South Yorkshire
Interim Local Guidance for
Sustainable Drainage Systems

Date	June 2015
Version	FINAL v1.0

Revision Schedule

South Yorkshire - Interim Local Guidance for Sustainable Drainage Systems

Revision	Prepared by	Tel	
01	***Derek Bell*** *Principal Network Resilience Manager*	*01226 787654*	*derekbell@barsley.gov.uk*
	Richard Ward *Senior Flood Risk Engineer*	*01302 862798*	*richard.ward@doncaster.gov.uk*
	Graham Kaye *Principal Engineer*	*01709 822983*	*graham.kaye@rotherham.gov.uk*
	Roger Nowell *SuDS Lead Officer*	*0114 273 5847*	*Roger.Nowell@sheffield.gov.uk*
	Paul Swales *Local Levy Officer*	*0113 819 6233*	*paulx.swales@environment-agency.gov.uk*

Contents

Contents

Contents

Figures

Tables

Appendices

PAGE INTENTIONALLY LEFT BLANK

1. Executive Summary

This document has been produced by a working group from the Local Authorities of Barnsley MBC, Doncaster MBC, Rotherham MBC and Sheffield City Council. The South Yorkshire Authorities are committed to making our area a place that provides the best possible quality of life for all who live and work here. Making it more sustainable is an important part of supporting this vision and it is therefore implicit that new development should incorporate sustainability measures that help achieve this goal. During the design and implementation of SuDS consideration should be given to ensuring that flood risk, both on and offsite and water quality is managed. In addition design should seek to provide environmental improvements and protection, manage health and safety proportionately and ensure stability and durability of construction.

This document provides guidance for the local standards for the South Yorkshire Lead Local Flood Authorities (LLFAs) and together with the Non-Statutory Technical Standards (NSTS) strongly promotes the use of Sustainable Drainage Systems (SuDS). The NSTS allow for the setting of Local Standards by the LLFA and Planning Authority (LPA), which relates to the framework set by the National Planning Policy Framework this allows specific to all local conditions, requirements, risks, and surface water management, and delivers important local benefits to be introduced.

The Local Guidance must be read in conjunction with the NSTS and all relevant policies and documentation detailed within the Local Standards. The Local Guidance sets out the objectives and explanation to give clarification and to aid implementation.

The guidance this document provides indicates the minimum recommended standards to ensure a satisfactory scheme is constructed; they are not intended to preclude any requirement for a higher standard that may be deemed necessary. Adherence to the minimum recommended standards set out in the document will ensure that adopting Local Authorities, Water Companies, Internal Drainage Board (IDB), Environment Agency, Developers and Management Companies or similar are willing to accept the new systems on completion.

This document is intended to be used by developers and their consultants as well as the planning authority. It is not intended to be a prescriptive document, although it does set certain standards which will normally be required as a condition for adoption of the new systems.

It is further intended that new ideas and approaches to design problems should not be suppressed. Developers and their designers are strongly urged to discuss their ideas with the Local Authority at an early stage in the scheme.

Developers will find it helpful to establish at the outset the relevant policy context for any proposed development as set out in the Local Plan for the area.

All SuDS applications shall be included and form part of the existing Local Authority Planning Process and shall comply with all existing Planning Policies.

2. Background and Legislation

The Flood and Water Management Act 2010 (FWMA) was introduced to address the concerns and recommendations raised in the Pitt Report following the 2007 floods.

The FMWA stipulates that in designing and implementing SuDS, consideration should be given to ensuring that they; reduce flood risk from surface water, improve water quality, protect and improve the environment, protect health and safety and ensure stability and durability of drainage.

To aid this the Government are strengthening existing planning policy which will make clear that the Government's expectation is that sustainable drainage systems will be provided in new developments wherever this is appropriate.

Local planning policies and decisions on planning applications relating to major development are set out in the Town and Country Planning (Development Management Procedure) (England) Order 2010 which states:

"major development" means development involving any one or more of the following—

(a) the winning and working of minerals or the use of land for mineral-working deposits;

(b) waste development;

(c) the provision of dwelling houses where —

(i) the number of dwelling houses to be provided is 10 or more; or

(ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);

(d) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or

(e) development carried out on a site having an area of 1 hectare or more;

Local Planning Authorities (LPAs) will need to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. Some nationally significant infrastructure will be exempt from these requirements.

Each LLFA became a statutory consultee to the planning authority from 15th April 2015 and will become responsible for providing advice to the LPA on surface water drainage systems for new major developments in line with a set of Non-Statutory Technical Standards for sustainable drainage systems (NSTS). This local guidance document provides clarity on how the LLFA expect the SuDS NSTS to be implemented by developers locally, with consideration for locally specific variances.

Under the updated planning policy, the Planning Authority will have to be satisfied that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development. SuDS should be designed to ensure that the maintenance and operation requirements are economically proportionate.

The arrangements for adoption by the local authorities are being developed but these potentially will include Section 106 and Section 38 agreements with developer contributions.

This document has been produced as a guide for developers to enable them to submit the appropriate information to the LPA for comment by the LLFA and to ensure a timely and successful response. In order to be acceptable, the proposed drainage system will have to meet the New National Standards. It is considered that discussions need to be held at the earliest possible stage with the Planning Authority and the LLFA to discuss the proposals.

Each Local Planning Authority will be setting specific local planning authority requirements to their area to support developers in their applications.

3. The Application Process

3.1. Pre-Application

The LLFA should be involved in any pre-application discussions relating to a development as it is recognised that the best and most viable SuDS outcomes are achieved if SuDS are considered early on in the formulation of the development design and layout. It would be beneficial for a range of people to be involved at the pre-application stage, including the LPA, LLFA, Highway Authority, Environment Agency (where relevant), sewerage undertakers, the developer, consultants, drainage engineers, landscape architects or urban designers and ecologists.

Where pre-application discussions are to be held with the LPA specific advice should be sought with the LPA regarding charges that are applicable. This will enable different areas or features to be integrated as part of the overall development at the different scales and for potential adoption by different bodies to be defined. Pre application will allow conceptual drainage designs to be developed with subsequent working up to outline designs. This will allow applicants to design to detail with confidence that applications will be approved.

Pre-application discussions are strongly encouraged as they will help identify the design criteria which apply to your development. No formal submission of information is required at this stage, however some important information is strongly recommended at this stage

Pre-design discussion with LLFA advised prior to any submission; these should cover the following:		
1	Site assessments including the existing drainage characteristics, geology and topography	
2	Existing flood risks	
3	Identification of any watercourses running through the site	
4	Natural flow paths, discharge locations, sub-catchments	
5	Identification of any potential off-site flood risk impact	
6	Likely design criteria applicable to the site	
7	Potential SuDS integration	
8	Evidence of discussions with Water Companies and the EA	
9	Adoption options/ownerships/easements	
10	Maintenance and access arrangements	

Table 1 – SuDS Pre-Development Check List

3.2. Outline Design

Following the initial meeting designers will be able to develop drainage design concepts working with other disciplines involved in the development. This can then be worked up to an outline design which provides information for an in-principle approval by the LPA.

Following pre-design discussion with LLFA it is recommended that the following be submitted prior to submitting the application in order to obtain an 'agreement in principle';		
1	Detailed Flood Risk Assessment	
2	Existing utilities plan (if applicable)	
3	Impermeable areas estimate	
4	Confirmed discharge locations and conditions	
5	Drainage sub-catchments	
6	Storage volume estimate	
7	Storage location(s) source to regional	
8	Flow control(s)	
9	Ecology and water quality implications, e.g. treatment train	
10	Areas where SuDS will form recreational features	
11	Public health and safety consideration	
12	Identification of adoption responsibilities	
13	Maintenance and access arrangements	

Table 2 – SuDS Application Check List

3.3. Master Planning

Master planning should be undertaken at the beginning of the design process to develop an area wide strategy especially where a number of developments could resolve SuDS issues together. This would enable the creation of larger schemes with lakes, ponds, basins etc. including access paths within the green infrastructure area.

When undertaking master planning the following should be taken into consideration;

- Large scale natural flow paths informing SuDS catchments
- Integration of SuDS within the overall green infrastructure of the site
- Distribution of water storage between regional and source/site controls
- Adoption arrangements of all infrastructure
- Solutions to investment requirements to cater for phased nature of developments
- Maintenance and access arrangements in perpetuity for all SuDS

3.4. Full application

Any application should clearly identify who will be responsible for maintaining the sustainable drainage systems and funding for maintenance

To complete the application the following needs to be submitted to the LPA;		
1	Detailed Flood Risk Assessment	
2	Detailed design	
3	Specification of materials	
4	Flow calculations (.mdx files where possible)	
5	Details of inlets, outlets and flow controls	
6	Construction details	
7	Phasing of development including Construction Management Plan	
8	Cross sections including design levels	
9	SuDS Design Statement	
10	Operation and Maintenance Plan	
11	Health and Safety Risk Assessment	

Table 3 – SuDS Application Submission Check List

3.5. Outline Planning Approval

The LLFA will be consulted on outline planning applications. An outline planning application should therefore include a conceptual Drainage Design for the LLFA to provide comments on, otherwise more information may be required at the reserved matters stage and the developer may discover problems later on that will be harder to resolve.

Reference shall be made to Table 2 – SuDS Application Check List to inform planning applications.

3.6. Check List

The above checklists of items required for applications and adoption can be found in Appendix 2, 3 and 4 at the end of this document.

4. Introduction to SuDS

Traditional piped drainage systems have always focussed on removing water from the surface of developed land during rainfall events and into pipes before rapid delivery to local watercourses and sewage treatment works. The modern and more sustainable approach is SuDS. SuDS help to slow down the flow rate, reduce pollutant loading and where possible reduce the volume of water flowing off paved surfaces by applying multiple stages where water is stored, treated and released back to local watercourses or groundwater at a controlled rate.

SuDS should deliver benefits in all of the following areas:

Quantity: SuDS reduce the risk of flooding and erosion by reducing surface water runoff rates and, where possible, volume compared to traditional drainage systems.

Quality: SuDS reduce pollutant loading in surface water from developments and in doing so protect, and in some cases enhance, the water environment.

Amenity: SuDS can provide various socioeconomic benefits to people and should be multi-functional spaces within new developments.

Biodiversity: SuDS should help to maintain or enhance habitat provision and encourage biodiversity against ongoing pressures from urban development.

Best practice is to use vegetated features on or near to the surface such as swales, basins, wetlands and filter strips that enhance the natural and visual amenity of a development but also offer significant benefits for pollution filtration and runoff control. However SuDS can also include where necessary engineered solutions such as permeable paving and filter trenches that can offer similar surface water management benefits, albeit with reduced amenity and biodiversity benefits.

Many of these SuDS components are described briefly in Section 7, although designers are advised to consult the more comprehensive guidance in the CIRIA SuDS Manual (C697) for a fuller description. However, this list should not preclude innovative drainage solutions from being explored.

4.1. The Cost of SuDS

Whilst a common misconception is that SuDS may cost more than traditional drainage systems, due to factors such as land take, maintenance and operation costs, a plethora of comparative evidence is now available that indicates that a SuDS system that is cheaper than the whole-life costs of a traditional system can be employed for any development, including high density urban development. The benefits of SuDS can be further demonstrated when intangible benefits such as amenity and biodiversity are considered.

Savings made by using SuDS will be vastly increased by considering SuDS early in the design phase, working with natural processes and incorporating appropriate SuDS for the development. For this reason, pre application discussion with the LLFA is strongly recommended to maximise savings on a SuDS scheme.

4.2. The SuDS Management Train

SuDS should utilise a cascading series of drainage features to collect, treat, store and convey surface water in a controlled manner. For any given area of development, surface water should pass through an appropriate number of treatment stages according to the land use and sensitivity of the receiving water body. This is known as the SuDS management train and allows SuDS systems to maximise benefits of SuDS for surface water flood risk and the environment.

