

Sustainable Urban Drainage Systems (SUDS) and the Draft Flood and Water Management Bill: Briefing for UK Roads Board



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UK Roads Board and implications from SUDS

(Paper by: Justin Ward, Senior Policy Officer at the Chartered Institution of Highways & Transportation for the UK Roads Board: justin.ward@ciht.org.uk)

This short briefing has been pulled together for the UK Roads Board and aims to provide an overview of Sustainable Urban Drainage Systems (SUDS) and draw out some highlights from the draft Flood and Water Management Bill that are pertinent to the UK Roads Board.

SUDS was discussed at the UK Roads Board meeting, held on the 24 February 2009: the note of the meeting stated:

"there was a discussion of some of the potential issues for transportation in areas of Asset Management and the need for a full inventory of drainage infrastructure. The Board commented that the implications of SUDS could place increased budgetary strain on Local Authorities in regards to ongoing maintenance. There was also a discussion of how SUDS would be important to design guidance going forward".

Subsequent to the meeting, on the 21st April 2009, the Government published a draft Flood and Water Management Bill. Drafted in response to recent flooding events and the recommendations made through the Pitt Review, this Bill seeks to:

- deliver improved security, service and sustainability for people and their communities;
- clarify responsibilities with respect to managing flood risk;
- protect essential water supplies;
- update legislation for managing flood risk and reservoir safety;
- encourage the wider use of sustainable drainage systems;
- enable water companies to control more non-essential uses of water during droughts.

This Bill is available for public consultation and is open until **24 July, 2009**.

<http://www.defra.gov.uk/corporate/consult/flood-water-bill/index.htm>

Some **highlights from the consultation**, relevant to the UK Roads Board, include: *The 'PROPOSED FUTURE ROLES AND RESPONSIBILITIES FOR FLOOD AND COASTAL EROSION RISK MANAGEMENT IN ENGLAND' include 'Drainage from non-Highways Agency roads' for Local Authorities (LAs) Local leadership role (county councils in two tier areas)' (page 28).*

The draft Bill places the leadership role in these partnerships on county and unitary local authorities. They will need to ensure that all relevant partners are engaged in developing a strategy for local flood risk management and securing progress in its implementation. This will build on the county and unitary authority leadership role in Local Area Agreements, and will allow them to develop centres of engineering and flood risk expertise alongside their existing highways functions, providing support to other partners and promoting collaboration across the whole area (page 36, paragraph 135).

'the Highways Agency maintains drainage from the strategic road network (trunk roads and motorways) while county and unitary authorities undertake this work on local roads' (page 34, paragraph 122)

On the implementation of SUDS: *'The Bill will require developers to include sustainable drainage, where practicable, in new developments, built to standards which reduce flood damage and improve water quality. It will also amend section 106 of the Water Industry Act 1991 to make the right to connect surface water run-off to public sewers conditional on meeting the new standards. It will give responsibility for approving sustainable drainage systems in new development, and adopting and maintaining them where they affect more than one property, to a SUDS approving body, generally local authorities'* (page 41).

Explaining the **issues surrounding conventional drainage** the following is noted: *'Conventional drainage systems, i.e. pipes and sewers, are designed to take surface water quickly away from properties and roads discharging it to watercourses and sewers. During intense or prolonged rainfall, drainage systems can become overwhelmed by surface run-off and result in a greater risk of fluvial flooding downstream, or flooding of properties with sewage'* (page 42: paragraph 161). Combined with increased pressure – and inability to cope – conventional drainage also has the problem that *'Surface run-off from urban areas carries a range of pollutants from roads, roofs, and misconnections of foul sewage to the surface water drainage system can also result in pollution of watercourses. These pollutants affect water quality, amenity and biodiversity and are very difficult to remove'* (page 42: paragraph 163).

The draft Bill goes onto explain **some of the benefits of SUDS:** *'The nature of SUDS with their 'soft engineering', low velocities and storage characteristics means that normal and extreme levels of rainfall can be better managed, and pollutants can be retained and where possible broken down within the system, improving water quality. There are a wide range of SUDS techniques, including permeable paving (including roads), swales, ponds and wetlands which can create attractive multi-functional green spaces in urban areas. In areas where space is very restricted, more engineered solutions such as attenuation tanks may also be part of the solution'* (page 42: paragraph 165)

