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SUDS Management Plan

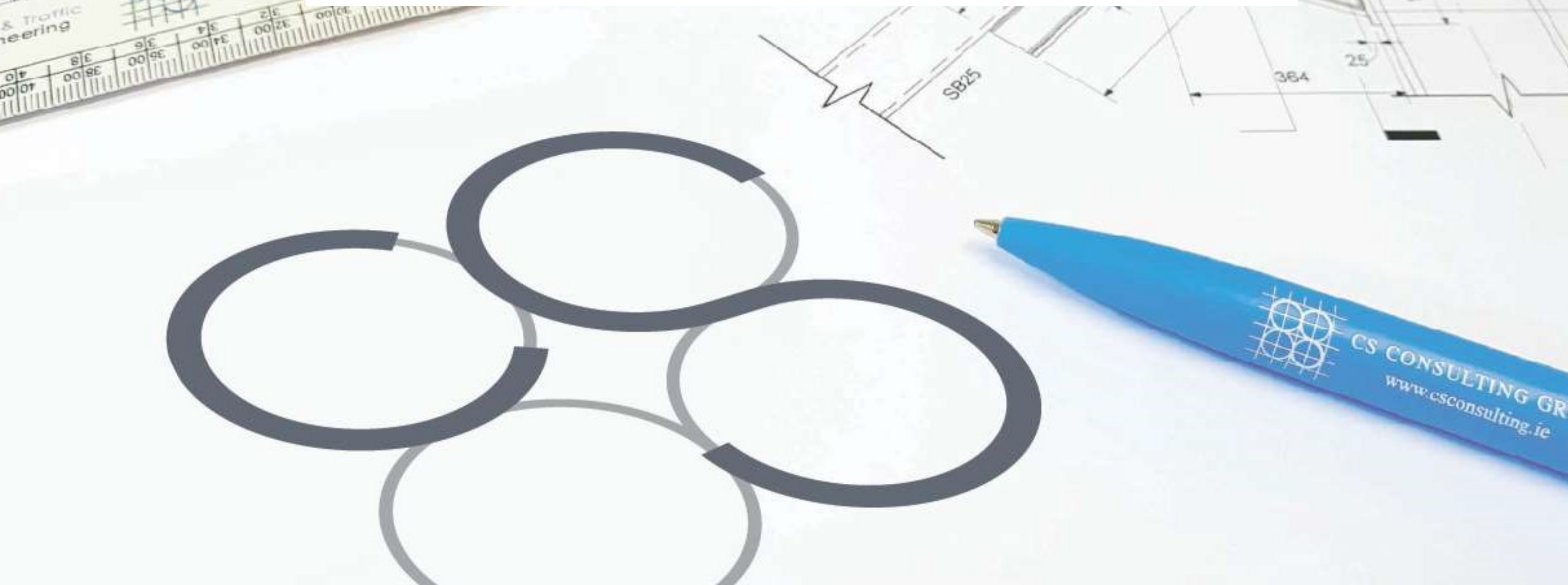
Proposed alterations, extension and upgrades to the existing terminal building

Weston Airport, Backweston Park, Leixlip, Co. Dublin.

Client: Weston Aviation Academy Ltd.

Job No. W012L

July 2023



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SUDS MANAGEMENT PLAN

PROPOSED ALTERATIONS, EXTENSION AND UPGRADES TO THE EXISTING TERMINAL BUILDING, WESTON AIRPORT, BACKWESTON PARK, LEIXLIP, CO. DUBLIN.

CONTENTS

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1.0 INTRODUCTION

Cronin & Sutton Consulting Engineers (CS Consulting) have prepared this Sustainable urban Drainage Systems (SUDS) Management Plan in response to Condition 7.v) issued by South Dublin County Council as a part of Notification of Decision to Grant Planning under reg.ref. SD22A/0345.

