Chapter 10- Low Impact Development Practices

Low impact development (LID) is a process of developing land that mimic the natural hydrologic regime. LID begins at the design phase of a new development, incorporating planning techniques that minimize site clearing and impervious surfaces to reduce impact and stormwater runoff generated from the site. By reducing the volume of water leaving a site, the pollutant loading is also reduced. Other techniques that will reduce the volume and peak flow rates of runoff from the development are then incorporated throughout the site. LID is an effective tool that reduces pollutant loading, thermal impacts, stream flows, and minimizes stream channel erosion. More information is available in Volume I of this manual on LID measures.

IMPORTANT:
Maine DEP strongly encourages the use of LID measures. LID is not a rigid set of standards or a one size fits all approach and has many benefits:

- **Benefits to the Developer:** The owner and developer will see reduced costs for land clearing and grading, infrastructure and stormwater management while seeing an increased aesthetic value in the development.
- **Benefits to the Municipality:** The local government and community will benefit from reduced infrastructure maintenance costs and reduces property damage from flooding while having more open space, protected natural resources and better quality drinking water.
- **Benefits to the Environment:** The hydrologic cycle is preserved; streams are less prone to erosion; and stream flows are maintained while benefiting fish and wildlife.

IMPORTANT:
LID goals and objectives should be incorporated into the site planning process as early as possible. The following steps serve as a guideline to use in the planning stage:

- Identify and preserve sensitive areas that will affect the hydrology of the site. Features that should be protected are highly permeable soils.
- Minimize site disturbance and impervious areas with an alternative layout for the development.
- Minimize the impervious surfaces directly connected to drainage conveyance systems to reduce the time of concentration.
- Break the site into smaller drainage areas that can be handled through basic LID practices

PLANNING FOR LID

Minimize Site Clearing: Development typically involves new impervious surfaces such as roads and buildings and landscaped areas for lawns. Avoid developing high-permeable soils by protecting areas that are less sensitive to disturbance and that will sustain groundwater recharge and reduce runoff. For example, developing a vegetated, tight clay soil area will have less impact on stormwater runoff than developing a forested area on sandy soils. Once the sensitive areas have been identified, the layout of the development should be aligned with the conservation of these areas.

Minimize Impervious Areas: The traffic distribution network (roadways, sidewalks, driveways, and parking areas) is generally the greatest source of site imperviousness and these should be the focus for reducing impervious area.

- *Alternative Roadway Layout*: Alternative road layouts can be used to reduce total pavement, while allowing for the same amount of development. Clustering will decrease imperviousness.
- *Narrow Road Sections:* The width of pavement can be reduced by including the primary driving surface, a pervious base for the shoulders, and ditch drainage swale in place of curb and gutter.
- *Sidewalks:* Sidewalks should be reduced to one side of the road or be eliminated.
- *On-Street Parking:* Reduction to one side or elimination of on-street parking can potentially reduce overall site imperviousness by 25 to 30 percent.
- *Rooftops:* The number and size of buildings dictates the impervious area associated with rooftops and vertical construction is preferred over horizontal construction.
- *Driveways:* Minimizing paved driveway area can be accomplished through narrower driveways or length reduction. Shared driveways will also reduce imperviousness. In addition, pervious materials would minimize runoff.

Minimize Connected Impervious Areas: The impacts from impervious surfaces can be minimized by disconnecting these areas from piped drainage networks and by treating these at the sources.

- Paved driveways and roads should be directed to stabilized, vegetated areas.
- Flows from large paved surfaces should be broken up and for on-site treatment of smaller flows. Breaking flows up allows the flows to be directed to vegetation as sheet flow.
- LID techniques should be dispersed throughout the development, such as at individual house lots to obtain the most benefit. They can be incorporated into the landscaping of the property to provide a natural treatment system.

Maintain Time of Concentration: When development occurs, the time of concentration (Tc) is often shortened due from the impervious area, causing greater flows over a shorter period of time. LID practices can maintain the pre-development Tc by:

- Minimizing land disturbance,
- Detaining flows on site,
- Increasing the flow length,
- Increasing the surface roughness of the flow path,
- Creating flatter slopes, or
- Disconnecting impervious areas, which will decrease their travel rates.

Manage Stormwater at the Source: The impact from a development should be mitigated at the source by reestablishing a more natural hydrologic cycle that sustains a clean stream base flow. Typically, the most economical and simplistic stormwater management strategy is achieved by controlling runoff at the source with a variety of small treatment structures that will result in the reduction of stormwater discharge and more flexibility in the site design.

