Sustainable Design and Low Impact Development Guidelines

Town of Manchester, Connecticut

Adopted: June 15, 2020

Purpose

The purpose of this document is to provide guidelines for implementation and maintenance of sustainable design practices and low impact development techniques with a particular focus on stormwater management. These guidelines should be referenced by any party, be it the Town or a private resident or business, who intends to implement LID practices during site development.

When LID stormwater management practices (including but not limited to those described in this document) are implemented as part of site development, a maintenance plan and schedule are required unless waived by the Planning and Zoning Commission. All other applicable enforceable or actionable items are described in the Town of Manchester Zoning Regulations.

Introduction

Sustainable Design and Low Impact Development (LID) techniques are highly encouraged in the Town of Manchester to achieve a number of goals which benefit both the environment and the community. These sustainability goals include, but are not limited to:

- Lower net energy consumption
- Reduced stormwater runoff and higher water quality
- Increased high canopy tree cover
- Natural landscaping
- Production of local food.

The conventional development approach to stormwater management often uses practices which quickly and effectively convey water away from developed areas. This unfortunately results in larger volumes of runoff flowing directly into streams and rivers, along with any pollutants contained in the runoff. In contrast, Low Impact Development (LID) is an ecologically-based stormwater and land use management approach which favors management of rainfall on site through a mostly vegetated treatment network. The goal of LID is to mimic natural hydrologic conditions by using techniques that infiltrate, filter, store, and evaporate stormwater runoff close to its source. These practices can effectively reduce the volume of runoff leaving the site, which will directly benefit water quality and aquatic ecosystems. LID can also remediate polluted runoff through a network of distributed treatment landscapes.

In addition to Low Impact Development for stormwater management, other Sustainable Design strategies have environmental and economic benefits. Strategies for reducing energy consumption in new building construction or renovation can reduce energy costs; increasing high canopy tree cover can reduce the urban “heat island effect”; natural landscaping with native plants supports ecological habitat while also decreasing maintenance needs; local food production supports healthy communities. All of these practices are beneficial to both the environment and the community.

Because LID and other Sustainable Design practices utilize a variety of techniques, designs should be customized for each site based on current and anticipated use, surrounding ecology, and community needs. These guidelines are intended to serve as a starting point and a reference for the application of Sustainable Design and Low Impact Development strategies within the Town of Manchester.

Stormwater Management

Purpose

The purpose of this section is:

1) To promote stormwater management practices that maintain pre-development hydrology through site design, site development, building design and landscape design techniques that infiltrate, filter, store, evaporate and detain stormwater close to its source;
2) To protect water resources, particularly streams, ponds, wetlands, floodplains and other natural aquatic systems from degradation that could be caused by construction activities and post-construction conditions;
3) To protect other properties from damage that could be caused by stormwater and sediment from improperly managed construction activities and post-construction conditions on the development site;
4) To reduce the impacts on groundwater and surface waters from impervious surfaces such as streets, parking lots, rooftops and other paved surfaces; and
5) To promote public safety from flooding and streambank erosion, reduce public maintenance costs ofremoving sediment from stormwater drainage systems and natural resource areas, and to prevent damage to municipal infrastructure from inadequate stormwater controls.

Stormwater Best Practices

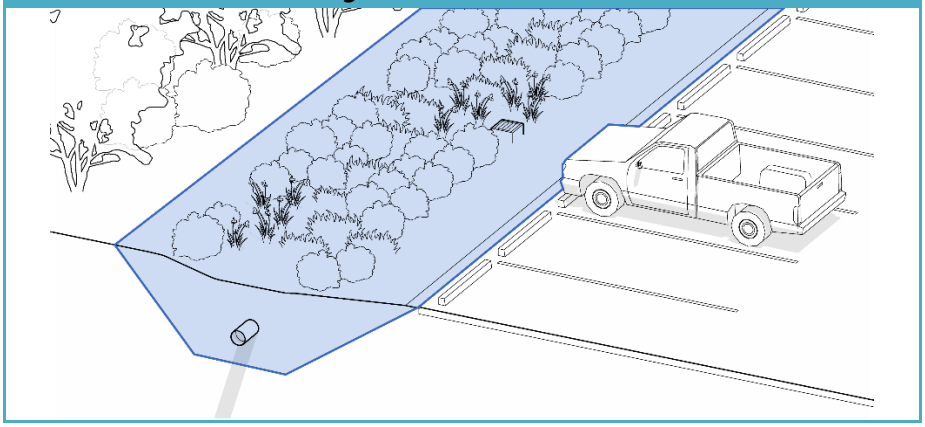
The post-construction peak runoff rate should not exceed the existing peak runoff rate for the same storm event from the site under pre-development conditions prior to redevelopment. Low Impact Development (LID) practices as identified below should be incorporated into the design as necessary to achieve the required runoff rate. For many of these practices, maintenance is a key factor in system efficacy. Maintenance guidelines are included and should be followed by the property owner in order to produce the maximum benefit. Please note certain applications may not be suitable for use in the public right of way and the Town of Manchester Public Improvement Standards should be consulted early during the design phase of any project.