This statement outlines the following aspects of the proposed development:

- SUDS Philosophy
- SUDS Strategy and management train
- SUDS Interception and Treatment design
- SUDS Maintenance plan

In preparing this report, CS Consulting has made reference to the following:

- Local Council Development Plan
- Local Area Plan (if any)
- Building Regulations 2010 (Part H)
- Greater Dublin Regional Code of Practice for Drainage Works (Version 6)
- Greater Dublin Strategic Drainage Study (GDSDS) 2005
- CIRIA C753 The SUDS Manual
- SDCC Sustainable Drainage Explanatory Design & Evaluation Guide 2022
- The Wallingford Procedure Volume 1

The SUDS Management Plan is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with all other relevant documentation submitted by other members of the project design team.

2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Site Location

The proposed development site is located on lands to the west of County Dublin, just west of Lucan and to the south of Leixlip. It is located predominantly within the administrative region of South Dublin County Council (SDCC) with the western portion of the runway being located within the Kildare County Council (KCC) administrative area. The area of land associated with the proposed development is in the administrative region of SDCC.

Figure 1 – Location of proposed development site
(map data & imagery: EPA, NTA, OSM Contributors, Google)

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 2.

The site is located within the townlands of Backweston park, and the site is accessed from Cooldrinagh Lane which leads onto the R403. M4 is located to the north of the site and River Liffey is situated along the north/north-western boundary of the subject lands.

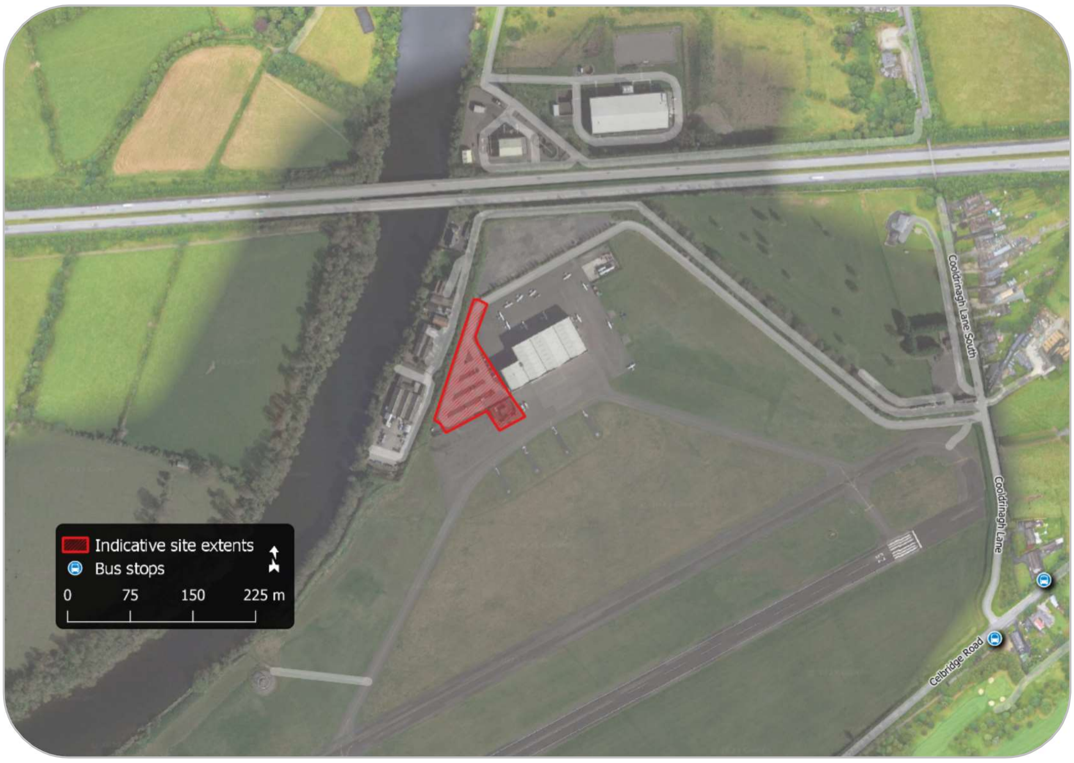

Figure 2– Development Site Surrounding Environment
(*map data & imagery: EPA, NTA, OSM Contributors, Google*)

2.2 Existing Land Use

The subject site is the airport terminal building with associated car parking.

