Low Impact Development

LID

* Effective Site Design
* Natural Stormwater Management Practices

Smart Growth / Smart Energy Toolkit
**The Problem**

**Conventional Development**

- Loss of natural land or open space
- Depleted drinking water supply
- Reduced quantity and quality of water resources
- Increased infrastructure costs & maintenance

**The Solution**

**Smart Development**

- Less land clearing and grading costs
- Reduced infrastructure costs
- Protection of regional water quality
- Reduced stormwater runoff

---

**Smart Growth / Smart Energy Toolkit**

**Low Impact Development**
“Conventional” Planning & Design

- Style of suburban development over the past 50 years
- Generally involves larger lots
- Clearing and grading of significant portions of a site
- Wider streets and larger cul-de-sacs
- Enclosed drainage systems for stormwater conveyance
- Large detention ponds
Site Design Planning Process

#1 **AVOID IMPACTS** – Preserve Natural Features and Use Conservation Design Techniques

#2 **REDUCE IMPACTS** – Reduce Impervious Cover

#3 **MANAGE IMPACTS** – Utilize Natural Features and Natural Low-Impact Techniques to Manage Stormwater
• Conservation of natural hydrology, trees, and vegetation
• Minimized impervious surfaces
• Dispersal of stormwater runoff
• Conservation of stream & wetland buffers
• Ecological landscaping
Site Design Practices

- Reduce storm pipes, curbs and gutters
- Preserve sensitive soils
- Cluster buildings and reduce building footprints
- Reduce road widths
- Minimize grading
- Limit lot disturbance
- Reduce impervious surfaces
Better Site Design on Roadways and Driveways

- Narrower streets
- Alternative cul-de-sacs
- Shared driveways
Better Parking Lot Design

- Incorporate green strips and buffers
- Create multiple small lots
- Reduce requirements near transit
- Allow shared parking
- Require compact spaces
- Set parking maximums
- Alternative permeable pavers in overflow areas
LID Stormwater Techniques

- Rain Barrels and Cisterns / Water Re-use
- Stormwater Planters, Tree Planting
- Permeable Paving
- Open Channels
- Bioretention
- Stormwater Wetlands
- Green Rooftop Systems
- Vegetative Buffers
- Infiltration
Rain Barrels and Cisterns
Runoff Reduction & Water Conservation

- Downspouts directed to tanks or barrels
- 50 - 10,000 gallons
- Excess diverted to drywell or rain garden
- Landscaping, car washing, other non-potable uses
Dry Well Infiltration of Roof Runoff

Disconnection of Rooftop Runoff to Vegetated Swale

Source: CWP
Permeable Pavement

- Berm Keeps Off-site Runoff and Sediment Out, Provides Temporary Storage
- Asphalt is Vacuum Swept, Followed by Jet Hosing to Keep Pores Free
- Reverse Perforated Pipe Only Discharges When 2 Year Storage Volume Exceeded
- Stone Reservoir Drains in 48-72 Hours or Less
- Undisturbed Soils with an tc Greater Than 0.27 Inches/Hour, Preferably 0.50 Inches/Hour or More
- Site Posted to Prevent Resurfacing and Use of Abrasives, and to Restrict Truck Parking

Copyright 2000, Center for Watershed Protection
Permeable Pavement @ Work

![Image of permeable pavement with a man walking on it and a close-up view of the pavement texture.](image-url)
Vegetated Swales
Conveyance, Treatment, Infiltration

• Roadside swales (“country drainage”) for lower density and small-scale projects
• For small parking lots
• Mild side slopes and flat longitudinal slopes
• Provides area for snow storage & snowmelt treatment
Bioretention Applications

- Parking lot islands
- Median strips
- Residential lots
- Office parks
Bioretention Applications

- Urban retrofits
- High-density areas
Vegetated Filter Strips
Pretreatment and Attenuation

• Mild vegetated slopes
• Adjacent to small parking lots and roadways
• Another opportunity for snow storage
Green Roofs

- Stormwater Runoff absorption/collection
- Reduced flooding of and damage to urban streets
- Interior heating and cooling benefits of 10 degrees or more
- Air purification
- Recreational amenity
- Improved aesthetics
- Extended roof life, estimated at 40 years
Stormwater Planters

- Vegetative uptake of stormwater pollutants
- Pretreatment for suspended solids before they reach water-treatment facilities
- Aesthetically pleasing
- Reduction of peak discharge rate

