MANCHESTER CITY COUNCIL

MCC Highways Developer Design Guidance – Sustainable Drainage Systems

Executive Summary:

In light of the climate emergency declared in 2019 and the councils net zero target of 2038, MCC Highways is committed to accelerate the changes required to help Manchester grow into a world renown sustainable city. One of these changes is to manage rainwater more efficiently and sustainably. The installation of SuDS is a scientifically proven method of doing this, with multiple case study examples across other cities in the UK and worldwide.

Sustainable Drainage Systems (SuDS) are predominantly natural drainage assets which are designed to assist the natural hydrological cycle while improving local ecosystems.

Some of the key benefits of SuDS are listed below:

- Reducing surface water flooding
- Improving water quality
- Providing surface water attenuation and storage
- Reducing surface water flows into the public sewer network
- Providing additional green space
- Improving local air quality
- Improving biodiversity

This document has been produced to encourage and standardise the approach of implementing SuDS on Highways Major Projects and on new private developments. The aim of this document is to ensure a consistent approach is achieved in terms of SuDS design, installation and ongoing maintenance requirements.

The document outlines the specific SuDS options that Manchester City Council Highways are prepared to adopt throughout the city, which includes rain gardens and SuDS enable street trees. The document provides detailed design guidance on how these assets should be constructed, as well as providing details on routine and long-term maintenance requirements.

The document also provides instruction for developers who seek MCC to adopt SuDS as part of new developments.

General Design and Adoption Guidance:

The design principles within this document are based on the CIRIA SuDS Manual C753, which should be reviewed in conjunction with this document for SuDS design.

The installation of SuDS features on the adopted highway will be subject to S278 and S38 agreements between the applicant and the MCC Highways Statutory Approvals Team. Technical approval sign off as part of the S278 / S38 Delegated Approvals process will ensure all SuDS features are installed to an adoptable standard.

SuDS features offered up for adoption by developers and contractors that aren't included in this list will not be considered for adoption and will result in delays to technical approvals.

All SuDS features offered up for adoption will be subject to commuted sums for the ongoing maintenance of the asset for a period of 20-40 years, with all costs to be provided by the developer / contractor and agreed as part of S278 / S38 process.

All proposed SuDS features should be agreed as part of the planning approval process and secured via planning condition. Therefore, it is recommended that developers agree the extents and types of SuDS feature at an early stage in the planning process, ideally at pre-planning stage, via early engagement with the MCC Flood Risk Management Team. This will ensure that the materials and design principles proposed are acceptable and will avoid delays, added costs or the requirement to redesign the streetscape as part of the S278 / S38 process.

All proposed SuDS designs should include cross section details clearly highlighting details of the inlet and outlet structures, the materials to be used, dimensions and associated hydraulic calculations where required. The design should be accompanied by a full detailed maintenance schedule. Note, longitudinal drawings may also be requested.

Each SuDS feature will need to be designed on a case-by-case basis, based on the location, and functional requirements of the asset. SuDS features which are to be adopted by MCC will need to follow the standard details outlined within this document. All SuDS designs should be produced and approved by a qualified engineer and landscape architect.

