Local Development Framework

ASHFORD BOROUGH COUNCIL

Sustainable Drainage SPD

Adopted October 2010

Ashford best placed in Britain

Contents

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Foreword

Water is a defining part of Ashford's landscape: indeed the town owes its very existence to the rivers on which it is located. The 16th century writer Philpot believed that "Essetesford" – Ashford's former name - stood for "ash trees growing near a ford", while Lampard, a 16th century local historian, suggested that it meant "a ford over the river Eshe or Eshet", which was the old name for the tributary of the River Stour which rises at Lenham. Over the centuries the town has been shaped by its relationship with its rivers. This relationship is as important now as it has always been; indeed it could be argued, that with the impact of climate change, this relationship is more important than ever.

Integrated water management is essential to Ashford's response to the 2003 Sustainable Communities Plan. Tackling flooding, water supply and water quality is imperative for the housing and economic growth planned for the area. Equally, Ashford's growth must not come at the expense of the town's environment; instead, it must be a force for urban and rural environmental improvement.

It is widely recognised that Sustainable Drainage Systems (SUDS) are an important contributor to effective water management. Just as Ashford's rivers have shaped the town in the past, SUDS can play an important role in shaping the town of the future. Whilst primarily serving to manage flood risk, SUDS use a wide range of techniques to manage the quantity of surface water run-off from development as close to the source as possible and can help reduce pollution and maintain water resources – an important consideration for the town as it is located in one of the most arid parts of the country. Furthermore, well-designed SUDS can contribute to quality neighbourhoods, providing opportunities for wildlife to thrive, and enhancing the leisure, play and educational offer within our public open spaces.

This Supplementary Planning Document (SPD) provides guidance for developers on what is expected of them as they bring sites forward. It is essential that the management of water is considered at the earliest stage of a development. By adopting a sequential approach to development site allocation and integrating SUDS into the site design, the maximum benefits can be achieved, for people and the environment. The means of managing water should become an asset to the development and the wider community.

'Flume; design in town centre represents Ashford's close association with water. Source: RTPI

1 Introduction

1.1 Ashford is set to double in size over a 30 year period to deliver 31,000 new homes and create 28,000 additional jobs by 2031. Delivering this level of growth will result in significant expansion of the current urban area and a commensurate increase in impermeable area and potential surface water run-off.

1.2 Ashford experiences flooding and the natural catchment has changed over the years to become more 'peaky' as surface water drains into the rivers and streams much quicker than it used to. To some extent this has been offset by the provision of upstream storage reservoirs at Hothfield and Aldington. Recent studies by the Environment Agency have identified that there is little scope for additional strategic flood risk management options – such as additional upstream storage - and that comprehensive provision of sustainable drainage systems will be required to manage surface water run-off.

1.3 The Council is committed to ensuring that Ashford's future growth contributes to a reduction in flood risk. Policies CS19 and CS20 of the adopted Core Strategy will help reduce any negative impacts of new development on flood risk and seek to improve the situation if possible.

1.4 The latest UK Climate Projections (UKCP 2009) reaffirm that winters are likely to get wetter and that we are also likely to experience more extreme weather conditions such as intense rainfall events. Existing surface water drainage systems are not designed to cope with these extreme conditions. Extensive flooding in the UK in the summer of 2007 was mostly due to surface water overwhelming traditional piped surface water drainage systems.

1.5 Historically the increased prevalence of impermeable surfacing has meant that less water permeates into the ground thus reducing the amount of water available for abstraction for public water supply. Ashford is already 'water stressed'.

1.6 Growth in Ashford, along with the effects of climate change, will require an innovative approach to the way we plan new communities. This guidance is designed to aid all those involved in the planning, design and construction of new developments within the Ashford Borough. This document sets out the specific detail and information required by the Council to determine the suitability of a development proposal in respect of sustainable surface water management.

Purpose

1.7 The main purpose of this SPD is to provide guidance on the measures and opportunities available to planners and developers to integrate sustainable surface water management into their development. Although this document specifically provides guidance for those developments required to comply with Policy CS20, the principles contained within this guidance are applicable to all new developments in the Borough.

1.8 The Ashford Local Development Framework Core Strategy was adopted in July 2008, and sets the strategic vision for development in the Borough between 2006 and 2021. A central part of this vision is to deliver high-quality, sustainable places, and a number of policies have been adopted to help deliver this aim. While sustainability covers an array of aspects such as the environment, economy and social issues, this SPD has been drafted to help applicants respond positively to the following Core Strategy policies:-

CS1 - Guiding Principles
CS8 - Infrastructure Contributions
CS10 - Sustainable Design and Construction
CS11 - Biodiversity and Geological Conservation
CS18a - Strategic Recreational Open Spaces
CS19 - Development and Flood Risk
CS20 - Sustainable Drainage

1.9 Of the above Core Strategy policies, Policy CS20 is obviously of most relevance to this SPD and is reproduced in full here:-

POLICY CS20: Sustainable Drainage

All development should include appropriate sustainable drainage systems (SUDS) for the disposal of surface water, in order to avoid any increase in flood risk or adverse impact on water quality.

For greenfield developments in that part of the Ashford Growth Area that drains to the River Stour, SUDS features shall be required so as to achieve a reduction in the pre-development runoff rate. On all other sites in the Borough, including those in the south-western part of the Growth Area that drains to the River Beult, developments should aim to achieve a reduction from the existing runoff rate but must at least, result in no net additional increase in runoff rates.

SUDS features should normally be provided on-site. In the Ashford Growth Area if this cannot be achieved, then more strategic forms of SUDS may be appropriate. In such circumstances, developers will need to contribute towards the costs of provision via Section 106 Agreements or the strategic tariff. In all cases, applicants will need to demonstrate that acceptable management arrangements are funded and in place so that these areas are well maintained in future.

SUDS should be sensitively designed and located to promote improved bio-diversity, an enhanced landscape and good quality spaces that improve public amenities in the area.

1.10 When adopted, this SPD will form part of the Ashford Local Development Framework (LDF).

1.11 The key objectives for this SPD are set out below:

• To ensure all new developments are designed to reduce the risk of flooding, and maximise environmental gain, such as: water quality, water resources, biodiversity, landscape and recreational open space.

• To ensure that all new developments are designed to mitigate and adapt to the effects of climate change.

• To provide guidance to developers on what will be expected to deliver the Core Strategy Policy CS20 standards, and the information that is required to be submitted with applications.

1.12 In this context SUDS involve a move from traditional piped drainage systems to engineering solutions that mimic natural drainage processes. SUDS are considered more sustainable than conventional drainage approaches as they:

• Lower runoff flow rates, 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; and

• Encourage natural groundwater recharge (where appropriate).

1.13 Ashford Borough Council has signed the Nottingham Declaration on Climate Change which is a public commitment to develop plans to progressively address the causes and impacts of climate change. Building more sustainable homes is also a key objective of the Ashford Sustainable Community Strategy, which sets out a shared long-term vision for the Ashford Borough that reflects local aspirations.

1.14 This SDP covers the provision of SUDS for all development except those serving the Strategic Road Network (SRN). The SRN is covered by separate provisions in respect of drainage and as a result is outside the scope of this SPD.

2 Policy Context

2.1 Sustainable surface water management is increasingly recognised as an important consideration in national, regional and local planning as an effective means to manage surface water flooding.

National Policy Guidance

2.2 **Planning Policy Statement 1** (PPS1) sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system. Key objectives include ensuring that developments are sustainable, durable and adaptable and make efficient use of resources. Tackling the causes and predicted effects of climate change within the planning system has received significant attention by the Government which has published a supplement to PPS1 on 'Planning and Climate Change' (2007). PPS 1 sets out a number of key objectives for the planning system in respect of climate change.

2.3 **Planning Policy Statement 9** (PPS9) sets out the Government's planning policies on protection of biodiversity and geological conservation through the planning system. PPS9 states that local planning authorities should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; and to biodiversity and geological interests within the wider environment.

2.4 **Planning Policy Statement 25** (PPS25) sets out the Government's planning policies on development and flood risk, and is the foundation on which this SPD is based. PPS25 states that flood risk should be taken into account at all stages in the planning process. Specifically local planning authorities should prepare and implement planning strategies that help to deliver sustainable development by appraising risk, managing risk and reducing risk. PPS25 has key planning objectives to reduce risk to and from new development by incorporating sustainable drainage systems (SUDS); using opportunities offered by new development to reduce the causes and impact of flooding through surface water management plans; making the best use of green infrastructure for flood storage, conveyance and SUDS.

2.5 In **Making Space for Water** (July 2004), the Government set out a more holistic approach to managing flood and coastal erosion risks in England. The approach involves taking account of all sources of flooding, embedding flood and coastal risk management across a range of Government policies, and stresses Government's support for the concept of integrated management of urban drainage.

2.6 The **Flood and Water Management Act 2010** encourages the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt SUDS for new developments and redevelopments. The Act requires developers to include sustainable drainage, where practicable, in new developments, built to standards which reduce flood damage and improve water quality. It also amends 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 gives 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, likely to be Kent County Council.

2.7 In February 2008, the UK Government consulted stakeholders on **'Improving Surface Water Drainage'**. This included questions on how to increase uptake of SUDS as the preferred option instead of connecting surface water rainfall runoff to sewers. It also reviewed the right of new developments to connect surface water flows to the public sewerage system, which is seen as a barrier to the use of SUDS. Subsequently, Sir Michael Pitt's Review put forward a number of recommendations which included action by the Government to determine which organisation should own and maintain SUDS. This issue is covered in Section 5.

2.8 The **Building Regulations** part H, Drainage and waste disposal, establishes a hierarchy for surface water disposal, which encourages a SUDS approach. The first option for surface water disposal should be the use of SUDS which encourage infiltration such as soakaways or infiltration trenches, followed by discharge to a watercourse and finally discharge to a sewer. This final option should only be considered where other forms are not practicable. In all cases, it must be established that these options are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. For example, using soakaways or other infiltration methods on contaminated land carries groundwater pollution risks and may not work in areas with a high water table. Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under Building Research Establishment (BRE) Digest 365 or to an alternative Kent County Council or Ashford Borough Council standard if appropriate.

2.9 The **Code for Sustainable Homes** was launched in December 2006 and sets a national standard for the sustainable design and construction of new homes. Attenuation of surface water through SUDS is included in the guidance. If SUDS are provided to attenuate runoff from both hard surfaces and roofs, 1 point can be awarded towards the overall sustainability rating. Additionally, it is mandatory for all levels of the Code that run-off rates and annual volumes of run-off post development will be no greater than the previous conditions for the site.

Local Guidance

2.10 **Kent Design Guide** seeks to provide a starting point for good design while retaining scope for creative, individual approaches to different buildings and different areas. It aims to assist designers and others achieve high standards of design and construction by promoting a common approach to the main principles which underlie Local Planning Authorities' criteria for assessing planning applications. Appendix C2 includes advice, guidance and information about design and implementation of drainage systems, including sustainable drainage solutions, for residential and industrial development.

2.11 In 2007, the **Catchment Flood Management Plan** (CFMP) for the River Stour was completed. This recommended flood risk management policies for various reaches of the River Stour over the next 50 years. For Ashford the CFMP recommended taking further action to sustain the current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change and climate change).

2.12 In August 2005, the **Ashford Integrated Water Management Study** (AIWMS) was published. The AIWMS assesses the constraints to growth that might arise in relation to meeting the demand for potable water; the provision of wastewater services and the impact of treated effluent on the receiving waters; and the management of flood risk. A key finding of the study was that post-development run-off rates would need to be over-attenuated, that is reduced to below pre-development rates. It suggests physical measures to manage flood risk resulting from the development of Ashford; identifying large-scale incorporation of SUDS throughout new development areas as the most effective flood risk management option.

2.13 **Water for Ashford** – the 2007 summary of the Ashford Water Cycle Strategy (2006 – 2031) – translates the recommendations of the AIWMS into policies and states: 'From 2006, all new sites in Ashford will need to reduce storm run-off to 4 litres per second per hectare on impermeable ground and 2 litres per second on permeable ground'.

2.14 Ashford's **Strategic Flood Risk Assessment** (SFRA) was completed in October 2006 as a Core Strategy Background Document. It describes how drainage systems should be developed in line with the objectives of sustainable development by balancing the different issues that should be influencing the design. It recognises that surface water drainage methods that take account of quantity, quality and amenity issues are more sustainable than conventional drainage methods because they:-

- Manage runoff flow rates and volumes, 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; and

• Encourage natural groundwater recharge (where appropriate).

2.15 The **Ashford Sustainable Drainage Study – Technical Guidance Document** - was completed in March 2008 by Atkins. This document forms the basis of the technical sections of this SPD and the SUDS examples in the appendices to this SPD.

3 Post-development run-off rates

3.1 The Core Strategy (at paras. 15.13 – 15.18) sets out the main aims for surface water run-off in different parts of the Borough. These are largely drawn from the Ashford Integrated Water Management Study (AIWMS). For ease of reference, the main aspects of these paragraphs are repeated below.

3.2 Rainfall on undeveloped greenfield areas either evaporates, is absorbed by plants, or drains naturally into streams and rivers over a period of time by infiltrating into the ground or running overland. New areas of built development are typically formed of impermeable surfaces such as roofs and roads. In these areas no water is intercepted by plants and trees, nor is it able to infiltrate into the ground. This can exacerbate the flood risk. Developed areas need to be drained to manage this incident rainfall. Urban drainage has traditionally sought to move water quickly from land to the river system. This typically means surface water arrives in our rivers and streams faster and in greater quantity – often resulting in increased flood risk.

3.3 SUDS are the primary means by which this increase in run-off should be mitigated. They can manage runoff flow rates to reduce the impact of urbanisation on flooding, protect or enhance water quality and provide a multi-functional use of land to deliver biodiversity, landscape and public amenity aspirations, and support Ashford's proposed network of green spaces and water bodies. They do this by dealing with runoff and pollution as close as possible to its source and protect water resources from point pollution. They may also allow new development in areas where existing drainage systems are close to full capacity, thereby enabling development within existing urban areas.

3.4 It is therefore important that all new developments should provide appropriate SUDS for the disposal of surface water rainwater so that it is retained either on-site or within the immediate area, or by other water retention and flood storage measures. SUDS should seek wherever possible to deal with surface water runoff locally, returning the water to the natural drainage system as near to the source as possible. This approach is commonly known as the 'surface water management train' or 'source-to-stream'.

3.5 Government planning guidance highlights the aims for greenfield and previously developed land applications of SUDS in PPS1 and PPS25. The latter (at Annex F10) establishes the key principles in relation to run-off from developments on greenfield and previously developed land that inform the policy guidance below.

3.6 It is common practice to restrict surface water run-off from developed areas to the equivalent greenfield run-off rate. Furthermore, in the Ashford Growth Area, the Ashford Integrated Water Management Study (AIWMS) has identified an approach and evidence base for the use of sustainable drainage and has set out respective target run-off rates for greenfield developments in different parts of the Growth Area. These are reflected in this SPD.

3.7 Therefore, in accordance with Policy CS20, all greenfield developments in the Ashford Growth Area, other than those in the south-western part of the Growth Area that are not within the Stour catchment, will be required, through appropriate SUDS features, to achieve a net reduction in surface water run-off below the previous greenfield run-off rate to meet the relevant standards specified in the AIWMS.

3.8 The AIWMS identifies the M20 as the boundary between different policy requirements for run-off rates. This is because the M20 closely follows the change in geological conditions, with increased infiltration possibilities to the north. This distinction reflects the greater prevalence of the less permeable clay-based soil types found south of the motorway which results in greater natural run-off rates from greenfield locations. This distinction is followed through into the run-off rate standards in Table 3.2 below.

