UNDERSTANDING

Subdivion Regulations

What it is

Subdivision regulations guide the private development of new roads. They control layout and construction, specifying municipal requirements for location, width, and grades of proposed ways. They also specify requirements for public utilities. As streets typically account for 50 to 75 percent of impervious cover in the developed environment, it is critical that these regulations encourage and even require best practices for stormwater management. These regulations should also be consistent with requirements within a municipality's stormwater management bylaw/ordinance.

Cost Savings in a Subdivision Project

Photo: Nashua Telegraph

In Pelham, New Hampshire, a subdivision that took a low impact approach to site development and used green infrastructure stormwater management practices **realized a 6% savings on the total cost of stormwater infrastructure**[1] The road shown here makes use of porous asphalt, allowing rainfall to soak into the surface and filter through underlying soils.
For more on porous asphalt, see related fact sheet.

Within subdivision regulations, best practices can be addressed in the early stages of the planning process itself, and within requirements for the following:

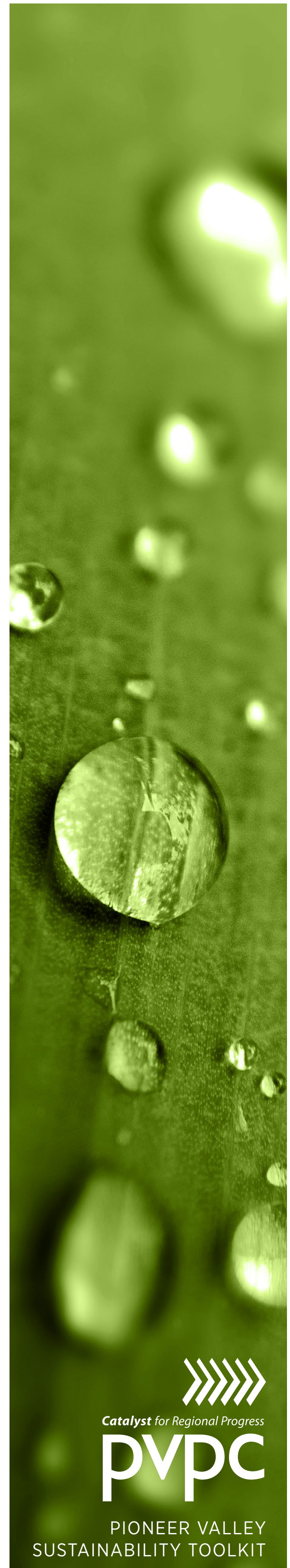
- » location and length of roadways
- » right of ways
- » paved roadway width
- » curbs
- » drainage
- » sidewalks
- » utilities
- » landscaping
- » cul de sacs

Planning process

Approval for a subdivision project typically begins with submission of a preliminary plan, which helps initiate a conversation about the project between the developer, planning board, and board of health. This early stage in the project provides communities with an opportunity to promote an integrated site design process and use of distributed stormwater management practices to best match the predevelopment hydrologic condition. This could include advancing provisions within stormwater management regulations and also within zoning regulations for: 1. Open Space Residential Development, which allows for a more compact development pattern to preserve open space and reduce the amount of paved surfaces through clustering of development to the least environmentally sensitive areas; or 2. where appropriate Traditional Neighborhood Development (TND), which involves the more traditional neighborhood pattern used prior to the automobile, and includes small lots and homes with porches oriented toward the street. TNDs typically have narrow roads and on-street parking coupled with reductions in required off-street parking.

For preliminary plan submission, municipalities could provide to developers a standard site analysis checklist to maximize design and functionality of best stormwater management practices. This could include many of the same steps within the conservation development process, beginning with a good site analysis to designate natural drainage areas, important conservation areas, and locating development areas. Applicants could bring the results of this analysis to a pre-application conference. As part of this analysis and reporting, the applicant could identify proposed best stormwater management practices. Soil testing for this site analysis could be for the site overall and not as rigorous as the more detailed soil work necessary to design a stormwater management facility.