The proposals for SUDS include: *'The following provisions relate to new surface water drainage systems from buildings and roads in England and Wales. They do not require any retro-fit of SUDS, or deal with groundwater or foul water'* (page 43: paragraph 173). So the provisions include: *'National Standards governing the way in which surface water drainage systems must be constructed, and operate. These will reflect the need to mitigate flood damage, improve water quality, protect the environment, protect health and safety, and ensure the stability and durability of drainage systems;* (page 43: paragraph 174), and - *'an approval system for the surface water drainage systems of the majority of new developments, including roads, in line with the National Standards'* (page 43: paragraph 174)

And in regards to **adoption and maintenance of SUDS:** *'The UK Government proposes to require county and unitary authorities to take responsibility for adopting and maintaining new build SUDS in the public realm in England....This approach is consistent with other new roles and responsibilities proposed for county and unitary authorities in England, e.g. coordinating action to prevent and mitigate surface water flooding. The county or unitary local authority is already responsible for adopting, draining and maintaining highways – roads, pavements and verges. In new*

developments, permeable paving, swales or French drains should take the place of traditional impermeable roads and pavements draining to sewers' (page 45: paragraph 189)

In relation to **connections to the public sewer**: *'Currently, water and sewerage companies must be notified of any proposed connection to the public sewer in order to ensure that the construction of the drain or sewer is adequate, before a new connection to sewer is made permanent. This enables the sewerage company to exercise the right to make the connection itself (page 47: paragraph 202). The draft Bill proposes modifying this process in three ways:*

- *the approval of the SUDS design is to be a necessary pre-requisite to seeking connection to the sewer under section 106;*
- *the sewerage company will be a statutory consultee for the purposes of approval; and*
- *the National Standards will be a material consideration when considering whether to agree that a road can be drained to sewer under section 115 of the Water Industry Act 1991 (page 47: paragraph 203)*

On the Drainage of roads to sewers: *'Section 115 of the Water Industry Act 1991 sets out the circumstances under which, by agreement, the Highways Authority may drain a road to a combined or surface water sewer. Under the Government's new proposals the drainage of new roads must be approved in line with the National Standards. However, in addition, if there is a dispute about whether either party has 'unreasonably refused' to enter into an agreement to drain a highway to a public sewer, the National Standards will be a material consideration' (page 48: paragraph 209). 'Whilst this proposal goes beyond the options considered in the 2008 consultation, it recognises that roads add considerably to the impermeable area of new development and increase the risk of flooding and poor water quality. Within high density developments, roads can be the largest area of land in the public realm. Permeable roads could provide sustainable drainage not only for the roads themselves, but also for adjacent buildings' (page 48: paragraph 210)*

And on **funding for SUDS the following is proposed**: *'We propose that the SAB [SUDS approving body] should have the ability to insist on a financial bond before work can begin on the SUDS. On satisfactory completion of the SUDS the bond would be released. This is similar to the current arrangements for adopted surface water sewers and highways. The benefits of such an approach are'*

- *it provides an incentive to the developer to complete SUDS to the required standards promptly, so the bond can be released;*
- *developers are already familiar with this mechanism; and*
- *a bond also provides insurance against the developer becoming bankrupt or being unable to complete the SUDS, enabling the SUDS approving body to use the bond to bring the SUDS up to the required standard and adopt it if needed' (page 46: paragraph 195)*

The Draft Bill states that **developments should fund the additional pressure** they put on budgets: *'The Department for Communities and Local Government is preparing secondary legislation that will determine how the new Community Infrastructure Levy (CIL) will work, which can help fund flood risk management in the area...However, funds raised by the CIL will be needed for a number of competing priorities – such as roads, schools, parks and playgrounds. It cannot be assumed that any receipts from CIL will be spent on flood risk management' (page 82: paragraph 429 and 430).*

Background to SUDS

Sustainable drainage is a concept that includes long term environmental and social factors in decisions about drainage. It takes account of the quantity and quality of runoff, and the amenity value of surface water in the urban environment. Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not proving to be sustainable.

Sustainable development and Agenda 21

Sustainable development and Local Agenda 21 was introduced to manage the balance between social, economic and environmental requirements minimising the conflict that can exist between economic development and the protection of the environment.

Sustainable development was the central theme of the UN Earth Summit at Rio de Janeiro in 1992, which called on governments to produce their own strategies for sustainable development. In the UK, the Government updated its national strategy in May 1999. Parallel to this the Local Government Management Board has published Local Agenda 21 - A framework for local sustainability. Local authorities have their own Agenda 21 strategies.

Cities, towns and villages create demands on the environment by using resources and producing waste. The built environment is therefore one area where the strategies of sustainable development should be put into practice.

