Sustainable Drainage Systems

Local Guidance

GOLUD·GWLAD·RHYDDID

Cyngor Sir
CEREDIGION
County Council

Contents

1. Introduction

1.1 Background to the development of the SuDS Approval Body (SAB)

The Pitt Review was published in response to the extensive flood events that occurred in 2007. This report put forward 92 recommendations that would ultimately shift flood risk management towards a more sustainable, integrated method and away from traditional hard engineering solutions. These recommendations influenced the measures contained within the Flood and Water Management Act (2010) which, together with the Flood Risk Regulations (2009) placed a greater responsibility on Local Authorities to manage flood risk.

The European Union Floods Directive (2007) was transposed into UK law in 2009, resulting in the Flood Risk Regulations (2009) and the establishment of Lead Local Flood Authorities (LLFAs), composed of upper tier and unitary local authorities.

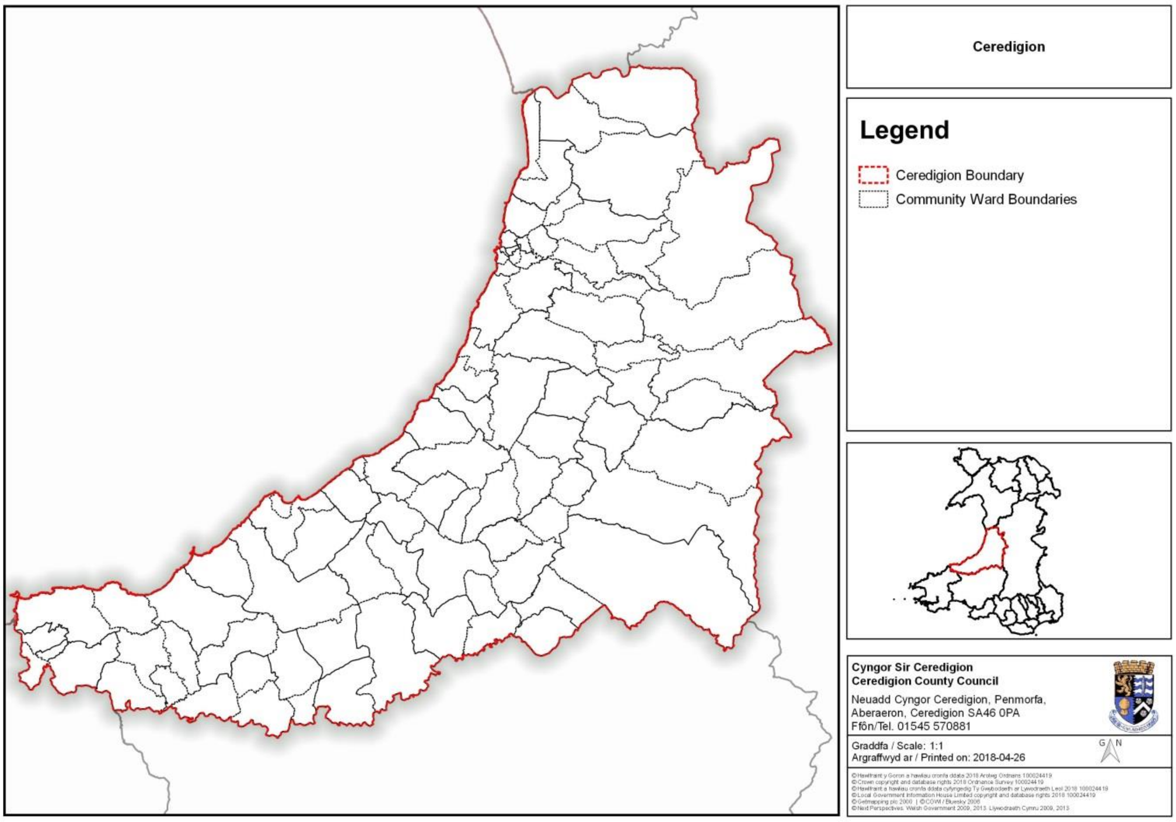

Figure 1: Ceredigion County Council boundaries

Therefore, Ceredigion County Council (CCC) is the LLFA for its administrative area (Figure 1) and its responsibilities are set out in the Flood and Water Management Act (2010). These include managing local flood risk from surface water and groundwater, and consenting and enforcement on ordinary watercourses.

From 7th January 2019, CCC's LLFA will also become the SuDS Approval Body (SAB), assessing Sustainable Drainage Systems (SuDS) applications for all new developments with a construction area of 100m^2 and over.

1.2 Why do we need the SuDS?

The existing drainage system in the UK does not have the capacity to cope with the requirements for a growing population. Therefore there is a requirement for alternative solutions. SuDS are a change from the traditional "pipe to sewer" systems and are now the preferred approach for managing surface water, offering an alternative to the traditional techniques that new developments urgently need. They offer a wide range of benefits to both the environment and the community, for example, pollution control, increasing biodiversity and reducing the risk to residents and their home from flooding. However, each SuDS structure provides a unique set of benefits which are dependent on site conditions. Therefore, to maximise the benefits of SuDS, it is important to have an understanding of both the proposed site and the functionality of different SuDS structures as early on in the development process as possible.

The primary purpose of SuDS is to mimic the natural drainage of the site prior to development by allowing rainfall to soak (infiltrate) into the ground where possible or by delaying discharges. When rain falls onto undeveloped sites, the water is intercepted naturally by vegetation, evaporates, infiltrates into the ground or flows overland and enters a waterbody. However, this hydrological response is altered significantly when development occurs, particularly when impermeable surfaces are introduced, resulting in increased rates and volumes of surface water runoff.

1.3 The National SuDS Standards for Wales

Schedule 3 of the Flood and Water Management Act (2010) requires new developments comprised of a construction work area[1] equal to or greater than 100m^2 to comply with the national standards (for reference, please see National SuDS Standards for Wales[2]). These National Standards are split into two types; Standard 1 (S1) which is a Hierarchy Standard, and S2 to S6 which are Fixed Standards.

S1, comprised of 5 levels, provides criteria for prioritizing the choice of runoff destination. Level 1 is the most preferred level and should be met to the maximum extent possible with lower levels used were appropriate justification is provided. S2 to S6 give both the minimum design criteria that all SuDS should satisfy and the standards which state how SuDS should be constructed, maintained and operated. These Fixed Standards do not have exception criteria or prioritised levels.