It may be useful to include credits for improved stormwater management practices. The Massachusetts Department of Environmental Protection (DEP) stormwater standards as incorporated into the state's Wetlands Protection Act Regulations has established a "LID Site Design Credit" whereby in exchange for directing runoff from roads and driveways to vegetated open areas, preserving open space with a conservation restriction, or



directing rooftop runoff to landscaped or undisturbed areas, developers can reduce or eliminate the traditional BMPs used to treat and infiltrate stormwater.2

Location and length of roadways

Protecting important natural features and minimizing disturbance and amount of paved area is a first line approach to protecting hydrology on a previously undeveloped site. This can be achieved by identifying opportunities to reduce:

- » **cut and fill, thereby minimizing disturbance of native soils**
- » **unnecessary contouring of the site, and**
- » **removal of native vegetation.**

In addition, streets ought to be located in order to protect important natural features, avoiding low areas and steep slopes.

Developers should be encouraged to limit clearing within the right-of-way to the minimum necessary for constructing roadway, drainage, sidewalk, and utilities, and to maintaining site lines. During site development, permeability of soils for infiltration should be preserved. Where soils are compacted by construction vehicles, contractors should be required to reestablish permeability.

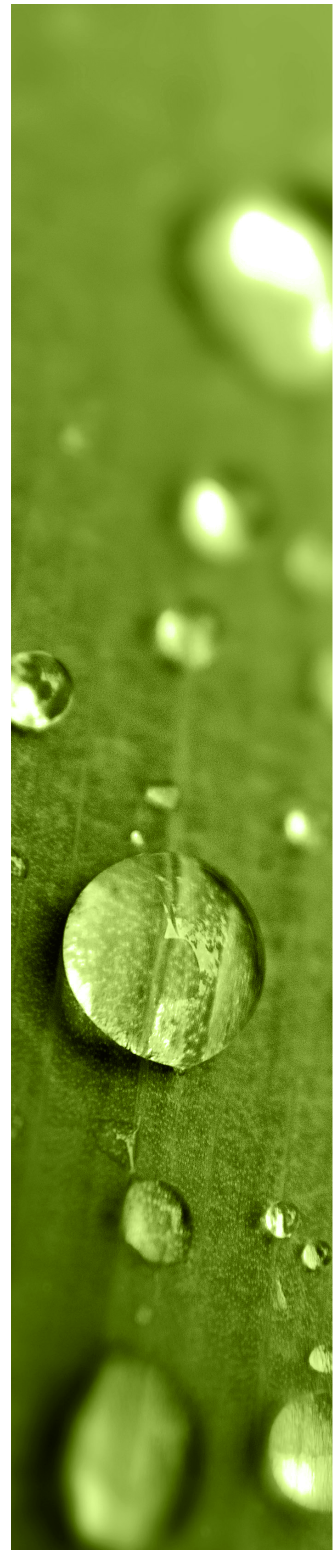
Alternative street layouts should be explored for options to increase the number of homes per unit length and minimize the length of the roadway. This might be achieved through clustering of the development or through Traditional Neighborhood Design as described above.

Right of ways

A right of way is the strip of land that contains all the elements of a roadway. At a minimum, this typically includes vehicle travel lanes, grading and drainage, and utilities. It also can include bike lanes, shoulders, on-street parking, curbs, sidewalks, and vegetated areas. Right of ways between 50 and 60 feet wide are standard, but this it has often led to overdesign with excessive clearing, grading and extensive use of the width for paving.

Good design has not so much to do with the width of the right of way itself, but considerations of context and what makes for efficient and effective use of the right of way. What makes sense for the elements of a right of way on a busy suburban road will likely not make sense for a low volume rural road.

Several communities in Minnesota have developed “Living Streets” policies that take context into consideration. This policy brings together “complete streets” objectives of providing for multiple modes of transportation (vehicular, pedestrian, and bicycle) and “green streets” objectives of reducing environmental impacts (through reduced impervious surface and improved stormwater management). In thinking about how to accommodate these various objectives within the right of way, these communities have developed design options that can be deployed depending on what specific objectives there may be for a project. In Maplewood, Minnesota, there are three design options for

