates
Swales, bio-retention, ponds, basins and soakaways	Refurbishment and landscaping enhancements dependent upon space and ground conditions
Oversized pipes, attenuation tanks, geocellular storage	Refurbishment and landscaping where space is limited or ground conditions for infiltration unfavourable
Permeable surfacing	Resurfacing of footpaths, hard surfaces or car parks

Figure 3 Table 26 of the London Sustainable Drainage Action Plan (2016)

Table 26: Options and opportunities for individuals

Likely sustainable drainage options	Likely opportunities to implement sustainable drainage
Water butts	Garden improvements
Raingardens and downpipe diversion	Roof repairs, extensions, community landscaping projects, garden improvements
Green/brown/blue roofs	Major roof repairs, extensions
Permeable driveways	Resurfacing of driveways, patios and other hardstanding areas

3.2 Strategy Vision

3.2.1 As the likelihood of flooding from tidal overtopping and failures of nearby flood defences is extremely low, this is not as much a concern as damage and safety issues that may be caused be excessive surface and groundwater build-up.

3.2.2 The SuDS strategy for this site should therefore effectively demonstrate how drainage will be sustainably managed on site so that existing levels of surface water runoff from rainfall events will not be exceeded, and if possible, reduced, in accordance with the hierarchy set out in Policy SI13 while giving sufficient consideration to site-specific conditions that could render some of these methods inappropriate or negligibly effective. The overarching aim should be to maintain or improve existing site conditions and safeguard these against the potential impacts of climate change on flood risk in general, using the appropriate return period assessment for the site and development.

3.2.3 All proposed drainage installations are shown in in **Drawing 009**.

3.2.4 Given conditions onsite and the nature of the development it is suggested that a combination of **(1) permeable paving**, **(2) attenuation of surface water within a soakaway**, **(3) rainwater harvesting** through the use of a suitably sized **water butt**, and **(4) interception through planting** should be the main SuDS components for surface water management.

3.3 Methods considered to be unsuitable for use onsite

Green/Brown/Blue Roofs

3.3.1 The traditional hipped main roof that has been approved for the dwellinghouse would not support a green/brown/Blue roof without significant and financially unfeasible cost to the developer. The proposed new flat or monopitched roof areas (rear-facing dormer window) and kitchen extension are not large enough to comfortably support such a feature.

Swales, bio-retention

3.3.2 Lack of space makes such techniques inappropriate for the development.

Oversized pipes, attenuation tanks, geocellular storage

3.3.3 The ground conditions are sufficient to allow the use of a crate soakaway and direct infiltration rather than these methods.

Raingardens / downpipe diversions

3.3.4 As the gradient of the land gently slopes down toward the southern boundary of the site and back of the rear garden, surface runoff will naturally be directed this way and to the lawn/planted parts of the garden. As such, routing runoff to these areas via piping is not required.

3.3.5 In this instance, the collection of runoff from the new property in a water butt for domestic use by residents is considered to be a better option for downpipe direction rather than pipe this toward planted areas.

3.4 SuDS Component 1: Permeable paving ('permeable driveways')

3.4.1 All proposed outdoor patio, driveway and pathway areas will be surfaced with a permeable block paving system, including the existing hard-surfaced driveway to no.67 which will be broken up and re-paved with the same system.

3.4.2 These areas will be underlain with a permeable bedding aggregate onto which traditional style concrete block paving will be laid, with a permeable jointing aggregate swept into the gaps between them. The favoured block paving system is Bradstone Driveway Infilta Block Paving in Autumn, or an equivalent product.

3.4.3 A low level block kerb will edge the hedging at the front of the site such as Bradstone Block Kerb Large in Charcoal, or an equivalent product. Both products are shown in **Drawing 009**.

3.5 SuDS Component 2: Attenuation of surface water within a soakaway

Location

3.5.1 A geocellular soakaway is proposed to be located below the private garden rear of the new dwellinghouse at a minimum distance of 5 metres away from the building (planned distance: 6.3m).

3.5.2 This will collect runoff from the roof of the new house and attenuate it before it is released into the ground. The soakaway must be maintained to the standard set out in Table 21.3 of the CIRIA C753 SuDS Manual 2015.

Scale

3.5.3 A soakaway made up of 20x geocellular crates (measuring 1m x 500mm x 400mm) will be sited in the rear garden. These will be set in 2 layers of 10 crates in a 2.7mx2.2mx1.4m deep pit with 100mm of shingle coating each side. The system is shown in **Drawing 009**.

3.5.4 The soakaway will have a total storage capacity of $4m^3$, by itself exceeding the total attenuation volume calculated to be required for the 1 in 1 yr^{6hr} return period and 1 in 30 yr^{6hr} return periods.

3.5.5 Considering the soil dispersal rate discovered on site by the percolation test (**APX 8**) the volume requirement for the 1 in 30 yr^{6hr} return period would likely be just $1.78m^3$ which is $2.2m^3$ less than the attenuation volume provided, as expressed in **APX 11**.

Figure 4 Table 21.3 of the CIRIA C753 SuDS Manual 2015

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

3.6 SuDS Component 3: Rainwater harvesting

3.6.1 A rainwater storage butt with minimum capacity of 210 litres is to be connected to downpipes at the rear of the dwellinghouse, within the patio of the large rear garden. Specifications and an image of the proposed product are provided in **Drawing 009**.

3.7 SuDS Component 4: Interception through planting

3.7.1 Borders of both the front and rear gardens belonging to the new house are to be planted with shrubs and evergreen plants to intercept rainwater at its' source and as it runs toward the northern part of the site.

3.7.2 Images of all proposed flora has been provided in **Drawing 009** with further details provided in **Planning Note 04** 'Landscaping and Wildlife Nesting Box Details'.

Front Garden

3.7.3 A line of Photinia x fraseri ‘Red Robin’ (evergreen hedge) will be planted along the front western boundaryline, screening the refuse storage area. This hardy species thrives in all soil types and shade conditions with an average growth rate of up to 40cm per year and a height that is easily maintained between 1-4m (2m max height is preferred).

Back Garden

3.7.4 4 species of shrub and flowering plants are proposed to be planted within the rear garden, along all three boundaries, as set out in the table below. All have been selected for their ability to thrive in sandy soil and borders that are either completely exposed to sunlight (per the side borders) or partially shaded (per the back border).

Table 3 Proposed flora

Species	Photinia x fraseri ‘Red Robin’ Hedge	Armeria Maritima ‘Alba’ (Thrift – Alba)	Stachys Byzantina ‘Silver Carpet’ (Lamb’s Ear – Silver Carpet)	Viola ‘Bridie’	Helleborus Thibetanus (‘Tibetan hellebore’)
Foliage	Evergreen	Evergreen	Evergreen	Evergreen	Deciduous
Flowering Season	Spring	Spring & Summer	N/A	Summer & Autumn	Spring
Ultimate Spread	4.0 m	0.5 m	1.0 m	0.5 m	0.5 m
Ultimate Height	4.0 m	0.5 m	0.5 m	0.5 m	0.5 m
Hardiness	H5	H5	H7	H5	H5
Pollinator	YES	YES	YES	YES	YES
Siting	Front garden	Back garden (borders)	Back garden (borders)	Back garden (borders)	Back garden (borders)

3.8 Responding to the details requested by Condition 3 of 21/02245/FUL

3.8.1 **It is likely that the same details requested by Condition 3 of the original consent would be required by any forthcoming planning consent to the current proposal. I have therefore provided a full response to each part of that condition below.**

A. Prior to commencement of the development (excluding demolition and below ground works), a scheme for a Sustainable Drainage System in accordance with the Bexley Sustainable Drainage Design and Evaluation Guide (2018) shall be submitted to and approved in writing by the Local Planning Authority. The submitted scheme shall include details of:

i. How reduction in surface water runoff to the greenfield runoff rate shall be achieved

3.8.2 Runoff will be reduced significantly via the SuDS methods proposed herein, particularly the degree of permeable surfacing and attenuation methods. The total amount of impermeable surfacing will be reduced to 37% inclusive of existing and proposed buildings and surfaces and 49% of runoff from these areas will be sustainably drained. Sitewide, runoff will be reduced from 40.2% to 13.4% (see **APX 10**).

ii. Calculations to demonstrate that the proposed system is fit for purpose, including correctly sized attenuation and surface water discharge rates;

Attenuation

3.8.3 Calculations detailing the surface water attenuation volumes required for the development on site are provided in **APX 11**.

3.8.4 For the 1 in 30 yr^{6hr} return period an attenuation volume of at least 3.9m^3 has been found to be required, although the total volume is likely to be less than this as previously explained. Together, the proposed soakaway and water butt exceed this volume by 0.4m^3 and will therefore easily attenuate the full annual runoff per the 30 year Growth Factor Curve (2.3x the current average rainfall; 1 in 30 yr^{6hr}).

