Key Definitions and Concepts

LID and GSI: What's the Difference?

The terms "low impact development" (LID), and "green stormwater infrastructure" (GSI) are often used interchangeably, although there are key differences between the two concepts. The following definitions for each of these terms are proposed for use during discussions about updating the Vermont Stormwater Management Manual (VSMM).

Low Impact Development (LID) is a land planning and engineering design approach which seeks to maintain a site's pre-development ecological and hydrologic function by using design techniques that infiltrate, filter, store, evaporate, and detain stormwater runoff as close to its source as possible. The LID site design process first protects sensitive areas (like existing lakeshore and riverbank buffers), then minimizes construction disturbance and the creation of new impervious surfaces, before designing structural practices to mimic pre-existing hydrologic conditions where the site has been disturbed. For more about planning and policy measures in Vermont related to LID, please visit http://www.vtwaterquality.org/stormwater/htm/sw_gi_planningandpolicy.htm.

Green Stormwater Infrastructure (GSI) is defined in The Vermont Green Infrastructure Initiative Strategic Plan: 2011-2013) as "systems and practices that restore and maintain natural hydrologic processes in order to reduce the volume and water quality impacts of the built environment while providing multiple societal benefits". At the scale of a city, neighborhood ,or individual site, GSI refers to engineered systems or practices that mimic nature by soaking up and storing water—extending the "green" functions of natural landscapes by means of rain gardens, green roofs, tree planting, permeable pavement, and other landscape-based stormwater management features. See http://www.vtwaterquality.org/stormwater/htm/sw_gi_systemsandfunctions.htm for more examples of GSI systems and practices.

The difference between LID and GSI is primarily that LID specifically incorporates a "site design" component to first avoid and then reduce the impacts of increased impervious cover during development or redevelopment, while GSI emphasizes the use of practices that mimic natural systems to reduce the impacts of increased impervious cover where LID (or a similar non-structural approach) alone is not sufficient.

Runoff Reduction: One Way to Implement LID and GSI

Some states and jurisdictions are in the process of moving toward a **runoff reduction (RR) framework or method** as an effective strategy for encouraging and supporting the implementation of LID and GSI at the project or site scale. Runoff reduction is a "tool that promotes better site design as the first step in compliance with both stormwater quality and quantity requirements, and strives to properly account for overall BMP effectiveness." (Battiata et al, 2010).

Under an RR approach, site design strategies that minimize the amount of runoff generated are considered first, coupled with green stormwater infrastructure practices that reduce runoff volume by emphasizing or mimicking natural processes. Runoff reduction is defined as "the total runoff volume that is reduced through canopy interception, soil infiltration, evaporation, rainfall harvesting, engineered infiltration, extended filtration (e.g., bioretention or dry swales with under drains that delay the delivery of stormwater from small sites to the stream system by six hours or more) or evapotranspiration" (Chesapeake Stormwater Network, 2009).

The goal of RR is usually to ensure that no runoff occurs from a particular amount of precipitation (often the 90th percentile rainfall event, or the first inch of rainfall regardless of percentile) in the post-development condition.

For more details, see Section 3 of the Advanced Stormwater Standards Compilation at http://www.anr.state.vt.us/dec/waterq/stormwater/docs/sw_advanced_standards_compilation.pdf.

Channel Protection Standards: Conflicts with LID and GSI Implementation

The primary purpose of a Channel Protection Volume (CPv) standard is to protect stream channels from excessive erosion caused by the increase in peak runoff rates from newly created impervious surfaces. The rationale for this criterion is that runoff will be stored and released in a gradual manner, such that critical erosive velocities will rarely be exceeded in downstream channels.

Key elements of Vermont's channel protection treatment standard in the 2002 VSMM include:

- Providing extended detention storage for the one-year, 24-hour rainfall event, with the time frame for extended detention being determined by whether the receiving water is a warm- or cold-water fishery, and
- Releasing the channel protection volume (CPv) at a roughly uniform rate over the required detention period.

The retention requirement of a CPv standard with no built-in flexibility can be problematic for LID or GSI implementation. There is an inherent conflict between design processes and practices that emphasize decentralization and infiltration (as with LID and GSI) and a requirement to collect water in order to detain it (for instance, in an extended detention facility to meet the CPv standard).

A number of different strategies have been used in other jurisdictions that attempt to resolve the conflict. In New York, for example, the CPv standard requires 24-hour extended detention only for the portion of the one-year, 24-hour storm event that cannot be treated using runoff reduction strategies—volume reductions achieved using GSI can be deducted from CPv. Another possibility is to use a "Modified Runoff Curve Number Method" as a means to account for the reduction in runoff volumes resulting from LID and GSI practices in the sizing of facilities to control runoff rates and volumes (see the Stormwater Practices Research Project Final Report prepared for VTrans at http://vtransengineering.vermont.gov/sites/aot_program_development/files/documents/materialsandresearch/completedprojects/VTrans_Stormwater_Research_Final_Report2012.pdf).