1) **Minimization of Impervious Surface** – Impervious surfaces can be minimized by providing only as much parking as required by applicable regulations, and by using short and narrow driveways, permeable paving, green rooftop systems, or other LID techniques.
2) **District/Subdivision Stormwater System** – When an entire district or large scale development is planned at once, one stormwater management system may be developed to manage the entire development. Increased runoff in one area can be balanced by greater infiltration in another, through incorporation into a collective

District Stormwater System which results in the reduction in release rates and runoff volumes.

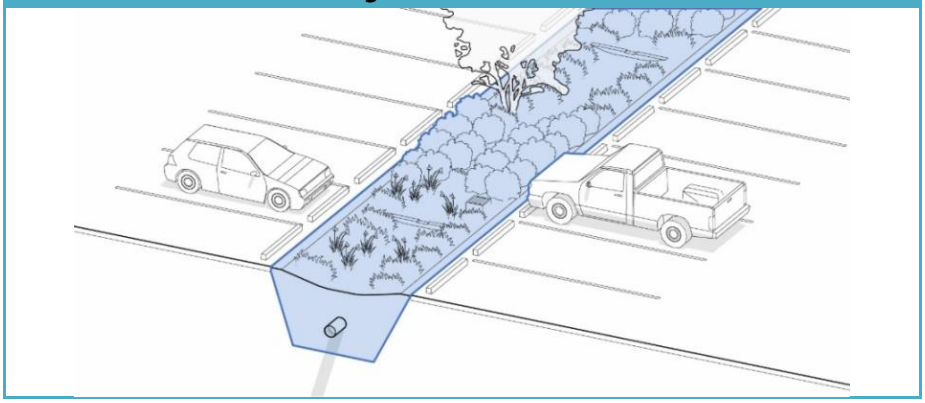
3) **Light Imprint Site Layout** – A light imprint site layout is one that minimizes changes to the existing conditions of a site during development. Light imprint applications should integrate hydrology and stormwater management into site design using existing conditions to influence the location and layout of roadways, buildings, and parking areas. Buildings and roadways should be placed in areas less sensitive to disturbance, and the stormwater management system design should create a symbiotic relationship between the development and natural hydrology. The attention to natural hydrology and nonstructural stormwater management creates a more attractive, multifunctional landscape.
4) **Filter Strips and Bioretention** – Filter strips are bands of densely vegetated slopes, designed to reduce water runoff volume and improve water quality prior to entering stormwater drainage basins. Filter strips are typically designed to break up impervious surfaces (such as parking lots) and provide initial stormwater treatment by filtration. They also provide infiltration of water, reducing the overall amount of runoff. Filter strips can be incorporated into roadway and parking lot designs.