3.9 For all other greenfield sites in the Borough, including those in the Growth Area that drain to the river Beult catchment, developments will be encouraged to meet the 4 l/s/ha AIWMS greenfield run-off standards for the Stour catchment (south of M20) as far as is possible but as a minimum, will be required to avoid any net increase in run-off rates. Developers should establish what the actual greenfield runoff rate is or, failing this, a 'rule-of-thumb' of 6 l/s/ha shall be used.

3.10 For brownfield developments in the Borough, the existing run-off rate may need to be calculated through a network analysis of the surface water drainage system. However, where this is not possible, a proxy rate may be calculated using the equation in paragraph A4.11 of Appendix 4 to this SPD. This should be based on an average 2 year return rainfall event of 6 hours duration, which equates to a run-off rate standard of 10.26 l/s/ha.

3.11 It is recognised that different rainfall events have different impacts. At a site level it is usually the short duration, very intense rainfall event that causes drainage systems to be overwhelmed. Whereas at a river catchment level it is usually the prolonged, less intense rainfall event that will cause river systems to flood. In Ashford, the wide scale usage of SUDS is required to reduce the risk of flooding at a river catchment scale, whilst at the same time protecting the site from short duration, intense rainfall events. As such, SUDS design will be, by necessity, a compromise. For Ashford, the catchment characteristics suggest a six hour rainfall event is generally appropriate for design purposes. A consequence of this is that surface water storage volumes are likely to be higher than would be necessary to purely protect the site. This should be allowed for in site layouts and design.

Scale	Rainfall duration	Intensity	Time to peak	Volume
Site	Short (< 2 hours)	> 50mm / hour	Fast (< 2 hours)	Low
River catchment	Long (> 24 hours)	< 10mm / hour	Slow	High
Design	6 hours	13mm / hour	Medium	Medium

Table 3.1 Site and catchment scale likely 'worst-case' rainfall events

3.12 It is possible some larger sites may lie on the watershed between two catchments – for example, Chilmington Green lies on the watershed between the Stour and the Beult. In such instances the general assumption is that surface water will continue to drain to the same catchment pre and post development.

3.13 Table 3.2 below sets out the run-off rate standards that will be applied in different parts of the Borough on either greenfield or previously developed sites.

Area	Type	Acceptable run-off rate (litres/second/hectare)
Growth Area - north of M20	Greenfield	2 l/s/ha
Growth Area - north of M20	Previously developed	'Best endeavours' to achieve 2 l/s/ha. Failing that, aim to achieve a reduction from the existing run-off rate for the site (where this can be established); As an absolute minimum, must not lead to a net increase in run-off rate above the existing rate for the site (where this can be established) or 10.26 l/s/ha (where the existing rate cannot be established).
Growth Area - south of M20, including urban	Greenfield (Stour catchment)	4 l/s/ha

Area	Type	Acceptable run-off rate (litres/second/hectare)
extension areas at Cheeseman's Green and Chilmington Green (east)		
Growth Area - south of M20, including Chilmington Green (west)	Greenfield (Beult catchment)	Encouraged to achieve 4 l/s/ha as far as possible, but must avoid any run-off rate in excess of existing greenfield rate for the site (where this can be established) or 6 l/s/ha (where the existing greenfield rate cannot be established).
Growth Area - south of M20, including town centre regeneration sites	Previously developed	'Best endeavours' to achieve 4 l/s/ha. Failing that, aim to achieve a reduction from the existing run-off rate for the site (where this can be established); As an absolute minimum, must not lead to a net increase in run-off rate above the existing rate for the site (where this can be established) or 10.26 l/s/ha (where the existing rate cannot be established).
Rest of Borough	Greenfield	Encouraged to achieve 4 l/s/ha as far as possible, but must avoid any run-off rate in excess of existing greenfield rate for the site (where this can be established) or 6 l/s/ha (where the existing greenfield rate cannot be established).
Rest of Borough	Previously developed	'Best endeavours' to achieve 6 l/s/ha. Failing that, aim to achieve a reduction from the existing run-off rate for the site (where this can be established); As an absolute minimum, must not lead to a net increase in run-off rate above the existing rate for the site (where this can be established) or 10.26 l/s/ha (where the existing rate cannot be established).

Table 3.2 Acceptable run-off rates by location and type of site

3.14 Policy CS20 recognises that on some sites, such as brownfield or small-scale infill developments, development in Conservation Areas, or small-scale development of constrained sites, it may not be possible to restrict run-off to the required rate. Where the applicant has identified this is the case they will need to submit a sound and fully justified case for why the policy requirement cannot be met. This is the 'best-endeavours' approach referred to in Table 3.2.

3.15 The Council will expect clear evidence and justification to be presented on why a development cannot achieve consistency with Policy CS20 through meeting the run-off rate standards set out in Table 3.2. This should include a detailed technical appraisal, open to clear inspection, demonstrating why lower run-off rates cannot be achieved for technical reasons.

3.16 Small sites present a particular challenge. If the standard run-off rate (4 l/s/ha) is applied to small sites (< 0.25 ha) it can result in a very small discharge which is difficult to design for. Flow control devices are generally available for discharges as low as 2 l/s. For this reason it is deemed applicable to apply a maximum discharge limit of 2 litres per second to all sites under 0.25 ha. It is not acceptable to artificially sub-divide sites so that this *de-minimus* rate applies. Indeed, wherever possible it is preferable to combine sites and treat drainage strategically.

4 Technical guidance - general

4.1 The technical guidance sections aim to provide developers, project managers, designers and relevant regulators for Ashford with clear and practical advice on designing, operating and maintaining sustainable drainage systems. It addresses the key design and construction issues that need to be considered when looking to comply with Core Strategy Policy CS20. Additional information is available from a variety of sources and these are referenced in the Appendices to this SPD. This document does not replicate detailed information and guidance referred to elsewhere; rather it seeks to set this within the Ashford context. SUDS design should be in accordance with National Standards, the CIRIA's SUDS guidance, Kent Design and local guidance in this SPD.

4.2 The Flood and Water Management Act 2010 introduces National Standards governing the way in which surface water drainage systems must be constructed and operated. The Act introduces an approval system for the surface water drainage systems of the majority of new developments, including roads, in line with the National Standards.

4.3 SUDS should be used as an integrated approach to water management that contributes positively to the goals of sustainable development. Specifically, the objectives of SUDS design are to:

- Reduce downstream flooding by attenuating runoff; reducing peak run-off rate and run-off volume (if possible) preferably by replicating natural processes.

- Minimise the impact of development on water quality by using drainage systems that provide treatment benefits; and in combined sewer areas, reduce the incidence of combined sewer outfall storm discharges.

- Maximising benefits by applying the SUDS “management train”, comprising a series of SUDS from runoff source through to the point of discharge.

- Maximise integrated amenity, green space and biodiversity opportunities.

- Develop drainage designs that are sympathetic with the surrounding landscape character.

- Store water for potential use, for example, irrigation of landscape features.

- Ensure appropriate long term ownership, management and maintenance arrangements are in place.

4.4 Successful SUDS design to achieve the SPD objectives requires the drainage to be carefully integrated into the site while taking into account the original greenfield drainage patterns. Integration is the most effective way to achieve the desired objectives of SUDS use. It is recommended that surface water management requirements are given early consideration in the design process – on no account should they be 'bolted-on' to a pre-determined layout.

Management train

4.5 An efficient and integrated approach to SUDS requires the careful use of a range of techniques to be designed in a sequential order. The concept of managing storm water runoff from source to discharge and infiltration is referred to as the SUDS "management train", shown in Figure 4.1. Each step of the management train changes the characteristics of run-off until it can be discharged.

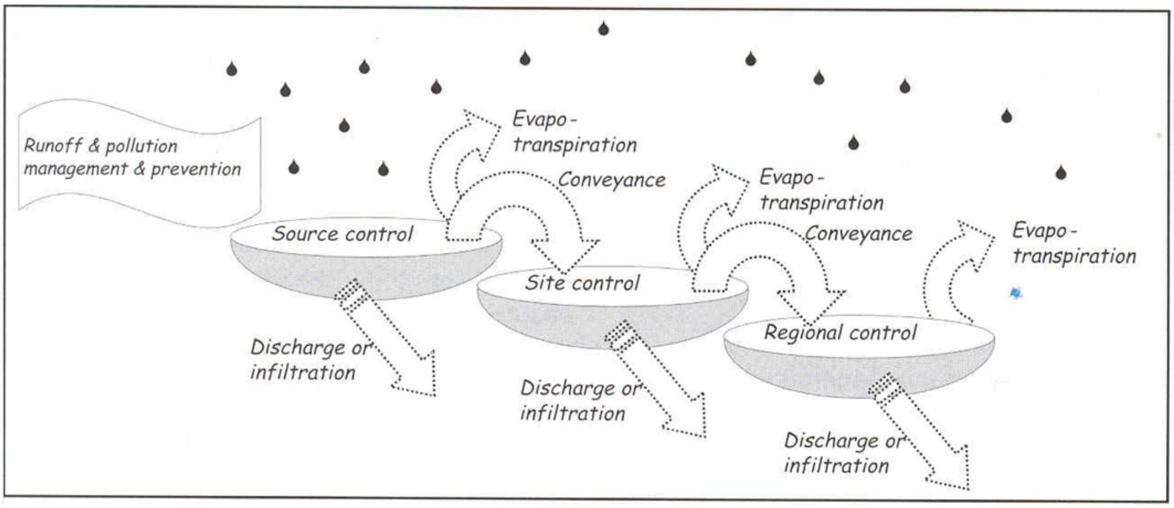

Figure 4.1 SUDS management train, Source: CIRIA 625

Local solutions to surface-water run off (on-site) as near to the source as possible are preferred but if a limited number of attenuation and treatment areas are needed downstream, such as in significant areas of planned built development, then there is a role for larger 'strategic' SUDS.

SUDS Types

4.6 There are a large range of SUDS types available to allow developers to integrate the SUDS management train into their site layout. These are detailed in Appendix 2. Table 4.1 below summarises these options. The most appropriate measures for Ashford have five 'diamonds', the least appropriate have one 'diamond'. However, it should be noted that the actual appropriateness will vary according to individual site conditions.

Name	Type	Appropriateness
Green roof	Source control	♦♦♦♦♦
Water butt / rainwater harvesting systems	Source control	♦♦♦♦♦
Soakaways	Infiltration	♦♦
Permeable paving	Infiltration / storage	♦♦♦♦
Filter strip	Conveyance / infiltration	♦♦♦♦
Swale	Conveyance / infiltration	♦♦♦♦♦
Infiltration trenches	Infiltration / conveyance	♦♦
Open channels, Rills,	Conveyance	♦♦♦♦
Infiltration basin	Storage / infiltration	♦♦♦♦
Wet ponds (retention basins)	Storage	♦♦♦♦♦
Detention basins	Storage / infiltration	♦♦♦♦♦
Constructed wetland	Storage / infiltration	♦♦♦♦
Online / offline storage, including over-sized pipes, 'modular storage' systems	Storage	♦♦
Infiltration techniques	Storage / infiltration	♦

Table 4.1 Types of SUDS and their appropriateness in Ashford

4.7 When selecting the type(s) of SUDS to be used on a particular site, developers should consider the following:

• Run-off rate;
• site topography and geology and groundwater level;
• flow routes and space availability;
• opportunities to enhance landscape value, public open space - including, where appropriate, access and recreational provision - biodiversity, water quality and water resources;
• land use and viability;
• long-term maintenance requirements and system legibility and
• health and safety.

4.8 Within urban areas it may be possible to incorporate open channels or rills to convey water rather than using traditional underground pipes. In dense urban areas – where space is at a premium - these are an effective way of providing SUDS and can add interest as well as water quality and biodiversity improvements. This has already been used successfully in Ashford, for example West Street Water Garden. They can also be useful in contaminated sites as they can reduce the need for deep excavation.

4.9 In assessing SUDS, the Borough Council will consider not just the flood risk management criteria, but also the opportunities to realise other environmental gains and amenity uses. As such, underground storage, such as over-sized pipes or modular systems, will only be approved as a last resort if all other forms of SUDS have been demonstrated to be impractical. The exception to this would be if the underground storage were part of a rainwater harvesting scheme.

On-site and strategic SUDS

4.10 In accordance with Policy CS20, developers will normally be expected to make provision for SUDS on site in order to achieve the appropriate run-off rate standard. Those SUDS techniques that can be used to control run-off close to the source and would be implemented within the development boundaries are termed ***on-site SUDS*** in this document. Such techniques could include green roofs, rainwater harvesting, infiltration systems, swales, small and medium sized ponds and wetlands.

4.11 Those SUDS techniques that are located lower downstream on the management train are termed ***strategic SUDS*** in this SPD. These strategic SUDS features would attenuate and treat runoff from larger catchment areas that was in excess of the on-site storage capacity. Strategic SUDS may in fact be located within a development area.

4.12 Where sufficient on-site SUDS provision cannot be achieved for developments in the Ashford Growth Area, developers will be required to make suitable in-lieu financial contributions through Section 106 Agreements or the proposed strategic tariff (subject to the details to be contained within the forthcoming Infrastructure Contributions SPD) to the provision, management and maintenance of strategic SUDS that provide a sustainable drainage solution for more than one site. The details, including the location of any such 'strategic' SUDS scheme, will be contained in site-specific DPDs.

4.13 It is likely that a combination of on-site and strategic SUDS will be required to achieve the required run-off targets. The amount of water that is required to be stored on-site will influence the type of on-site SUDS selected. The balance or ratio of water storage in each of these stages of the management train will change the likely SUDS to be selected and the land-take for SUDS.

4.14 In exceptional cases, SUDS may be provided 'off-site' but only provide storage for a single development site. These may also be acceptable if they can help the development achieve the appropriate run-off rate standard and would also need to be delivered via a Section 106 Agreement.

4.15 In all cases where a development scheme is relying in whole or in part on an 'off-site' SUDS to achieve the necessary run-off rate standard, then development may only be allowed to commence once the off-site SUDS has been completed even if a contribution towards its delivery has been agreed, or a phased programme of works has been agreed to allow the early implementation of the development, where it can be demonstrated that it will not increase the risk of flooding elsewhere. Appropriate Grampian-style conditions will be attached to any grant of planning permission to ensure this is the case.

Source control

4.16 ABC requires that developers maximise run-off (source) control opportunities early in the management train. The expectation is that all residential developments incorporate rainwater harvesting features. These could be water butts for individual properties or incorporated into rainwater use systems for blocks of flats. Within commercial developments, buildings should incorporate the use of brown and / or green roofs to maximise treatment and habitat opportunities.

4.17 ABC requires developers to use swales and other "landscaped" features to collect and convey water as far as practicable. It discourages the use of piped systems and will not normally approve of schemes relying on these.

4.18 Across the Ashford area the Council is seeking to provide a range of habitats and SUDS features. Developers and their consultants should therefore approach ABC at an early stage to discuss appropriate solutions for their site.

4.19 Much of the Ashford Growth Area is underlain by impermeable clays, infiltration devices are not appropriate in these areas. Systems requiring infiltration may not be permitted in groundwater source protection zones (SPZs).

4.20 When sizing SUDS features, an allowance should be included for climate change, siltation and vegetation, in accordance with National Standards, CIRIA, Environmental Agency and PPS25 guidelines. The climate change allowance can be adjusted according to the design life of the development as shown in Table 4.2.