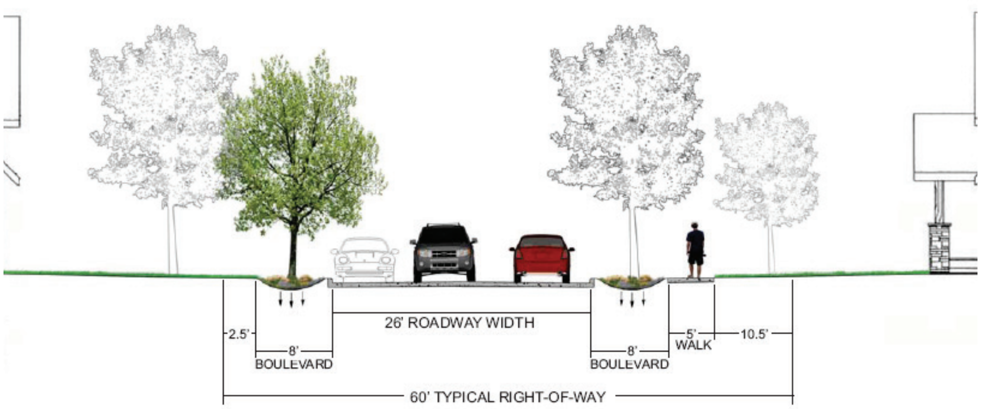


a local street with a 60-foot right of way (note that not all 60 feet in the right of way is used):

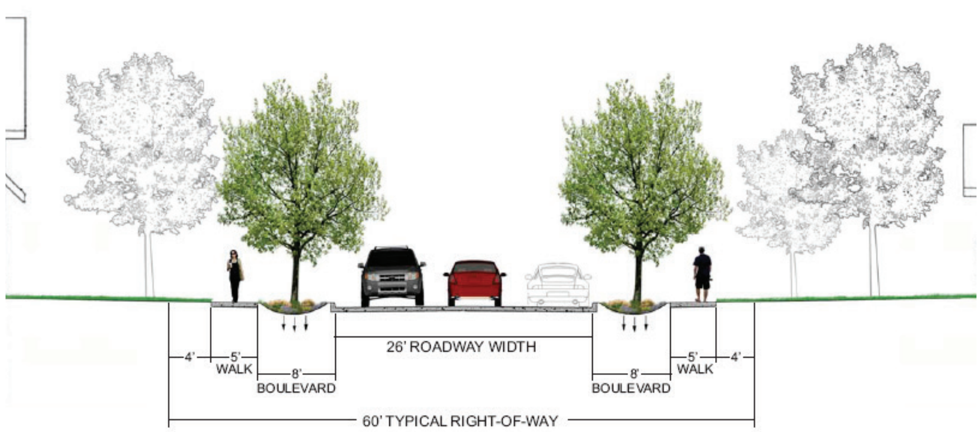
Guidelines from Edina, Minnesota's Living Street Policy are useful in thinking about right of way use:

- » **Provide bicycle accommodation on all primary bike routes.**
- » **Allocate right-of-way for boulevards (stormwater infiltration facility)**
- » **Allocate right-of-way for parking only when necessary and not in conflict with Living Streets**
- » **principles**
- » **Consider streets as part of our natural ecosystem and incorporate landscaping, trees, rain**
- » **gardens and other features to improve air and water quality**

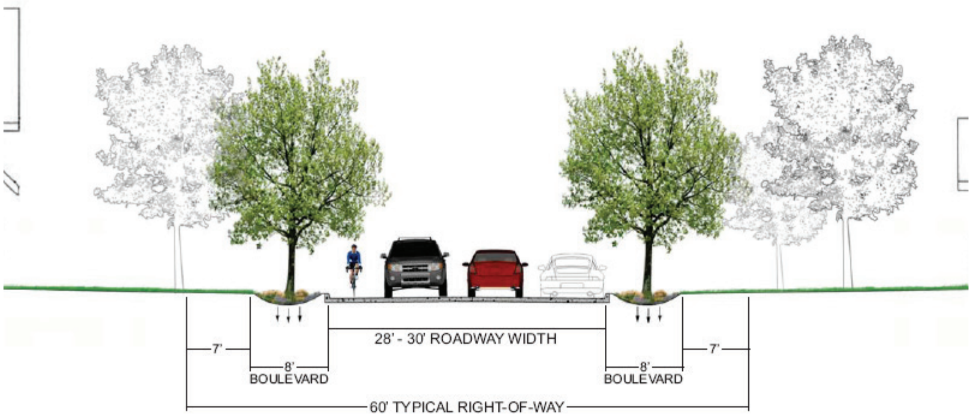
Municipalities ought to consider the use of drawings that show how the elements of a right of way cross section might vary given different contexts. Such drawings provide a clear understanding about objectives and efficient and effective use of the right of way area.



