

# *SuDS*

*SOLUTION GUIDE*



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# GLOSSARY

## **Hydrological cycle**

Describes the continuous journey of water on, above and below the surface of the Earth.

## **SuDS**

Acronym for Sustainable Drainage System.

## **Biodiversity**

Describes the variety of life on earth and the habitats they depend on.

## **Urbanisation**

Defines an increase in the proportion of people living in urban areas compared to rural areas.

## **Urban Heat Island Effect**

An increase in temperature due to urbanisation, the increase in population and the infrastructure required to support.

## **Green and blue corridors**

The creation of interconnected natural areas that enable and promote the movement of fauna through urban landscapes.



Our approach to construction encompasses innovative sustainable products, efficient building systems and practical solutions. We recognise the important role we have in promoting sustainable construction by optimising our products, their use and whole life performance. This document is one of a suite that identifies and considers specific construction approaches and solutions that can help deliver a sustainable built environment. They explore the

characteristics and requirements of construction approaches and how the performance benefits of specific systems can be implemented into a project to deliver a sustainable outcome.

This document introduces Sustainable Drainage Systems (SuDS) establishing their need to be integrated into developments, key components and considerations for implementation.

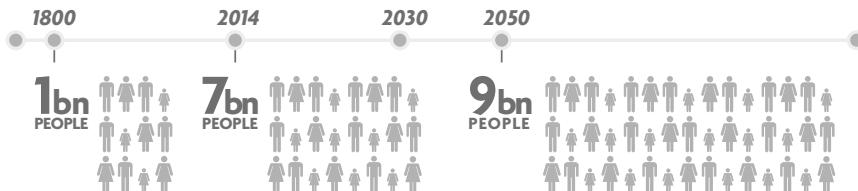


# INTRODUCTION

The combined effect of climate change, population growth and rapid urbanisation has increased the risk and severity of disruptive flooding events driving an increase in the need to incorporate Sustainable Drainage Systems (SuDS).

SuDS can help mitigate the effects due to climate change, population growth and urbanisation when employed in thoughtful and sensitive design. They can also be effectively retrofitted to existing developments to improve their sustainability credentials.

Population growth is one significant driver of urbanisation. The Lyons Review of Housing Supply<sup>2</sup> published in 2004 identified a requirement for the construction of 250,000 homes per year to satisfy demand, however this has been revised on a number of occasions with figures quoted up to 300,000. It is not just the construction of these new homes that will increase urbanisation but the intrinsically linked infrastructure such as roads, retail, amenities and hospitals.




While population growth and urbanisation increase the day to day demand for water, significant additional demands are placed on its management within the landscape. Existing pervious ground conditions give way to the installation and construction of impervious surfaces such as pavements and footpaths, and buildings which divert water to these surfaces. This creates a significant change to the pre-existing hydrological cycle where surface water would be absorbed into the underlying strata and released slowly back into water courses. The increase of impervious surfaces creates instantaneous surface runoff which has the capability to overwhelm existing drainage infrastructure and lead to flash flooding, disruption and extensive damage.

Pollution increases can be a direct result of urbanisation as those pollutants settling on impervious surfaces are washed off and discharged directly into rivers, streams and treatment plants.

Whilst urbanisation on its own threatens to increase flood risk when combined with the effects of climate change, the provision of SuDS is even more relevant. It is expected that as a result of climate change winters will continue to become wetter and milder, summers drier and hotter, with increases in extreme weather events such as periods of intense rainfall.



A gravel driveway leads towards a large, multi-story stone building with a dark roof. The building has several windows, some with shutters. The foreground is a close-up of the gravel, and the background is a grassy area and a cloudy sky.

If a surface of over 5m<sup>2</sup> is to be covered planning permission is required to be obtained if the surface is impermeable and discharges to a road.<sup>3</sup>

## Legislation and regulation

National Planning and Policy Framework<sup>4</sup> sets out the Government's policy on development and flood risk. Its aim is to ensure that flood risk is taken into account at every stage during the planning process to avoid inappropriate development in areas of a high flood risk. The implementation of Sustainable Drainage Systems (SuDS) recommended by Government and supported through the Planning Practice Guidance<sup>12</sup>.