Design Life	To 2085	Beyond 2085
Peak rainfall intensity	+20%	+30%

Table 4.2 Climate change allowances

5 Technical guidance - landscape, heritage and amenity

5.1 It is recommended a landscape architect should be included in the design process from inception though to implementation to ensure that SUDS are designed as an integrated part of the site layout and landscape framework. This section gives an overview of the aspects that should be considered by designers at each phase of the design process.

5.2 At the scoping phase the landscape consultant should identify those key environmental issues on site and in the local area that need to be taken into consideration by the developer to ensure an integrated approach to designing SUDS. Examples could include heritage assets, existing amenity space and the local Landscape Character Assessment. This is an ongoing activity during the life cycle of the development planning and design process and may need to be reactivated as new information comes to light as a result of consultation or available options are designed in more detail.

5.3 The borough contains many designated sites, including Sites of Special Scientific Interest (SSSI), Areas of Outstanding Natural Beauty (AONB) and Local Wildlife Sites. If a site is designated, it is likely to affect the type of SUDS that are appropriate and the on-going maintenance. With respect to the Kent Downs AONB, the Statutory Duty of Regard (Section 85) requires any schemes to ensure conservation and enhancement of the AONB and its setting in accordance with the objectives and policies of the Kent Downs Management Plan 2009- 2014.

5.4 Examples of appropriate landscape and amenity design objectives and principles are as follows; SUDS should be designed to:

- Be a ‘seamless’ and integrated part of the site layout and landscape framework of open space and planting;
- Enhance the aesthetics of the open space;
- Embrace local distinctiveness, promote quality and protect existing features of cultural, and visual and historical importance;
- Minimise the impact on heritage assets;
- Be part of the open space of a development and assist the creation of an ‘Ashford Green and Blue grid’;
- Promote the movement of people - walking or cycling through open space;
- Enhance the amenity of open space - considering layout and profile, user interaction, finishes, and planting.
- Augment the biodiversity benefits associated with landscape and amenity;

- Be easily accessible for maintenance, and
- Be safe.

Where SUDS meet all or the majority of the above principles, they will be considered as contributing to the overall on site open space provision.

5.5 The local landscape character and context of the proposed site must be respected in the design of all aspects of new development. The inclusion of landscape appraisal in the design process of SUDS will help to conserve and enhance the distinctive characteristics and quality of the landscape.

5.6 Landscape characterisation has increased in importance as a tool for countryside planning policy. Planning Policy Statement 7 promotes the character approach in order to offer more tailored guidance for the whole of the countryside. The Landscape Assessment of Kent provides a description of the landscape and a vision or strategy that directly reflects the condition and sensitivity of the area. Information can be downloaded from the Kent Landscape Information System Website (http://extranet7.kent.gov.uk/klis/home.htm). In addition, regard should be had to Ashford's heritage. This can be informed by consulting the Kent Historic Environment Record and also the Historic Landscape Characterisation Survey (2001) which provides an important tool for understanding the time-depth and historic character of Kent's modern environment by examining patterns of land-use, field boundaries and tracks and lanes.

5.7 This regional landscape assessment should be supplemented with information on the local landscape character and pressures of the site taking account of the combination of natural, man made and cultural features which includes an assessment of topography, scale, landscape features, movement and access, open space, colours, style, detailing of the surrounding area and links with the ‘Ashford Green and Blue grid’. This information will be included in the site appraisal which also includes the items identified in the Site Appraisal checklist (Source Kent Design Guide 2005/2006) and the identification of constraints and opportunities. The site appraisal identifying constraints and opportunities should be included in the Design and Access Statement and submitted with the planning application and Environmental Impact Assessment (where one is required). This approach should help to enrich the existing local landscape character whilst helping to integrate the development – reinforcing the positive design of the site.

5.8 Tree Surveys may indicate the presence of veteran trees - these should be identified, retained and managed in accordance with English Nature’s publication ‘Veteran Tree management’.

5.9 The site appraisal should feed into the design of SUDS within a development. In addition the environmental design objectives and principles can be used to help to define the environmental advantages and disadvantages of each option, which should include an assessment of the potential benefits of the SUDS to the amenity of the future development, the community and environment. These options should be presented to ABC, Environment Agency and Kent County Council (KCC) for their early consideration to determine the best solution for the site and local area.

5.10 SUDS should be included in the site plan which should show the SUDS designed as 'seamless' and integrated part of the site layout and landscape framework of open space, habitat creation and planting. The key environmental aspects and heritage assets of the site should also be identified. This should advise ABC as to how the developer intends to manage the SUDS as an integrated part of the site layout and landscape framework.

5.11 The detail landscape design of the development should design the aesthetic layout of the SUDS - detailing layouts, profile, finishes and planting mixes, and sizes. The specification should include planting and habitat creation e.g. translocation of species, local provenance, suppliers etc. This information should be submitted to ABC to discharge conditions, a SUDS management and monitoring plan should also be submitted.

5.12 It is expected that the provision of SUDS will be addressed in the Flood Risk Assessment (FRA) submitted in support of the planning application. In the absence of an FRA a Surface Water Drainage Assessment will be required.

5.13 Wherever practicable existing trees and hedges should be retained on site. Site clearance should be specified in the contract documents if required. The timing of this activity should reflect seasonal constraints imposed by the bird nesting period, nominally March to August, with detailed checks being undertaken mid February and September to ensure conformity with the Wildlife and Countryside Act. Other species requirements may be different and the ecologist should advise on timing and any method statement set out in any protected species licence application. Developers should refer to the Schedule 5 list at http://www.naturenet.net/law/sched5.html

5.14 Existing topsoil and subsoil should be separated and stored on site according to BS 3882. The import of topsoil should be avoided unless agreed with ABC in advance of the works.

5.15 New planting and translocation of existing plants should be undertaken in the planting season, nominally 31 October to 31 March. The exception to this would be for the seeding of grassland, wetland etc - this will need to be done in the autumn from the 31st of August to the beginning of October. Planting should be supervised by an environmental clerk of works to ensure that the implementation of the planting and seeding reflects the specification and the design aspirations of the landscape framework.

5.16 Maintenance and management of habitats and planting should be included in the management plan which should reflect the environmental design objectives and principles identified at conception. Maintenance activities may include coppicing or pollarding of trees or clearance of sediment from ‘sacrificial’ ponds.

5.17 SUDS may have both direct and indirect impacts on the historic environment. Direct impacts could include damage to known heritage assets - for example if a historic drainage ditch is widened and deepened as part of SUDS works. Alternatively they may directly impact on unknown assets such as when SUDS works damage buried archaeological remains. Indirect impacts are when the ground conditions are changed by SUDS works, thereby impacting on heritage assets. For example, using an area for water storage, or improving an area's draining can change the moisture level in the local environment. Archaeological remains in particular are highly vulnerable to changing moisture levels which can accelerate the decay of organic remains and alter the chemical constituency of the soils. Historic buildings are often more vulnerable than modern buildings to flood damage to their foundations.

5.18 When SUDS are planned it is important that the potential impact on the historic environment is fully considered and any unavoidable damage is mitigated. This is best secured by early consideration of the local historic environment following consultation with the Kent Historic Environment Record (HER) and by taking relevant expert advice. Kent County Council maintains the County HER and can offer guidance on avoiding damage to the County's heritage.

6 Technical guidance - engineering

6.1 Engineering considerations for SUDS are broad ranging, as for any drainage system. Conveyance, attenuation and, where possible, infiltration are primary considerations. To maximise the water quality treatment opportunities provided by SUDS, designers need to be cognisant of the characteristics of SUDS types and likely pollutant loads.

6.2 Examples of appropriate engineering design objectives and principles are as follows:

• Sufficient conveyance and attenuation to achieve runoff targets;

• Generally SUDS must not be located in the 1 in 100 year floodplain as shown on the Environment Agency's website http://www.environment-agency.gov.uk/ or as set by a more detailed Flood Risk Assessment (FRA) of the site. However, some forms of source control techniques, such as green roofs, would be acceptable.

• Suitable discharge points of SUDS features into rivers, lakes or drainage ditches must be identified, and only to an existing public sewer if permissible.

• Site topography should be designed to ensure runoff can be captured by SUDS, where possible;

• Selection of SUDS suitable to site gradients to avoid erosion, and

• Design in liaison with ecologists to ensure vegetation is consistent with roughness assumptions etc. and selection of fast growing vegetation to minimise erosion during and immediately following construction.

6.3 Site specific infiltration tests should be carried out in accordance with the latest standards if devices relying on infiltration are proposed. Note infiltration devices will not normally be permitted in Source Protection Zone 1 (SPZ1). Infiltration is unlikely to be feasible in areas of Ashford south of the M20 due to the geology.

6.4 Designs should be mindful of desired water quality requirements. For example, wet ponds should be designed to avoid short circuiting and to achieve required residence times.

6.5 Oil separators or other contaminate control solutions, may be required in commercial or industrial areas where runoff could be contaminated. However, where SUDS are used this may remove the requirement for an oil separator. Drainage from areas such as scrapyards, storage and handling areas for chemicals (solvents, acids etc), and washing bays are likely to be contaminated with substances other than oil, and should normally drain to the foul sewer with the approval of the sewer provider. The local sewer provider might require the discharge to have a separator and you must consult them. Discharge from such areas may not be suitable for drainage to surface water drains, a watercourse or to the ground even where SUDS are provided. Site specific guidance should be sought from Ashford Borough Council/Environment Agency/Kent Highways Services.

6.6 If extended detention basins or other features are proposed as sports fields, ABC will require evidence of the frequency that these areas will be inundated. Detention basins should be designed to have a low level drainage channel that will be inundated more frequently than the full basin invert.

6.7 Provision should be made for raised cycle lanes and footpaths in or adjacent to linear SUDS features such as swales where appropriate.

6.8 Inlets and outlets should be designed to avoid amphibians and other species becoming trapped.

6.9 Any feature storing more than 10,000m^3 of water above natural ground level will fall under the requirements of the Reservoirs Act 1975.

Health and safety

6.10 Health and safety issues are often raised as reasons for not implementing SUDS, particularly where wet ponds are located in residential areas or near playgrounds. With effective design, SUDS features can be made safe. The following examples demonstrate how health and safety issues can be managed:

• Designs should follow best practice, for example use of safety benches in wet pond features;

• Use of fences as safety barriers will not normally be approved. Designers should use barrier planting if necessary;

• Designs with shallow side slopes and barrier planting;

• Stagnant water can encourage mosquitoes;

• The Royal Society for the Prevention of Accidents (RoSPA, http://www.rospa.com/) provides safety advice and can audit designs;

• CDM regulations should be followed; and

• Health and safety risk assessment should be carried out on a site by site basis.

6.11 When specifying SUDS provision, CIRIA guide C697 should be followed and designs should be to the appropriate British or European Standard.

Construction

6.12 The protection of SUDS during construction is imperative. For example, permeable paving can easily become blocked by fine sediment eroding from unprotected surrounding areas. The designers should consider the construction sequence with care. See Section 8 for more detail.

Maintenance

6.13 Adoption and maintenance issues are addressed in Section 9 with reference to the Flood and Water Management Act 2010 which provides for SUDS to be adopted by the SUDS Approval Body (SAB). Regular and effective maintenance is essential to ensure that SUDS perform satisfactorily throughout their design life. For example, over time, available storage in retention ponds may decrease through vegetation growth and siltation. Considering future maintenance at the design stage can reduce lifetime costs of SUDS features.

6.14 The following should be considered at the engineering design stage:

• Open forms of storage should generally be over-sized to allow for vegetation and siltation;

• Silt control should be used, for example sediment forebays should be incorporated into the design of any pond features;

• Silt should be managed so that it does not block infiltration systems and filters;

• Vehicular access to areas where silt will be deposited is required to aid removal. Reinforced grass access is appropriate;

• All designs that will require grass mowing should be designed to allow this to be carried out using commercial mowing vehicles. A maximum gradient of 1 in 3 and minimum width of 1.5m is required;

• Discussions with ABC may identify areas where cattle grazing will be used to manage vegetation. Where this is the case, designs should be sympathetic with this requirement;

• Particular attention should be paid to inlets, outlets and controls to ensure ease of access for routine inspection and maintenance;

• Specified maintenance frequency should accord with design assumptions on reductions in flood storage volumes from silt accumulation, and

• Designs should avoid the creation of 'islands' as water levels rise.

Developments on previously developed sites

6.15 Developments on previously developed sites can present particular engineering challenges. However, SUDS are often more acceptable in such locations as they can involve shallower excavations than traditional piped systems.

6.16 Generally infiltration devices should not be used where contaminated soil is present, although if pre-treatment is provided it may be acceptable;

6.17 Source control systems, such as green roofs, and the use of swales, can help to reduce required excavation depths, which can in turn reduce volumes of contaminated material requiring disposal.

Further guidance

6.18 CIRIA guide C609 provides comprehensive guidance and specifications for SUDS design. Designs should follow the best practice provided in this document, including hydraulic design, water quality and maintenance recommendations unless otherwise stated in this document or required by ABC.

7 Technical guidance - biodiversity

7.1 Many SUDS features, particularly “landscaped” SUDS, can provide wildlife and ecology benefits and could help to achieve the aims set out in the UK and Kent Biodiversity Action Plans (BAPs). Where a proposed development has the potential to disrupt existing habitats, SUDS can provide additional habitat. However, it should be remembered that the primary purpose of SUDS is surface water management not biodiversity, and the provision of SUDS features shouldn't be seen as mitigating ecological impact - though they can help.

7.2 The design of SUDS for biodiversity needs to be informed by site specific wildlife considerations and integrated within the wider development needs as set out in the Core Strategy. Suitable plant species should be specified so that rapid vegetation occurs to prevent the erosion of SUDS during construction. Rather than making standard specifications, consultants should develop local lists for different parts of the development area comprising species found within 30 km of the site.

7.3 The presence of pollutants in water draining into SUDS features can mean that they are likely to support only relatively robust and common pollution-tolerant species, particularly early in the management train. Typical pollutants in residential and commercial areas can include hydrocarbons and heavy metals from road runoff. The choice of plants should allow for the levels of pollution that are likely to occur.

7.4 Selection of SUDS types should consider habitat creation possibilities and green links – corridors and stepping stones – especially links to Ashford’s Green and Blue Grid. Wherever possible and practicable SUDS should contribute to delivering Biodiversity Action Plan (BAP) priority habitats and the wider objectives of the Kent BAP. In the town centre, the provision of green roofs can provide habitats where it would be difficult to achieve at ground level.

Drainage and erosion control

7.5 Planting should be appropriate to meet the conveyance requirements in accordance with the engineering design. For swales this is likely to involve an engineering grass seed mix. Planting can also be used for stabilisation of surfaces, erosion control, interception of silt and prevention of silt re-suspension.

Water quality

7.6 Selecting appropriate planting can be very effective in treating pollution; for instance, green roofs, grassed filter strips, swales. In permeable paving, a bioremediation substrate can aid treatment of pollution.

7.7 Plants should be selected that are suitably resistant to the quality of water likely to be received in the SUDS.

Health and safety

7.8 ABC will consider favourably the use of barrier planting to prevent access. Fences are unlikely to be acceptable.

Amenity

7.9 Planting should be provided that gives attractive visual character and all season interest. Where SUDS features are used for other purposes some of the time – such as informal sports / play areas - species appropriate to proposed uses, for example hard-wearing, low growing grasses should be used.