In designing a SuDS management train, it should be demonstrated that surface water is managed in a number of sub-catchments which characterise the land use and drainage type of each area. Each sub-catchment should employ source control measures that treat surface water runoff as close to source as possible to remove the first flush of pollutants. Sub-catchments may then drain to a site control, which may serve a number of sub catchments and finally to a regional control, where a network of sub catchments or the whole site may eventually drain to prior to discharge off site.

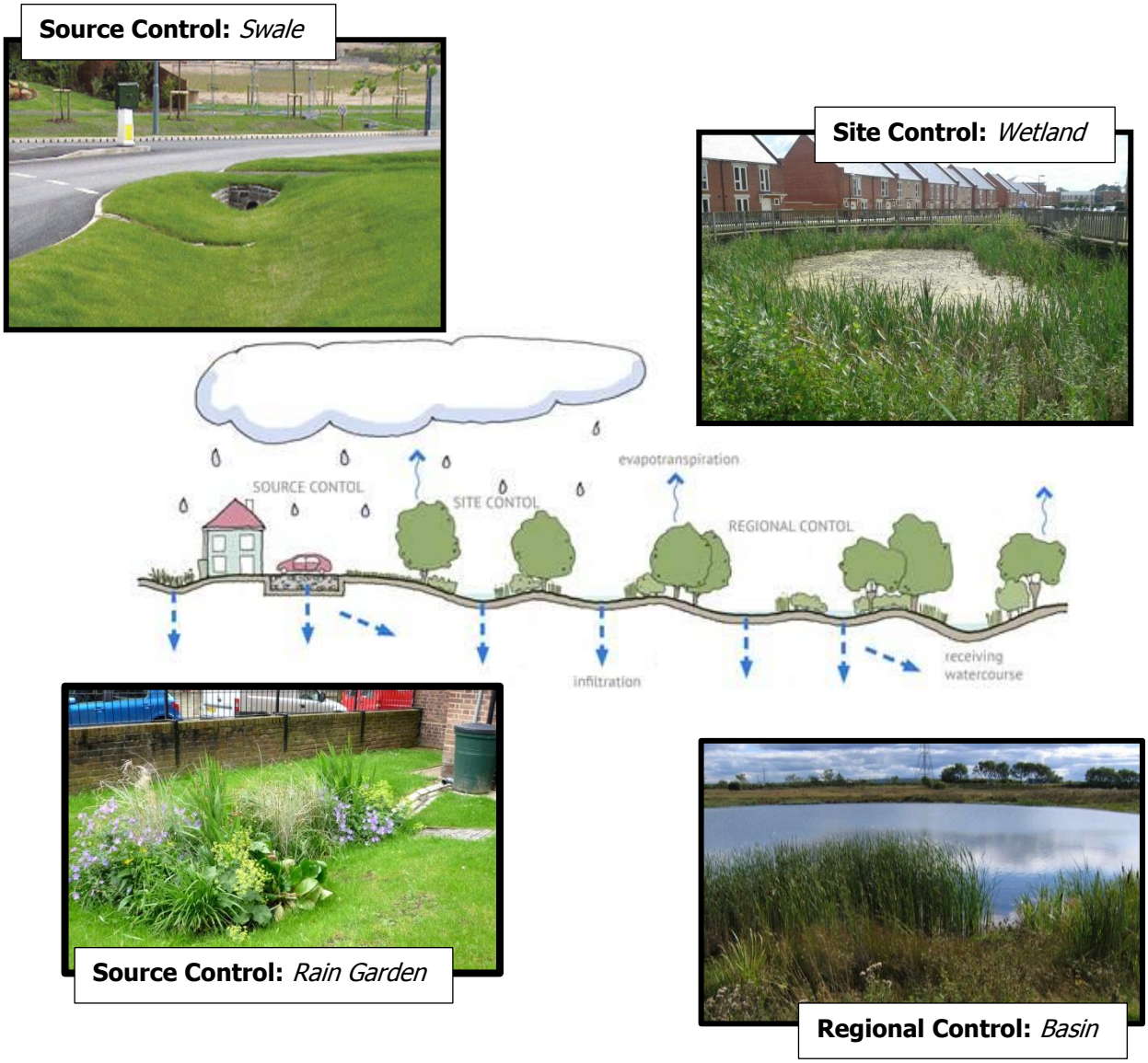

Figure 1 – The SuDS Management Train

5. Design Standards

5.1. Local Principles and requirements

Our SuDS design principles are as follows:

a) Plan for SuDS

SuDS should be incorporated into the early design process. Investing in good design and identifying the requirements, issues and opportunities for SuDS at the early stages of a project is likely to pay dividends for the final SuDS scheme.

b) Integrate With Public Places

Where possible SuDS should be combined with public space to create multi-functional use areas and provide amenity. For example SuDS features could be incorporated into traffic calming and parking areas (on street and car parks).

By considering different development layouts and densities, green infrastructure (GI) can be used to deliver wet or dry SuDS as well as other functions. Sports pitches, squares, courtyards, playgrounds, landscapes around buildings, urban parks, green corridors and woodlands are all popular types of open space which can be integrated with SuDS. SuDS can also contribute to development targets for open space where they are designed to be multi-functional.

c) Manage Rainfall at Source

Surface water runoff should be captured as close to where it falls as possible. Management and conveyance of surface runoff should be kept on the surface as far as possible.

d) Mimic Natural Drainage

SuDS networks will be designed to match natural drainage routes, infiltration rates and discharges as far as possible.

e) Design for Water Scarcity

New development should incorporate rainwater/grey water re-use facilities.

f) Enhance Biodiversity

Consideration for landscape and biodiversity is critical to delivering contextually appropriate SuDS schemes.

g) Link to Wider Landscape

Opportunities to link SuDS to existing or potential future blue and green infrastructure should be explored. SuDS schemes should fit with the local landscape character. Designers should take advantage of local topography and other landscape features such as trees, hedgerows, fence lines and local materials to enhance local character.

h) Design to be maintainable

It is extremely important to incorporate maintenance requirements for SuDS from the outset. Throughout the process, it should be considered how features can be accessed, who will be responsible for maintaining them and how much it is likely to cost. Good management and design go together.

i) Use a Precautionary Approach

The natural floodplain must be protected and considered in design. Where SuDS are proposed in a fluvial floodplain the SuDS feature may fill up with fluvial flood water when the area floods and will not have capacity to hold the rainfall run off from the site as originally intended. SuDS should be carefully designed where there is the presence of contaminated soils. System components should be designed to maximise their adaptive capacity.

j) Have a Regard to the Historic Environment

SuDS design and construction should be complementary to the heritage of the area

k) Show Attention to Detail

SuDS must be carefully designed using attention to detail to ensure they function as intended

l) SuDS Elements

All SuDS elements should be designed to eliminate or minimise risk to the general public

m) Climate Change

Peak rainfall intensity shall be taken as +30% (Refer to Table 4 Page 14)

n) Urban Creep

Shall be taken as +10% for housing estates, other developments should be discussed on an individual basis with the relevant LLFA

6. Design Criteria

6.1. Background Information

The natural characteristics of the area from the point of view of rainfall and geology need to be determined and understood by the applicant in order to determine the drainage design and discuss the information with the LLFA at an early stage.

Additional details can be obtained via a range of online geological tools which can be found on the British Geological Society's (BGS) website. The BGS geoindex map viewer provides further information http://mapapps2.bgs.ac.uk/geoindex/home.html

Another essential source of information is the HR Wallingford – UK Sustainable Drainage Guidance & Tools and their SuDS design toolkit can be found at http://www.ukSuDS.com/index.htm

6.2. Affordability

Where compliance with the following criteria and guidance would necessitate a drainage system that is more expensive, taking into consideration whole life costs, than an equivalent conventional design then full compliance is not required. Instead the drainage system must comply with the standards to the greatest extent possible, without exceeding the cost of the equivalent conventional design.

The integration of landscape design with drainage is to be encouraged and indeed can lead to saving as a result of combined investment. In assuming affordability there needs to be clarity on the boundaries between investment to ensure drainage costs are separated from other costs.

Requests for a relaxation of the standards on the grounds of affordability may need to be evidenced and substantiated by the LPA and LLFA.

6.3. Drainage Destination

Drainage design should always aim to discharge surface water to the ground or surface water bodies in a way that allows for evaporation, evapo-transpiration and further infiltration by managing water at the surface. The runoff destination should be considered hierarchically and should be evidenced;

- **Harvesting**
- **The ground**
- **A surface water body**
- **A surface water sewer or highway drain where appropriate**
- **A combined sewer**

Depending on conditions, water can drain from a site using a combination of these tiers, although where possible water should be managed at source, on the surface and allowed to infiltrate into the ground. Water should only be discharged to a combined sewer if other destinations are demonstrated to be impractical.

6.4. Into the Ground – Infiltration

The following considerations should be fully evaluated before determining the extent to which infiltration can be used on a site;

- The infiltration capacity of the soil
- The risk of ground instability or subsidence as a result of infiltration
- The risk of slope instability or solifluction as a results of infiltration
- The risk of pollution from mobilising existing contaminants on the site
- The risk of pollution from infiltrating polluted surface water runoff from the site

- The risk of groundwater flooding as a result of infiltration
- The risk of groundwater leakage into the combined sewer as a result of promoting infiltration on the site

A Ground Investigation should assess the soil infiltration rate, depth to groundwater and, if necessary, note any geotechnical implications. This should be submitted with all applications, ideally during pre-application discussion. Note SUDS within brownfield sites may need to be lined to prevent any incidental infiltration.

6.5. Soil Infiltration Rate

The infiltration rate of the ground should be determined within a site specific trial pit(s), ideally in the approximate location of the proposed infiltration feature. For potentially large area infiltration features, a trial pit should be dug at intervals of approximately every 10m. Trial pits should be dug to the same depth as that anticipated for the proposed soak away (around 1.0m –1.5m below the anticipated invert level of the pipe discharging to the proposed soak away); be between 0.3m – 1.0m wide; and, approximately 1m – 3m long, with trimmed vertical sides. Infiltration testing should be completed as per the method given in BRE Digest 365. The minimum calculated infiltration rate for a given location should be used for design purposes.

To ensure the adequate performance of a proposed soakaway structure a minimum 1.0m 'buffer' should be ensured between the bottom of a proposed soakaway structure and the groundwater table.

6.6. Into a Watercourse

If infiltration proves to be unacceptable consideration should then be given to discharge to a watercourse. The following criteria may be reason for the watercourse being unviable as a discharge location;

- Access e.g. Where distance is regarded as too costly to cover, third party land issues
- Pumping requirements
- Increased risk of flooding

6.7. Into a Surface Water Sewer or a Highway Drain

The same criteria to the watercourse would apply

6.8. Into a Combined Sewer

The same criteria to the watercourse would apply

6.9. Surface Water Run-Off (Off-Site Flood Risk)

Surface water run-off hydraulic control shall:

- Seek to achieve the prevention of any discharge of surface water from the site for rainfall events less than 5mm in depth and to prevent run off for the first 5mm of rainfall in a larger event.
- 1 in 1 year return period should be considered to mitigate the effect of development run off on the environment.
- 1 in 100 year return period should be managed to protect people and property on site from internal flooding, and to mitigate increased flood risk in the receiving water body, and protect people and properties downstream of the development or site.
- Events greater than 1 in 100 year return period should be evaluated where it could have an impact in terms of social disruption, damage or risk to life, and to mitigate flood risk problems to reduce these impacts.
- Drainage design proposals should be assessed for the likelihood and consequences of any structural or blockages failures and associated flood risks.

- Surface water run off or overland flows shall be considered to minimise the risk of flooding off site. The design of the SuDS and associated drainage system and levels on and off site shall demonstrate where surface water run off flows will travel in an exceptional event and where the design of the drainage systems is exceeded.
- A flood route drawing will be required which must show the route of the surface water run-off, off site.

