

MAYOR OF LONDON



**Reimagining rainwater
in the office sector**

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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.

Improving our existing buildings and landscapes creates better places for people and nature. Sustainable Drainage Systems, or SuDS, can contribute to this and are widely accepted as a better approach to managing rainfall than traditional drainage. SuDS help to deliver beautiful spaces and places through increasing biodiversity, improving places to work and reducing risks of waterlogging, local flooding and water pollution. This helps provide greater resilience and respond to the climate and ecological emergencies we are facing.

Figure 1.1 Retrofit rain garden in Westminster

Image courtesy Victoria BID

1.1. PURPOSE OF THIS BOOKLET

This document explains SuDS and their role in creating better places to work, enabling readers to make informed decisions about their inclusion. This document is designed for those operating and managing offices and associated landscape, making decisions on the quality and upkeep of premises and the surrounding estate as well as managing opportunities for expansion and refurbishment. This potentially includes landlords; property and estate managers; sustainability managers and facility managers.

Business Improvement Districts that have an interest in greening commercial areas may also find this document useful to understand how buildings and landscape can better integrate rainwater and create attractive places and spaces for businesses, employees and the wider community.



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. 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 around offices are presented in table 2.1. These include rain planters, rain gardens and swales. Where it is not possible to manage water at the surface or in green features permeable paving and car parking, green/blue roofs, green walls, or if necessary underground storage tanks can also be used to manage runoff. Rainwater harvesting can also use surface water runoff, reducing

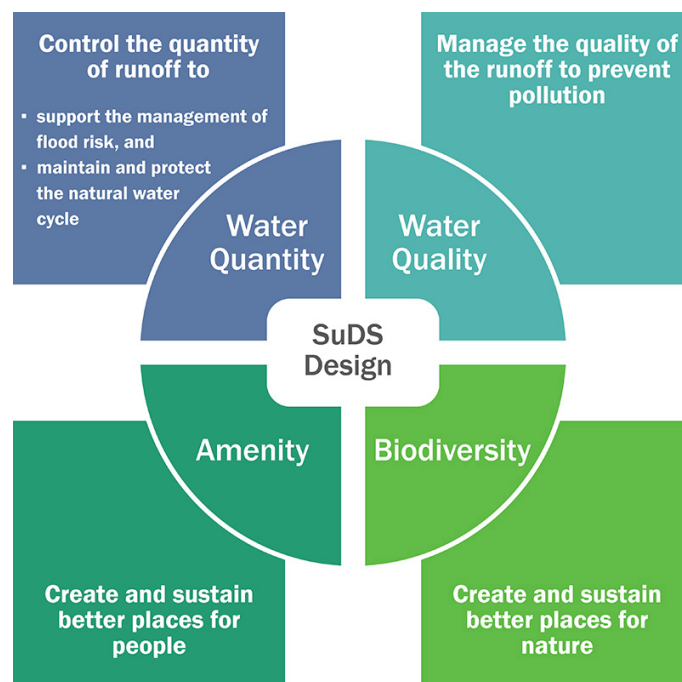
local flood risks and the amount of mains water used for watering gardens and flushing toilets.

SuDS can be inexpensive to design, build and maintain. The SuDS approach includes simple changes, like diverting a rainwater downpipe into a rain planter (→ table 2-1) and other approaches where runoff soaks into the ground. 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 national planning requirement since 2015 and are prioritised in the London Plan. Many new commercial developments have included SuDS on, and around their property.

The SuDS approach is not new and is no more difficult than traditional drainage, it is just different. Case studies of successfully retrofitted SuDS are included in Section 5 of this document. The [susdrain website](#) also includes over a hundred case studies or award submissions where SuDS have been successfully delivered.

Figure 2.1 The four pillars of SuDS



2.1 WHY USE SuDS TO MANAGE RAINWATER?

SuDS offer a fantastic opportunity to improve the quality of the office estate by connecting people to nature and providing views of attractive green spaces. As a consequence of COVID-19, access to green spaces and high-quality public realm in office areas has become more valued. The quality of outdoor space close to work is becoming more important in providing a calm place where employees can rest.

There is substantial research linking green features and better connectivity to nature to improved health and wellbeing (Sharp et al, 2020). Green and lush spaces welcome and attract businesses and employees, improving productivity and reducing stress. SuDS are an integral part of greening our existing buildings and spaces and can be particularly effective in adapting and responding to the challenges posed by climate change, urbanisation and poor water management.

Well-designed SuDS provide more benefits and are often cheaper than traditional approaches to drainage and landscaping. SuDS can be

easy to maintain, often requiring little more than standard landscape maintenance which in most instances can be undertaken by site managers or existing landscape contractors.

Offices and business parks have many opportunities for retrofitting SuDS (with green/blue roofs, permeable paving) as they often have large roofs and in some parts of London car parking with impermeable surfaces which generate significant amounts of surface water runoff.

Using SuDS to manage rainfall delivers exciting opportunities and a range of benefits for the office sector that include improvements for:

- Office operations and management – improving performance
- Spaces and places for people – amenity
- Spaces and places for nature – biodiversity
- Managing water quantity – flooding and water availability
- Managing water quality - pollution

Figure 2.2 Rain garden in council offices

Image courtesy Robert Bray Associates



2.1.1 Office operations and management – improving performance

Effective rainwater management that integrates attractive blue and green spaces increases rental and property values by 7% and 9.5% (respectively) (Winch et al, 2020).

Retrofitting some SuDS features into buildings and providing views of nature and green spaces can improve the wellbeing, attention and productivity of staff. Exposure to nature through green features can also reduce sick leave and staff turnover (Winch et al, 2020).

Some SuDS features reduce costs associated with energy use (for heating and cooling) and mains water use. For example, green roofs and green walls can provide 7% and 15% (respectively) in energy savings associated with cooling spaces directly below, or behind these features (Winch et al, 2020). An 850 m² green roof retrofitted in Canary Wharf was estimated to save up to £4,000 - £5,000 per year in electricity (figure 2.4) and was potentially a better investment option than a traditional bare roof (GLA, 2008).

By improving resilience to the risks of climate change SuDS can assist with organisations' responses to the Task Force on Climate-related Financial Disclosures (TCFD) recommendations ([see the website](#)). These encourage organisations to demonstrate how physical climate related risks (such as flooding and drought) are being managed, together with setting out a transition to low carbon processes and technology.

The integration of green features like SuDS into buildings and associated estates can provide reputational benefits for organisations. The positive contribution of SuDS can make them an important differentiator recognised by the public, industrial awards and buildings sustainability accreditation schemes, like BREEAM. SuDS can contribute to an organisation's Corporate Social Responsibility, by improving its impact

on the environment, and its facilities for tenants, employees and the wider community. This also supports longer term environmental, social and governance (ESG) performance.

Operationally SuDS can be readily integrated within the capital and maintenance investment programmes of those managing offices and business parks. Features like green roofs and green walls can prolong the life of other assets by protecting building components from the elements (e.g. a green roof can extend the life of a flat roof by an average of 23 years) (Winch et al, 2020). SuDS (especially those on the surface) can be easier to maintain when considered within existing landscape design and maintenance activities.

Figure 2.3 Permeable parking at new build office

Image courtesy Robert Bray Associates



2.1.2 Spaces and places for people – amenity

SuDS features that include plants, and/or manage rainfall on the surface provide attractive desirable new spaces, or revitalise underused areas by enabling people to relax, socialise and play during and following their working day. They can provide sensory and healthy green spaces that improve the quality of life for people who can see them or spend time within them.

Green features on, or within buildings, particularly offices, can provide a fantastic venue for meetings, events and corporate hospitality. During the pandemic ‘pop-up’ pocket parks and meeting spaces are becoming more common as people, offices and restaurants make greater use of outdoor space.