Wildlife

7.10 SUDS features should be created that provide the optimum habitat structure. Opportunities should be sought that encourage wildlife to inhabit SUDS features - further details are given in the Biodiversity Section of the Kent Design Guide.

7.11 Where possible, plant species should be allowed to colonise naturally. There is a tendency to over-plant initially to give a natural, established look from the outset, this can result in SUDS features quickly becoming ‘choked’.

7.12 Use local provenance species where possible. ABC will consider plans to include ‘alien species’ where these are particularly appropriate, for example for maintenance or landscape purposes and where they have value to wildlife i.e. produce high pollen and attract in invertebrates.

Management

7.13 The selection of grass types is of particular importance for mowing and maintenance. If SUDS are to be designed for wildlife, mowing should be kept to a minimum with one or at the most two cuts a year after the habitat has been established. Regular mowing will vastly reduce biodiversity value and where possible low intensity grazing should be the preferred management technique. Where larger trees are used, access for pruning and pollarding should be considered. Provision for the management of green waste should be onsite if possible.

Further guidance

7.14 The Biodiversity Appendix to the Kent Design Guide has a section dedicated to SUDS. It identifies key principles including:

• Land that is already low-lying and wet may be of existing wildlife value and should be retained;

• Use of a sediment forebay to capture sediment can enhance SUDS;

• Maximum wildlife benefit is likely to be achieved from the creation of a series of ponds, together with an associated habitat mosaic of wet, rough grassland, than a single pond;

• Swales are of greatest value to wildlife when they are designed to retain some water for most of the year (though this can make maintenance more onerous); and

• SUDS features requiring regular maintenance should not be designed to attract protected species such as great crested newts or water voles as this will increase the likelihood that work will need to be licensed.

7.15 The Biodiversity index to the Kent Design Guide can be found at http://www.kent.gov.uk/publications/council-and-democracy/kent-design-guide.htm. It also provides useful guidance on general principles of design for wildlife, creating green links, sourcing plant material, ponds and lakes and green roofs. Guidance for designing ponds and wetland to enhance wildlife and amenity provision is also provided in CIRIA C609 (Section 9.11.1) and in CIRIA Book 14.

Swale in residential location. Source: CIRIA

8 Technical guidance - construction

8.1 Development sites within Ashford will be designed to incorporate SUDS to attenuate and treat runoff during their operational phase. However, runoff generated during the construction phase of the developments will also need management and treatment. Some permanent SUDS features can be used for this and some additional temporary works will also be required. Attention to detail during the construction of SUDS is important if they are to be successfully implemented.

8.2 This section highlights the potential risks to SUDS during construction, and outlines those SUDS features that are the most appropriate for use in temporary works. Issues of construction phasing are addressed and a best practice approach for the construction of each type is highlighted. Temporary erosion and sediment control devices are outlined.

SUDS suitable for use during construction

8.3 SUDS that are suitable for use during construction, subject to good management practice, are:

- Swales;
- Detention basins;
- Green roofs;
- Rainwater harvesting systems; and
- Online and offline storage.

Construction risks

8.4 As with all construction activities there is a risk of poor delivery if workers are not familiar with the necessary techniques for the construction of SUDS features. A lack of attention to detail can reduce or remove the effectiveness of the SUDS.

8.5 The main risks to permanent SUDS during the construction phase are caused by:

- Greater sediment volumes during construction than during the operational phase;

- Contaminated silt; and

- Blockages and accumulation of silt causing damage to the permanent SUDS.

8.6 The most important aspect to consider during the construction period is the management and control of silt or other pollutants at all stages to prevent blockages and deposition. This is particularly important where SUDS used to control runoff during construction are subsequently incorporated in the permanent works.

8.7 Good practice to adopt during the planning and construction phases is shown in Table 8.1. The design and phasing of temporary SUDS should be in accordance with CIRIA 648.

8.8 Pre-construction planning can help ensure the successful delivery of SUDS. Key activities before, during and after construction are:

Preconstruction Phase

• Plan site set up (control mechanisms, sequencing, and contingency measures).

• Identify potential for pollution from runoff from compound areas, car parks, haul routes and storage areas and other construction activities.

• Apply for discharge consents if site runoff to be discharged to watercourses (not usually required for domestic surface water run off).

Construction Phase

• Monitor water quality at several locations in water bodies around and within the site.

• Monitor erosion and sediment runoff.

Post Construction Phase- Handover

• Clean sediment forebays as required.

• Remove temporary structures used within SUDS.

• Ensure permanent SUDS structures are operational.

Temporary construction sediment and erosion control mechanisms

8.9 Design of temporary construction sediment and erosion control mechanisms should be undertaken in accordance with:

• CIRIA C648, which recommends the installation of sediment and erosion control mechanisms as soon as SUDS features are constructed to prevent damage due to siltation;

• CIRIA C532; and

• Environment Agency Pollution Prevention Guidelines 5 and 6, which give particular focus to silt management.

8.10 Sediment control mechanisms that may be used as temporary works in conjunction with SUDS include:

• **Pumping to grassland and filtration infiltration.** This solution is not appropriate for long term use and is only suitable for water that is unpolluted aside from its silt content (i.e. not including chemical or biological pollutants such as oil, concrete or sewage). Performance depends on the infiltration and permeability of the underlying ground.

• **Settlement Ponds.** Settlement ponds have the advantage of being simple and effective and require less maintenance than other sediment control techniques. They can be converted to permanent SUDS features at the completion of works. Construction site runoff or water is pumped from excavations and channelled into a pond. Contractors must have the consent to discharge effluent from a settlement pond during site works even if it will form part of the permanent system. Advice on the design of settlement ponds for treatment of runoff during construction is provided in CIRIA guidance C648.

• **Filtration.** There are two methods that can be used to remove construction runoff silt prior to discharge. The first method comprises techniques used to trap sediment as water is flowing across site or along channels. The second is filtration by pumping water through steel tanks or skips filled with a suitable filter such as fine single sized aggregate, geotextiles or straw bales.

8.11 Erosion control mechanisms that may be used as temporary works during construction and in conjunction with SUDS include:

• **Seeding and planting.** Temporary stabilisation of soil during construction works to reduce erosion and runoff with high silt content can be achieved through planting of grasses. Temporary stockpiles should be seeded along with any cleared areas where construction activities have ceased, especially if they have steep sides. Care is needed when considering seeding and planting temporary stockpiles as this can attract protected species as they make ideal hibernation sites for reptiles and amphibians. It is wise to check for these species within the area before enhancements are considered.

• **Geotextiles and mats.** Meshes, netting and sheeting made of natural or synthetic material can be used to stabilise soil temporarily or permanently. They are suited to post construction site stabilisation but may be used for stabilisation of easily eroded soils in sensitive areas including channels and streams where flow may cause erosion.

• **Diversion drains and slope drains.** Diversion drains allow construction run-off to be channelled to appropriate areas on site where it can be controlled and treated appropriately. Generally diversion drains are located around disturbed areas and at the toe of stockpiles or cut/fill embankments. Diversion drains are simple to construct and consist of linear ditches with earth bunds. Slope drains allow runoff flowing directly down a slope by confining all the runoff into an enclosed pipe or channel.

- **Check Dams and sediment traps.** Check dams can be constructed across a swale or drainage ditch to reduce the velocity of concentrated runoff thereby reducing the erosion of the swale or ditch and promoting sedimentation. Properly anchored wood, straw bales, hay bales or rock filter bunds may be used.

- **Silt Fence.** A silt fence comprises of a geotextile filter fabric or straw bales or a combination of both and is installed in the path of sheet flow runoff to filter out heavy sediments. Silt fences may be useful to filter out heavy sediments but will not reduce turbidity.

8.12 Some SUDS, such as ponds, can usefully be used to protect watercourses from silt arising during construction. These features need to be restored to their design capacity at the completion of construction;

8.13 Throughout the construction period, appropriate inspections should occur in accordance with adopting / approval agency requirements (ABC, KCC, and Environment Agency).

SUDS Technique	Construction Risks	Construction Best Practice	Suitability for temporary works
Filter Strips	Erosion if used before vegetation is established or no protection provided. Poor attention to detail can result in unevenly graded filter strips.	Allow one full growing season for vegetation to establish before allowing runoff across or provide erosion protection. Design in accordance with C648 and C697 Chapter 21 in particular.	Not suitable. Construction runoff should not be allowed to flow across filter strips.
Swales	Poor timing of swale construction can result in unacceptable siltation. Flow can bypass swale inlets if surrounding surfaces, including turf, are	Avoid compacting soil. Runoff should not be allowed into the swale until the vegetation is sufficiently established to prevent erosion of the soils from the side and base. If necessary, control erosion using jute, straw or geosynthetic mats and check dams until vegetation becomes established.	Suitable if check dams installed and if cleaned appropriately before the contractor hands them over to the owner or operator.

SUDS Technique	Construction Risks	Construction Best Practice	Suitability for temporary works
	laid too high and prevent water entering the swale and inlets.	Design in accordance with C648 and C697 Chapter 21 in particular.	
Infiltration basins	Risks of soil compaction reducing infiltration. Risks of uneven infiltration due to undulations in constructed basin bed. Risk of infiltration capacity being reduced due to excessive quantities of silt from construction runoff.	Base of infiltration basin must be constructed at an even grade to avoid undulations and promote infiltration. Base and sides of the basin should be stabilised before runoff is allowed to enter it. Construction runoff should not be allowed to enter. Design in accordance with C648 and C697 Chapter 21 in particular.	Possible - If basin is to be used to deal with construction runoff a sacrificial layer should be left in the basin which will need to be removed before the basin's operational phase (typically 450mm).
Wet Ponds and Constructed Wetlands	Siltation from runoff during construction. Erosion of inlets, outlets and pond sides during construction until vegetation is established.	Construction runoff should be prevented from entering the ponds. If unavoidable, straw bales should be used to isolate the sediment forebay from the main pond. All construction silt should be removed from the forebay before hand over to the owner. Sides of inlets and outlets should be protected against erosion until the vegetation is established.	Possible in worst case but not recommended in particular for wetlands.

SUDS Technique	Construction Risks	Construction Best Practice	Suitability for temporary works
		Design in accordance with C648 and C697 Chapter 21 in particular.	
Extended detention basins	Siltation from runoff during construction.	The sediment forebay must be cleaned at the completion of construction before handover to the client. Banks of the basin should be stabilised within two growing seasons to minimise the risk of erosion. Area around the inlet and outlet should be stabilised before a basin is commissioned. Design in accordance with C648 and C697 Chapter 21 in particular.	Suitable if sediment forebay is cleaned appropriately before the contractor hands it over to the owner or operator.
Filter drains and perforated pipes	Risk of clogging due to high sediment loads from construction runoff.	Construction runoff should not be allowed into filter strips. Design in accordance with C648 and C697 Chapter 21 in particular.	Not suitable.
Infiltration devices	Soil compaction reducing infiltration.	Construction runoff should not be allowed to enter excavations for soakaways or completed devices as this will cause silting. Soils around the sides and base of the infiltration device should not be allowed to become smeared or compacted.	No - it is not advised to allow construction runoff to enter soakaways.

SUDS Technique	Construction Risks	Construction Best Practice	Suitability for temporary works
		Design in accordance with C648 and C697 Chapter 21 in particular.	
Rainwater Harvesting Systems	Risk of other trades requiring access to roof and damaging system.	Ensure that trades needing access to roof are sequenced appropriately	Suitable. Should be installed as development progresses to reduce runoff volumes.
Green Roofs	Risk of other trades requiring access to roof and damaging surfacing.	Erosion protection should be provided until vegetation is established - blanket or mulch (note: mulch will enrich the soil on green and brown roofs. As many of the habitats that can be created on these roofs require poor deprived soil, such as grassland habitat, caution is needed when adding enriched substrate to these structures). Ballasting of individual components to prevent uplift due to wind. Provision of safe access to green roof. Plant irrigation until full establishment. Design in accordance with C648 and C697 Chapter 21 in particular.	Yes - should be installed as development progresses and will reduce runoff volumes.
Online / Offline storage	Construction plant can impose significant loads on systems	Prevent construction traffic from driving above storage tanks.	Yes - if silt and blockages are removed prior to handover to

SUDS Technique	Construction Risks	Construction Best Practice	Suitability for temporary works
	before they are provided with final cover.	Design in accordance with C648 and C697 Chapter 21 in particular.	owner or operator.
Filtration techniques	Clogging of filter during construction. Non level filter beds creating localised filtration with possible early failure.	The tank structure should be filled with water for 24hr to identify leakages. Design in accordance with C648 and C697 Chapter 21 in particular.	No - construction runoff should not be allowed to enter the filter.
Pervious Paving	Clogging and siltation from construction runoff.	Must inform site staff of nature of paving. Once installed paving should not be allowed to collect runoff from elsewhere in the site. Paving should be installed last or protected from site use when completed early. Design in accordance with C648 and C697 Chapter 21 in particular.	No - Permeable paving should never be used to collect construction runoff prior to operational phase.

Table 8.1 Risks to SUDS during construction

9 Submission documents - complying with the standards

Consultation

9.1 Consultation is an essential part of the design process and should be started at the earliest opportunity. The Council recommends that the following bodies are consulted:

- The Environment Agency about proposed discharge rates and the control of pollution from the site;

- ABC about the initial proposals for the design, the requirement for any strategic SUDS features and other key planning, Building Regulation and Code for Sustainable Homes/BREEAM related issues;

- The sewerage undertaker - Southern Water Services – about availability and capacity of existing sewerage networks if discharge to them is permissible, and

- ABC, Kent County Council (as approving body once the Flood and Water Management Act 2010 is implemented) Kent Highways Services, Kent County Council Heritage Conservation and Southern Water about the design proposals, within the context of long term maintenance.

- Kent Wildlife Trust about biodiversity, habitat and protected species issues.

9.2 Consultation is expected to be an ongoing part of an iterative design process. Designers should note that PPS25 recommends that developers consult with the Environment Agency and the Internal Drainage Board (IDB), namely River Stour (Kent) IDB, Upper Medway IDB or Romney Marshes Area IDB as appropriate, during design. Appendix H of PPS25 outlines the roles and responsibilities of all parties in relation to drainage and flood risk.

9.3 All designs will require approval both as part of the planning process and by any adopting authorities. It is important that sufficient time is included within the design process for these approvals to take place.

Pre-application

9.4 The developer should initially consider the advice provided in this SPD, and contact the Council, potentially KCC, and the Environment Agency with any queries this may raise. It is important at this stage to identify what is the applicable acceptable run-off rate for the specific site (from Table 3.2) It is expected that SUDS proposals will be included in the site-specific Flood Risk Assessment (FRA) when one is required. If a FRA has been submitted at this stage, the Council will check it to ensure that all the necessary information has been provided including the predicted run-off rates and indicative storage requirements.

Outline application

9.5 Effective and sustainable surface water run-off management should be considered from the outset, and integrated throughout the development. Although specific development information may be limited at this early stage, an outline planning application will still need to give consideration to, and make a commitment to, the requirements of Policy CS20 – including allocating land for SUDS measures such as swales and detention ponds. This will require sufficient detail to be provided with the outline application to enable a judgement to be taken, for example by expressing a maximum development quantum or footprint.

9.6 If submitting details for layout and scale as part of an outline application, the Council will expect more detailed information on the proposed form of SUDS to be provided.

9.7 In line with the Core Strategy the Council will impose planning conditions to ensure that reserved matter applications provide the same degree of detail that is expected of full applications.