3.0 SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)

3.1 Benefits of SUDS Philosophy

When rain falls on a natural landscape, it soaks into the ground, evaporates, is taken up by plants (evapotranspiration) and some of it eventually finds its way into streams and rivers.

These stages of the water cycle can be impeded when land is altered by development. In urban areas, there tends to be less permeable ground available for infiltration and less vegetation for evapotranspiration. When rain falls on impermeable surfaces, much more of it turns into surface water runoff which can cause flooding, pollution and erosion problems. As well as contributing to more surface water runoff, increasing urbanisation has also reduced wildlife in urban areas, leading to some species being lost from our green spaces to the detriment of the local ecosystem and the human population.

Sustainable Drainage Systems is a series of management practices and control structures that aim to mimic natural drainage in developed areas. The philosophy of sustainable drainage systems is about maximising the benefits and minimising the negative impacts of surface water runoff from developed areas.

The SUDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing conveying and treating runoff on site, and where possible, on the surface rather than underground.

By adopting this approach, SUDS have the opportunity to deliver and enhance the green space within the developments, supporting the provision of habitats and places for wildlife as well as providing a positive impact for the wellbeing of the communities. As stated in the CIRIA C753 SUDS manual, there are four main categories of benefits that can be achieved through the implementation of SUDS: water quantity, water quality, amenity and biodiversity.

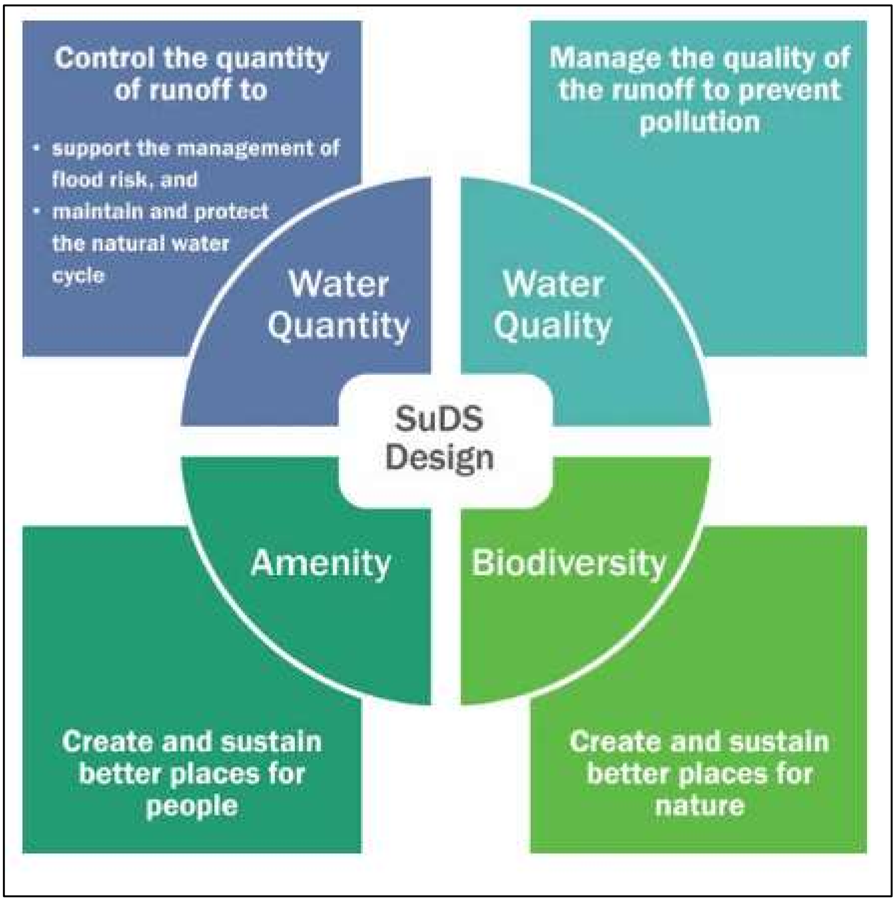

Figure 3 – The four pillars of SUDS design
(*CIRIA C753 SUDS Manual*)

These benefits are aligned with the objectives established in Chapter 4 of the SDCC Development Plan 2022-2028.