There are also examples where SuDS support opportunities to improve employee welfare and promote healthier lifestyles. Initiatives include the provision of food growing, urban horticulture and even beehives producing honey for office buildings. Programmes to refurbish cycle stores, and other shelters can integrate SuDS locally and improve facilities. There may also be opportunities to improve outdoor spaces to encourage employees to get away from desks during lunchtime. Companies that integrate sustainability initiatives like SuDS can be more attractive places to work, particularly if employees are actively engaged in the planning, design and use of the spaces.

SuDS can also help manage extreme temperatures, that impact energy use and the wellbeing of people in buildings. In the summer trees cool neighbouring buildings by providing shade from the sun, and SuDS features on, or around buildings (e.g. green roofs, or rain gardens) help cool through evaporation (from surface water) and transpiration (from plants and soil). In winter they provide a layer of insulation. These types of features provide a healthier and more comfortable temperature in both the summer and winter and reduce the impacts of climate change.

By absorbing, filtering and dispersing harmful airborne pollutants from traffic and industry, SuDS features can also improve local air quality. They also help absorb and reduce noise from traffic etc, with green SuDS features capable of reducing noise by between 4 and 46 decibels (Winch et al, 2020).

Figure 2.4 Retrofitted green roof at Canary Wharf

Image courtesy Dusty Gedge



2.1.3 Spaces and places for nature - biodiversity

SuDS features deliver important urban wildlife habitats and plants that encourage invertebrates, birds, bees and other pollinators (figure 2.5). Designing green features to promote biodiversity, will also improve rainwater management. SuDS can help combat the decline in biodiversity (i.e. the ecological emergency), contribute to the delivery of Biodiversity Net Gain (in new build or refurbishments) and many of the outcomes included in corporate and local Biodiversity Action Plans.

Figure 2.5 Retrofitted green roof with bug hotels

Courtesy Bridgman & Bridgman



2.1.4 Managing water quantity – flooding and water availability

The frequency and severity of localised flooding is increasing as a result of urbanisation and climate change. SuDS slow the flow and reduce the amount of surface water runoff that can cause flooding in our towns and cities. SuDS enable a once waterlogged footpath or car park to be more accessible and useable. SuDS also reduce the impact of rain entering our drainage and sewerage systems, which in many parts of London is easily overwhelmed. This can often trigger overflows of sewage into our streams and rivers (creating pollution), and worse still cause homes and businesses to be flooded by sewage.

Some SuDS features also allow water to soak into underground aquifers helping maintain water supply and the flows in rivers and streams in periods of dry weather. Offices with large roofs to collect rainwater and with high water demand for toilet flushing are ideal for rainwater harvesting systems that can collect, treat rainwater and supply water for toilet flushing and garden watering. As well as helping to manage bills, reducing water usage can help manage local water resources and adaptation to climate change.

2.1.5 Managing water quality – pollution

Some offices and business parks have car parks which, runoff from which picks up pollutants. 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 and local environment through filtration and break down of pollutants by the sun, potentially reducing pollution in our surface water runoff by up to 90%. Where SuDS reduce the amount of rainfall entering drainage and sewerage systems they also reduce overflows of polluted water into watercourses. This can improve the quality of water and biodiversity in our streams and rivers.

2.2 SuDS FEATURES FOR OFFICES

The SuDS approach includes a ‘toolkit’ of various SuDS features, offering different benefits that can be used at different scales and budgets.

Not all SuDS 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. These have been ordered on the basis of ease of delivery (easiest first), i.e. overall level of disruption caused, ease of construction, likely costs and the potential value.

Table 2.1 SuDS features


	SuDS feature	Benefits
 <p data-bbox="97 1585 459 1619">Image courtesy Dusty Gedge</p>	<p data-bbox="619 1093 906 1126">Green or blue roof</p> <p data-bbox="619 1155 999 1547">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.</p> <p data-bbox="619 1592 1023 1704">A blue roof captures more water to slow the flow and reduce the volume of runoff.</p>	<ul data-bbox="1086 1099 1481 1917" style="list-style-type: none"> • Supports biodiversity. • Can provide cooler buildings in the summer. • Can prolong the lifespan of a flat roof. • Cleans roof runoff. • Improves efficiency of solar panels on the roof. • Reduces runoff for day-to-day rainfall. • Can improve air quality. • 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
 <p data-bbox="108 763 437 792">Image courtesy Gary Grant</p>	<p data-bbox="612 405 943 443">Rainwater harvesting</p> <p data-bbox="612 483 1007 875">Rainwater from roofs and impermeable surfaces can be stored and used in and around buildings. This can range from simple water butts to more comprehensive systems that harvest and provide non-mains water for garden watering and toilet flushing.</p> <p data-bbox="612 920 1034 1111">Rainwater harvesting can slow the flow of runoff, reducing the amount of water that is released to drains or other SuDS features.</p>	<ul data-bbox="1082 394 1469 696" style="list-style-type: none"> • Reduces runoff for day-to-day rainfall. • More sophisticated systems can be used to manage heavy rainfall. • Reduces mains water usage.
 <p data-bbox="108 1559 580 1588">Image courtesy Robert Bray Associates</p>	<p data-bbox="612 1193 804 1232">Rain planter</p> <p data-bbox="612 1272 1038 1424">A raised planter with the ability to collect and soak roof runoff into soil and drainage layers in the planter.</p> <p data-bbox="612 1469 963 1704">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.</p>	<ul data-bbox="1082 1182 1465 1697" style="list-style-type: none"> • 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.

Table 2.1 continued

	SuDS feature	Benefits
 <p data-bbox="97 808 596 1010">Image courtesy Robert Bray Associates</p>	<p data-bbox="596 376 1066 436">Rain garden</p> <p data-bbox="596 436 1066 660">A small planted basin, typically designed to receive runoff from roofs or hard surfaces.</p> <p data-bbox="596 660 1066 1010">The water can be directed to the rain garden using pipes or rills.</p>	<ul data-bbox="1066 376 1493 1010" style="list-style-type: none"> • Highly visual and attractive feature. • Easily incorporated into small green spaces which are fairly close to buildings. • With appropriate planting supports biodiversity. • Effectively cleans runoff. • Reduces runoff for day-to-day rainfall.
 <p data-bbox="97 1413 596 1541">Image courtesy DSA Environment & Design</p>	<p data-bbox="596 1010 1066 1108">Permeable or pervious surfaces</p> <p data-bbox="596 1108 1066 1541">Hard surfaces that can support vehicles (including ambulances), which also allow rainwater to soak into the ground, or into underground storage to slow the release of runoff.</p>	<ul data-bbox="1066 1010 1493 1541" style="list-style-type: none"> • Good range of attractive product types available. • Enables use of surface for footpaths, courtyards or parking. • Cleans runoff. • If designed appropriately can help cool local area.
 <p data-bbox="97 2018 596 2132">Image courtesy Green Blue Urban</p>	<p data-bbox="596 1541 1066 1624">SuDS tree pits</p> <p data-bbox="596 1624 1066 1937">SuDS tree pits can be used on their own or integrated into other SuDS features like rain gardens, wetlands etc. Existing tree pits can also be adapted to manage surface water.</p> <p data-bbox="596 1937 1066 2132">The tree canopy intercepts rain and trees also draw up large amounts of water through the soil.</p>	<ul data-bbox="1066 1541 1493 2132" style="list-style-type: none"> • 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. • Can be used as part of traffic calming.