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[1] "Construction work area" refers to the area of the development where the permeability of the ground has been altered.

[2] https://gov.wales/docs/desh/publications/181015-suds-statutory-standards-en.pdf

Table 1: Summary of S1. For further guidance on each level, see **National SuDS Standards for Wales**.

S1 Surface water runoff destination	
Priority Level 1 **(Highest Priority)**	Surface water runoff is collected for use.
Priority Level 2	Surface water runoff is infiltrated to the ground.
Priority Level 3	Surface water runoff is discharged to a surface water body.
Priority Level 4	Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.
Priority Level 5 **(Lowest Priority)**	Surface water runoff is discharged to a combined sewer.

Table 2: Summary of SuDS Standards S2 to S6. For further guidance, see **National SuDS Standards for Wales**.

SuDS Standards S2 to S6	
S2 **Surface water runoff hydraulic control**	The aim of Standard S2 is to manage the surface water runoff to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.
S3 **Water quality**	Standard S3 addresses the drainage design requirements to minimise the potential pollution risk posed by the surface water runoff to the receiving water body.
S4 **Amenity**	Standard S4 addresses the design of SuDS components to ensure that, where possible, they enhance the provision of high quality, attractive public space which can help provide health and wellbeing benefits, they improve liveability for local communities and they contribute to improving the climate resilience of new developments.
S5 **Biodiversity**	Standard S5 addresses the design of SuDS to ensure that, where possible, they create ecologically rich green and blue corridors in developments and enrich biodiversity value by linking networks of habitats and ecosystems together. Biodiversity should be considered at the early design stage of a development to ensure the potential benefits are maximised.
S6 **Design of drainage for construction, operation and maintenance and structural integrity.**	Standard S6 deals with designing robust surface water drainage systems so that they can be easily and safely constructed maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.

2. The SuDS Management Train

It is often useful to visualise SuDS in terms of a management train (Figure 2) where different drainage techniques are used in sequence to alter the flow and quality of surface water runoff. This represents how processes work in natural catchments.

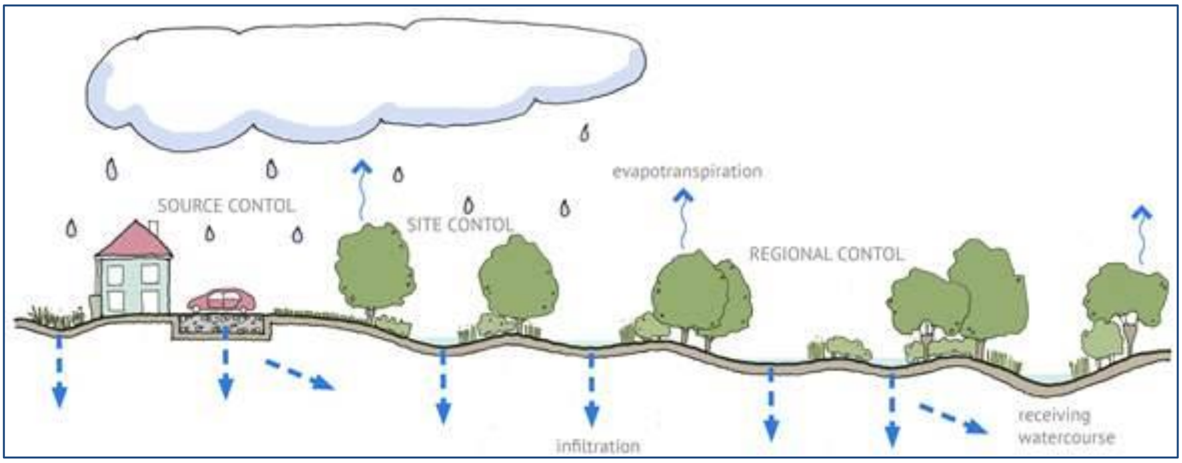


Figure 2: SuDS management train (Credit: https://www.susdrain.org/delivering-suds/using-suds/suds-principles/management-train.html).

The management train naturally promotes the division of the proposed site into sub-catchments with different drainage characteristics. It is important to keep in mind how each sub-catchment can affect the management of the whole catchment and hydrological cycle. It also discourages the use of end of pipe solutions where runoff is discharged directly into a pond or wetland. Such systems do not have the same benefits when compared to the management train.

Traditionally, the primary aim of surface water management is to convey surface water downstream as rapidly as possible, usually through a system of subterranean pipes. This often increases the risk of flooding at these downstream locations by generating a higher concentration of flows within a confined area. Another disadvantage is the pollutant issue arising from the lack of natural infiltration.

SuDS function in contrast to these traditional techniques. They aim to manage surface water on, or as close as possible, to the surface of the ground, mimicking natural responses. This controls the water closer to the source which in turns reduces the rate of flow downstream. There is also an improvement to biodiversity, water quality and visual amenity when surface water is managed in this way (Figure 3). Often, the greatest benefits are derived when a combination of SuDS features are used in conjunction with each other.

3. Selecting SuDS – Best Practices

Each objective of the 4 pillars (Figure 3) should be considered in equal measure. Their delivery, however, will be dependent on the constraints and opportunities presented by both the proposed site and the local community.

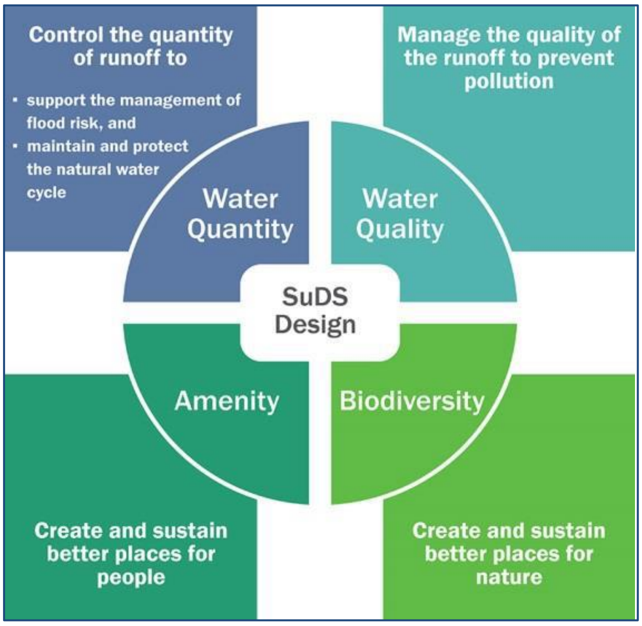


Figure 3: The four pillars of SuDS design which describe the principles of SuDS. Credit: CIRIA C753 (2015), p.6.

