LID Site Planning and Design Techniques:
A Municipal Self-Assessment

Produced by URI Cooperative Extension with funding from the RI Department of Transportation and support from the Rhode Island Department of Environmental Management. *December, 2019.*

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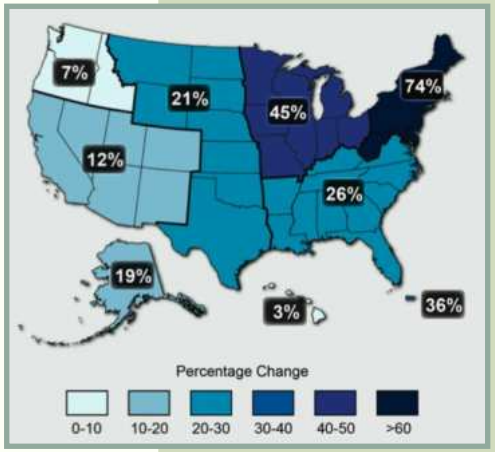
INTRODUCTION

Why Are We Being Asked To Complete The Assessment?

In 2011, RIDEM asked all Rhode Island municipalities to complete the first round of self-assessments to identify how they proposed to incorporate low impact development (LID) techniques into their community's rules and regulations. *Since then, RIDEM finds that the number of applications without LID still exceeds those with proper LID design*. As water quality impairments from stormwater runoff continue to increase throughout the state, the need for better development practices is evident.

Although developers are required to apply LID stormwater practices, municipal ordinances often either prevent the use of LID designs or favor conventional practices. Since municipalities' post-construction program must be consistent with the *Rhode Island Stormwater Management, Design, and Installation Rules* under the MS4 permit, RIDEM will be requesting municipalities to complete the assessment, identify ordinance changes that can incorporate LID, and submit results as part of the MS4 permitting program's annual reporting. The process of completing the assessment will help you understand model LID practices.



Climate change is causing the percentage of precipitation fall to increase nationwide, with New England projected to experience the highest increase (Office of the New Jersey State Climatologist).

Remind Me About Low Impact Development

LID is both a site planning and design strategy that attempts to mimic natural treatment processes in soil and vegetation in order to maintain pre-development hydrology. LID is required by the Cleaner Bay Act of 2007 (RIGL 45-61.2) because it is far more effective in protecting water quality than constructed BMPs alone.

Specifically, LID seeks to:

- **AVOID** increased runoff by preserving and protecting as much of the natural site condition as possible,
- **REDUCE** runoff by minimizing impervious cover (pavement and roof) to the maximum extent possible, and
- **MANAGE** impacts by treating runoff close to the point where it is generated, using small-scale, vegetated systems, rather than conveying and managing stormwater in large, costly drainage systems.

Because municipalities have primary authority over land use, they are responsible for implementing LID. RIDEM does not have the authority to override local land use decisions but focuses on minimum standards for the design of constructed BMPs.

The use of LID design will mitigate the increasingly frequent flooding brought on by rising yearly precipitation (GIC).

INTRODUCTION

*Preserving and maintaining trees in the right-of-way adds beauty to streets and helps fight the urban heat island effect (*Boston Complete Streets*).*

Bumpouts in sidewalks can be used to catch stormwater and to provide enough rooting space for trees as well as slowing traffic and creating safer crossing for pedestrians (NACTO).

What Is The Self-Assessment?

The self-assessment allows an in-depth review of the standards, ordinances, and regulations that shape development in your community, which directly influences the health and quality of land and water resources. The assessment attempts to guide you through a systematic comparison of your local development rules against current model development principles. The questions identify specific methods to reduce runoff from new construction and redevelopment and include topics ranging from open space and land disturbance to impervious surfaces and soil erosion control.

This assessment has been significantly updated from the 2011 version, with many new questions taken from guidance provided by the EPA and the Center for Watershed Protection. *The self-assessment provides a comprehensive set of possible planning and design techniques for your consideration, though we recognize that not all of them will be possible for every municipality.* Detailed instructions for completing the assessment are provided.