Surface Water Runoff

3.8.5 All remaining runoff from impermeable surfaces, this now being limited to the roof of the existing dwellinghouse, will continue to discharge to the main run along sewer which will have capacity to accommodate the now reduced runoff.

iii. Installation of petrol/oil interceptors as necessary;

3.8.6 N/A – these are not necessary.

iv. Distribution of foul water flows into the surrounding sewer network as necessary;

3.8.7 The existing house is connected to the public foul sewer that runs east-west along the access road. The new dwelling would connect to this for which permission will be sought from Thames Water.

v. Installation of rainfall attenuation units for capturing and reusing water;

3.8.8 This will be delivered via the water butt.

vi. Information about the design storm period and intensity, the method employed to delay and control surface water discharged from the site and measures taken to prevent pollution of the receiving groundwater and/or surface waters;

3.8.9 As previously mentioned, the SuDS Manual (CIRIA, 2015) 'SuDS should be designed so that runoff is completely contained within the designated drainage system for all events up to the specified standard of service for the critical duration event for the system. This level of service will normally be 1 in 30 years as a minimum unless otherwise specified or agreed with the planning approval or SuDS approving body.' Site discharge rates (l/s) have therefore been calculated for two critical storm events; 1 in 1 year, 1 in 30 year return periods.

3.8.10 The minimum attenuation volume requirement was first calculated, per standard procedure, on the basis of the proposed new roof footprint (or other such impermeable areas draining to attenuators) and known 'good' soakage conditions. Where ground has good soakage (such as sand/gravel) then the size/volume of a crate type soakaway can be calculated as follows: ***{Volume = Roof area being drained x (50mm rainfall rate per hr/3000)} x 2.56 for the 1 in 30 year return periods***. The volume calculated was 3.9m^3. This is 0.8m^3 more than the volume required for the original approval resulting from the increased roof space over the ground floor kitchen extension.

3.8.11 A second estimate is provided to give a more accurate reading of attenuation requirement for both return periods considering the dispersal rate known to occur at the site as found by the Percolation Test. Where soil is found to have good soakage, the storage requirement will often be significantly less than the minimum value calculated by the calculation based on the footprint of the roof, as has been found to be the case here.

3.8.12 Greenfield Runoff Rates for each storm period have been provided within the HR Wallingford Greenfield Runoff Rate Estimation (**APX 8**). These have been input to the Return Period Datasheet (**APX 11**) and evaluated against the known dispersal rate recorded during the percolation test and proposed total rain water attenuation features to establish the minimum attenuation requirement and whether the proposed system is able to exceed this. The volume calculated was 1.78m^3.

3.8.13 The combined capacity of both attenuation features therefore meet and exceed the required volume and the total surface water found by both calculations and hence the discharge rate will be no greater than existing site conditions.

3.8.14 No measures to prevent pollution are necessary due to the nature and scale of development and past uses of the land.

vii. Include a timetable for its implementation;

3.8.15 All drainage elements described herein and as shown on the supporting plan drawings will be implemented prior to the first occupation of the unit, in the month commencing the completion of the external structure (excluding finishing decorative features). The following installation timetable is proposed.

Table 4 Drainage and SuDS Implementation Timetable

When	Action/s
Prior to the installation of new drainage features or connections to existing drainage features	1. Survey condition of existing manholes and drain runs on site. 2. Repair these where necessary. 3. Plan new connections/runs.
During ground works.	4. Install new foul drain runs and manholes. 5. Install soakaway and drain run to soakaway.
As build commences.	6. Break-up existing impermeable hardstanding. Remove from site/reuse as hardcore. 7. Re-surface driveway and surface new paved areas with permeable block paving. 8. Install rainwater harvesting butt.
Upon completion of the structure and prior to occupation.	9. Lay lawn. 10. Plant shrubs and garden plants.

viii. Provide a management and maintenance plan for the lifetime of the development;

3.8.16 A Drainage Management and Maintenance Plan is provided in Table 5. In addition to this maintenance regime it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.

3.8.17 The maintenance of the site will be the responsibility of the Owner, and any future Owner of the dwellinghouse.

Table 5 Maintenance Schedule

When	Action/s
Weekly or Monthly	1. Tend to garden on a basis as appropriate for the season. 2. In the winter, clear hard surfaced areas of waste plant matter (e.g. leaves) as regularly as necessary to allow rainwater infiltration.
Every 3 months	3. Inspect soakaway. 4. Inspect manholes. 5. Clear drains of waste plant matter. 6. Prune shrubs.

B. The Scheme must demonstrate how the drainage hierarchy set out in London Plan Policy SI13 has been followed:

1st Store rain water for later use;

3.8.18 Rainwater will be harvested in the water butt.

2nd Use infiltration techniques, such as porous surfaces in non-clay areas;

3.8.19 All hard surfaced areas will be surfaced or re-surfaced with a permeable block paving system.

3rd Attenuate rainwater in ponds or open water features for gradual release to a watercourse

3.8.20 Not applicable.

4th Attenuate rainwater by storing in tanks or sealed water feature for gradual release to a watercourse

3.8.21 Runoff from the developed area not diverting to the water butt will divert to the proposed soakaway for gradual release into the soil within the rear garden.

5th Discharge rainwater direct to watercourse

3.8.22 Not applicable.

6th Discharge rainwater to a surface water drain

3.8.23 Not applicable.

7th Discharge rainwater to a combined sewer

3.8.24 Not applicable.

4.0 Conclusion

4.1 **It has again been demonstrated that the proposals set out herein present a site drainage strategy incorporating SuDS techniques that is suitable for the site and that will satisfactorily accommodate the proposed development without worsening flood risk for the area or without placing the development itself at risk of flooding, as per National guidance provided within the National Planning Policy Framework (NPPF) 2021, the National Planning Practice Guidance (NPPG), DEFRA's National Standards for Sustainable Drainage, and Local guidance provided in the draft London Plan SI13 Sustainable Drainage and London Borough of Bexley SuDS policies.**

4.2 **If any element of this application is found to be unacceptable or needing improvement, please do not hesitate to contact me as soon as possible so that we may come to a proactive conclusion by way of amendments to the design or further reasonable negotiations prior to a decision being issued.**

Janine R. Mustafa BSc (Hons)
Urban Planning & Design Consultant
Langleys Chartered Surveyors

15th April 2024

Appendix

SuD(S) Strategy for

67 Royal Oak Road, Bexleyheath, DA6 7HQ

LONDON BOROUGH OF BEXLEY
Trusted by Bexley residents

Development Management
Civic Offices, 2 Watling Street,
Bexleyheath, Kent, DA6 7AT
Telephone 020 8303 7777

To: **Vertical Sunrooms Ltd.**
c/o Langleys Chartered Surveyors
Miss J Mustafa
249 Broadway
Bexleyheath
DA6 8DB

TOWN AND COUNTRY PLANNING ACT 1990
TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (ENGLAND) ORDER 2015

GRANT OF PERMISSION TO DEVELOP LAND SUBJECT TO CONDITIONS	Reference Code : **21/02245/FUL**

TAKE NOTICE that Bexley Council, the Local Planning Authority under the Town and Country Planning Acts, **HAS GRANTED PERMISSION** for the development of land situated at :

67 Royal Oak Road
Bexleyheath
Kent
DA6 7HQ

For Erection of a 3 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping.

Referred to in the application for permission for development received on 12th July 2021.

SUBJECT TO THE CONDITIONS as attached.

Date of Decision: 5th October 2021

R. Lancaster
Head of Development Management

LONDON BOROUGH OF BEXLEY
Trusted by Bexley residents

Reference Code :

21/02245/FUL

CONDITIONS AND REASONS

1 The development hereby permitted shall be begun not later than three (3) years beginning with the date on which the permission is granted.

Reason: To comply with the requirements of Section 91 of the Town and Country Planning Act 1990 (as amended by the Planning and Compulsory Purchase Act 2004) to prevent the accumulation of unimplemented planning permissions.

2 The development hereby permitted shall only be carried out in accordance with the following approved plans and documents:
Plans:
Site Location Plan; DRAW/67-ROR/0721/001; DRAW/67-ROR/0721/003; DRAW/67-ROR/0721/004; DRAW/67-ROR/0721/005; DRAW/67-ROR/0721/006; DRAW/67-ROR/0721/007

Reason: For the avoidance of doubt and in the interests of good planning.

3 Prior to commencement of the development (excluding demolition and below ground works), a scheme for a Sustainable Drainage System in accordance with the Bexley Sustainable Drainage Design and Evaluation Guide (2018) shall be submitted to and approved in writing by the Local Planning Authority. The submitted scheme shall include details of:
i. How reduction in surface water runoff to the greenfield runoff rate shall be achieved;
ii. Calculations to demonstrate that the proposed system is fit for purpose, including correctly sized attenuation and surface water discharge rates;
iii. Installation of petrol/oil interceptors as necessary;
iv. Distribution of foul water flows into the surrounding sewer network as necessary;
v. Installation of rainfall attenuation units for capturing and reusing water;
vi. Information about the design storm period and intensity, the method employed to delay and control surface water discharged from the site and measures taken to prevent pollution of the receiving groundwater and/or surface waters;
vii. Include a timetable for its implementation; and
viii. Provide a management and maintenance plan for the lifetime of the development.

