Water & the Future of Your Community

Groundwater Flow Paths: Undeveloped Condition
Figure 3. Water Budget Approach

Four Main Water Use Development Scenarios:
1.) Public Water Supply & Public Wastewater
2.) Public Water Supply & Private Wastewater (septics)
3.) Private Water Supply & Private Wastewater (septics)
4.) Private Water Supply & Public Wastewater

Notes:
- GWDP - Ground Water Discharge Permit (Public Wastewater)
- PWS - Public Water Supply
- Water Budget Inputs are (+) and Outputs are (-)
Figure 4-1.
Taunton Watershed and
Rattlesnake Sub-watershed

Legend
- Taunton River Watershed
- Rattlesnake Sub-watershed
- Sub-watersheds
Figure 5-3. Surficial Geology in Coweeset Sub-watershed

Legend

- Town Line
- Coweeset Sub-Watershed
- Sub-watersheds
- Sand Gravel
- Till Bedrock
- Fine Grained Deposits
- Floodplain Alluvium

Legend

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3,000 Feet
Low Impact Development (LID)
Horsley Witten Group
Experience & Qualifications

- USEPA Workshops
- MA Stormwater Advisory Committee
- MA Smart Growth & Smart Energy Toolkit
- Hawaii LID Manual
- MA CZM LID Model Bylaw
- Guam Stormwater Mgt Manual
- Maine LID Guidance Manual
- RI LID Master Certification Course
- Groundwork Lawrence - Urban LID
- Site Designs and Peer Reviews
Integration of Smart Growth into Comprehensive Planning

This Toolkit provides easy access to information on twelve different planning, zoning and subdivision techniques that will make smart growth a reality in your community. The materials are designed to increase understanding of smart growth tools and how to customize the techniques to local circumstances. The commonwealth encourages communities to pass and implement these smart growth measures.

Planning - the importance of context to successful implementation of smart growth

Successful implementation of these measures will require planning. Adoption of any of the 12 techniques included here will require customization, and communities should never simply copy and use model bylaws, either those provided here or elsewhere, without modifications to address circumstances within the community. Ideally, users of this toolkit will take a comprehensive approach to achieving smart growth. At a minimum, once a decision has been made to pursue implementation of a particular technique, such as open space residential design, community meetings will be needed to answer basic questions and how the model provided should be customized.
Smart Growth Techniques

- Transfer of Development Rights (TDR)
- Traditional Neighborhood Development (TND)
- Transit Oriented Development (TOD)
- Open Space Residential Design (OSRD)
- Accessory Dwelling Units (ADU)
- Agricultural Preservation
- Low Impact Development (LID)
- Inclusionary Zoning
- District Improvement Financing (DIF)
- Tax Increment Financing (TIF)
- Chapter 40R
- Reuse: Brownfields
- Water Resource Management
Low Impact Development (LID)

In Brief: Low Impact Development (LID) is a more sustainable land development pattern that results from a site planning process that first identifies critical natural resources, then determines appropriate building envelopes. LID also incorporates a range of best management practices (BMPs) that preserve the natural hydrology of the land.

The Problem

Development patterns based on conventional zoning codes in Massachusetts often result in “sprawl” with its associated large impervious areas, loss of natural areas, and alteration of hydrologic systems. Too often, the development process begins with the clearing and leveling of an entire parcel. Conventional developments that follow, commonly contain wide roads and large parking lots. These large impervious areas prevent water from infiltrating into the ground (which normally replenishes groundwater supplies and supports nearby wetlands and streams with baseflow) and convey polluted runoff into waterbodies. In order to deal with water that runs off of these sites, structural stormwater controls such as catch basins, pipes, and detention ponds are used. Conventional landscaping of these developments brings additional concerns including the introduction of non-native plants, use of herbicides, pesticides and fertilizers, and excessive water consumption.
“Low-Impact” Planning and Design

“Lower Impact”
“Better Site Design”
“Smart Growth”
“Positive Impact Development”
“Sustainable Development”

Incorporates biological/vegetative approaches into new and redevelopment projects to reduce impacts on watersheds
Low-Impact Development, Better Site Design – What Is It?
It’s not this!
I don’t think so......!
Nope!
Number of Accidents as a Function of Residential Street Width

Source: Swift, et. al., 1998
Formula for Low Impact Development

LID = engineering
    + hydrology
    + ecology
    + land use planning
Water & the Future of Your Community

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Groundwater

Soil Moisture

Infiltration

Surface Storage

Evaporation

Precipitation

Direct Runoff

Groundwater

Surface Waters

Evaporation

Transpiration

Direct Runoff
Water Cycle Diagram

**PRE DEVELOPMENT CONDITIONS**
- Precipitation
- Evaporation
- Runoff
- Infiltration

**POST DEVELOPMENT CONDITIONS**
- Precipitation
- Evaporation
- Runoff
- Infiltration
Changes in Water Balance as Land Use Changes

**Natural Ground Cover**
- 40% Evapo-Transpiration
- 10% Runoff
- 25% Shallow Infiltration
- 25% Deep Infiltration

**10-20% Impervious Surface**
- 38% Evapo-Transpiration
- 20% Runoff
- 21% Shallow Infiltration
- 21% Deep Infiltration

**35-50% Impervious Surface**
- 35% Evapo-Transpiration
- 30% Runoff
- 20% Shallow Infiltration
- 15% Deep Infiltration

**75-100% Impervious Surface**
- 30% Evapo-Transpiration
- 56% Runoff
- 10% Shallow Infiltration
- 5% Deep Infiltration
The process begins with determining how many lots could be developed under conventional zoning; this is the base yield of the property. From that point, the plan development process follows four basic steps:
1. Identify Conservation Value Areas on the site such as wetlands, significant trees or tracts of forest, habitat, cultural resources or buffer zones. Remove these from the “developable area”.
2. Place houses in the remaining area in a way that would maximize residents enjoyment of these areas by providing access to open space and preserving views.
3. Align roads and trails on the site to provide pedestrian and vehicle access.
4. Draw lot lines around the homes.
LID Techniques / Integrated Management Practices

- Bioretention and Rain Gardens
- Stormwater Planters, Tree Planting
- Green Rooftop Systems
- Rain Barrels and Cisterns / Water Re-use
- Infiltration
- Permeable Paving
- Open Channels
- Vegetative Buffers
- Stormwater Wetlands
- Stream Daylighting
- “Cutting Edge” - Atriums, Green Walls
Bioretention & Rain Gardens
Water & the Future of Your Community

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Raingarden Performance

- Vegetative uptake of stormwater pollutants
- Pretreatment for suspended solids
- Groundwater recharge
- Aesthetically Pleasing
- Reduction of peak discharge rate
Green Rooftops and Gardens
Pedestrian Design
Stormwater Planter Performance

- Vegetative uptake of stormwater pollutants
- Pretreatment for suspended solids
- Aesthetically Pleasing
- Reduction of peak discharge rate

Source: City of Portland, OR.
Scuppers into Stormwater Planter
Stormwater Planters
Green Rooftops and Gardens
Porous/Grid Pavement Performance

- Stormwater Runoff infiltration
- Best overall treatment Practice
- Limitations in high traffic areas & where sanding/salting is necessary

SIGNIFICANT MAINTENANCE CONSIDERATIONS
Open Vegetated Channels
Impervious Cover Reduction