Preliminary Rainfall Runoff Management for Developments
EA/Defra Report Procedure W5-074/A
Summary Guidance for Developers and Engineers

1. Objective of this guidance and Procedure W5-074/A is to assist developers and their designers to conform to **Planning Policy Guidance Note 25 (PPG25) – Development and Flood Risk** (and therefore the **Code for Sustainable Homes (CSH)**) and applies both to Greenfield and Brownfield sites. It does not address ALL the requirements of a Flood Risk Assessment to comply with PPG25.
2. Greenfield – new development, usually at the periphery of existing urban areas creating increased rainfall runoff that has an impact on existing sewer systems and watercourses. Brownfield – redevelopment of a previously developed site. Therefore, the term Greenfield and Greenfield performance is considered to mean the existing site conditions for Brownfield development sites.
3. In the case of Brownfield sites, drainage proposals will be measured against the existing performance of the site (although it is preferable for solutions to provide runoff characteristics which are similar to Greenfield behaviour as stated above).
4. Part H of the Building Regulations requires that the first choice of surface water management should be to discharge to infiltration systems where practicable. Infiltration techniques should therefore be applied wherever they are appropriate.
5. Drainage calculations, where appropriate, should comply with *Sewers for Adoption* (5th edition).
6. The key objectives of the procedure are
    a. For stormwater runoff discharged from urban developments to replicate or achieve a reduction from the Greenfield response of the site over an extended range of storm probabilities (return periods).
    b. To manage runoff for extreme events (i.e. the 100 year 6 hour event plus climate change effects).
7. This requires
    a. The **peak rate** of stormwater to be controlled.
    b. The **volume** of runoff to be reduced.
    c. The assessment of **overland flows and temporary flood storage** across the site and;

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d. Any **pollution** load to receiving waters to be minimised.

8. It is the Environment Agency that normally requires that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event), the developed rate of runoff into a watercourse should be no grater than the undeveloped (Greenfield) rate of runoff for the same event. Exceptions only apply where it is not practical to achieve this due to the size of the hydraulic control unit (see also 14 and 23). The purpose of this is to retain a natural flow regime in the receiving watercourse and not increase peak rates of flow for events of the annual probability greater than 1%. Three annual probabilities merit specific consideration: 100% (1 in 1 year event); 3.33% (1 in 30 year event) and 1%. **This is equivalent to the April 2008 CSH.**
9. The 100% annual probability is the highest probability event to be specifically considered to ensure that flows to the watercourse are tightly controlled for these more frequent events.
10. The 3.33% probability has been selected since it represents the boundary between high and medium risks of fluvial flooding defined by PPG25 and also recognises that it is not possible to fully limit flows for the most extreme events. Also *Sewers for Adoption* recognises that, during extreme wet weather, the capacity of surface waters may be inadequate. *Sewers for Adoption* requires that the site layout should be such that internal property flooding does not result, by demonstrating safe above ground flow paths. The return period for this analysis is not specified, but it is recommended that the 1% annual probability event is used.
11. Flood flows up to the 1% annual probability event should preferably be contained within the site at designated temporary storage locations unless it can be shown to have no material impact in terms or nuisance or damage, or increase river flows during periods of river flooding. Analysis for overland flood flows within the site will need to use short high intensity rainfall events of between 15 minutes and 1 hour duration.
12. The calculation of peak rates of runoff from Greenfield sites is related to catchment size, annual rainfall and soil type (see also 17). The values derived should be regarded as indicative due to the limitations of the procedure.
13. The stormwater runoff volume from a site should be limited to the Greenfield runoff volume wherever possible. The additional runoff volume **(Long Term Storage)** caused by development should be controlled by two criteria

a. **Where possible, infiltration or other techniques are to be used to ensure minimal discharge to receiving waters for rainfall depths up to 5mm**

b. **The difference in runoff volume pre and post development for the 100 year 6 hour event (plus climate change) i.e. the additional runoff generated, should be disposed of by way of infiltration , or if this is not feasible due to soil type, discharged from the site at flow rates below 2L/s/ha. This is equivalent to the April 2008 CSH with the addition that the Code also allows for the additional volume to be used as a replacement for potable water use in non-potable applications such as WC flushing or washing machine operation.**