Urban drainage

Built-up areas need to be drained to remove surface water. Traditionally this has been done using underground pipe systems designed for quantity, to prevent flooding locally by conveying the water away as quickly as possible. The alteration of natural flow patterns can lead to problems elsewhere in the *catchment*. Water quality issues have become increasingly important, due to pollutants from urban areas being washed into rivers or the groundwater. Once polluted, groundwater is extremely difficult to clean up. Conventional drainage systems cannot easily control poor runoff quality and may contribute to the problem. The amenity aspects, such as water resources, community facilities, landscaping potential and provision of varied wildlife habitats have largely been ignored. Conventional drainage systems are not designed with these wider considerations in mind. Continuing to drain built up areas with limited objectives and ignoring wider issues is not a sustainable long-term option causing an impact on the terrestrial and aquatic environments.

Sustainable drainage

Drainage systems can be developed in line with the ideals of sustainable development, by balancing the different issues that should be influencing the design. Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as Sustainable Drainage Systems (SUDS). These systems are more



J4M8 Business Park, Scotland

sustainable than conventional drainage methods because they:

- Manage runoff flowrates, reducing the impact of urbanisation on flooding
- Protect or enhance water quality
- Are sympathetic to the environmental setting and the needs of the local community
- Provide a habitat for wildlife in urban watercourses
- Encourage natural groundwater recharge (where appropriate).

They do this by:

- Dealing with runoff close to where the rain falls
- Managing potential pollution at its source now and in the future
- Protecting water resources from point pollution (such as accidental spills) and diffuse sources.

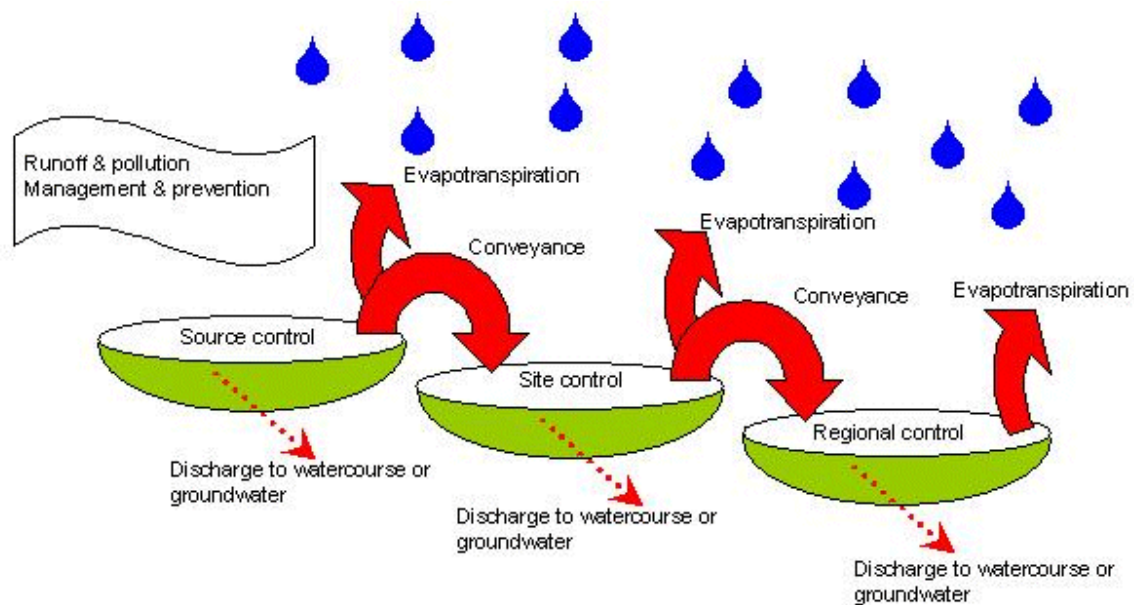
They may also allow new development in areas where existing sewerage systems are close to full capacity, thereby enabling development within existing urban areas.

Urban drainage is moving away from the conventional thinking of designing for flooding to balancing the impact of urban drainage on flood control, quality management and amenity.



SUDS management train

A useful concept used in the development of drainage systems is the surface water management train, illustrated below. Just as in a natural *catchment*, drainage techniques can be used in series to change the flow and quality characteristics of the *runoff* in stages.