Source: City of Portland, OR
**LID BENEFITS**

**Environmental and Community**

- Protects unique or fragile habitats
- Reduces the pollution impacts of stormwater runoff
- Promotes aquifer recharge
- Provides opportunities to link wildlife habitats
- Conservation values are part of the planning process
- Can further goals of open space and community development plans

The planning process inherently protects natural resources and promotes recharge to underlying aquifers.
Local Authorities

Better Site Design will—

- Identify and preserve natural features
- Maintain natural hydrology
- Help respect abutter’s properties
- Retain property values
- Augment groundwater supplies
- Maintain high water quality
- Provide new green space as a amenity
Local Authorities

- Green strips in parking lots provide shade, serve stormwater collection and treatment needs, and reduce the need for large unsightly detention basins.
- Reduction in overall parking area reduces runoff volumes.
- Shared parking allows for more retail tax revenue.
- Enhanced aesthetics can increase retail traffic and sales revenue.
Local Authorities

- Infiltration replenishes groundwater supplies, increases aquifer recharge, and maintains base flows to streams and wetlands.
- Less runoff and sediment going into public drainage systems = lower maintenance costs, more overall capacity, and a longer lifespan for drainage systems.
- Reduced frequency and severity of Combined Sewer Overflow (CSO) events improves water quality and public health.
The permitting structure encourages smart growth and facilitates a process that is clear, easy to understand, and cost-effective to developers.

LID BENEFITS

For Developer and Realtor

- Streamlines the plan review process, reduces time and costs
- Adds valuable amenities that can enhance marketing and sale prices
- Decreases site development costs by designing with the terrain
Developer and Realtor

- Low Impact Development practices can cost less than conventional drainage techniques.
- LID can reduce the size and number of detention facilities and the size and cost of drainage infrastructure.
- Systems designed to mimic nature can enhance aesthetics and property home values.
- Surface vegetative systems are more visible, thereby facilitating routine maintenance and requiring less maintenance than underground practices.
Genzyme Corp. Headquarters
Cambridge

- Green roof
- Recycled roof runoff for “make up” water for cooling system
- Moisture sensors in green areas to minimize irrigation needs
Olmsted Green, Boston

- Significantly improve existing physical site conditions
- Increase the infiltration of rainfall into soils and groundwater
- Reduce surface flooding
- Protect and enhance wetlands on the property
- Preserve existing mature specimen trees
Olmsted Green, Boston

LID methods will include—

- Tree preservation
- Soil amendments to improve vegetative growth and erosion control
- Vegetated swales and rain gardens
- Subsurface infiltration
- Permeable pavers and pavements
- Stormwater System Operations & Management Plan
Pinehills, Plymouth

* Small clusters * Natural features retained
* Minimum impervious surfaces * Narrow roads
* Shared driveways
* Houses sited with natural terrain
* Vegetation retained

* Narrow roads
* “Country drainage”
LID Model Bylaw

• Provides incentive for conservation site planning

• “Stormwater Credits” reduce the size and number of conventional practices

• Requirement to treat stormwater

• Expands upon Massachusetts Stormwater Policy by including all land areas (beyond Wetland Protection Act jurisdiction)
Links for More Information

- The Low Impact Development Center
  [www.lowimpactdevelopment.org](http://www.lowimpactdevelopment.org)

- ECONorthwest applies economic analysis to better understand the benefits of low-impact developments including a presentation by Ed MacMullan

- Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewers Overflows

- Low Impact Development, Buzzard’s Bay National Estuary Program
  [www.buzzardsbay.org/lid.htm](http://www.buzzardsbay.org/lid.htm)

- The University of New Hampshire Stormwater Center
  [www.unh.edu/erg/cstev/](http://www.unh.edu/erg/cstev/)

- Greenscapes
  [www.nsrwa.org/greenscapes/default.asp](http://www.nsrwa.org/greenscapes/default.asp)
Links for More Information

- Low Impact Development Center: Urban Design Tools
  [www.lid-stormwater.net/](http://www.lid-stormwater.net/)

- Massachusetts Low Impact Development Toolkit, developed by the Metropolitan Area Planning Council (MAPC)
  [www.mapc.org/LID.html](http://www.mapc.org/LID.html)

- Green Roofs for Healthy Cities
  [www.greenroofs.net/index.php](http://www.greenroofs.net/index.php)

- Heat Island Effect – Trees and Vegetation
  [www.epa.gov/hiri/strategies/vegetation.html](http://www.epa.gov/hiri/strategies/vegetation.html)

- Building Better II: A Guide to America's Best New Development Projects
  [www.sierraclub.org/healthycommunities/buildingbetter/](http://www.sierraclub.org/healthycommunities/buildingbetter/)