S104 SuDS Guidance Document

Basin

Version 3 (October 22)

(This document should be read in conjunction with S104 SuDS Technical appraisal form for Basins)

Comment no.	Technical Guidance
Types of basins	
1	It's essential that it is made clear what type of basin is being utilised within the design at an early stage to enable an effective assessment to be completed and this must be referenced correctly on the S104 Agreement Plan. The different types of basins are noted below; **Infiltration basin** **Dry detention/attenuation basin** **Vegetated detention/attenuation basin** See CIRIA C753 Chapter 23 (figure 23.5) for further guidance on permanent pool/aquatic bench design specifications
High level considerations, location & layout	
2	**Topography:** The surface should be level to allow distribution of flows across it. **Shape, location & maintenance considerations:** Length / width ratio for online detention basins should be between 3:1 and 5:1. However, the location and shape of the component should be agreed with the local planning authority but where the component is not located in a verge, other public open space or the boundary between the highway and a private garden, provision should be made for access including any specific features that are likely to pose maintenance difficulties and any associated mitigation measures that have been put in place – see chapter 32 of CIRIA C753 for guidance. Consideration should be given to planting of trees etc. which may hinder access for the maintenance particularly around ancillaries and access points
3	**Flood risk to existing features**: No surrounding properties or features should be at risk – see chapter 36 of CIRIA C753 for guidance.
Design requirements	
4	**Flow path requirements**: Flow paths should be maximised through the length of the component. If a low-flow channel is required through the basin, a swale shall be the preferred option. Where a swale is used its design shall follow CIRIA C753: SuDS Manual Chapter 17. Any engineered channels should be between 100-150mm deep. The minimum width size should mimic the incoming pipe size(s) and/or maximum width size should be no wider than the width of the headwall. Infiltration basins do not require low flow channels.
5	**Hydraulic assessment information criteria;** **Representing feature for hydraulic calculations**: For conveyance it must be represented as part of the online piped network. If labelled as a storage component then it must be explained how this is linked in the model as part of the online network. Volumetric allowances for vegetation of up to 25% should be provided to ensure flood control criteria are met. **Longitudinal fall** needs to be represented in the model between 1 in 100 and 1 in 400 **(this will not be applicable for infiltration basins)** **Inflow velocities** must be acceptable and any erosion protection must show suitable flow spreading and energy dissipation ensuring that they are physically and aesthetically proportionate to the size of the basin. Any erosion protection must be reflected in the hydraulic model by applying a **headloss** of 0.5 at the point of outfall. The same headloss value of 0.5 needs to be applied for catch pits where applicable. **Water depths** should not exceed 1m in the 100 year event and the maximum water depth in any event should not exceed 2m. This can be achieved by having a robust SuDS management train. The maximum water level must be at least 500mm below the lowest FFL of any adjacent properties. Most Local Authorities will require a much lower maximum depth, for safety reasons. Any depth must be justified in checklist B.5 (Health and Safety) – see CIRIA C753 chapters 22.2 & 24.2.3 for further guidance. For basins, the maximum design storage depth should provide a **freeboard** of between 400-600mm below the top of the banks, depending on the scale of the component – see section C7.7.6 of Design & Construction Guidance.

	Requirements to be discussed with LLFA (from 100yr + cc level to top of banks), taking into consideration periodic sediment accumulation. **Flow control diameter should** usually be a minimum of 100mm, however if the flow control has robust upstream protection which prevents debris this could be reduced to a minimum of 50mm **Component drain down time** must be within 24hrs and will need to be supported with calculation. For infiltration systems, this is 48hrs (or half drain down within 24hrs) **Designing for exceedance & considering overland flow** Overland flows from surrounding land must be considered particularly if adoptable components are designed to accept surface inflow. Flow routes for significant offsite flow paths must be provided as part of the overall site design and should be separated from any new adoptable network design See chapter 36 (table 36.1) of CIRIA C753 for guidance on acceptable velocities for exceedance. **Very large basins:** If the storage volume exceeds 10,000m^3 then the design may have to comply with the Reservoirs Act 1975.
6	**Side slopes** need to be within a gradient of 1:3 and 1:5 for the perimeter of the component, 1:5 is preferred around any access to ancillaries (i.e. inlets & outlets). **UU will not adopt a feature with the minimum slope around the entire perimeter of the surface SuDS feature.**
7	**Pre-treatment / Sediment control** must be provided on any open SuDS component. For systems with multiple inlets distanced apart, pre-treatment should be provided at or upstream of each inlet. Adoptable pre-treatment can be provided in the form of forebays and catch-pit details, or in the case of infiltration systems proprietary treatment systems such as vortex separators. If a forebay is chosen see chapters 22 & 28.4.8 of CIRIA C753 for further guidance. The forebay area must be at least 10% of the total component. If the area is <10m2 then the depth of the forebay should be 200mm deep, if the area is >10m2 it should be 300mm deep – see CIRIA C753 chapter 18.8.1 (EQ.18.2). The top of the permeable berm for the forebay must be set at the 30yr level as shown on our inlet headwall & forebay details drawing located on our website. Each forebay should be accessible and easily maintained. A fixed sediment depth marker is recommended to monitor silt levels over time. Consideration can be given to a concrete lined forebay as this would also protect from erosion and can facilitate desilting (without damage to a liner for example). If using catch pit manholes, they must be sufficiently sized and representative of the upstream catchment with sump depths between 300-500mm. Suitable access should be provided for maintenance and the management and maintenance document must consider potential increase for maintenance activities. For an infiltration basin, pre-treatment can be in the form of an additional upstream SuD component (i.e. attenuation basin/swale) or an adequate sediment management system.
8	**Erosion protection** will be required for any outfall to a SuDS component and should extend to the base of the component. It can be in the form of a gabion mattress, rip rap, large stone spillway or can be incorporated into a forebay design if applicable.
9	**Water quality** For the 1yr, 30 minute event; Average residence time in basin > 9 minutes for effective treatment Flow height to be < 100mm Velocity < 0.3m/s for effective treatment This is to ensure good pollutant removal performance – see CIRIA C753 section 22.5 for further guidance. The residence time in component can be calculated by the following; length of low flow channel or component (m) / velocity (m/s)* = residence time (seconds) / 60 = residence time in component (mins) *Velocity through the component must be less than 0.3m/s during a 1yr 30min event