The management train starts with **prevention**, or good housekeeping measures, for individual premises; and progresses through local **source controls** to larger downstream **site and regional controls**. Runoff need not pass through all the stages in the management train. It could flow straight to a site control, but as a general principle it is better to deal with runoff locally, returning the water to the natural drainage system as near to the source as possible. Only if the water cannot be managed on site should it be conveyed elsewhere. This may be due to the water requiring additional treatment before disposal or the quantities of runoff generated being greater than the capacity of the natural drainage system at that point. Excess flows would therefore need to be routed off site. This process supports the environmental principle of **subsidiarity**.

The design of SUDS will require active decisions between different options, often depending on the risks associated with each course of action. The risks of an area flooding have to be balanced with the costs of protecting the area from different levels of floods.

The management train concept promotes division of the area to be drained into **sub-catchments** with different drainage characteristics and land uses, each with its own drainage strategy. Dealing with the water locally not only reduces the quantity that has to be managed at any one point, but also reduces the need for conveying the water off the site.

When dividing catchments into small sections it is important to retain a perspective on how this affects the whole catchment management and the hydrological cycle.

SUDS techniques

SUDS are made up of one or more structures built to manage surface water runoff. They are used in conjunction with good management of the site, to prevent flooding and pollution. There are four general methods of control:

- Prevention
- Filter strips and swales

- Permeable surfaces and filter drains
- Infiltration devices
- Basins and ponds

These controls should be located as close as possible to where the rainwater falls, providing *attenuation* for the runoff. They also provide varying degrees of treatment for surface water, using the natural processes of sedimentation, filtration, adsorption and biological degradation.

SUDS can be designed to function in most urban settings, from hard-surfaced areas to soft landscaped features. The variety of design options available allows designers and planners to consider local land use, land take, future management and the needs of local people when undertaking the drainage design, going beyond simple drainage and flood control. The range of options means that active decisions have to be made that balance the wishes of different stakeholders and the risks associated with each option.

Selection

Sustainable drainage systems are designed using the same underlying principles of hydrology and hydraulics as conventional drainage systems, but applying them in a different way. Alongside the purely technical issues are wider considerations of amenity and environmental enhancement.

Principles

When selecting SUDS it is important to consider quality, quantity and amenity *design criteria* equally. There will not be a single "correct" answer: several options may meet the design criteria, and judgement will be needed.

Selection and design of SUDS are multi-disciplinary processes. Unlike conventional drainage systems, factors that influence the final choice will include planning, water quality, water resource, architectural and landscape requirements.

The Selection Tool

Once an initial assessment of the site has been made and the design strategies for the drainage system have been agreed, drainage techniques can be selected.

The selection tool is based on the *surface water management train* and is designed to lead the designers through the selection process in accordance with the principles that:

- Drainage techniques will be used in series to meet the design criteria
- Drainage techniques at the top of the management train are generally to be preferred to those further downstream
- There is no single correct solution; selection may be the result of factors external to the normal remit of drainage designers
- The drainage system should be inspired by the original drainage pattern.

The process is cyclical, and various factors have to be considered in increasing detail as a final solution is approached. Some of the additional factors that may influence the choice are discussed later in this section.

The suggested route to select a drainage system is not rigorous; value judgements have to be given and subjective assessments made of the capabilities of the site. Do not approach the selection process as a linear path through the flowchart – the decisions required need to be put in a wider context than just the pure technical details. In some cases the decision to use ponds for environmental enhancement or increasing property values may override other considerations.

Source control is preferred over controls elsewhere in the management train as it:



Swale drainage, Dundee

- Follows the natural drainage pattern
- Assigns the management of surface water to those responsible for the runoff
- Prevents problems arising rather than trying to mitigate them.

(Source: <http://www.ciria.org.uk/suds>)

Frequently Asked Questions

Why use SUDS?

SUDS provide a flexible approach to drainage, with a wide range of components from soakaways to large-scale basins or ponds. The aim of the SUDS approach is to mimic as closely as possible the natural drainage from a site before development and to treat runoff to remove pollutants. Adopting a holistic approach towards surface water drainage provides the benefits of combined water quality and quantity control, as well as increased amenity value. This is accomplished by managing the increased flows and pollution from surface water runoff that can arise from development, ideally utilising a management train to achieve an equal balance of quantity, quality and amenity.

Are SUDS really cheaper than conventional systems?

In the majority of cases – but more research is required on the long term costs of SUDS.

