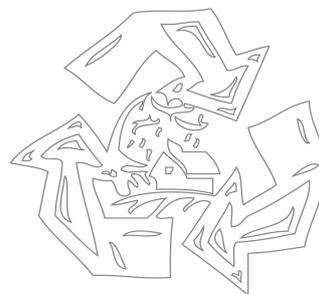


Surface Water Run-off



Issue ID	Description	No. of Credits Available	Mandatory Elements
Sur 1	Management of Surface Water Run-off from Developments	2	Yes

Aim

To design surface water drainage for housing developments which avoid, reduce and delay the discharge of rainfall run-off to *watercourses and public sewers* using SuDS techniques. This will protect receiving waters from pollution and minimise the risk of flooding and other environmental damage in watercourses.

Note: This section will be revised when the National Standards for Sustainable Drainage and associated regulations come into force.

Assessment Criteria*

Criteria		
	Credits	Mandatory Elements
<p>Hydraulic Control Criteria</p> <p>The <i>SuDS Management Train</i> should be used as a guide to achieve the following:</p> <p>1) <i>Peak Rate of Run-off</i></p> <p>If there is no increase in the man-made impermeable area as a result of the new development, then the peak rate of run-off criterion does not apply.</p> <p>Where there is an increase in impermeable area, ensure that the peak rate of run-off over the development lifetime, allowing for climate change, will be no greater for the developed site than it was for the <i>pre-development</i> site. This should comply at the 1 year¹ and 100 year² return period events (see Calculation Procedures).</p> <p>Where the pre-development peak rate of run-off for the site would result in a requirement for the post-development flow rate (referred to as the <i>limiting discharge</i>) to be less than 5 l/s at a <i>discharge point</i>, a flow rate of up to 5 l/s may be used where required to reduce the risk of blockage.</p> <p><i>Note: If as a result of the new development, there is an increase in the volume of run-off discharged for the 100 year 6 hour event and section 2A cannot be met (see section 2 below), these run-off rates do not apply.</i></p>	None	All Levels

continued

* Supplementary guidance will be published by the Welsh Assembly Government to reflect planning policy and practice in Wales. The guidance which will not materially affect the aims and objectives of the Surface Water Run Off requirements of the Code, will be based on Technical Advice Note 15 (TAN 15) which supplements Planning Policy Wales, and surface management techniques currently in force in Wales.

¹ This can also be referred to as the 1 in 1, 1:1 or 100% probability of an event occurring in any year.

² This can also be referred to as the 1 in 100, 1:100 or 1% probability of an event occurring in any year.

	Credits	Mandatory Elements
<p>2) <i>Volume of Run-off</i></p> <p>If there is no increase in the man-made impermeable area as a result of the new development, then the volume of run-off criteria does not apply.</p> <p>If the developed site would otherwise discharge, over the development lifetime allowing for climate change, a greater volume of rainwater run-off than the pre-development site for the 100 year 6 hour event, (see Calculation Procedures) then criterion A applies. If A cannot be satisfied then B applies.</p> <p>A: Ensure that the post development volume of run-off, allowing for climate change over the development lifetime, is no greater than it would have been before the development.</p> <p>The additional predicted volume of run-off for the 100 year 6 hour event must be prevented from leaving the site by using infiltration or other <i>SuDS techniques</i> (see Definitions).</p> <p>OR</p> <p>B: If A cannot be satisfied (full justification must be provided) then reduce the post development peak rate of run-off to the limiting discharge.</p> <p>The limiting discharge is the pre-development flow rate equivalent to the 1-year peak flow rate, mean annual flood flow rate (Qbar) or 2 l/s/ha, whichever is the highest flow rate.</p> <p>For the 1-year peak flow rate the 1 year return period event criterion in section 1 above, applies. For all other events up to the 100 year return period event, the peak rate of run-off for the developed site must not exceed the limiting discharge.</p> <p>Where the limiting discharge flow rate would require a flow rate of less than 5 l/s at a discharge point, a flow rate of up to 5 l/s may be used where required to reduce the risk of blockage.</p> <p><i>Note: Criterion B generally results in more storage than compliance with criterion A.</i></p> <p>3) <i>Designing for local drainage system failure.</i></p> <p>Demonstrate that the flooding of property would not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance).</p> <p><i>Note: Where the run-off is being discharged into an existing drainage system, the responsible body may stipulate a more stringent set of hydraulic flow rate criterion which will therefore take precedence.</i></p>		
<p>Water Quality Criteria</p> <p>1. One credit can be awarded by ensuring there is no discharge from the developed site for rainfall depths up to 5 mm (see Calculation Procedures).</p> <p>2. One credit can be awarded by ensuring that:</p> <ul style="list-style-type: none"> The run-off from all hard surfaces shall receive an appropriate <i>level of treatment</i> in accordance with The SuDS Manual to minimise the risk of pollution. <p><i>Note: The SuDS Manual best practice recommendations should be followed where there is a risk to groundwater from infiltration (for example contaminated land, developments with high risk of pollution incidents)</i></p>	<p>1</p> <p>1</p>	
<p>Default Cases:</p> <p>The mandatory criteria can be deemed to be met by default if the site discharges rainwater directly to a <i>tidal estuary</i> or the sea. Credits cannot be awarded unless the relevant water quality criteria are met.</p>		