The Environment Agency (EA) advises planning authorities on development and flood risk matters, with a view to steer developments away from flood risk areas and to restrict development that

would increase the risk of flooding. The EA actively encourages local authorities to include pervious pavements through supplementary planning guidance<sup>5</sup>. Housebuilders are encouraged by both the EA and through sustainability accreditation schemes to adopt SuDS.

Further to the Government's recommendations to implement SuDS, additional planning controls have been enacted restricting domestic installation of impermeable surfaces. Planning permission is required for all impervious hard standings over 5m<sup>2</sup> which discharges on to the highway.

Building Regulations reinforce the preference for sustainable drainage with the requirement to avoid where possible discharge into sewers<sup>6</sup>. BREEAM recognises SuDS with its inclusion contributing to the achievement of a number of credits.

Drainage solutions are further influenced by a number of European directives and legislation. The Water Framework Directive (WFD)<sup>7</sup>, focused on the delivery of a better water environment, and the Floods Directive<sup>8</sup> which is in place to manage the risk and impacts of floods. In England and Wales the Flood Risk Regulations<sup>9</sup>

transpose the European Floods Directive into domestic law, with the Flood and Water Management Act<sup>10</sup> providing more comprehensive flood risk management.



## **WHAT ARE SuDS?**

SuDS are the preferred method for dealing with the consequences of urbanisation and its effects on increasing the volume and speed of surface water runoff.

They are designed to manage the environmental risks created by development whilst enhancing, wherever possible, the environment in which it is situated.

Through the provision of SuDS the process of replacing natural drainage with impermeable surfaces, whose effect is to increase flood risk, can be reduced or reversed. SuDS can be utilised for onsite storage and infiltration, reduction of offsite runoff rates and the associated effects of sewer surcharging.

As a consequence of development increasing impervious surfaces, pollution is noted to increase, in the form of oils, heavy metals, sediments and organic materials. Traditional drainage solutions result in the direct transport of these pollutants to water courses, whereas SuDS systems have the ability to intercept, filter and remove these pollutants before runoff reaches these watercourses.

Where runoff water storage is employed it is possible to enhance an areas biodiversity by utilising the storage area to create ponds and wetlands. Capture and infiltration systems can provide natural irrigation for the existing landscape or where linked to a building a source for reuse, reducing the demand on external potable water supplies.

As a strategic option for new developments, SuDS are not only a sustainable option to address the impact of urbanisation but are capable of providing added value to the community, through the provision of open space. Space that is left free of development can create a useable municipal recreational area for the community improving attractiveness and the promotion of green and blue corridors.

## What are the principles of SuDS?

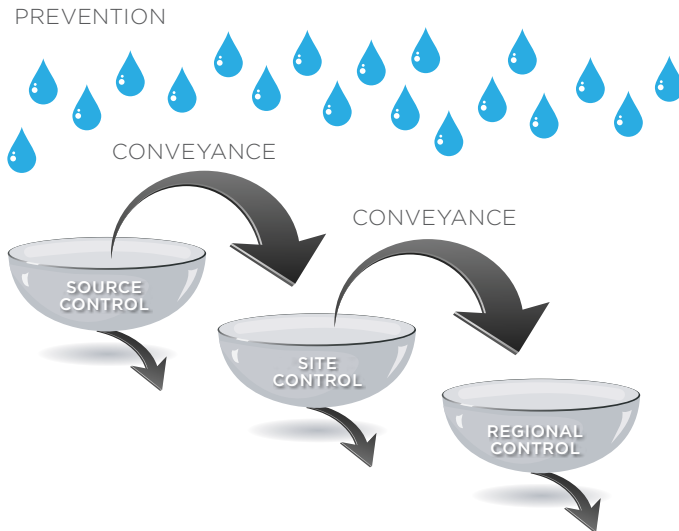
When considering the design and implementation of SuDS the following key principles need to be assessed:

<i><b>ATTENUATION</b></i>	<i><b>INFILTRATION</b></i>	<i><b>CONVEYING</b></i>	<i><b>POLLUTANT REMOVAL</b></i>
The storing and slowing of the discharge of runoff	Allowing runoff to soak into the ground as would have naturally occurred prior to development	The movement of water at surface level	Filtering of runoff to avoid the discharge of pollutants into watercourses

Each aspect is present in and required to be considered as part of the surface water management train, which is fundamental to the creation of integrated SuDS.

## Surface Water Management Train

The surface water management train<sup>11</sup> describes a range of drainage techniques to control runoff and reduce watercourse pollution. Each stage aims to reduce the quantity and improve the quality of water that leaves a development. The management train starts with prevention and extends to regional controls, encompassing source and site control.