The Scheme must demonstrate how the drainage hierarchy set out in London Plan Policy SI13 has been followed:
* 1st Store rain water for later use;
* 2nd Use infiltration techniques, such as porous surfaces in non-clay areas;
* 3rd Attenuate rainwater in ponds or open water features for gradual release to a watercourse;
* 4th Attenuate rainwater by storing in tanks or sealed water feature for gradual release to a watercourse;
* 5th Discharge rainwater direct to watercourse;
* 6th Discharge rainwater to a surface water drain; and
* 7th Discharge to the combined sewer

The development shall only be carried out in accordance with the approved details.

Reason: To ensure that the site is sustainably drained. These details are required at an early stage to ensure the drainage measures are factored into the build process.

4 The development shall be carried out in full accordance with the materials and finishes with the details contained within the submitted Schedule of Materials and Finishes SMF/67.ROR/0721 being:
Red stock brickwork and ivory render and red plain concrete tiles, white frames to windows, concrete block permeable paving system, concrete block kerbing, red brick for dwarf/boundary/retaining walls, coping stone for boundary walls, white fascias, white soffits, white gutters and down pipes, close boarded fencing

Reason: To ensure the satisfactory external appearance of the development.

5 Prior to occupation of the development hereby approved, details of bird nesting boxes/bricks to be incorporated into the development shall be submitted to and approved in writing by the Local Planning Authority.

Bird nesting boxes/bricks should be suitable for urban living bird species. The details shall include the exact location, number specification and design of the habitats.

The boxes/bricks shall be installed within the development in accordance with the approved details, prior to the first occupation of the building to which they form part or the first use of the space in which they are contained and shall be maintained as such thereafter.

Reason: To ensure the development provides the maximum possible provision towards creation of habitats and valuable areas for biodiversity.

6 The use of the land for vehicle parking shall not be commenced until the area has been laid out, surfaced and drained in accordance with details first submitted to, and approved in writing by, the Local Planning Authority and shall be permanently maintained and available for such use thereafter.

Reason: To ensure a satisfactory standard of development and highway safety.

7 Prior to occupation detailed arrangements shall be agreed with the Local Planning Authority and put in place to ensure that, with the exception of disabled persons, no resident or business of the Development may obtain a parking permit within the " Bexleyheath Town Centre" Controlled Parking Zone at any time.

Reason: In the interests of the amenities of the locality.

8 The landscaping details submitted in the supporting Landscaping Details document PN.03/67.ROR/0721 and Block Plan shall be carried out in the first planting and or seeding season following the first occupation of the dwelling or the practical completion of the development whichever is the sooner. The new planting shall comply with the requirements specified in BS 3936 (1992) 'Specification of Nursery Stock Part 1 Trees and Shrubs', and in BS 4428 (1989) 'Recommendations for General Landscape Operations'. None of the new trees, plants or shrubs planted shall be lopped or topped within a period of five years from the completion of the development.

Any trees, plants or shrubs, which, within a period of five years from the practical completion of the development die, are removed, or become seriously damaged or

diseased, shall be replaced in the next planting season with others of a similar size and species to those originally planted.

The approved landscaping scheme shall be maintained in accordance with the approved maintenance plan in perpetuity.

Reason: In the interest of the visual amenities of the locality and the amenity of future occupiers of the development.

9 The refuse storage arrangements detailed in the submitted document Refuse and Recycling Storage and Collection Strategy shall be installed before the development is first occupied and shall be permanently maintained thereafter.

Reason: In order to provide adequate refuse storage facilities and in the interests of the visual amenities of the area.

10 The cycle storage facility detailed in the submitted Parking Provision document and shown the approved Block Plan shall be installed before the development is first occupied and shall be permanently maintained as such thereafter.

Reason: To ensure a satisfactory standard of development and to promote the use of sustainable modes of transport.

11 The fire safety arrangements detailed in the submitted document Planning Design and Access Statement shall be installed before the development is first occupied and shall be permanently maintained thereafter.

Reason: In order to provide fire safety measures within the new dwelling, to comply with the requirements of London Plan (2021) policy D12 (Fire Safety).

12 The access to the parking area shall be provided with those parts of 2.4m x 2.4m pedestrian visibility splays which can be accommodated within the site in both directions and shall be maintained free of all obstacles to the visibility between heights of 0.6m and 2.0m above the level of the adjoining highway.

Reason: In the interests of highway safety.

13 If any unforeseen contamination is encountered at the development site a risk assessment of the potential contamination should be carried out by a suitably qualified person. The risk assessment will enable a scheme to deal with the contamination to be submitted to and approved in writing by the Local Planning Authority. The remediation scheme will be implemented to the satisfaction of the Local Planning Authority and a completion report provided.
Where no contamination is identified during construction then a signed verification report to confirm this should be submitted to and approved by the Local Planning Authority.

Reason: To ensure that risks from land contamination to the future users of the land and neighbouring land, together with those to controlled waters, property and ecological systems, are minimised and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other off-site receptors.

14 All of the dwellings shall comply with Building Regulations Optional Requirement Approved Document M4 (2) Category 2: Accessible and adaptable dwellings (2015 edition).

Evidence of compliance shall be notified to the building control body appointed for the development in the appropriate Full Plans Application, or Building Notice, or Initial Notice to enable the building control body to check compliance.

Reason: In order to ensure that the development provides (or can be adapted to provide) satisfactory accommodation for people with a wide range of needs.

15 The window in the eastern elevation of the dwelling at first floor hereby approved shall be fitted with glass that has been obscured in the manufacturing process to Pilkington level 3 or higher (or equivalent) and shall be permanently fixed non-openable below a height of 1.7m above the finished floor level of the room it serves, and shall thereafter be maintained as such.

The obscured glazing shall be an integral part of the manufacturing process and not a modification or addition made at a later time, such as a film adhered to the glass. The windows shall thereafter be retained as such.

Reason: To protect the amenities and privacy of the neighbouring properties.

16 Prior to occupation of the development, the development shall comply with Building Regulations Optional Requirement Approved Document G2 - Water efficiency (2015 edition).

Prior to occupation evidence of compliance shall be notified to the building control body appointed for the development in the appropriate Full Plans Application, or Building Notice, or Initial Notice to enable the building control body to check compliance.

Reason: In the interest of sustainable development.

INFORMATIVES :-

1 The implementation of this planning permission will require the assignment of a postal number(s). The Council, as the Local Street Naming and Numbering Authority, are responsible for approving new road names, assigning postal numbers and entering the information on the National Land & Property Gazetteer, a national database of address information. An application must be submitted to the Council at the earliest opportunity, to ensure that any new number(s) are assigned before the development is occupied. A fee will be required for this service (see Bexley Council's web site for details or telephone 0203 045 5884).

2 The applicant should be aware that this development is liable for both the Mayoral Community Infrastructure Levy and the London Borough of Bexley's Community Infrastructure Levy (CIL). Before the implementation of this planning permission someone will need to assume Liability for any CIL Charge for the development. Therefore the Council's CIL Administration Officer should be contacted at the earliest opportunity, to discuss what is required and to ensure that the correct process is followed. Contact in the first instance can be made by email to CIL.AdminTeam@bexley.gov.uk or by
telephone to 020 3045 5912.
Please note: - any failure to follow the correct process can lead to surcharges being applied to any CIL Charge due and subsequent legal proceedings can be taken including the issuing of a CIL Stop Notice.

3 The responsibility to properly address contaminated land issues, including safe development and secure occupancy, and irrespective of any involvement by this Authority, lies with the owner/developer of the site. The applicant/developer is requested to contact the Councils Environmental Protection Team (Tel: 020 3045 5629) as soon as is practicable should

unexpected contamination be encountered during the development of the site

PLEASE NOTE

In dealing with this planning application, Bexley Council has worked with the applicant in a positive and proactive manner, in accordance with the requirements of paragraphs 186 & 187 of the National Planning Policy Framework, to seek solutions to problems where practicable. Detailed advice is available in the form of the Council's Development Plan as well as in the Mayor of London's and Bexley Council's Supplementary Planning Documents and Guidance. The Council also offers a full pre-application service that is available to all applicants to assist in formulating their proposals.