In general a SUDS system should not cost more than a traditional system. In selecting a design for drainage the overall scheme costs and benefits should be considered. SUDS aim to cater for both drainage, quality and amenity issues. When comparing cost estimates, the contribution SUDS make to the water quality and landscape should be considered. An increase in drainage costs may be offset when the drainage and landscape budgets are considered. The increase in cost for one item (such as paving) may be offset elsewhere (in ease of construction and lack of gully pots for permeable surfaces). At the Ravenswood development in Ipswich, using SUDS meant a £600,000 saving in construction costs.

An UKWIR project is currently looking at post-project monitoring of BMPs/SUDS to determine performance and whole-life costs results on this work should be available shortly.

Would SUDS have prevented Boscastle?

No.

The Boscastle valley is not an urban catchment and the flooding was not caused by drainage failure, the disaster at Boscastle was the result of an extreme flash flood. Intense downpours led to more than 5 inches of rain falling around Boscastle in just a few hours, and possibly more over higher ground. With the ground already saturated from recent rains, the storm waters were funnelled down steep river valleys which acted as huge funnels for this water, channelling it very quickly down to the sea. While SUDS aim to mimic natural drainage and delay the time it takes for drainage water to river water courses, it cannot control freak storm events at such a level. On a smaller scale storm events in urban catchments SUDS would be more effective than conventional drainage systems at controlling flooding.

Would using SUDS help Combined Storm Overflow (CSO) management and improve water quality in rivers?

Within London and other major conurbations much of the sewer system is used to convey foul water and storm water away from properties. During periods of intense rainfall the drainage system can be inundated with water and the sewer system is designed to discharge water into watercourses through CSOs to help manage the flooding risk. The principle behind SUDS of treating and managing water close to its source should reduce the amount of water entering into the drains and sewers and reduce CSO spills and potentially improve water quality in watercourses.

Can SUDS be used in areas which have little or no infiltration?

Yes.

Although many SUDS techniques using infiltration are highly effective, there are many sites where infiltration is not possible, due to impermeable ground conditions, contamination or a high water table. This does not prevent the use of the SUDS approach, but requires careful thought to be given to how water can be treated to improve quality and attenuated to reduce peak flows. Rainwater harvesting, green roofs, permeable surfaces, swales, ponds and wetlands can all operate without infiltration. Permeable surfaces, used for car parks and drives are very effective, even where infiltration is not possible. The M40 motorway services at Wheatley is a good example of the use of SUDS where infiltration is not possible. At this site infiltration was not used due to the risk of mobilising contamination in the underlying soil. Here the car park uses permeable paving for the parking bays, offering treatment and attenuation of the run-off.

Can SUDS be used on brownfield or contaminated sites?

Yes.

Conventional drainage on these sites often involves complex arrangements to ensure that drains are sealed, that material excavated from trenches is properly disposed of and that drainage trenches are filled with suitable materials. SUDS techniques can be used to keep the runoff at or close to the surface, for example using permeable surfaces, swales and wetlands, reducing or eliminating the need to disturb, remove or import materials to the site. Up to 40% of sites developed using SUDS in Scotland have been brownfield sites. The Scottish SUDS Working Party have produced an advice note on the subject, which highlights the benefits of integrating the use of the SUDS approach at the earliest stage possible in the planning for the site and its remediation.

Can SUDS be used where space is limited?

Yes.

Constraints on space are often cited as a reason for not using the SUDS approach, as many developers believe that the use of SUDS will inevitably mean the use of ponds and similar surface features. However, there are a wide range of SUDS techniques that can be used to attenuate and treat rainwater flows, starting at an individual property scale, even on the most constrained sites. It is also the case that green

space provision is required in many developments and that open drainage features such as swales and ponds can be imaginatively integrated into these.

HR Wallingford are currently working on a project to investigate the implementation of SUDS in high density developments (consistent with PPG3 – Housing).

Do SUDS pose a greater risk of groundwater contamination?

No, if designed appropriately.

SUDS should not increase groundwater contamination risks if designed appropriately for the site. All drainage systems have to be designed for exceedance so they are safe when overloaded. Certain measures can be taken to protect more sensitive areas by considerably reducing or prohibiting infiltration. In marginal areas, where polluted water may have an impact on the groundwater, the runoff can pass through one or more treatment stages, depending on the possible level of pollution and the hydro-geological conditions. If all infiltration was prohibited it is likely that a SUDS system would still represent an improvement over a traditional system drained using pipes, the SUDS system could still attenuate flow from the site and improve the surface water runoff quality.

What happens when the capacity of the SUDS drainage is exceeded or it fails?