Well designed, easy to maintain SuDS will deliver a range of important benefits for the local environment, the development and local communities. They can:

- contribute to the delivery of Water Framework Directive, Local Flood Risk Management and Local Biodiversity Action Plan objectives;
- add social, economic and environmental value by improving the quality of urban design, adding enhanced amenity space and providing habitats and wildlife corridors;
- contribute to health and wellbeing through access to green space, reduced urban temperatures, improved air quality and noise buffering;
- help strengthen communities, providing a focus for environmental education and public engagement in environmental protection close to home;
- help improve the adaptability of the drainage system to development pressures;
- support development resilience to climate change.

Early assessment of the proposed site is essential when selecting SuDS components. **Ceredigion County Council recommends that developers seek out Pre-Application Advice in order to identify any constraints of the site, environmental or otherwise**. Engaging in Pre-Application discussions early on can ensure a robust, cost effective and viable surface water management strategy and SuDS Scheme. The more technical advice that can be given at this stage, the more "Development-Specific" technical advice can be given by the SAB.

This guidance document will provide a brief description of the different types of SuDS components (Chapter 6) but for a detailed description, it is recommended to also utilise information published by CIRIA, particularly CIRIA's SuDS Manual (C753) (2015) which explains in more detail the relevant technical information. It is important to emphasise that each site will have its own technical specifications; there is no "one size fits all" where SuDS are concerned and it is essential that developers have an understanding of the proposed site as early in the life of the development as possible.

As well as this document, there are also Pre-Application and Full-Application guidance documents available on CCC's website[3].

4. Purpose of this Guide

The primary purpose of this guidance is to aid developers in the implementation of Schedule 3 of the Flood and Water Management Act (2010). Schedule 3 provides a framework for the approval and adoption of surface water systems serving new developments. It does not apply to retrofit and existing drainage systems.

As previously stated, Schedule 3 of the Act requires surface water drainage for new developments to comply with mandatory National Standards. It also requires surface water drainage systems to be approved by the SAB **before** construction work with drainage implications may begin. Provided National Standards are met, the SAB would be required to ensure that there is a mechanism in place so that the approved SuDS is adopted and maintained if it services more than one property. Where the SAB adopts a SuDS asset, the LLFA will include the adopted asset in a SuDS Asset Register within 28 days of adoption. More information on the SuDS Approval process can be found in Chapter 7.

5. Ceredigion Landscape

5.1 Background

Ceredigion is a Unitary Authority situated in Mid Wales. The county has an area of 1783km^2 which is a mixture of mountainous terrain (predominantly the Cambrian Mountains) in the east and coastline environments to the west. At the county's highest point, five rivers have their source including; The Severn, The Wye, The Dulas, The Llyfnant and The Rheidol. The largest river within the County is the River Teifi with other notable rivers including the

Figure 4: SuDS pond serving a section of the A487, Glandyfi.

[3] http://www.ceredigion.gov.uk/resident/planning-building-control-and-sustainable-drainage-body-sab/sustainable-drainage-approval-body-sab/

River Rheidol and the River Ystwyth.

Ceredigion is a predominantly rural county comprised of smaller villages with larger towns along the coast, including Cardigan, Aberaeron and Aberystwyth, and well as Lampeter and Llandysul in the south of the county. According to the 2011 census, the population of Ceredigion is 75,941. There are 35,640 residential properties in the area, a figure obtained from OS AddressBase Plus. Critical services properties include fire and police stations, hospitals, surgeries, electrical sub stations, water treatment plants, telephone exchanges, etc.

Due to the rural nature of the county, it is important that all new developments include SuDS to ensure that Greenfield runoff rates are achieved. There are lots of opportunities for SuDS in Ceredigion and developers should not view certain site constraints as reasons for opting for pipe-to-sewer surface water systems. A common constraint of Ceredigion's landscape includes the clay soils that are common here. Whilst clay soils often slow the drainage of surface water, it is encouraged that developers carry out the relevant percolation tests in accordance with BRE Digest 365. If these rates are not acceptable, there are many alternatives to infiltration-based SuDS but it is important that Developers have an understanding of this as early on as possible.

5.2 Flood risk in Ceredigion

The nature of flood risk within Ceredigion is extremely varied and widespread across the county (Figure 5). The coast, high and low laying land and numerous river valleys means that there are many sources of flooding within Ceredigion. The risk of flooding is then made worse when urban areas such as Cardigan and Aberystwyth are introduced.

The main sources of flooding in Ceredigion include:

- **Surface water flooding (pluvial):** High intensity rainfall produces runoff across the surface of the ground. Waterlogged (saturated) ground or overwhelmed drainage systems often leads to higher volumes of surface runoff.
- **River flooding (fluvial):** When a watercourse is overwhelmed, this can cause significant flood events. Rivers are categorised into 'Main Rivers' (dealt with by Natural Resources Wales) and 'Ordinary Watercourses' (dealt with by the LLFA).
- **Groundwater flooding:** Often occurs after long periods of heavy rainfall, the water levels in the ground rise above the surface.
- **Coastal Flooding:** Typically occurs during storm surges but there is greatest risk when there is a combination of high tides and storm surges.
- **Sewer flooding:** Occurs when the sewer network cannot cope with the volume of water or when the network becomes blocked.