APPEALS

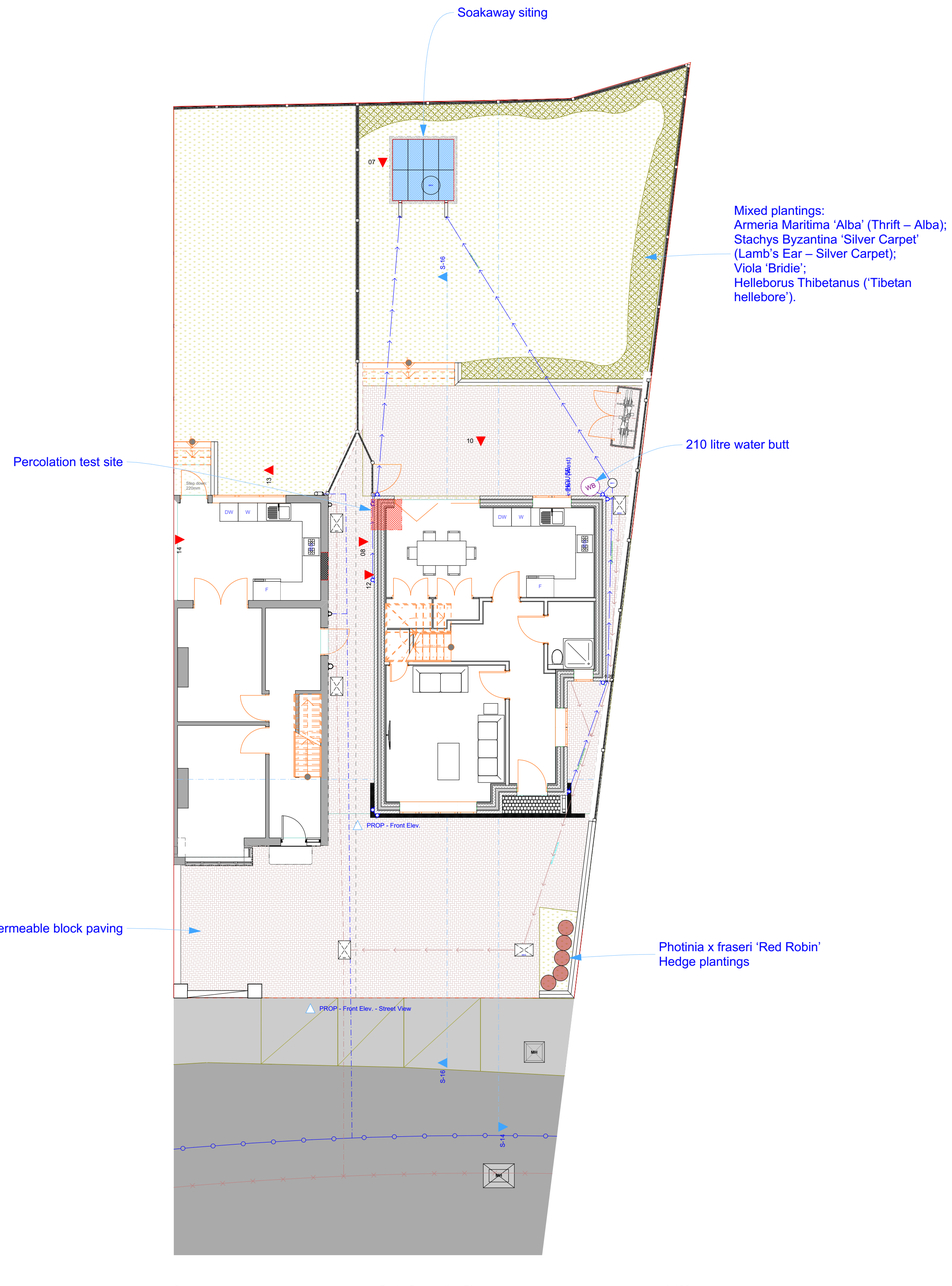
If you are aggrieved by the decision of your local planning authority to refuse permission for the proposed development or if granted subject to conditions, then you can appeal to the Secretary of State. More details of the time limits for appeals and how you go about appealing along with Purchase Notices can be found on the following websites:

https://www.gov.uk/government/organisations/planning-inspectorate

https://www.planningportal.co.uk/info/200207/appeals

APX 2

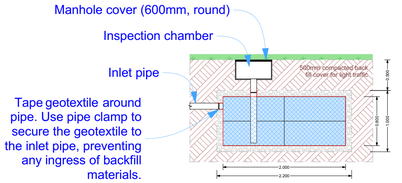
LEGEND Drainage	
	Existing Public Sewer: Foul Water
	Existing site connections to public foul sewer
	Proposed new site foul drain runs
	Existing Public Sewer: Surface Water
	Existing site connections to surface water sewer
	Proposed new site surface water drain runs
	Existing Public Sewer: Combined Water
	Existing site connections to public combined sewer
	Proposed new site connections to public combined sewer
	Water main
	Proposed new connection to water main
MH	Existing manhole
MH	Proposed manhole
WB	Rainwater Butt



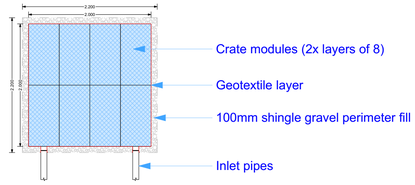
A. Crate Soakaway

A soakaway made up of 16x geocellular crates (measuring 1m x 500mm x 400mm) will be sited in the rear garden. These will be set in 2 layers of 8 crates in a 2.2mx2.2mx1.4m deep pit with 100mm of shingle coating each side.

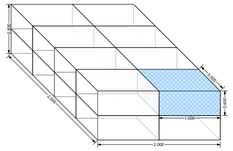
FRONT VIEW 1:50



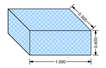
TOP VIEW 1:50



16x geocellular crates modules, as they are to be arranged



One crate module



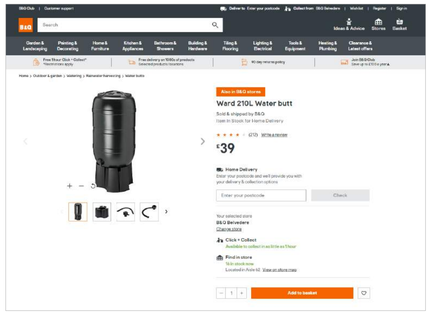
B. Domestic Water Butt

A rainwater storage butt with minimum capacity of 210 litres is to be connected to downpipes at the rear of the dwellinghouse, within the patio of the large rear garden.

The proposed product is the **Ward 210L Water Butt** (B&Q listing, June 2023), shown *right*.

Source:

Ward 210l Water Butt: https://www.diy.com/departments/ward-210l-water-butt/405866_BQ.prd?storeId=1139&&&&&ds_rl=1272379&ds_rl=1272409&ds_rl=1272379&gclid=Cj0KCQjw7aqkBhDPARIsAKGa0oJjAPwxplBuJVvP0LYKrVKAknuMWcwXN6wuvdWqv1qwwosiGMajK9MaApYOEALw_wcB&gclsrc=aw.ds (accessed July 2023)



C. Permeable Block Paving & Hard Surfacing

All proposed outdoor patio, driveway and pathway areas will be surfaced with a permeable block paving system, including the existing hard-surfaced driveway to no.67 which will be broken up and re-paved with the same system.

These areas will be underlain with a permeable bedding aggregate onto which traditional style concrete block paving will be laid, with a permeable jointing aggregate swept into the gaps between them. The favoured block paving system is Bradstone Driveway Infilta Block Paving in Autumn, or an equivalent product.

A low level block kerb will edge the hedging at the front of the site such as Bradstone Block Kerb Large in Charcoal, or an equivalent product.

Sources:

Bradstone Driveway Infilta Block Paving in Autumn: https://www.simplypaving.com/products/driveway-block-paving/permeable-block-paving/bradstone-driveway-infilta/autumn/ (accessed July 2023)

Bradstone Block Kerb Large in Charcoal: https://www.simplypaving.com/products/driveway-block-paving/permeable-block-paving/bradstone-driveway-infilta/autumn/ (accessed July 2023)

Fig. 1

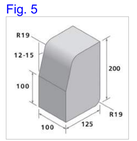
Fig. 2

BRADSTONE DRIVE INFILTA BLOCK PAVING (AUTUMN)

Fig. 3

Fig. 4

Fig. 5



BRADSTONE BLOCK KERB (CHARCOAL)

D. Plantings

The gardens belonging to the new house will be planted with a mixture of predominantly evergreen plants to intercept rainwater.

A line of Photinia x fraseri 'Red Robin' (evergreen hedge) will be planted along the front western boundaryline, screening the refuse storage area. This hardy species thrives in all soil types and shade conditions with an average growth rate of up to 40cm per year and a height that is easily maintained between 1-4m (2m max height is preferred).

4 species of shrub and flowering plants are proposed to be planted within the rear garden, along all three boundaries, as set out in the table below. All have been selected for their ability to thrive in sandy soil and borders that are either completely exposed to sunlight (per the side borders) or partially shaded (per the back border).