Soil Considerations:

- *Minimize Compaction:* Compaction reduces the natural infiltrating ability of soils; and disturbance from heavy equipment should be avoided. If possible, impervious surfaces and development disturbances should be directed towards the more impermeable soils of a site, leaving the pervious soils to continue infiltrating runoff.
- *Increase Organic Content of Soils:* When constructing many of the LID vegetated techniques, a quality topsoil is necessary to optimize pollutant removal. The soil bed should consist of at least 20-30% organic material and 30% planting or topsoil. This highly organic layer traps contaminants, absorbs more runoff and provides a medium for biological activity that helps break down pollutants. Planting soil provides a healthy growing medium for vegetation by encouraging strong root growth. In addition, microbes found in healthy soils transform nutrients for plant growth. Compost or other organic amendments can be added at the site preparation level, typically by the truckload. It is also available for little or no cost from many community leaf compost programs. For rain gardens and

bioretention areas, compost addition is also valuable in absorbing and retaining moisture for plant life, filtering pollutants and providing an active layer for microorganisms to reside and reproduce. A healthy microorganism population is key to the decomposition of many pollutants, whether in the home rain garden or in a parking lot.

- *Avoid Pesticides/Herbicides:* Healthy soil is alive with microorganisms that decompose and inactivate pollutants, but these may be killed by excessive chemicals. Although the soil microorganisms are not typically the target of these chemicals, many of them may fall victim to the use of pesticides. Additionally, insect species that prey on pests are also killed by pesticides. Since the predatory species tend to have slower reproduction than the pest species, a natural defense against insect pests may be lost.

LID TECHNIQUES

Many of the LID techniques rely on infiltration, retention, and evapotranspiration of stormwater to reduce runoff. When infiltration is not a possibility, the initial planning techniques described above should be the primary focus, followed by the use of small disconnected underdrained systems that rely on soil and vegetation to retain runoff. Examples of LID design standards and techniques are shown on Table 11.1 and Table 11.2.

- *Filters (Bioretention Cells and Rain gardens):* Bioretention areas or rain gardens are built with a specific soil filter media (containing organic material and planted with vegetation that can handle wet and dry conditions) that will reduce the volume of runoff through absorption and evapotranspiration. A slight depression allows the ponding of stormwater as it filtrates through the soil media and into the groundwater or to an underdrain for surface discharge. Refer to Chapter 7.2 and 7.3 of this manual for further information on the performance and design of bioretention practices.
- *Infiltration:* Infiltration reduces runoff and mimics the natural hydrologic cycle by redirecting water into the ground rather than to a piped system. It is best to use many smaller infiltration basins that fit into the natural landscape. The design information in Chapter 6.0 should be followed for any infiltration practice.
- *Buffers:* Vegetated buffer use soils and vegetation to remove pollutants from stormwater. Buffers can be used as a stormwater BMP for small developments by minimizing the amount of runoff generated through infiltration and evapotranspiration. Filter strips are typically used as pretreatment devices for bioretention cells and other infiltration practices. Refer to Chapter 5.0 for information on the performance and design of vegetated buffers.
- *Collection Cisterns:* In a commercial setting, the collection of rain runoff can be put to use in the building to off-set the cost of their water supply. Cisterns can be located either above or below ground, and in out-of-the-way places that can easily be incorporated into a site design. Commercially available systems are typically constructed of high-density plastics and can include pumps and filtration devices. Rain barrels are inexpensive, effective, and easily maintainable when used in residential applications to capture roof runoff for later watering of lawns and gardens.
- *Vegetated Rooftops:* Vegetated rooftops provide three primary benefits: attenuation of stormwater runoff and peak flows, reductions of the heat island effects with an increase in building insulation, and a longer life expectancy for the base roof material. The stormwater benefit is the smaller more common storm events are absorbed, minimizing peak runoff and the net volume of runoff typically produced by roofs. Refer to Chapter 7.6 for further information on the performance of rooftop greening.
- *Porous Pavement:* Porous pavement is a permeable surface (pervious asphalt, concrete or pavers), a granular base, and subbase materials which allow the penetration of runoff into the underlying soils. The efficiency of pavement alternative systems depends on whether the pavement is designed to store and infiltrate most runoff, or only limited volumes of runoff (e.g., "first-flush") with the remainder discharged to a storm drainage system or overland flow. Maintenance is essential for long-term use and effectiveness. Pavement alternatives vary in load bearing capacities but are generally appropriate for low traffic areas such as sidewalks, parking lots, overflow parking and residential

roads. It is important to choose a material appropriate for the desired use (light, moderate or heavy use). Refer to Chapter 7.7 for further information on the performance of porous pavement and other manmade pervious surfaces.

- *Other Techniques:* As previously stated, LID is about creativity. Multiple practices can be implemented and adapted into various sites and situations. However, they are mostly dependent upon the layout of the development and the disconnection of its individual elements.