Figure 1 – Bioretention



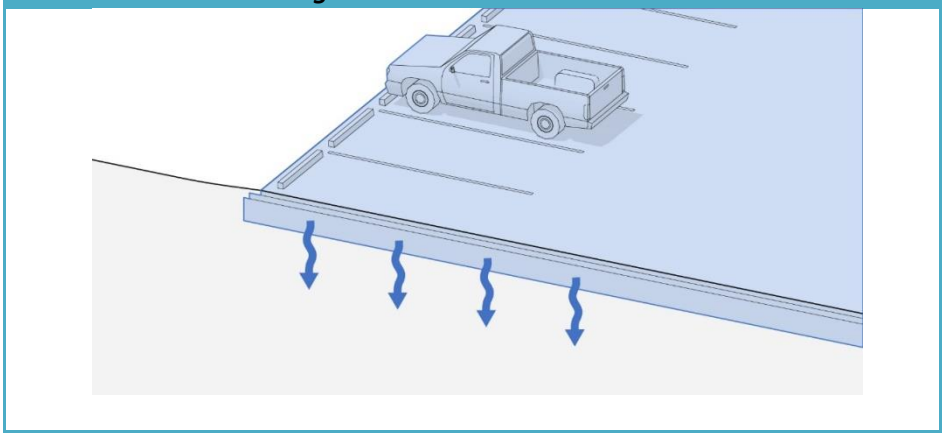
5) **Vegetated Swales (Bioswales)** – Vegetated swales are broad, shallow channels designed to convey and infiltrate stormwater runoff. Swales can be used as a preferred alternative to closed, non-infiltrating drainage systems. The design of swales should seek to reduce stormwater volume through infiltration, improve water quality through both infiltration and vegetative filtering, and reduce runoff velocity by increasing the distance the water must flow and the roughness of the channel through which it travels.

Figure 2 – Bioswale



6) **Bioretention Cells (Rain Gardens)** – Rain gardens (also known as bioretention cells) are vegetated depressions that store and infiltrate runoff. Rain gardens are designed to encourage vegetative uptake of stormwater to reduce runoff volume and pollutant concentrations. A well designed rain garden has an engineered soil, which maximizes infiltration and pollutant removal while avoiding stormwater ponding for longer than 24 hours. Combined with filter strips, bioretention cells are important components of the LID treatment process and are incorporated into roadway and parking lot designs.
7) **Pervious Pavement** – Pervious (or permeable) paving reduces stormwater runoff volume, velocity and pollutants by allowing water to infiltrate into the sub-surfaces below parking areas. It is generally appropriate for low-traffic parking lots. Such treatment can be incorporated as a hybrid parking lot, which uses conventional paving for driveways and aisles, and permeable paving for parking stalls. Pervious paving may also be appropriate for overflow parking areas, which are generally used only a few weeks out of the year. Maintenance of pervious pavements is critical to maintain the permeability (see *Maintenance* section below).

Figure 3 – Pervious Pavement



8) **Subsurface Retention Facilities** – Subsurface retention facilities are typically constructed below parking lots (either pervious or impervious) and can be built to any

depth to retain, filter, infiltrate, and alter the runoff volume and timing. This practice is well suited to higher density sites with open space constraints. Subsurface facilities can provide a considerable amount of runoff storage. The water is filtered through the stone aggregate and infiltrates into the ground at a controlled rate. Similar techniques include gravel storage galleries, sand filters, infiltration basins, and infiltration trenches (for areas with space constraints).

9) **Stormwater Vaults** – An alternative strategy is to construct the subsurface facility as a Stormwater Vault, with a filtering and pumping mechanism so that collected water can be reused for non-potable uses such as irrigation or flushing of toilets.
10) **Green Streets and Stormwater Planters** – Green streets are thoroughfares that capture, temporarily store, and treat road runoff at its source by incorporating vegetated water catchment and filtration devices in the form of small rain gardens and bioretention systems. Components such as flow-through planters and other sustainable stormwater solutions allow stormwater from the street to enter planters through cuts in the curb where the plant material removes impurities and allows water to naturally infiltrate or be stored elsewhere. Water-loving plants and those that are able to remove the impurities while thriving so close to traffic and in more urban environments are used in green street design, adding beauty and function. Additional infiltration can be achieved using pervious paving materials for sidewalks and streets.