Fig. 6

Fig. 7

FRONT PLANTINGS

REAR PLANTINGS

Figs. 6 & 7: Photinia x fraseri 'Red Robin' Hedge

Fig. 8: Armeria Maritima 'Alba' (Thrift – Alba); Evergreen, flowering in spring and summer / Ultimate Spread: 0.5m / Ultimate Height: 0.5m / Hardiness: H5 / Pollinator

Fig. 9: Stachys Byzantina 'Silver Carpet' (Lamb's Ear – Silver Carpet); Evergreen / Ultimate Spread: 1m / Ultimate Height: 0.5m / Hardiness: H7 / Pollinator

Fig. 10: Viola 'Bridie'; Evergreen, flowering in summer and autumn / Ultimate Spread: 0.5m / Ultimate Height: 0.5m / Hardiness: H5 / Pollinator

Fig. 11: Helleborus Thibetanus ('Tibetan hellebore'); Deciduous, flowering in spring / Ultimate Spread: 0.5m / Ultimate Height: 0.5m / Hardiness: H5 / Pollinator

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Scale (Metres)

1 : 100 — 0 1 2 3 4 5 6 7 8 9 10

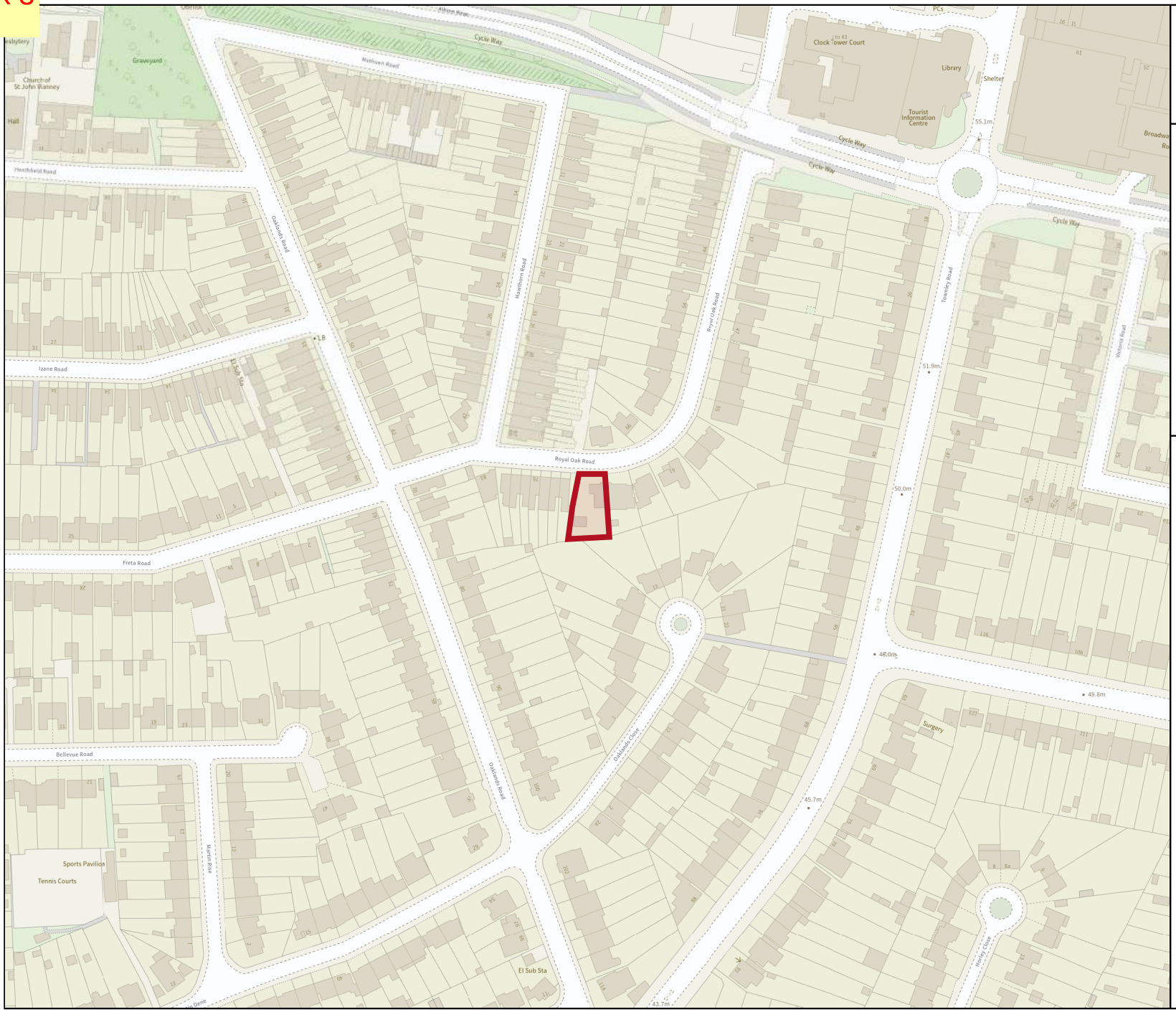
1 : 50 — 0 1 2 3 4 5

LANGLEYS CHARTERED SURVEYORS

LANGLEY HOUSE, 249 BROADWAY, BEXLEYHEATH, KENT DA6 8DB

Drawn By: Miss. Janine R. Mustafa BSc Hons
janine@langleyscs.co.uk

Site Address	Drawing Type	Proposal	Drawing Description	Revision Number	For the Client:	NOTES
67 Royal Oak Road Bexleyheath, Bexley, Kent DA6 7HQ	PLANNING	Approval of details pursuant to condition 3 (SuDS) of planning consent 21/02245/FUL.	Proposed Drain Connection and SuDS Management Plan Drawing	N/A	Mr. K Mustafa	
Project Reference	**Drawing Reference**		**Scale** / **Date**	**Revision Date**	**Local Authority**	
DRAW / 67.ROR / 0721.01	DRAW / 67.ROR / 0721 / 009		1:50 / 1:100 @ A1 Or as specified below each drawing / 18 / 07 / 2023	N/A	The London Borough of Bexley	



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
548872/174973

Scale
1:2500

Created
20 Jul 2023 10:37

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

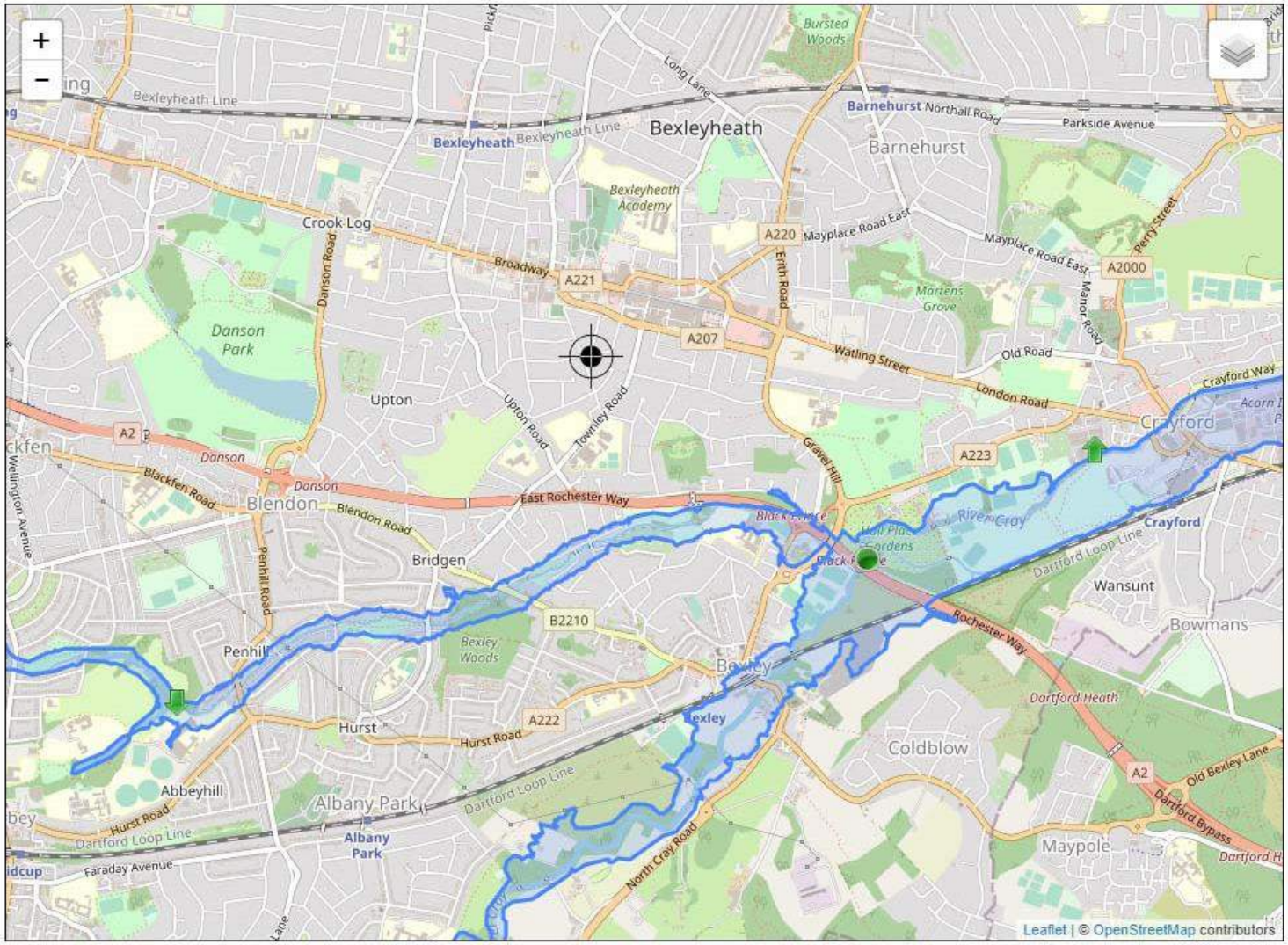
Page 2 of 2

67 Royal Oak Road (black point) in relation to the Rivers Shuttle and Cray (blue)

Environment Agency, Obtained 10.06.23

The area bounded in blue on the map shows the area covered by flood alerts and warnings for Shuttle and Cray.