Table 2.1 continued




	SuDS feature	Benefits
 <p>Image courtesy Illman Young Landscape Design</p>	<p>Filter drain</p> <p>A stone-filled trench that collects runoff from hard surfaces (road or car park) to clean and transport it.</p> <p>It can include a perforated pipe to slow the flow and enable runoff to soak into the ground.</p>	<ul style="list-style-type: none"> • Effective where space is limited. • Collects, cleans and transports runoff to other parts of the site.
 <p>Vegetated swale</p> <p>Image courtesy Robert Bray Associates</p>  <p>Grassed swale</p> <p>Image courtesy North Bristol NHS Trust</p>	<p>Swale</p> <p>This is a shallow, flat bottomed ditch with gentle sloping sides.</p> <p>They can be used to transport water from one part of the site to another, or to temporarily store runoff when it rains.</p> <p>Dry most of the time, they typically have around 50-150 mm depth of water when it rains.</p> <p>They can be planted with grasses or more attractive vegetation.</p>	<ul style="list-style-type: none"> • Can be visually appealing. • 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. • Can fit in relatively narrow spaces such as within car parks. • Can form a wildlife corridor.

Table 2.1 continued

	SuDS feature	Benefits
 <p data-bbox="97 763 598 801">Image courtesy Groundwork, London</p>  <p data-bbox="97 1189 598 1227">Image courtesy Robert Bray Associates</p>	<p data-bbox="628 387 719 421">Basin</p> <p data-bbox="628 465 1002 656">Typically a shallow depression. These can be covered with amenity or meadow grass. They can also be hard landscaped.</p> <p data-bbox="628 701 1018 857">Basins capture water and can allow it to soak into the ground where possible, or slow the flow of runoff.</p>	<ul data-bbox="1096 398 1481 992" style="list-style-type: none"> • Can be a multifunctional space, e.g. used for amenity (if designed appropriately). • Reduces runoff for day-to-day rainfall. • Can easily be fitted into roundabouts or other pockets of landscape. • Depending on basin size it can be used to manage rain from heavy storms.
 <p data-bbox="97 1659 598 1697">Image courtesy Robert Bray Associates</p>	<p data-bbox="628 1299 884 1332">Wetland or pond</p> <p data-bbox="628 1377 994 1534">A permanently wet area designed as a wildlife habitat resource, amenity feature or both.</p> <p data-bbox="628 1579 1007 1736">Before entering a wetland, or pond, runoff may need to go through other SuDS features to clean it.</p>	<ul data-bbox="1096 1310 1417 1780" style="list-style-type: none"> • Creates a valuable ecological and amenity resource. • Can be visually appealing. • Effectively cleans runoff. • Connects people to water on the surface and is simple to maintain.

Table 2.1 continued


	SuDS feature	Benefits
 <p data-bbox="97 757 576 790">Image courtesy Red Carnation Hotels</p>	<p data-bbox="603 405 775 439">Green Wall</p> <p data-bbox="603 468 991 663">These are sometimes called a ‘living wall’. These are vertical structures that have different plants or greenery attached to them.</p> <p data-bbox="603 703 991 981">The greenery is often planted in a mixture of soil, stone and water. Only green walls watered by rainwater harvesting systems will be beneficial for rainwater management.</p>	<ul data-bbox="1070 394 1469 902" style="list-style-type: none"> • Attractive feature that contributes to health and wellbeing. • Supports biodiversity. • Can provide cooler buildings in the summer. • Can improve air quality. • Can help reduce noise levels. • Reduces runoff for day-to-day rainfall.

Figure 2.6 Raingarden planting between parking and office

Image courtesy Robert Bray Associates



2.3 INCLUDING SuDS IN AND AROUND OFFICES

When considering changes to the existing building or estate there may be opportunities to retrofit SuDS features, for example changing courtyards, renewing surfaces or roofs. Opportunities for SuDS differ from site to site depending upon budget and whether the estate has reasonable amounts of green space, is in a constrained dense urban setting, or has predominantly hard surfaces.

Most SuDS features introduced will have a benefit for the estate and local environment. The more features that can be created, the greater the benefits.

Approaches to the introduction of SuDS in and around offices vary. Some buildings and office complexes introduce relatively simple interventions such as rain planters and

rain gardens and stop there. Other projects develop more aspirational schemes with different SuDS features linked together.

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

Figures 2.7 to 2.10 show how particular SuDS features can be used in and around offices and how people may interact with them. The suitability of these features is outlined in table 2.1 and will depend on the opportunities and constraints of the site, as well as the benefits sought.