Information Required to Demonstrate Compliance

Schedule of Evidence Required	
Design Stage	Post Construction Stage
<p>Mandatory Elements:</p> <p>Statement from the <i>appropriately qualified professional</i> confirming that they are qualified in line with the Code definition.</p> <p>AND</p> <p>The appropriately qualified professional’s report containing all information necessary to demonstrate compliance with the peak rate of run-off and volume of run-off requirements. The report should include:</p> <ul style="list-style-type: none"> • Areas of permeable and impermeable surfaces on the site pre- and post- development <p>Where the impermeable area has increased post development the report should also include:</p> <ul style="list-style-type: none"> • Details of the permeability characteristics of the site pre- and post-development (e.g. infiltration tests etc where appropriate) • Peak rates of run-off (l/s) calculations for the 1 year and 100 year events, pre- and post-development, including an allowance for climate change over the development lifetime • Detailed documentary evidence showing the methods used to reduce the peak rate of run-off to pre-development rates • The pre- development volume of run-off (m³) for the 100 year 6 hour event • The additional volume of run-off (m³) for the 100 year 6 hour event caused by the development without mitigation measures • The additional volume of run-off (m³) with the proposed mitigation 	<p>Mandatory Elements:</p> <p>Written confirmation from the developer or <i>appropriately qualified professional</i> that the solutions designed have been implemented as specified in the design stage evidence</p> <p>OR</p> <p>Where different from the design stage, provide the evidence as listed for the design stage but representing the development as built</p> <p>OR</p> <p>For post construction stage only assessments, provide evidence as listed for the design stage but representing the development as built</p> <p>Evidence must be provided at post construction to confirm that maintenance responsibilities have been defined for any SuDS solutions installed.</p> <p><i>For information: Where SuDS have been implemented, the location and brief explanation of their purpose should be included in the Home User Guide (in Code Category 8: Man 1) where supplied.</i></p> <p>Where more than five years have passed since the Flood Risk Assessment was carried out:</p> <ul style="list-style-type: none"> • Confirmation that the basis of the Flood Risk Assessment has not changed.

- Information to demonstrate that the hierarchical approach to reducing the additional volume of run-off was followed
- Information on the calculation methods used, as well as summary results

AND

A *Flood Risk Assessment* confirming the risk of flooding from all *sources of flooding* (this may be contained within the appropriately qualified professional's report)

AND

Drawings showing the pre-development drainage for the site (natural or constructed)

AND

Drawings showing the proposed drainage solution, system failure flood flow routes, potential flood ponding levels and ground floor levels

AND

Confirmation from the appropriately qualified professional that local drainage system failure would not cause an increase in the risk of flooding within dwellings either on or off site

Where credits are sought:

The appropriately qualified professional's report detailing the design specifications, calculations and drawings to support the awarding of the credit(s)

Where credits are sought:

Written confirmation from the developer or appropriately qualified professional that the solutions designed have been implemented as specified in the design stage evidence

OR

Where different from the design stage, provide the evidence as listed for the design stage but representing the development as built

	OR
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	For post construction stage only assessments, provide evidence as listed for the design stage but representing the development as built
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Definitions

Annual flood probability

The estimated probability of a flood of given magnitude occurring or being exceeded in any year. Expressed as a 1 in x year event. This is the equivalent to 1-in-x, 1:x or x% chance of a flood event occurring in any one year.