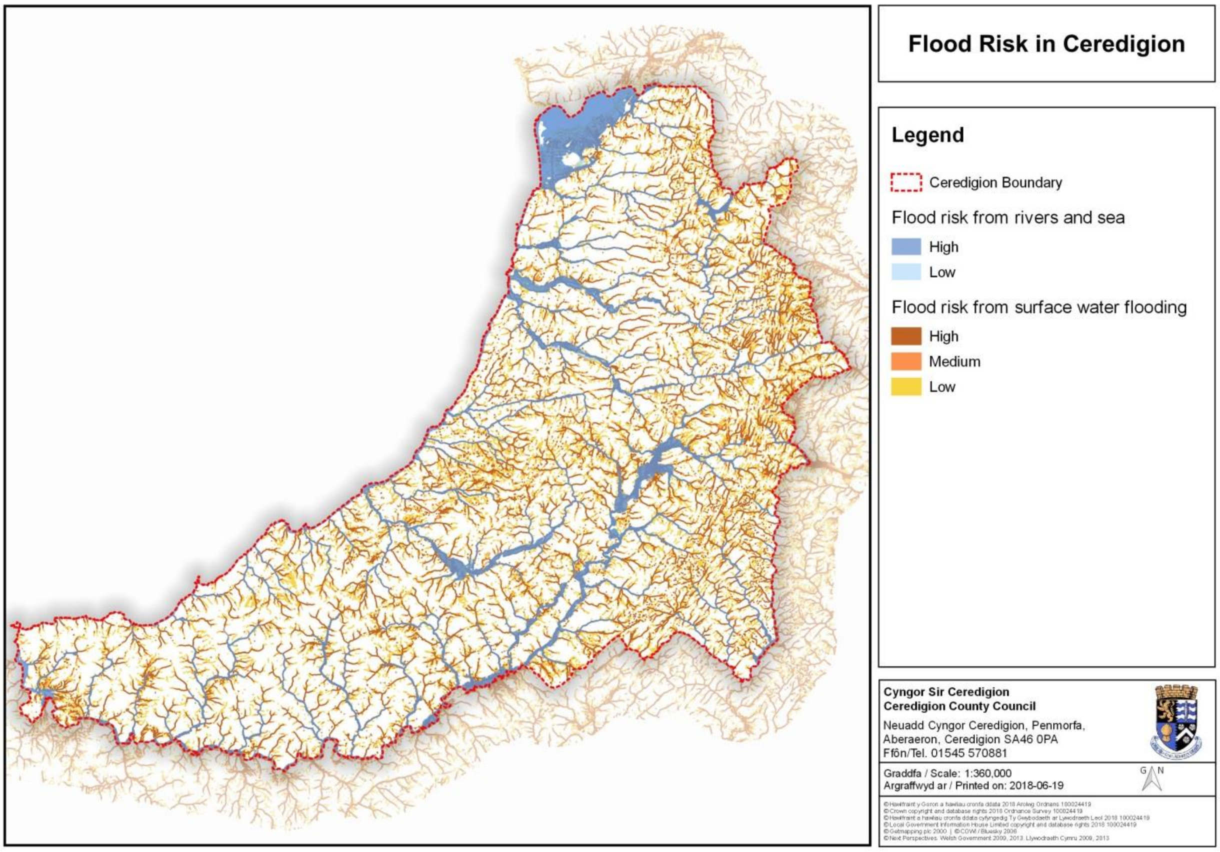


Figure 5: Flood risk within Ceredigion showing both surface water, and rivers and sea sources.

5.3 SuDS on previously developed sites

There is limited opportunity for new developments on previously developed sites in Ceredigion due to its rural nature but those that are available should not be viewed as a barrier to the use of SuDS. There is always an opportunity to deliver and enhance the green space within developments if there is careful and detailed planning from an early stage.

Certain site constraints, such as contaminated soils or high groundwater levels, may limit the use of certain SuDS but it will never limit all. Instead of infiltration, it may be appropriate to use storage SuDS, possibly treating the water to remove pollutants. CCC recommends that developers seek early advice from professionals early on so that drainage strategies can be integrated into the design in as cost-effective a way as possible.

There are a number of ways in which developers can deal with pre-existing site constraints. For further information, CCC recommends that developers check the CIRIA C753 SuDS Manual, Part C (Ch. 7-10).

5.4 SuDS in high density developments

Whilst there are few high density developments currently within Ceredigion, it is likely that with continued population growth and urban creep, their numbers will increase.

Therefore, the challenge of managing surface water effectively is likely to intensify, particularly with the ever increasing threat of climate change.

SuDS should always place the focus on people and communities. SuDS are an effective way of encouraging local residents to interact with each other and with the environment. The aesthetic and recreational opportunities that SuDS provide are an important asset to any new development, particularly developments that have a higher density. The provision of biodiversity enhancement is also a requirement of Planning Policy Wales (Tan 5).

There are a number of ways in which developers can incorporate SuDS into high density developments. For further detailed information, CCC recommends that developers check the CIRIA C753 SuDS Manual, Ch. 10. The next chapter includes different types of SuDS and their benefits

6. Types of SuDS

6.1 Key benefits of specific SuDS measures

Water storage

Providing long and short term storage of water during storm event

Silt removal

Removing suspended sediments in water

Pollution treatment

Effective treatment of polluted water

Infiltration

Allows water to soak into the ground

Biodiversity

Increased plant and wildlife variety

Visual amenity

Providing attractive, useable features

Physical amenity

Providing open space for physical activities

Education

Providing opportunities to learn about wildlife and water management

Energy

Reduction in construction energy

Adaptability

Can be easily changed for additional future capacity

Key for Chapter 6

✓ (green)	SuDS Benefit Included
✓ (black)	SuDS Benefit Possible Depending on Design

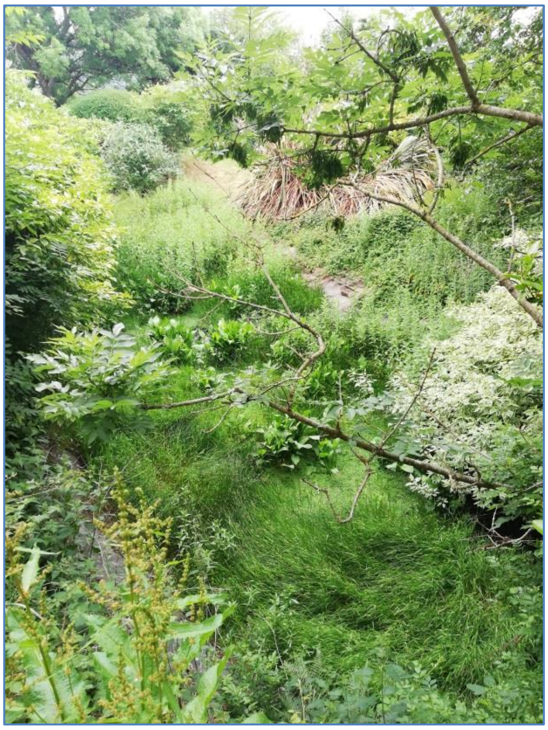
6.2 Ponds and Wetlands

CIRIA C753 Ch. 23

	Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
Ponds	✓	✓	✓	✓	✓	✓		✓	✓	
Wetlands	✓	✓	✓	✓	✓	✓		✓	✓	✓