How Does The Assessment Benefit My Municipality?

While the assessment fulfills a reporting requirement, its true value lies in helping municipalities not only to evaluate their current planning and design practices but also to move toward improved practices that have multiple community benefits far beyond stormwater management.

Once the assessment is complete, we recommend taking a summary of the findings to the Planning Board, along with suggestions for new ordinances and existing ordinance revisions. The self-assessment checklist includes links to concise educational resources about LID, while the 2011 *RI LID Site Planning and Design Guidance Manual* provides more in-depth information and example ordinance language to assist with this process.

The long-range goal of the assessment is to help your municipality protect and restore the quality of local waters while becoming a greener, more attractive, and more livable community.

INSTRUCTIONS

The self-assessment will require a significant amount of time, but we are confident that the end result will be worth the investment. We strongly recommend a team approach, involving others experienced in various aspects of land development.

Preparing for the Assessment

The preparatory tasks are critical!

1. **Identify all the development rules that apply in your community.** Gather the key documents. Primary sources listed in the assessment are shown in **Table 1** on page *v*.

   Other sources typically include separate stormwater management and drainage ordinances, but many others should be considered. Please see **Table 2** on page *v*.

   Keep in mind that the information you might need for a particular question will not always be found in codes or regulations, but might be embedded in supporting application checklists, design manuals and guidance documents, or construction specifications. In addition, standard operating procedures and municipal policies for the review and approval of development applications or drainage alterations should be considered.

2. **Identify the local authorities who administer or enforce those rules.** Once you've considered who would be best to assist with the assessment, please ask them for a formal commitment and agree upon a time to work together. **Table 3** on page *vi-vii* provides an example framework for identifying the staff or local officials who influence development in your community.

3. **Gather your team.** Ideally, the assessment should be completed by your municipality's planner, with significant input from staff in other departments, such as the Department of Public Works, Engineering, and Building. Involving people with different responsibilities and perspectives will enhance the opportunity it provides for your municipality to truly consider new planning and design techniques.

SUGGESTED STEPS:

1. *Identify all the development rules in your community.*
2. *Identify the local authorities who administer the rules.*
3. *Work through the assessment with a team of staff.*
4. *Share results and finalize recommended actions with other staff and boards.*
5. *Submit the completed assessment to RIDEM with the MS4 Annual Report.*

Completing the Assessment

The assessment consists of 65 questions, each representing RIDEM minimum standards or model development practices. The questions are grouped together by the three major LID goals (avoid, reduce, and manage impacts).

This interactive PDF document is meant to be used with Adobe Reader or Adobe Acrobat Pro. It includes a self-assessment followed by a primer of topics that summarize, illustrate, and provide additional resources about the Low Impact Development design techniques and principles addressed throughout the self-assessment.

INSTRUCTIONS

Getting Started

» When beginning to work, save a new version of the file with a descriptive name. Save your work periodically.

» Select the **hand tool**, which allows you to drag pages up and down. The hand will change into a pointing hand when hovered over interactive areas and a text cursor when hovered over text fields.

Using the Primer

» Some items on the checklist are accompanied by interactive areas. Click on the **topic name** to jump to the corresponding topic page within the primer where you will find a description of the technique or principle and related images.

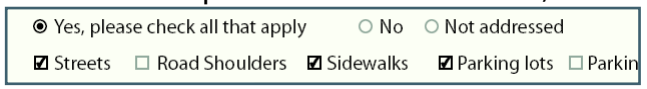
» Some topics contain direct hyperlinks to references or resources. Clicking on the hyperlinks will automatically open a web browser if the computer is connected to the internet.

» When ready to return to the related Self-Assessment question or objective, simply choose the correct item from the line of the text at the bottom of the educational statement. Hover over the item until the hand tool turns into the **pointing hand** and click. The target item will appear *as close to the top of the page as possible* without landing on a page break.