Figure 2.7 SuDS featuring a rain garden in a courtyard

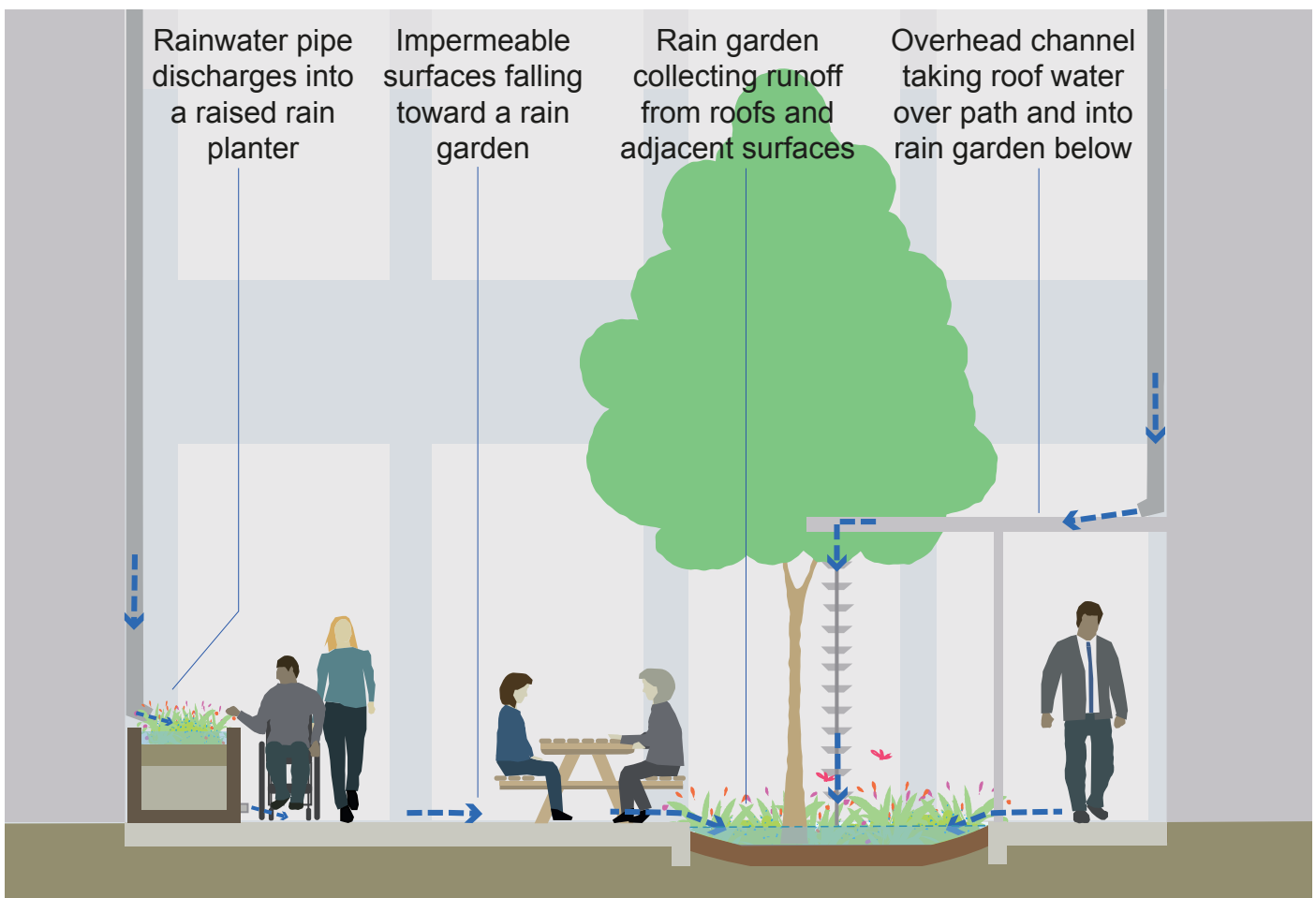


Figure 2.8 SuDS featuring green roof and tree pit

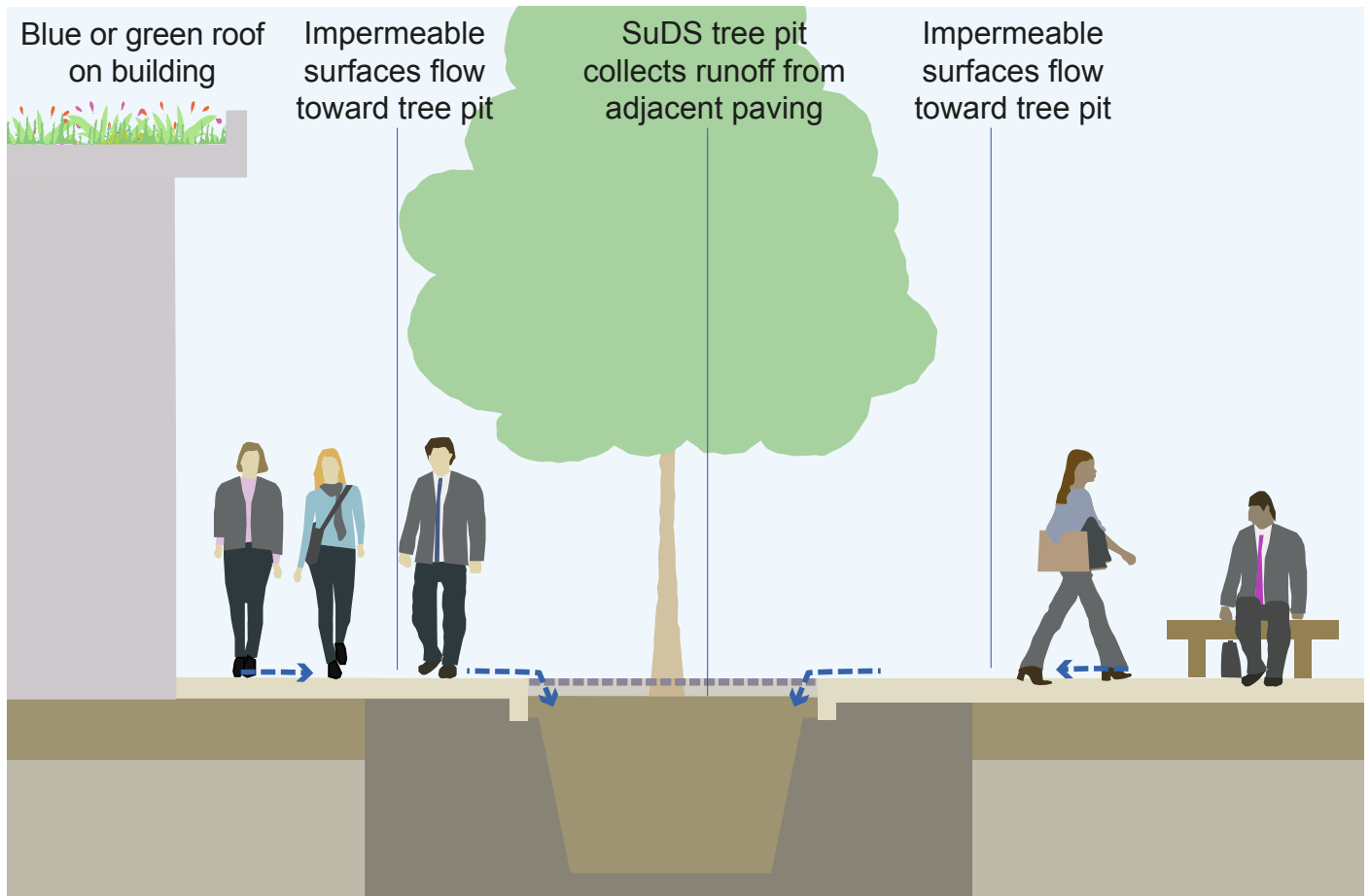


Figure 2.9 Permeable surface and rain garden