Policy GI4: Sustainable Drainage Systems
Require the provision of Sustainable Drainage Systems (SuDS) in the County and maximise the amenity and biodiversity value of these systems.
GI4 Objective 1: To limit surface water run-off from new developments through the use of Sustainable Drainage Systems (SuDS) using surface water and nature-based solutions and ensure that SuDS is integrated into all new development in the County and designed in accordance with South Dublin County Council's *Sustainable Drainage Explanatory Design and Evaluation Guide*, 2022.
GI4 Objective 2: To incorporate a SuDS management train during the design stage whereby surface water is managed locally in small sub-catchments rather than being conveyed to and managed in large systems further down the catchment.
GI4 Objective 3: To require multifunctional open space provision within new developments to include provision for ecology and sustainable water management.
GI4 Objective 4: To require that all SuDS measures are completed to a taking in charge standard.
GI4 Objective 5: To promote SuDS features as part of the greening of urban and rural streets to restrict or delay runoff from streets entering the storm drainage network.

Figure 4 – South Dublin Development Plan GI Objectives
(*Sustainable Drainage Explanatory Design & Evaluation Guide*)

4.0 SUDS STRATEGY – DESIGN APPROACH

This SUDS Management Plan outlines the proposed approach for the management of rainfall runoff from the development to ensure that there is no increase in the risk of flooding for the development nor the adjacent areas whilst the development benefits from the improvements in the water quality, amenity and biodiversity.

The approach to the SUDS design has followed the below steps as recommended by CIRIA The SUDS Manual:

- Identify and existing and modified flow routes.
- Identify suitable mechanisms of discharge for site drainage.
- Allocate a management train and appropriate number of subcatchments to provide the collection, treatment and storage of runoff across the site.
- Identify suitable SUDS components which are aligned with the landscape character of the site.

In relation to the above it is worth noting that the proposed development consists of proposed alterations, extension and upgrades to the existing terminal building. In that regard the provision of SuDS elements and the type of SuDS elements were based on the requirements of the proposed works.

4.1 FLOW ROUTE ANALYSIS

4.1.1 Existing Flow Route Analysis

Proposed development alteration works that impact on the existing flow routes relate to the alteration works of the existing car park area. The topography of the existing car park area has been assessed to determine how the existing car park behaves. The findings of the assessment were that the existing carpark surface falls in various directions which are coordinated with the existing surface water drainage system.

4.1.2 Modified Flow Route Analysis

The modified flow route analysis is the basis for low flow conveyance, overflow arrangements and exceedance routes when design criteria are exceeded. The modified flow routes have been assessed, based on proposed alterations to the existing car park layout and proposed alterations to the existing surface water drainage system. Newly incorporated SuDS elements take full cognisance of the modified flow routes. Refer to CS Consulting drawing **W012L-CSC-XX-XX-DR-CP-0003** for further information.

4.2 Drainage Hierarchy

As set in section 5.2 of the SDCC Explanatory, Design and Evaluation Guide 2022, SUDS designs should explore opportunities for sustainable reuse of rainfall, recharge of aquifers and direct discharge to open watercourses The following ways of managing or releasing surface runoff to the wider environment should be considered and are set out in order of preference:

1. Use surface water runoff as a resource
2. Provide nature-based SUDS features that promotes interception losses.
3. Where appropriate infiltrate runoff into the ground.
4. Discharge to an open surface water drainage system.
5. Discharge to a piped surface water system.

In relation to the above it is worth noting that the proposed development consists of proposed alterations, extension and upgrades to the existing terminal building. In that regard the provision of SuDS elements and the type of SuDS elements was based on the requirements of the proposed works.