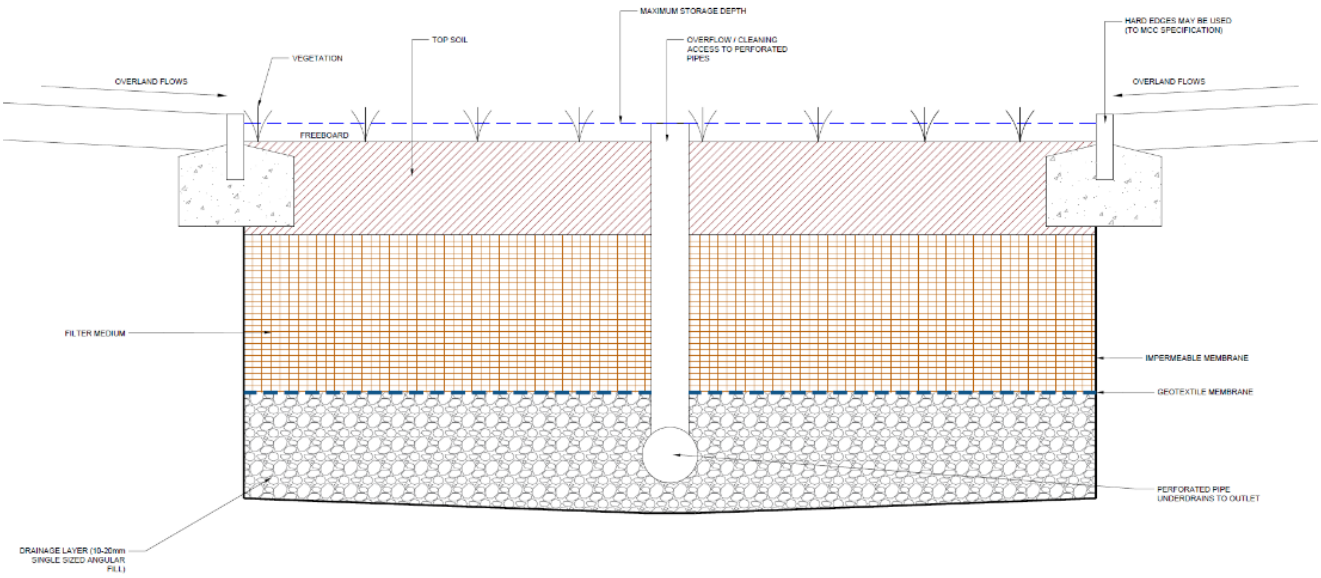
Rain Gardens:

Rain Garden – Design Principles (Non-infiltrating):

Raingardens enable surface water attenuation and outfall in a way which is sustainable and environmentally friendly, whilst increasing biodiversity and improving local amenity. This design focuses on reducing peak surface water flow rates into the highway gully network, which assists in reducing localised flood events and improving the gully network capacity and outflowing water quality. The below detail shows a design which is wrapped by an impermeable membrane with a perforated pipe which acts as an outfall for the system. An overflow pipe is positioned at just below the footway level to account for extreme rainfall events and asset failure.

Whilst the principle of the drawing shown below should be adhered to, each design will be subject to its specific highway locality and as such should be submitted for technical review. A larger scale version of the below drawing can be found in Appendix 1.

Detail 1 – A typical rain garden design with inlet from overland flows.



Accompanying Design Notes:

- The details and notes included on this drawing are guidelines only, each SuDS asset will need to be designed on a case-by-case basis, based on the location, and functional requirements of the asset. All SuDS designs should be produced and approved by a qualified engineer and landscape architect.
- Inlets should be designed to prevent erosion and scour, allowing an even distribution onto the surface layer.
- Nonorganic mulch/gravel should be considered above the topsoil layer (especially around the inlets). This is to ensure that the toil soil layer is not eroded or displaced following heavy storm events, this will allow the proposed plants to have adequate conditions to grow.
- An overflow pipe should be installed within the system with the inlet just below kerb level, to ensure the system does not flood or become oversaturated during heavy storm events. The overflow pipe inlet should be installed within an appropriately sized grate to ensure the risk of blockage is minimised.
- Prior to approval of the design, all underground services should be located via survey and where appropriate necessary measures should be taken to ensure neither the functionality of the SuDS or services are compromised.
- Where necessary, consultations with service providers should be evidenced, confirming service easements and that the provider has no concerns with the SuDS design impacting on the concerning services.
- The system should not be positioned directly above or encroach into existing building basement layouts and foundations.
- A modular designed system could be considered appropriate, subject to MCC approval.
- The perforated pipe (outfall) should connect either to an existing highway drain or public sewer and the appropriate approvals for connection should be sought from the relevant authority/water company.
- The perforated pipe should be laid at a gradient which allows self-cleansing.
- Invert levels should be based on achieving a gravity connection to the proposed existing drainage system (highway drain/public sewer) and should be confirmed on site prior to installation.
- The developer/landscape architect should provide justification to MCC that the species of vegetation and soil type to be used are suitable.
- Species of vegetation to be specified by landscape architect, but to be approved by MCC.
- The dimensions of the raingarden should be based on the catchment area and infiltration rate of the soil, ensuring good functionality of the system.
- A freeboard depth of 100-200mm should be applied where possible to encourage water to flow into the rain garden and to accommodate silt accumulation and build-up of leaf litter.