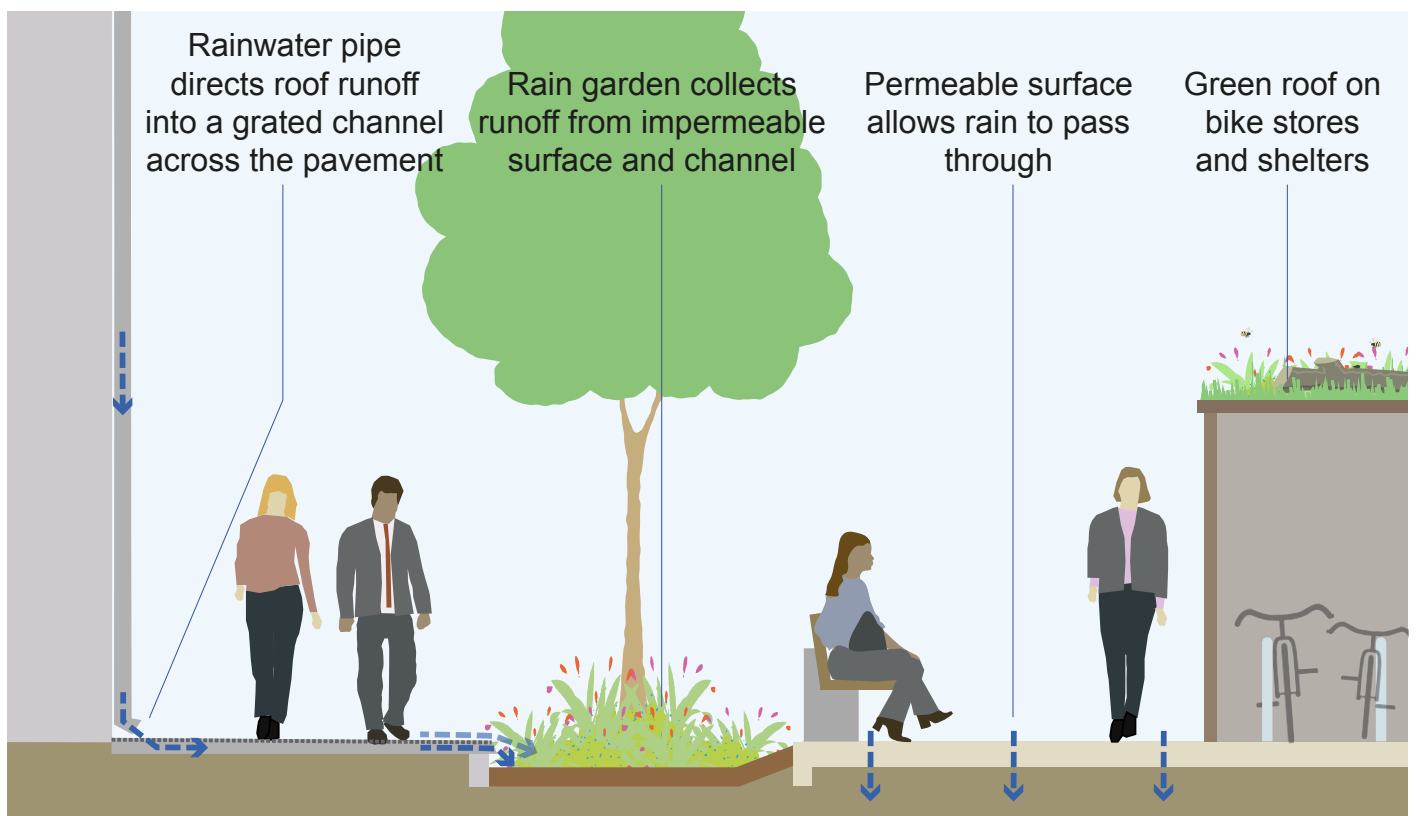


Figure 2.10 Car park and swale

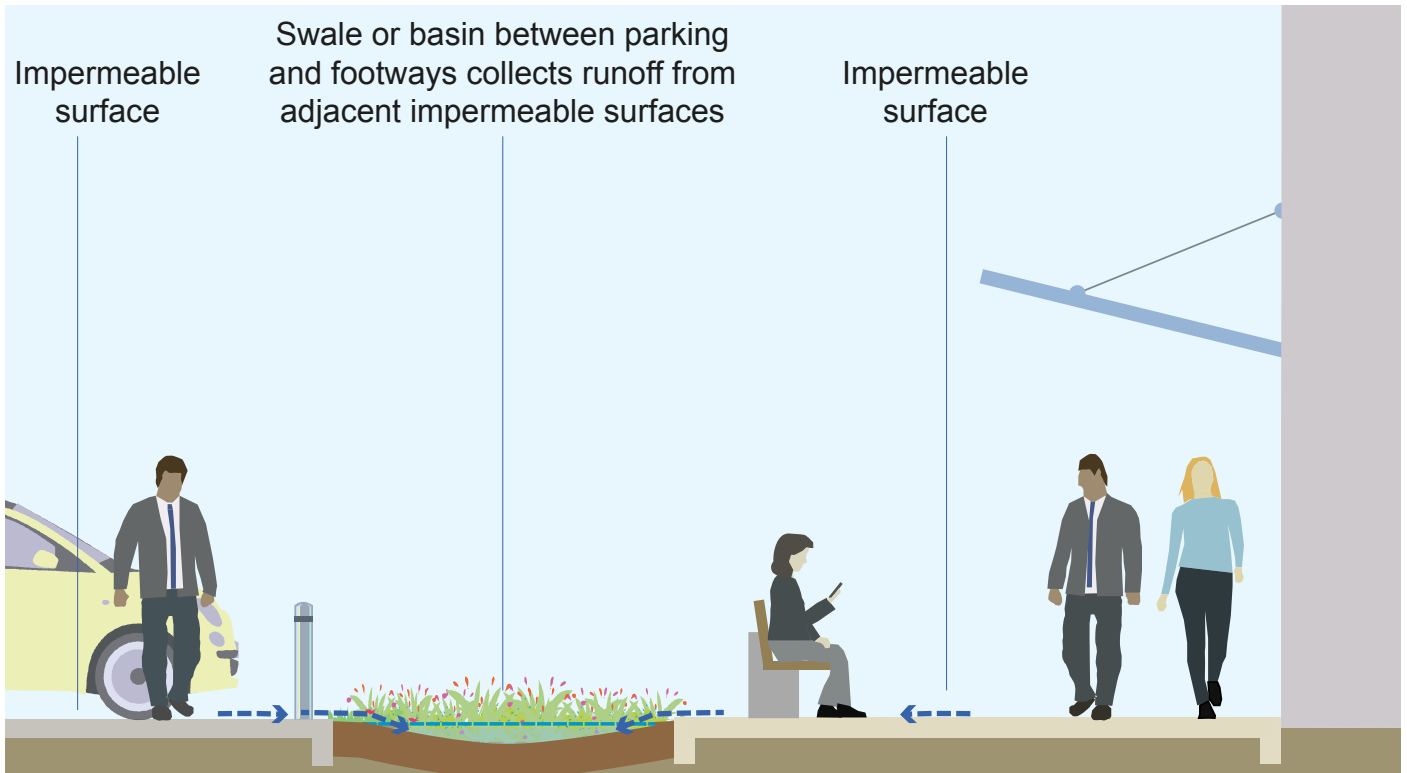


Figure 2.11 Car park and pond

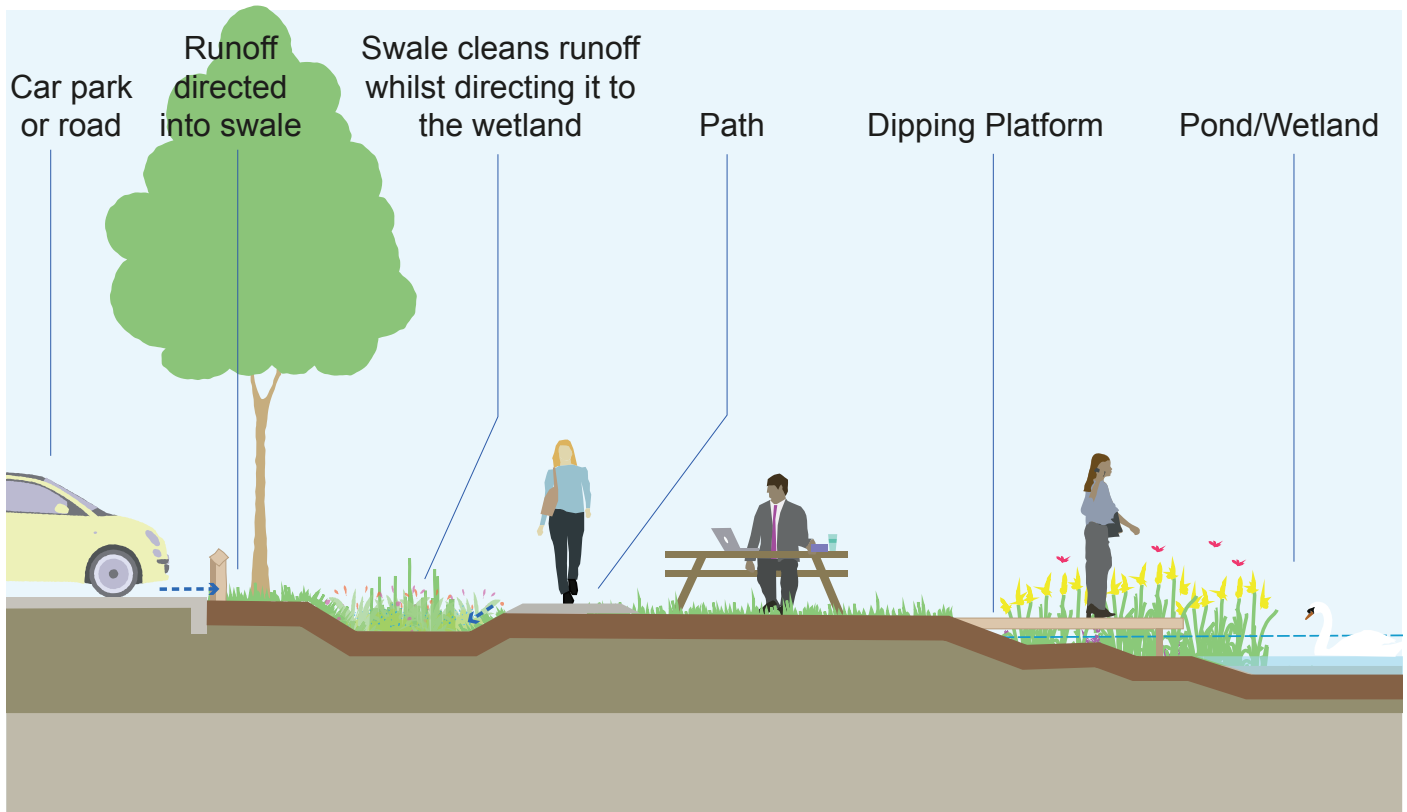
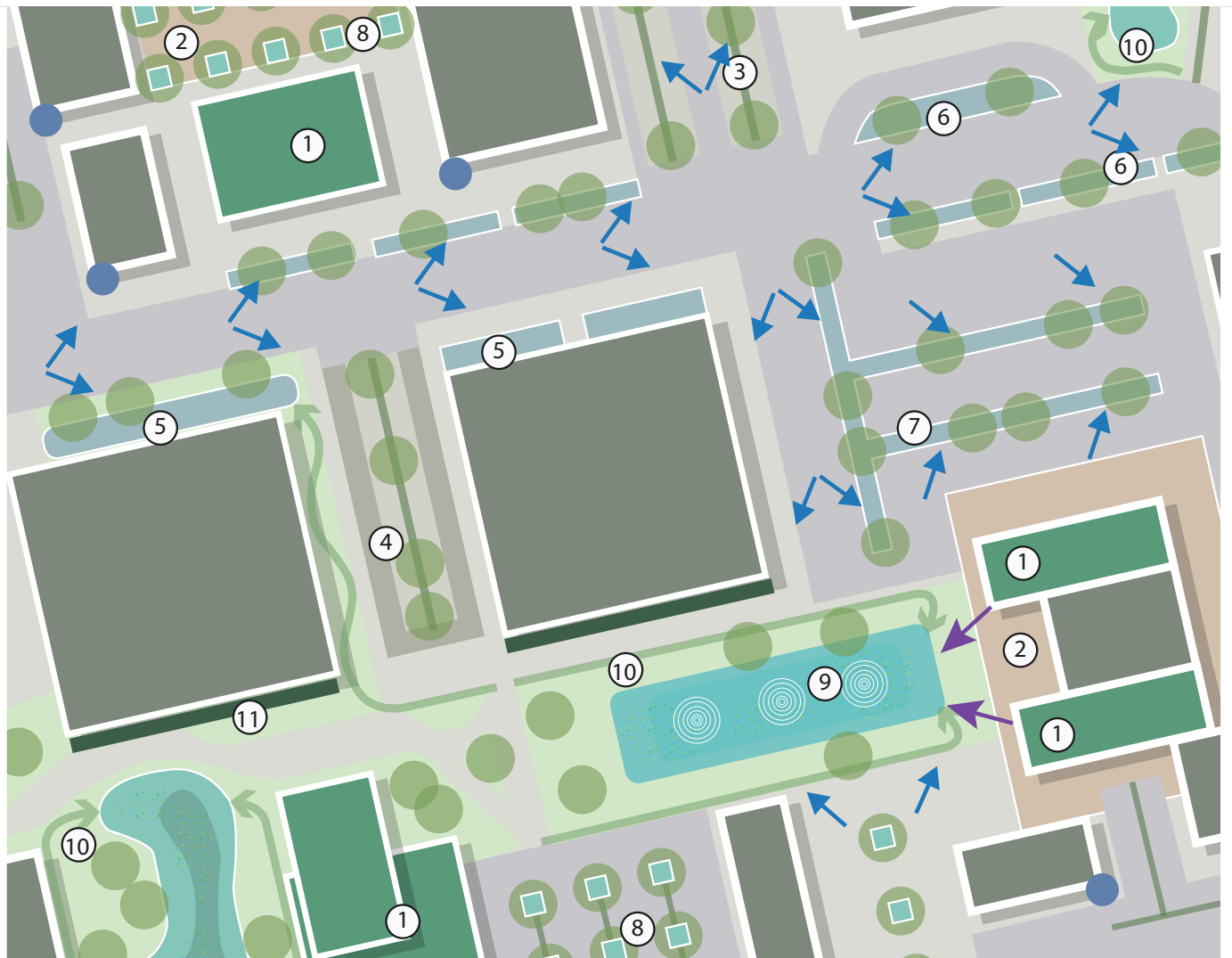