Annual flow rate probability

The estimated probability of a flow rate of given magnitude occurring or being exceeded in any year. Expressed as a 1 in x year event. This is the equivalent to 1-in-x, 1:x or x % chance of the flow rate being exceeded in any one year.

Appropriately qualified professional

A professional or team of professionals with the skills and experience to champion the use of SuDS within the overall design of the development at an early stage.

The professional or team of professionals must be capable of understanding the site's particular surface water management needs and opportunities. In addition, they must have knowledge and experience in using SuDS-based solutions to influence the holistic design of a development's drainage system and provide the robust hydraulic design calculations referred to in key guidance documents such as *The SuDS manual* (CIRIA C697, 2007) and *Preliminary rainfall runoff management for developments* (EA/DEFRA, 2007).

Suitable professionals may be found in a variety of disciplines, such as engineering, landscape design or hydrology or a combination.

Geotechnical advisers or specialists may be required for SuDS techniques that allow infiltration.

Brownfield site

Land which is or was occupied by a permanent structure, including the curtilage of the developed land and any associated hard surfaces.

Catchment

The area contributing surface water flow to a drainage point or a point on a watercourse. It can be divided into sub-catchments.

Control devices

Any drainage structure or unit designed to control the runoff of stormwater.

Examples of SuDS control devices are check dams within swales and basins, and combined weir/orifice controls for ponds. Examples of traditional control devices are throttles constructed with pipes and vortex controls. The control devices must be capable of regular inspection and maintenance, and the system should be fail-safe so that upstream flooding does not result from blockage or other malfunction. For guidance on control devices, refer to *The SuDS manual* (CIRIA C697, 2007) and other best practice guidelines.

Discharge point

The point of discharge into watercourses and sewers (see definition of 'Watercourses and sewers')

Flood probability

The estimated probability of a flood of given magnitude occurring or being exceeded in any specified time period. For example, the 100-year flood has a 1-in-100 or 1% chance of occurring in any given year.

Flood risk

An expression of the combination of flood probability and the magnitude of the potential consequences of the flood.

Flood Risk Assessment (FRA)

A study to assess the risk of a site flooding and the impact that any changes or development on the site will have on flood risk on the site and elsewhere. A flood risk assessment must be prepared according to good practice guidance as outlined in PPS25 *Development and Flood Risk: Practice Guide* (available from www.communities.gov.uk). For developments of less than 1 ha (10,000 m²), the level of detail required in an acceptable FRA (for Sur 1) will depend on the size and density of build. This will range from a brief report for small, low-density developments, to a more detailed assessment for a high-density development of 2000–10,000 m². For example, for very small developments (2000 m² and less), an acceptable FRA could be a brief report carried out by the contractor's engineer confirming the risk of flooding from all *sources of flooding*, including information obtained from the Environment Agency, water company/sewerage undertaker, other relevant statutory authorities, site investigation and local knowledge.

Flood risk management hierarchy

The hierarchy of flood risk management measures and the role of the planning process in reducing flood risk (see PPS25 as applicable).

Flood storage

The temporary storage of excess run-off or river flow in ponds, basins, reservoirs or on a flood plain during a flood.

Greenfield land

Land that has not been previously developed.

Greenfield run-off rate

The rate of run-off that would occur from the site in its undeveloped state.

Impermeable surfaces

Often referred to as impervious or hard surfaces, these are surfaces which do not allow water to pass into the ground.

Infiltration techniques

Techniques which allow the passage of water into the ground. Techniques used purely for infiltration purposes would typically involve soakaways or pervious paving. Other SuDS techniques, such as swales and filter strips, will also achieve a level of infiltration but, unlike soakaways, they also normally function as a conveyance mechanism for transporting run-off.

Level of Treatment

When used in the context of one, two or three levels of treatment for surface water, treatment level should be regarded as the number of SuDS components in series through which run-off passes from the originating surface on which rainfall fell to the site discharge point.

Where a SuDS component has more than one treatment process, it might be considered to provide more than one level of treatment. In these circumstances advice should be sought from the Code service provider.

Limiting discharge

The limiting discharge is based upon the calculated pre-development flow rate at a discharge point, but may be increased to 5 l/s.

Peak rate of run-off

Referred to as Q_p [m^3/sec], this is the highest rate of flow from a defined catchment area assuming that rainfall is uniformly distributed over the drainage area, considering the entire drainage area as a single unit and estimation of flow at the most downstream point only.