Icons on the map show nearby level monitoring stations. They are not necessarily related to this particular flood warning area.



Note: the area shown on the map is the area covered by flood alerts and warnings. It is not a live map of current flooding. The area covered broadly equates to the area where the risk of flooding in any year is greater than 1% (the "hundred year" flood risk).

Long Term Flood Risk: Flood risk from rivers or the sea (Extent of Flooding)

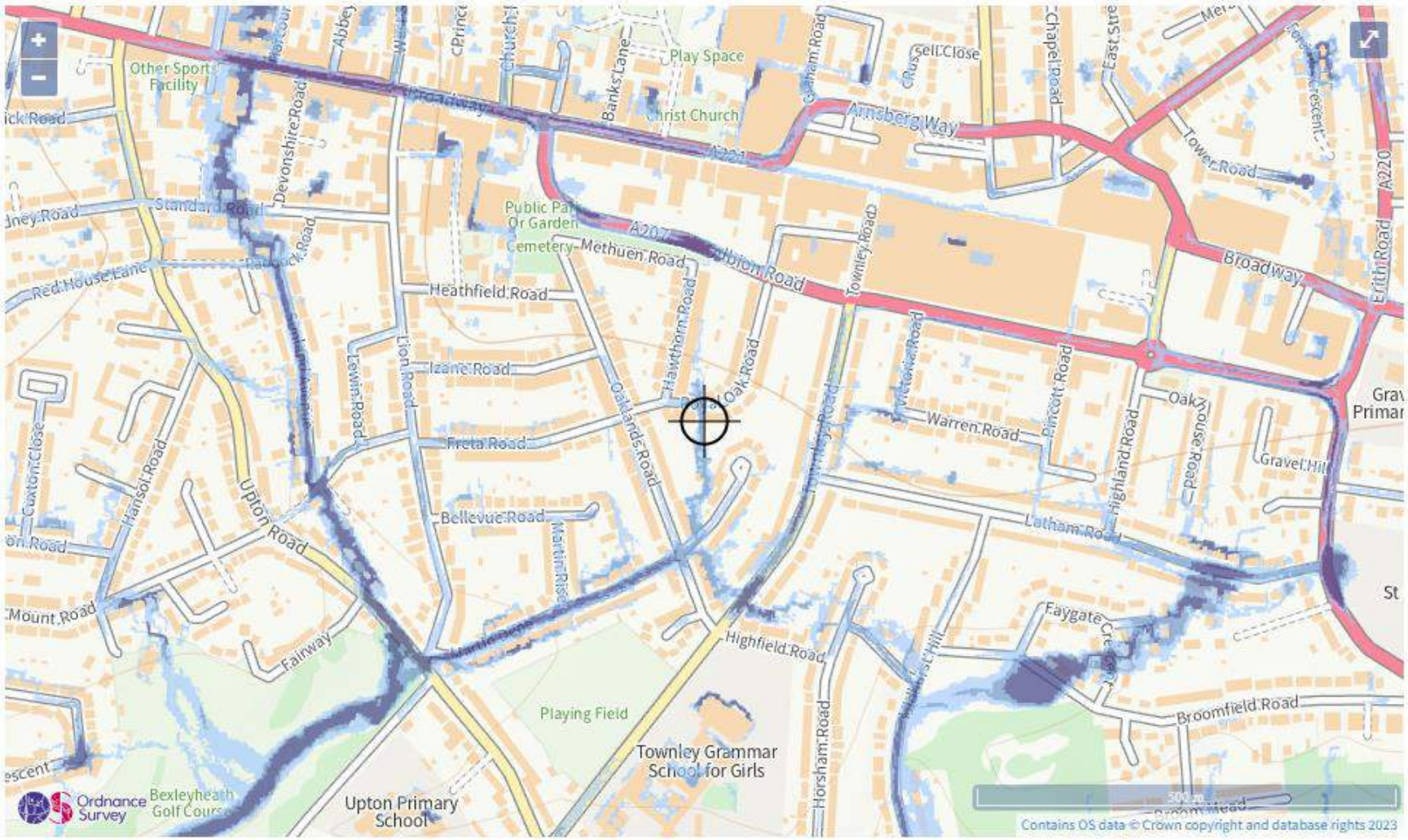
Environment Agency, Obtained 18.07.23

Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

Long Term Flood Risk: Flood risk from surface water (Extent of Flooding)

Environment Agency, Obtained 18.07.23

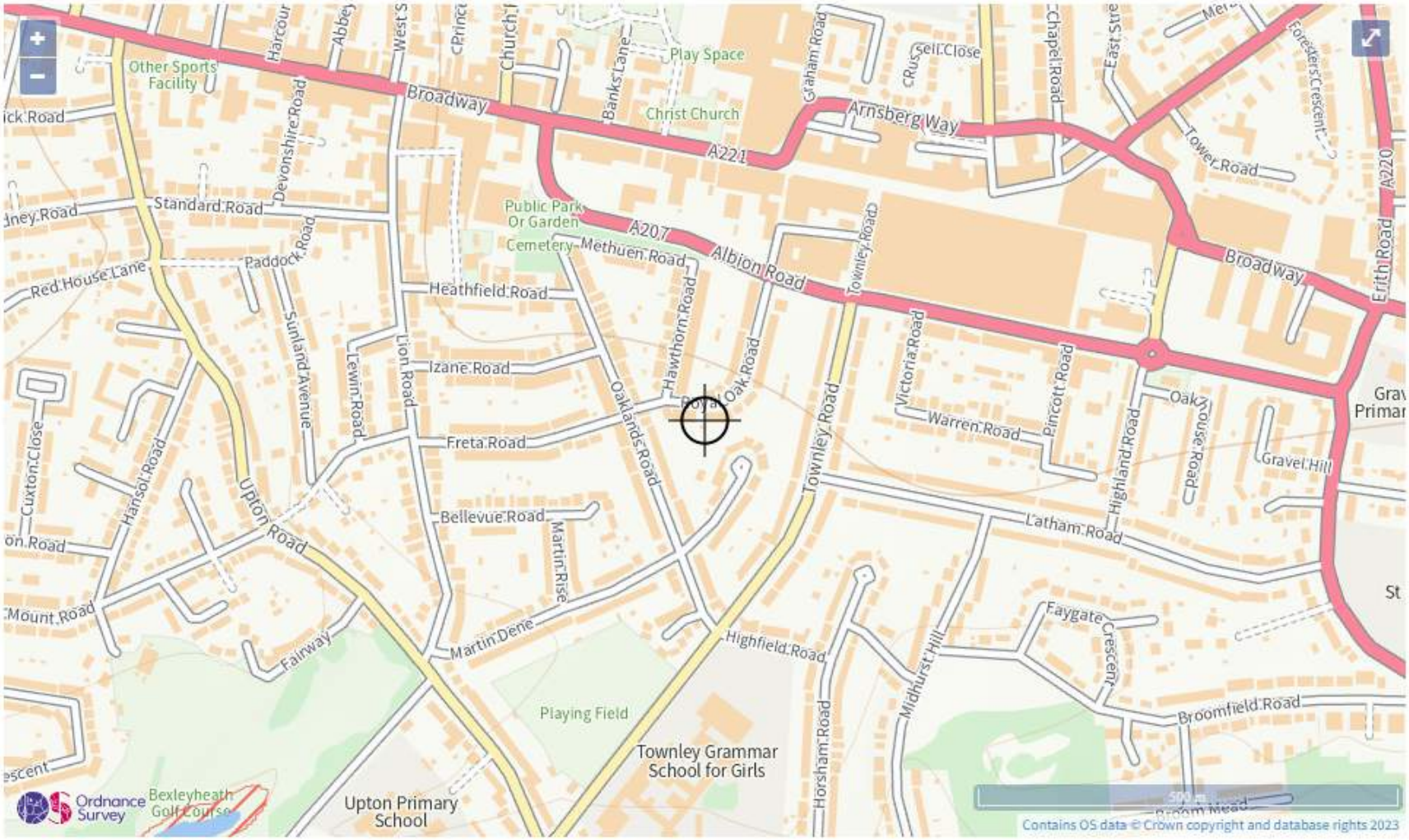


Extent of flooding from surface water

High Medium Low Very low Location you selected

Long Term Flood Risk: Flood risk from sewers (Extent of Flooding)

Environment Agency, Obtained 18.07.23



Maximum extent of flooding from reservoirs:

when river levels are normal when there is also flooding from rivers Location you selected

hr wallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Janine Mustafa
Site name:	67 Royal Oak Road
Site location:	Bexleyheath

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:	51.45427° N
Longitude:	0.14114° E
Reference:	2491152527
Date:	Jul 11 2023 11:11

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	0.1

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	14
BFI / BFIHOST:	0.702
Q_{MED} (l/s):	0.09
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	599	599
Hydrological region:	7	7
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.