6.10. Peak Flow Control

The drainage design should be tested using 1 in 1, 1 in 2, 1 in 30, 1 in 100 and 1 in 100+ climate change rainfall events to determine the maximum storage volume.

The *SuDS NSTS: S4 & S5* sates that for greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must not exceed the peak greenfield runoff rate for the same event, unless there are exceptional circumstances where further restrictions may be required in order to control flows for both the 1 and 100 year return period events, two or more flow control components or a multi-level system should be included in the design. Achieving multiple level flow control is challenging and therefore reasonable tolerances to achieving the criteria are required.

Surface runoff from previously developed land (brownfield) which has ceased to be in use for a period of time beyond 10 years may not be able to be accommodated in the downstream surface water system due to recent development in the locality which has taken up the surplus capacity from the site. For these previously developed sites where it is demonstrated that it is not possible to restrict surface water runoff to greenfield runoff rates it should ideally be demonstrated that a minimum of 30% betterment on existing runoff rate is achieved based on a 1 in 1 year event.

The design rainfall events should be applied for the critical site duration and must include the recommended climate change allowance. The impermeable area of the development must also include an allowance for urban creep through an increase in 10% of the impermeable area. For non-housing sites this will be reviewed on a case by case basis.

Where site run-off is to be discharged to the surface water sewer or combined sewer, the sewerage undertaker should be consulted as to whether any additional or alternative discharge controls are required.

Where site run-off is to be discharged to a highway drainage network, the highway authority should be consulted as to whether any additional or alternative discharge controls are required.

It is important to note that the LLFA must be consulted at all times where any drainage system discharges to a watercourse. Some watercourses are classed as sensitive and have flooding problems therefore further restriction may be required by the LLFA where any drainage system discharges into the receiving watercourse.

Where run-off rates from the development are greater than the allowable discharge rates from the site, attenuation storage and/or infiltration systems should be used to allow events up to the design return period to be adequately controlled.

To meet peak flow rate design criteria for the site, there should be a form of hydraulic control upstream of the point of discharge.

The pipe or throttle size should be considered to minimise the risk of blockage from sediment or other debris and a comprehensive SuDS management train should be included in the design.

Additional Notes

Submissions should demonstrate that exceedance design has been considered so that the risk to people and property from extreme rainfall events is minimised, in line with the SuDS NSTS.

If the proposed system connects to an existing drainage system, whether it is a sewer, highway drain, water body or sustainable drainage system, consideration must be given to the operational capacity and functionality of the existing system to ensure that there is no adverse impact or flood risk is increased within the site. For example;

a) Surcharge within an existing system must be prevented from entering the approved drainage system and increasing the flood risk and impacting on the water environment (e.g. connection to a combined sewer must incorporate a non-return valve to prevent contamination of the surface water system)
b) The existing system may be required to be redesigned or resized to accommodate additional flows from an approved system.

National precautionary sensitivity ranges for peak rainfall intensities and peak river flow

Parameter	1990 to 2025	20025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		

NOTE This table was adapted from National Planning Policy Framework: Technical Guide (46).

Table 4 – Peak Rainfall Intensities Comparison with Peak River Flows

6.11. Volume Control

It will be a requirement for the runoff volume from the developed site to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event to not exceed the greenfield runoff volume for the same event.

If this is not reasonably practicable the designer must demonstrate that:

- The volume of storage required would lead to the development becoming unviable
- The volume of storage required could not be accommodated on the development site
- The additional volume must be discharged at a rate that is not deemed by the LLFA to adversely affect flood risk.

6.12. Flood Risk Within the Development

For the design to demonstrate that the drainage system accommodates the 1 in 30 year rainfall event design calculations will be required to be submitted (preferably as mdx files) with any drainage application to support all the design criteria, including, but not limited to, climate change.

Other drawings, plans and specification, as required by the LLFA to demonstrate functioning of the drainage system, will also be required.

The discharge rates from the site will be restricted to the existing greenfield run off rates for the 1 in 1 year and 1 in 100 year, in line with the SuDS NSTS (S4 and S5) with sufficient storage within the system to accommodate a 1 in 30 year storm.

For sites <50ha the method used for calculating existing greenfield run off should be the Interim Code of Practice SuDS method. The design shall also ensure that storm water resulting from a 1 in 100 year event with a 30% increase for climate change and surcharging the drainage system can be stored or attenuated on site without risk to people or property and without overflowing off the site.

Flow paths should be clearly shown for the above and below ground drainage system to demonstrate that flooding does not occur in any part of building or utility plant for the design areas. Flow routes should be clearly shown for events that overwhelm the system to demonstrate that conveyance routes minimise risks to people and property on or off site.

7. Water Quality

The SuDS design should demonstrate that the Water Quality Criteria set out in The SuDS Manual CIRIA C697 Section 3.3 and the requirements of the LLFA have been considered and incorporated in the SuDS design. An appropriate management train of SuDS components should be implemented to effectively mitigate the pollution risks associated with different site users/activities, (refer to the detail in 4.2 above).

Where surface water is likely to be contaminated for example from oils and heavy metals effective management will be required to capture and treat pollutants in order to prevent discharge to habitats and watercourses. This is best done on the surface.

A management train approach should be taken. This should be done close to the surface to reduce the build-up of downstream parts of the system thus reducing blockage, maintenance and visual impacts.

7.1. The Water Framework Directive

The Water Framework Directive (WFD) is a piece of European Union legislation that requires member states to make plans to protect and improve the water environment. It was implemented into law in the UK in 2003.

The Environment Agency is the lead competent authority for implementing the WFD in England. The WFD applies to surface freshwater bodies, including lakes, streams, rivers and canals and also to groundwaters, coastal waters and estuaries.

There are four main aims of the Water Framework Directive, these are to;

- Improve and protect inland and coastal waters
- Drive wiser, sustainable use of water as a natural resource
- Create better habitats for wildlife that lives in and around water
- Create a better quality of life for everyone

Sustainable drainage systems can contribute to the aims of the Water Framework Directive by improving watercourse water quality through removing flows from combined sewer systems and reducing future risks to watercourses by treating surface run-off. They can also contribute to conserving water, providing habitats and raising awareness of water environments.

The Catchment Data Explorer is publically available source of WFD information. You can use the catchment data explorer to navigate to catchments and water bodies, view catchment summaries and download data.

7.2. Protection of the Groundwater or Receiving Watercourse

To remove the major proportion of pollution from surface water runoff and limit the impacts of development on receiving waterbodies, it is necessary to capture and treat the initial surface water runoff with the first flush of pollutants from surface equating to 10 - 15mm.

Receiving water sensitivity → / Runoff catchment characteristics ↓	Low	Medium	High
Roofs ONLY	1	1	1
Residential roads, parking areas, commercial zones	2	2	3
Refuse collection/ industrial areas/ loading bays/ lorry parks/ highways	3	3	4

Table 5 – Number of Treatment Train Components *(Extract from CIRIA C697)*

7.3. Groundwater Source Protection Zones (SPZ)

Groundwater sources such as wells, boreholes and springs used for public drinking water supply are defined as Source Protection Zones (SPZs). These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity to an SPZ the greater the risk. There are 3 main zones (inner, outer and total catchment) and a fourth zone of special interest, is occasionally applied, to a groundwater source.

It is crucial that we look after these sources and ensure that your water is completely safe to drink. Therefore, where any SuDS proposal interacts with an SPZ there is a requirement for a groundwater risk assessment to be undertaken.

8. Structural Integrity

SuDS need to be designed to be fit for purpose over the proposed development design life. The design should also allow for the replacement or repair of drainage components and minimise the need for maintenance and replacement of components. This statement applies to all elements of the SuDS including green infrastructure.

Any drainage component installed below or adjacent to other infrastructure, such as highways, should have a design life compatible with the adjacent infrastructure.

Components which need to be replaced or repaired during the design life should be designed to be accessible without undue impact on the adjacent infrastructure or drainage system.

Material must not react and/or degrade over time to the detriment of the system or adjacent infrastructure

The suitability of the material proposed for a particular drainage component should be assessed as fit for purpose.

8.1. Interaction With Utilities

Wherever possible utility apparatus should avoid being placed or routed through or under any SuDS feature, if this is unavoidable early discussions with the relevant utility company should be held. Where SuDS features are adopted as highway, by the Highway Authority, the highway will be designated under section 63 of the New Roads and Street Works Act (1991) as 'Special Engineering Difficulty' and Section 38 of the Highway Act (1980).

8.2. Compliance Assessment

Compliance with structural integrity requirements would be demonstrated by:

- Provision of information relating to the design life of the components and/or adjacent infrastructure. This includes information regarding materials and installation, including any compliance with relevant standards.
- Health and Safety assessment
- Consideration of all relevant infrastructure, and structural calculations if appropriate

For those components which have a shorter design life than the development, then a repair/replacement procedure must be included within the maintenance plan as further discussed in Section 12.2. With this scenario, a commuted sum will also be requested.

9. Health and Safety

The main health and safety concerns regarding SuDS include

- The risk of drowning.
- Waterborne disease.
- Slips, trips and falls

Good design practice that reduces health and safety risks is included as appropriate in the SUDS components later in the document:

In addition there are the following points:

Wherever possible, surface water runoff from roads and hard standing should pass through an appropriate SuDS management train including effective source control to enhance the trapping of potential contamination

There is a potential risk of waterborne infection which should be considered in the management of open water features. It is important to recognise that the risk of infection is low.

Where ponds fall under the Reservoirs Act 1975 or the Flood and Water Management Act 2010, then additional requirements may be needed.

In some areas dry basins may be preferred to open water features or ponds. The Local Authority must be consulted at an early stage e.g. Pre Planning Application Stage.

The Construction (Design and Management) Regulations 2015 (CDM) must be applied to the planning, design, construction and long term maintenance of SuDS and a risk assessment undertaken for the design, construction and future maintenance (see The SuDS Manual CIRIA C697), for example:

- All SuDS features must provide safe access for maintenance.
- All SuDS features must provide a safe environment for the general public.
- Access points for vehicles should be level, secure and stable.

As part of the submission to the LLFA it may be a requirement for the risk assessment to be included.

Danger signs and lifesaving equipment should not be necessary where the conditions set out above are followed, as SuDS should be considered inherently safe features in the landscape.

The drainage designer will demonstrate that amenity has been provided in the SuDS design and that all components conform with recognised health and safety best practice as required by the local authority.

10. SuDS Features

In all cases the LLFA must be consulted at an early stage e.g. Pre Planning Application Stage to determine the SuDS requirements for each local area.

SuDS must be designed to ensure that development and occupants are protected from flooding, and that off-site flood risk is not increased. Where possible SuDS should aim to reduce the overall risk of flooding off-site and drain via infiltration as a preference.