Table 10.1 – LID Measures and Techniques

LID Measure	Technique	Design
Protect natural drainage system	• Maintain a minimum 25 foot buffer on all natural water resources including intermittent channels • Do not divert stormwater from its natural sub-watershed	Design practices developed at the planning phase that will help mitigate environmental impacts. Ideally, these are cost-effective and environmentally friendly.
Minimize the decrease in time of concentration	• Break up or disconnect the flow of runoff over impervious surfaces • Sheet flow over pavement that is less than 100 feet	
Minimize impervious area or the effect of impervious area	• Go vertical with multi story buildings and parking garages • More than 25% of pavement area (overflow) in pervious pavement All pedestrian walkways are pavers or pervious pavement • Infiltrate as much roof runoff as standards allow	
Minimize soil compaction	• Minimize the construction window • Rototilling all areas to be revegetated	
Minimize lawns and maximize landscaping that encourages runoff retention	• Low maintenance Maine native plants • No invasive plants • No pesticides • Fertilizer application only during initial planting and repair of damaged areas	
Provide vegetated open-channel conveyance systems	• No curb/gutters and no roof gutters • Level spreaders to buffers where possible • Underdrained swales	
Rain Collection Cisterns	Rainwater is stored for later reuse for the building or landscape	
Buffers	Design, size, install and maintain per the Maine recommended guidelines found in this manual.	Chapter 5
Infiltration (basins, trenches, dry wells, etc.)		Chapter 6
Underdrained grass filters		Chapter 7.1
Underdrained filter bioretention		Chapter 7.2
Roofline filtration		Chapter 7.5
Roof Greening		**Chapter 7.5**
Pervious Pavement		**Chapter 7.7**

<table>
<tr><th colspan="3"><u>Table 10.2 - LID Minimum Design Standards</u></th></tr>
<tr><th>Each standard should be addressed</th><th>Residential Subdivisions</th><th>Commercial, Industrial, or Institutional Developments</th></tr>
<tr><td>Protect as much undisturbed land as possible to maintain pre-development hydrology and allow rainfall infiltration</td><td>• Clustered development with remaining land protected by deed restriction</td><td>• Clustered development with protected land by deed restriction
• Maximum 1000 ft road per 10 lots or with buffers only</td></tr>
<tr><td>Protect natural drainage systems such as wetlands, watercourses, ponds and vernal pools to the maximum extent practicable</td><td colspan="2">• 25 ft wooded buffer on all natural resources, including intermittent channels
• Wetland impact no greater than 4300 sqft and is limited to crossings
• No diversion of stormwater from its natural subwatershed</td></tr>
<tr><td>Minimize land disturbance including clearing and drainage to the extent practicable</td><td>• 10000 sq.ft maximum development for house lots (house/driveway/lawn/septic)</td><td>• 25 feet max. disturbance around buildings and pavement (or be rototilled, revegetated and maintained as meadow grass)</td></tr>
<tr><td>Minimize the decrease in the time of concentration from pre-construction to post-construction to the extent practicable</td><td>• Raingardens for pretreatment (18 inches of filter media, no underdrain, with 6 inch ponding and an overflow), or
• Buffers only for treatment</td><td>• 1 acre or less per stormwater management structure (buffer, filter, infiltration)
• Maximize sheet flow
• Rain collection for reuse in building</td></tr>
<tr><td>Minimize soil compaction to the extent practicable</td><td>• Rototilling all areas to be revegetated</td><td>• A construction window that is no more than 25 feet around structures
• Rototilling all compacted areas to be revegetated</td></tr>
<tr><td>Utilize low-maintenance landscaping that encourages the retention and planting of native vegetation, and minimizes the use of lawns, fertilizers and pesticides</td><td colspan="2">• Maine native plants, no invasive
• No pesticides/fertilizers/herbicides except during initial planting and repair of damaged areas
• Mulch all landscape with wood waste</td></tr>
<tr><td>Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces to the extent practicable</td><td>• Road width that is 18 feet or less</td><td>• Multi-story buildings and, if feasible, parking garages
• 1 acre or less per stormwater structure (filter, infiltration)
• Sheet flow over pavement that is less than 100 feet or intercepted by and underdrained vegetated depression island
• Parking lots must have 25% of area (overflow) in pervious pavement or grass
• All pedestrian walkways are pavers or pervious pavement</td></tr>
<tr><td>Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas</td><td colspan="2">• No curb/gutters or roof gutters
• Level spreaders to buffers
• Underdrained swales
• No direct connection (piped discharge) to a resource</td></tr>
<tr><td>Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff</td><td>• No salt use</td><td>• No development with ‘dirty’ outdoor practices (fueling stations, car washing/maintenance, etc.)
• Good housekeeping practices according to Multi-sector program
• No salt use</td></tr>
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