APX 8

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.1	0.1
1 in 1 year (l/s):	0.09	0.09
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):	0.38	0.38

LANGLEYS CHARTERED SURVEYORS

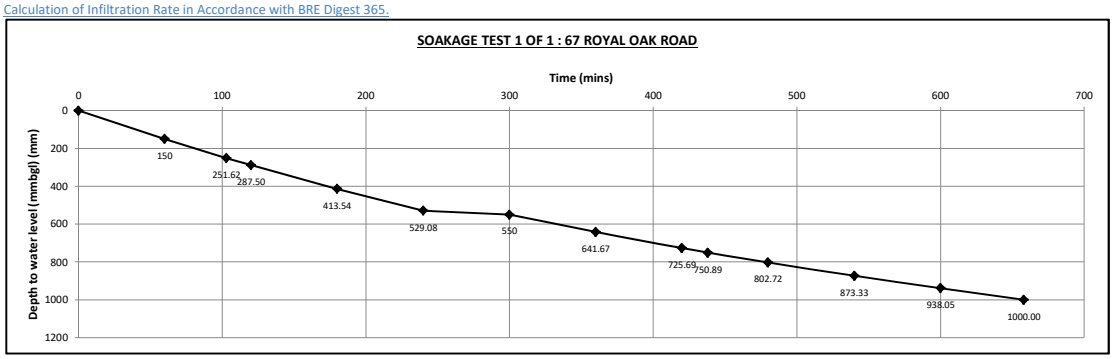
PERCOLATION TEST

Completed by: JRM
Test Date: 23-06-23
Datasheet No.: 1

PROJECT REF:	67.ROR/0424
PROJECT:	67 Royal Oak Road, Bexleyheath, Bexley, Kent DA6 7HQ
DOC REF:	SUDS.D1/67.ROR/0424
APPLICATION:	PART-RETROSPECTIVE Erection of a 4 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping (enlargement of the implemented 3 bedroom dwellinghouse permitted under planning application 21/02245/FUL).

SOAKAGE TEST RESULTS

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where f= using:

VP75-25	VP75-25 =	Volume outflowing between 75% and 25% of effective depth.
ip50 x tp75-25	ap50 =	Mean surface area through which the outflow occurs.
	tp75-25 =	Time for the outflow between 75% and 25% of the effective depth.

100% percolation occurred within:
10.97 Hours
658 Minutes

VP75-25 =	0.56	m^3
ap50 =	0.44	m^2
tp75-25 =	335	min

Reference: Handbook of Geotechnical Investigation & Design Tables (Look, 2007)

Permeability Guideline (m/s): Typical Permeabilities of Soils

Soil Type	Description	Permeability (k) (equivalent rainfall rate)	Suitability
Cobbles and Boulders	Permeability may be greater as flow may be turbulent	1 m/s	Excellent
Gravels	Uniformly graded coarse aggregate with zero fines and minimal sand	10^{-1} to 10^{-2} m/s (>3600 mm/hr)	Very Good
Gravel Sand Mixtures	Clean, well graded, with minimal fines (e.g. crushed stone or 'Type 3' road aggregate	10^{-3} to 10^{-4} m/s (3600 to 360 mm/hr)	Good
Clean Sands	Sands with low silt or clay content	10^{-4} to 10^{-6} m/s (360 to 3.6mm/hr)	Good to moderate
Silt Mixtures	Mixtures of sand, silt and clay (topsoil is typically in this category)	10^{-6} to 10^{-10} m/s (<3.6mm/hr)	Moderate to poor
Clays	Pure clays	10^{-10} to 10^{-12} m/s	Practically Impermeable
Artificial	Bituminous mixtures, cement stabilised soil, geosynthetic liners	$<10^{-12}$ m/s	

General Geological Profile:

1 The HR Wallingford Greenfield Runoff Estimation tool has identified that the site has a soil classification level of 1. Soil type 1 has the highest potential rainwater 'storage' volume capacity and overall permeability and lowest winter run-off potential of all FEH Soil Types

2 The British Geological Survey's Geology Viewer has identified that the site is underlain with Harwich Formation Sand (sand and gravel). This typically varies from a high to medium level of permeability dependant on the degree of clay content found in it.

Soil Infiltration Rate (f) =			
0.0089	m^3/m	8.8632	l/m
0.0001	m^3/s	0.1477	l/s

Site Permeability Level Found

0.0001 m^3/s

10^{-4} **Good to moderate (clean sands)** - highest permeability for this level.

SOAKAGE TEST DATA SHEET

Trial Pit Dimensions (m)		
Width	Length	Depth to Base
1	1	1
Trial Pit Volume		
	m3	litres
Water fill	1	1000

SAMPLE 1 Start Conditions		
Date	Friday 23rd June 2023	Data collected by Mr. E Tola of Milestone Groundworks
Time	11:00 hrs	
Temparature	24 °C (outdoor)	
Weather	Dry, very light breeze	

Time		Depth to water level (mmbgl)	Volume Drained	Remaining Volume			Discharge Rate
Hr	Mins	(mm)	%	(litres)	(m3)		l/m
11:00 AM	0	0	0	1000	1.00	*RECORDED ON SITE | E. TOLA | 23.06.23*	N/A
12:00 PM	**60**	150	**15**	850	0.85	*RECORDED ON SITE | E. TOLA | 23.06.23*	**2.50**
12:43 PM	**103**	251.62	25.16	748.38	0.75	Extrapolated assuming constant dissipation rate of -10.4%/hr	2.35
1:00 PM	120	287.50	28.75	712.50	0.71	Extrapolated assuming constant dissipation rate of -10.4%/hr	2.29
2:00 PM	180	413.54	41.35	586.46	0.59	Extrapolated assuming constant dissipation rate of -10.4%/hr	2.10
3:00 PM	240	529.08	52.91	470.92	0.47	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.93
4:00 PM	**300**	550	**55**	450	0.45	*RECORDED ON SITE | E. TOLA | 23.06.23*	**1.67**
5:00 PM	360	641.67	64.17	358.33	0.36	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.53
6:00 PM	420	725.69	72.57	274.31	0.27	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.40
6:18 PM	**438**	750.89	75.09	190.28	0.19	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.37
7:00 PM	480	802.72	80.27	197.28	0.20	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.28
8:00 PM	540	873.33	87.33	126.67	0.13	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.18
9:00 PM	600	938.05	93.80	61.95	0.06	Extrapolated assuming constant dissipation rate of -10.4%/hr	1.08
9:58 PM	**658**	1000.00	100.00	0.00	0.00	Extrapolated assuming constant dissipation rate of -10.4%/hr	0.00
	Total volume:	**1000**				**Infiltration rate was extrapolated assuming a constant rate of dissipation**	

Discharge Rate at 1st Site Measurement	2.5	l/m
Discharge Rate at 2nd Site Measurement	1.67	l/m
No. Hours between measurements	4	hrs
No. Minutes between measurements	240	mins
By 2nd measurement, discharge rate reduces to this	66.7%	percent
Discharge rate reduction (240 minute)	33.3%	percent
Equivalent reduction 1 HOUR (60 minute)	8.3%	percent

∴ data may be extrapolated assuming a reduction in discharge rate of 33.3% every 240 minutes (4 hrs), or 8.3% per hour.

LANGLEYS CHARTERED SURVEYORS

IMPERMEABLE & PERMEABLE SURFACES

Completed by: JRM
Datasheet No.: 2

PROJECT REF:	67.ROR/0424
PROJECT:	67 Royal Oak Road, Bexleyheath, Bexley, Kent DA6 7HQ
DOC REF:	SUDS.D2/67.ROR/0424
APPLICATION:	PART-RETROSPECTIVE Erection of a 4 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping (enlargement of the implemented 3 bedroom dwellinghouse permitted under planning application 21/02245/FUL).