10	**Inlet and outlet connections** There are various point inlet details within the DCG and CIRIA SuDS manual which can differ based on pipe size, component type and application, if discharging via piped network inlets up to 350mm diameter, are to be constructed as per the standards set out in the Design & Construction Guidance (DCG) or our inlet headwall details drawing located within our SuDS technical library on our website Inlets greater than 350mm diameter, are to be constructed as per our inlet headwall details drawing or our standard detail drawings which can be found within our S104 technical library on our website. Outlet construction details can be based on the inlet details above. For dry features the outlet invert level should be set to the base of the headwall detail.
11	**Lining considerations:** Below is a list of information/considerations required when lining is proposed; Unlined components should not be used on brownfield sites unless it has been demonstrated that the risks posed by leaching of contaminants is managed to acceptable levels. Specification of chosen liner will be required. Geosynthetic barriers should be designed in accordance with BS EN 13361 or BS EN 13362 (see section E2.45 of Design & Construction Guidance), this includes tensile load, tear resistance and puncture resistance. These should have welded joints, taping would not be acceptable.
12	The **full design detail** should show all individual components which may include; inlet, forebay, permeable berm, low flow channel, vegetation/planting, (aquatic pool – vegetated basins), outlet etc. as applicable. **Materials** should be shown on the **sectional drawing** i.e. subsoil, topsoil, geotextile membrane, geosynthetic barrier, permeable berm, low flow channel etc. as applicable. See CIRIA C753 chapters 22 (Basins), 30 (Materials including specification for liners – see 30.5.4) and 31 (Construction) along with chapters 21 (Soils) & 22 (Materials), of CIRIA C768 for further guidance.
Additional requirements for infiltration basins only	
A	Infiltration Basins will require good quality backfill/bedding/surround 300mm of Engineering soil is required to ensure reduce top soil saturation. See Chapter 13 and 21 of the CIRIA guidance, in particular section 21.10
B	The bottom of the system must be flat the guidance states that the tolerance should be 10mm in 3m. See chapter 13 of CIRIA C753 for guidance in particular page 261

Construction

Construction of Detention Basins should be in accordance with the guidance provided in the appropriate chapters of CIRIA C753 (22.11) and CIRIA C768 chapter 35 along with CIRIA C753 Appendix B: Construction assessment checklist.

Figure 22.2 provides a typical plan view and profile for the design of a detention basin.

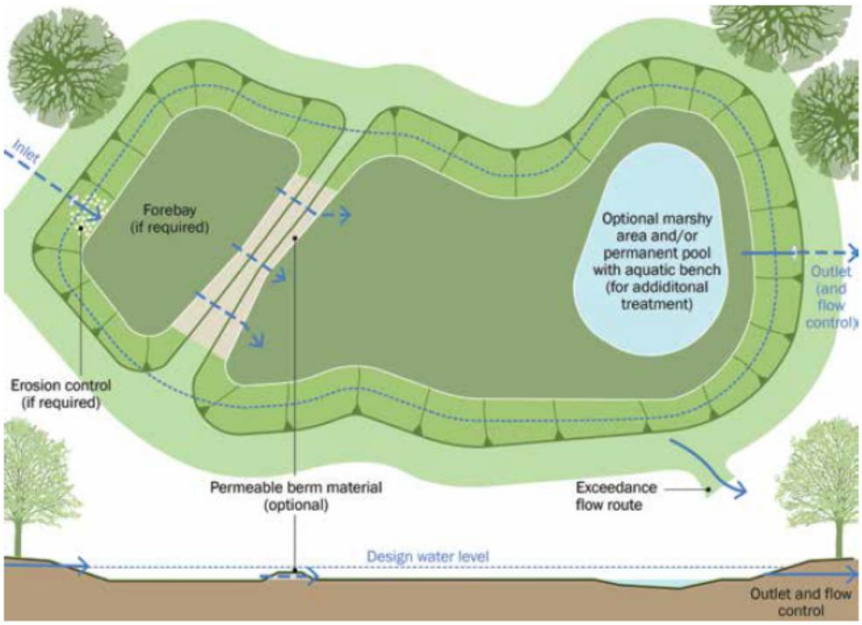

PHOTO OF CONCRETE SEDIMENT FOREBAY

PHOTO OF STONE EMBANKMENT SEDIMENT FOREBAY