Pervious paving

Also referred to as porous and permeable paving. Pervious pavements are SuDS structures and provide a pavement suitable for pedestrian and/or vehicular traffic,

while allowing rainwater to infiltrate through the surface and into the underlying layers. The water may be temporarily stored before infiltration into the ground, re-use or discharge to a watercourse or other drainage system (see CIRIA C697 *The SuDS manual* for additional information).

The design of the pervious pavement will depend on its drained area, climate and local geological and hydrological conditions.

For example, a block paved surface on a permeable sub-base on permeable ground, will store the water temporarily and allow it to seep into the soil.

For less permeable soils, more storage volume may be needed to compensate for reduced infiltration rates. For very low permeability areas (e.g. less than 1×10^{-6} m/s) water may be discharged to a conveyance system, with the pervious paving providing attenuation and water treatment.

Pre-development

The site's condition immediately before project commencement, i.e. brownfield or greenfield.

Probability of flooding – Low (Zone 1)

Probability of river and sea flooding, but does not take into account other sources of flooding or defences. These are defined in PPS25.

Low annual probability of flooding is an area where the chance of both river and sea flooding each year is <0.1% (1 in 1000) or less.

Probability of flooding – Medium (Zone 2)

An area where the chance of river flooding in any year is 1% (1 in 100) or less but greater than 0.1% (1 in 1000), and the chance of flooding from the sea is 0.5% – 0.1% (between 1 in 200 and 1 in 1000).

Probability of flooding – High (Zone 3a)

An area where the chance of river flooding in any year is >1% (1 in 100) and the chance of flooding from the sea is >0.5% (1 in 200) or greater.

Probability of flooding – Functional flood plan (zone 3b)

The land where water flows or is stored in times of flood.

Qbar

An estimation of the mean annual flood flow rate from a catchment (see Report IH124 *Flood estimations for small catchments*).

Rainfall intensity

Depth of rain falling in a period of time, e.g. mm/hour, sometimes given in l/s/m².

Rainwater discharge

Rainwater discharge is the rainwater which flows from the development site to watercourses and sewers. It is also referred to as run-off.

Relevant statutory body

In England and Wales this will in most cases be the Environment Agency, and for Northern Ireland will be the Rivers Agency.

Run-off rate

The rate of flow of water from a surface.

Sewerage undertaker

This is a Body with statutory responsibility for the disposal of foul wastewater and also surface water from roofs and hard surfaces.

Sewers for Adoption

A guide agreed between sewerage undertakers and developers (through the Home Builders Federation) specifying the standards to which private sewers must be constructed to facilitate adoption.

Soakaway

Underground structure designed to permit infiltration into permeable/slightly permeable ground. They can be grouped and linked together to drain large areas including highways.

Sources of flooding and flood risk

Streams and Rivers: Flooding that can take place from flows that are not contained within the channel due to high levels of rainfall in the catchment.

Coastal or Estuarine: Flooding that can occur from the sea due to a particularly high tide or surge, or combination of both.

Groundwater: Where the water table rises to such a height where flooding occurs. Most common in low-lying areas underlain by permeable ground (aquifers), usually due to extended periods of wet weather.

Sewers and highway drains: Combined, foul or surface water sewers and highway drains that are temporarily over-loaded due to excessive rainfall or due to blockage.

Surface water: The net rainfall falling on a surface (on or off the site) which acts as runoff which has not infiltrated into the ground or entered into a drainage system.

Infrastructure failure: canals, reservoirs, industrial processes, burst water mains, blocked sewers or failed pumping stations.

SuDS

As defined in the SuDS manual, sustainable drainage systems are an approach to surface water management that combines a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques.

These systems infiltrate, store, convey and partially treat surface water runoff, which minimises environmental impact and maximises environmental opportunities. SuDS should aim to maximise the use of on-the-surface techniques for operational and maintenance reasons.