The surface water management train details the progress that surface water makes through drainage interventions which have replaced original natural drainage routes, although it is not required to progress through each stage of the management train.

A fundamental principle of sustainable drainage is that runoff should be dealt with as close to its source as is possible and returned to the natural drainage system, only when this is not viable should it be conveyed elsewhere.

SURFACE WATER MANAGEMENT TRAIN	
<b>PREVENTION</b>	Prevention is the first stage of the management train. It incorporates good housekeeping practices in order to minimise water course pollution and is focused on the reduction of impermeable surfaces, where such action will prevent surface runoff and maintain existing natural drainage routes.
<b>SOURCE CONTROL</b>	The management and control of water at or very near to its source, for example within the grounds of a house. A number of different methods can be employed to facilitate this approach; one such example is rainwater harvesting to create a grey water source, reducing demands on potable water supplies.
<b>SITE CONTROL</b>	The expansion of source control procedures to consider a single site or local area, typically involving the use of soakaways or infiltration areas; where the rate of flow of surface water entering the system is reduced and attenuated.
<b>REGIONAL CONTROL</b>	The last step in the flood management train is the design of a system which can manage the runoff from several sites. At this stage larger drainage solutions are typically required, such as wetlands, which can reduce the risk of wider flooding.




## ***COMPONENTS OF SuDS***

**Within each stage of the surface water management train there are a number of SuDS components that can be employed to fulfil its individual requirements.**

These components can be defined by their role with respect to the principles that govern a SuDS system; infiltration (I), attenuation (A), conveyance (C) and pollutant removal. Pollutant removal can occur throughout the SuDS train and as such specific components have not been identified.

## COMPONENTS OF SUDS

Bioretention Areas (A)	Planted and landscaped areas which filter pollutants and can reduce and attenuate surface runoff.
Channels / Canals (C)	Used to convey water from one area to another within a development and can be utilised for the removal and storage of silts and oils.
Detention Basin (A)	An excavated depression designed to temporarily store and control the flow of runoff through attenuation, typically dry during periods and can be used for recreational purposes.
Filter Strip (I,C)	Strips of vegetation that act as a buffer between surface runoff sources and natural water courses, they intercept runoff allowing for pollutant filtering and settlement of particulates.
Filter Trench (A,C)	A shallow linear excavation, filled with stone that creates a reservoir for runoff during periods of high or sustained rainfall. It can also be used as a method to convey runoff along the water management train.
Geocellular Systems (A)	Plastic honeycombed structured modular units which marry high strength properties with large internal voids for the attenuation and storage of runoff in underground reservoirs.
Green Roofs (A)	A roof structure that is covered or partly covered by vegetation and landscaping, it is a system which reverses the impermeable properties of traditional roof construction systems, creating a solution which can retain and intercept precipitation.
Infiltration Basin (I,A)	Similar to detention basins, infiltration basins are designed to provide storage during periods of high rainfall but also allow the subsequent runoff to be dealt with within the basin, through infiltration, reducing runoff volumes.
Infiltration Trench (I)	Comparable to a filter trench, an infiltration trench consists of a shallow trench filled with stone, however it does not convey runoff but enables infiltration through its sides and bottom.
Permeable Pavements (I)	Pavements suitable for vehicular and pedestrian traffic but also allow runoff to penetrate and percolate through the surface to underlying strata. Existing levels of permeability can be maintained and the pavements can act as screen trapping pollutants and allowing the breakdown of organic pollutants prior to discharge into watercourses.

A scenic view of a wetland area. In the foreground, there is a body of blue water with gentle ripples. To the right, tall, golden-brown reeds stand densely. On the left, there are bare, brown branches of trees. In the background, a line of green trees stretches across the horizon under a bright blue sky with scattered white clouds. The overall atmosphere is peaceful and natural.