10.1. Rainwater Harvesting *(Ref CIRIA SuDS Manual – Chapter 6)*

Rainwater harvesting is the process of collecting and using rainwater. If designed appropriately the system can be used to reduce the rates and volumes of runoff;

- Can range from complex district-wide systems to simple household systems linked to a water butt
- Most simple rainwater harvesting systems are relatively easy to manage
- Rainwater harvesting system can be combined with grey water recycling systems to form an integrated process

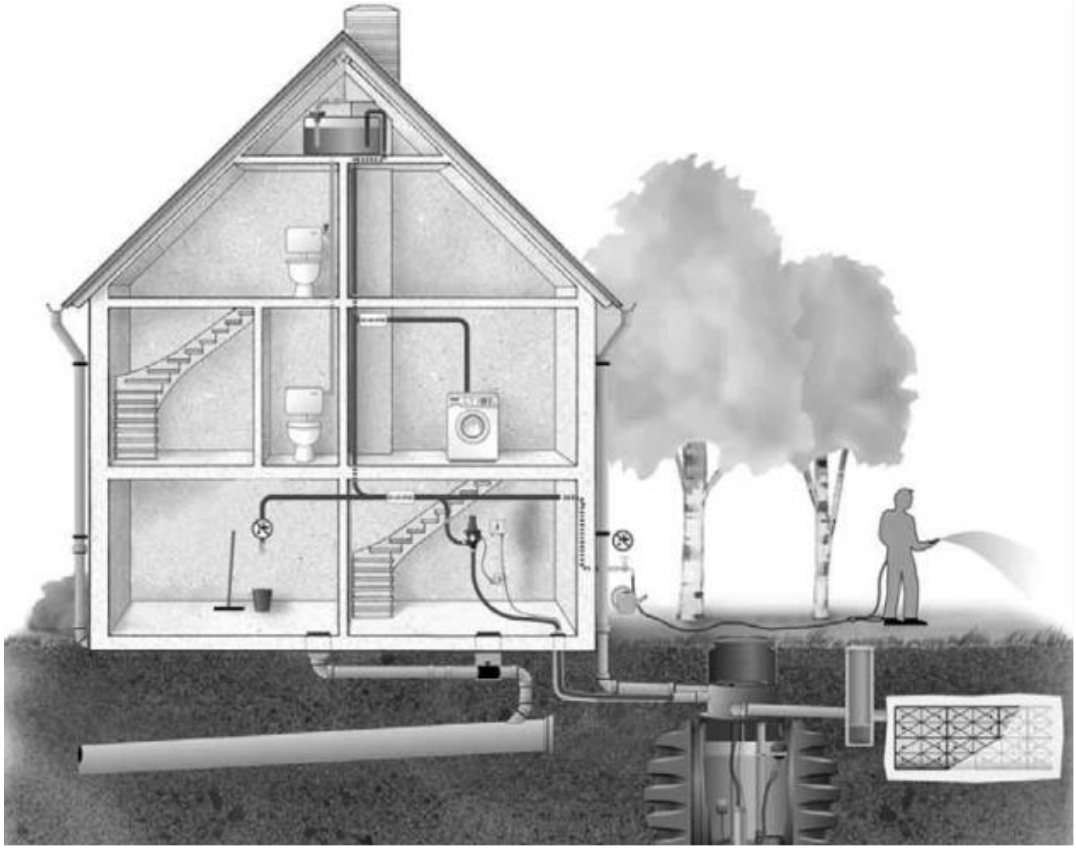

Figure 2 - A Conceptual Rainwater Harvesting System

10.1.1 Green Roofs: Are a multi layered system for intercepting and storing rainwater. They often comprise a waterproof membrane overlain with granular material, topped off with low maintenance planting such as sedum to reduce or eliminate run-off from roof areas.

Green roofs cannot be accepted as a volume or flow control structure although they may be effective source control features.

Figure 3 - A Typical Green-Roof Construction

10.1.2 Soakaways: Can be square or circular excavation, filled with suitable aggregate or lined with brickwork, or pre-cast storage structures surrounded by granular backfill. They can be located in hard or soft areas and surfaced to match adjacent areas.

- Infiltration testing carried out in accordance with BRE Digest 365
- Minimum design standard for soakaways is to contain a 1/30yr event
- Filter material should provide >30% void space
- Base of soakaway at least 1m above groundwater level
- Minimum of 5m away from foundations
- Not located under the highway

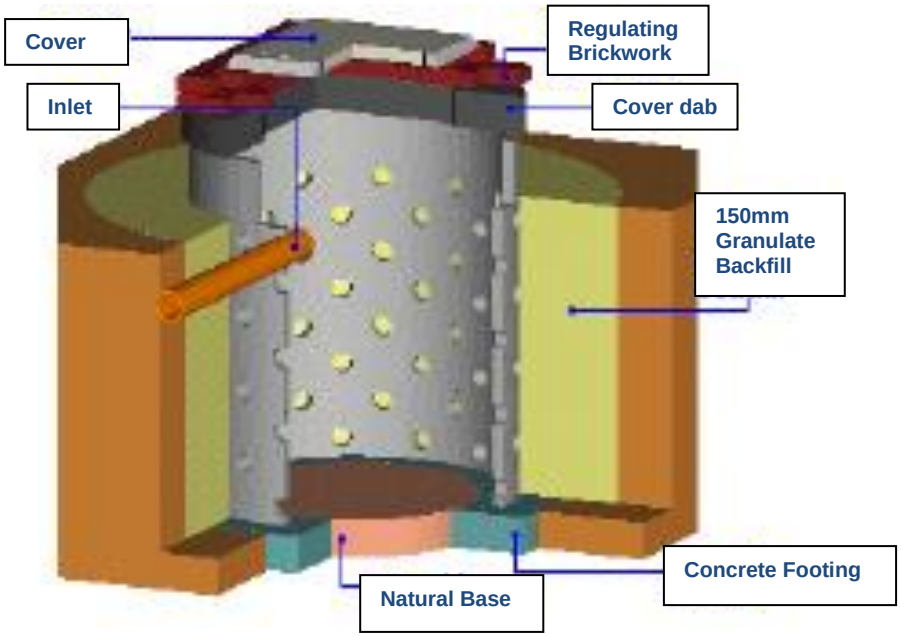

Figure 4 - A Typical Soakaway Construction

10.1.3 Water Butts: Are the most common means of harvesting rainwater for garden use. They are small, off-line storage devices that are designed to capture and store roof runoff. They should not be taken into consideration when calculating drainage sizes.

10.2. Filter Strips *(Ref CIRIA SuDS Manual – Chapter 8)*

Vegetation strips of land designed to accept overland sheet flow;

- Runoff must be distributed across the filter strip
- Gradients not exceeding 1 in 20 and a minimum of 1 in 50

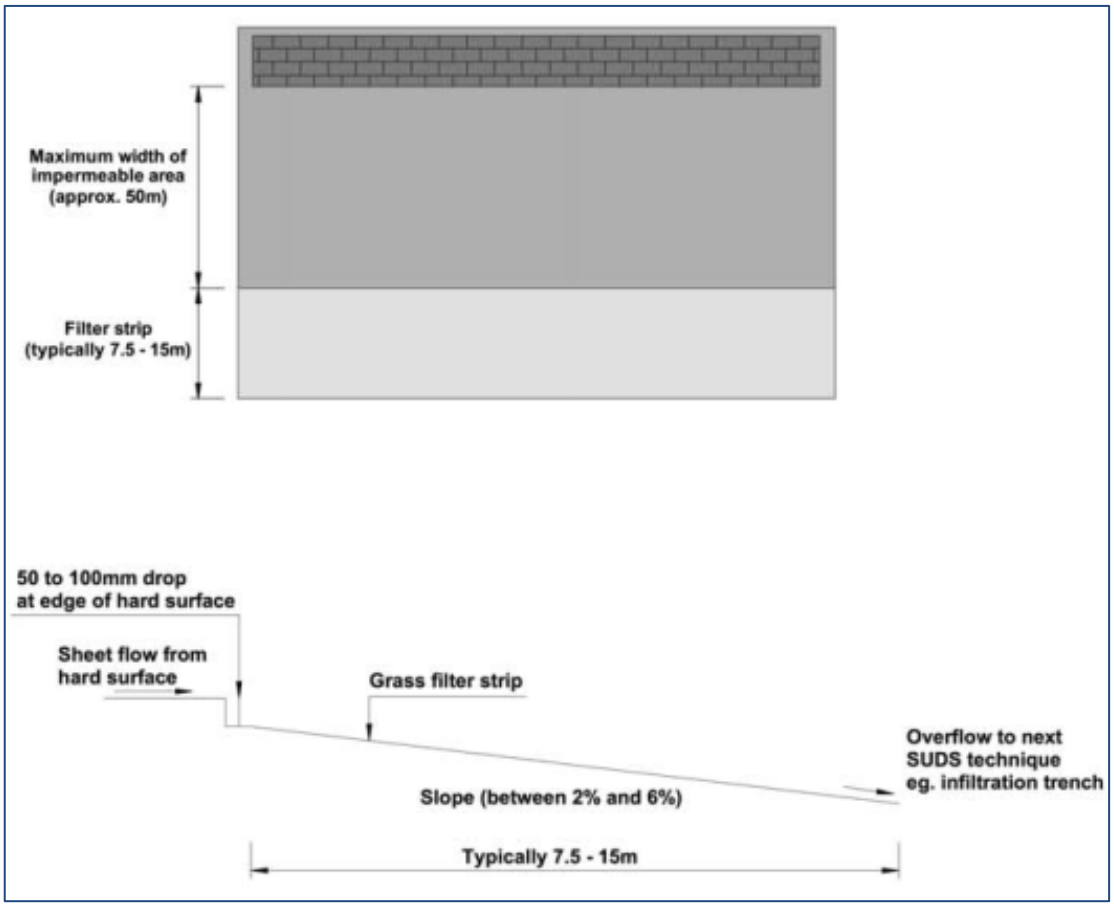

Figure 5 - A Typical Filter Strip Arrangement

10.3. Swales *(Ref CIRIA SuDS Manual – Chapter 10)*

Linear vegetated features in which surface water can be stored or conveyed. Can be designed to allow infiltration where appropriate.

- Swales should be shallow with side slopes no more than 1 in 4 to allow flow across the edge, easy maintenance and for safe access.
- Swale depth should not exceed 450mm wherever possible.
- A 100-150mm depth for normal flows uses the vegetation to reduce flow and allow filtration.
- A maximum 300mm storage above normal flow depth, to include freeboard if necessary.
- Flow rate should be restricted to 1-2m/s 0.5l/s or 1 in 50 maximum gradient to prevent erosion and ensure effective pollution control. Check dams and other flow restrictions should be used if the layout is steeper
- A minimum base width of 0.5m
- Reasonable access for maintenance by mowers should be provided.
- Low maintenance materials and plants and vegetation shall be considered.

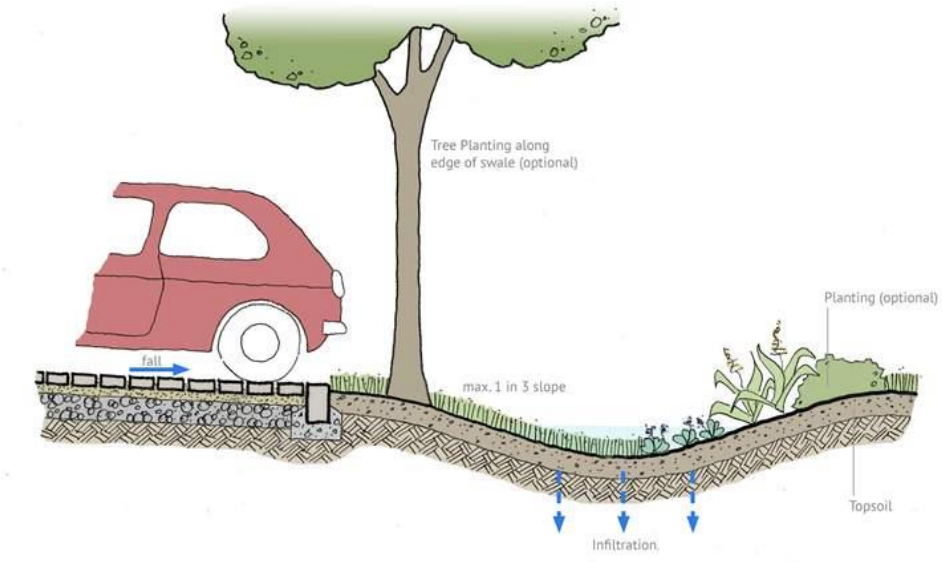

Figure 6 - A Typical Swale Construction

10.4. Bioretention Areas and Rain Gardens *(Ref CIRIA SuDS Manual – Chapter 11)*

Bioretention areas and rain gardens are planted areas that are designed to provide a drainage function as well as contribute to the soft landscape.

They are located where surface water runoff flows from surrounding impermeable hard surfaces and collect the polluted first flush volume in shallow planted basins.

