MAYOR OF LONDON

Reimagining rainwater in parks and green spaces

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1 Introduction

1.0 INTRODUCTION

How we manage water within our spaces and places has a huge impact on the quality of our environment and lives. Good management of rainfall and surface water within towns and cities can make the places in which we live, work and play greener, more attractive and resilient to climate change.

Sustainable Drainage Systems, or SuDS, are widely accepted as a better approach to managing rainfall than traditional drainage. They create beautiful spaces and places for people and wildlife, as well as reduce the risk of waterlogging, local flooding and water pollution.

SuDS will be fundamental in responding to the climate and ecological emergencies we're facing as they are one of the few measures that provide a tangible approach to help London adapt to changes in climate as well as delivering impoved resilience and biodiversity gain. Designed well, SuDS shouldn't cost more than traditional approaches either.

Using SuDS to manage rainfall delivers exciting opportunities to change and enhance a variety of places and spaces providing a range of benefits for those that manage and use green spaces and neighbouring areas.

Figure 1.1 Rain garden at Crescent Gardens
Image courtesy Robert Bray Associates

1.1. PURPOSE OF THIS BOOKLET

This document explains SuDS, their contribution to climate change adaptation, place making and other benefits enabling readers to make informed decisions about their inclusion in the management and operation of parks and green spaces. This document is primarily designed for those who are making decisions on future capital investment, quality and upkeep of the estate and associated buildings in and around green space. This includes park managers, officers dealing with the public realm, green infrastructure, biodiversity and landscape as well as site managers or supervisors and project managers.

The guidance may also be useful for other local authority departments that can utilise green space to help alleviate surface water management challenges (i.e. flooding, water pollution). Community or 'Friends of' groups that have an interest in improving local green spaces may also find this document useful to understand how they can better integrate rainwater management in green spaces.

Figure 1.2 Swale at Rectory Gardens SuDS Scheme
Image courtesy Robert Bray Associates

2 What are SuDS?

2.0 WHAT ARE SuDS

Sustainable Drainage Systems (SuDS) manage surface water runoff (the flow of rainwater across the surface) by capturing, using, absorbing, storing and transporting rainfall in a way that mimics nature. SuDS slow the flow and reduce the amount of rainfall that drains into sewers, streams and rivers which reduces the risk of flooding. They can also treat and reduce pollutants in runoff. The most beneficial SuDS manage rain close to where it falls, are on (or close to) the surface and often include vegetation.

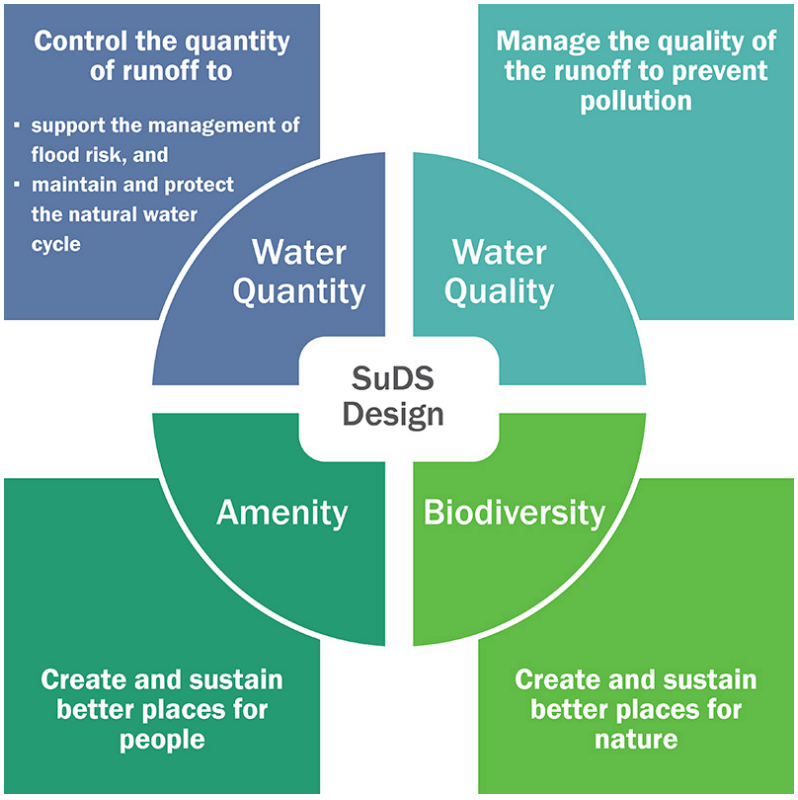
High quality SuDS deliver a variety of benefits, this delivery of multiple benefits is sometimes referred to as the "four pillars of SuDS" (figure 2.1).

Typical SuDS features used in and around parks and green spaces are presented in table 2.1, they include rain gardens, wetlands, ponds and swales. Where it is not possible to manage water on the surface (e.g. where space is at a premium) SuDS can also include underground storage tanks, permeable paving, green roofs and hard landscaping.

SuDS can be inexpensive to design, build and maintain. The SuDS approach includes simple changes, like allowing runoff to soak into the ground or diverting a roof's downpipe or runoff from roads and paths into a rain garden (→ table 2-1). SuDS can also include more complex features such as a wetland, or a larger scheme where many features are connected (→ case studies in section 5).

SuDS for new major developments have been a planning requirement since 2015. However, the SuDS approach is not new. There are case studies of successful SuDS retrofitting in Section 5 of this document. The susdrain website also includes over a hundred case studies and award submissions where SuDS have been successfully delivered, including a dozen in the public realm.

Figure 2.1 The four pillars of SuDS



2.1 WHY USE SuDS TO MANAGE RAINWATER

SuDS help us adapt and respond to the challenges posed by poor water management, climate change and urbanisation.

SuDS also offer a fantastic opportunity to improve the quality of urban environments and social cohesion by connecting people to each other, places and nature which all improve wellbeing.

As well as providing more benefits, well-designed SuDS are often cheaper than traditional approaches to drainage. SuDS can be easily integrated into the management of green spaces and with good engagement and appropriate training SuDS in parks and green spaces are easy to maintain, often requiring nothing more than standard landscape maintenance which in most instances can be undertaken by site managers, existing landscape contractors and community volunteers.

Our towns and cities often have areas of land that can be better used to manage rainfall and runoff and SuDS can be used to ensure that existing, underused and uninspiring green or grey and impermeable spaces can deliver attractive and resilient environments for the community. Within London there are thousands of gardens, squares, parks and green spaces that are next to densely packed buildings, roads or areas of hard, impermeable surfaces that generate significant amounts of surface water runoff increasing flood risk and urban pollution. These areas can be used for SuDS to deliver a number of benefits that can include improvements in:

- Spaces and places for people – amenity
- Spaces and places for nature – biodiversity
- Managing water quantity – flooding and water availability
- Managing water quality - pollution
- Management and operation of parks and green spaces

Figure 2.2 Firs Farm, Enfield

2.1.1 Spaces and places for people - amenity

SuDS features that manage rainfall on the surface provide attractive vibrant places and spaces that improve public areas enabling people to exercise, play, meet and socialise (figure 2.3). They can improve areas for people living locally, contributing to their quality of life and helping provie a sense of communtiy and pride. Integrating SuDS features and changing the way green spaces are used by including new paths, landscapes and play elements can positively change a local area. Changes like these can turn a once underused and sometimes abused green space into a destination and revitalise local economies and communities. The Firs Farm Wetlands in Enfield inspired the creation of a Friends of Firs Farm group that has run a series of community events, including two Wetlands Festivals.

(→ Firs Farm and Newton Park case studies).

Many of the case studies in section 5 brought local residents and community members together to form of strengthen “Friends of” groups.

SuDS in green spaces within dense urban areas can also cool neighbouring buildings. Trees provide shade from the sun, and SuDS features on, or around buildings (e.g. rain gardens) help cool through evaporation of rainwater from surfaces and transpiration by plants. These types of enhanced features provide a healthier and more comfortable living environment in both the summer and winter. SuDS can also improve local air quality by dispersing, absorbing and filtering harmful airborne pollutants from vehicles. They can also help absorb and reduce noise from traffic.