SuDS Management Train

An approach to drainage design that combines a sequence of appropriate surface water drainage structures using SuDS systems for management of the runoff to treat the flow, reduce runoff volume and restrain the runoff rate in order to minimise man's impact on the environment. Additional benefits associated with operation and maintenance, ecology and amenity are aspects which are considered when designing a management system. The management train incorporates a hierarchy of techniques:

1. Source control. Examples of SuDS techniques include:
 - Soakaways
 - Porous/pervious paving
 - Roof water directed to garden (rather than piped drains)
 - Rainwater re-use/harvesting
 - Green roofs
 - Other surface infiltration, attenuation and conveyance techniques that deal with run-off at source.
2. Site/local control. Examples of SuDS techniques include:
 - Swales
 - Pond
 - Infiltration basins
 - Detention Basin
 - Larger soakaways
 - Pervious (porous or permeable) paving.
3. Regional control. Examples of techniques include:
 - Balancing ponds
 - Wetlands
 - Large detention basin

SuDS techniques

One or more components built to manage surface water run-off to prevent flooding and pollution, including:

- Wet ponds
- Infiltration basins
- Detention basins
- Swales
- Reed beds
- Pervious (porous or permeable) paving
- Soakaways
- Rainwater harvesting
- Filter strips
- Filter drains and trenches with or without perforated pipes
- Green roofs
- Underground Attenuation storage.

For more information refer to *The SuDS manual* (CIRIA C697, 2007)

Surface water run-off

Rainfall that flows off the catchment.

Tidal estuary

A semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from land drainage.

Tidal rivers (i.e. where no measurable seawater content is present during normal tidal movements) cannot be included as part of the estuary.

Treatment

Improving the quality of water by physical, chemical and/or biological means.

Volume of run-off

The volume of run-off that is generated by rainfall occurring on the site. This is typically measured in cubic metres.

Additional predicted volume of run-off is the difference between the volumes of run-off pre- and post-development, usually calculated for a specific rainfall event.

Watercourses and sewers

A term that includes rivers, streams, ditches, drains, cuts, culverts, dykes, sluices, sewers and passages through which water flows.

Assessment Methodology

The assessment criteria should be read with the methodology and the definitions in this section. Mandatory requirements are met and credits are awarded where the performance requirements (set out in the assessment criteria table) have been met.

Design Stage

- Owing to the nature of Issue Sur1, it is critical in all cases that compliance with the criteria is clearly demonstrated at this stage.
- The assessor is not required to perform any calculations. These must be provided, with all the necessary supporting information, by the appropriately qualified professional.

Mandatory requirements:

- Check that an appropriately qualified professional has been appointed
- Check that an appropriate Flood Risk Assessment (FRA) has been carried out
- Check that allowances have been made for climate change over the lifetime of the development in all post-development calculations
- Where the impermeable area draining to watercourses or sewers has increased, check that the appropriately qualified professional's report contains the following:

Peak rate of run-off calculations:

- Calculations for the 1 year and 100 year return periods for both pre- and post-development, including an allowance for climate change for the post-development state.
- Check that the calculation methodology used complies with the requirements in the Calculation Procedures.

Volume of run-off calculations:

- The additional volume of run-off for the 100 year 6 hour event including an allowance for climate change for the post-development state. The additional volume with and without mitigation measures should be provided.
- Check that the appropriately qualified professional's report demonstrates that the hierarchy specified has been followed and the additional volume of run-off is zero in line with criterion A or, if this cannot be satisfied, then evidence to demonstrate criterion B has been met and full justification has been provided.
- Check that the route of water over ground in the event of a local drainage system failure (system failure flood flow routes), for whatever reason have

been demonstrated, and the possible consequences have been evaluated, ensuring that there is no increased risk of flooding to properties either on or off site.

Note: Site drainage design should drain using gravity based systems in preference to those which require the use of pumping stations.

Credits:

- Where credits are sought, check that the report contains the information needed to allow the credit(s) to be awarded.

Post Construction Stage

- If a design stage assessment was carried out, the appropriately qualified professional should confirm that the design stage solutions have been implemented or, if designs have changed, evidence should be supplied showing the as-built design and construction.
- If a design stage assessment was not carried out, follow the Assessment Methodology guidance for the design stage to document the post construction evidence representing the development as built.
- Check the time elapsed since the FRA was carried out. Where this is significant, for example, more than five years (or less if major surface water regulation changes have occurred during this period), or it does not include an allowance for climate change, ask the appropriately qualified professional to confirm that the design basis of the surface water system is still valid.
- Confirm that the maintenance responsibilities have been defined for any SuDS components present, including all necessary control devices, and that maintenance regimes have been put in place.

Calculation Procedures

Assessors are not required to carry out calculations. The information below is for the appropriately qualified professional to use when completing calculations. It will also be helpful to guide assessors when checking that sufficient evidence has been provided to demonstrate compliance.