14. A practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactory flow rate while keeping the risk of blockage to an acceptable level.
15. Long Term Storage volumes are largely influenced by the soil runoff volumes and more importantly, the percentage of impermeable area in the development and the **minimum % used in the Guide is 50%**. *Note: the 100 year 6 hour event plus climate change for South Somerset is circa 70mm rainfall.*
16. **Where compliance to the 100 year volumetric criterion, as defined in 13 above, is not provided, the limiting discharge for the 30 and 100 year return periods will be constrained to the mean annual peak rate of runoff for the Greenfield site (called QBAR). This is equivalent to the April 2008 CSH.**
17. The percentage runoff of the rainfall on a Greenfield site can be assumed to be approximately equal to the SPR value of the soil type of the site. The procedure contains a UK map allowing the SPR value to be obtained. *Soils in South Somerset are typically type 3 or type 4 soils, with % runoff of 37 and 47% respectively.*
18. All use of infiltration units in clay soils (types 3 and 4) should include high level overflows connected to the site drainage system.
19. Calculation of the runoff volume from the developed site for preliminary assessment and design of drainage facilities will assume 100% runoff from paved areas and 0% runoff from pervious areas. Runoff from impermeable surfaces served by effective infiltration systems can be assumed to contribute no runoff for storage volumes assessment. In

practice, the use of certain SUDs units, particularly **pervious pavements**, provide highly modified runoff characteristics and the storage provided by these and other units should be taken into account in the **detailed design stage**.

20. All detailed design for stormwater runoff and proof of compliance in meeting peak flow rate discharge criteria, using computer simulation, should be provided by the engineers as appropriate and use the standard Wallingford procedure variable runoff model using appropriate parameters or similar software.
21. Long Term Storage, if provided as infiltration units, need **not** be specifically modelled to demonstrate compliance **unless they are expected to contribute positive runoff** during extreme events (i.e. the 100 year 6 hour event). However, **where it is provided as storage with a throttle to limit the discharge to less than 2L/s/ha, this should be modelled as part of the whole drainage system**. Compliance should be demonstrated by showing that the total volume which is discharged when outflows are above 2L/s/ha for a 100 year 6 hour event is equal to less than the calculated Greenfield runoff volume (i.e. QBAR).
22. SUDs units should be used to achieve water quality improvements and amenity benefits as well as achieving compliance to these hydraulic criteria. Best practice in achieving water quality protection should be used.
23. At present, certain SUDs units are considered to have some degree of risk of medium term hydraulic failure, due to either maintenance or possible change of status. In these situations, to ensure compliance with pipe capacity criteria, they will be deemed not to be effective when calculating pipe sizes and storage requirements. For pipe sizing, the current view of the Water Undertakers should be sought. For storage sizing of all structures which are not to be adopted by Water Undertaker, the view of the Environment Agency should normally apply.
24. Climate change will be taken into account in hydrological regions (*South Somerset is within region 8*) by increasing the rainfall depth by 10% for computing storage volumes. The official advice by Defra on river flows is that a 20% increase should be added for climate change. Due to the relationship between rainfall and runoff being non-linear, the use of 10% additional rainfall is considered to approximate to a 20% increase in runoff for larger events. No allowance for climate change should be applied to calculated Greenfield peak rates of runoff from the site for any hydrological region. It should be

recognised, that although climate change is acknowledged as taking place, certainty regarding the hydrological changes, particularly of extreme short duration events, is very low.

25. There are a number of safety factors built into the method used in the procedure to ensure that the storage volumes are not undersized and it is intended that the procedure will provide an estimate of volume which is **within 20% of that determined by detailed design**.
26. Pipework which serves SUDs units that is to be adopted by the Sewerage Undertaker will need to be designed on the basis that all hard surfaces contribute runoff in the standard manner even if attenuated or reduced in volume by SUDs components. This is a precaution which is being taken to ensure that long term failure or change of drainage practice in the future will not result in flooding due to pipe capacities being overloaded which will require future modification to the network. Exceptions to this rule will need to be agreed specifically with the adopting authority.
27. It should be appreciated that there is a **significant difference** between the original **Technical Guide under the CSH** October 2007 compared to the revised Guidance April 2008 in relation to surface water runoff (Category 4). The original 'time attenuation' requirements have been replaced. The new version of the Technical Guide follows the Guidance in the EA/Defra Report Procedure W5-074/A much more closely.

Key Points

- The Flood Risk and Runoff Assessment (FRRA) is only required under planning legislation if the development site is over 1 ha in area or not in Flood Zone 1 as defined by the Environment Agency.
- The Flood Risk Assessment is compulsory for the Code for Sustainable Homes.
- Flood Risk and Runoff Assessments should be carried out in parallel with planning requirements.
- The first choice solution will be to utilise the Long Term Storage volume calculated as replacement for potable water in non-potable applications such as WC flushing or washing machine operation.

- The second choice solution is to dispose of the same volume by way of infiltration in conjunction with the above and the third choice is to dispose of the same volume by infiltration alone.
- Infiltration units in South Somerset should include high level overflows connected to the drainage system because of prevalent soil types.
- Confirmation of compliance with the CSH will normally consist of a completed FRRA report and confirmation from drainage engineers that the findings and recommendations of the FRRA report have been complied with for the detailed surface water management design, including confirmation from Sewerage Undertakers and the Environment Agency as appropriate.
- Maintenance arrangements for SUDs devices are important to confirm in the FRRA report.

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