24 to 26-foot roadway width with parking on one side; 8-foot boulevard/ stormwater infiltration facility on each side; and 5-foot sidewalk on only one side



24 to 26-foot roadway width with parking on one side; 8-foot boulevard/ stormwater infiltration facility on each side; and 5-foot sidewalk on each side



28' to 30' roadway width with parking on one side; and 8-foot boulevard/stormwater infiltration facility on each side

Source: City of Maplewood, Minnesota, Living Streets Policy, Adopted January 28, 2013

Paved roadway width

Narrower road widths produce advantages not only in terms of reduced stormwater impacts, but also lower development costs, improved community character, and enhanced pedestrian safety. As a result, it is important for municipalities to revisit and update roadway width standards within subdivision regulations. Many existing standards are based on universal application of guidelines for highways or very large scale subdivisions planned more than 50 years ago. Revised standards should involve the minimum required pavement width and derive from careful considerations with public works and emergency response officials of traffic volume, on-street parking (where required), and passage of emergency vehicles and school buses. Typical road width reduction standards are shown on the following page.

Communities might also explore the use of permeable shoulders to reduce overall imperviousness of a roadway. This would involve combining a traditional asphalt surface for the travel lanes and an adjacent porous surface for the shoulder or bike lane area. Snow and ice management for the roadway must avoid sand so as to avoid clogging of the porous shoulder area. For more information, see a recent publication entitled, "Permeable Shoulders with Stone Reservoirs," referenced more fully in the Links to More Information Section below.

Emergency Vehicle Access

Emergency access considerations can have direct bearing on street width. Under the Massachusetts' fire marshal code, the minimum fire access lane width is 18 feet. Generally speaking, this can be met by two 9-foot travel lanes. The purpose of a fire access lane is to allow one fire truck to operate while allowing enough space for a second truck to pass by during the event of an emergency. Fire access lanes can be located on roads, but they must not be obstructed (i.e. by parked cars or snow).

While the state fire marshal code provides a minimum width, fire access lanes cannot be standardized across the state. Each community has different needs and fire apparatus that range in size. Communities may increase minimum fire access lane widths if required for their particular equipment. Alternatively, municipalities may select fire access equipment that allows for narrower lanes consistent with community design goals.

Table 5: General Parameters for Residential Road Design

Parameter	Single Use Residential Wide	Single Use Residential Medium	Single Use Residential Narrow	Single Use Residential Alley
Traveled Way				
Typical ADT	4,999 < 1,500	1,499 < 400	399 < 0	100 < 0
Design speed	25-30 mph	20 mph	20 mph	15 mph
Operating speed	20-25 mph	20 mph	15-20 mph	15-20 mph
Number of Through Lanes	2	2	2	1
Lane Width	10-12 feet	10-12 feet	10 feet	9-10 feet
Shoulder	2 feet	2 feet	2 feet	2 feet
Bike Lanes	Shared road Or 6 feed wide	Shared road	Shared road	Shared road
Utility Easement Width	----	----	10 feet	10 feet
Range of ROW Width	40-50 feet	36-40 feet	33-36 feet	20 feet
Roadside				
Desirable Roadside Width (pedestrian, swale, and planting strip)	5.5-12 feet	5.5-10 feet	5.5 feet	None
Grass Plot/Planting Strip	0-6 feet	0-6 feet	0-6 feet	None
Minimum Sidewalk Width	4 feet one side ok	4 feet/Shared road	Shared road	Shared road
Street Lighting	At intersections and pedestrian scale lighting at residential driveways.	At intersections and pedestrian scale lighting at residential driveways.	At intersections and pedestrian scale lighting at residential driveways.	At intersection with road
Intersections				
Traffic control	Stop signs, 4-way yield	4-way yield	4-way yield	Yield exiting alley
Curb Radii	15-25 feet	15-25 feet	15-20 feet	15 feet