Full application (or approval of reserved matters)

9.8 Full planning applications will need to address the key principles detailed in the earlier chapters of this SPD, as well as committing to all parts of the policy. If the site has a previous outline permission the details being proposed as part of the full application should be in line with previous proposals. If different, a justification should be provided to the Council setting out any differences and reasons for change. A planning condition requiring the implementation and maintenance of the approved system will be imposed.

Documents to be submitted

9.9 **In addition to the documents referred to elsewhere in this SPD, the Council requires the following details to be provided with all planning applications (and with reserved matters applications if not previously supplied):-**

• a location plan identifying which catchment(s) the site falls in;

• an estimation of existing, pre-development run-off rates;

• an estimation of the post development run-off rates;

• a statement as to how surface water run-off will be managed post-development;

• calculations showing the required stormwater storage provision;

• details of the proposed SUDS to meet the stormwater storage requirements;

• details of the adoption arrangements and maintenance requirements, identifying who is responsible and including the heads of terms for any proposed section 106 agreement (see Section 10 for further details).

• the 'SUDS Checklist' at Appendix 6.

The use of planning conditions

9.10 The Council will be cautious about allowing the details of SUDS schemes to be submitted after permission has been granted. Where there is any doubt that the feasibility of the proposed scheme can be met within the site constraints (particularly whether the space requirements for balancing ponds, swales, reed beds etc can be met), or that it will enable the appropriate run-off rate standard to be met, then the SUDS will be deemed inadequate and the application may fail.

9.11 An example of a standard planning condition for Policy CS20 for both residential and non-residential schemes is shown below:-

Condition

No development shall commence until plans and particulars of a sustainable drainage system (including the details below) for the disposal of the site's surface water have been submitted to and approved in writing by the Local Planning Authority.

The submitted system shall comprise retention or storage of the surface water on-site or within the immediate area in a way which is appropriate to the site's location, topography, hydrogeology and hydrology. The submitted system shall be designed to (i) avoid any increase in flood risk, (ii) avoid any adverse impact on water quality, (iii) achieve a reduction in the run-off rate to __l/s/ha, (iv) promote biodiversity, (v) enhance the landscape, (vi) improve public amenities, (vii) return the water to the natural drainage system as near to the source as possible and (viii) operate both during construction of the development and post-completion. The submitted details shall include identification of the proposed discharge points from the system, a timetable for provision of the system and arrangements for future maintenance (in particular the type and frequency of maintenance and responsibility for maintenance).

The approved system shall be provided in accordance with the approved timetable. The approved system shall be maintained in accordance with the approved details and shall be retained in working order until such time as the development ceases to be in use.

Reason

In order to reduce the impact of the development on flooding, manage run-off flow rates, protect water quality and improve biodiversity and the appearance of the development pursuant to Core Strategy Policy CS20.

It will only be appropriate to grant permission subject to such a condition where it is clear from the application documents that the appropriate run-off rate standard can be achieved, but some of the detail about exactly how is not available.

10 Adoption, management and maintenance

A range of SUDS may be required within new developments in order to produce an effective drainage system. These features have different maintenance requirements and design lives and it is important that an appropriate management system is put in place for all SUDS. An assessment of management requirements should be made at the design stage. The Council will need to be satisfied that suitable arrangements for future maintenance of SUDS are in place.

10.1 This section of the SPD should be read in conjunction with the drainage systems section of the Kent Design Guide. This provides advice, guidance and information about the design and implementation of drainage systems, including SUDS, for residential and industrial developments.

Maintenance

10.2 Maintenance of all drainage features – including 'traditional' piped systems - is essential in order to ensure their successful ongoing operation. SUDS also require effective maintenance, which is no more difficult than maintaining traditional systems but may include a number of different activities or skills. Tables setting out the typical range of maintenance activities for SUDS are included in CIRIA guide C697.

10.3 The ongoing management and maintenance of SUDS features should not compromise the biodiversity or other amenity value of the site. Careful consideration should be given to the method and timing of such operations. For example, avoid weed cutting during birds' nesting season. Conversely, it should be remembered that the primary purpose of SUDS is sustainable water management.

10.4 Wherever possible, SUDS techniques, excluding source control methods such as water butts, should be located in the public realm to facilitate access for maintenance.

Adoption by the Council

10.5 The Council may choose to adopt SUDS which form part of a development for which the Council has granted planning permission. Generally, the Council will only choose to adopt SUDS that are both:

- Located in a public open space and safely integrated therein. The public open space must be one which the Council is willing to adopt at the same time as the SUDS in question, and
- Above ground, accessible and normally mostly dry, such as infiltration basins and detention basins.

Developers must enter into early discussions with the Council if they wish the Council to adopt SUDS.

10.6 Where the Council chooses to adopt SUDS, an agreement under section 106 of the Town and Country Planning Act will be required and ownership of the land in question will have to be transferred to the Council. The section 106 agreement will include provisions regarding the quality of construction and require the developer to carry out maintenance during an interim period (typically 12 months starting with completion of construction) before adoption by the Council is completed.

10.7 A supervision fee for construction of the SUDS and a commuted sum towards future maintenance will have to be paid through the section 106 agreement. The agreement may also require a bond to be lodged with the Council in order to guarantee SUDS are constructed and any defects are satisfactory remedied.

Private SUDS and Adoption by Others

10.8 Where SUDS features – such as source control measures - are located in private areas the site occupier / owner will usually be responsible for maintenance. It is recommended that details of the management and maintenance requirements are included in the information supplied to householders. This is particularly important for permeable paving of private drives, green roofs and rainwater harvesting systems.

10.9 There is the potential for long term maintenance to be carried out by third parties, such as a maintenance company or trust. This is the least preferred option. Where this is the case, the details should be discussed in detail with the Council, including how the maintenance will be funded. It is likely that there will be additional requirements placed on a developer should the drainage not be adopted by a statutory authority. The use of private 'management companies' to maintain SUDS is discouraged in residential areas but may be appropriate for commercial uses.

10.10 Where Kent Highway Services adopt surface water drainage systems as part of the public highway, this will be in accordance with section 38 or 278 of the Highway Act 1980. Where Southern Water Services adopt any surface water drainage systems, this will be in accordance with section 104 of the Water Industry Act, together with the guidance set out in current edition of Sewers for Adoption and DEFRA's Unified Build Standard.

Flood and Water Management Act 2010

10.11 When it comes into force, the Flood and Water Management Act 2010 will require developers to obtain approval of their drainage system from an approving body. For developments in the Borough, the approving body will be Kent County Council. The County Council will make its determination by considering National Standards, which will deal with matters of design, construction, maintenance and operation. Sustainable drainage systems which are approved by the County Council and which also meet certain criteria will be adopted and maintained by the County Council.

10.12 The Act includes a provision to enable the Minister to make regulations about the timing and procedure for determining applications for approval, and to specify what should happen if the timetable set is not complied with. This should ensure that the SUDS approval process is fully in line with the timetable for determining planning applications where joint applications for both approvals are made at the same time.

10.13 Even when a particular SUDS proposal meets the National Standards and is approved by the County Council, this does not guarantee that the Council will find the proposal acceptable in planning terms based on the development plan, this SPD and other material considerations. When seeking approval from the Council, developers should therefore propose schemes that comply with the development plan and this SPD and which takes into accounts the CIRIA guidance, both before and after the separate approval regime under the Flood and Water Management Act 2010 is in force.

10.14 Once the Flood and Water Management Act 2010 has comes into force and the National Standards have been published, the Council will review this SPD and consider if any changes need to be made.

Appendix 1: Glossary of terms and acronyms

This glossary includes terms, phrases and abbreviations that may be cause confusion to those unfamiliar with SUDS.

Term / acronym	Definition / meaning
ABC	Ashford Borough Council
AONB	Area of Outstanding Natural Beauty
Attenuation	Reduction of peak flows and increased duration of flow event.
Balancing pond	A pond designed to attenuate flows by storing runoff during a rainfall event and releasing it at a controlled rate. The pond always contains some water.
BAP	Biodiversity Action Plan
Basin	A depression in the ground acting as a flow control or water treatment structure, designed to detain water temporarily (detention basin) or retain water permanently (retention basin)
Berm	A mound of earth formed to control the flow of surface water
Biodiversity	The diversity of plant and animal life in a particular habitat.
Bioretention area	A depressed area designed to collect runoff so that it percolates through the soil into a drain thereby promoting pollutant removal.
Block paving	A pre-cast concrete or clay brick modular paving system. Can be used to form permeable paving.
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
Brown roof	Previously developed sites can be valuable ecosystems, supporting rare species of plants, animals and invertebrates. Increasingly in demand for redevelopment, these habitats are under threat. Brown roofs can partly mitigate this loss of habitat by covering the flat roofs of new developments with a layer of locally sourced material. Construction techniques for brown roofs are typically similar to those used to create flat green roofs, the main difference being the choice of growing medium (usually locally sourced rubble, gravel, spoil etc...) to meet a specific biodiversity objective.

Appendix 1: Glossary of terms and acronyms

Term / acronym	Definition / meaning
BS	British Standard
Bund	A barrier, dam, mound or suchlike, usually formed of earthworks, used to contain or exclude water (or other fluids).
CAMS	Catchment Abstraction Management Strategy
Catchment	The area contributing surface water flow to a point on a drainage or river system
CDM	Construction Design Management Regulations 2007
CESWI	Civil Engineering Specification for the Water Industry
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research Association
Combined sewer	Sewer that takes both foul and surface water
Constructed wetland	Specifically designed wet area with shallow water and aquatic vegetation that provide biofiltration
Conventional drainage	The traditional method of draining surface water using underground pipes.
Conveyance	Moving water from one location to another – swales / pipes are conveyance systems.
CSO	Combined sewer overflow (outfall)
DCLG	Department for Communities and Local Government
Detention basin	Basins that contain water during periods of runoff; normally dry.
EA	Environment Agency
Educational offer	Educational offer relates to the additional information that can accompany SUDS features by way of information boards or, perhaps, pond dipping. It is one way of engaging the community in the importance of the water cycle.
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. Sometimes referred to as a 'French drain'
Filter Strip	A vegetated area of gently sloping ground designed to drain water evenly off impermeable areas. Useful in removing silt sand other particulates.

Appendix 1: Glossary of terms and acronyms

Term / acronym	Definition / meaning
Filtration techniques	Methods to remove sediment and other particles from a fluid by passing it through a filter.
Forebay	A small basin or pond upstream of the principal drainage feature with the function of trapping sediment. Should be designed to allow ease of access.
FRA	Flood Risk Assessment
Freeboard	The distance between the design water level and the top of a structure before it overtops. It is provided as a safety measure against early system failure.
French drain	A filter drain.
GADF	Greater Ashford Development Framework
Geocellular storage	Underground stormwater storage formed from a plastic box structure (similar to milk crates).
Geomembrane	An impermeable plastic sheet.
Geotextile	A permeable plastic fabric.
Grampian condition	A planning condition attached to a decision notice that prevents the start of a development until off-site works have been completed on land not controlled by the applicant.
Green roof	A roof with plants growing on its surface which provides some retention, attenuation and treatment of rainwater and contributes to biodiversity. Ideal for commercial buildings.
HER	Historic Environment Record
Infiltration	The passage of surface water into the ground.
Infiltration basin	A dry basin designed to promote surface water into the ground.
Infiltration device	A feature specifically designed to aid infiltration into the ground.
Infiltration trench	A linear feature designed to aid infiltration of surface water into the ground.
IWMS	Integrated Water Management Strategy
KCC	Kent County Council
LDF	Local Development Framework

Appendix 1: Glossary of terms and acronyms

Term / acronym	Definition / meaning
Local Wildlife Sites	Local Wildlife Sites in Kent used to be known as Sites of Nature Conservation Interest (SNCIs). These are areas which are important for the conservation of wildlife in the administrative areas of Kent and Medway. They may support threatened habitats, such as chalk grassland or ancient woodland, or may be important for the wild plants or animals which are present. Local Wildlife Sites are not the same as Sites of Special Scientific Interest (SSSIs). SSSIs are legally protected, and are nationally important for wildlife. Local Wildlife Sites are important at the county level, and have no statutory protection.
Management Train	The concept of the SUDS management train is commonly used by the industry and addresses the quality and quantity of runoff at all stages of a drainage system. It uses drainage techniques in series to improve the quality and quantity of runoff incrementally by reducing pollution, flow rates and volumes. The management train provides a hierarchy of techniques in order of preference. These are prevention, source control, site control and strategic or district control.
Off-Site SUDS	See Strategic SUDS
On-Site SUDS	Those SUDS techniques that can be used to control run-off close to the source and would be implemented within the development boundaries are termed on-site SUDS in this document. Such techniques could include green roofs, rainwater harvesting, infiltration systems, swales, small and medium sized ponds and wetlands.
Open channel	A means of conveying water as opposed to a piped system.
Orifice plate	A simple flow control device.
Permeable paving	A surface that is paved and drains through voids between solid parts of the pavement.
Pervious surface	A surface that allows flow of rainwater into the underlying construction or soil.
Porous Surface	A surface that allows water to infiltrate across the whole surface; e.g. grass, gravel.
POS	Public Open Space.
PPG	Planning Policy Guidance

Appendix 1: Glossary of terms and acronyms

Term / acronym	Definition / meaning
PPS	Planning Policy Statement
Rain garden	A type of bioretention area.
Rainwater harvesting	A system for collecting rainwater where it falls (at source) and putting it to positive use – e.g. irrigation. Can be simple rain butts through to tanks providing water for flushing toilets.
Retention basins	Basins that contain additional water during periods of runoff; normally retain some water.
Rill	A small open channel for conveying water, usually in an urban setting.
RoSPA	Royal Society for the Prevention of Accidents
SA	Sustainability Appraisal
SAB	Sustainable drainage Approval Body
Soakaway	A type of infiltration device
Source control	SUDS features that control rainwater where it falls – the top of the management train.
SPD	Supplementary Planning Document
SPG	Supplementary Planning Guidance
SPZ	Source Protection Zones
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest. Sites that are legally protected, and are nationally important for wildlife or geographic features.
Strategic SUDS	Those SUDS techniques that are located lower downstream on the management train. These strategic SUDS features would treat runoff from larger catchments areas and would be located, where possible, on land adjacent to the development site.
SUDS / SuDS	The abbreviation SUDS historically stems from **S**ustainable **U**rban **D**rainage **S**ystems. Over time there has been recognition that drainage should be sustainable even in non-urban situations and the abbreviation SuDS has been used for **Su**stainable **D**rainage **S**ystems. However, national

Term / acronym	Definition / meaning
	convention is now that SUDS is the norm, and related to Sustainable Drainage Systems and has been used throughout this document. The two abbreviations SuDS and SUDS are interchangeable.
SUDS features	This term refers to all possible methods and practices used to implement sustainable drainage. By extension a SUDS feature is one particular way of achieving sustainable drainage, it could for instance refer to a swale or a detention pond. Any number of SUDS techniques can be used to achieve a sustainable drainage system.
Swale	A shallow vegetated channel designed to retain and convey water. The vegetation filters particulate matter.
Vortex flow control	A control device that induces a spiral / vortex into the water to restrict the flow forward that provides superior hydraulic performance over conventional flow regulators.
Water Butt	A source control device usually fitted to the downpipe to collect rainwater for subsequent reuse – a type of source control.
Wet pond	Permanently wet depression designed to retain stormwater above the permanent water level.
WRMU	Water Resources Management Unit

Appendix 2: SUDS Types

Filter strips

Description		Engineering design, opportunities and risks
	Wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas. Properly designed, filter strips are very effective at removing silt from surface water, particularly when included as the first element of the treatment process. Appropriateness to Ashford: ♦♦♦♦ Potential to be adopted by local authority: Yes	Filter strips should be located at least 1 m above the water table if infiltration is likely to occur. Design in Ashford should take into account limited infiltration opportunities in most areas. Filter strips may still slow water flows and improve water quality. Slope gradients to be between 2% and 6 %.Sheet flow must occur across the filter strip to encourage filtration by the vegetation. Even in areas of low permeability, reduction in volumes of water can be achieved through evaporation.
Landscape and amenity opportunities and risks		**Biodiversity opportunities and risks**
There is the potential to integrate filter strips into the landscape and layout of most developments. Ashford's rural character would lend itself well to large areas of shrub planting, particularly native species such as hedgerows or shelter belts.		Filter strips can easily be incorporated into development areas and offer a range of habitat possibilities. Can be used in conjunction with swales to enhance habitat opportunities.