Given that the proposed works generally relate to the proposed alterations to the existing car park layout it has been identified that the SuDS elements compatible with the proposed works in this instance will be tree pits and bioretention area. These proposed SUDS elements will provide interception and treatment and allow for infiltration of runoff in to the ground based on the available infiltration potential on site and will in turn ensure that the rate of flow from the proposed car park is reduced when compared with the existing rate of flow from the existing car park area.

4.3 Management Train

A management train is usually required when developing a SUDS strategy. A management train sets a hierarchy of SUDS techniques which are subsequently linked together. Each technique employed contributes in different ways and degrees to the overall drainage network. Following a review of all the information presented in the previous sections and taking into consideration the site constraints the following SUDS components have been considered the most suitable for the development in question.

<u>SUDS Tree Pits</u>

SUDS tree pits are designed to collect runoff from the surrounding landscape. They are versatile as they can be integrated into both new and urban renewal enabling trees to thrive by being watered every time it rains. Healthy trees also need sufficient soil to grow, and this growing medium can also be used to store water before being released slowly to the next component of the management train. Tree pits associated with kerb inlet gullies and hit and miss kerb inlets have been proposed throughout the scheme to capture, intercept and treat runoff from hardstanding areas before being released into the existing surface water drainage system. Refer to CS Consulting drawing **W012L-CSC-XX-XX-DR-CP-0003** for the locations of the proposed tree pits and drawing **W012L-CSC-XX-XX-DR-CP-0005** for tree pit details.

SUDS Bioretention areas

Bioretention areas employ an engineered topsoil which is used to manage polluted urban rainfall runoff in street locations and car parks. The runoff entering bioretention features will normally carry silt and pollution from vehicles and urban street use. Therefore, maintenance will be required to remove the build-up of inorganic silt. The free-draining nature of engineered soil leads to the washing away of nutrients from the soil. The proportion of organic matter should be relatively high and replenished yearly by the application of a mulch layer of well composted green waste of shredded plant matter arising from maintenance. Bioretention areas associated with kerb inlet gullies and hit and miss kerb inlets have been proposed throughout the scheme to capture, intercept and treat runoff from hardstanding areas before being released into the existing surface water drainage system. Refer to CS Consulting drawing **W012L-CSC-XX-XX-DR-CP-0003** for the location of the proposed bioretention area and drawing **W012L-CSC-XX-XX-DR-CP-0005** for bioretention area details.

5.0 INTERCEPTION DESIGN

5.1 Tree Pits

Interception provided by the tree canopy will vary with tree type and will increase over the life of a tree as it grows and will provide a long-term benefit and will reduce volumetric runoff loads to the existing surface water drainage system. Interception provided by the proposed 15 No tree pits is able to dispose of 5mm of rainfall depth over the contributing catchment area of 4900 m^2 providing combined interception volume of 24.5 m^3.

5.2 Bioretention Areas

Bioretention systems deliver interception because there is no runoff from them for the majority of small rainfall events. The water soaks into the filter medium and is removed by evapotranspiration and infiltration. Proposed alterations to the existing car park include one bioretention area that provides interception of 10mm of rainfall depth for a catchment of 260 m^2 in turn providing an interception volume of 2.6 m^3.

6.0 TREATMENT DESING - WATER QUALITY

6.1 Water Quality Requirements.

Proposals for the site will comprise a development with non-residential car parking with frequent change and therefore considered to be medium risk. Treatment provision for the roads and car parking areas will be via the SUDS management train consisting of tree pits and bioretention areas.

Analysis of the effectiveness of chosen SUDS components to achieve water quality criteria follows the 'Simple Index Approach' described in Chapter 26 of the Ciria C753 SuDS Manual.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 5 – Pollution Hazard Indices for different land use classification
(*Source:* CIRIA C753 The SuDS Manual)

As per the simple index approach, each SuDS component is assigned a 'mitigation index' relative to the three primary sources of pollution listed above; TSS, metals and hydrocarbons. Mitigation indices are added together and water quality criteria are met if the mitigation index is greater than the risk index. Secondary / further stages in the treatment train are assigned treatment indices 50% of stated value identified by SuDS Manual (as per advice provided by SuDS Manual).