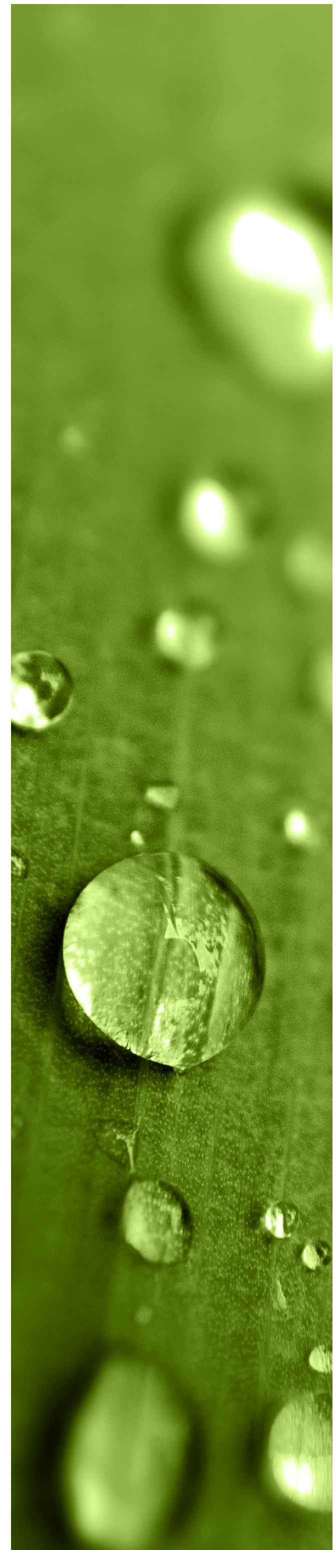
Source: Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns, May 2011, American Planning Association, Massachusetts Chapter and Home Builders Association of Massachusetts (page 27).

Cul de sacs

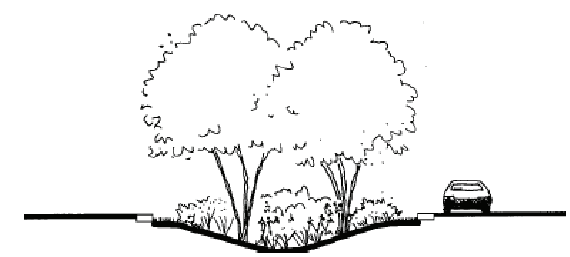
The required radius for a cul-de-sac also impacts the amount of impervious area. In the Pioneer Valley, minimum cul-de-sac radius requirements (at outer road edge) are typically set between 60 and 120 feet, and hammerhead turnarounds, which would greatly reduce impervious cover, are not typically allowed. Better stormwater management recommendations often call for cul-de-sacs to be designed with an outer road radius of 30 to 40 feet, as well as allowing for hammerhead turnarounds in lieu of cul-de-sacs.

Also in subdivision regulations, there are opportunities to reduce the required radius of a cul-de-sac (down to an outer road radius of 30 to 40 feet), and to allow hammerhead turnarounds. On dead-end streets, hammerhead turnarounds can provide a feasible way to reduce paved area while providing sufficient turnaround space for larger fire vehicles.

- **E. Cul de sac or dead end street -- Revise cul de sac requirements for granite curbing to allow bioretention area on landscaped island (soils permitting). This could entail curbing that is perforated to allow for the flow of runoff to the bioretention area;**



- Minimize the required radii for cul-de-sacs - radius of 35 feet is optimal, depending on emergency vehicles;
- Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. The radius of cul-de-sacs should be the minimum required to accommodate emergency and maintenance vehicles. Alternative turnarounds should be considered.



Cul-de-sac infiltration island accepts stormwater from surrounding pavement. Note flat curb.

The cross section drawing to left shows how a cul de sac can be designed to serve as a bioretention area for stormwate runoff. The photo to the right shows a bioretention cul de sac in Waterford, Connecticut, that is designed to collect and filter roadway runoff from a residential development.

Curbs

Currently subdivision regulations typically call for the use of curb and gutter infrastructure connected to storm sewer infrastructure. This traditional approach produces stormwater flows that have greater impacts on local rivers and streams. As an alternative, regulations can promote roads without curbs where appropriate or the use of "perforated curbs." Perforated curbs are curbs with gaps that allow stormwater to move from the street through to a stormwater management facility that could include swales or planters, such as tree box filters. (See image on the following page.)

Another alternative involves the use of "invisible curbs." Invisible curbs are granite curbs that are buried along the street edge so as to allow stormwater to flow over into a stormwater management facility. Invisible curbs provide the structural support needed to plow from curb to curb, thereby retaining the desired roadway width even in snowy conditions. (See images on the following page.)

Perforated Curbs

Perforated curbing allows stormwater to enter planters that are designed to soak up rainfall.

Invisible Curbs

"Invisible" curbs along the street edge allow runoff to move into bioretention swales.