Figure 2.3 Swale at Rectory Gardens

Image courtesy London Borough of Haringey

Figure 2.4 Biodiversity at Firs Farm, Enfield

2.1.2 Spaces and places for nature - biodiversity

SuDS deliver attractive and lush green places for biodiversity by creating new habitats or improving existing ones. Improving the connectivity and integration of water through strategically planned SuDS can substantially change the ecological characteristics of an area, e.g. provision of wildlife corridors. The flora and fauna associated with wetlands and meadow planting can introduce a greater variety of insects and birds, particularly wildfowl. SuDS features also deliver important urban biodiversity, including plants that encourage wildlife including pollinators and positively contribute to Biodiversity Net Gain.

2.1.3 Managing water quantity - flooding and water availability

Where SuDS have been delivered in parks and green spaces they can slow the flow and reduce the amount of surface water runoff that can cause flooding to local homes, businesses and communities. SuDS also enable a once waterlogged park, play or sports area to become more useable (see figure 2.5). SuDS can improve accessibility by reducing the risk of paths and roads being flooded.

SuDS in green spaces can divert and manage runoff to reduce the impacts on rivers and streams and manage flooding within the local area, as well as reducing the impact of rain entering our drainage and sewerage systems, which in many parts of London becomes easily overwhelmed. This can often trigger overspills of sewage into our streams and rivers, creating pollution, and cause homes and businesses to be flooded with sewage.

Where soil permeablility and geology allow, some SuDS features encourage rainwater to soak into underground aquifers helping maintain the flows of streams and rivers in periods of dry weather.

Figure 2.5 Using a swale to manage flooding in Ealing (before and after)

Images courtesy London Borough of Ealing

2.1.4 Managing water quality - pollution

Most of London's rivers or streams are polluted to some degree, with only one of London's 41 rivers being classed as "good" under EU environmental legislation. SuDS can improve our water quality through filtration, adsorption and the breaking down of pollutants by vegetation, soil and the sun, potentially reducing pollution in our surface water runoff by up to 90%. The Road Runoff Water Quality Study funded by the GLA highlights the challenge of water pollution faced in London and suggests parks that incorporate wetlands can improve the quality of our streams and rivers.

London Boroughs like Haringey, Harrow and Enfield have all implemented SuDS in green spaces and parks to reduce misconnections from buildings, and improve the quality of runoff entering local streams and rivers (→Groveland case study).

2.1.5 Management and operation of parks and green spaces

Operationally SuDS can easily be encompassed within the capital and maintenance investment programmes for parks and green spaces. In addition, many SuDS features, like swales, basins, wetlands and ponds can be relatively simple to maintain when considered within existing landscape design and maintenance activities.

Well-designed SuDS features should be cost neutral, or less expensive than traditional drainage and landscape practices.

Managing flooding and waterlogging will improve the operation and functionality of parks and green spaces. Enabling spaces like areas of grass, play areas, green gyms, sports facilities and event spaces to be used for longer periods throughout the year.

The delivery of multiple benefits from SuDS within parks and green spaces can also help improve the relationship and interactions between the local authority, businesses and the local community.

'The introduction of a scrape channel at Lammas park has not only ended the flooding of paths that used to be a problem, it has also provided a delightful setting for wildflowers and a new home for frogs. Local residents have grown to enjoy the area!'

Irvin, a resident local to Lammas Park in Ealing

2.2 SuDS FEATURES FOR PARKS AND GREEN SPACES

The SuDS approach includes a 'toolkit' of various SuDS features, offering different benefits that enable most SuDS features to be considered as 'green infrastructure' i.e. green features that deliver multiple functions and benefits. This can help deliver a variety of different policy outcomes for the local authority as well.

SuDS features can be used at different scales and budgets. Not all features will be suitable for every site, but their flexibility means that better rainwater and surface water management can be delivered by SuDS anywhere. Table 2.1 provides some examples of common SuDS features that can be integrated within parks and green spaces. There's a mixture of features to treat runoff from surfaces and buildings provided within parks, changing rooms, cafés, community centres etc. The features in the table have been ordered on the basis of ease of delivery, i.e. overall level of disruption caused, ease of construction, likely costs and the potential value.

'What a wonderful transformation and certainly a heaven for the wildlife. What a difference to the park. Hopefully we shall see more amphibians which are in decline'

Friends of Broomfield park

(→ case studies)

Table 2.1 SuDS features

	SuDS feature	Benefits
	**Basin** Typically a shallow depression covered with amenity or meadow grass. Basins are normally dry but capture water and allow it to soak into the ground where possible, or slow the flow of runoff.	• Can be a multifunctional space if designed appropriately. • Lots of opportunity for informal play features. • Cleans runoff. • Reduces runoff for day-to-day rainfall.

Table 2.1 continued

	SuDS feature	Benefits
 Vegetated swale. Courtesy London Borough of Ealing  Grassed swale. Courtesy London Borough of Haringey	**Swale** This is a shallow, flat bottomed ditch with gentle sloping sides. They can be planted with grasses or more attractive vegetation.	• Can form a wildlife corridor. • Can be visually appealing. • Can be used to define different parts of a park. • Can be used as an informal play area, e.g. swale mazes • Effectively cleans runoff. • Connects people to water on the surface and is simple to maintain. • Reduces runoff for day-to-day rainfall. • Collects, cleans and transports runoff to other parts of the site.
 Courtesy London Borough of Haringey	**Rain garden** A small planted basin, typically designed to receive runoff from roofs or hard surfaces like roads. The water can be directed to the rain garden using channels, rills or pipes.	• Highly visual and attractive feature. • Easily incorporated into small green spaces which are fairly close to roads and buildings. • With appropriate planting supports biodiversity. • Effectively cleans runoff. • Reduces runoff for day-to-day rainfall.

Table 2.1 continued

	SuDS feature	Benefits
 Courtesy London Borough of Ealing	**Rain planter** A raised planter with the ability to receive roof runoff into soil and drainage layers in the planter. An overflow into a drain or another SuDS feature is recommended as it is rare the planter alone will cope with rainfall from a heavy storm.	• An attractive display of sustainable rainwater management. • Enables SuDS where space is limited, or is only available close to buildings. • Can be integrated with additional outdoor seating. • Can be used for food growing and gardening.
 Courtesy OTA Water	**Rainwater harvesting** Rainwater from roofs and impermeable surfaces can be stored and used in and around buildings and on gardens. They can range from simple water butts to more comprehensive systems that harvest and provide non-mains water for irrigation, vehicle washing and toilet flushing. Rainwater harvesting can slow the flow of runoff, reducing the amount of water that is released to drains or other SuDS features.	• Reduces runoff for day-to-day rainfall. • More sophisticated systems can be used to manage heavy rainfall • Reduces mains water usage.

Table 2.1 continued

	SuDS feature	Benefits
 Courtesy London Borough of Enfield	**Wetland or pond** A permanently wet area designed as a wildlife habitat resource, amenity feature or both. Before entering a wetland, or pond, runoff may need to go through other SuDS features to clean it and protect wildlife.	• Creates a valuable ecological and amenity resource. • Cleans already relatively clean runoff.
 Courtesy Illman Young Landscape Design	**Filter drain** A stone-filled trench that collects runoff from hard surfaces (road or car park) to clean and transport it. They enable runoff to soak into the ground and can include a perforated pipe to convey flows.	• Effective where space is limited. • Collects, cleans and transports runoff to other parts of the site.
	**Green or blue roof** Sometimes called a 'living roof' these are roofs that are adapted or designed to support plants. A range of plants can be used. The roofs can slow the flow of runoff, reducing the amount of water that is released to drains or other SuDS features. A blue roof captures more water to slow the flow and reduce the volume of runoff.	• Supports biodiversity. • Can provide cooler buildings in the summer. • Can improve air quality. • Cleans roof runoff. • Improves efficiency of solar panels on the roof. • Reduces runoff for day-to-day rainfall. • Can prolong the lifespan of a flat roof. • A blue roof is similar to a green roof but it can be used to temporarily store runoff and slow the flow from heavy rainfall.

Table 2.1 continued

	SuDS feature	Benefits
	**Permeable or pervious surfaces** Hard surfaces that also allow rainwater to soak into the ground, or into underground storage to slow the release of runoff.	• Good range of attractive product types available including coloured porous surfaces as well as a diverse range of resin-bound gravel and reinforced gravel solutions. • Enables use of surface for a play area, paths or parking. • Can reduce slip hazards during freezing weather. • Cleans runoff effectively.
 Courtesy Groundwork london	**SuDS tree pits** SuDS tree pits can be used on their own or integrated into other SuDS features like rain gardens, wetlands etc. The tree canopy intercepts rain and trees also draw up large amounts of water through the soil.	• Attractive feature that contributes to health and wellbeing. • Supports biodiversity. • Can provide cooling and shade. • Can improve air quality. • Reduces runoff for day-to-day rainfall. • Cleans runoff.