- A minimum depth of 200mm of topsoil is recommended, the type of soil should be determined by which species of plants are proposed, landscape architect to specify. Topsoil should be to the latest BS3882.
- Typical filter medium depths should be between 300mm-800mm, depending on the storage requirements of the system. Subsoil should be to the latest BS8601.
- Geotextile layer should be included to reduce fines washing into the drainage layer and reducing infiltration. The layer should be designed using the standard geotechnical filter criteria.
- The drainage layer should provide adequate cover to the perforated pipe (at least 50mm around the pipe) and should be a sufficient thickness to ensure the flow rate of water through it is greater than that of the flow rate through the filter medium.
- Perforated pipes should be installed with a rodding eye/inspection point to allow for jetting where required. The rodding eye should tie in with the existing/proposed footway/highway build up and be positioned and designed to ensure efficient jetting of the perforated pipe can be achieved. The rodding point cover level should be positioned above the inlet level of the overflow pipe within the Tree pit.
- Generally, the raingarden surface area should be sized between 5%-10% of the total catchment area, to ensure the plants are not over or under watered.
- Appropriate hydraulic calculations should accompany the SuDS detail once dimensions and soil CBR values have been confirmed.

Maintenance:

The main causes of asset failure to bioretention systems, such as raingardens, is the surface layer of the system or the underdrains and drainage layers becoming blocked. While the blockages to the surface layer can be visible at ground level, blockages to the underdrains and sub surface drainage layers are more difficult to detect. A blockage to the underdrain could result in surface ponding of the system which could be detected by above ground inspection. However, inspection points should be situated within the system to check the underdrain, to ensure that above ground ponding does not occur. Frequent checks via the inspection points will help ensure the system is functioning efficiently. On this basis, adequate access should always be provided to the SuDS feature (including inspection points) to enable maintenance works to be carried out.

The maintenance plan for the system should consider the need to maximise biosecurity, by removing all invasive species. The use of pesticides, herbicides and fertilizers to achieve biosecurity is not permitted.

Following the first few months of installation, the system should be visually inspected regularly, the inspections should also include noting the amount of deposition present on the surface after certain periods of time. This information should serve as an indicator in understanding the expected rate of sediment deposition. After this initial period of several months, the systems should be inspected every quarter, to verify and where required update, the maintenance schedule.

The system will receive runoff from public highways and footways. Therefore, the sediments excavated from the surface of the system will generally be nontoxic or not hazardous and so can be safely disposed of by either land application or landfilling. However, in some circumstances it is advised that consultation should be had with the concerning environmental regulator to confirm appropriate protocols are followed. This may result in sediment testing being required before sediment excavation, to determine its classification and appropriate disposal methods.

The maintenance plan and the party responsible for maintaining the asset during the initial 2-year period should be confirmed and agreed prior to installation. Generally, maintenance plans and schedules should be developed during the design phase of schemes.

Private developers will be required to maintain the feature for the first 2 years of its lifecycle, prior to MCC formally adopting the feature. Following this maintenance period and prior to handover, a report should be presented to MCC Highways evidencing that the agreed maintenance schedule has been monitored and followed to a satisfactory level. In addition, an enhanced maintenance schedule should also be presented to MCC Highways based on observations made over the initial 2-year maintenance period and should include

any additional maintenance which is recommended to ensure the functionality of the SuDS.