Selecting and Entering Answers

» Choose from "Yes/No" or other answer options as well as "Action: Leave as is/To be revised".

» Note that **Radio Button Fields** only allow one choice per button field. **Check Boxes** allow for multiple selections to be made, if multiple selections are applicable.



» Some answer sections have **text fields** where information can be entered. Be aware of the unit of measurement (feet, cubic yards, etc.) following the text field.

Ordinance Sections

» Select or enter the type of ordinance(s) (see **Table 1** on the next page). Beside "Section name & number" enter the section name and/or page numbers within the source document. After entering text, you can press Tab to go to the next field.

» Note that you may not be able to fit the entire title of the documents referenced in the text boxes; text that extends beyond the original text field will appear cropped when printed, with a small bold "+" in the corner of the text field. This text will be preserved and viewable if shared in digital PDF format.

» Use the "Notes" section to enter any additional information relating to the answers given or, if the completed Self-Assessment will be shared via hardcopy, as extra room for "Other" ordinance type or the "Section name & number" text.

TIP If more space is needed for notes, keep a corresponding document of expanded comments with the completed LID self-assessment.

INSTRUCTIONS

If You Are Having Trouble Saving...

If you are working in **Adobe Reader**, the "Save" command may open the "Save As" dialog box. Simply overwrite the file that you are working on with the same name to keep all changes you made since last saving.

If you are working in **Adobe Acrobat Pro**, the "Save" command may trigger an error message due to user settings. You may be prompted to save the file with a new name to keep all changes.

TABLES

Table 1. Key Documents & Their Abbreviations

Ordinance	***Abbreviation***
Zoning	ZO
Land Development and Subdivision Regulations	LDSR
Soil Erosion and Sediment Control Ordinance	SESC
Post-Construction Stormwater Management Ordinance	SW
Other source document used	Other

Table 2. Secondary Sources of Development Rules

These are locally applied or locally adopted standards:
Building and fire regulations / standards
Street standards or road design manual
Emergency response master plans
Flood damage prevention or mitigation regulations
Wetland, flood plain, or coastal zone regulations
Tree protection or landscape ordinances
Wastewater management ordinances
Environmental / water supply protection regulations

Table 3. Municipal Authorities Responsible for Land Development

Does your community have a Technical Review Committee? If so, this would be an excellent group to involve.

Municipal Responsibilities:	**Name:**	**Title:**	**Board/Dept.:**	**Contact:**
Sets municipal standards for road design and maintenance				
Reviews Development Plan applications				
Revises Land Development and Subdivision Regulations (LDSR)				
Reviews / approves subdivision and land development applications				
Revises Zoning Ordinances				
Reviews building permits for SESC and stormwater management				
Establishes / reviews stormwater management or drainage criteria				
Provides fire protection and code enforcement				

Table 3. (cont...) Municipal Authorities Responsible for Land Development				
Does your community have a Technical Review Committee? If so, this would be an excellent group to involve.				
Municipal Responsibilities:	**Name:**	**Title:**	**Board/Dept.:**	**Contact:**
Reviews applications related to wetlands, OWTSs, floodplains, or coastal zone				
Reviews applications related to protection of drinking water sources (WHPAs and watersheds)				
Reviews / approves forest / landscaping / tree protection plans				
Reviews / approves SESC and stormwater management plans				
Conducts field inspections for SESC and stormwater management				
Reviews / approves utility plans				

GOAL #1: *Avoid the impacts of development to natural features and pre-development hydrology.*

TIP If more space is needed for notes, pages 24 through 34 are reserved for further comments.

MORE INFO...

PROTECT UNDISTURBED OPEN SPACE

TOPIC A

***Objective I**: Protect as much undisturbed open space as possible to maintain predevelopment hydrology and allow precipitation to naturally infiltrate into the ground.*

1. Has Conservation Development, or other types of compact development that require the preservation of natural resources, been adopted to protect open space and predevelopment hydrology?