Figure 4 – Green Street Design and Stormwater Planters

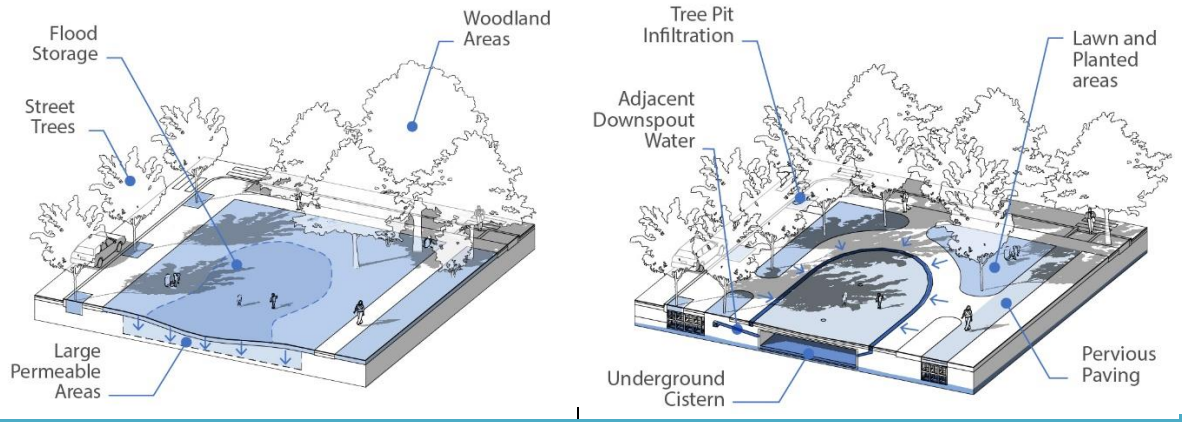
11) **Downspout Redirection** – Building downspouts are commonly directly connected to centralized sewer or stormwater systems. An LID design application should redirect roof water runoff onto pervious surfaces, most commonly a lawn. This reduces the amount of directly connected impervious area in the drainage area.
12) **Rain Barrels/Cisterns** – Rain barrels are typically outside of a building at roof downspouts to collect and store rooftop runoff, which can later be reused for lawn and garden watering. Care should be taken to prevent mosquito breeding in standing water by keeping all openings covered and emptying the rain barrel regularly.
13) **Green Walls and Roofs** – A green roof, or living roof, is a roof of a building that is partially or completely covered with a growing medium for vegetation, planted over a

waterproofing membrane. Green walls function similarly, but are installed on vertical surfaces. Green roofs capture rain water on the roofs of buildings to support plantings that reuse the water, reducing the overall amount of runoff leaving the roof. The plants and the soil they are growing in provide additional insulation for the building. Roof drains should be recharged into the site with the use of structural and/or non-structural LID drainage systems. Green walls should be designed to provide habitat, mitigate afternoon and seasonal heat gain, and re-introduce indigenous plants to the site.

Figure 5 – Green Roofs and Walls

14) **Infiltration Parks** – This form of bioretention allows rainwater to be temporarily captured and stored for a short time, cleaning stormwater runoff before infiltration. Portions of public parks and open spaces may be part of the stormwater system. Surrounding areas can be graded so that the rainwater flows toward the open area. Creating a gradual and imperceptible depression allows water to collect in the open space and stay there long enough to infiltrate without giving the appearance of a stormwater facility that should store water for no more than 24 hours.

Figure 6 – Infiltration Parks



Maintenance

Proper maintenance of the LID practices detailed above is critical to long term effective operation. The maintenance guidelines below should be followed, and when possible, documentation of visual inspections and any corrective measures taken is recommended. Any proposed LID measures should be accompanied with a maintenance plan.