See Table 1 for an example maintenance schedule which provides guidance on the type of operation and maintenance that should be followed. Each maintenance schedule should be development in conjunction with the SuDS individual design. Note that the first 2 years following construction completion is likely to require a more intensive maintenance strategy while the plants become established.

Table 1 – Example Rain Garden Maintenance Schedule

Maintenance Schedule	Required action	Typical Frequency
Regular inspections	Inspect filtration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of inspection chamber/overflow pipe	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 (do **NOT** use weedkiller)	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 and replacing mulch	As required
	Jetting of perforated pipes	Annually, or as required
	Inspection of the overflow pipe	Annually, or as required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be >20 years.
	The rain garden should also be inspected post heavy rainfall events and/or high wind speeds. The inspection should include checking there is no physically damage, checking inlet and outlets and that there has been limited or no soil erosion.	As required

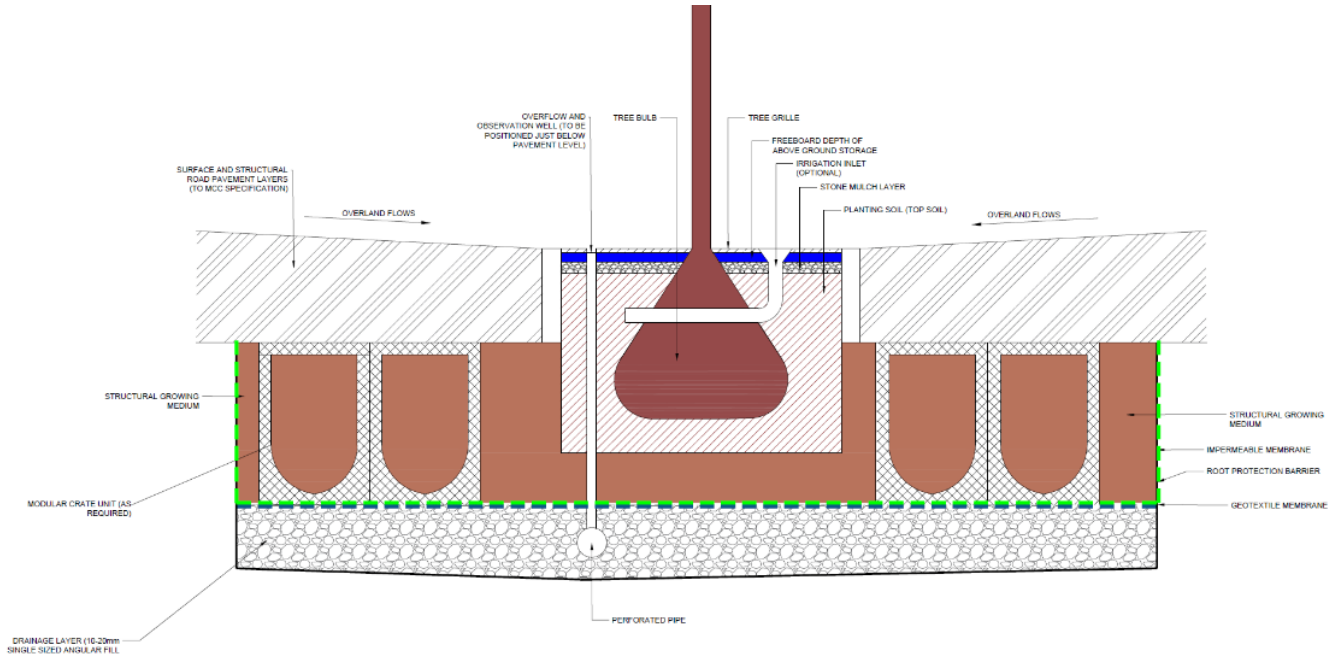
SuDS Enabled Tree Pits:

SuDS Enabled Tree Pit – Design Principles (Non-infiltrating):

SuDS enabled Street Trees allow for surface water attenuation and outfall in a way which is sustainable and environmentally friendly. This design focuses on reducing peak surface water flow rates into the highway gully network, which assists in reducing localised flood events and improving the gully network capacity and outflowing water quality. The below detail shows a design which is wrapped by an impermeable membrane with a perforated pipe which acts as an outfall for the system. An overflow pipe is positioned just below pavement level to account for extreme rainfall events and asset failure.