- Key publications that should be referred to for guidance include:
 - *The SuDS Manual*, CIRIA C697 (2007) – Useful Link: <http://www.ciria.org.uk/suds/publications.htm>
 - *Preliminary rainfall run-off management for developments*, W5-074/A/TR/1 Revision D, EA/DEFRA (September 2005) – Useful Link: <http://www.defra.gov.uk/environment/flooding/documents/research/sc030219.pdf>
 - *Development and Flood Risk*, Planning Policy Statement 25. Communities and Local Government (2006 as revised 2010), along with the latest version of the practice guide. Useful Link: <http://www.communities.gov.uk/documents/planningandbuilding/pdf/planningpolicystatement25.pdf>

Peak rate of run-off:

The peak rate of run-off calculations must be carried out as follows:

- Climate change

An allowance for climate change must be made for all sites in accordance with current best planning guidance. The climate change allowance must be added to the post-development run-off rate and volume calculations only. Information regarding the percentage allowance can be found in PPS25 as applicable.

- Greenfield sites of less than 50 ha

The calculation of greenfield run-off rates must be in accordance with IH Report 124, *Flood estimation for small catchments* (Marshall and Bayliss, 1994). The pro-rata method on the size of *catchment* detailed in Table 4.2 in *The SuDS Manual*, CIRIA C697 (2007) must be followed.

- Greenfield sites of 50 ha to 200 ha

The calculation of greenfield run-off rates must be in accordance with IH Report 124, *Flood estimation for small catchments* (Marshall and Bayliss, 1994). FEH can be used for these sites as an alternative, where there is a preference to do so, but only if the catchment is considered to be suitable for its application.

- Greenfield sites of more than 200 ha

The calculation of greenfield run-off rates must be in accordance with the *Flood Estimation Handbook* (Centre for Ecology & Hydrology, 1999) and any subsequent updates. Where the *Flood Estimation Handbook* is not considered appropriate for the development IH Report 124 can be used.

- *Brownfield sites*

The calculation of brownfield run-off rates should be as follows:

a) If the existing drainage is known then it should be modelled using best practice simulation modelling, to determine the 1 year and 100 year peak flow rates at discharge points (without allowing surcharge of the system above cover levels to drive greater flow rates through the discharge points).

b) If the system is not known, then the Brownfield run-off should be calculated using the greenfield run-off models described above but with a Soil Type 5.

- Limiting discharge rate

The limiting discharge for each discharge point should be calculated as the flow rates from the pre-developed site, as detailed in the calculation procedures above. The calculation should include the total flow rate from the total area of site feeding into the discharge point (this should include both Code and non-Code parts of the development, if applicable). The discharge point is defined as the point of discharge into the watercourse/sewers (including rivers, streams, ditches, drains, cuts, culverts, dykes, sluices, public sewers and passages through which water flows, see Definitions). Where this calculation results in a peak flow rate of less than 5 l/s, the limiting discharge rate may be increased up to a level of no more than 5 l/s at the point of discharge from the site to reduce the risk of blockage.

For example, if the flow rate for the 1 year and 100 year events were 4 l/s and 7 l/s respectively, then the limiting discharges would be 5 l/s and 7 l/s. Similarly, if it was calculated to be 2 l/s and 4 l/s, then a maximum of 5 l/s limiting discharge rate could be applied to both discharge points.

Sites should not be subdivided to enable higher overall limiting discharge rates to be claimed. It is, however, recognised that some sites may require more than one discharge point as a result of the local topography or existing surrounding drainage infrastructure, and in such cases the limiting discharge flow rate may be increased to a level no more than 5 l/s at each discharge point. The assessor should seek evidence that the number of discharge points is necessary due to topography and/or infrastructure limitations. Evidence may be in the form of a topographical map and an explanation from the appropriately qualified professional as to why multiple discharge points are required, stating that it is not feasible to have fewer discharge points.

- 100-year peak rate event: Excess volume of run-off

The storage of excess flows from the 100-year event does not necessarily have to be contained within the drainage system or SuDS features (the features designed solely for the purpose of drainage). Where appropriate, storage of some or all of this volume can be achieved using temporary surface flooding of areas such as a playing field. Specific consideration should be given to overland flow routing. Overland flood flows and temporary storage of flood water on the surface must not be so frequent as to unreasonably inconvenience residents and other users.