2.3 INCLUDING SuDS IN AND AROUND PARKS AND GREEN SPACE

The following diagrams show multiple SuDS features in cross-section and plan views. Many of these features such as rain gardens, ponds and wetlands can be installed individually and still provide significant benefits.

Figures 2.6 to 2.9 show how particular SuDS features can be used in and around green spaces and demonstrates how people may interact with them. The suitability of these features is outlined in table 2.1 and will depend on the site, as well as the benefits you are looking for.

The plans presented in figures 2.10 – 2.11 demonstrate the types of measures that can be integrated into parks and green spaces. It may not be possible in terms of space and budget to include all of the features included in the plans. However, these plans are to demonstrate what is possible and there will be benefit from embracing any of the individual features.

In a formal park setting (figure 2.10), it's helpful to consider how SuDS can complement and enhance the existing character and uses of the park. Features such as raised edges, geometric features and ornamental planting can all be incorporated to add visual interest and more opportunities for relaxation and play. Consideration could be given to how visible the SuDS features are, perhaps siting them in prominent locations to maximise benefits to both park users and passers-by.

With less formal green spaces or parks (figure 2.11), the SuDS features can be more naturalistic or rustic. Parks may contain existing features that have to be considered when siting SuDS features. In this example, runoff from parkland pathways is channelled into a play area where, together with runoff from the play area paths, it is used to create an adventure playground landscape with bridges over swales that will sometimes run with rainwater, a wetland area and basins between play zones.

By and large with retrofitting SuDS, the soft landscape offers the most cost effective solutions and greatest benefits.