1) **Filter strips, Bioswales, Rain Gardens, and other Bioretention Systems** – Inspection and maintenance of bioretention systems, including filter strips, bioswales and rain gardens, can typically be performed as part of standard landscaping procedures. The most common maintenance activity is the removal of leaves and debris from the system. Routine visual inspections should include looking for standing water, accumulated leaves, holes in the soil media, signs of plant distress, and debris and sediment accumulation in the system.
    - If the filter bed is draining poorly, or standing water covers more than 15% of the surface 48 hours after a precipitation event, any sediment material should be removed from the surface and the remaining soil media tilled or raked as needed.
    - Leaves and debris should be raked from the system, and inlets and outlets should be cleared if obstructed.
    - Soil erosion should be repaired if it occurs. Any holes from animal burrows should be filled in and lightly compacted.
    - Vegetation coverage is integral to the performance of the system, including infiltration rate and nutrient uptake. Vegetation care is therefore important to system productivity and health. If at least 50% vegetation coverage is not established after 2 years, reinforcement planting should be added in the form of herbaceous plant material.
2) **Pervious Pavement** – Pervious pavements are subject to sediment and other debris accumulating on the surface, which can slow infiltration over time. It is therefore recommended to periodically inspect and clean these pavements.
    - *Pervious Concrete or Asphalt* – Avoid sealing or repaving with impervious materials. Visually inspect routinely to ensure that the paved area is clear of debris and sediments, and that water infiltrates between storms.
        - Keep the pervious pavement surface free of sediment by blowing, sweeping, or vacuuming as needed.
        - Avoid the use of chemicals for cleaning.
        - Maintain upland and adjacent grassy areas. Excessive water flow carrying debris toward the pavement should be diverted.
        - Pressure washing and/or vacuuming should be performed just before winter. (Care should be taken to avoid extremely high pressures with a pressure washer.)
        - If periodic maintenance is lacking, deep cleaning and/or unclogging may be necessary over time. This is best accomplished by simultaneous pressure washing and vacuuming. For best results,

follow the recommendations of the manufacturer of the equipment being used.

- ***Winter maintenance*** – Fortunately, permeable systems tend to stay drier with minimal ice due to the natural draining of the pavement. Deicing materials should not be used within the first year. After the first year, calcium chloride impregnated sand can be used for deicing. Course sand (minimum 1/8 inch) or small crushed aggregate can be used as anti-skid material with the understanding that vacuum cleaning will be performed after the winter season. The following should *never* be used for deicing pervious pavements:
    a) Fine sands
    b) Anti-icing pre-treatments
    c) Deicers containing magnesium chloride, calcium magnesium acetate or potassium acetate
    d) Deicing agents containing fertilizer ingredients such as ammonium sulfate and ammonium nitrate

  Snow plowing can be performed, but the plow should be fitted with a polyurethane cutting edge. Snow removal should *not* be performed using front end loaders or skid loaders by either scooping or back dragging. Snow blowing may be a better alternative to plowing, if available.

- *Pervious Pavers* – Ensure that installation is done by an experienced contractor. Visually inspect routinely to ensure that the paved area is clear of debris and sediments, and that water infiltrates between storms.
    - Keep the pervious pavement surface free of sediment by blowing or sweeping debris regularly.
    - Vacuum sweep the entire paved area yearly (or more frequently if pavement is heavily trafficked).
    - Inspect joints and refill with proper joint material to the top of the paver when necessary.
    - Area of settlement of more than ½ inch, and any protruding pavers that lip by more than ¼ inch from surrounding pavers, should be picked up and re-laid after repair of base or bed layers.
    - Damaged pavers should be replaced.
    - If infiltration during a rain event is not occurring, joint material may be clogged. Removed the top ½ inch of joint material which contains debris and replace it with new joint material.
    - ***Winter maintenance*** – Snow and ice can be removed via brushing or blowing. Shovels or snow plow blades should be equipped with a rubber edge and set at ¼ inch above the pavement to prevent damage to the pavers. The use of rock salts or sodium based deicers can be used, but may produce efflorescence (color change as a result of salt coating). Fine products meant to provide

traction, such as sand, should be avoided as these will increase clogging.

3) **Stormwater Vaults** – Maintenance of below grade stormwater vaults is usually conducted by periodically pumping out sediments and debris. Specialists often perform maintenance and cleaning of the systems, particularly when they are located below structures or pavements.
4) **Green Streets and Stormwater Planters** – Green street care and maintenance is largely the same as that of bioretention systems as described above. Encouraging community stewardship of these resources can be helpful in reducing instances of trash in stormwater planters.
5) **Green Walls and Roofs** – Green walls and roofs should be installed by an experienced contractor, and the type of maintenance activities required will depend on the system and plantings selected. Green roof systems are typically designed using hardy, drought resistant varieties that require less maintenance. General maintenance guidelines include the following:
    - Plants should be watered as needed during periods of prolonged drought or heat. Some extensive systems may utilize irrigation systems.
    - Weeding should be done several times throughout the growing season. Roof drains can be inspected at the same time to ensure that water not being utilized by the green roof is draining appropriately off the roof.
    - Fertilizing and regular trimming of plants may be necessary depending on the varieties used. In general, the vegetation should be trimmed every 2-3 years to encourage additional leaf development.
    - Plant health should be monitored and plants should be replaced as necessary.
    - Restorative maintenance of green roofs that have not been maintained should be done under the guidance of an experienced professional.