Whilst the principle of the drawing shown below should be adhered to, each design will be subject to its specific highway locality and as such should be submitted for technical review. A larger scale version of the below drawing can be found in Appendix 2.

Detail 2 – A typical SuDS Enabled Tree Pit (Non-infiltrating)



Accompanying Design Notes:

- The details and notes included on this drawing are guidelines only, each SuDS asset will need to be designed on a case-by-case basis, based on the location, and functional requirements of the asset. All SuDS designs should be produced and approved by a qualified engineer and landscape architect.
- Inlets should be designed to prevent erosion and scour, allowing an even distribution onto the surface layer.
- Erosion at inlet points should be considered and prevented by reducing the surface water flow velocity, this can be via a reinforced textured zone or an alternative method subject to approval by MCC.
- Nonorganic mulch/gravel should be considered above the topsoil layer (especially around the inlets). This is to ensure that the toil soil layer is not eroded or displaced following heavy storm events.
- An overflow pipe should be installed within the system with the inlet just below kerb level, to ensure the system does not flood or become over saturated during heavy storm events. The overflow pipe inlet should be installed within an appropriately sized grate to ensure the risk of blockage is minimised.
- A freeboard depth of 100-200mm should be applied where possible to encourage water to flow into the tree pit and to accommodate silt accumulation and build-up of leaf litter.
- In cases, where root barriers have suitable pour sizes to filter the water efficiently without allowing the above soil fines to filter through, an additional geotextile membrane may not be required.
- Prior to approval of the design, all underground services should be located via survey and where appropriate necessary measures should be taken to ensure neither the functionality of the tree pit or services are compromised.
- Where necessary, consultations with service providers should be evidenced, confirming service easements and that the provider has no concerns with the SuDS design impacting on the concerning services.
- The tree should not be positioned directly above or encroach into existing building basement layouts and foundations.
- The perforated pipe (outfall) should connect either to an existing highway drain or public sewer and the appropriate approvals for connection should be sought from the relevant authority/water company.
- The perforated pipe should be laid at a gradient which allows self-cleansing.
- Invert levels should be based on achieving a gravity connection to proposed existing drainage system (highway drain/public sewer) and should be confirmed on site prior to installation.
- Only mature or semi mature trees will be permitted. The developer/landscape architect/ arboriculturist should provide justification to MCC that the age, species of tree and soil type to be used are suitable.

- The species of tree should be chosen on a site-by-site basis. The species of tree should be specified by a landscape architect/arboriculturist, but to be approved by MCC.
- Anchor points may be required to ensure the tree remains in situ, to be specified by engineer.
- The dimensions of the tree pit should be based on the catchment area and infiltration rate of the soil, ensuring good functionality of the system.
- Perforated pipes should be installed with a rodding eye/inspection point to allow for jetting where required. The rodding eye should tie in with the existing/proposed footway/highway build up and be positioned and designed to ensure efficient jetting of the perforated pipe can be achieved. The rodding point cover level should be positioned above the inlet level of the overflow pipe within the Tree pit.
- Perforated pipes should be wrapped in geotextile to prevent the ingress of fines.
- Modular units should be considered under areas of heavy loading to ensure root space is not reduced and structural stability is maintained.
- The drainage layer should provide adequate cover to the perforated pipe (at least 100mm around the pipe) and should be a sufficient thickness to ensure the flow rate of water through it is greater than that of the flow rate through the growing medium.
- Planting soil layer depth to be determined based on species of tree planted, landscape architect to specify. Topsoil should be to the latest BS3882.
- Ground level vents should be considered where the pit extends directly beneath the footway to improve soil health.
- The depth of the structural growing medium should be determined based on the level of attenuation required and on the species of tree planted, landscape architect to specify. Generally, the depth from the bottom of the root bulb to the drainage layer should not be less than 500mm to allow root growth. Subsoil should be to the latest BS8601.
- Appropriate hydraulic calculations should accompany the SuDS tree pit detail once dimensions and soil CBR values have been confirmed.