Figure 2.6 SuDS feature connecting road to a swale (with a bridge) then a basin

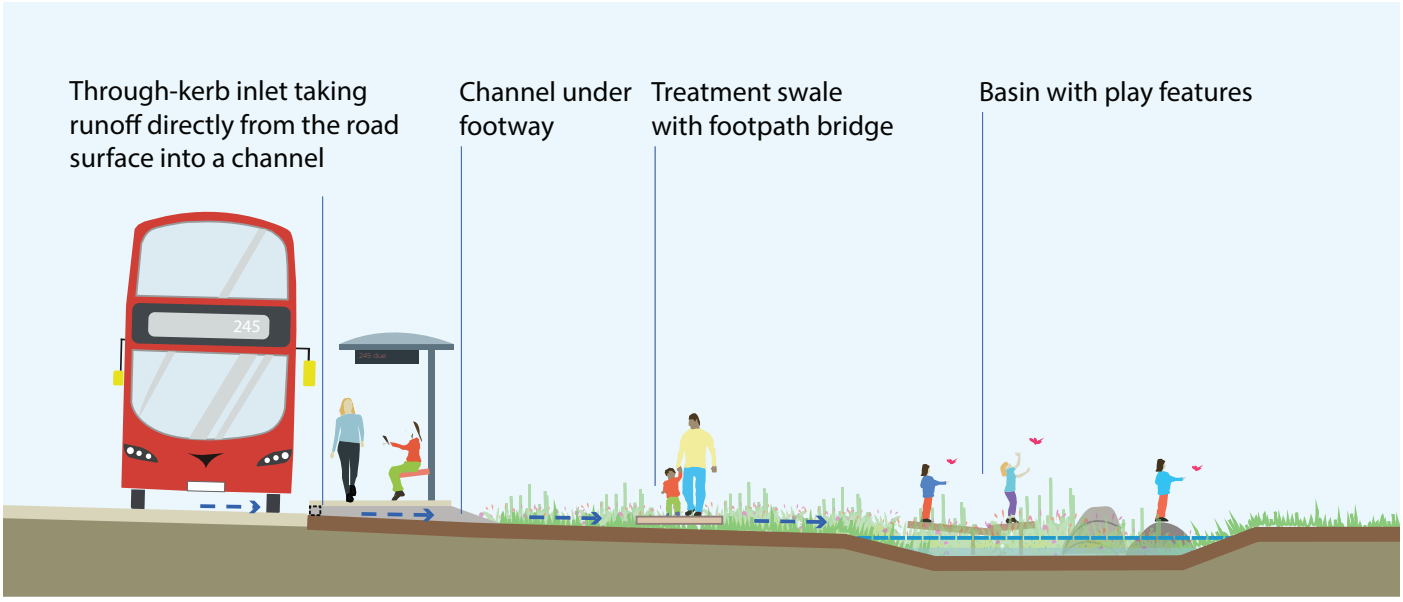


Figure 2.7 SuDS features with footpaths in parks and green spaces

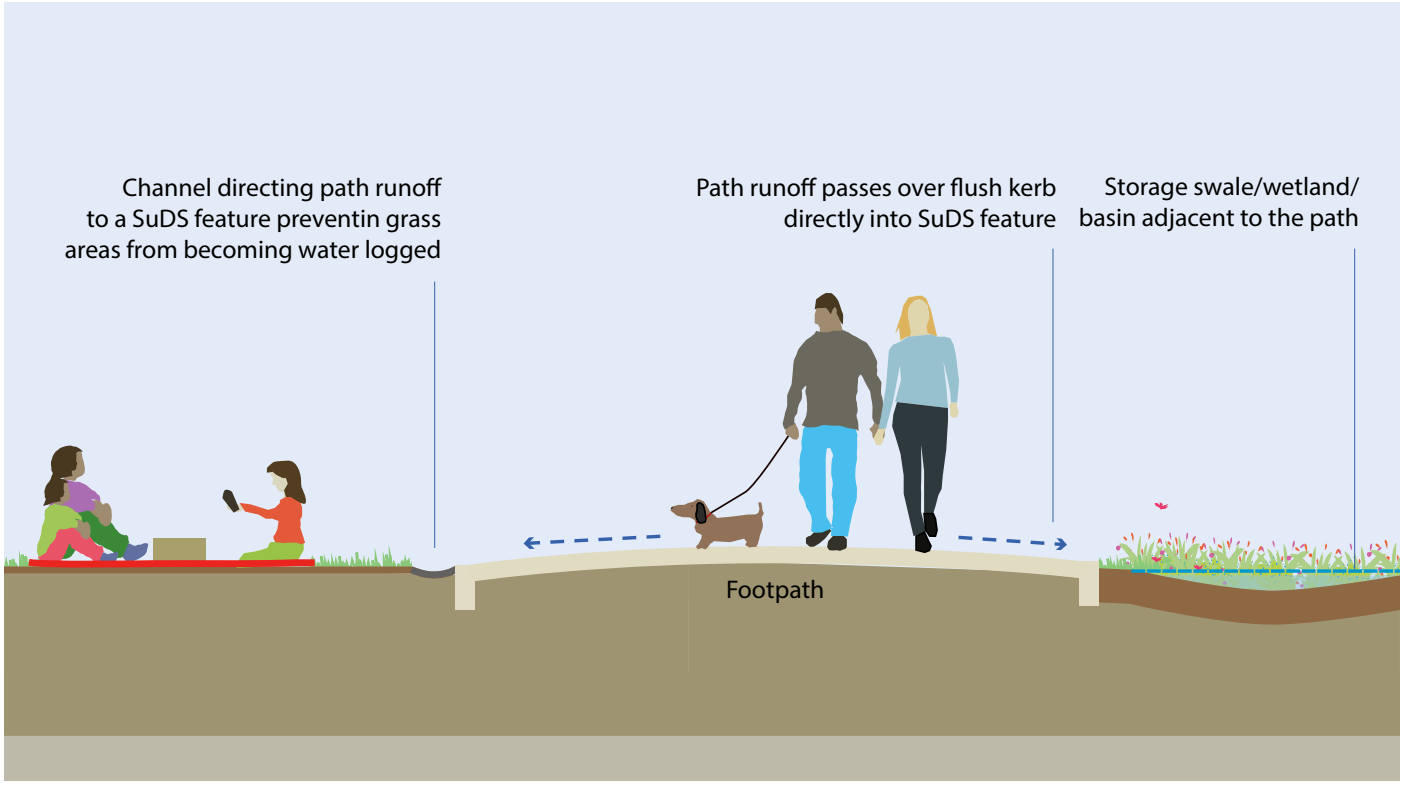


Figure 2.8 Integrating SuDS green space and buildings

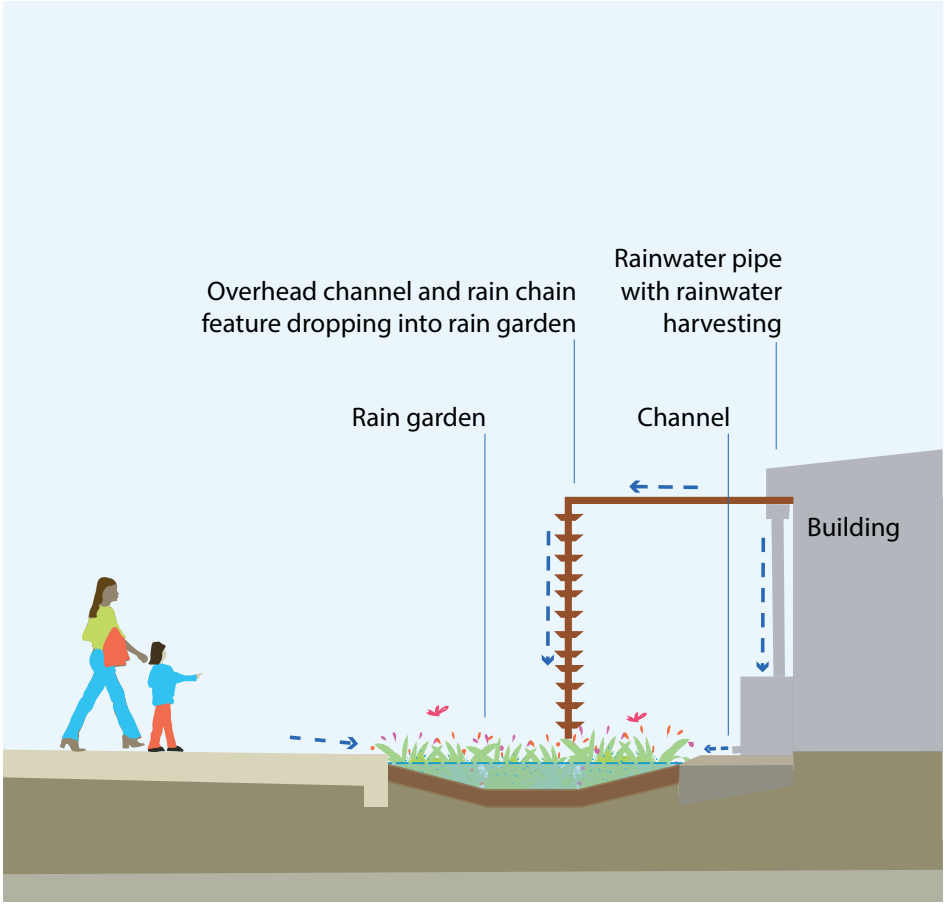


Figure 2.9 Car park and wetland

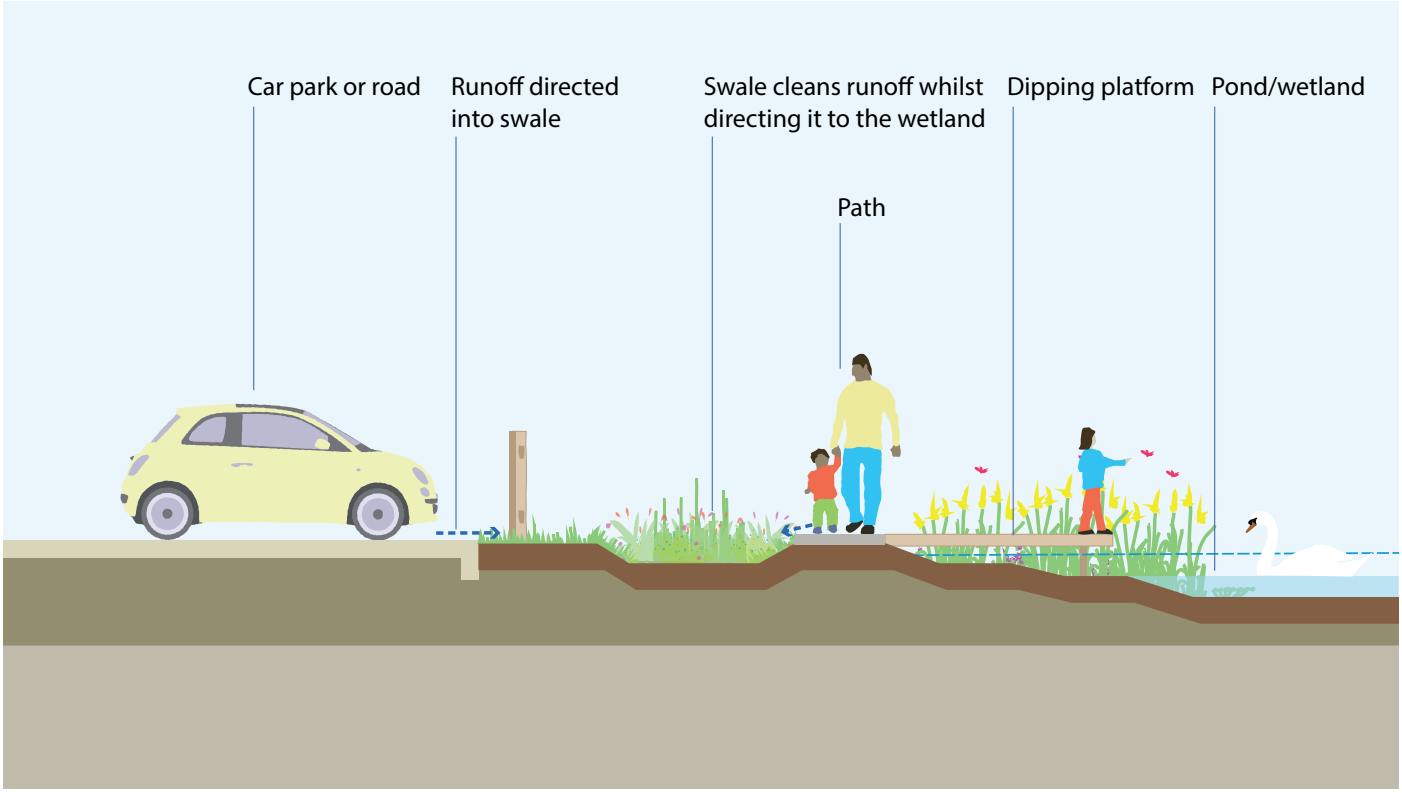
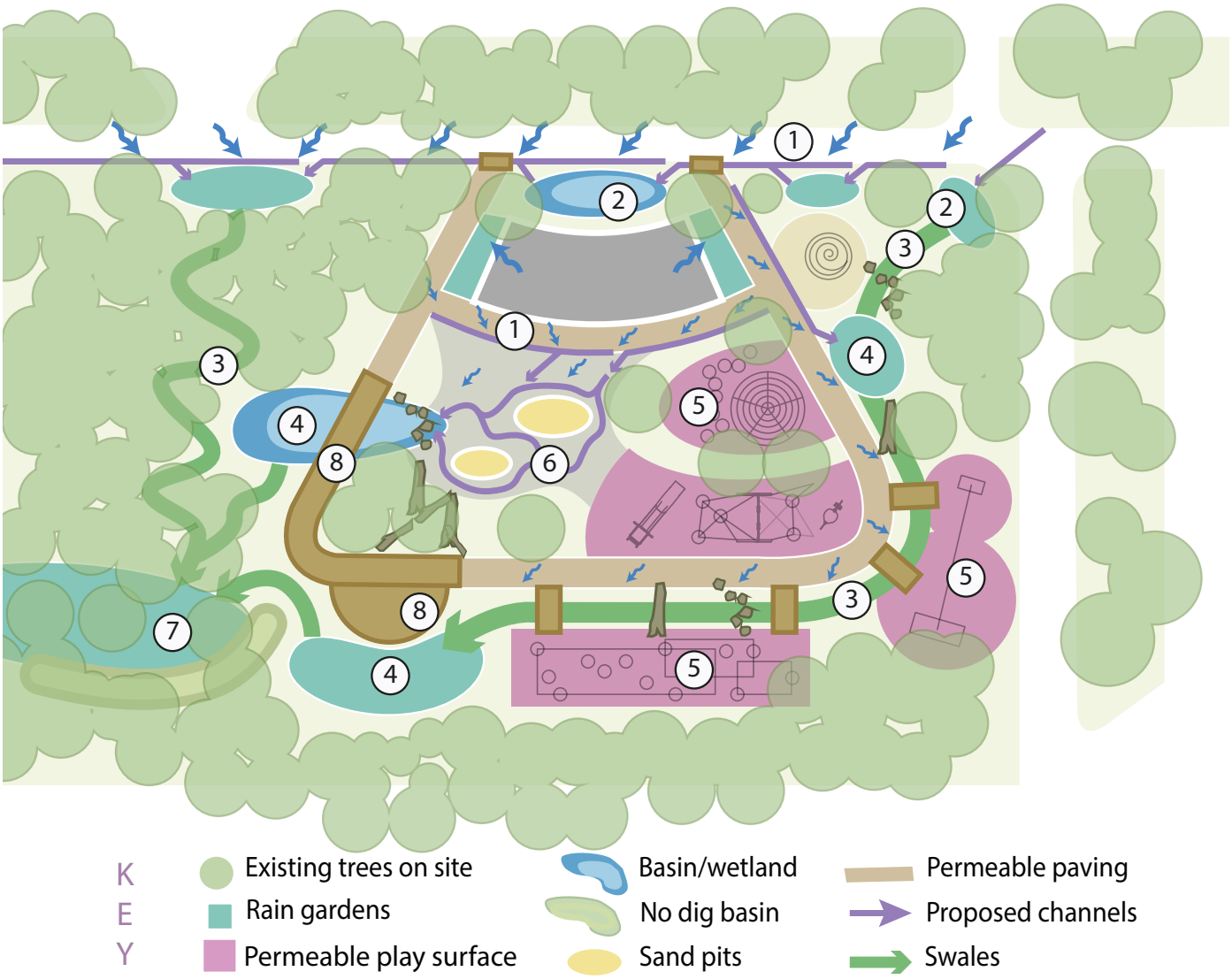