6.2.1 Description

Ponds and wetlands are areas of open, permanent water designed as both treatment and attenuation, with volumes increasing after periods of heavy rainfall. Where vegetation covers over 75% of the pond's surface, they are usually referred to as wetlands but both features should maximise biodiversity potential. Wetlands are generally shallower than ponds with a maximum depth of 150mm. Permanent water within ponds should never exceed 400mm and the maximum storage should not exceed 600mm.



To allow safe access to the water edge, developers should include a level dry bench and slopes with a maximum gradient of 1:3 as well as a wet bench at permanent water level to aid egress from the water which will also support a range of marginal and aquatic plants.

The longer the residency time (the time the water is held within the water body), the more effectively the water can be treated before it is discharged down the Management Train. Slowing water enables more silt to be deposited which subsequently gives plants the opportunity to remove pollution.

Well-planned and managed ponds and wetlands can add significant aesthetic, and therefore economic, value to a development, increasing property values and attracting businesses and tourism.

6.2.2 Issues and Opportunities

- The space required should be considered early on in the development.
- Open areas of permanent water should be designed to enable safe access and egress.
- Overflows are required to deal with blockages and exceedance flows.
- The design of wetlands and ponds should aim to maximise biodiversity interest and enhance visual amenity.

6.2.3 Maintenance

- There should be an annual rotation of silt and/or vegetation removal (25-30% of the area per year).
- Intensive maintenance should only be carried out between September and November to limit the impact upon wildlife – for further advice; it is recommended that the developer contact the Council's ecologist.
- Safe access for maintenance should be included in the design.

6.3 Bioretention systems (including rain gardens)

CIRIA C753 Ch. 18

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓	✓	✓	✓	✓	✓		✓	✓	✓

6.3.1 Description

Bioretention systems are landscaped features that provide both treatment and attenuation. The flexibility in design of these features means that there are very few sites where they cannot be included in the surface water management system. They are often shallow depression with either gentle side slopes in low-density developments or hard-edged vertical sides in high-density developments.

Typically, a ‘root zone’ (usually soil) supports a vegetated layer. Water drains (percolates) through the root zone into an underlying drainage layer before entering into the next stage of the Management Train.

6.3.2 Issues and Opportunities

- Consideration in design should be given to issues such as potential contaminants.
- Overflows are required to deal with blockages and exceedance flows.
- The vegetated layer should aim to maximise biodiversity interest and enhance visual amenity.

6.3.3 Maintenance

- Surface mulch replenishment.
- Overflows are required to deal with blockages and exceedance flows. Must have simple access for inspection.
- Landscape maintenance must be considered for vegetated layer.

Table 3 List of native plants to consider for use in Rainwater Gardens/Bioretention Systems

Erect marginal plants to consider	**Low-growing marginal/aquatic plants to consider**
Flowering-rush (*Butomus umbellatus*)	Amphibious bistort (*Persicaria amphibia*)
Gipsywort (*Lycopus europaeus*)	Brooklime (*Veronica beccabunga*)
Great water-dock (*Rumex hydrolapathum*)	Watercress (*Nasturtium officinale*)
Hemp Agrimony (*Eupatorium cannabium*)	Floating sweet-grasses (*Glyceria* spp.)
Marsh Woundwort (*Stachys palustris*)	Marsh foxtail (*Alopecurus geniculatus*)
Pendulous sedge (*Carex pendula*)	Marsh marigold (*Caltha palustris*)
Purple loosestrife (*Lythrum salicaria*)	Meadowsweet (*Filipendula ulmaria*)
Rush (*Juncus* spp.)	Water forget-me-not (*Myosotis scorpiodes*)
Yellow iris (*Iris pseudacorus*)	Water mint (*Mentha aquatica*)

6.4 Swales and Filter Strips

CIRIA C753 Ch. 15 + 17

	Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
Swales	✓		✓	✓	✓	✓	✓		✓	
Filter Strips		✓		✓	✓	✓	✓			

6.4.1 Description

Swales and filter strips are often used together, replacing conventional pipework as a means of conveying runoff and removing the need for kerbs and gullies along road networks.

Swales are broad, grassed/vegetated, shallow channels with a flat base. To aid with infiltration, a French Drain can be included beneath the base of the swale. Their design will determine their function but all swales should meet the following criteria:

- Maximum linear slope 1:50 to prevent erosion. On steep slopes, this can be attained by incorporating check dams to slow the flow.
- Minimum retention time of 10 minutes for pollution control.
- Maximum side slopes 1:3.
- Minimum height of grass of 50mm.

Filter strips are gently graded strips of grass or dense vegetation designed to treat runoff from adjacent impermeable surfaces. They encourage runoff to flow as a sheet as low velocities, enabling effective treatment of the water.

6.4.2 Issues and Opportunities

- Wildflower turf should be considered for extended cut intervals.
- Design should include safe access for maintenance.

6.4.3 Maintenance

- Rounded 'shoulder' profile of the swale to allow safe mowing.
- Swales require regular maintenance.
- Safe access for maintenance and inspections should be included in the design.
- Mowing should maintain grass lengths of 70-150mm.

6.6 Filter Drains

CIRIA C753 Ch. 16

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓	✓	✓			✓				

6.6.1 Description

Filter drains, also known as 'French Drains', are shallow trenches filled with stone/gravel and a perforated pipe that allows for either infiltration directly into the ground or travel along the pipe to the outfall.

The trench may be lined with a geotextile, geomembrane or other impermeable liner, depending on the suitability of the underlying soils and the sensitivity of the groundwater. A high-level perforated pipe can also be installed to cater for overflows and local overloading. They can replace conventional pipework as conveyance systems and work best when incorporated into the Management Train.