*WETLANDS CAN ATTENUATE LARGE VOLUMES  
OF RUNOFF AND CAN PROVIDE POLLUTANT  
TREATMENT IN THE FORM OF SEDIMENTATION AND  
FILTRATION, WHILST ENHANCING BIODIVERSITY*

## COMPONENTS OF SUDS

Pervious Surfaces (I)	There are two distinct types of pervious surfaces however in general terms they both enable and facilitate the infiltration of rainwater through a surface to underlying layers. Porous surfaces allow water to penetrate across its entire surface area whereas permeable surfaces allow infiltration through voids in what would otherwise be an impermeable material.
Rain Garden (I)	A small, shallow depression planted with vegetation that is accepting of periods of rainfall inundation. It acts as infiltration point for runoff and is typically linked to roofs or other runoff sources which have low contaminant levels.
Rainwater Harvesting(A)	The capture and storage of storm water, reducing site discharge, with the potential for reuse in a range of applications.
Retention Pond (A)	Open body of water that is used to provide water attenuation and treatment. The pond detains runoff from rainfall events for an extended period of time allowing for the processes of sedimentation and vegetation uptake to reduce pollutant and nutrient concentrations.
Soakaway (I,A)	An alternative to direct connection to existing or new surface water discharge systems, providing on site attenuation and infiltration of runoff. Soakaways are created using perforated or permeable rings or boxes, that are placed within excavations or are excavations filled with granular materials. They enable the direct infiltration of water into the surrounding ground.
Swale (I,A,C)	Linear, shallow, vegetated channels which convey runoff through to subsequent stages of the management train. Typically dry in periods without rainfall they also have the capacity to attenuate runoff and the presence of vegetation enables the reduction and removal of surface pollutants.
Wetlands (A)	Typically used as a final stage in the water management train, they are densely vegetated shallow depressions which remain wet throughout the year irrespective of rainfall events. Wetlands can attenuate large volumes of runoff and can provide pollutant treatment in the form of sedimentation and filtration, whilst enhancing biodiversity.
Blue Roofs (A)	A roof designed to specifically attenuate rainfall either temporarily, permanently or for harvesting for reuse.



### ***GREEN ROOF***

A green roof system reverses the impermeable properties of traditional roof construction systems, creating a solution which can retain and intercept precipitation



### ***CANALS***

Convey water from one area to another and can be utilised for the removal and storage of silts and oils.



### ***PERMEABLE PAVEMENTS***

Enable and facilitate the infiltration of rainwater through a surface to underlying layers.

## SUDS DESIGN CONSIDERATIONS

The design and implementation of a successful SuDS solution is dictated by a number of key characteristics relating to existing site conditions, post construction performance and longevity. The following identifies aspects which should be considered when implementing SuDS, but should not be considered as exhaustive.

### **ONSITE EVALUATION**

It is not possible to have a one size fit all approach to SuDS, each site is different and requires steps to be taken to assess the suitability and scale of SuDS that can be implemented. This evaluation should consider the existing geology, topography, runoff and flows, with any new drainage scheme designed to maintain and not surpass predevelopment characteristics.

### **MASTERPLANNING**

The provision of SuDS should not be thought about as part of a separate discipline when undertaking a site development. The most successful solutions are integrated at very early project stages, they should not just focus on the site itself, but should reference and tie into wider local authority water management plans and broader green infrastructure strategies.



## **BIODIVERSITY**

As part of the SuDS implementation process it is integral that the existing level of biodiversity at a site is considered. Any new system must maintain the existing levels of biodiversity; however it should be taken as an opportunity to increase biodiversity through the planting of native species and provision of suitable habitats.

## **WATER QUALITY**

Urban developments can give rise to the increased potential for pollution to reach existing natural watercourses. Consideration should be given to the type of users and activities taking place on the development site, in order to ensure that suitable SuDS techniques are employed and to mitigate pollution risks.

## **DESIGN CONSTRAINTS**

Sub-grade permeability plays an important role in determining what SuDS components can be employed, whether attenuating,

infiltrating or conveyance. High water tables affect water storage capacity, which requires intelligent consideration of the site and required storage capacities. Certain systems will not be viable in areas subject to trafficking, limiting the use of selected components. Whilst legislation exists on a national level for the provision of drainage systems, additional requirements can be enforced by local authorities and these should be considered at the time of design, for example discharge consents.

## **MAINTENANCE**

Any design should consider the whole life of the system, not only its construction but its end of life scenarios and long term maintenance. During early stages of design responsibility for the ongoing maintenance of any SuDS should be determined, along with a suitable maintenance plan to ensure continued performance.

Tarmac offers a range of solutions which are aligned to the principles and can contribute to the creation of SuDS at various stages through the management train. As alternatives to impermeable paving and permeable block paving products permeable asphalt and concrete is suitable for wide range of pavement applications. When incorporated into a SuDS design these products can fulfil part of the solution to deliver attenuation, filtration and infiltration.