All drainage systems should be designed to incorporate provision for flows above the design capacity to be conveyed off site with the minimum impact. The design of SUDS should mean that less damage is done when their design capacity is exceeded or if it should fail, than with conventional systems. The SUDS design philosophy, unlike traditional systems, is to use a train of management methods. For example, once the soakaway has reached its capacity, the overland flow can be stored in a pond or wetland or underground storage. Flooding, should it occur, can also be managed to reduce impact, for example careful planning and design can ensure that areas such as playing fields should be flooded before roads and that houses are positioned so they are less likely to be inundated.

Are SUDS dangerous?

No.

If designed appropriately for the site, SUDS should not present risks to safety and health. There is often a fear of dangers such as increased risk of drowning or overturning of vehicles into swales but with careful thought these risks can be designed out. If ponds are designed with shallow side slopes, shallow shelving edges and strategically placed barrier vegetation they will be as safe as any natural watercourse. Swales designed with slopes of less than 1:3 and shallow pose much less of a hazard than common roadside ditches.

SUDS can often improve health and safety of drainage systems by:

- Reduced use of culverts, manholes and grills
- Lower concentration of pollutants and contaminants

- By separating surface drainage from foul sewers, there will be fewer routes for vermin to enter the pipes and therefore lower risk of spreading diseases
- Reduced variation in flow rates which can lessen the effect of flash floods.

Do I need to use an oil separator for car park drainage?

Not necessarily.

You might not need an oil separator if you use SUDS. The SUDS approach should be used on all sites to minimise the impact of the development on the environment.

Techniques

that control pollution close to the source, such as permeable surfaces or infiltration trenches, might offer suitable means of treatment for run-off from low risk areas such as roofs, car parks, and non-operational areas. In higher risk areas, you might need other SUDS facilities such as constructed ponds, wetlands or swales.

Where there is a high risk of oil contamination, such as a fuelling point, it may be appropriate to use an oil separator as part of the SUDS scheme.

Glossary of Terms

Attenuation

Reduction of peak flow and increased duration of a flow event.

Balancing pond

A pond designed to attenuate flows by storing runoff during the peak flow and releasing it at a controlled rate during and after the peak flow has passed. The pond always contains water. Also known as wet detention pond.

Basin

Flow control or water treatment structure that is normally dry.

Biodegradation

Decomposition of organic matter by micro-organisms and other living things.

Bioretention area

A depressed landscaping area that is allowed to collect runoff so it percolates through the soil below the area into an underdrain, thereby promoting pollutant removal.

Brown roof

A roof that incorporates a substrate (laid over a waterproof membrane) that is allowed to colonise naturally. Sometimes referred to as an alternative roof.

Catchment

The area contributing surface water flow to a point on a drainage or river system. Can be divided into sub-catchments.

Combined sewer

A sewer designed to carry foul sewage and surface runoff in the same pipe.

Controlled waters

Waters defined and protected under the Water Resources Act 1991. Any relevant territorial waters that extend seaward for 3 miles from the baselines, any coastal waters that extend inland from those baselines to the limit of the highest tide or the freshwater limit of any river or watercourse, any enclosed dock that adjoins coastal waters, inland freshwaters, including rivers, watercourses, and ponds and lakes with discharges and groundwaters (waters contained in underground strata). For the full definition refer to the Water Resources Act 1991.

Curtilage

Land area within property boundaries.

Design criteria

A set of standards agreed by the developer, planners and regulators that the proposed system should satisfy.

Detention basin

A vegetated depression, normally is dry except after storm events constructed to store water temporarily to attenuate flows. May allow infiltration of water to the ground.

Diffuse pollution

Pollution arising from land-use activities (urban and rural) that are dispersed across a catchment, or sub-catchment, and do not arise as a process effluent, municipal sewage effluent, or an effluent discharge from farm buildings.

Dry

Free of water under dry weather flow conditions.

Environmental Footprint

A measure of environmental impact based on the distance that resources for a development are transported.

Environmental management

A management agreement for an area or project set up to plan and make sure the declared management objectives for the area or project are met. Environmental Management Plans are often undertaken as part of an environmental impact assessment and are set out in several stages with responsibilities clearly defined and environmental monitoring procedures in place to show compliance with the plan.

Evapotranspiration

The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.

Extended detention basin

A detention basin in which the runoff is stored beyond the time normally required for attenuation. This provides extra time for natural processes to remove some of the pollutants in the water.