Figure 2.12 Concept for SuDS in a business park

Figure 2.12 is a typical SuDS plan which demonstrates a range of SuDS features that could be created around existing offices, or a business park where there are likely to be opportunities across the estate. Figure 2.12

suggests how SuDS may be retrofitted within a dense setting. Usually SuDS within the soft landscape offer the most cost effective solutions and provide the greatest benefits.











- | | | |
|------------------------------|------------------|----------------------------|
| K SuDS tree pits | Rain planter | Permeable parking bays |
| E Basins/rain gardens | Overhead channel | Permeable pedestrian areas |
| Y Green or blue roofs | Surface flows | Trees |
| Swale | Green walls | Water butts |

- | | |
|---|---|
| ① Green or blue roofs installed on buildings. | ⑥ Rain gardens next to roads. |
| ② Permeable pedestrian surfaces. | ⑦ Rain gardens breaking up parking areas. |
| ③ Permeable parking bays taking runoff from impermeable circulation routes. | ⑧ SuDS tree pits. |
| ④ Permeable parking bays and circulation routes. | ⑨ Formal pond with water features. |
| ⑤ Rain gardens taking roof and pavement runoff. | ⑩ Swales taking runoff to basins or pond. |
| | ⑪ Green walls absorb and clean roof runoff. |

Figure 2.13 Concept for SuDS in city centre offices



- | | | |
|--|--|---|
| K  SuDS tree pits |  Rain planter |  Permeable parking bays |
| E  Basins/rain gardens |  Overhead channel |  Permeable pedestrian areas |
| Y  Green or blue roofs |  Surface flows | |

- | | |
|---|--|
| ① Green or blue roofs installed on buildings. | ⑤ Rain gardens in courtyard area taking runoff from roofs via overhead channels. |
| ② Green or blue roofs to bike shelter or bin store. | ⑥ SuDS tree pits. |
| ③ Permeable pedestrian surfaces. | ⑦ Rain planters next to building entrance taking roof runoff. |
| ④ Permeable parking bays taking runoff from impermeable forecourt area. | |

3 Getting the best outcomes

3.0 GETTING THE BEST OUTCOMES

Obtaining engagement and buy in from key decision makers such as land and property owners, as well as tenants is one of the most important tasks in delivering SuDS. This together with engaging those who will use the area (businesses and employees) should be one of the first activities undertaken as it helps develop a shared vision for the SuDS scheme.

It is also important to engage with those who will be maintaining the SuDS to ensure they are happy with the design and associated maintenance requirements.

To get the best outcomes contact a 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 context, drivers and potential funders for the SuDS scheme helps to focus on what benefits are desired. This will also be informed by those likely to design, use and maintain the space. There are some common approaches to getting the best from SuDS. The following opportunities should be discussed with those involved in designing the SuDS:

- Manage water on the surface as much as possible. It can cool buildings and the surrounding area, enable people to connect with the SuDS features, planting, wildlife and makes SuDS easier and cheaper to construct and maintain. It also delivers biodiversity and allows breakdown of pollutants by sunlight and microbes.
- Manage rainfall as close to where it falls as possible. This ensures that flows through the SuDS features are slowed and any low levels of pollution are treated and therefore beneficial for workers, visitors and wildlife.
- Ensure that appropriate safety is considered as part of the design process for SuDS features. This would not normally mean fencing them off in an office environment, particularly if features are designed to store water at relatively shallow depths. Integrate discussions about risks around water into the stakeholder engagement process if necessary.
- Specific approaches to maximising benefits are discussed in table 3.1 and there is also guidance on overcoming some of the challenges faced in table 3.3.