TOPIC A

○ Yes, it is required unless proven infeasible ○ Yes, it is allowed ○ No ○ N/A to highly urban *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

2. Is it required to mark limits of disturbance on all construction plans with details?

TOPIC B

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

3. Is it required to have limits of disturbance installed prior to site work?

TOPIC B

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

4. Are there limits on lawn area for residential lots in order to protect undisturbed open space?

TOPIC C

○ Yes ○ No ○ N/A to highly urban *Action:* ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

5. Are undisturbed vegetated areas required on individual lots?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

PROTECT NATURAL DRAINAGE AND BUFFERS

***Objective II**: Maximize the protection of natural drainage areas, streams, surface waters, wetlands, and jurisdictional wetland buffers.*

6. Do regulations require or encourage new lots to exclude freshwater and/or coastal wetland jurisdictional areas?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

7. Do regulations direct building envelopes away from any of the following?

TOPIC D

☐ steep slopes *Action:* ○ Leave as is ○ To be revised

☐ riparian corridors *Action:* ○ Leave as is ○ To be revised

☐ hydric soils *Action:* ○ Leave as is ○ To be revised

☐ floodplains *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

MORE INFO...

8. Has a community buffer program been created to establish and restore a naturally vegetated buffer system along all surface waters and wetlands? TOPIC E

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

9. Are zoning setback distances flexible in residential districts to avoid requiring house lot locations to be unnecessarily close to surface waters, wetlands, and riparian corridors?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

MINIMIZE LAND DISTURBANCE

***Objective III**: Minimize land disturbance, including clearing and grading, and avoid areas susceptible to erosion and sediment loss.*

10. Has your community adopted an erosion and sedimentation control ordinance that references and/or includes provisions from the *RI SESC Handbook*? TOPIC F

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

A. Has the municipality included the *RI SESC Handbook Appendix P* Soil Erosion and Sediment Control Plan Review Checklist in their application requirements? TOPIC G

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

B. Are SESC controls required for projects disturbing less than one acre, and if so, what is the area threshold or applicable resource area? TOPIC H

○ Yes, local threshold/criteria: _____ ○ No

Action: ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

11. Has your community adopted grading limitations, requiring applicants to limit clearing, grading, and land-disturbing activities to the absolute minimum needed?

TOPIC I

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

A. Are numeric standards used to limit cuts and fills, such as 2 feet in critical areas and 4 feet elsewhere?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Please specifiy dimensions regulated: Vertical ft: _____ Horizontal ft: _____ Cubic yards disturbed: _____

B. Are restrictions or incentives in place to avoid disturbance of slopes 15% or greater?

○ Yes ○ No ○ Other _____ % or greater *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

12. Has your community adopted a forest-cover, tree-protection, or tree-canopy ordinance, or other tree-preservation standards?

TOPIC J

TOPIC M

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

MINIMIZE SOIL COMPACTION AND RESTORE SOILS

***Objective IV**: Minimize soil compaction and restore soils compacted as a result of construction activities or prior development.*

13. Have you adopted provisions within land development regulations that prohibit the compaction of soils in areas needed for stormwater recharge and OWTS infiltration? TOPIC B

Stormwater recharge: ○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

OWTS infiltration: ○ Yes ○ No ○ N/A *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

14. Have you adopted requirements for construction site inspections to ensure that soils are not compacted and limits of disturbance are adhered to? TOPIC B

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

15. Where construction disturbance is unavoidable, are standards and procedures in place to ensure that soils are decompacted and restored with adequate depth and quality of topsoil before planting and seeding? TOPIC K

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

DON'T FORGET TO SAVE YOUR WORK!

GOAL #2: *Reduce the impacts of land alteration to decrease stormwater volume, increase groundwater recharge, and minimize pollutant loadings from a site.*

MORE INFO...

LANDSCAPE WITH LOW-MAINTENANCE, NATIVE VEGETATION

TOPIC L

***Objective V**: Provide low-maintenance, native vegetation that encourages stormwater infiltration and minimizes the use of lawns, fertilizers, and pesticides.*

16. Have LID landscaping standards been adopted that require the preservation of as much natural vegetation as possible and encourage low-maintenance native landscaping?