6.6.2 Issues and Opportunities

- Crushed stone rather than pea gravel enhances the treatment process.
- A level edge along the trench will reduce erosion.
- A protective grass strip may enhance the design life.

6.6.3 Maintenance

- Safe access for maintenance and inspections should be included in the design.

6.7 Pervious Paving

CIRIA C753 Ch. 20

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓	✓	✓	✓						

6.7.1 Description

Pervious pavements allow rainwater to infiltrate to an underlying structural layer. It is then either temporarily stored, infiltrated directly into the ground beneath or is discharged downstream in a controlled manner. The method used is typically dependant on the soil conditions. Such pavements are designed for pedestrian and/or light-traffic use, such as parking. They are now also accepted for use by the Highways Authority for access roads.

They are effective source-control structures as surface water runoff is dealt with either at or close to its source. There are two types of pervious paving that are dependent on the surfacing materials:

- **Porous pavements**: Infiltrate surface water runoff across the whole surface material, for example reinforced grass/gravel structures, porous concrete etc.
- **Permeable pavements**: The surface material itself is impermeable but their layout design includes a void space to allow infiltration to the sub-base.

The treatment layer consists of a grit bedding material which removes pollutants from the water as it passes to the final layer where it is either stored or moved on downstream. The storage layer, the sub base, consists of crushed stone. Water is stored in the voids between the stones and it is at this point that it is either infiltrated directly into the ground or is discharged via a perforated pipe or fin drain.

6.7.2 Issues and Opportunities

- Ideal for driveways and carparks.
- Silt from runoff of adjacent areas must be kept off pervious pavements to prevent gaps between units from clogging.

6.7.3 Maintenance

- Regular inspections and construction following specific guidelines (CIRIA C753) are critical to ensure correct installation.
- Regular sweeping and suction treatment should be carried out to ensure the surface is free from silt.
- Gravel and grass may require scarification and mowing, depending on its location.
- Free draining surface soils require an appropriate ‘root zone’ specification.

6.8 Green Roofs

CIRIA C753 Ch. 12

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓				✓	✓		✓		

6.8.1 Description

Green roofs are installed for a range of reasons, including ecological, aesthetic and to enhance building performance. They can be split into two categories; extensive and intensive (see Table 3).

Green roofs typically consist of several layers, including vegetation, the substrate (growing medium), filter fabric, the drainage layer, root barrier and a waterproof membrane. These layers vary depending on the green roof type and site constraints.

Whilst green roofs can be more expensive to install compared to traditional roofs, they do offer many long-term benefits, including the reduction in building energy costs due to the plants and substrate cooling the roof through evapotranspiration during summer months. Where there are sufficient green roofs in a populated area, they can also contribute towards improved air quality by capturing dust particles. Blue roofs are the same as green roofs but the water is stored rather than discharged to the next stage in the Management Train.

Table 4 Comparison of extensive and intensive green roof systems (taken from CIRIA C753 (2015))

	Extensive green roof	Intensive green roof
Access	Not usually accessible	Accessible as public space/garden
Growing medium	Thin growing medium 20-150mm	Deeper growing medium
Irrigation	Only during plant establishment	Occasional to frequent
Maintenance	Minimal to none	Low to high
	Advantages • lightweight • suitable for roofs with slope of up to 1 in 3 • little or no need for irrigation and specialised drainage systems • often suitable for retrofits • little management of vegetation • relatively inexpensive • attractive to pioneer species colonisation, which can lead to a more biodiverse long-term ecosystem • can support arrested pioneer communities, which are important for nature conservation **Disadvantages** • More stressful conditions for plants, leading to lower potential diversity and associated biodiversity • limited insulation provision • limited surface water retention benefits • limited aesthetic benefits	**Advantages** • more favourable conditions for plants leading to greater potential diversity of plants and habitats • good contribution to thermal performance of the building • can be made very attractive • often accessible, with opportunities for recreation and amenity benefits • food surface water retention capacity **Disadvantages** • greater loading on roof structure • need for irrigation and drainage systems requiring energy, water, materials • higher capital and maintenance costs

6.8.2 Issues and Opportunities

- Consideration should be given to site constraints when deciding on roof type.
- Developer should consider the biodiversity objectives when considering roof types.
- If access is required for maintenance, this should be designed safely.
- Depth of soils will depend on type of vegetation chosen. For more information, please see CIRIA C753, Ch. 12, Tables 12.3 and 12.4.
- Correct application of the waterproof membrane is essential.
- Safe access is required for construction of the green roof.

6.8.3 Maintenance

- Maintenance contractors with specialist training should be used, where possible.
- Most maintenance for an extensive green roof is during the establishment phase (12-15 months).
- If mechanical systems are located on the roof, then spill prevention measures should be exercised to ensure that roof runoff is not contaminated.
- All maintenance carried out at roof level must be carried out in full compliance with the appropriate health and safety regulations.
- Walkways should be kept clear of obstructions.

6.9 Soakaway

CIRIA C753 Ch. 13

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓	✓								

6.9.1 Description

Modern small soakaways, typically serving single properties, are usually constructed with geocellular units which save space when compared to traditional soakaways which tended to be excavations filled with rubble or lined with brickwork.

Larger soakaways may be constructed with perforated precast concrete manhole rings surrounded with granular backfill or by using larger geocellular structures such as large attenuation tanks (CIRIA C753 Ch. 21).

The performance of soakaways is dependent on the ability of the surrounding soils to drain naturally and the depth to groundwater. A minimum distance of 1m between the base of the soakaway and the maximum likely groundwater level should always be adopted.

Whilst soakaways may not have any inherent amenity value, the fact that they are subsurface means that they can promote multi-functional space by freeing up the land above for recreation or other amenity facilities.

6.9.2 Issues and Opportunities

- Long-term structural integrity and the anticipated service life of the asset should be addressed.
- Runoff must be suitably clean before entering the soakaway to avoid groundwater contamination.
- Should not be used for untreated drainage from sites that are likely to contain silt, debris or pollutants.
- Soakaways should be strong enough to cater for the loads acting on them during their service life.