Maintenance:

The main causes of asset failure to bioretention systems, such as SuDS Tree Pits, is the surface layer of the system and the underdrains and drainage layers becoming blocked. While the blockages to the surface layer can be visible at ground level, blockages to the underdrains and sub surface drainage layers are more difficult to detect. A blockage to the underdrain could result in surface ponding of the system which could be detected by above ground inspection. However, inspection points should be situated within the system to check the underdrain, to ensure that above ground ponding does not occur. Frequent checks via the inspection points will help ensure the system is functioning efficiently. On this basis, adequate access should be always provided to the SuDS feature (including inspection points) to enable maintenance works to be carried out.

The maintenance requirements of the system during the first few years, when the tree is becoming established, will be the most intense. Early maintenance should involve regular visual inspections of the surface layer and include the removal of invasive vegetation where required. Early maintenance should also include appropriate irrigation where required, such as during long dry periods. This intense period of maintenance should allow the tree roots sufficient time to establish good root-soil contact, which will ensure efficient water uptake. It is recommended that the expertise of an arboriculturist / landscape architect should be sought, regarding appropriate irrigation schedules which should be based on the species of tree.

The system will receive runoff from public highways and footways. Therefore, the sediments excavated from the surface of the system will generally be nontoxic or not hazardous and so can be safely disposed of by either land application or landfilling. However, in some circumstances it is advised that consultation should be had with the concerning environmental regulator to confirm appropriate protocols are followed. This may result in sediment testing being required before sediment excavation, to determine its classification and appropriate disposal methods.

The maintenance plan and the party responsible for maintaining the asset during the initial 3-year period should be confirmed and agreed prior to installation. Generally, maintenance plans and schedules should be developed during the design phase of schemes.

Private developers will be required to maintain the feature for the first 3-years of its lifecycle, prior to MCC formally adopting the feature. Following this maintenance period and prior to handover, a report should be presented to MCC Highways evidencing that the agreed maintenance schedule has been followed to a satisfactory level. In addition, an enhanced maintenance schedule should also be presented to MCC Highways based on observations made over the initial 3-year maintenance period and include any additional maintenance which is recommended to ensure the functionality of the SuDS.

See Table 2 for an example maintenance schedule which provides guidance on the type of operation and maintenance that should be followed. Each maintenance schedule should be development in conjunction with the SuDS individual design. Note that the first 3 years following construction completion is likely to require a more intensive maintenance strategy while the tree becomes established.

Table 2 – Example SuDS Enabled Tree Pit Maintenance Schedule

Maintenance Schedule	Required action	Typical Frequency
Regular inspections	Inspect filtration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of inspection chamber/overflow pipe	Annually
	Assess tree for disease infection, poor growth, invasive species etc	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Remove sediment, litter and debris build up from around inlets or from forebays	Quarterly to biannually
	Manage other vegetation and remove nuisance plants (do not use weedkiller)	Monthly (at start, then as required)
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)
	Jetting of the perforated pipe	Annually, or as required
	Inspection of the overflow pipe	Annually, or as required
Remedial actions	The trees should also be inspected post extreme heavy rainfall events (100-year event) or following storms which include high wind speeds. The inspection should include checking that the tree is not physically damaged, checking inlet and outlets and that there has been limited or no soil erosion.	As required