Figure 2.10 Concept for SuDS in park



1. Runoff from paths collected in channels leading to rain gardens or wetlands.
2. Rain gardens or biodiversity wetlands receiving path runoff.
3. Swales connecting SuDS features weaving between play zones or through woodland areas with briges and natural play crossings.
4. Shallow basins or wetlands managing heavy rainfall.
5. Play zones with permeable surfaces.
6. Meandering channels between sandpits are made playable using dams.
7. No-dig basin created in woodland area using excavated soil to form shallow berms to contain runoff in large rainfall events.
8. Deck and boardwalks to allow people to observe wildlife in the SuDS features.

Figure 2.11 Concept for SuDS in green space

1. Road runoff collected by through-kerb inlets and directed under the pavement in grated channels.
2. Rain gardens designed to provide the first stage of cleaning of pollution from the road.
3. Basin occasionally managing heavy rainfall, including biodiversity planting and playful features.
4. Road runoff collected by dropped-kerb inlets leading to rain gardens designed to provide the first stage of cleaning of pollution from the road.
5. Swales transporting surface flows from one feature to another, passing below bridges in paths.
6. Structural tree pits with paved surface designed to manage runoff from the surrounding paving.
7. Play surfacing can be permeable and slow down rainfall within the sub-surface layers.
8. Soil arising from the excavation of rain gardens and basins can be used to form berms and mounds to provide additional visual interest, play potential and definition of spaces.

3 Getting the best outcomes

3.0 GETTING THE BEST OUTCOMES

Obtaining engagement and buy in from colleagues, key decision makers, local community and businesses is one of the most important tasks in delivering SuDS. It should be one of the first activities undertaken as it helps develop a shared vision for the SuDS and helps dispel some misconceptions that people typically have about them.

Collaboration with local authority colleagues will be helpful when exploring solutions to challenges (particularly local flooding) and opportunities for SuDS delivery. Discussions between professionals who work in parks, highways, planning and flood risk management (Lead Local Flood Authority, LLFA) functions can help identify mutual benefits as well as whether they have the knowledge, expertise, equipment and funds to help deliver the schemes. In many circumstances using green spaces to manage flooding is likely to be cost neutral, or more cost effective than other interventions, like changing underground drainage.

Figure 3.1 Amenity space at Firs Farm

It is also important to engage with those who will be maintaining the SuDS and neighbouring infrastructure to ensure they are happy with the design and associated long term maintenance requirements for the potential SuDS features.

There are some inspiring examples of effective engagement when integrating SuDS in green space where the residents have helped with the design, planting and maintenance of SuDS in and around their area (→Firs Farm and Broomfield Park case studies).

To get the best outcomes it may be necessary to contact an experienced SuDS specialist, Landscape Architect or engineer early in the process. They should engage other relevant disciplines on your behalf if necessary, depending on the scale and type of SuDS required.

3.1 MAXIMISING THE VALUE FROM SUDS

Understanding the drivers, relevant Biodiversity Action Plans, management plans as well and potential funding requirements for the SuDS scheme helps to focus on what benefits are desired. This will also be informed by those likely to design and use the space. There are some common approaches to getting the best from SuDS, these should be discussed with those involved in designing the SuDS:

- Consider the context of the space surrounding potentially flood prone areas where the green space can be integrated into a SuDS approach.
- Start by looking at natural low points that collect water, or flow routes such as ditches in that parks and green spaces. These could be modified to increase the storage of water, or divert runoff into larger areas that can help manage flood risk as well as improve the biodiversity or amenity value by creating SuDS features. It may also be useful to consider the existing value of the

spaces in terms of biodiversity and use.

- Manage water on the surface as much as possible. It enables people to connect with SuDS and makes them easier and cheaper to construct and maintain. It also allows breakdown of pollutants by sunlight, vegetation and soil as well as encourages people's connectivity with water, planting and wildlife within the SuDS scheme.
- Manage rainfall as close to where if falls as possible. This ensures that flows through the SuDS features are treated and therefore safe and beneficial for wildlife and the local community.
- Ensure that appropriate safety is considered as part of the design process for SuDS features. This does not mean fencing them off. Integrate discussions about risks around water into the community engagement if necessary with emphasis placed on the depth and likely frequency of there being surface water.

Specific approaches to maximising benefits are discussed in table 3.1 and there is also guidance on overcoming some challenges you may face in table 3.3.

Table 3.1 Approaches to maximising the benefits

Category	Approach
Management and operation of parks and green spaces	• Consider whether funding opportunities and changes to park or green space will enable SuDS features to be cost effectively retrofitted. • Consider whether improvements to the green space can also provide flood risk and water quality benefits as this could unlock additional funds from different local authority functions or grant schemes to improve the park or green space. • Ensure the designers consider ease of construction and access for maintenance of SuDS features when planning and designing the SuDS. • Encourage designers to exploit natural gradients, flow paths and existing waterlogging to keep flows on the surface and thereby reduce overall costs of the SuDS (by reducing the need for excavation etc). • Make good use of community engagement and 'Friends of' groups to improve relationships with businesses and the local community. Celebrate the green space and the potential to improve the quality of places and spaces. • Consider approaches to actively involve and where appropriate develop the skills of the local community in the delivery and maintenance of SuDS features.

Table 3.1 Continued

Category	Approach

Amenity	• Work with the community to develop an inclusive strategy to engage with the them and users of the green space to run activities that raise awareness and celebrate the new green space they have.
	• Consider the inclusion of interpretation boards to inform users about the function of the SuDS features and how they will develop over time.
	• Consider the number, variety and quality of the uses of SuDS, such as recreation, play, dog walking, socialising, food growing, relaxing etc.
	• Consider multifunctional SuDS features that can:
	  • promote play and learning (e.g. by integrating natural play mounds, balance beams, stepping stones, etc.),
	  • provide shady areas
	  • be planted and managed by park users
	  • be integrated with areas for socialising and picnicking
	  • help support urban cooling (e.g. rain gardens)
	  • help improve urban air quality.
	• Ensure that safety is considered as part of the design process for SuDS features - reducing the need for fences
	• Consider how the SuDS feature and places will be used by the local community and people walking through the site.

Biodiversity	• Use appropriately vegetated SuDS features wherever possible. • Incorporate SuDS into the Biodiversity Action Plan. • Improve habitats for local wildlife by using the local authority's Biodiversity Action Plan to help inform the design. • Prior to runoff being drained into the areas designed for biodiversity ensure it is managed and clean. • Create diverse, attractive and connected habitats designed to attract wildlife.