6.9.3 Maintenance

- Should include monitoring points where water level can be observed or measured. For small, filled soakaways, a 50mm perforated pipe is adequate but for larger installations, inspection access should provide a clear view of the infiltration surface.
- The frequency of maintenance is dependent on the use of the soakaway. For detailed information, see CIRIA C753 Ch. 13, Table 13.1.
- Replacement of aggregate or geocellular units will be necessary if the system becomes blocked with silt.
- Maintenance schedules should be developed during the design phase.

6.10 Rainwater Harvesting

CIRIA C753 Ch. 11

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓						✓	✓		✓

6.10.1 Description

Rainwater harvesting (RWH) systems store rainwater for reuse. They vary in size from domestic water butts to small ponds for agricultural use. In more urban environments, proprietary geocellular structures have been designed to assist with watering tree root zones. There are three main types of RWH system:

- **Gravity-based systems**: Rainwater is collected by gravity and stored at elevation, often in roof spaces, so that it can also be supplied by gravity.
- **Pumped systems**: More commonly used. Water is stored below ground where it is then pumped for its supply purposes. There is less constraint on size than gravity-based systems. They pump water either to a header tank or directly to appliances within the building.
- **Composite systems**: Use the advantages of both gravity and pumped systems. Runoff collected by gravity is stored in a header tank whilst excess is stored in a main tank below ground.

Selecting the type of RWH system is dependent on existing conditions and, therefore, the suitability of runoff for harvesting. The siting of the RWH system will also depend on the size and access requirements of the tank and the physical constraints of the site.

6.10.2 Issues and Opportunities

- A Geotechnical investigation should be undertaken to ensure the soils are suitable for the tank foundation.
- Where groundwater levels are close to the ground surface, the issue of flotation will need to be addressed.
- The sizing of the tank is a function of the demand for non-potable water. More information and an automated calculation of storage tank size for residential RWHs can be found at www.uksuds.com.
- Design needs to include either an inlet valve that closes once the tank is full or an overflow arrangement.

6.10.3 Maintenance

- RWH systems should be provided with appropriate information on maintenance requirements and expected performance of the system.
- Most systems require periodic checking to ensure that it is operating as expected. Manufacturer's guidelines should always be followed.
- Tanks should be accessible for internal inspection.
- Maintenance requirements are largely dependent on the source of the runoff and the runoff use.

6.11 Trees

CIRIA C753 Ch. 19

Water Storage	Silt Removal	Pollution Treatment	Infiltration	Biodiversity	Visual Amenity	Physical Amenity	Education	Energy	Adaptability
✓	✓	✓	✓	✓	✓				✓

6.11.1 Description

Trees are an important part of any developed setting. They provide surface water management benefits in a number of ways, including:

- **Transpiration**: Water uptake from roots in the soil is evaporated through the pores or stomata on the surfaces of the leaves.
- **Interception**: Leaves, branches and tree trunks intercept and store rainfall, reducing the amount of water that reaches the ground.
- **Increased infiltration**: Decomposition of leaf litter and root growth increase the soil's infiltration capacity and rate.
- **Phytoremediation**: Trees also take up trace amounts of chemicals that might be present in the soil thus increasing the quality of the water.

Trees should be selected on a site-by-site basis. Mature, large species of tree provide the most effective surface water management so it is therefore important to understand any site constraints so effective planning can take place. It is recommended that developers seek the advice of an arboriculturalist for choosing the most appropriate tree for the area.

6.11.2 Issues and Opportunities

- Roots require sufficient drainage so that they do not become waterlogged.
- The main risks for trees in urban environments are soil compaction by vehicles and limited access to air and water for the roots.
- The maximum likely groundwater level should always be at least 1m below the lowest level of the tree pit.
- Can be combined with other plants to form a Bioretention system.
- Can provide a critical role in improving an urban environment's biodiversity.

6.11.3 Maintenance

- Requirements will be greatest during the first few years of tree establishment.
- Maintenance early on will involve regular inspections, weeding and, during period of low rainfall, irrigation may be required.
- Advice from an arboriculturalist or landscape architect with local knowledge should be sought for detailed advice.
- Maintenance plans should be developed during the design phase.
- CDM 2015 requires designers to ensure all maintenance risks have been identified and dealt with.

7. The SuDS Approval Process

7.2 Pre-Applications

It is often necessary for a pre-application to be undertaken in order to quicken the process of the Full Application. CCC does charge for Pre-Applications (Table 5).

Table 5 Pre-App Fees

Construction Area (ha)	Pre-App Fee
0.01 to 0.099	£100
0.1 to 0.99	£100 plus £50 per 0.1ha (or part of)
1.0 to 2.9	£570 plus £20 per 0.1ha (or part of)
3.0 and greater	£1000

Preparation and planning the site for management of surface water as early as possible is key to meeting the SAB requirements and a layout suitable for planning. It is strongly recommended to take advantage of the pre-application service that is on offer, especially if this is the first time that SAB approval is sought. We recommend that applicants submit as much detail as possible during this stage.
There is no timescale for this stage but it is important that adequate time is allowed so that any planning permission deadlines are not compromised by the new requirements of the SAB process. A list of likely pre-application questions can in found in Appendix 1.

Planning a strategy for dealing with surface water runoff early will provide better opportunities for low cost solutions to be implemented. Whilst this will save money in the long term, it will also ensure that the requirements from a planning authority perspective do not restrict a suitable drainage design for the whole site.

7.3 Full Application

All qualifying developments will require a full application to obtain SAB approval. The fees applicable for validating and determining each SAB application are fixed by legislation[4]. Table 6 below shows the scale of fees for a full application SAB submission.

Table 6 Full-App Fees

Construction Area (ha)	Fee
0.01 to 0.099	£420
0.1 to 0.5	£420 plus £70 per 0.1ha (or part of)
0.5 to 1.0	£700 plus £50 per 0.1ha (or part of)
1.0 to 5.0	£950 plus £20 per 0.1ha (or part of)
Greater than 5.0	£1,750 plus £10 per 0.1ha (or part of) subject to a maximum of £7,500

[4] http://www.assembly.wales/laid%20documents/sub-ld11778/sub-ld11778-e.pdf

A full application will require adequate information to be provided to the SAB before it can be considered for SAB approval. The pre-app service will assist with preparing and collating this information to reduce the risk of delays in obtaining a SAB determination decision. Only once an application is validated, i.e. all the information required to determine the application has been received in full, will the SAB fee become payable and the timescale for approval begin.