A bioretention area should collect and temporarily store the treatment volume or first flush volume (10-15mm from contributing hard surfaces) at a usual depth of 150mm.

- A grass filter strip or silt forebay for point inlets is required to control siltation and blockage of the basin.
- The water must drain down within 24 hours to anticipate the next storm.
- They usually require a drainage layer with perforated pipe and overflow.
- Should be planted to enhance the local landscape with robust species appropriate to the site and drainage requirements
- Low maintenance materials, plants and vegetation shall be considered.

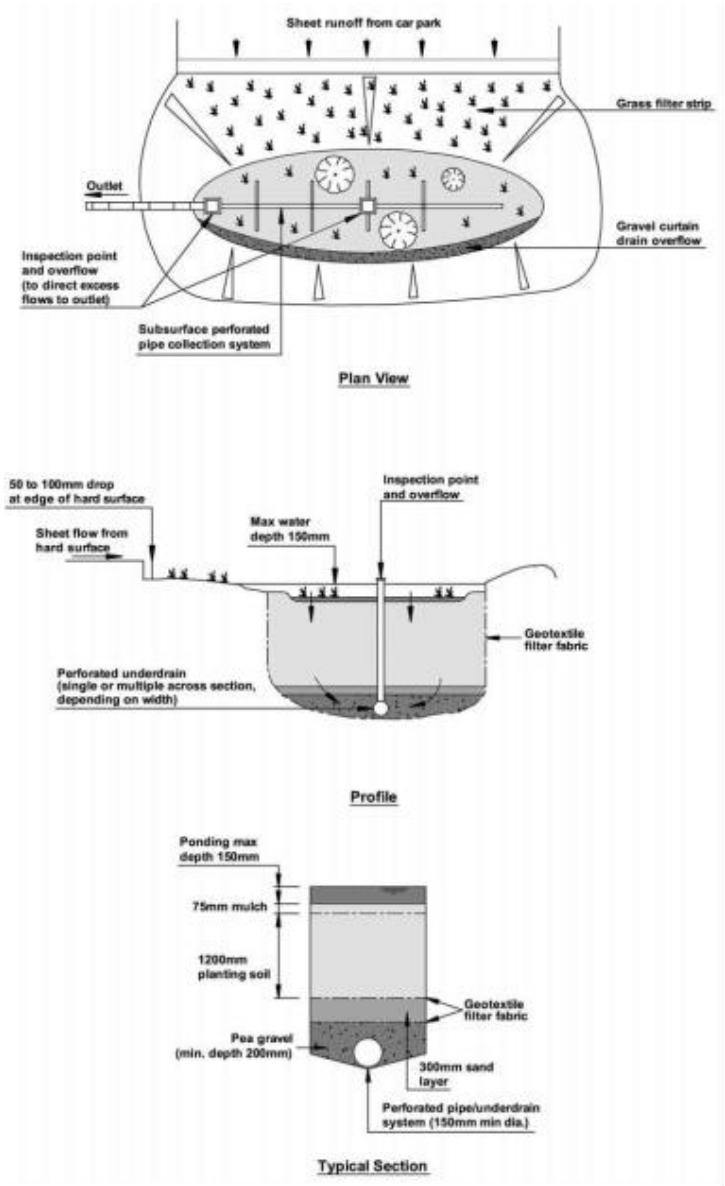

Figure 7 - A Typical Bioretention Configuration

10.5. Filter Drains and Trenches *(Ref CIRIA SuDS Manual – Chapter 9)*

Filter drains and trenches (often called French drains) are linear excavations filled with a suitable aggregate that ideally collect surface water runoff laterally as sheet flow from impermeable surfaces, although point inlets can be used with care to prevent damage to the structure.

- Effective upstream pre-treatment to remove sediment and fine silts. A perforated pipe may be appropriate to convey water onward from the drain and should include access for rodding or jetting with open outfalls.
- Perforated pipes should normally be provided for the last few metres of the trench to maximise filtration.
- The edge of the drain should be level to encourage sheet flow and prevent gully erosion where taking a lateral flow.

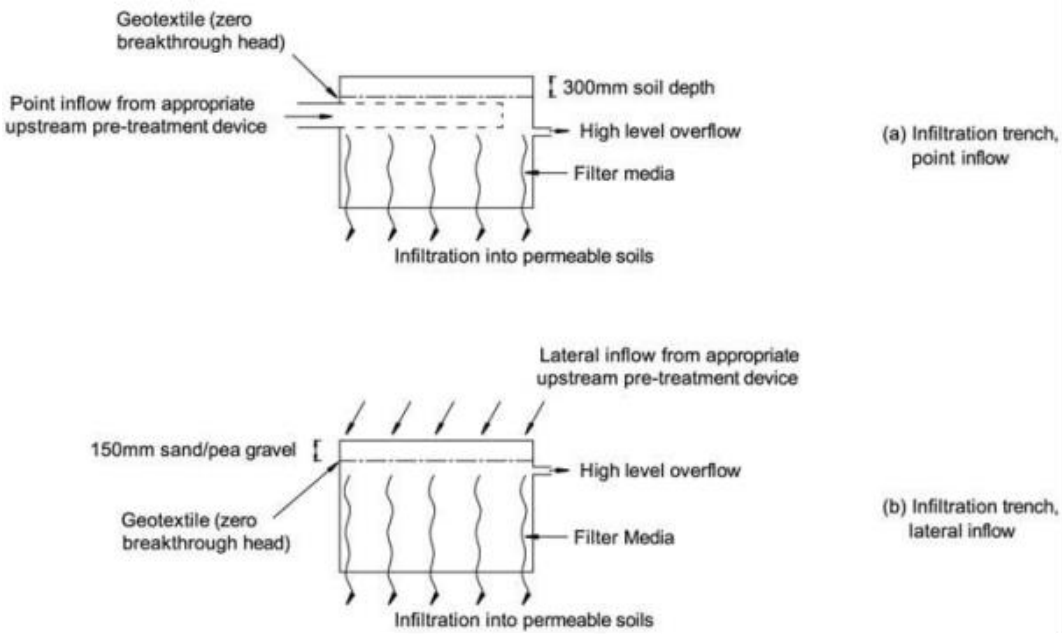

Figure 8 - A Typical Filter Drain Arrangement

10.6. Permeable Pavements *(Ref CIRIA SuDS Manual – Chapter 12)*

Permeable pavements provide a surface that is suitable for pedestrian or vehicular traffic while allowing surface water runoff to percolate directly through the surface into underlying open stone construction.

- Permeable pavements need to be designed structurally to meet loading and traffic requirements.
- Storage must be sufficient for infiltration rates or to meet attenuation requirements.
- The use of a geotextile as an upper separating or treatment layer may be considered as an option depending on site constraints.
- Pervious surfaces may be susceptible to silt blockage from the surrounding landscape details, slopes and maintenance plans must take this into account.
- Sub-bases can be augmented with geocellular structures with the advantage that surface water runoff is clean before it enters underground storage.
- Utility apparatus would not be allowed in these areas except for in designated service strips.
- Shall not be used where gradient of road is greater than 1 in 20.

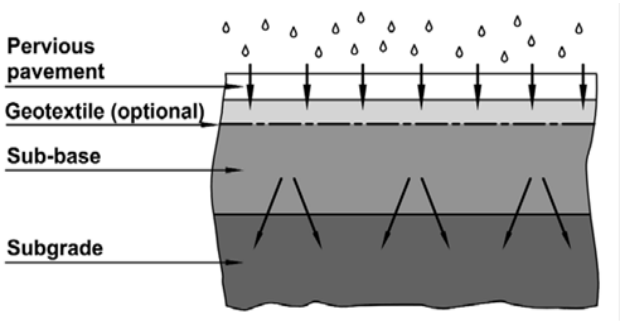

Figure 9(a) - Pervious Pavement System Types: Type A – Total Infiltration

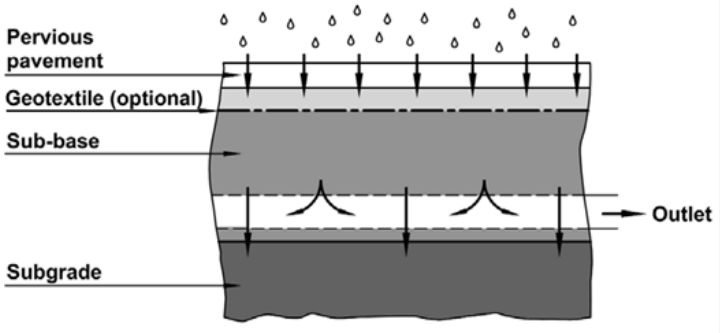

Figure 9(b) - Pervious Pavement System Types: Type B – Partial Infiltration

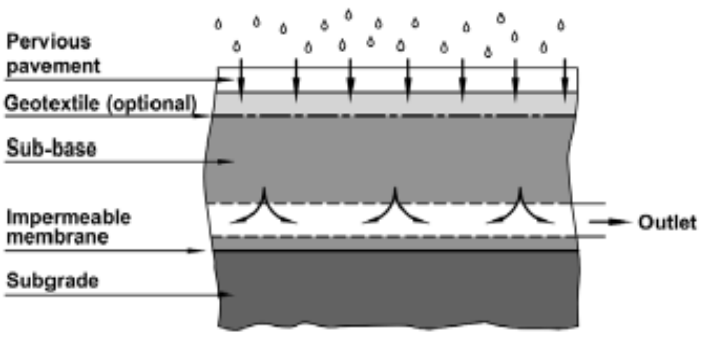

Figure 9(c) - Pervious Pavement System Types: Type C – No Infiltration

10.7. Geocellular Structures, Oversized Pipes/Tanks *(Ref CIRIA SuDS Manual – Chapter 13)*

Modular plastic geocellular structures, with a high void ratio, are a below ground storage arrangement that can replace underground pipes or tanks that have been used to store water. These should be designed to the current Sewers for Adoption standards and the manufacturer's recommendations.

It is important to recognise that all below ground storage structures only provide attenuation of surface water runoff and not treatment. Cleaning of surface water runoff, preferably before entering the structures, is required before release to the environment.

- Silt interception and management arrangement is critical to long-term effectiveness of these structures and this must be demonstrated at design stage and confirmed for the design life of the development.
- The storage volumes will be designed using limited or restricted discharges.
- Access for plant, materials and labour must be provided in perpetuity for maintenance purposes.

10.8. Infiltration Basins *(Ref CIRIA SuDS Manual – Chapter 15)*

Infiltration basins are similar to detention basins except that they are designed to allow water to soak into the ground as well as provide storage.

- The infiltration potential of the soil and subsoil must be confirmed by geo-technical tests.
- The stability of the ground must be confirmed and an analysis of likely infiltration pathways and risk to surrounding features undertaken.
- Silt and pollution must be removed upstream in source control features.
- An inlet flow spreader is required to distribute flows across the basin ideally using a widening grass channel inlet.
- The base should be level across the basin to encourage even infiltration with a slight fall of between 1 in 100 and 1 in 200 along the basin to distribute water evenly.
- The water table should be at least 1m below the surface.
- Side slopes to the basin should be 1 in 4 maximum with clear access for maintenance.
- Maximum storage depth 600mm
- Toddler-proof fence 600-750mm high maybe appropriate
- Unrestricted visibility is required
- Low maintenance materials, plants and vegetation shall be considered.
- Basins require an overflow to allow for design exceedance or outlet blockage.
- Access for plant, materials and labour must be provided in perpetuity for maintenance purposes.