Volume of run-off:

The volume of run-off calculations must be carried out as follows:

- Calculation methodology

Refer to Chapter 4, Section 4.5.5 of *The SuDS Manual* (CIRIA C697, 2007) for guidance on calculating the additional volume of run-off caused by the development.

- Allowance for climate change

An allowance for climate change must be made in accordance with current planning guidance. The climate change allowance must be added to the post-development run-off calculation only. Information regarding the percentage allowance can be found in PPS25 as applicable.

- Criterion A or B

If the development causes an additional volume of run-off, meeting criterion A must be preferred to B. If criterion A cannot be met, the appropriately qualified professional must provide evidence within their report to justify the reason(s); criterion B must be met through the use of appropriate SuDS techniques.

- 5 l/s flow rate

Where criterion B is met, the limiting discharge rate at the discharge point(s) may be increased to 5 l/s, as described in the calculation procedures above.

Designing for system failure:

The consequences of system failure caused by extreme rainfall, lack of maintenance, blockage or other causes, should be considered /evaluated fully.

CIRIA publication C635 (2006) *Designing for exceedence in urban drainage – good practice* should be referred to for guidance.

Water Quality Credits:

- Where one credit is sought for preventing discharge from the site for rainfall depths up to 5 mm

A range of SuDS techniques can be used to prevent discharge from the site for rainfall depths of up to 5 mm, however, end-of-pipe solutions, such as ponds and basins, will only be deemed to comply where the principal run-off control to prevent discharge from the first 5 mm of a rainfall event, is achieved using source control and site control methods.

Green roofs can be deemed to comply with this requirement for the rain that falls onto their surface. However evidence is still required to demonstrate that the 5 mm rainfall from all other hard surfaces on site is being dealt with, to allow this credit to be awarded.

- Treatment levels

Where treatment levels are introduced to gain a credit, section 3.3 and chapter 5 of *The SuDS Manual* (CIRIA C697, 2007) should be referred to for guidance. The run-off from hard surfaces must receive treatment before being discharged from the site.

General guidance:

- Using computer software

Reputable computer drainage software can be used to demonstrate compliance. However, where hydrograph tables are provided as output, the relevant calculations should be highlighted.

- Rainwater harvesting

BS 8515 *Rainwater harvesting systems: Code of Practice*, Annex A should be followed where rainwater harvesting systems are used for stormwater control. To ensure *flood risk* is not increased if the rainwater harvesting system is, for some reason, not utilised, the exceedance flow route capacity provided in accordance with CIRIA report C635 should ignore the beneficial effect of the rainwater harvesting system.

- Assessing mixed Code and non-Code dwelling developments

Where Code dwellings are dispersed throughout a larger development of non-Code dwellings, there are a number of options for assessment under Sur 1.

1. Individual dwellings (as part of a larger site) can only be assessed independently where the run-off is being dealt with on a dwelling by

dwelling basis (i.e. each dwelling has its own dedicated sub-catchment that serves only that dwelling).

2. Where assessing groups of Code dwellings within a larger development, the drainage assessment must incorporate the local sub-catchment serving all of those dwellings.
3. Where assessing the run-off from both Code and non-Code dwellings (or Code and non-domestic buildings) the assessment must take into account the drainage from the local sub-catchment serving all those dwellings/buildings.

Note that proportioning cannot be used to calculate the percentage of run-off discharging into the local sub-catchment resulting from just the Code dwellings.

4. Alternatively the whole development can be assessed for compliance.

Whichever approach is taken to demonstrate compliance, it must be consistent when completing both the rate of run-off and volume of run-off calculations.

Note the special case regarding highways and impermeable areas when assessing a site.

- Contaminated sites

Drainage designs for sites must take into account legislation relating to contaminated sites, such as the Water Resources Act 1991, the Environmental Protection Act 1990, the Groundwater Directive (2006/118/EC) and, more recently, the Groundwater (England and Wales) Regulations 2009. Where the site risk assessment confirms that infiltration SuDS techniques are not appropriate, SuDS techniques that do not allow infiltration, such as swales lined with an impermeable membrane, can be used. It may be the case that only some areas of the site are contaminated and therefore infiltration SuDS techniques can be used elsewhere on the site. There may also be a requirement to remediate the contaminated soils, creating opportunities for the use of infiltration SuDS post-remediation.