Figure 3.1 Raised wetland receiving rainwater

Image courtesy Robert Bray Associates

Table 3.1 Approaches to maximising the benefits

Category	Approach
Office operations and management	<ul style="list-style-type: none"> • Consider whether funding opportunities and changes to the building fabric, or other parts of the site will enable SuDS features to be retrofitted, e.g. re-roofing, or re-surfacing car parks. • Ensure the designers consider ease of construction and 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, reduce the estate's flood risk and reduce overall costs of the SuDS (by reducing the need for excavation). • Celebrate the greenspace and the potential to improve the quality of the places and spaces. Make good use of engagement activities to improve relationships with employees, other businesses and the local community. • Consider approaches to actively involve, and where appropriate train and develop the skills of employees and local residents in the delivery and maintenance of SuDS features.
Spaces and places for people	<ul style="list-style-type: none"> • Involve employees, visitors and volunteers as early as possible to obtain their input in design decisions, planting and potential upkeep. Work with them to run events to celebrate the new green space they have. • Consider the number, variety and quality of the uses of SuDS, such as recreation, car parking, rainwater harvesting etc. • Consider multifunctional SuDS features that can: <ul style="list-style-type: none"> ▪ provide a sanctuary where users can have an enjoyable break from work ▪ provide shaded meeting places ▪ be seen from inside buildings ▪ be planted and managed by volunteers, e.g. employees and local community ▪ be used for food growing ▪ help support comfortable building temperatures (e.g. green roofs) ▪ help improve air quality ▪ Ensure that safety is considered as part of the design process for SuDS features. ▪ Consider how the SuDS features and places will be used by people. ▪ Consider the inclusion of interpretation boards to inform people about the function of the SuDS features.

Table 3.1 Continued

Category	Approach
Spaces and places for nature	<ul style="list-style-type: none"> • Use vegetated SuDS features wherever possible. • Improve habitats for local wildlife by using appropriate Biodiversity Action Plans to help inform the design. • Prior to runoff being drained into the areas designed for biodiversity ensure it is managed and clean.
Managing water quantity	<ul style="list-style-type: none"> • 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 soil moisture and 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.
Managing water quality and pollution	<ul style="list-style-type: none"> • Prioritise SuDS features that include vegetation and healthy soils to assist with the treatment of pollution. • Ensure the designers consider risk of pollution and include the right type and right number of connected SuDS features.

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 of success of delivering cost effective SuDS.

Once you have decided that you would like a designed SuDS scheme 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 an outline/ concept design, detailed design, construction of features and then inspection. 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 for the residents and local community.

It is difficult to provide an indication of costs, as each site is likely to have specific requirements, opportunities and challenges. However some rough estimates of costs are provided in Table 3.2. Experience has shown that well designed SuDS are often cheaper than traditional drainage approaches. SuDS also deliver more benefits that may attract funding from other organisations (→ section 4). If funders request quantification of benefits your SuDS specialist can use a free tool called B£ST to provide this information (→ [B£ST resources](#)).

Table 3.2 Estimated costs for delivery activities

Activity	Estimated cost
Cost of initial consultation	£300-£1,400
Cost of design (scale dependent)	£3,000-£20,000
Construction of surface SuDS features in existing soft landscape	£20-£50/m ²
Construction of surface SuDS features in existing hard landscapes	£50-£100/m ²
Permeable paving	£50-£70/m ²
Construction of green/blue roof	£50-£150/m ²

Figure 3.2 Beehive on retrofit green/blue roof

Image courtesy Polypipe



3.3 DISPELLING THE MYTHS

Although widely and successfully used across the UK, misconceptions about SuDS can arise which should be challenged. Most concerns for example from colleagues, businesses or workers, can be overcome with good design, effective engagement and education.

There are a number of examples of SuDS being successfully delivered in and around office buildings, see Section 5 for some relevant case studies. Some potential misconceptions and responses 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
<p>Safety</p> <p>‘Do SuDS have permanent water and can they be dangerous?’</p>	<p>Good SuDS are designed to be safe.</p> <p>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.</p> <p>Typically, SuDS are shallow, with gentle side slopes and controlled water flows.</p> <p>A risk assessment should be undertaken for the scheme which takes into account how the area will be used and who will use it. It should also consider how the feature will be designed, the likelihood of it being full of water and the potential depth.</p>
<p>Costs</p> <p>‘Are SuDS more expensive?’</p>	<p>SuDS are often no more expensive than traditional drainage. They tend to be cheaper in new developments and can easily be achieved in retrofit situations. However, costs will be dependent on the site and the design. It is also important to consider the benefits provided. A high quality SuDS scheme will deliver more benefits than traditional drainage.</p> <p>The more that designs are incorporated into the fabric of development to manage rainwater, the more cost effective they become. Note that SuDS features such as planting, trees, and block paving should not be considered as extra costs if these items would be provided anyway.</p>

Table 3.3 Overcoming challenges for SuDS delivery cont.

Misconception	Response
<p>Maintenance</p> <p>‘Are SuDS difficult and expensive to maintain?’</p>	<p>Thoughtfully 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, and/or and members of the community.</p> <p>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.</p> <p>Soft-landscape and permeable surfaces usually require the least additional or specialist maintenance. Features like green walls, and rainwater harvesting systems may need specialist maintenance to ensure long term performance.</p>
<p>Litter</p> <p>‘Will SuDS create more litter?’</p>	<p>Studies have shown that spaces that look more attractive and cared for suffer less littering than unattractive, poorly maintained spaces.</p> <p>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.</p> <p>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.</p>
<p>Suitability of ground conditions</p> <p>‘If water cannot soak into the ground, or we have poor ground conditions can we use SuDS?’</p>	<p>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. These conditions however will not prevent SuDS being used.</p> <p>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.</p>

4. Funding approaches

4. FUNDING APPROACHES

Sufficient funds and resources will be required to cover both the capital and maintenance costs of SuDS. Finding funds can be challenging and is likely to be required from multiple organisations. This is also where effective and early engagement can be helpful.

It may also be possible to alter the approach to planned changes or annual maintenance

to enable gradual implementation of SuDS features or implementation of SuDS principles.

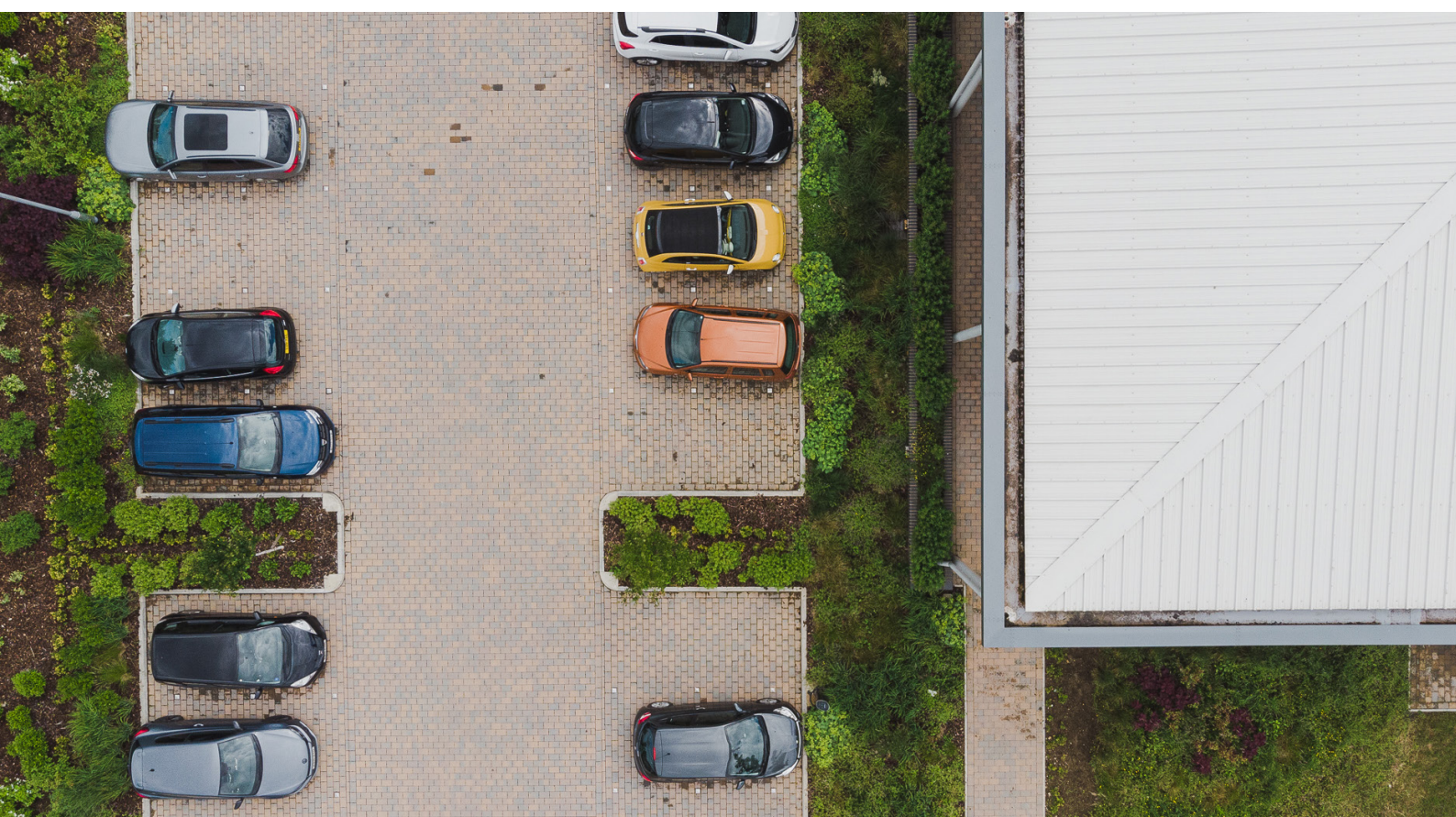
Where the benefits can be clearly understood and are greater than the costs of SuDS the case for funding will be more attractive. Some options for finding additional external funds are presented in table 4.1.