Swales

Description		Engineering design, opportunities and risks
	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow). Swales should be sited so that water can flow into them laterally from impermeable areas and designed to have a trapezoidal cross section. Appropriateness to Ashford: ♦♦♦♦♦ Potential to be adopted by local authority: Yes	Flow through the swale is calculated using Manning's equation and should be limited to between 1-2 m/s to prevent erosion. Flow height of water to be below vegetation. Design in accordance with CIRIA 697. Infiltration tests should be in accordance with the BRE digest no 365. Swales should be used in conjunction with other SUDS techniques as storage can be limited. Similarly to filter strips, ground conditions in the Ashford area will generally limit infiltration. Increased attenuation will still be a benefit of swales.

Landscape and amenity opportunities and risks	Biodiversity opportunities and risks
Swales represent an opportunity combine drainage with other amenity features and hardstanding, particularly footpaths and cycle ways. They can be designed as a feature if created as new landform in public open space. All housing and industrial areas should aim to incorporate these as they can be small scale. Swales are primarily planted with grass species which may have a utilitarian visual effect and require regular maintenance to keep them effective and visually pleasing.	Steep slopes and high flows can cause erosion and damage to the vegetation. Plants and grasses with a dense root structure such as perennial ryegrass and fescues should be used. Habitat benefits are maximised by ensuring some standing water in the swale invert, achieved using check dams although this may not be appropriate in residential areas for amenity reasons. Livestock grazing may be used to maintain grass in larger swales around Ashford. This should inform the selection of vegetation types. Reference can be made to Case Study 9 for illustration of the importance of suitable plant selection in swales.

Infiltration Basins

Description		Engineering design, opportunities and risks
	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value. Even in areas of low permeability, reduction in volumes of water can be achieved through evaporation. Appropriateness to Ashford: ♦♦♦♦ Potential to be adopted by local authority: Yes	Infiltration basin design must be based on a full site investigation data including infiltration tests. Maximum storage depth should be limited to 0.8 m to limit effects of pressure on vegetation and should be designed to be half empty within 24 hours to avoid distress to the vegetation. Design should be in accordance with BRE 365, CIRIA Report 156 and CIRIA 697. A “low flow” channel or area should be provided to prevent extended saturation of larger areas. The use of infiltration basins may not be possible in locations where groundwater levels are high or where permeability of the underlying soils is low.

Landscape and amenity opportunities and risks	Biodiversity opportunities and risks
Basins can be used to form distinct landscape arrangements and patterns to make distinctive sculptural features. All primary parks and secondary green spaces with appropriate geology should be considered as sites for these features. These features should aim to replicate existing landform hollows for example at Park Farm. If the basins do not drain effectively and fencing or protective barriers are required around them, this can dramatically lower the aesthetic value of the open spaces. There are potential health and safety risks associated with deep water, during extreme rainfall events, which should be considered when designing and locating these features.	Planting needs to be able to withstand both wet and dry periods and deep rooted plants are preferable to prevent erosion. “Lowland meadow” or “ Lowland Dry Acid Grassland” habitats may be possible (Kent BAP priority Habitats). Livestock grazing may be used to maintain grass in large infiltration basins around Ashford. This should inform the selection of vegetation types.

Wet Ponds

Description

Wet ponds are basins that have a permanent pool of water. They provide temporary storage for additional storm runoff above the permanent water level. The temporary storage normally promotes pollutant removal provided the pond is of suitable size.

Appropriateness to Ashford: ♦♦♦♦♦

Potential to be adopted by local authority: Yes

Engineering design, opportunities and risks

Pond shape should be irregular with islands and bars. Velocity at the inlet should be limited to 0.3-0.5 m/s. A sediment forebay is required at the entry of the pond, to be 20 % of permanent pool area. Required storage to be calculated using numerical modelling. Side slopes to be limited to a maximum of 1:4.

Where soils are highly permeable or land is contaminated, a liner may be required to maintain the wet pool and prevent groundwater pollution.

Design in accordance with CIRIA 697 and CIRIA 14 for flood routeing into ponds and with reservoirs Act 1975 when storage volumes greater than 25,000 m^3.

Potential health and safety risks are associated with deep water levels in ponds. Barrier planting is considered preferable to fencing. ABC requires barriers to be designed out of SUDS if they are to be acceptable in areas of public use.

Landscape and amenity opportunities and risks

Ponds provide high amenity value when designed in a naturalistic form which integrates them with the landscape. They have the potential to be associated with the existing landscape features such as copses.

Sides must not be too steep as this lowers the aesthetic value of the system and isolates them from being integrated in open public space.

Further reference highlighting opportunities to maximise landscape and amenity value with wet ponds/constructed wetlands SUDS can be seen from case study 2, 3 or 4.

Biodiversity opportunities and risks

Ponds can provide a very rich habitat and are important to aquatic invertebrates, plants and amphibians. Shoals and sediment bars can provide habitat to wading birds and other wildlife.

“Standing Open Water” and “Reedbed” habitats may be suitable (Kent BAP priority habitats).

Attracting high quality species such as water voles can create problems for maintenance. Ponds may be at risk of being smothered by reeds and other introduced aquatic weeds if sufficient depths not provided.

Further reference highlighting issues with biodiversity and habitat creation with wet pond SUDS can be seen from case study 8.

Extended Detention Basins

Description		Engineering design, opportunities and risks
	Extended detention basins are designed to detain a certain volume of runoff as well as providing water quality treatment. Although they are normally dry, they may have small permanent pools at the inlet and outlet. Appropriateness to Ashford: ♦♦♦♦♦ Potential to be adopted by local authority: Yes	Pond shape should be irregular with islands and bars. The length to width ratio should be in the order of 1.5:1 to 4:1 with side slopes limited to a 1:3 ratio and velocities at the inlet should be controlled. A sediment forebay is required at the entry of the pond, to be 20 % of permanent pool area. Required storage to be calculated using numerical modelling. A low flow channel should be incorporated to prevent the whole basin being used for storage during small rainfall events. Design in accordance with CIRIA 697 and CIRIA 14 for flood routeing into ponds. Potential health and safety risks associated with deep water, during extreme rainfall events. Basins located on contaminated land may require lining to prevent infiltration.

Landscape and amenity opportunities and risks	Biodiversity opportunities and risks
Extended detention basins provide high amenity value when designed in a naturalistic form which integrates them within the landscape. All sites which link proposed residential neighbourhoods, green spaces and public parks should be considered as sites for these features. Basins which are not integrated into the landscape may appear too "engineered" and may contrast with the existing landscape character.	"Lowland meadow" type habitat may be possible (Kent BAP Priority Habitat). Livestock grazing may be used to maintain the grass. This needs to be considered when selecting vegetation types. Planting needs to be able to withstand both wet and dry periods.

Constructed Wetlands

Description

Constructed wetlands are specifically designed to treat pollutants in runoff and comprise a basin with shallow water and aquatic vegetation that provides biofiltration.

Appropriateness to Ashford: ♦♦♦♦
Potential to be adopted by local authority: Yes

Engineering design, opportunities and risks

Ratios between length and width typically 1.5 :1 to 4:1. A forebay between 10-12% of total volume of wetland and around 1.2m deep is required. Wetlands must provide a combination of deep and shallow areas and offer retention times between 16-24 hours. Required storage to be calculated by a numerical model.

Design in accordance with CIRIA 697 and CIRIA report 180.

Potential health and safety risks are associated deep and standing water. Barrier planting is preferable to fencing. ABC requires barriers to be designed out of SUDS if they are to be acceptable in areas of public use.

Landscape and amenity opportunities and risks

Constructed wetlands can provide high amenity value as they offer all year interest when designed as a naturalistic form integrated within the landscape. New vegetation should respond to the local character.

An appropriate management structure must be in place for these to be effective. Fencing or protective measures would be out of character with these landscape types.

Further reference highlighting opportunities to maximise landscape and amenity value with wet ponds/constructed wetlands SUDS can be seen from Case study 2 and Case study 4.

Biodiversity opportunities and risks

Wetlands provide varying degrees of deep and shallow water which offer valuable wildlife habitat. Wetlands can provide a very rich habitat and are important to aquatic invertebrates, plants and amphibians.

“Standing Open Water” and “Reedbed” Habitats may be suitable (Kent BAP Priority Habitats). Plant selection needs to match pollutant load and risks.

Infiltration Devices (soakaways and infiltration trenches)

Description

Infiltration devices collect runoff, temporarily store it and allow it to percolate into the ground. Infiltration devices include soakaways and infiltration trenches. Infiltration devices can also be used to release water from below other SUDS techniques such as pervious pavements.

Appropriateness to Ashford: ♦♦

Potential to be adopted by local authority: No

Engineering design, opportunities and risks

The base of the infiltration device must be at least 1 m above the maximum groundwater level. Design based on infiltration surface area proportional to hydraulic properties of soil, catchment area and rainfall characteristics.

Observation and clear-out wells and pipes are required for maintenance.

Design must be based on full site investigation data including infiltration tests in accordance with BRE 365 or CIRIA report 156 and CIRIA 697.

Infiltration devices are only suitable for use in areas of the GADF with appropriate underlying geology.

Landscape and amenity opportunities and risks

Opportunities to integrate with the local character should be sought where possible.

Biodiversity opportunities and risks

None.

Pervious pavements / Surfaces

Description

Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water. There are two types of pervious surfaces:

Porous surfaces – which allow water to infiltrate across their entire surface (examples of porous media include grass, gravel, porous concrete, porous asphalt).
Permeable surfaces – which consist of material that is impervious itself, but allows infiltration through voids in the surface (for example, some types of concrete paving).

Appropriateness to Ashford: ♦♦♦♦
Potential to be adopted by local authority: No – only suitable for use in private drives or roads / car parks not to be offered for adoption.

Engineering design, opportunities and risks

Structural design methods are similar to those of conventional paving but allow for material properties and presence of water in construction. Section 2.2.7 of the Kent Design Guide provides detailed design guidance.

Storage within permeable surfaces is designed based on the relationship between rainfall and outflow during storms. This should be demonstrated using a numerical model. Systems should be designed for an "end of life" storage capacity, allowing for sedimentation of voids.

If permeable paving is used to infiltrate it should be designed in accordance with BRE 365, CIRIA 156 in addition to CIRIA 697.

May not be suitable for steeply sloping sites. Membranes may be required to protect weak sub grades or prevent infiltration in certain cases. Care is required to ensure that there is no clogging of the pervious surface during construction.

Landscape and amenity opportunities and risks

Permeable paving provides an opportunity to integrate SUDS in areas of hard landscape including residential properties, public spaces and commercial areas.

There is a limited range of surfacing materials available for this technique which limits the opportunity to create visually distinctive places and landscapes.

Reference can be made to Case Study 1 on effective ways to incorporate Permeable Paving in an urban context.

Biodiversity opportunities and risks

May provide green links between areas if a paving type incorporating grass is used but opportunities for biodiversity are limited. Biodegradation of pollutants is possible.

The design should prevent weed invasion. Erosion of soil from adjacent landscaped areas can cause blockages and is to be avoided.

Rainwater Harvesting (collection) Systems

Description		Engineering design, opportunities and risks
	Includes simple water butts to more complex rainwater use systems. Rainwater from impermeable surfaces flows via down pipes to a storage tank and is filtered to restrict leaves and large solids from entering the tank. Appropriateness to Ashford: ♦♦♦♦♦ Potential to be adopted by local authority: No – unless public building. Note: ABC requires that developers maximise source control opportunities early in the management train. The expectation is that all residential developments incorporate rainwater harvesting features.	The guide, *harvesting rainwater for domestic uses: an information guide* (EA 2003) gives general information on sizing rainwater harvesting systems. Any storage allowance may not be available if the system is full at the start of the critical duration storm. But to encourage their use they can be considered as empty when sizing storage requirements. Use of rainwater harvesting systems is expected for all domestic properties in Ashford. Where possible storage should be above ground to allow discharge by gravity without resorting to pumped systems. Where pumping is unavoidable, consideration should be given to pumps utilising renewable energy sources.

Landscape and amenity opportunities and risks	Biodiversity opportunities and risks
Site specific design can ensure the feature is sympathetic to the surrounding development. In streetscapes the storage should be under the footways to allow drain pipes to run directly into the foot way. This improves the aesthetic character, reduces the staining to the pavement surfaces and prevents damage to down pipes. Poor design would result in aesthetic design out of character with the building which it serves.	Water can be used to irrigate greenspaces.

Green / Brown Roofs (Eco roofs or vegetated roof covers)

Description

Multilayered system that covers the roof of a building with vegetation over a drainage layer. This reduces the volume of run-off and attenuates peak flows from roofs. There are two main types of green roofs:

Intensive roofs – landscaped environments that are usually publicly accessible; and Extensive roofs – cover the entire roof area with low-growing, low maintenance plants, and are designed to be accessible for maintenance purposes only.

Appropriateness to Ashford: ♦♦♦♦♦

Potential to be adopted by local authority: No (unless public building)

Engineering design, opportunities and risks

Green roofs can generally attenuate storms up to 50 per cent annual probability (1 in 2 year return period. The impact of green roofs on below ground drainage can be allowed for in sizing SUDS).

Multiple outlets should be provided to minimise risks of blockage. Soils must have sufficient infiltration rate for the design storm and a field capacity to absorb water to reduce runoff volumes.

A well designed and installed drainage layer is extremely important to prevent water ponding.

Design in accordance with CIRIA 697. Hydraulic design of green-roof drainage should follow the advice based on BS EN 12056-3:2000.

Required to be considered for all commercial developments in Ashford.

Landscape and amenity opportunities and risks

Green roofs have the potential to be designed in conjunction with residential and industrial premises to provide areas of recreation. They can be highly effective at integrating the built form within the landscape.

Design should consider using a range of species, not only sedum, to maximise the potential these structures have to offer with regards to landscape design and aesthetics.

Sufficient maintenance needs to be in place to manage these systems.

Biodiversity opportunities and risks

Green roofs can be used to help achieve the targets set in the biodiversity action plan and provide green links and green "stepping stones" between developments.

The layout, design and planting of the roof must be targeted towards achieving the desired habitat for the species concerned. "Lowland dry acid grassland" habitat may be suitable (Kent BAP Priority Habitat).

Periodic rainfall interspersed with drought and high winds require tolerant species. Some designs may require alpine or sub-alpine species not native to the Ashford area. Access for watering and maintenance may be limited.

Online / Offline Storage

Description

Storage of run-off in underground tanks or other structures such as oversized pipes. Tanks can take the form of oversized pipes, concrete tanks, corrugated steel pipes and plastic modular geocellular tank systems.