FEH

Flood estimation handbook, produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology)

Filter drain

A linear drain consisting of a trench filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water, but may also be designed to permit infiltration.

Filter strip

A vegetated area of gently sloping ground designed to drain water evenly off impermeable areas and filter out silt and other particulates.

Filtration

The act of removing sediment or other particles from a fluid by passing it through a filter.

First flush

The initial runoff from a site or catchment following the start of a rainfall event. As runoff travels over a catchment it will pick up or dissolve pollutants and the "first flush" portion of the flow may be the most contaminated as a result. This is especially the case in small or more uniform catchments, however, in larger or more complex catchments pollution wash-off may contaminate runoff throughout a rainfall event.

Flood frequency

The probability of a flowrate being equalled or exceeded in any year.

Floodplain

Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions (see Environment Agency's Policy and practice for the protection of flood plains for a fuller definition).

Flood routing

Design and consideration of above-ground areas that act as pathways permitting water to run safely over land to minimise the adverse effect of flooding. This is required when the design capacity of the drainage system has been exceeded.

Flow control device

A device used to manage the movement of surface water into and out of an attenuation facility, eg a weir.

Greenfield runoff

This is the surface water runoff regime from a site before development, or the existing site conditions for brownfield redevelopment sites.

Green roof

A roof with plants growing on its surface, which contributes to local biodiversity. The vegetated surface provides a degree of retention, attenuation and treatment of rainwater, and promotes evapotranspiration. (Sometimes referred to as an alternative roof).

Greywater

Wastewater from sinks, baths, showers and domestic appliances this water before it reaches the sewer (or septic tank system).

Groundwater

Water that is below the surface of ground in the saturation zone.

Highways Agency

The government agency responsible for strategic highways, ie motorways and trunk roads

Highway authority

A local authority with responsibility for the maintenance and drainage of highways maintainable at public expense.

Highway drain

A conduit draining the highway. On a highways maintainable at the public expense it is vested in the highway authority.

Hydrograph

A graph illustrating changes in the rate of flow from a catchment with time

HOST (Hydrology of Soil Types)

A classification used to indicate the permeability of the soil and the percentage runoff from a particular area

Impermeable

Will not allow water to pass through it.

Impermeable surface

An artificial non- porous surface that generates a surface water runoff after rainfall.

Infiltration - to the ground

The passage of surface water though the surface of the ground.

Infiltration - to a sewer

The entry of groundwater to a sewer.

Infiltration basin

A dry basin designed to promote infiltration of surface water to the ground.

Infiltration device

A device specifically designed to aid infiltration of surface water into the ground.

Infiltration potential

The rate at which water flows through a soil (mm/h).

Infiltration trench

A trench, usually filled with stone, designed to promote infiltration of surface water to the ground.

Interflow

Shallow infiltration to the soil, from where it may infiltrate vertically to an aquifer, move horizontally to a watercourse or be stored and subsequently evaporated.

Interim Code of Practice

An agreed provisional document within the existing legislative framework that establishes good practice.

Lagoon

A pond designed for the settlement of suspended solids.

Lateral drain

(a) That part of a drain which runs from the curtilage of a building (or buildings or yards within the same curtilage) to the sewer with which the drain communicates or is to communicate; or

(b) (if different and the context so requires) the part of a drain identified in a declaration of vesting made under section 102 or in an agreement made under section 104.

Model agreement

A legal document that can be completed to form the basis of an agreement between two or more parties regarding the maintenance and operation of sustainable water management systems.

Natural Capital

The natural resource stocks from which resources useful for livelihoods are derived e.g. water, land, environmental resource

Offstream

Dry weather flow bypasses the storage area

Onstream

Dry weather flow passes through the storage area.

Pavement

Technical name for the road or car park surface and underlying structure, usually asphalt, concrete or blockpaving. NB the path next to the road for pedestrians (colloquially called pavement) is properly termed the footway.

Permeability

A measure of the ease with which a fluid can flow through a porous medium. It depends on the physical properties of the medium, for example grain size, porosity and pore shape.

Permeable pavement

A paved surface that allows the passage of water through voids between the paving blocks/slabs.

Permeable surface

A surface formed of material that is itself impervious to water but, by virtue of voids formed through the surface, allows infiltration of water to the sub-base through the pattern of voids, eg concrete block paving.

Pervious surface

A surface that allows inflow of rainwater into the underlying construction or soil.

Piped system

Conduits generally located below ground to conduct water to a suitable location for treatment and/or disposal.