Any fees received for applications that are NOT validated will be returned.

There is no timescale for validating a SAB application.

A guidance document and checklist for a full application are available here[5] but **as a minimum, the following documents will be required for validation**:

- The full application form
- Site plans
- Drawings of the proposed SuDS Scheme including detailed design
- Maintenance plan for the SuDS scheme (See Appendix 2 for a list of maintenance activities)
- Flood risk map
- Percolation test results (if infiltration methods are used).

It is worth contacting the SAB to check what documents are required. We advise that this is done through a Pre-App or by making use of our initial free phone call.

Once a SAB application has been validated and the SAB has received confirmation of payment, you will be informed of the date it was validated. This will be done in writing via email or letter directly to the applicant or agent dealing with the application. The default timescale for assessing applications is 7 calendar weeks from the date of validation. This will allow technical checks to take place and statutory consultation responses to be received. If the application is subject to an Environmental Impact Assessment (EIA) under the *Town and County Planning (Environmental Impact Assessment) (Wales) Regulations 2017*[6], the timescale for SAB approval is 12 weeks from the date of validation. If you are unsure whether your development requires an EIA you are advised to contact the Local Planning Authority[7].

Whilst there are statutory timescales for determining an application, the timescale can be extended by agreement in writing.

Fees for validated applications that are refused are non-refundable.

[5] http://www.ceredigion.gov.uk/media/4830/04-full-app-guidance-version-05_11_18-ccc.pdf
[6] https://www.legislation.gov.uk/wsi/2017/567/contents/made
[7] http://www.ceredigion.gov.uk/resident/planning-building-control/planning-and-ecology/

7.3.1 Determination

Once a SAB determination decision has been formally issued, it may contain conditions that will need to be satisfied before full approval is given i.e. SAB Approval subject to conditions.

Conditions may refer to such things as timescales, phasing the construction or carrying out inspections during construction. To discharge any conditions, a form[8] will need to be completed and returned to the SAB.

To enable some or all of the conditions to be discharged in a formal manner, a legal agreement may be necessary between the SAB and the applicant. This will lay out what each party will do, when they will do it and how to do it.

7.3.2 Adoption

There is a duty under Schedule 3 of the FWMA for the SAB to ensure that ALL sustainable drainage systems are maintained in the future. This will include ensuring that funding arrangements are in place to achieve this.

For single dwellings where SAB approval applies, the SAB does **not** have any obligations to adopt and maintain the drainage systems. The SAB will, however, ensure that the system complies with legislation and has a maintenance plan in place for the owner to follow.

For all other approved sustainable drainage systems, and providing the system is installed and functions as designed, the SAB will adopt and maintain the SuDS. A SAB adoption will require prior arrangements to be agreed such as funding arrangements for ongoing maintenance and access. Full legal liability of all SAB approved SuDS will remain with the developer until formal notification is provided by the SAB that the drainage systems has been adopted.

[8] http://www.ceredigion.gov.uk/media/4832/06-approval-of-conditions-form-final-version-05_11_18-ccc.pdf

Appendices

Appendix 1 – Pre-Application

Pre-Application – likely questions (taken from CIRIA C753 (2015))	
1	An important part of any SuDS scheme is to determine the means of outfall and location of the final discharge destination in relation to the hierarchy of discharge. Has this been considered?
2	If the surface water infiltrates to the ground, have discussions taken place with Natural Resources Wales/Dŵr Cymru in relation to pollution risk to any underlying aquifers?
3	If the surface water discharge is to a sewer/highway drain, have discussions taken place with Dŵr Cymru and the Highways Authority?
4	If the surface water discharges to a waterbody, have discussions taken place with either Natural Resources Wales (manage Main Rivers and the sea) or the Lead Local Flood Authority (manage Ordinary Watercourse) on the consent to discharge.
5	There may be a number of constraints within/outside of the development that may have an impact of the SuDS scheme which could include; issues around soil geology, topography, groundwater etc. Have all constraints been identified?
6	Within the development, has the connectivity of the SuDS scheme been determined for the impermeable areas both around the properties and outside of the properties?
7	Are there any offsite issues for the surface water discharge? Have these been considered? For example, access to third-party land, or offsite works to proposed destinations.
8	As part of the development and the SuDS scheme are there any environmental or ecological issues that need to be considered? For example, water quality or biodiversity issues.
9	Will the SuDS scheme require phasing?
10	The topography of a development is an important factor of the SuDS scheme. Is there any substantial re-grading of the development which will affect the SuDS scheme?
11	What is the anticipated development programme for the site?
12	Are there any temporary arrangements that you are aware of for the drainage that needs to be discussed?
13	Have discussions taken place with the Highways Authority around the interaction of managing the surface water?
14	Have you had initial discussions with the Local Planning Authority and the Lead Local Flood Authority where issues may need to be considered as part of the SuDS scheme?
15	Have matters surrounding accessibility and future maintenance needs been incorporated into the design?
16	What will the required bond be and have all the considerations surrounding this been taken into account?
17	What inspections and tests are likely to be required by the SAB?
18	Will there be any flood risk features which will require designation?

Appendix 2 – SuDS Maintenance

Typical key SuDS components operation and maintenance activities (taken from CIRIA C753 (2015))												
Operation and maintenance activity	**SuDS Components**											
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretenntion /trees	Filter strip	Green roofs
Regular maintenance												
Inspection	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■	
Grass cutting	■	■	■	■	□	■	■	□	□	■	■	
Weed and invasive plant control	□	□	□	□		□	□		□		□	■
Shrub management (including pruning)	□	□	□	□					□	□	□	
Shoreline vegetation management	■	■	□									
Aquatic vegetation management	■	■	□									
Occasional maintenance												
Sediment management[1]	■	■	■	■	■	■	■	■	■	■	■	
Vegetation replacement	□	□	□	□						□	□	■
Vacuum sweeping and brushing								■				
Remedial maintenance												
Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning				□	□	□	□		□	□	□	

Key:

▪ will be required

▫ may be required

Notes

1 Sediment should be collected and managed in pre-treatment systems, upstream of the main device.