TOPIC L

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

17. Have regulations been adopted to require re-vegetation or reforestation of previously cleared areas with native species?

TOPIC M

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

18. If trees are required in areas with limited space, such as streets, parking lots, and along buildings, are the planting area and minimum soil volume specified to provide sufficient rooting space to support large trees and maintain tree health and longevity?

TOPIC N

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

MORE INFO...

19. Are trees required to be grouped together to allow shared root space and better health rather than individual plantings or use of tree boxes that restrict root growth?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

MINIMIZE IMPERVIOUS SURFACES

***Objective VI**: Minimize impervious surfaces through community limitations; street width, right-of-way, cul-de-sacs, turnarounds, sidewalks, driveways; parking ratios, stall and aisle dimensions; frontage and front yard setbacks; and landscape requirements.*

20. Have you adopted maximum lot percent impervious cover limits in addition to maximum lot building coverage?

TOPIC O

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

21. Do your regulations allow pervious pavers, permeable pavement, or other pervious surface techniques for any of the following?

TOPIC P

○ Yes, please check all that apply ○ No ○ Not addressed

☐ Streets ☐ Road Shoulders ☐ Sidewalks ☐ Parking lots ☐ Parking lot overflow

☐ Driveways ☐ Other: *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

STREET WIDTH

22. Is the stated goal of your roadway standards to minimize impervious surfaces to the extent possible while accommodating traffic volumes and other uses appropriate for the density and type of development?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

A. What is the minimum pavement width allowed for streets in low density residential developments that have less than 400 average daily trips (ADT)?

Minimum: _____ ft *Action:* ◯ Leave as is ◯ To be revised

(eg. 18-20 ft)

B. What is the minimum pavement width allowed for streets in higher density areas such as medium-to-high density suburban developments?

TOPIC Q

Minimum: _____ ft *Action:* ◯ Leave as is ◯ To be revised

(eg. 20-24 ft)

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

RIGHT-OF-WAY

23. Have you adopted street right-of-way widths to be the minimum width necessary to accommodate the pavement, any utilities, stormwater management, sidewalk(s), snow storage, intersection sight-lines, or street trees, as may be required?

TOPIC R

◯ Yes, minimum: _____ ft ◯ No *Action:* ◯ Leave as is ◯ To be revised

(eg. 35-40 ft)

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

MORE INFO...

24. Are curb extensions or bumpouts that narrow the roadway for bioretention areas permissible in urban or high density areas?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

25. Can utilities be placed below the paved section of the right-of-way to limit clearing and allow compact development?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

DEAD-ENDS AND TURNAROUNDS

26. Has your community modified the dimension, design, and/or surface material of cul-de-sacs to reduce total impervious cover?

TOPIC S

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

A. Is the standard radius for cul-de-sacs 30 feet with no island and 40 feet with required landscaped island?

○ Yes to both ○ No, standard radius of local cul-de-sac is _____ ft with no island and _____ ft with required landscaped island.

Action: ○ Leave as is ○ To be revised

B. Can a landscaped island or native vegetation be within the cul-de-sac?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

C. Are alternative turnarounds (such as hammerheads or one-way loop roads) allowed?

○ Yes ○ Yes, with standards specified ○ No ○ Not addressed ○ N/A to highly urban *Action:* ○ Leave as is ○ To be revised

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

SIDEWALKS

27. Have sidewalk design standards been adopted that limit impervious cover?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

A. Is the maximum sidewalk width four (4) feet in residential areas?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

B. Do your regulations allow for either no sidewalks, or sidewalks only on one side of the street, in low-density neighborhoods?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

C. Are sidewalks required to be gently sloped so that they drain into the front yard rather than the street?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