Drainage

Standards for drainage within the subdivision regulations should encourage and even require better site design with a low impact development approach that includes:

- **conservation of open space, natural drainage systems, native vegetation and other resources on site;**
- **minimizing and disconnecting impervious surfaces;**
- **clustering, and eliminating impervious surfaces that are connected to the municipal stormwater system; effective BMP selection and placement**

This section should also refer to and be consistent with the stormwater management bylaw/ordinance. It should identify which size projects require a stormwater management permit, and what are the design parameters for drainage (i.e., water quality volume treatment, which targets pollutant transport; channel protection volume, which targets erosion; and overbank and extreme flood protection). For communities that have adopted for upland areas the *Massachusetts Stormwater Handbook*, the design parameters with Standard 2 address downstream and off-site flooding. It requires that the post-development peak discharge rate is equal to or less than the pre-development rate from the 2-year and the 10 year 24 hours storms. The Model LID Bylaw prepared by the Massachusetts Executive Office of Energy and Environmental Affairs suggests performance standards that go further, including treatment of discharges and protection for channels, overbank flooding, and extreme flooding.

The drainage section should also address requirements for bridge openings and major culverts. There are now important habitat preservation and climate change adaption considerations that ought to be considered in the design of these facilities. *The Massachusetts River and Stream Crossing Standards* should be referenced as an important resource for design of these facilities.

Sidewalks

In addition to roadways, sidewalks provide another important opportunity to reduce impervious area or provide better management of stormwater runoff. Regulations can promote a variety of strategies for achieving this, including:

Use of porous surfacing material for sidewalks and bus waiting areas. A recent publication on complete streets by the City of Boston that promotes the use of porous materials in certain sidewalk zones describes the advantages of this choice in paving:

> Permeable pavements provide increased traction when wet because water does not pool, and the need for salt, sand, and plowing is reduced during winter due to low/no black ice development. Compared to traditional paving methods, long-term maintenance costs may be lower in cold climates since permeable pavements resist cracking and buckling in freeze-thaw conditions. Nevertheless, permeable paving requires regular maintenance including: annual inspection of paver blocks for deterioration; periodic replacement of sand, gravel and vegetation; and annual industrial vacuuming of pavements to unclog sand and debris (Note: The use of sand in ice prevention should be avoided because it will clog pavement pores.)[3]

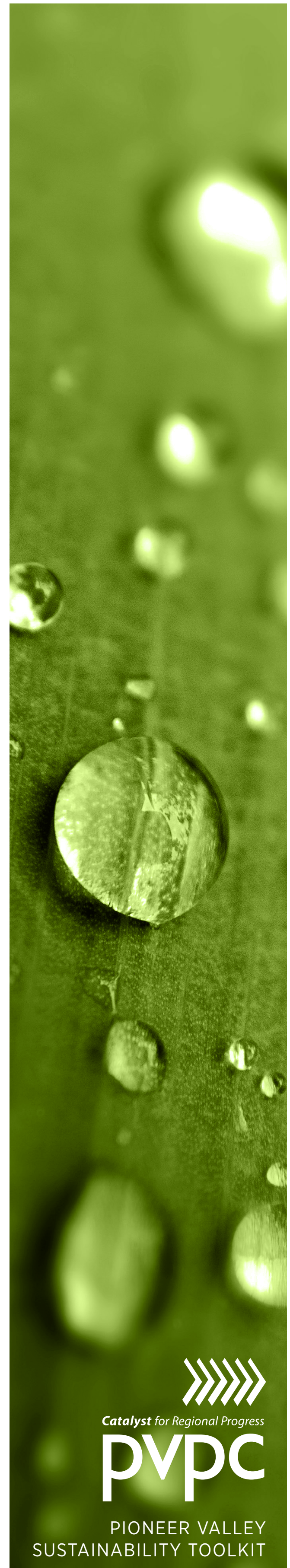
Flexibility in sidewalk standards to accommodate best management practices. This might include allowing alternatives to the minimum sidewalk standards or alternatives to sidewalk layout where pedestrian circulation makes use of common areas rather than street rights of way.

Grading of impervious sidewalk surfaces to direct stormwater runoff to bioretention areas or other such facility to eliminate or keep flow out of the municipal storm drain system

Utilities

Rather than require all electric, telephone, cable TV, fiber optic, and other conduits to be installed away from the road and its edge, allow placement of utilities under the paved section of the right of way. This creates essential space along the roadway edge for stormwater management facilities.