Table 3.1 Continued

Category	Approach
Water quality and pollution	• Prioritise SuDS features that include vegetation and healthy soils to assist with the treatment of pollution. • Design SuDS features and the scheme to enable easy management and removal of silt and sediments can easily be managed e.g. forebays etc. • Ensure the designers consider risk of pollution including the groundwater and include the right type and right number of connected SuDS features.
Water quantity and availability	• Use surface water as a resource, allow it to be used to water gardens and green spaces. Rainfall should also be allowed to soak into the ground to help replenish underground aquifers. • Prioritise SuDS features that manage water at the surface (allowing water to soak into the ground, evaporate and transpire from plants) and discharge to watercourses in preference to drainage and sewer systems. • Include water harvesting (such as water butts, or rainwater harvesting systems) to reduce the dependency on mains water. • Consider where the water will flow during extreme rainfall or if there is a blockage in the system and design-in a flow path.

3.2 DELIVERING SuDS

The SuDS design should be tailored to the opportunities and challenges of the site as well as how the area will be used. As explained earlier, the effective engagement of stakeholders and early involvement of the right design team will provide the greatest chance for success in delivering cost effective SuDS.

Once you have decided that you would like a SuDS scheme designed for your site and have considered what you would like to achieve you should engage a SuDS specialist to talk about the process. This is likely to involve an initial consultation, the development of a concept design to test out ideas, sometimes an outline design to confirm the chosen option, detailed design to inform construction of features and then inspection of the construction work. During this process it would be useful to discuss how and when to engage with others, the likely costs and timescales involved as well as the timing of works to reduce disruption and ensure the best delivery, by for example avoiding earth movement and planting in the winter.

Figure 3.2 Play area at Holland Park

Image courtesy of Royal Borough of Kensington and Chelsea (Justin Thomas)

Table 3.2 Estimated costs for delivery activities

Activity	Estimated cost
Cost of initial consultation	£300-£1,200
Cost of design (scale dependent)	£3,000-£10,000
Construction of surface SuDS features in existing soft landscape	£20-£50/m^2
Construction of surface SuDS features in existing hard landscape	£50-£100/m^2
Permeable paving	£50-£70/m^2
Construction of largescale ponds and wetlands	£75-£150/m^2

It is difficult to provide an indication of total costs, as each site is likely to have specific requirements, opportunities and challenges however some estimates of costs are provided in Table 3.2. SuDS deliver benefits that may attract funding from other organisations (→ section 4). If potential funders request quantification of benefits your SuDS specialist can use a free tool called B£ST to provide this information (→B£ST resources).

3.3 DISPELLING THE MYTHS

SuDS features are different, rather than difficult when compared to traditional drainage approaches with their delivery and management being very similar to existing landscape practices.

Although widely and successfully used across the UK, misconceptions on SuDS can arise which should be challenged. Most concerns can be overcome with good design, effective engagement and education.

Examples of SuDS in parks and green spaces can be found in section 5 and also at → susdrain case studies.

Some potential misconceptions and responses, or solutions are presented in table 3.3. to help you navigate some of these challenges.

Table 3.3 Overcoming challenges or misconceptions for SuDS delivery

Misconception	Response
Safety **'Do SuDS have permanent water and can they be dangerous?'**	Good SuDS are designed to be safe and are frequently delivered in schools and other public areas. Unless a feature has been designed to permanently hold water, such as a pond or wetland, SuDS are dry most of the time except after heavy rainfall. Typically, SuDS are shallow, with gentle side slopes and controlled water flows. A risk assessment should be undertaken for the scheme which takes into account how the site will be used and by who. It is also important to consider the frequency of the SuDS features being full, the potential depth of water and ensure that water quality of accessible permanent water is managed by preceding SuDS features.

Table 3.3 Overcoming challenges for SuDS delivery cont.

Misconception	Response
Costs **'Are SuDS more expensive?'**	SuDS do not need to be more expensive than traditional drainage or landscape approaches. However, costs will be dependent on the site and the design. It is also important to consider the wider benefits that a high-quality SuDS scheme will deliver. The more that designs are integrated into green space, for example working with levels and ground conditions, the more cost effective they become. SuDS features such as planting, trees, permeable surfaces and play features should not be considered as extra costs if these landscape components would be provided anyway.
Maintenance **'Are SuDS difficult and expensive to maintain?'**	With most SuDS components being at, or near to the surface, monitoring performance and undertaking maintenance should be simpler than traditional (underground) drainage. Well designed SuDS can be easy to maintain with minimal, if any additional costs over a traditionally drained site. Those designing the SuDS features should provide a maintenance schedule that outlines the tasks and whether maintenance should be undertaken by SuDS specialists, or landscape maintenance teams, site managers, or members of the community. When choosing SuDS features, consideration should be given to both the day-to-day and long-term maintenance of the SuDS and whether they are appropriate and practical.

Table 3.3 Overcoming challenges for SuDS delivery cont.

Misconception	Response
Antisocial behaviour **'Will SuDS encourage anti-social behaviou and more nuisance?'**	Antisocial behaviour can include noise, alcohol or drug use and dog fouling. This should be considered through the design process as with any landscape design, considering 'Secured by Design' crime prevention and safety perception principles. When retrofitting SuDS into existing landscapes, consideration should also be given to promoting positive use of the landscape. By revitalising neglected communal spaces SuDS can help give the community a sense of pride and ownership of their environment. It is important that positive and meaningful community engagement is carried out so that the communities and businesses are supportive of emerging designs and the finished scheme. Where possible, involve the community and existing 'Friends of' groups in the construction and maintenance of SuDS features through planting days, construction skills training and weeding - if they truly feel that they have helped create the new landscape, they are far more likely to protect it from antisocial behaviour and vandalism and help keep it tidy.
Litter **'Will SuDS create more litter?'**	Soft landscape areas tend to collect litter because of the trapping effect of planting, however, corners in raised surfaces such as kerbs, edges and walls as well as sheltered spaces beneath seating also tend to collect litter. There are many factors that affect the amount of litter in our landscapes including the types of uses/activities, the amount of footfall and the number of litter bins. Studies have shown that spaces that look more attractive and cared for suffer less littering than unattractive, poorly maintained spaces.
Suitability of ground conditions **'If water cannot soak into the ground, or we have poor ground conditions can we use SuDS?'**	The ability of rainfall to soak into the ground (infiltration), the levels of the water in the ground, and potential soil contamination can influence the type of SuDS feature used, but will not prevent their use. SuDS do not need to soak runoff into the ground. It is quite common for schemes to use other ways to manage the runoff if clay and other factors stop or slow infiltration. This includes using flow control devices to slow the flows of runoff and allow it to be drained to a watercourse, surface water sewer - or combined sewer if neither of these is available.

4. Funding approaches

4. FUNDING APPROACHES

Including SuDS in green space and parks may unlock funds from different sources within local authorities and elsewhere. Sufficient funds and resources will be required to cover both the capital and maintenance costs of SuDS.

In some cases it is possible the funds for SuDS may be needed from multiple organisations. This is also where effective and early engagement can be helpful. Particularly within local authorities, other departments such as flood risk management, highways, planning and regeneration may be able to provide funds for SuDS and improvements to green space and parks. It may also be possible to alter the programming and approach to investment and annual maintenance to enable gradual implementation of SuDS features or SuDS principles.

It is well worth capturing the benefits of a SuDS scheme. Where the benefits are well understood and outweigh costs, the case for funding is more attractive. Some options for funding are presented in table 4.1.