Useful in constrained, previously developed sites but not favoured for greenfield locations. Should only be considered as a 'last resort'.

Appropriateness to Ashford: ♦♦

Potential to be adopted by local authority: No (unless public building)

Engineering design, opportunities and risks

Modular plastic geocellular units should be designed using structural theory to allow for dead and live loading situations. Available storage to be assessed using standard surface water drainage design using a limited outflow rate to determine storage volume.

Voids can become clogged with time and this needs to be allowed for in the hydraulic design.

Design in accordance with CIRIA 697. Pipes and tanks should be designed in accordance with Sewers for adoption, 6th edition (WRc,2006). The structural design of pipes should also be designed in accordance with BS EN 1295:1998 Structural Design of buried pipelines under various conditions of loading.

Underground construction means these structures can be difficult to maintain. Very limited treatment is provided.

Landscape and amenity opportunities and risks

There are limited opportunities to provide amenity or landscape benefits with this type of SUDS technique. The area above the tank can be used for parking – subject to loading constraints – or for play areas.

Biodiversity opportunities and risks

This SUDS type provides no biodiversity benefit and is not favoured by ABC. Inlets and outlets to be designed to ensure that species are not trapped in the system.

Filtration Techniques

Description	Engineering design, opportunities and risks
Constructed tank or lagoon whose base contains a filter material through which water percolates to promote pollution removal. Filtration techniques can take the form of surface lagoons or underground perimeter drains or underground filters. Appropriateness to Ashford: ♦ Potential to be adopted by local authority: Yes	The tank or lagoon must provide sufficient storage area to store the water volume as a thin layer on the surface. Infiltration time through the filter is based on permeability and head of water. CIRIA 697 gives further guidance. Not suitable to used on flat sites with shallow outfalls, as process requires head drop. Effective operation of filters is dependent on frequent maintenance and replacement of filter media. Limited application in the Ashford area due to underlying geology.
Landscape and amenity opportunities and risks	**Biodiversity opportunities and risks**
Present high amenity value in conjunction with planting and naturalistic design. These features have the potential to be integrated fully if properly incorporated within existing topography. Lack of maintenance could result in these becoming unsightly and of low aesthetic value so this should be avoided. Features may require safety fencing which could be contrary to landscape character.	None.

Appendix 3: Case studies

CASE STUDY 1	
LOCATION: South London	**DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT**
SuDS FEATURE / TYPE: Permeable Paving	Permeable paving has been used as part of a landscaped public space for this new residential development in South London.
CONCLUSION: Good practice	Permeable paving represents one of the means of storing the 1 in 30 year flood event within a development and abides to the “management train concept” of reducing runoff at source. As a SuDS type, it is generally most suited to roads or pedestrian spaces with low traffic volumes. This is a successful example of how to integrated SuDS into an urban landscape. The road drainage inlets are well designed and integrate well with the overall development character. This case study exemplifies good use of permeable paving which adds aesthetic value to the development. Key points of note are: Permeable paving can readily allow the integration of SuDS into the urban landscape. Many developments have substantial areas for car parking that can be constructed using a pervious surface to attenuate runoff. If used in conjunction with underground filter treatments this SuDS type can provide additional treatment for surface water runoff. Permeable paving systems represent an opportunity to reduce runoff volumes in urban spaces and should be used wherever possible in developments in the Ashford area.
	

CASE STUDY 2

LOCATION: South London

SuDS FEATURE / TYPE: Wet pond and wetland

CONCLUSION: Good practice

DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT

The photograph shows a constructed wetland and wet pond adjacent to a children's play area. The use of a wetland system provides good biodiversity and water treatment benefits in addition to providing runoff attenuation. This SuDS has been designed to add amenity value and aesthetic benefits to the site.

This shows how large ponds can be linked in with recreational areas which provide green spaces for local residents. However, until the newly planted tree and shrub barrier has had time to establish, unsightly temporary fencing has been used to prevent access to areas of deep water.

The design has maximised the opportunities to create new ecological habitats. Shallow pond side slopes and a vegetative barrier will create optimal opportunities for the establishment of wildlife communities.

This case study highlights some important issues to be considered when locating SuDS techniques with permanent water pools close to leisure areas to which the general public has access.

A vegetated buffer zone should be maintained around extended basins and can be used as natural barrier to prevent public access to water edges. Careful selection of vegetation can improve the visual effect and to maximise bio-diversity opportunities. A health and safety risk assessment for wet ponds in residential areas should be carried out where appropriate to confirm that the level of risk is acceptable. Temporary fencing should be provided whilst vegetation in barrier planting establishes itself. Permanent fencing should only be used when no other barrier is possible .

Areas such as play areas should be fenced off until barrier planting has developed sufficiently to prevent access to the pond. A small earth mound could be built along the back edge of the play area to reduce the immediacy of the link between the wet pond and the play area.

CASE STUDY 3

LOCATION: Hopwood Services , M42 Redditch

SuDS FEATURE / TYPE: Wet Pond

CONCLUSION : Best Practice

DESIGN PHILOSOPHY, KEY POINTS/LESSONS TO BE LEARNT

This photograph of a wet pond at Hopwood service station near Redditch shows the use of ponds in public urban spaces. The pond is used to attenuate and treat runoff from the petrol service station and car park which is likely to be contaminated with hydrocarbons and heavy metals.

The wet pond forms a landscape focal point and consideration has been given to the final appearance of the structure. Shallow side slopes and careful planting selection allows for ease of maintenance. A small wooden terrace enables the public to take advantage of the feature .

The insertion of a small fountain at the centre of the pond adds visual interest and aids with water oxygenation and biological treatment of the hydrocarbons. This may prevent eutrophication of the water which in turn could lead to weeds covering the water surface. Fencing in this formal setting is an appropriate barrier.

This case study exemplifies good practice which manages runoff and creates opportunities for habitat and amenity development within a very urban setting.

Opportunities to control and treat polluted surface runoff using ponds should be sought even in very urban / industrial settings. Ponds can be combined with formal and informal recreational areas, public footpaths and cycle paths and a wider green network. In high profile locations SuDS should be combined with landscape features and techniques to increase the amenity value of the area.

Expertise in different fields should be used to maximise opportunities for conservation through habitat creation using native species and replicating existing landforms, even in such formal settings.

CASE STUDY 4

LOCATION: Harrow Way, Kingsnorth, Ashford

SuDS FEATURE / TYPE: Wet Pond

CONCLUSION: Poor practice

DESIGN PHILOSOPHY, KEY POINTS/LESSONS TO BE LEARNT

These photographs show an example of very poor wet pond design in a medium density residential development. The main issue with the design of the pond are the steep slopes which:

- Pose significant safety hazards to residents in particular to younger children;
- Create a system difficult to manage and operate as access is difficult and dangerous; and
- Do not create the most suitable habitat to promote the establishment of aquatic and land based fauna and flora.

As a result, fencing is required around the pond and danger signs have been erected. This lowers the aesthetic value of the system and isolates it from being integrated in public open space. The feature is seen as an eye sore and a hazard.

The case study highlights the importance of good engineering practice and integrated design with the input of all team members at the conceptual stage. The following points summarise the key lessons to be learnt from the case study.

- The aims and objectives of the feature should be established prior to design. A whole life approach should be taken when designing to take into account risks involved with construction, maintenance and use of the feature;
- The design of all SuDS should allow for safe and easy access by people and vehicles to undertake maintenance;
- Opportunities to create a visually positive and integrated drainage system must be explored and promoted at the planning stage to maximise landscape, amenity and biodiversity benefits. It would not be possible to significantly augment this feature in this post-

	construction phase; • Side slopes for SuDS features have a maximum gradient of 1:3; • Designers should use barrier planting if necessary but generally the use of barriers must be designed out of SuDS if they are to be acceptable in areas of public use in Ashford; and • Health and safety risk assessments be carried out for all pond features in a residential setting.

CASE STUDY 5

LOCATION: Ashford and London

SuDS FEATURE / TYPE : Swale, pond spillway

CONCLUSION : Poor practice

DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT

These photographs taken at sites in Ashford and in the London area raise some issues as to the selection of fencing in particular with relation to its aesthetics and effectiveness. They illustrate the importance of the engineer / landscape architect relationship.

The top photograph gives an example of "off the shelf" fencing selected by designers without consideration of its future use and integration into the finished environment.

The bottom photograph highlights the inadequate use of fencing which does not take into account how the public may use the space.

The following points summarise the main lessons to be learnt from the case studies:

- Designers and Landscape architects should work together from the onset of the project to design a system that meets the engineering needs and the enhances visual aspect of the SuDS technique;
- Designers should use barrier planting if necessary but generally the use of barriers must be designed out of SuDS if they are to be acceptable in areas of public use in Ashford; and

Fencing type should be selected on a case by case basis to meet individual site requirements to ensure public safety.

	

CASE STUDY 6	
LOCATION : London and Ashford	**DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT** These case studies highlight the importance of good design and attention to detail for inlet and outlet structures used in SuDS techniques. The top photograph shows a small outlet discharging to a water course. The outlet head wall is poorly finished and is not integrated into the original earth bank environment. The construction and finish quality is poor, resulting in cracking of the brickwork. There is evidence of sediment build up at the interface between the pipe and the receiving water course. The bottom SuDS feature does not follow the surrounding ground profile. However, a mixture of plant species have colonised the surrounding areas, which may in time reduce the visibility of the feature. Construction detailing and fitness for engineering purpose has been achieved but it is not clear that landscape objectives have been met. The photographs illustrate the main difficulties in designing suitable and visually in unobtrusive outlet structures. The lessons to be learnt from the case studies are summarised in the following key points: • Design must include methods to prevent blockage of the outlet by vegetation or other debris;
SuDS FEATURE / TYPE: Outlets of a piped system and a wet pond	
CONCLUSION : Poor practice	
	

	• SuDS outlet structures should be constructed of suitable, durable materials in accordance with relevant British Standards; • Attention to detail is important even in utilitarian structures, and • Consideration must be given to the integration of all details of SuDS features into the finished landscape.

<table>
<tr><th colspan="2">CASE STUDY 7</th></tr>
<tr><td>LOCATION : Hayes

SuDS FEATURE / TYPE: Series of wet ponds

CONCLUSIONS : Best practice

</td>
<td>DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT

This photograph illustrates how good engineering design has been combined successfully with local residential context, and has created a living recreational space within a residential setting to great effect.

The design has made best use of the natural shallow slope of the site and arranged the ponds in series, which also maximises water quality benefits.

The shallow slopes used in the pond design do not prevent public enjoyment of the open space.

Unobtrusive fencing has been chosen to fit in with the landscape and is used sparingly only when required.

This case study exemplifies excellent practice which maximises opportunities for managing runoff, creating new habitat opportunities and developing a public recreational network of paths and green space.

SuDS techniques should allow for the provision of new urban and rural spaces. These can be combined with formal and informal recreation areas, public footpaths and cycle paths and the wider green network. In high profile locations SuDS should be combined with landscape features and techniques to provide high amenity value

The ponds have been designed in a holistic manner and designers, ecologists and landscape architects should be consulted and involved throughout the process.

Expertise in different fields should be used to maximise opportunities for conservation through habitat protection and creation using native species and replicating existing landforms.</td></tr>
</table>

CASE STUDY 8	
LOCATION : Ashford	**DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT**
SuDS FEATURE / TYPE : Concrete headwall and inlet into pond	The photograph of a SuDS inlet structure to a wet pond shows a positive example of the use of a smooth concrete finish inlet head wall. Although traditionally seen as an industrial material, this particular example shows that the concrete headwall can integrate well into an operational SuDS wet pond. The visual impact of the overall structure can be diminished with a suitable selection of adjacent planting. However, the photograph also highlights some issues regarding habitat management. The presence of litter in standing water in the pond raises the issue of maintenance and management and the ease with which these tasks can be carried out by site operatives. Conveyance in high flow events may be reduced by the in-stream vegetation. This case study highlights the conflicting issues between successful plant colonisation of the pond and the need for management and control of planting. Although this pond is successful, a number of design points can be made to improve the system; • Suitable pond depths should be designed to promote the colonisation of different species. Engineers should liaise with ecologists to ensure optimal design. • Ponds may be at risk of being smothered by reeds and other introduced aquatic weeds. Sufficient pond depths should be provided to prevent excessive colonisation. • Any inlets / outlets should be designed to allow regular cleaning and maintenance work. • Engineering design assumptions must be consistent with proposed planting schedules to ensure appropriate selection of roughness co-efficients and sufficient conveyance and storage in flood events.
CONCLUSION : Not best practice	
	

CASE STUDY 9

LOCATION : Ashford

SuDS FEATURE / TYPE : Roadside swale

CONCLUSION : Bad practice

DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT

The photograph of a swale running parallel to a road in a residential area in Ashford raises a number of important issues. Steep side slopes:

- Present health and safety hazard concerns to traffic, cyclists and pedestrians;
- Are difficult to maintain. Operatives may not be able to safely use mowing machinery to maintain the swale as required.; and
- Have caused localised slope slippages and inhibited the establishment of grass. This could lead to erosion in high rainfall events but will aid conveyance.

Also, the length of the grass in the bottom of the swale would reduce conveyance, despite providing additional habitat opportunities.

This case study highlights a number of key issues that need to be considered as part of the design philosophy if roadside swales are to be successful and effective.

The example would be more successful with barrier planting and longer grass types on the bank and shorter grass in the base of the swale. This would provide habitat , reduce the health and safety risks to roadside users, eliminate the need to mow the steep banks and improve conveyance in the operating section of the swale.

Designers should work with ecologists to select the most appropriate planting for the feature maximise the opportunities to develop habitat. Engineering design should adopt appropriate roughness factors to ensure sufficient conveyance.

Regular maintenance agreements (overgrowth cutting, watering) must be established prior to SuDS planning approval.

Suitable grasses and plants should be selected to match site characteristics, uses and weather conditions. Plants and grasses with a dense root structure such as perennial ryegrass and fescues should be used to prevent erosion due to sheet flow on the bank and high flow velocities in the main channel.

CASE STUDY 10

LOCATION : Scotland

SuDS FEATURE / TYPE : Linear wetland

CONCLUSION : Best practice

DESIGN PHILOSOPHY, KEY POINTS / LESSONS TO BE LEARNT

This linear wetland feature provides both conveyance and treatment for runoff form the adjacent highway. It is aesthetically pleasing and the variety of plants in the channel invert provide good biodiversity opportunities. Flatter slopes towards the top of the swale are grassed and can be accessed for mowing.

A number of key points highlighting good design practice emerge from this case study:

Runoff from roads and highways can be contaminated with heavy metals and hydrocarbons. Wetland planting encourages low water velocities and deposition of particles including metals, resulting in improved water quality. When selecting plants designers should ensure that they are suitably robust.

Runoff must be able to enter the swale feature. Erosion is minimised by encouraging flow entry along the full length of the swale, not at concentrated locations. Kerbs and channels should not be used.

Hydraulic design must assume an appropriate channel roughness to ensure sufficient conveyance.

Maintenance issues need to be thought out in detail.

Appendix 4: Rainfall - Runoff and stormwater storage estimation

This section suggests a methodology to provide initial guidance on the likely surface water storage requirement. Further, more detailed, analysis will be required to complete site-specific sizing based on the run-off criteria and site characteristics.

Introduction

A4.1 This guidance is aimed at developers and their consultants to advise on the management of surface water for developments and in particular to assist in the **initial** sizing of storage elements for the control and treatment of stormwater runoff.