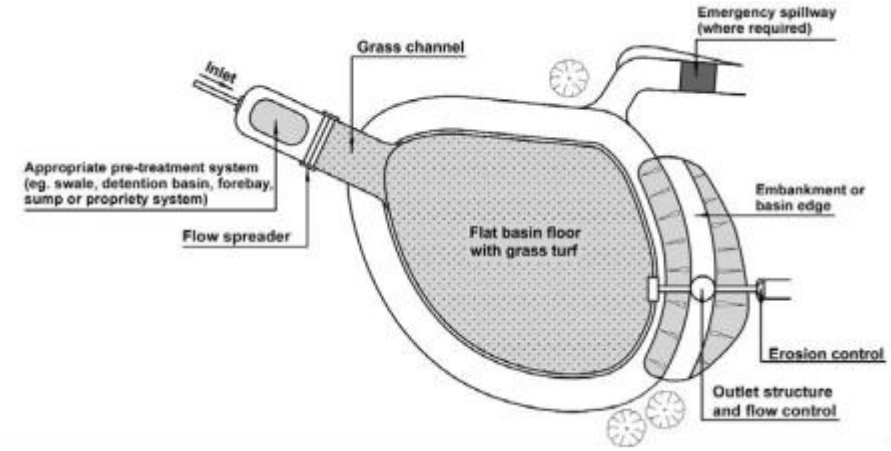

Figure 10(a) – A Typical Infiltration Basin (Plan View)

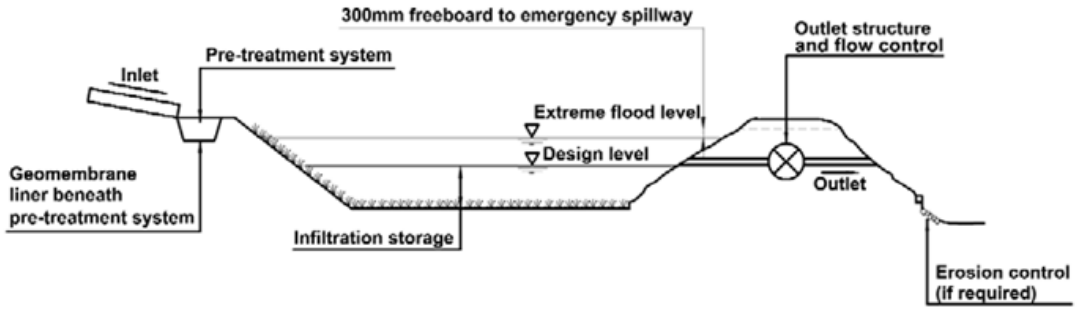

Figure 10(b) – A Typical Infiltration Basin (Side Elevation)

10.9. Detention Basins *(Ref CIRIA SuDS Manual – Chapter 16)*

Detention basins are vegetated depressions in the ground designed to store surface water runoff and flow out at a controlled rate.

They should be designed as landscape features that allow other leisure uses when dry, visual enhancement and habitat creation. These opportunities are enhanced when there are source control features upstream that prevent silt and pollution reaching the basin and reduce the frequency at which surface water runoff reaches the basin.

- Silt should be intercepted at source wherever possible or be intercepted in a forebay where surface water runoff enters the basin.
- Surface water runoff should flow into the basin from upstream source control features to reduce the risk of erosion but if entry is uncontrolled through a point inlet then an erosion control structure will be necessary to manage the flow.
- Detention basins should have a 2:1 to 5:1 length to width ratio to provide maximum opportunities for settlement at the inlet and filtration of surface water runoff.
- There should be a gentle fall to the outlet of about 1 in 100 to encourage surface sheet flow by gravity.
- A controlled outfall at or just below ground level is usual to ensure drain down unless preceded by a micro-pool. This ensures a generally dry surface when it is not raining. A micro-pool enhances treatment, avoids a muddy area at the outlet and provides biodiversity interest.
- Side slopes to the basin should be 1 in 4 maximum, with clear access for maintenance.
- Maximum storage depth 600mm
- Toddler-proof fence 600-750mm high may be appropriate
- Unrestricted visibility is required
- Basins require an overflow to allow for design exceedance or outlet blockage.
- Low maintenance materials, plants and vegetation shall be considered.
- Access for plant, materials and labour must be provided in perpetuity for maintenance purposes.

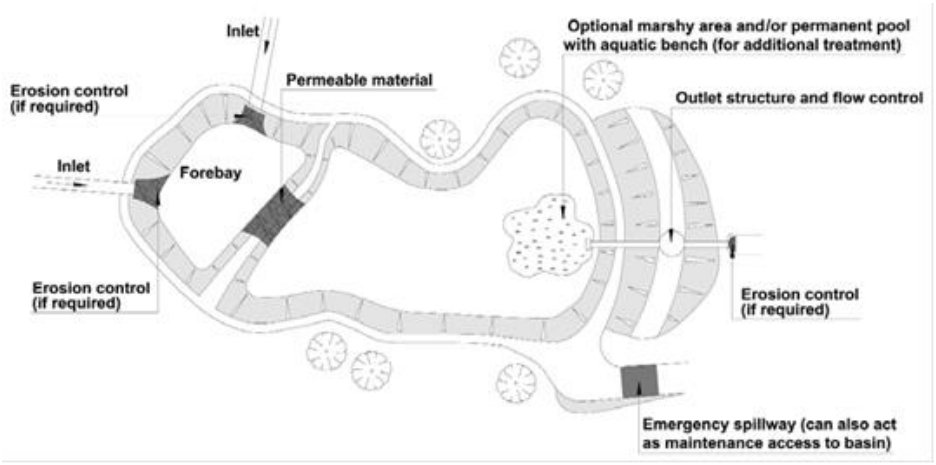

Figure 11(a) – A Typical Detention Basin (Plan View)

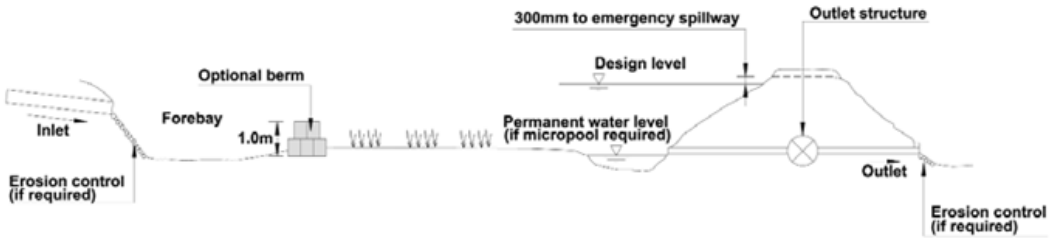

Figure 11(b) – A Typical Detention Basin (Side Elevation)

10.10. Ponds *(Ref CIRIA SuDS Manual – Chapter 17)*

SuDS ponds are usually separate structures with a storage capacity above the permanent water volume and a defined edge design to satisfy safety concerns. In all other characteristics they should mimic natural pond systems. Ponds and wetlands should be designed to receive silt-free surface water runoff with light loading of dissolved pollution that can be processed in the water column by microorganisms.

- There should be a dry bench minimum width of 1m, to allow people to stand safely before descending towards the pond.
- Slopes down to the ponds and within them should be no more than 1 in 4, both for ease of access and maintenance.
- There should be a level wet bench minimum width of 1.5m, unless the pond is very small, to allow people to stand safely before the water's edge.
- Toddler-proof fence 600-750mm high may be appropriate
- Unrestricted visibility is required
- The permanent water depth should be appropriate to the setting
- Maximum storage depth 600mm
- A robust, simple and easily maintained control structure will be necessary to limit flows from the pond unless all flows have been controlled further up the management train.
- Basins require an overflow to allow for design exceedance or outlet blockage.
- A sediment forebay is often recommended to intercept silt but is unnecessary if source control measures are in place higher up the management train.
- A variation in depth is recommended for treatment and ecological reasons but water depths in excess of 600mm are not required for habitat reasons and can affect safety assessments and maintenance operations.
- Low maintenance materials, plants and vegetation shall be considered.
- Access for plant, materials and labour must be provided in perpetuity for maintenance purposes

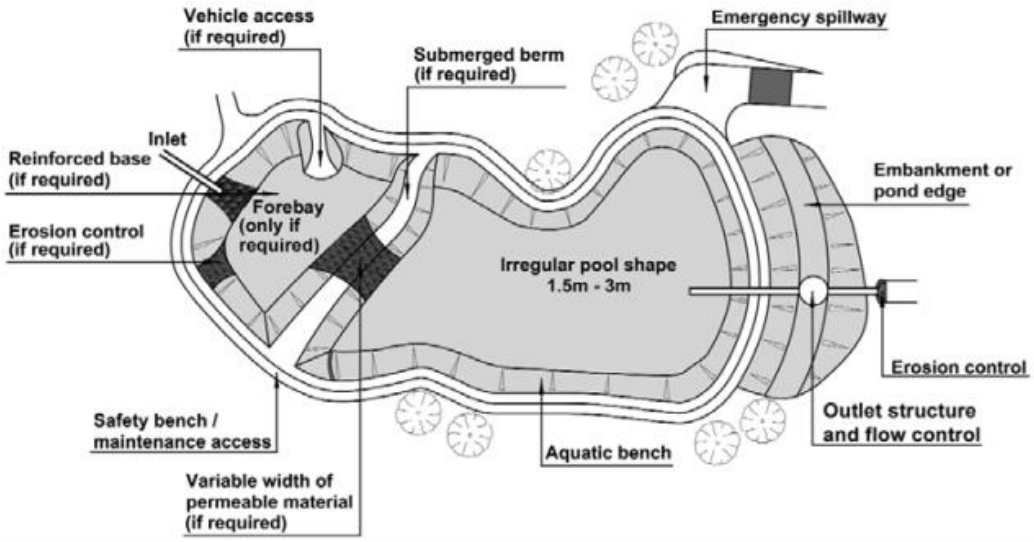

Figure 12(a) – A Typical Pond Arrangement (Plan View)

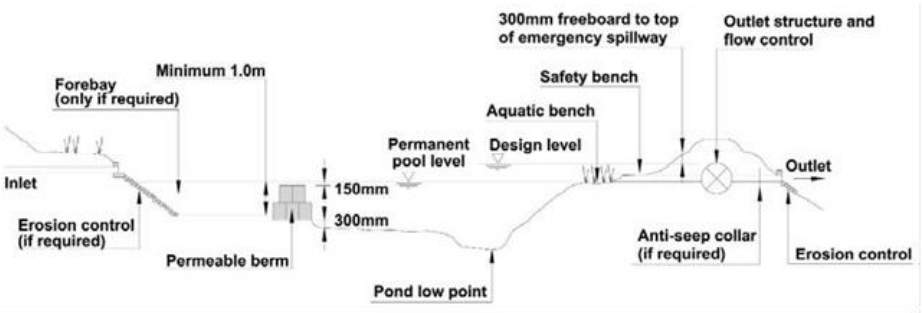

Figure 12(b) – A Typical Pond Arrangement (Side Elevation)

10.11. Wetlands *(Ref CIRIA SuDS Manual – Chapter 18)*

Wetlands are shallow depressions that are nearly or completely covered in marsh vegetation, generally with little open water.