Figure 4.1 Swale

Image courtesy of London Borough of Ealing

Table 4.1 Potential funding sources

Potential funding source	Comments
Local Authority	Those managing flood risk or regeneration may have opportunities to unlock funds from other sources (e.g. Section 106 Agreements and Community Infrastructure Levy). They may also be able to provide links to other Council funding pots, that may benefit from delivering SuDS such as community greening initiatives, highway maintenance as well as external partnerships and funders. If appropriate the Local Authority may also support a grant application for Central Government funds related to flood risk management. This is best discussed with the Local Authority's Flood Risk Manager.
Greater London Authority (GLA)	The GLA occasionally provides grants for delivering greener communities and improving green spaces. The funding opportunities are often time limited so for 'greening' projects look at https://glagrants.org.uk/ for further information.
Thames Water	Thames Water is setting up a fund (for 2020-2025) to improve surface water in their catchment, this specifically includes SuDS. Funding decisions will be based on the site and the potential social and environmental benefits of the proposed scheme. For further information contact swm.partnerships@thameswater.co.uk or contact your Local Authority's Flood Risk Manager.
Local Wildlife Trusts **Local River Trusts**	Wildlife and river trusts may occasionally have access to funds and partners from the private sector that may be interested in supporting the delivery of SuDS in communities, particularly if they also deliver some of their remit too.
Other groups	Third sector organisations and charity organisation with aligned drivers (health and wellbeing, improving communities etc) like the National Lottery Heritage Fund, and possibly private sector organisations (e.g. Biffa Award) may be interested in supporting SuDS if the benefits for their interests (like community and/or biodiversity) are clearly stated.

5 Case studies

HOLLAND PARK ADVENTURE PLAYGROUND

ROYAL BOROUGH OF KENSINGTON AND CHELSEA

The adventure playground was extensively redesigned in 2018/19. Previously the playground suffered drainage problems and waterlogging.

Topography of the site splits the playground into two sub-catchments. The majority of play surface is permeable and stores runoff within its structure. Any remaining flows are directed into a series of shallow swales and basins. In other parts of the site surface water runoff is collected from impermeable footpaths via granite channels and swales and directed into two shallow basins.

Most of the runoff will soak into the ground. Within the western part of the site, roof water from the ecology centre as well as runoff from impermeable footpaths is collected via granite channels and allowed to soak into the ground. Any remaining flows are stored within a planted wetland and are slowly released into the existing ditch.

Benefits include:

- Encourages children to interact with natural environment and inspires curiosity in the water cycle and ‘rainplay’
- Provision of new wetland habitat
- Inclusion of attractive planting and biodiversity beneficial to insects and birds.
- Reducing the flows and amount of surface water runoff running into drainage system.

Overall project size: 4150m^2

Area of SuDS features: 1500m^2

Total cost: Around £1.2 million

Images courtesy of Royal Borough of Kensington and Chelsea (Justin Thomas)

GROVELANDS PARK WETLANDS

LONDON BOROUGH OF ENFIELD

The Grovelands Park Wetlands are set in a wooded area of the park. Two surface water sewers were intercepted to create a wetland system.

Day to day low flows and the first flush (the most polluted water during a rainfall event) are brought through planted swales into the wetland basin for cleaning. Water soaks into the ground or, during prolonged wet weather, the basin fills and overtops a weir to discharge to the stream at the bottom of the valley.

A new length of boardwalk was created to allow better access to the wetland. The project was developed by the Council in consultation with the community and the 'Friends of Grovelands Park'.

Benefits include:

- Significantly improved water quality.
- The wetland basin attracts widlife.
- Reduction in local and wider flood risk.

The scheme includes swales and Wetlands. The project was funded by the London Borough of Enfield, Defra, Environment Agency and Thames Water.

Project size: 2000m^2

Cost:

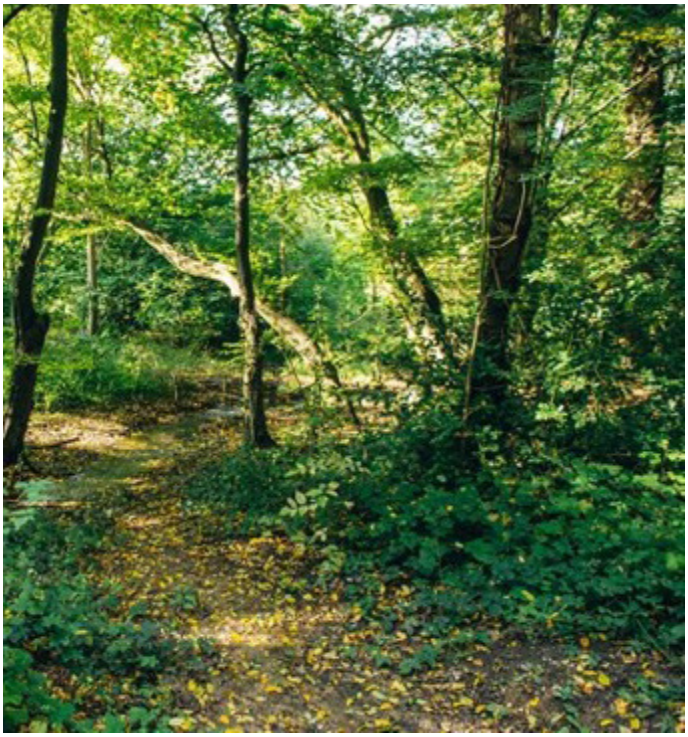
Wetland £40,000

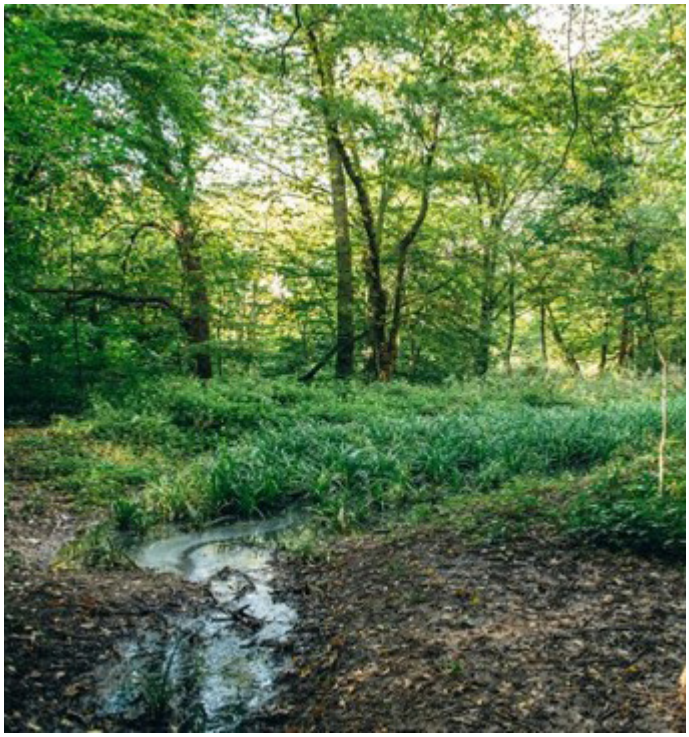
Daylighting stream £30,000 and associated flood defences £60,000

Reedbed £15,000

See further information here

Images courtesy of Thames21





FIRS FARM WETLANDS

LONDON BOROUGH OF ENFIELD

Firs Farm Wetlands is a public open space and park which is owned and managed by the London Borough of Enfield. Prior to the project, this area of Firs Farm Playing Fields was an underused open space that offered little value to local residents.

The scheme involved daylighting the 'lost' Moore Brook, previously contained in an underground concrete channel (culvert) which flows via Pymmes Brook to the River Lea. It also receives flow from surface water sewers reducing pressures on local sewer capacity.

Benefits include:

- Reduction in local and wider flood risk.
- Management of water pollution.
- Enhanced biodiversity and wildlife (particularly birds).
- Provides a vibrant and well-loved public space used by the community and local schools.
- Improved community cohesion with the formation of a 'Friends of the Park' group who undertake events and maintenance.

The SuDS features include wetlands, a pond, permeable surfaces and a channel that enables the breakdown of pollutants in runoff. Funding came from multiple partners including the London Borough of Enfield, Thames Water, Greater London Authority, Transport for London (cycleway) and the Environment Agency.

Project size: 4500m^2

Cost: Around £1 million

See here for further information

PRIORY ROAD RAIN MEADOW

LONDON BOROUGH OF HARINGEY

Priory Road had been identified as an area of high flood risk in the Surface Water Management Plan with properties at risk of flooding and it provide a potential route for flooding. It is also close to the Moselle Brook, one of London's lost rivers and suffering from water pollution.

The project was designed to divert runoff from a busy road (A504), footways and associated drainage to reduce the risk of surface water flooding and improve the quality of green space. This project has also enhanced the quality of the urban streetscape through the series of SuDS features integrated with street furniture.

Benefits include:

- Creates a high-quality streetscape which is highly valued by the local community and business.
- Slows the flow of runoff entering the drainage and sewer system during heavy rainfall.
- Manages surface water flood risk in a high-risk area.
- Reduces the risk of polluted runoff entering the River Moselle
- Improves community cohesion by facilitation a "Friends of" group that connects the community to the local enivronment and water cycle.
- Delivers a valued educational resource to five local schools.