Common Cases of Non-Compliance

Neither the mandatory element nor credits can be awarded where the assessed development has proceeded against the recommendation of the Environment Agency regarding surface water drainage.

Special Cases

Minimum flow rate/maximum storage requirement set by sewerage undertaker (or other statutory body)

Where the statutory authority have exercised their statutory powers and have set specific *minimum* flow rate/*maximum* storage requirements that are less onerous than the specific Sur 1 criterion, the statutory requirements will take precedent over the specific Code criterion. All other criteria will still be applicable. Evidence should be provided to confirm that this is the case and should be formal documentation from the statutory authority. This should include evidence such as planning approvals/ conditions and/or correspondence from a statutory body setting out specific requirements, i.e. sewerage undertaker, Environment Agency etc. The Flood Risk Assessment may contain some of the evidence required to demonstrate compliance.

Note: Where the statutory authority has approved a design on the basis of a minimum discharge rate identified through a FRA, compliance with this minimum standard, will be deemed to meet the mandatory peak rate of run-off requirement, where supported by the documentary evidence. In all other cases, the approval of a specific design feature or the setting of a non-compliant discharge rate will not be sufficient to demonstrate compliance.

Maximum flow rate set by sewerage undertaker (or other statutory body)

If a maximum flow rate is set that can be discharged, the peak rate of run-off requirement within the Code will still apply unless the maximum flow rate set is more rigorous (lower rate) than the Code, in which case compliance with the Sewerage Undertaker's requirements will apply.

Highways and impermeable areas

Where new non-adoptable highways are built, including those for developments with a mixture of Code and non-Code dwellings, all of the new impermeable surfaces must be included in calculations to demonstrate compliance with the peak rate of run-off and volume of run-off criteria.

Where Code dwellings are built beside existing highways or where adoptable highways are built, the impermeable area of the highway does not need to be included in the calculations.

Derelict sites

If the site has been derelict for over five years, the appropriately qualified professional must assess the previous drainage network and make reasonable assumptions to establish probable flow rates and volumes. The Wallingford Procedure Modified Rational Method should be used. To complete the calculations, a site visit prior to development will be required unless accurate data already exist from a previous survey. The resultant professional report can then be used to determine the pre-development volumes and rates of run-off. Without this professional input, the site must be deemed *greenfield* pre-development, assuming Soil Type 5 for the calculation of the pre-development site run-off.

No change or reduction in impermeable area

Where a man-made impermeable surface draining to the watercourse and sewers has decreased or remained unchanged post-development, the peak rate of run-off



and volume of run-off requirements will be met by default and run-off calculations will not be required. Instead, drawings clearly showing the man-made impermeable surfaces of the site draining to the watercourse and sewers should be provided for the pre- and post-development scenarios. Figures must also be given (ideally on the drawings as well) to show a comparison between the areas of drained man-made impermeable surfaces pre- and post-development.

Sites with existing infrastructure/planning approval

Some sites may not be in a position to meet the requirements set out in the Code owing to existing or approved infrastructure strategies that pre-date the requirement for a Code rating.

- a) For sites where planning approval (covering the *detailed* drainage strategy for the site) has been granted prior to the Code requirement being set for the development, the mandatory element of Sur 1 can be met by default. No credits for water quality can be awarded if the mandatory element is met using this method. Evidence requirements 1, 2 and 3 as listed below.
- b) For sites where the assessed dwellings are *directly* connected to existing infrastructure which pre-dates the Code requirement for the site, the mandatory element of Sur 1 can be met by default. No credits for water quality can be awarded if the mandatory element is met using this method. Evidence requirements 3 and 4 as listed below.

Note: The phrase 'directly connected to existing infrastructure' should be interpreted as individual dwellings being directly connected to the existing sewer without any significant shared installation (this Special Case is predominantly only relevant for single dwellings). It does not cover instances where an entire site or new shared system is being connected into the existing main sewer. It should be a simple connection from a dwelling into an existing manhole/sewer rather than a new network being created.

Evidence referred to in a) and b) above is as follows:

1. Planning approvals/conditions.
2. HCA grant approvals or planning conditions which demonstrate the date the Code requirement was enforced.
3. Plans showing coverage of existing and approved drainage designs and the connections to them
4. Flood Risk Assessment – this may contain some of the evidence required in items 1 to 3 above and therefore, if completed in accordance with the Calculation Procedures, may also be provided for any of the above scenarios in support of any of the above evidence.