RATIO OF PERMEABLE TO IMPERMEABLE SURFACES

Total Site Area: 442.013 m^2

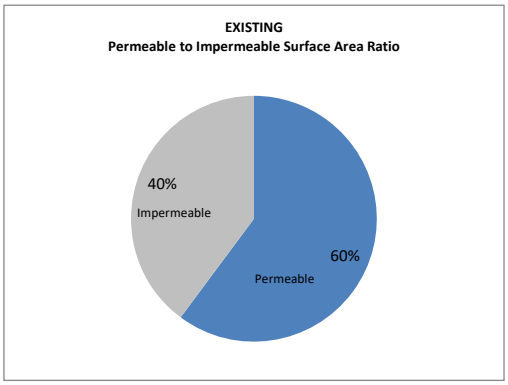
Existing

Permeable Surfaces

	Description	area (m^2)	% of site	Area sustainably drained (m^2)
1	Rear and Side Garden	266.01	60.2%	266.01
2	n/a			
3	n/a			
4	n/a			
5	n/a			
	TOTAL:	**266.01**	**60.2%**	**266.01**

Impermeable Surfaces

	Description	area (m^2)	% of site	Area sustainably drained (m^2)
1	Roof - house (67 Royal Oak Rd) (GEA)	59.26	13.4%	0.00
2	Steps up to house (concrete)	3.37	0.8%	0.00
3	Driveway (incl. garden walls)	65.02	14.7%	0.00
4	Roof - Outbuilding (GEA)	37.88	8.6%	0.00
5	Roof - Garage	10.48	2.4%	0.00
	TOTAL:	**176.00**	**39.8%**	**0.00**



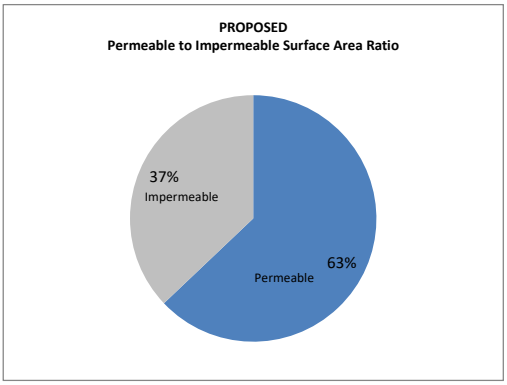
Proposed

Permeable Surfaces

	Description	area (m^2)	% of site	Area sustainably drained (m^2)
1	Rear Gardens (both houses)	142.06	32.1%	142.06
2	Permeable paving (driveways, path, patio)	134.65	30.5%	134.65
3	Front garden planted area	2.82	0.6%	2.82
4	n/a		0.0%	
5	n/a		0.0%	
	TOTAL:	**279.53**	**63.2%**	**279.53**

Impermeable Surfaces

	Description	area (m^2)	% of site	Area sustainably drained (m^2)
1	Roof - house (67 Royal Oak Rd) (GEA)	59.26	13.4%	0.00
2	Steps up to *existing* house (front & rear)	5.88	1.3%	0.00
3	Roof - new house (67a Royal Oak Rd) (GEA)	90.68	20.5%	90.68
4	Steps up to *new* house (rear, garden-patio)	2.20	0.5%	0.00
5	Front garden walls/new retaining walls	6.66	1.5%	0.00
	TOTAL:	**164.68**	**37.3%**	**90.68**



	Area sustainably drained (m^2)		
	area (m^2)	% of site	% runoff
Existing	266.01	60.2%	39.8%
Proposed	370.22	83.8%	16.2%

LANGLEYS CHARTERED SURVEYORS

ATTENUATION AND STORM PERIOD CALCULATIONS

Completed by: JRM
Datasheet No.: 3

PROJECT REF:	67.ROR/0424
PROJECT:	67 Royal Oak Road, Bexleyheath, Bexley, Kent DA6 7HQ
DOC REF:	SUDS.D3/67.ROR/0424
APPLICATION:	PART-RETROSPECTIVE Erection of a 4 bed detached dwellinghouse with associated car and cycle parking provision, refuse storage and landscaping (enlargement of the implemented 3 bedroom dwellinghouse permitted under planning application 21/02245/FUL).

ATTENUATION AND RETURN PERIOD CALCULATIONS

GREENFIELD RUNOFF RATES		
Site Conditions		
Q_{BAR} (HR Wallingford)	0.1	l/s
Percolation Test	0.14772056	l/s
Storm Events		
1 in 1 year return period	0.09	l/s
1 in 30 year return period	0.23	l/s
1 in 100 year return period	0.32	l/s
1 in 200 year return period	0.38	l/s

RESULT SUMMARY			
1 in 30 year return period design			Are Calculated Volumes (A) and (B) more or less than capacity to be provided?
6 hour	Critical Duration		
Minimum attenuation volume required:			
A:	3.8625	m^3	0.35 m^3
			MORE THAN REQUIREMENT
Actual likely maximum volume FILL:			
B:	1.7772	m^3	2.43 m^3
B: incoming volume (m^3 / l^3) - dispersed volume (m^3 / l^3) (percolation test result)			MORE THAN REQUIREMENT
			SYSTEM PASSES

Attenuation Features Proposed

Description	Dimensions			Capacity (m^3)	No. Units	Capacity	
	Length (m)	Width (m)	Height (m)	1 unit		(m^3)	(l^3)
Soakaway	1	0.5	0.40	0.20	20	4.00	4000
Water Butt	n/a	n/a	n/a	n/a	1	0.21	210
					TOTAL:	4.21	4210

A. Crate System Soakaway Attenuation Requirement

Roof Area (footprint)
90.68 m^2
UK Hydrological Region
7
SAAR
586.00 mm
0.586 m
Annual average rainfall
0.000586 m^3

1 in 1 year return period design		
50mm rainfall rate per hr	Divider	Attenuation Requirement
50 m^3	3000	1.5114 m^3
50000 l^3		1511.4000 l^3

1 in 30 year return period design			
50mm rainfall rate per hr	Divider	Multiplier	Attenuation Requirement
50 m^3	3000	2.56	3.8625 m^3
50000 l^3		*30yr return; 2.56x greater than 1:1yr*	3862.4667 l^3

Where ground has good soakage (such as sand/gravel) then the size/volume of a crate type soakaway can be calculated as follows:

Volume = Roof area being drained x (50mm rainfall rate per hr/3000).

B. Water Incoming/Dispersal Analysis: a more accurate calculation of attenuation requirement

1 in 1 year return period design						Notes
per:	1 second	1 minute	1 hour	3 hour	6 hour	Water disperses faster than incoming rate. Water routed to the **soakaway** will disperse into the ground almost immediately (no attenuation).
incoming m^3	0.00009	0.0054	0.324	0.972	1.94	
dispersed (m^3)	0.0001	0.009	0.532	1.595	3.191	
incoming/ dispersed (m^3)	-0.0001	-0.0035	-0.2	-0.6	-1.2	
incoming l^3	0.090	5.400	324.0	19440.0	1166400.0	
dispersed (l^3)	0.148	8.863	531.8	31907.6	1914458.5	
incoming/ dispersed (l^3)	-0.148	-8.9	-531.5	-31906.7	-1914456.6	

1 in 30 year return period design						Notes
per:	1 second	1 minute	1 hour	3 hour	6 hour	Taking into account the known dispersal rate, the combined capacities of the **soakaway and water butt** provides 1.8m^3 / 1066342 l^3 capacity over the attenuation requirement for the 1:30 year 6hr critical duration and is therefore acceptable.
incoming m^3	0.00023	0.0138	0.828	2.484	4.97	
dispersed (m^3)	0.0001	0.009	0.532	1.595	3.191	
incoming/ dispersed (m^3)	0.0001	0.0049	0.3	0.9	1.8	
incoming l^3	0.230	13.800	828.0	49680.0	2980800.0	
dispersed (l^3)	0.148	8.863	531.8	31907.6	1914458.5	
incoming/ dispersed (l^3)	0.082	4.9	296.2	17772.4	1066341.5	

Return periods, probability of occurrence and critical durations

*The **return period** of a rainfall event is the average time between events of a given or greater magnitude, usually expressed in years. A 100-year return period event refers to an event that occurs or is exceeded on average once every hundred years. This can also be expressed as the 1 in 100 or 1:100 year event. // Alternatively, an event can be described as having a **probability of occurrence** (or frequency of occurrence), which is 1/return period but often expressed as a percentage. For a 1:100 year event, this would be 1%, ie there is a 1% change of the event occurring or being exceeded in any one year. // Estimates of return periods are subject to uncertainty, so, in reality, consecutive events can occur at intervals greater or smaller than their average return period. A 1:1 year event refers to an event that has a 100% change of occurring in any one year, and thus could be interpreted as a range of events beneath a certain threshold. However, for the purpose of these standards, when referring to a 1:1 year event, this should be taken as meaning an event occurs, on average, once a year. // The **critical duration** is the duration of rainfall event for a specified return period event (usually given in hours) that results in the greatest peak flow rate, flood volume or flood level (depending on the purpose of the analysis) at a particular location. It will be different for different locations on a site.*

Reference: CIRIA SuDS Manual 2015, page 44. Box 3.1.

SuDS capacity Design

The SuDS should be designed so that runoff is completely contained within the designated drainage system for all events up to the specified standard of service for the critical duration event for the system. This level of service will normally be **1 in 30 years** as a minimum unless otherwise specified or agreed with the planning approval or SuDS approving body.

Reference: CIRIA SuDS Manual 2015, page 47. 3.3.3 Water quality standard 3: Control of on-site flood risk arising from the surface water management system

Critical duration

The critical duration used to assess SuDS design for a 1 in 30 year return period in the UK is typically around **6 hours** as a minimum unless otherwise specified or agreed with the planning approval or SuDS approving body.