The main SuDS features include swales, basins, rain gardens and landscaped mounds. Swales convey water between the basins and rain gardens. Funding was from the GLA, Environment Agency and Thames 21

Project size: 675m^2

Cost: Around £43,000

NEWTON PARK, HARROW

LONDON BOROUGH OF HARROW

Rivers in London have low flows in dry weather and then fill very quickly with surface water runoff during subsequent heavy rain. This surface water carries silt and pollutants into the rivers and damages river health and the park amenity.

Newton Park was rundown and not well used by the local community before the project to manage flooding and restore the river. This has transformed the area and delivered multiple benefits for the park and its users.

More than managing flood risk the introduction of constructed wetlands reusing material from the site for log walls, earth bunds combined with new planting to create new wildlife habitats, environmental and amenity improvement.

Benefits include:

- Reduced local flood risk.
- 200m of river restored.
- Improved water quality throughout the park.
- Improved amenity value with better access.
- Provided habitats and increased biodiversity through the use of wetlands, log walls and planting native wildlfowers.
- An engaged local community with a new park user group and volunteer involved in maintenance.

Four wetland areas were created, covering 2000m^2. The river is diverted through the wetlands containing reed beds which clean the runoff before it returns to the river.

Partnership was essential to delivery of the scheme, the partners were: Harrow Council, Environment Agency, Thames Water, Thames 21, Harrow Green Grid and the Crane Valley Partnership.

More details are in this short video

Project size: 2000m^2

Cost: Around £400,000

'It's something that I've really enjoyed being part of and it shows what can be done when everyone comes together'

Managing Director of contractor

Images courtesy of London Borough of Harrow

RECTORY GARDENS SUDS SCHEME, HIGH STREET

LONDON BOROUGH OF HARINGEY

Rectory Gardens had been identified as an area of high flood risk in the Surface Water Management Plan with properties at risk of flooding and as a potential route for flooding.

The aims of the project were to reduce the risk of flooding and reduce the amount of rainwater entering sewers. Polluted runoff from Priory Road is treated in two separate systems, with their own areas that manage and clean the runoff, before being slowly released to the river Moselle.

Day to day rainfall is managed in wildflower play areas. Play features such as balance beams and islands sit above colourful native planting providing a cost-effective means of encouraging wildlife and play into the scheme.

Benefits include:

- Slowing the flow of rain entering local sewers, reducing surface water flood risk.
- Improving the amenity value of the site.
- Managing the quality of runoff discharge into local watercourses.
- Creating a high-quality multiple use streetscape.

The main SuDS features include a series of swales, rain gardens and mounds. The mounds reduce the surface water flow, the wooden bridge and balance beams are included as play features. Funding was secured from the Environment Agency and Thames 21

Project size: 650m^2

Cost: Around £71,000

'Where everyone works together from the start a well-designed, well-maintained SuDS can make a real difference- controlling dirty flash floods in the street and brightening up a neglected open space'

Friends of Rectory Gardens, N8

Images courtesy of London Borough of Haringey

CRESCENT GARDENS SUDS PROJECT

LONDON BOROUGH OF HARINGEY

SuDS features were retrofitted to the green space in Crescent Gardens. This improved the attractiveness and usability of the park while also helping to collect and clean runoff from nearby roads. This reduced the risk of flooding and pollution of local rivers. Visually interesting and interactive features are included in the design of the SuDS scheme.

Benefits include:

- Reducing surface water flooding both locally and in the drainage network.
- Enhancing a public park and improving the quality of the environment.
- Provision of public place making that promote people's health and wellbeing.
- Improving the amenity value of the site.
- Managing the quality of runoff discharge into local watercourses.
- Creating a high-quality multiple use streetscape.

The main SuDS features include a series of rain gardens, circular basins, swales and meadow style planting. Swales convey water between the basins and rain gardens. Funding was from Haringey Counci's Drainage Capital Funding.

Project size: 9400m²

Cost: Around £200,000

Image courtesy of Robert Bray Associates

BROOMFIELD PARK WETLANDS

LONDON BOROUGH OF ENFIELD

The existing surface water sewer running through the park drained an urban area of approximately 40 hectares. The wetland captures surface water from this area and removes pollutants before discharging to Pymmes Brook, a tributary of the Lower Lea, one of the most polluted river catchments in the UK.

The surface water drainage system was diverted to a new constructed wetland within a well-used park to fit into the existing parkland setting. The wetland was delivered with the full support of the parks Friends Group, with planting events attended by them, the general public and donor organisations' staff.

Benefits include:

- Flood storage with a capacity of 3,250m^3
- Improved water quality and mitigating the harmful impact of urban diffuse pollution.
- Creation of a new space within an existing park with improved opportunities for recreation, connecting with the local environment, education and community involvement and volunteering.
- Improvements to biodiversity and creation of new natural habitats.
- A planting programmed and maintenance plan which includes involvement of local groups and organisations.

The project was delivered by the London Borough of Enfield with the support of Thames21 and the Rivers Trust. The project was carried out using funding from the 'replenish programme' which is a global fund from Coca-Cola Foundation and WWF

Project size: 1350m^2

Cost: Around £150,000

'This fantastic project ticks all the boxes with regards to increasing biodiversity, improving water quality, addressing flood risk and, of course, tackling climate change. It has already established itself as a key local amenity and will bring immense benefit to the area'

Daniel Anderson, Local Councillor

Images courtesy of London Borough of Enfield

ISLIP MANOR PARK,

LONDON BOROUGH OF EALING

The central area of the park suffered from regular localised flooding in winter months. Ealing Council's parks and highways officers worked together to develop designs for a chain of naturalistic swales and shallow pools. An old backfilled ditch was re-established alongside the main entrance path directing overflow water from the swales down to two large attenuation tanks concealed below raised planting beds either side of the park's main gates. A fifth swale is planned to mitigate another area of flooding. New, native and nectar-rich plants, shrubs, meadows and standing water are attracting diverse bird and insect species including flocks of goldfinches and several varieties of damselfly and dragonfly.

Benefits include:

- Attenuation and cleaning of surface water before it is discharged into the drainage system.
- System manages seasonal flooding of park footpaths and shopping parade pavement.
- Rain planter creates a feature and talking point at the park entrance rather than being hidden underground.
- Mown grass 'desert' was replaced with species-rich meadows and seasonal standing water all of which provide new habitats for local wildlife.
- Swales provide opportunities for local people and especially for children to explore and interact with water and nature.

Project size: 900m^2

Cost: Swales system £20,000, attenuation tanks and associated path works £16,000

Images courtesy of London Borough of Ealing

LAMMAS PARK,

LONDON BOROUGH OF EALING

Four ponds and channels were created to redirect and store water from a surcharging surface water sewer which was flooding part of the park and blocking a path. The ponds are all linked together by swales with check dams and stepping stones separating them and providing crossing points. Eventually the ponds will also be connected to a nearby road junction which is prone to flooding. To enhance the wildlife value of the ponds and add interest the surrounding area has been converted to meadow. The whole feature is currently 146m long.

A future phase will see the complex being further extended to create a flood storage area, once complete the whole feature will be 500m long which is almost the full length of the park.

Benefits include:

- The site has a range of wetland and meadow habitat types that greatly enhance local biodiversity.
- Encourages interaction and play with the natural environment and inspired curiosity in the water cycle.
- Reducing the amount of surface water runoff running into drainage system, managing local flooding and allowing more water to soak into the ground.
- Helping to clean water discharge.

SuDS features included in the scheme were ponds and swales integrated within a meadow.

Project size: 1000m^2

Cost: Around £50,000

Images courtesy of London Borough of Ealing

Before

After

Main pond in summer

Ponds and swales in the winter

6. FURTHER GUIDANCE

- GLA SuDS sector guidance. Web link
- GLA - Parks and green spaces. Web link
- CIRIA - susdrain website. Web link
- Graham, A, Day, J, Bray, B, Mackenzie, S. (2012) Sustainable drainage systems – maximising the potential for people and wildlife. RSPB and WWT. Web link
- Woods Ballard, B, Wilson, S, Udale-Clarke, H, Illman, S, Scott, T, Ashley, R, Kellagher, R. (2015). The SuDS Manual, CIRIA C753, London (ISBN: 978-0-86017). Web link

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