As demonstrated in the Table below, the mitigation indices are greater than the risk indices for the proposed development, so water quality requirements are deemed to have been met.

Table 1 – SUDS Mitigation Indices

Type of SUDS Component	TSS	Metals	Hydrocarbons
Bioretention areas	0.8	0.8	0.8
Tree Pits	0.8	0.8	0.8
Minimal required mitigation indices	0.7	0.6	0.7

7.0 OUTLINE SUDS MAINTENANCE REQUIREMENTS

7.1 Tree Pits.

Maintenance requirements of trees will be greatest during the first few years, when the tree is becoming established. Early maintenance should involve regular inspection, removal of invasive vegetation and possibly irrigation during long dry periods, particularly in soils with high void ratios. Tree roots need to establish good root–soil contact before they can efficiently extract water from the soil. The expertise of an arboriculturist/landscape architect with local knowledge should be sought regarding appropriate irrigation schedules. Maintenance responsibility for a tree pit or planter should always be placed with an appropriate organisation.

The following table provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive, and some actions may not always be required.

Table 2 - Operation & Maintenance Requirements for Trees		
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional Maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Sediments excavated from a tree pit or planter that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For runoff, from busy streets with high vehicle traffic sediment testing will be essential.

Many of the specific maintenance activities for trees can be undertaken as part of a general landscaping or specific tree maintenance contracts.

7.2 Bioretention Areas

Dalrymple (2013) concluded that bioretention systems will typically require approximately 2.5 times more maintenance than typical landscape designs. Bioretention systems will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities along with likely machinery requirements and typical annual costs – within the Maintenance Plan. The treatment performance of bioretention systems is dependent on maintenance, and robust management plans will be required to ensure that maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements, but this section gives some generic guidance. Ease of access for maintenance and inspection is essential.

The main cause of failure of bioretention systems is clogging of the surface, which is easily visible. Underdrains and drainage layers are beneath the ground, and malfunctioning is not so easy to detect and therefore could potentially be ignored. However, the results of any malfunction are likely to cause

surface ponding. The clogging of the surface or drainage layers can cause poor outflow water quality due to water bypassing the filter medium to the overflow more frequently than allowed for. During the first few months after installation, the system should be visually inspected after rainfall events, and the amount of deposition measured, to give the operator an idea of the expected rate of sediment deposition. After this initial period, systems should be inspected each quarter, to verify the appropriate level of maintenance.

Adequate access should be provided for all bioretention areas for inspection and maintenance, including for the appropriate equipment and vehicles.

Litter picking should be frequent, as rubbish is detrimental to the visual appearance of bioretention systems. Frequent street sweeping in the catchment area will increase the time interval between cleaning out forebays or the filter surface and will reduce the loading of fine suspended solids that can potentially clog the filter medium. All vegetation management activities should take account of the need to maximise biosecurity and prevent the spread of invasive species.

Sediments excavated from pre-treatment devices that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation, to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. Proper disposal of sediment and debris removed must be ensured, and the environmental regulator should be approached for advice where there are any doubts concerning disposal options.

In general, the maintenance for bioretention areas can often be undertaken as part of routine landscape maintenance.

Maintenance responsibility for all systems should be placed with an appropriate organisation, and Maintenance Plans and schedules should be developed during the design phase. The following table provides guidance on the type of operation and maintenance schedule that may be appropriate. The list of actions is not exhaustive, and some actions may not always be required. The most intensive maintenance is required during the establishment period. Herbicides and pesticides (such as Roundup) and fertilizers should not be used on bioretention systems. This is because these pollutants will wash through the system quite easily.

Table 3 - Operation & Maintenance Requirements for Bioretention Systems		
Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary.	Quarterly
	Check operation of underdrains by inspection of flows after rain.	Annually
	Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary.	Quarterly
	Inspect inlets and outlets for blockage.	Quarterly
Regular Maintenance	Remove litter and surface debris and weeds.	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density.	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays.	Quarterly to biannually
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required.	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch.	As required
Remedial Actions	Remove and replace filter medium and vegetation above.	As required but likely to be > 20 years