- SUDS wetlands should be longer than wide, with a ratio greater than 3:1.
- A sediment forebay is often recommended to intercept silt but is unnecessary if source control measures are in place higher up the management train.
- A variation in depth is recommended for treatment and ecological reasons but water depths in excess of 600mm are not required for habitat reasons and can affect safety assessments and maintenance operations.
- Basins require an overflow to allow for design exceedance or outlet blockage.
- Must be supplied with a maintenance plan including, but not limited to, maintenance schedule and planting requirements to ensure long term efficacy of wetland.
- Low maintenance materials, plants and vegetation shall be considered.
- Access for plant, materials and labour must be provided in perpetuity for maintenance purposes

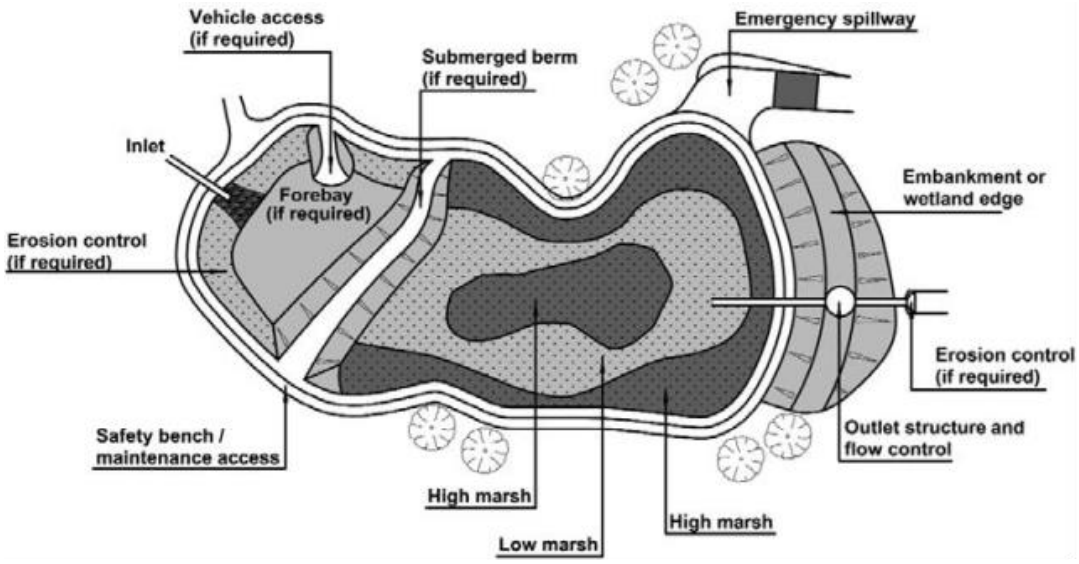

Figure 13(a) – A Typical Wetland Arrangement (Plan View)

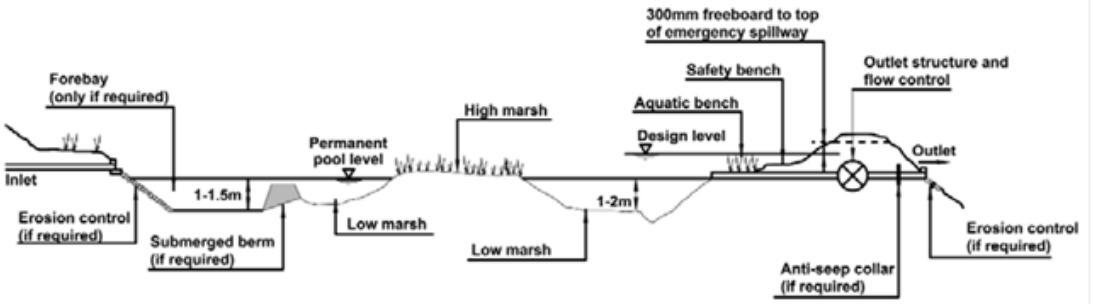

Figure 13(b) – A Typical Wetland Arrangement (Side Elevation)

10.11.1. Maintenance of Slopes

If any gradient which is to be grassed with a slope of more than 1 in 4 discussions are required with the relevant LLFA with relevant provisions made in the maintenance plan. Information available on the HSE website provides the following;

- Slopes of up to 1 in 6 managed through normal maintenance methods using ride on mowers with specific risk assessment
- Slopes of 1 in 5 cut using approved pedestrian machines in line with site specific risk assessments
- Slopes of 1 in 4 or 1 in 3 cut with specialist equipment only, pedestrian bank mower, brush cutter & only with a site specific risk assessment
- Slopes of over 1 in 3 to be cut with side-arm flail or remote control mower only no pedestrian based operations.

10.12. Inlets, Outlets, and Control Specification Requirements

Inlets, outlets and other control structures are key elements of well-designed SuDS. Inlet and outlet features allow water to flow into and out of features and also limit the rate at which water flows along and out of the system.

There are many different designs and variations, including landscaped pipes, perforated pipes, weirs, orifices, vortex control devices and spillways. Each inlet or outlet structure should be designed specifically for its location to add interest to the urban landscape. All structures should consider the implications of maintenance, as regular inspections and cleaning may be required.

These structures can present a trip hazard or create unsafe vertical falls within the landscape that then require protection in the design. Structures should therefore be designed to sit flush to the batter of slopes where possible.

It's preferable for surface water runoff to flow across the surface into a SuDS component but sometimes it is necessary to collect it into a pipe from a grating, channel or chute gully. The collector should not include a silt trap or pot, as in gully pots, as they add to the risk of blockage and maintenance costs. Silt and pollution control is managed within the source control SuDS components.

Surface water runoff collected through permeable surfaces or other filter mechanisms, such as an under-drained swale, will not contain debris so can enter SuDS components through a grille or hidden inlet. The advantage with a covered inlet, particularly in public open space, is that they are difficult to block from the inlet end of the pipe. No orifice should be less than 100mm to reduce the risk of blockages.

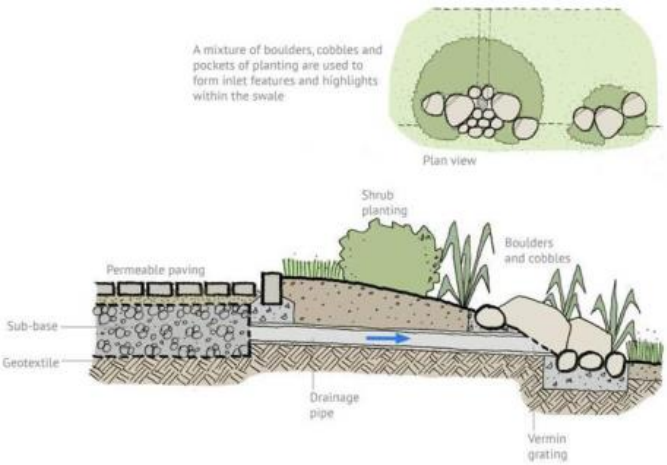

Figure 14 – A Typical Outlet Arrangement (Side Elevation)

10.12.1 Inlets and Outfalls Protections

All SuDS inlets and outfalls will require protection to stop debris or people gaining access to the system. Designers should refer to the LLFAs for guidance on the provision of trash and security screens.

10.13. Pumping Stations

Pumping should only be used where the site cannot drain by gravity. All design and construction of pumping stations shall be in accordance with Sewers for Adoption (latest edition).

11. Planting Design and Biodiversity Criteria

11.1. Planting Design Strategy

Planting as part of a SuDS scheme should be designed specifically for that location. It is preferable that all planting in public open space SuDS features including swales, basins, ponds and wetlands should be native to Great Britain, ideally of local provenance. However, where a scheme is within the urban area a more ornamental species mix may be more suitable.

The planting objective for most SuDS is to establish a robust native vegetation cover as soon as possible that will assist the drainage function and develop into a biodiversity asset. This is particularly true of grassed surfaces within detention basins and ponds. To achieve a successful planting scheme we recommend developers seek advice from a local ecologist particularly in relation to seed mixes and waters-edge planting that is located within the potential wet or flooded areas of the SuDS system.

Tall emergent plants such as reeds will be planted in some SuDS schemes to take up pollutants, however planting of marginal floating-leaved and aquatic plant species in SuDS ponds is unnecessary in terms of function or visual effect and should be avoided.

11.2. Planting Requirements

All landscape areas adjacent to SuDS must develop a robust ground vegetation to prevent silt migration. Grass edges in landscape are usually specified at 10-20mm above hard surfaces to allow for mowing. In SuDS where surfaces shed water to grassed areas, it must be 20 to 25mm below the edge of the hard surface, assuming the grass will be cut to a height of 50 to 100mm. Planted areas should also be lower than adjacent hard surfaces.

Subsoil and topsoil should not be compacted by excessive tracking of machinery. Compaction affects the infiltration capacity of the soil and results in roots not being able to penetrate the soil and anaerobic soil conditions. Nutrient rich topsoil should not be used as this can add pollutants to the system.

Planting techniques in SuDS areas should also be varied slightly. Where drainage systems are to be planted the use of grass or a dense ground cover is preferable, without mulch. This avoids soil erosion and prevents soil and mulch washing into the SuDS.

SuDS need rapid establishment of a dense grass/wildflower sward that is self –repairing. Therefore a minimum of 50mm topsoil blinding should be used on wildflower areas adjacent to SuDS to ensure rapid establishment and 100-150mm topsoil used on vegetated SuDS features to ensure a robust surface for the life of the development.

Planting areas should be designed to avoid initial fertilizers. Also ongoing maintenance should require only physical cutting with no application of herbicide, fertilizer or other chemical applications, which can cause pollution tree and shrub selection and subsequent care must take into account the requirement of a permanent and robust ground vegetation cover.

11.3. Planting List for SuDS

It will be a requirement to provide an as constructed drawing listing all plants and positions

Good ecological practice includes:

- Creating ecologically designed corridors between habitat areas
- Good water quality is key to ensuring ecological benefits and is provided by using the SuDS quality concepts of the management train
- Using accredited suppliers of native plants to ensure UK or local provenance and avoid alien species The Wildlife and Countryside Act 1981 (Variation of Schedule 9) (England and Wales) Order 2010 has an up to date list of plants that cannot be planted
- Avoid invasive species such Bulrush and use generalist planting that allow for further ecological development
- Using local plant material and allowing natural colonisation of SuDS features.
- Retaining and enhancing natural drainage features
- Including shallow aquatic edges to 450mm max depth and 1m minimum width to ponds and wetlands
- Increasing vertical and horizontal structural diversity in open SuDS features.
- Reduced maintenance intensity with 25-30% maximum vegetation removal at any one time
- Where SuDS incorporates semi-natural habitats or has objectives for protecting or enhancing biodiversity, the submitted proposal and maintenance plans should demonstrate this

SuDS Technique	Brief Description	Water Quantity	Water Quality	Biodiversity	Amenity
Permeable Pavings	Infiltration through the surface into the underlying layer	✓	✓	✗	✗
Filter Drains	Drain filled with permeable material with a perforated pipe along the base	✓	✓	✗	✗
Infiltration Trenches	Similar to filter drains but allows infiltration through the sides and base	✓	✓	✗	✗
Soakaways	Underground structure used for store and infiltration	✓	✓	✗	✗
Detention Basins	Dry depressions outside of storm periods, provides temporary attenuation, treatment and possibly infiltration	✓	✓	✓	✓
Retention Ponds	Designed to accommodate water at all times, provides attenuation, treatment and enhances site amenity value	✓	✓	✓	✓
Wetlands	Similar to Retention Ponds but are designed to provide continuous flow through vegetation	✓	✓	✓	✓
Rainwater Harvesting	Capturing and reusing water for domestic or irrigation uses		✗	✗	✗

Table 6 – SuDS Environmental Benefits

12. Construction

Once the design process and SuDS design has been submitted, evaluated and confirmed as acceptable then the construction phase will follow to realise the SuDS proposal. The developer needs to ensure that all SuDS features are constructed as designed so that they perform as intended are easy to maintain and have a long design life.

The developer during the construction phase of a SuDS scheme should demonstrate that the installation of the SuDS scheme has been carried out competently and will be required to verify that the correct materials have been used.

During all stages of construction, relevant officers either of the LLFA or adopting body should be provided with access for inspection. Any work that cannot be inspected due to insufficient notice being provided will be required to be re-opened for inspection and reinstated at the Developer's expense.

It is vital that, where requested, the developer contacts the Council before construction commences so that a pre-construction meeting can be held. During this meeting the following will be required. As part of the detailed design submission, the following should be made available to the LLFA:

- Method statement of construction and of protection of the SuDS during the construction phase
- An adoption file and inspection sequence for use during construction.
- Details of the adopting body for all SuDS.
- Post-construction maintenance.