Often there is concern that such placement of utilities under the road will result in traffic delays and additional costs to utility companies. In the *Rhode Island LID Site Planning and Design Guidance for Communities*, however, authors from the Horsley Witten Group



note that the reality is, "The amount of pavement needed to be removed during such operations can be decreased through better diagnostic tests and trenchless technologies for utility construction and repair."

If the idea of putting utilities under the road edge is too great a concern for Departments of Public Works, then the next best strategy is to place utilities directly abutting roadway pavement, within 1 to 2 feet.

Landscaping and trees

Trees, shrubs, and ground covers are essential to good stormwater management. Leaves, needles, branches, and bark intercept rainfall so that it can then evaporate to the atmosphere. Leaf litter and mulch on the ground creates a spongy surface for retention of stormwater. Rainfall that reaches the roots is taken up into plants and then transpired to the atmosphere. Roots also help to stabilize soils and prevent erosion.

Subdivision regulations can recognize these important benefits through the following:

- **Encourage both preservation of existing stands of trees and mature trees on site as well as plans that incorporate trees into stormwater management practices. This can be done through specific requirements and through a system of credits. Calculating stormwater benefits of certain species based on size can be done through the National Tree Benefit Calculator at: www.treebenefits.com/calculator/**
- **Allow for bioretention areas or other vegetated stormwater facilities within treebelt areas and to count toward other required landscaping features, including site, parking or perimeter screening. This creates areas that function on several levels, including aesthetics and stormwater management.**

LINKS TO MORE INFORMATION

AHBL FOR PUGET SOUND PARTNERSHIP. NOVEMBER 2011. INTEGRATING LID INTO LOCAL CODES: A GUIDEBOOK FOR LOCAL GOVERNMENTS. SEE:
http://www.psp.wa.gov/LID_GLG.php

AMERICAN PLANNING ASSOCIATION, MASSACHUSETTS CHAPTER, AND HOME BUILDERS ASSOCIATION OF MASSACHUSETTS. MAY 2011. "SUSTAINABLE NEIGHBORHOOD DESIGN: A GUIDEBOOK FOR MASSACHUSETTS CITIES AND TOWNS." SEE:
www.apa-ma.org/apa-ma_documents/.../NRB_Guidebook_2011.pdf

CENTER FOR WATERSHED PROTECTION AND USDA FOREST SERVICE. "USING TREES TO REDUCE STORMWATER RUNOFF." FOR THIS POWERPOINT PRESENTATION, SEE:
http://www.slideshare.net/watershedprotection/using-trees-to-reduce-stormwater-runoff-formatted-presentation?type=powerpoint

ALSO SEE WEB PAGE RELATED TO THIS COLLABORATION:
http://www.forestsforwatersheds.org/reduce-stormwater/

LAWRENCE, TIMOTHY AND MYERS, MONIQUE. 2009. "EMERGENCY SERVICES AND STORM WATER MANAGEMENT." CALIFORNIA SEA GRANT PROGRAM. SEE:
www-csgc.ucsd.edu/BOOKSTORE/Resources/LID_FACTSHEET.pdf

RHODE ISLAND DEPARMENT OF ENVIRONMENTAL MANAGEMENT AND COASTAL RESOURCES MANAGEMENT COUNCIL. MARCH 2011. "RHODE ISLAND LOW IMPACT DEVELOPMENT SITE PLANNING AND DESIGN GUIDANCE MANUAL." SEE:
www.dem.ri.gov/programs/bpoladm/suswshed/pdfs/lidplan.pdf

1 In his presentation, "Right Practice, Right Place: Green Infrastructure Technologies that Work in New England" at EPA's Growing Your Green Infrastructure Program, December 2012, Robert Roseen noted that in addition to reducing the number of acres to be cleared, the developer was able to avoid the use of 1,616 feet of curbing, 785 feet of pipe, 8 catch basins, 2 detention basins, and 2 outlet control structures.

2 Information on the LID Site Design Credit is found in Volume 3 of the Massachusetts Stormwater Handbook.

3 For more information, see the document from which this quote is drawn:
http://www.bostoncompletestreets.org/pdf/2/chap2_5_sidewalk_materials.pdf

FOR MORE INFORMATION, PLEASE CONTACT

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