Table 4.1 Potential funding sources

Potential funding source	Comments
Local Authority	<p>Those managing flood risk or the public realm may have the ability to unlock funds from others sources such as Section 106 Agreements and Regeneration projects. They may also be able to provide links to other Council funding pots, such as community greening initiatives as well as external partnerships and funders.</p> <p>If appropriate, the Local Authority may also support a grant application for Central Government funds related to flood risk management.</p>
Central Government	<p>Government departments like Homes England, the Ministry of Housing, Communities & Local Government and Department for Business, Energy & Industrial Strategy occasionally make funds available to improve the quality of housing, commercial and local areas.</p>
Greater London Authority (GLA)	<p>The GLA occasionally provides grants for delivering greener communities.</p> <p>The funding opportunities are often time limited so for 'greening' projects look at https://glagrants.org.uk/ for further information.</p>
Business Improvement Districts (BIDs)	<p>Many BIDs have programmes where the local businesses have focused on improving the local environment and the quality of the places and spaces in their local area. Many BIDs have been successful in the delivery of green features like SuDS and may be open to exploring other opportunities to improve the area they operate in.</p>

Table 4.1 Potential funding sources

Potential funding source	Comments
Thames Water	Thames Water has a fund (for 2020-2025) to improve surface water in their catchment, which 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.
<u>Local wildlife trusts</u> <u>Local river trusts</u>	Wildlife and river trusts may occasionally have access to funds and partners that may be interested in supporting the delivery of SuDS in communities, particularly if they also deliver some of their remit too.
Other charity and third sector groups	Third sector organisations and charity organisation with aligned drivers (health and wellbeing, improving communities etc) like the Heritage Lottery Fund, and possibly local companies may be interested in collaboratively supporting SuDS if the benefits for them and their interests are clearly stated.



5 Case studies

JOHN LEWIS HEAD OFFICE, WESTMINSTER

An audit of green space within the Victoria Business Improvement District (BID) was carried out in 2010. Biodiversity and improved drainage were priorities.

The John Lewis building was one of the first to be identified. The John Lewis Partnership wanted to showcase the company's environmental and sustainability values and benefit the local environment.

The downpipe was diverted into a new rain garden area planted in 2015 which replaced an impervious cobbled area. Existing poor quality trees were replaced. The rain garden project, which also included replanting five large planters, was planned with the John Lewis Partnership and received support from Natural England as well as the Mayor of London's Greening the BIDs project, via the Cross River Partnership.

Rain gardens are an attractive way of managing runoff, helping to reduce surface water being discharged into the sewers and greening the area.

Benefits include:

- Effective surface water drainage
- Improved green space and aesthetics
- Improved water quality
- Reputation and image benefits

The site before retrofit SuDS
Courtesy Victoria BID



After rain garden installation
Courtesy Victoria BID



GREEN-BLUE ROOF, KENT

When Polypipe's office in Aylesford, Kent required roofing renovation, the company wanted to demonstrate the viability of providing multifunctional benefits through retrofit green infrastructure.

The decision to create a blue-green roof also provided the opportunity to design and develop a new, intelligent water management system and provided a valuable space for wildlife and staff.

A blue-green roof comprising a sedum top layer and other vegetation was retrofitted to an existing flat roof. The roof stores rain and is an ideal environment for bees. Beehives were installed and

are managed by a member of staff.

Benefits include:

- Increased biodiversity on site, particularly pollinators
- Improved environmental awareness of people working in the building
- Excellent visual product display for Polypipe clients
- Enjoyable outdoor seating area for staff
- Improved rainwater management
- Improved thermal comfort

Information and images courtesy of Polypipe



160 OLD STREET, ISLINGTON

160 Old Street is a nine-storey office redevelopment scheme. The refurbishment project was finished in 2018. The office comprises a complex array of 29 different roof zones over multiple floor levels, with 16 of the areas re-designated as blue roofs and/or green roofs. This was in response to requirements to manage surface water and deliver climate change adaptation as well as responding to planning requirements.

The project's dense and constrained site meant that managing runoff as close to its source as possible on the roof was necessary. Blue roofs were used to manage runoff and slow down the rate of runoff within the building footprint, as ground space is limited for other drainage features.

Water is temporarily retained within the blue roof and green roof system for plants to flourish. The system also allow excess water to drain away, preventing pooling.

For the green roof and biodiverse roof areas, large stones, sand piles and native hardwood logs have been placed to support invertebrates and other wildlife.

Benefits include:

- Increased local biodiversity
- Managing rainwater at source – reducing local flood risk
- The project achieved a BREEAM 'Excellent' rating.

Information and images courtesy of ABG



6. FURTHER GUIDANCE

1. **Bray, B, Gedge, D, Grant, G, Leuthvilay, L. Rain Garden Guide. Reset. [Web link](#)**
2. **CIRIA - susdrain website. [Web link](#)**
3. **Greater London Authority SuDS sector guidance. [Web link](#)**
4. **Greater London Authority. 2008. Living roofs and walls. Technical report: supporting London Plan policy. [Web link](#)**
5. **Graham, A, Day, J, Bray, B, Mackenzie, S. (2012) Sustainable drainage systems – maximising the potential for people and wildlife. RSPB and WWT. [Web link](#)**
6. **Kukadia, J, Lundholm, M, Russell, I. (2018). Designing rain gardens – a practical guide. Urban Design London. [Web link](#)**
7. **Sharp, Liz, Kenyon, Anna, Choe, Eun Yeong. (2020). Designing Blue Green Infrastructure (BGI) for water management, human health, and wellbeing: summary of evidence and principles for design. The University of Sheffield. [Web link](#)**
8. **Winch R., Hartley S., Morrison R., Lane J., Mant A., Skeldon A. and Evans S. (2020). Nature-based solutions to the climate emergency – the benefits to business and society. IGNITION Partnership [Web link](#)**
9. **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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