Sustainable Landscaping, Parking, and Open Space

General Requirements

The following design standards should apply to all planted areas.

1) To the greatest extent possible, existing native trees and shrubs should be maintained.
2) No tree, shrub or plant identified as an Invasive Species by the Connecticut Invasive Plant Working Group should be used (https://cipwg.uconn.edu/invasive_plant_list/).
3) Existing invasive plants should be eradicated and disposed of in such a manner that they cannot regrow in another area.

Natural Landscaping

1) Natural and context-sensitive landscaping with plants native to local climate and soil conditions are highly encouraged. These plants thrive naturally, requiring less maintenance and irrigation than most hybrid or imported varieties.
2) Natural resource preservation and landscaping should be used to minimize the need for irrigation systems and improve planting longevity. Preserving existing wooded areas, mature trees, and natural terrain can give new developments a premium "mature landscape" appearance and provide residents with additional recreation amenities.
3) Existing wetlands and Natural Diversity areas (as listed in the Connecticut Department of Energy and Environmental Protection's Natural Diversity Data Base) should be preserved whenever possible.
4) Plant materials should be selected for their form, color, and texture, as well as solar, soil, and moisture requirements. Native plants (vegetation that grows naturally in particular climates or regions) should be used whenever possible due to their performance, site enhancement, and life-cycle cost benefits.
5) Organic fertilizers are preferred over chemical compounds; however, whenever possible, the use of fertilizers should be avoided altogether. When the nutrient-rich components of fertilizers inevitably enter groundwater or surface waters, such as streams, pond and lakes, they alter water chemistry significantly. Excess nutrients deposited from fertilizers are a primary contributor to the development of algal blooms in surface waters, which alter the aquatic ecosystem excessively by using up oxygen in the water and releasing toxins, resulting in damage to aquatic life.

Canopy and Shade Trees

The broad use of canopy trees is a simple and attractive solution to reducing heating and cooling needs for buildings and sites. When planted on the south and west sides of buildings, shade trees keep buildings cool in summer and then drop their leaves during the cooler fall season allowing warming sunlight on buildings. Canopy trees also provide sunlight on parking lots in the winter and shade in the summer while absorbing rainfall which reduces the amount of stormwater. The use of native deciduous shade trees is highly encouraged.

Building Applications

All buildings should strive for high levels of energy efficiency through best practices in design and construction practices such as governed by the Energy Star Program or the U.S. Green Building Council LEED Rating System. Some specific methods are as follows:

- Solar orientation and utilization
- Natural cooling through appropriate glazing, shading of glazed surfaces, and operable windows
- Daylighting (using natural light as the primary source of general illumination)

- Heat reflective roofs and pavement
- Wind and roof-mounted solar energy generation
- Groundsource heat exchange (closed system geothermal energy)
- On-site biomass use for energy production
- Non-renewable heat and cooling
- Combined heat and power systems
- Green walls and green blocks
- Increased insulation (e.g., R-26 and triple-glazed windows)
- Energy Star rated appliances
- EcoStar or shared recycling programs
- Dual-flush and waterless toilets
- Ultra-efficient heat and hot water systems
- Open and simple floor plans (i.e. square and cubes)
- Improved building air seal (i.e. taped sheathing)
- Greywater systems

Local Food Production

To address sustainability issues such as open space conservation, self-sufficiency, improved nutrition, recreation, exercise, and reduced food expenses, the Town of Manchester encourages small scale agriculture to strengthen the local food system. Some techniques include the following:

1) **Community Gardens** – A private, not for profit, or public common area used by a group of households to grow and harvest food crops or non-food crops for personal or group consumption or donation.
2) **Edible Landscapes** – The utilization of plants and landscaping that produce edible food in settings that conventionally have been limited to ornamental or non-food producing plants.