The impact of ongoing construction works on SuDS features should be minimised therefore it is important that the SuDS is protected from construction traffic during construction of the development

12.1. Pollution and Sediment Control

Runoff from the construction site must not be allowed to enter SuDS drainage systems unless it has been allowed for in the design and specification. Construction runoff is heavily laden with silt which can clog infiltration systems, build up in storage systems and pollute receiving waters. No traffic should be allowed to run on permeable surface components if it is likely to introduce sediments onto the pavement surface from dusty or muddy areas, or result in over compaction. Discharge of contaminated or nutrient rich water must be positively treated to reduce the impact on the receiving watercourse.

It is essential during the SuDS establishment phase that run off from bare soils be minimised,

- Green cover on slopes should be rapidly established
- Base of slope trenches should be used to intercept run off and sediments

12.2. Management and Maintenance

SuDS Management/Maintenance Plan should be provided and should comprise:

- A description of the SuDS scheme, how it works and a general explanation of how it should be managed in the future, as submitted to the adoption body(s) and/or individual landowners.
- A Schedule of Work to set out the tasks required to maintain the site and the frequency necessary to achieve an acceptable standard of work. A spillage control procedure should also be included.
- A Site Plan (Drawing) – showing maintenance areas, access routes, inlets, outlets and control structure positions, location of any other chambers, gratings, overflows and exceedance routes.
- Health and safety issues.
- Contact details denoting responsibilities for the future maintenance of the SuDS feature(s).

12.3. SuDS in Private Property

It is reasonable to expect the owners/occupiers of properties drained by sustainable drainage systems that do not also drain other properties to maintain their own sustainable drainage system. The developer should provide the owner or owners with full instructions on the maintenance of the sustainable drainage systems including repair and replacement requirements. The developer should also inform all purchasers of their responsibilities in regards to the SuDS management train.

Source control SuDS components within private property are the responsibility of the landowner or property manager.

SuDS may be designated as a flood risk management asset by the LLFA.

If a SuDS needs to cross adjoining land, not owned by the developer, it will be a requirement that the developer negotiates Easements directly with the landowner.

13. Adoption and Handover for Relevant Local Authorities

All adoption agreements including Deed of Grants of Easements must be discussed and agreed with the LLFA at an early stage e.g. Pre-Planning Application Stage.

The applicant must explore all other adoption options available e.g. Water Companies, Management Companies etc.

The SuDS scheme will only be handed over when the Authority is satisfied that the scheme is performing satisfactorily and has been built in accordance with the agreed design and specification, and is in accordance with the Council adoption requirements.

13.1. Maintenance

Following completion of the whole development a maintenance period of 2 years will be required for the soft landscaping scheme, to ensure good establishment of all vegetation, particularly grassed areas. During this period the developer will be responsible for all maintenance aspects and remedial works relating to the SuDS until adoption. The final inspection should be a joint inspection and the adopting authority will provide written confirmation that the SuDS is acceptable. If SuDS are found not to perform satisfactorily, the adopting authority will notify the developer who should rectify the situation or otherwise the adopting authority will arrange to carry out remedial works using money contained within the non-performance bond if necessary.

One of the key objectives of the adoption process is to ensure that the SuDS installation can be maintained easily over the lifetime of the development. Like all drainage systems SuDS components should be regularly inspected and maintained to ensure efficient operation and prevent failure.

Usually SuDS components are near the surface and can be managed using landscape and watercourse management techniques. Inlets, outlets, control structures or other below ground features should be shallow to allow easy access for maintenance and to reduce safety risks.

13.2. Highway Drainage

SuDS features within highway curtilage serving only the highway surface water (i.e. no private surface water) may be adopted by the Local Authority and maintained as part of the wider highways maintenance programme. The incorporation of SuDS that involves road drainage usually requires the developer either to enter into an agreement under Section 38 of the Highways Act, if involving new development, or an agreement under Section 278 of the Act, if existing highway arrangements are to be modified.

14. Other Risk Management Authorities

14.1. Internal Drainage Boards

There are 3 Internal Drainage Boards (IDB's) managing water levels within the South Yorkshire area, these are the;

a) Danvm Drainage Commissioners
b) Doncaster East IDB
c) Black Drain Drainage Board

The IDB's predominately cover the Doncaster area, but also extend into Rotherham and Barnsley.

Each IDB is an independent public authority and collectively maintain 72 pumping stations and 700 km of ordinary watercourses to permit the flow of surface water through defined drainage districts. SuDS such as swales and attenuation ponds within their drainage district are normally considered by the IDB for maintenance and may present developers with a further opportunity to manage surface water run-off from their sites, however this would be subject to legal agreement.

Further information can be obtained from http://www.shiregroup-idbs.gov.uk or by emailing planning@shiregroup-idbs.gov.uk

14.2. Yorkshire Water

Where SuDS are considered and require the involvement of Yorkshire Water then the applicant or developer should contact Yorkshire Water on **0845 1242424**.

14.3. Severn Trent Water

Where SuDS are considered and require the involvement of Severn Trent Water then the applicant or developer should contact Severn Trent Water on **0800 783 4444**.

15. Useful References

Title	Content Description	
Flood & Water Management Act 2010	Statutory Instrument	http://www.legislation.gov.uk/ukpga/2010/29
Town and Country Planning (Development Management Procedure) (England) Order 2010	Statutory Instrument	http://www.legislation.gov.uk/uksi/2010/2184/made
The SUDS Manual (CIRA C697).	This guidance provides best practice guidance on the planning, design, construction, operation and maintenance of sustainable drainage systems (SUDS) to facilitate their effective implementation within developments.	http://www.ciria.org/Resources/Free_publications/the_SuDS_manual.aspx
BS 8582:2013: **Code of Practice for Surface Water Management for Development Sites**	BS 8582 gives recommendations on the planning, design, construction and maintenance of surface water management systems for new developments and redevelopment sites	http://shop.bsigroup.com/ProductDetail/?pid=000000000030253266
Guidance on permeable paving	Industry guidance on permeable paving as SuDS on new development and redeveloped sites	http://www.paving.org.uk/commercial/permeable.php
UK Sustainable Drainage Guidance & Tools	Preliminary rainfall run-off management for development and SuDS tools available	http://www.ukSuDS.com

APPENDIX 1

Glossary

Adoption	Adoption is the process of taking legal responsibility for SuDS devices for their whole life, which includes maintenance responsibilities.
Attenuation	The reduction of peak water flow by spreading it over a longer time period. This is done by providing storage in sewers, tanks or soft SuDS structures. The principle of SuDS is to provide flow attenuation in order to manage surface water effectively. Any form of flow attenuation is a form of SuDS
Base-Flow	The sustained flow in a channel or drainage system
Biodiversity	The diversity of plant and animal life in a particular habitat
Bioretention Area	A depressed landscaping area that is allowed to collect runoff, so it percolates through the soil below the area into an under drain, thereby promoting pollutant removal.
Brownfield Sites	Sites that have been previously developed
Catchment	The area contributing surface water flow to a point on a drainage or river system.
Combined Sewer	A sewer designed to carry foul sewage and surface runoff in the same pipe.
Diffuse Pollution	Pollution that comes from non-point source contamination in urban and rural land-use activities spread out across a catchment or sub-catchment.
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.
Flood Estimation Handbook (FEH)	The FEH is produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology) to aid calculation of the possible severity of flooding.
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 and 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.
Flood Frequency	The probability of a flow rate being equalled or exceeded in any year
Flood Routeing	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.
Floods and Water Management Act, 2010	The Act takes forward a number of recommendations from the Pitt Review into the 2007 floods and places new responsibilities on the Environment Agency, local authorities and other risk management authorities to manage the risk of flooding.
Floodplain	Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions.

APPENDIX 1

Glossary – *Cont'd ...,*

Flow Control Device	A device used to manage the movement of surface water into and out of an attenuation facility, for example a weir.
Forebay	A small basin or pond upstream of the main drainage component with the function of trapping sediment
Greenfield Runoff	This is the surface water runoff regime from a site (previously un-developed land) before development.
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
Hydrograph	A graph illustrating changes in the rate of flow from a catchment with time
Impermeable Surface	An artificial non-porous surface that generates a surface water runoff after rainfall
Infiltration Device	A device specifically designed to aid infiltration of surface water into the ground.
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.
Pervious Surface	A surface that allows inflow of rainwater into the underlying construction or soil
Pitt Review	Sir Michael Pitt was asked by Ministers to conduct an independent review of the flooding emergency that took place in June and July 2007
Recharge	The addition of water to the groundwater system by natural or artificial processes
Runoff	The amount of water from precipitation, which flows from a catchment area past a given point over a certain time period.
Site and Regional Controls	Manage runoff drained from several sub-catchments. The controls deal with runoff on a catchment scale rather than at source.
Source Control	The control of runoff or pollution at or near its source, the principles of SuDS are to mimic as far as possible the natural drainage characteristics of a site to maintain the drainage regime. By returning water to the natural drainage system as close to where it falls as possible represents effective management of surface water. Source control devices include Soakaways, Permeable surfaces, Infiltration basins and Swales. **Sub-catchment** A division of a catchment, allowing runoff management as near to the source as is reasonable.
Treatment Volume	The volume of surface runoff containing the most polluted portion of the flow from a rainfall event.

APPENDIX 1

Glossary – *Cont'd ...,*

UKCIP	The UK Climate Impacts Programme (UKCIP) has developed the UK Climate Projections (UKCP09). These projections of our changing climate provide information for the UK up to the end of this century. Sea levels will also rise partly due to melting of polar ice caps. Drier summers will cause pollution problems in watercourses with reduced flow and increased periodic liberation of pollutants that have gathered during extended drier periods.
Water Cycle	The continuous circulation of water in systems throughout the planet, involving condensation, precipitation, runoff, evaporation and transpiration. It is also known as the hydrological cycle.
Water Table	The point where the surface of groundwater can be detected. The water table may change with the seasons and the annual rainfall.
Water Framework Directive	The Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) is a European Union directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to one nautical mile from shore) by 2015. It is a framework in the sense that it prescribes steps to reach the common goal rather than adopting the more traditional limit value approach.
Water Resources Act, 1991	This Act aims to prevent and minimise pollution of water. The policing of this act is the responsibility of the Environment Agency. Under the act it is an offence to cause or knowingly permit any poisonous, noxious or polluting material, or any solid waste to enter any controlled water. Silt and soil from eroded areas are included in the definition of polluting material. If eroded soil is found to be polluting a water body or watercourse, the Environment Agency may prevent or clear up the pollution, and recover the damages from the landowner or responsible person.

APPENDIX 2

Check List: Pre-Development Advice

Pre-design discussion with LLFA advised prior to any submission;		
1	Site assessments including the existing drainage characteristics, geology and topography	
2	Existing flood risks	
3	Identification of any water courses running through the site	
4	Identification of any potential off-site flood risk impact	
5	Potential SUDS locations	
6	Evidence of discussions with Water Companies and the EA	
7	Maintenance and access arrangements	

APPENDIX 3

Check List: Pre-Design Advice

Following pre-design discussion with LLFA it is recommended that the following be submitted prior to submitting the application in order to obtain an 'agreement in principle';		
1	Detailed Flood Risk Assessment	
2	Existing utilities plan (if applicable)	
3	Impermeable areas estimate	
4	Storage volume estimate	
5	Storage location(s)	
6	Flow control(s)	
7	Areas where SUDS will form recreational features	
8	Public health and safety consideration	
9	Identification of maintenance liabilities	
10	Ecology and water quality implications	
11	Maintenance and access arrangements	

APPENDIX 4

Check List: Detailed Design

To complete the application the following needs to be submitted to the LLFA;		
1	Detailed Flood Risk Assessment	
2	Detailed design	
3	Specification of materials	
4	Flow calculations (.mdx files where possible)	
5	Details of inlets, outlets and flow controls	
6	Construction details	
7	Phasing of development including Construction Management Plan	
8	Cross sections including design levels	
9	SuDS Design Statement	
10	Operation and Maintenance Plan	
11	Health and Safety Risk Assessment/Plan	
12	Water Framework Directive Requirements (Water Quality)	
13	Full details of responsibility of overall surface water management of site	