A4.2 This guidance may be used to form part of a Flood Risk Assessment (FRA) to comply with PPS 25, but it does not address issues such as risk of flooding from a watercourse, effects of changes in floodplain storage or in floodplain conveyance.

A4.3 It is stressed that the approach provided for sizing of stormwater storage is only to be used at pre-planning / outline planning application stage to assist with defining indicative volumes. Detailed analysis will be required to determine actual storage requirements. It is appreciated that the method outlined may over-estimate the storage required as it does not optimise the rainfall / runoff / storage. The rationale for this is that it is much easier to scale-down SUDS provision than it is to increase provision once the site layout has been defined.

A4.4 To assist developers and their consultants a Sustainable Drainage Checklist has been produced (see Appendix 6).

‘Greenfield’ run-off rate

A4.5 For most greenfield sites, the maximum allowable discharge will be that set out in Table 3.2 of this SPD, depending on location. In the Ashford Growth Area these rates are lower than existing greenfield rates as justified by the IMWS.

A4.6 For greenfield sites outside of the Growth Area, or not draining to the Stour catchment, it will be necessary to limit flow to the equivalent of the two-year peak flow rate calculated using one of the methods outlined below or, where no calculations are undertaken, a ‘rule of thumb’ figure deemed appropriate for the area: nominally 6 l/s/ha.

A4.7 The calculation of peak rates of runoff from a greenfield site is related to its size. The following approach is acceptable for sites between 0 – 50 ha and is based on The Institute of Hydrology Report 124 Flood Estimation for Small Catchments (1994). The analysis for determining the peak discharge rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development to 50 ha. FSSR 2 and 14 regional growth curve factors are to be used to calculate the greenfield peak flow rates for 2, 30 and 100 year return periods.

A4.8 For sites between 50 ha – 200 ha IoH Report 124 should be used to calculate greenfield peak flow rates. Regional growth factors to be applied.

A4.9 For sites above 200 ha it is recommended that the Flood Estimation Handbook (FEH) should be applied. Both the statistical approach and the unit hydrograph approach should be used to calculate peak flow rates. The unit hydrograph method will also provide the volume of greenfield run-off.

The calculation of brownfield run-off rate

A4.10 For previously developed, brown-field sites, a network analysis of the surface water drainage system can be used to determine the existing run-off rate.

A4.11 In the absence of a network analysis a simple Rational Method (Lloyd – Davis) approach is acceptable:

$$Q = 2.78\ C\ i\ A$$

Where Q = run-off in l/s

A = Area being drained in hectares

i = rainfall intensity in mm/hr

C = non-dimensional catchment coefficient, which is dependent on the catchment characteristics (for pre-planning purposes in Ashford, a figure of 0.9 is appropriate for previously developed, brownfield sites).

This discharge rate applies to the area that is being drained to the proposed drainage features. It does not include areas of green space that are not positively drained.

A4.12 Different rainfall events have different impacts. At a site level it is usually the short duration, very intense rainfall event that causes drainage systems to be overwhelmed. Whereas at a river catchment level it is usually the prolonged, less intense rainfall event that causes river systems to flood. In Ashford, the wide scale usage of SUDS is required to reduce the risk of flooding at a river catchment scale, whilst at the same time protecting the site from short duration, intense rainfall events. As such, SUDS design will be, by necessity, a compromise. For Ashford the catchment characteristics suggest a six hour rainfall event is appropriate for design purposes. A consequence of this is that surface water storage volumes are likely to be higher than would be necessary to purely protect the site. This should be allowed for in site layouts and design.

A4.13 For Ashford the following rainfall intensities (i) are deemed acceptable based on a six hour event (highlighted).

Storm Duration, min	Return Period		
	1 in 2 yr, mm/hr	1 in 30 yr, mm/hr	1 in 100 yr, mm/hr
60	13.4	34.4	50.3
120	8.5	20.7	29.7
240	5.3	12.5	17.6
360	**4.1**	**9.3**	**12.9**
600	2.9	6.4	8.8

Table A.1 RAINFALL INTENSITIES(i)

The allowable brownfield discharge rate is derived from a 2 year storm of 6 hour duration generating 4.1 mm/hr.

A4.14 The maximum discharge rate from brownfield sites shall not exceed the run-off arising from the equivalent of a two-year rainfall event. Substituting 4.1 mm/hr for i and 0.9 for C in the equation in paragraph 4.11 gives:

$$Q = 2.78\ (0.9)\ (4.1)\ A$$

$$= 10.26\ A$$

Therefore the allowable brownfield discharge will be 10.26 l/s/ha (substituting 1 ha for A in the above equation).

Estimating the volume required to store stormwater run-off

A4.15 The Environment Agency has simplified the storage requirements by providing a Sustainable Drainage Checklist that enables the storage to be estimated for pre-planning purposes using site specific data.

A4.16 The indicative storage volumes per hectare based on the allowable discharge rates included in Table 3.2 of the main report are shown in Table A.2 below.

Area	Allowable Discharge, l/s/ha	Indicative volume of storage per hectare of impermeable development, m^3/ha
Growth Area - north of M20	**2**	**863**

Area	Allowable Discharge, l/s/ha	Indicative volume of storage per hectare of impermeable development, m^3/ha
Growth Area - south of M20 (Stour)	4	820
Growth Area - south of M20 (Beult)	6	777
Rest of Borough	6	777

Table A.2 ESTIMATED STORAGE VOLUME (m3/ha)

The indicative storage volumes in Table A.2 are estimated assuming a change from one hectare of greenfield land to one hectare of impermeable development. It also assumes no infiltration.

A4.17 For previously developed (brownfield) sites throughout the borough the allowable discharge rate is 10.26 l/s/ha which requires an indicative storage volume of 685 m^3/ha. In situations where a higher brownfield discharge rate has been agreed with the Local Authority an alternative storage volume will need to be calculated.

A4.18 The above indicative storage volumes have been calculated using a catchment coefficient of 0.9 (assuming that the development area is impermeable). It may be appropriate to use an alternative catchment coefficient for areas of the development that are proposed to have permeable or semi-permeable surfaces that are positively drained, for instance green roofs or permeable paving. Justification of an alternative catchment coefficient should be provided.

A4.19 The above indicative storage volumes include an allowance of 30% for the increased rainfall predicted from climate change. Alternative allowances for climate change can be applied for alternative development design lives, according to Table 4.2.

A4.20 No allowance has been made for siltation or vegetation factors, both of which can take up storage volume. These should be applied as applicable, according to early considerations of the SUDS features to be implemented. For pre-planning it is recommended to include an allowance for siltation or vegetation to ensure sufficient space is allocated for SUDS.

Storage Type	Recommended % increase in storage volume to allow for siltation and / or vegetation
Green roof	As recommended by supplier

Storage Type	Recommended % increase in storage volume to allow for siltation and / or vegetation
Water butt / rainwater harvesting	-
Permeable paving	As recommended by supplier
Conveyance (swale / rill etc)	10
Infiltration basin	10
Wet ponds (retention basins)	20
Detention basins	10
Construction wetlands	20
Underground systems including modular storage	10

Table A.3 Allowances for siltation and / or vegetation

A4.21 The indicative storage volumes given above give the total storage volume for the site. This can be comprised of several different features, e.g. swales flowing into a small pond, where the swales provide some of the required storage.

Worked examples

Example 1

Consider a greenfield site of four hectares to the south east of the town. Three hectares are to be developed for a dense, mixed-use development. The remaining hectare will be gardens and public open space which will not be positively drained.

The location of the site places it in the Stour catchment, south of the M20. It is greenfield so from Table 3.2 the maximum permitted discharge rate is 4 l/s/ha.

The size of the site is 4 hectares. The developable area is 3 hectares of impermeable development. The development is of high density with no permeable paving / green roof therefore the catchment coefficient is 0.9 and Table A.2 can be used without modification.

From Table A.2 the required storage is 820 m^3/ha. The total indicative storage volume required will be 820 x 3 = 2,460 m^3. This could be made up as follows:

Storage Type	Volume m^3	Siltation / vegetation allowance %	Total m^3
Green roof	None		
Water butt / rainwater harvesting	15	-	15
Permeable paving	None		
Conveyance (swale / rill etc)	500	10	550
Infiltration basin	-	10	-
Wet ponds (retention basins)	1000	20	1200
Detention basins	845	10	930
Construction wetlands	-	20	-
Underground systems including modular storage	100	10	110
Total required	**2460**	**Total to be provided**	**2805**

Example 2

Consider a greenfield site of six hectares to the north east of the town. Five hectares are to be developed for mixed use development with one hectare allocated for public open space which will not be positively drained. The five hectares of development will incorporate one hectare of green roofs and permeable paving.

The location of the site places it in the Stour catchment, north of the M20. It is greenfield so from Table 3.2 the maximum permitted discharge rate is 2 l/s/ha.

The size of the site is 6 hectares. The developable area is 5 hectares. The area of impermeable development is 4 hectares. The storage required for his area is given by Table A.2 as 863 m^3/ha, giving a total of 3,452 m^3.

The additional storage required for the hectare of green roofs and permeable paving cannot be given by Table A.2. A minimum of 863 m^3 should be allowed for this area, unless specific runoff calculations can be provided for the proposed systems.

Example 3

Consider a town centre brownfield regeneration site of two hectares to the south east of the town. The whole site is to be developed for a dense, mixed-use development. All of the site will be positively drained to a nearby watercourse.

The location of the site places it in the Stour catchment, south of the M20. It is brownfield so from Table 3.2 the developer should use 'Best endeavours' to achieve 4 l/s/ha; failing that, aim to achieve a reduction from the existing run-off rate; as an absolute minimum must not lead to net increase in run-off rate. Nominally 10.26 l/s/ha.

Firstly considering the 'best endeavours' approach (4 l/s/ha):

The size of the site is 2 hectares. The developable area is 2 hectares, all of which will be positively drained. Therefore Table A.2 can be used, which gives an indicative storage volume of 820 m^3/ha. This gives a total storage volume of 1,640 m^3.

Secondly, considering a reduction from the 'brownfield' situation. No network analysis is available so use the allowable brownfield discharge rate of 10.26 l/s/ha:

From Section A4.17 the required storage is 685 m^3/ha, giving a total storage volume of 1,370 m^3.

The minimum storage to be allowed for is 1,370 m^3, but best endeavours should be used to try and achieve 1,640 m^3.

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Appendix 6: SUDS Checklist

ASHFORD BOROUGH COUNCIL

SUSTAINABLE DRAINAGE CHECKLIST

POLICY CS20 of the adopted Core Strategy requires that all development should include appropriate sustainable drainage systems (SUDS) for surface water management, in order to avoid any increase in flood risk or adverse impact on water quality. This policy is supported by the Sustainable Drainage Supplementary Planning Document (SPD).

This Checklist aims to help developers demonstrate compliance with CS20, and should be included with the Flood Risk Assessment or Surface Water Drainage Assessment.

SECTION 1 Site Details

1. Planning Reference Number:..

2. Site Name:…………………………………………………………….................

3. Location (NGR):…………………………………………………………………….

4. Total size of site (Note 1): …………………………………...(ha)

5. Developable area (Note 2) A=……..……………………….…(ha)

6. Current Use (Note 3) Greenfield / Brownfield / Mixed*

7. Catchment (Note 4): Stour (North) / Stour (South) / Beult / Other* ....

8. Max allowable discharge rate [per unit area] (Note 5):

   2 4 6 10.26 other (define)*……............ l/s/ha

9. Max discharge (Note 6):………………………(l/s)

SECTION 2 Assessment of storage volume required

10. Design life of development: (Note 7): up to 2085 / beyond 2085*

11. Indicative storage volume [per unit area] (Note 8):……………………..m^3/ha

12. Total indicative storage volume required (Note 9):…………..…………m^3

* circle as appropriate

SECTION 3 Assessment of indicative storage to be provided

13. Indicative storage to be provided (Note 10):……………………m^3 made up as follows:

Storage Type	**Volume m^3**	**Siltation / vegetation allowance %**	**Total m^3**
Green / brown roof			
Water butts		-	
Other rainwater harvesting			
Permeable paving			
Soakaways / infiltration			
Filter strips			
Conveyance (swale / rill etc)		10	
Infiltration basin		10	
Wet ponds (retention basins)		20	
Detention basins / ponds		10	
Construction wetlands		20	
Underground systems including modular storage (not preferred)		10	
Other			
Total indicative storage required		**Total indicative storage to be provided**	

SECTION 4 Description (Note 11):

Any questions on this checklist should be directed to:

Name:…………………………………..

Contact details:……………………………………………………………………

Notes:

1. *The size should be the total size of the site in hectares including large areas of greenspace. Note, large areas of public open space within the site can be used to accommodate SUDS features.*

2.*The developable area (in hectares) is that part of the site that will be developed, excluding undeveloped areas incidental to the development, such as gardens, public open space etc which remain unmodified – i.e. not positively drained. Greenspace, including gardens, that is positively drained or is likely to drain to the SUDS should be included in the developable area. A plan should be provided showing the areas expected to be drained.*

3. *The current use (Circle: Greenfield / Brownfield / Mixed) is one of the parameters used to determine the allowable discharge from Table 3.2. For sites that are 'mixed' – that is partly greenfield partly previously developed – it is acceptable to undertake separate calculations for each element of the site.*

4. *The catchment is the second parameter used to determine the allowable discharge from Table 3.2. (Circle Stour (North) / Stour (South) / Beult / Other as appropriate). 'Other' relates to any location outside of the Growth Area. Please check with the Environment Agency / Ashford Borough Council if you are unsure. For sites falling in two or more catchments it is advisable to complete a Checklist for each catchment.*

5. *The maximum allowable discharge rate [per unit area] is looked up from Table 3.2 based on the site's previous use and its location. (Circle one of the options: 2 / 4 / 6 / 10.26 l/s/ha). If a figure other than those given is used circle 'other' and state what the figure is. You will need to provide detailed calculations to justify the use of an alternative to those given.*

6. *The maximum discharge (total run-off) (l/s) is the allowable discharge per unit area (l/s/ha) (from 9) multiplied by the developable area (ha) (from 5).*

7. *The design life of the development will affect the climate change allowance. If the design life is beyond 2085 [assumed for all housing] then Table A.2 can be used (which includes a 30% allowance for climate change as recommended in Table 4.2). If the design life is less than 2085 then a 20% allowance is appropriate and Table A.2 cannot be used.*

8. *The indicative storage volume per unit area in m^3 is looked up from Table A.2 in Appendix 4 for greenfield sites; or is a nominal 685 m^3/ha for previously developed sites where no higher figure has been agreed with the Local Authority. Note: this figure contains an allowance for climate change but not for siltation / vegetation.*

9. *The total indicative storage required in m^3 is the indicative storage volume per unit area in m^3/ha (from 12) multiplied by the developable area in ha (from 5).*

10. *At this stage the storage to be provided is still indicative and as such should suggest the type of SUDS features that are likely to be used on the site and the volume that each could provide. If infiltration methods are proposed, separate calculations will need to be provided to indicate expected infiltration rates. An allowance for siltation and / or vegetation is applied to some forms of storage at this stage to ensure enough space is allocated for the volumes required. The Local Authority will expect to see a commitment to the 'management train' approach with a variety of storage methods proposed. Proposals that suggest 100% storage in underground tanks are unlikely to gain approval.*

11. *Use Section 4 'Description' to briefly describe the SUDS design principles adopted: management train, environmental considerations, evidence supporting 'best endeavours' approach etc. This section should also be used to give an early indication of maintenance and adoption requirements.*

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