Pollution

A change in the physical, chemical, radiological or biological quality of a resource (air, water or land) caused by man or man's activities that is injurious to existing, intended or potential uses of the resource.

Pond

Permanently wet basin designed to retain stormwater and permit settlement of suspended solids and biological removal of pollutants.

Porous paving

A permeable surface allowing the passage of water through voids within, rather than between, the paving blocks/slabs.

Porous surface

A surface that infiltrates water to the sub-base across the entire surface of the material forming the surface, for example grass and gravel surfaces, porous concrete and porous asphalt.

Pound

A section of a swale designed to detain runoff.

Prevention

Site design and management to stop or reduce the occurrence of pollution and to reduce the volume of runoff by reducing impermeable areas.

Proper outfall

An outfall to a watercourse, public sewer and in some instances an adopted highway drain. Under current legislation and case law, the existence of a proper outfall is a prerequisite in defining a sewer.

Public sewer

A sewer that is vested in and maintained by a sewerage undertaker.

Rainwater harvesting or rainwater use system

A system that collects rainwater from where it falls rather than allowing it to drain away. It includes water that is collected within the boundaries of a property, from roofs and surrounding surfaces.

Recurrence interval

The average time between runoff events that have a certain flow rate, e.g. a flow of 2 m/s might have a recurrence interval of two years in a particular catchment.

Retention pond

A pond where runoff is detained (e.g. for several days) to allow settlement and biological treatment of some pollutants.

RoSPA

Royal Society for the Prevention of Accidents.

Runoff

Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.

Section 38

An agreement entered into pursuant to Section 38 Highways Act 1980 whereby a way that has been constructed or that is to be constructed becomes a highway maintainable at the public expense. A publicly maintainable highway may include provision for drainage of the highway. (Drainage of highways is defined in Section 100 (9) of the Highways Act 1980).

Section 102 or 104

Section within the Water Industry Act 1991 permitting the adoption of a sewer, lateral drain or sewage disposal works by the sewerage undertaker. Sometimes referred to as S102 or S104.

Section 106 (Town and Country Planning Act 1990)

A section within the Town and Country Planning Act 1990 that allows a planning obligation to a local planning authority to be legally binding.

Section 106 (Water Industry Act 1991)

A key section of the Water Industry Act 1991, relating to the right of connection to a public sewer.

SEPA

Scottish Environment Protection Agency.

Separate sewer

A sewer for surface water or foul sewage, but not a combination of both.

Sewer

A pipe or channel taking domestic foul and/or surface water from buildings and associated paths and hardstandings from two or more curtilages and having a proper outfall.

Sewerage undertaker

This is a collective term relating to the statutory undertaking of water companies that are responsible for sewerage and sewage disposal including surface water from roofs and yards of premises.

Sewers for Adoption

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

Site and regional controls

Manage runoff drained from several sub-catchments. The controls deal with runoff on a catchment scale rather than at source.

SNH

Scottish Natural Heritage.

Soakaway

A subsurface structure into which surface water is conveyed to allow infiltration into the ground.

SOIL

Soil Index Value obtained from the WRAP soil classification, used in the Wallingford Procedure to calculate the treatment volume.

Source control

The control of runoff or pollution at or near its source.

STORM

A computer model based on equations used in the California Stormwater Best Management Practice Handbook. Used to assess detention basin performance.

Sub-base

A layer of material on the sub-grade that provides a foundation for a pavement surface.

Sub-catchment

A division of a catchment, allowing runoff management as near to the source as is reasonable.

Sub-grade

The surface of an excavation prepared to support a pavement.

Subsidiarity

The principle that an issue should be managed as close as is reasonable to its source.

SUDS (Sustainable Drainage Systems)

Sustainable drainage systems or sustainable (urban) drainage systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques (may also be referred to as SuDS).

Surface water management

The management of runoff in stages as it drains from a site.

Suspended solids

Undissolved particles in a liquid.

Swale

A shallow vegetated channel designed to conduct and retain water, but may also permit infiltration; the vegetation filters particulate matter.

Treatment

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

Treatment volume

The volume of surface runoff containing the most polluted portion of the flow from a rainfall event.

Watercourse

A term including all rivers, streams ditches drains cuts culverts dykes sluices and passages through which water flows.

WRAP (Winter Rain Acceptance Potential)

Classification used to calculate the permeability of soils and the percentage run-off from a particular area.

Wet

Containing water under dry weather conditions.

Wetland

A pond that has a high proportion of emergent vegetation in relation to open water.