APPLICATIONS	
	TARMAC SuDS SOLUTIONS
Lightly trafficked roads	✓
Parking	✓
Pedestrian areas	✓
Domestic areas	✓
Sports / Leisure facilities	✓

SuDS create the opportunity for the intelligent handling of water related issues that occur as a result of development. Tarmac offers a range of solutions that can contribute to creating sustainable drainage systems.

For more information visit [tarmac.com](http://tarmac.com) or email [sustainability@tarmac.com](mailto:sustainability@tarmac.com)

## ***BREEAM SUDS SPECIFIC ACREDITATION***

BREEAM is a UK and international assessment scheme which serves to benchmark the sustainable performance of a building or scheme.

Its overarching aim is to minimise the adverse effects that buildings can have on the local and global environment, specifically to consider the life cycle impacts of buildings and provide support in minimizing and mitigating these. This enables buildings to be recognised for their environmental and sustainable credentials and creates a credible labelling scheme for buildings.

The following assessment criteria can be directly linked to the provision of SuDS systems:

## BREEAM

### **Wat 01 – Water consumption**

This issue is linked to the consumption of potable water for the sanitary use in buildings, credits are awarded based upon the reduction of potable water use. SuDS can be integrated to include rainwater harvesting which can subsequently be used to offset the potable water demands.

### **Wat 04 – Water efficient equipment**

The focus of this issue is to minimise and reduce unregulated water consumption, by utilising efficient water equipment. Whilst SuDS do not provide the complete solution to achieve the associated credit, they can partially fulfil the assessment criteria by providing water for irrigation through rainwater harvesting and support the planting and landscaping which is a direct consequence of the implementation of SuDS.

### **Le 04 – Land use and ecology - Enhancing site ecology**

SuDS create the opportunity for increases in biodiversity through the provision of opportunities for increased native planting and creation of habitats to encourage wildlife. This issue requires actions to be taken to maintain and increase the ecological values of sites, it achieved through the implementation of recommendations from the required ecologists survey. SuDS present the opportunity to implement said requirements as part of fulfilling a specific development requirement of site drainage.

### **Pol 03 – Surface water run off**

Concerned with the avoidance, reduction and delay of rainwater discharge into local water courses and the minimising of flood risk and pollution, this issue specifically identifies SuDS as a solution. SuDS create the opportunity to minimise or completely remove the issue of discharge into local water courses through on site storage, infiltration and reuse. Pollution risks can be reduced or removed through thoughtful design and implementation of the water management train.

CREDIT/TARGET

# PEOPLE



Safety and health  
Our people  
Community involvement

# PLANET



Climate change  
Environmental stewardship  
Resource efficiency

# PERFORMANCE



Economic value  
Governance and ethics  
Communication

# SOLUTIONS



Sustainable supply chain  
Innovation and quality  
Sustainable construction

# *OUR SUSTAINABILITY STRATEGY*

Sustainability is about securing long-term success for our business, customers and communities by improving the environmental, social and economic performance of our products and solutions through their life-cycle. This means considering not only the goods we purchase, our operations and logistics but also the performance of our products in use and their reuse and recycling at the end of their life. By doing this, we can understand and take action to minimise any negative aspects, while maximising the many positive sustainability benefits our business and products bring.

Using this 'whole life' thinking we have engaged with our stakeholders to develop our sustainability strategy. The strategy defines the main sustainability themes and our key priorities, those issues which are most important to our business and our stakeholders. It sets out our commitments to transform our business under four main themes: **People, Planet, Performance and Solutions**.

Building on progress already made, we have set ambitious 2020 milestone targets for each of our key priorities. These ambitious targets have been set to take us beyond incremental improvement programmes to business transforming solutions.

## *FOUR THEMES*

Twelve key priorities

Twelve commitments

Twelve 2020 milestones

Forty four other performance targets

Our 2020 milestones are supported by a range of other performance targets.

This hierarchy helps make it easier to build understanding, drive improvement and enables us to report progress in a meaningful and measurable way.

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T3 Tarmac, Ground Floor, T3 Trinity Park  
Bickenhill Lane, Birmingham B37 7ES  
*For more details visit [tarmac.com/contact](http://tarmac.com/contact)*

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