D. Can alternative pedestrian access such as trails or unpaved footpaths be used instead of sidewalks? TOPIC T

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

28. Are alternative sidewalk designs that provide sufficient soil rooting volume for street trees (e.g., pop-outs or bulb-outs, curving sidewalks, tree islands) allowed? TOPIC T

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

DRIVEWAYS

29. Are driveway widths required to be reduced to the maximum extent possible?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

A. Do you require driveways to be a maximum of nine feet for one lane and 18 feet for two lanes?

○ Yes to both ○ Not addressed ○ No (enter specifications into text field below)

☐ No to max. of 9 feet for one lane, dimensions specified are: _____ ft ○ minimum ○ maximum

☐ No to max. of 18 feet for two lanes, dimensions specified are: _____ ft ○ minimum ○ maximum

Action: ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

30. Are maximum front yard setback distances set as appropriate to minimize driveway length?

TOPIC U

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

31. Do you allow shared driveways to be used in residential developments?

TOPIC V

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

PARKING RATIOS

32. Do your parking ratio requirements aim to reduce excess impervious cover by considering local factors and business-specific needs? TOPIC W

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

A. Have maximum parking ratios been adopted to provide adequate parking while reducing excess impervious cover?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

B. Have your minimum parking requirements been reduced to facilitate LID?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

33. Are parking ratios reduced, or parking credits or relief provided, if the site is served by mass transit, on-street parking, off-site parking, or has good pedestrian access?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

34. Is shared parking encouraged and implemented wherever feasible in order to reduce total impervious cover?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

35. Is shared parking required in mixed-use developments?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

36. Can the number of parking spaces be reduced and additional parking be reserved as native vegetation or green space until need is proven?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

37. Are there any incentives or requirements to providing parking within garages rather than surface parking lots?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

MORE INFO...

PARKING STALLS AND AISLES

38. Are the standard stall dimensions for a parking space 9 x 18 feet or less?

○ Yes ○ No

Dimensions for standard parking space: _____ ft x _____ ft *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

39. Do you have requirements for compact cars, such as:

reduced stall dimensions of 8 x 16 feet for compact cars?

○ Yes ○ No

Reduced stall dimensions for compact cars are: _____ ft x _____ ft *Action:* ○ Leave as is ○ To be revised

30% or more of the parking lot reserved for compact cars?

○ Yes ○ No

Other amount: _____ *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

40. Are there minimum or maximum driving aisle widths for standard two-way traffic?

○ Yes, **minimum:** _____ **maximum:** _____ ○ No *Action:* ○ Leave as is ○ To be revised

(eg. 22 feet) (eg. 24 feet)

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

41. Do your regulations allow the use of angled parking and one-way aisles?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

PARKING LOT LANDSCAPING

42. Do parking lot landscaping requirements allow or require a portion of the landscaped areas to be designed to accept runoff from the parking lot, or otherwise serve a dual purpose as landscaping and stormwater management?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

A. For parking lots of 10 or more spaces, is at least 10% of the parking lot area required to integrate landscaping internal to the parking lot to 'break up' the pavement, disconnect impervious surfaces, and accept parking lot runoff?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

43. Is the minimum landscaping surface area requirement at least 20% of the total parking area?

○ Yes ○ No, minimum surface area requirement is _____ % ○ Not addressed *Action:* ○ Leave as is ○ To be revised

A. Is 25-30% tree canopy coverage over parking lots required?

TOPIC X

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

GOAL #3: *Manage impacts at the source.*

TIP If more space is needed for notes, pages 24 through 34 are reserved for further comments.

MORE INFO...

INFILTRATE TO VEGETATED SYSTEMS

Objective VII: *Infiltrate precipitation as close as possible to the point it reaches the ground using vegetated conveyance and treatment systems.*

44. Have you amended regulations to require development projects to comply with the *Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)* and the *Rhode Island Stormwater Design and Installation Standards Manual*? TOPIC RR

- ○ Yes, for projects disturbing less than 1 acre (fill in local threshold/criteria): _____
- ○ Yes, for projects disturbing 1 acre of more
- ○ No

Action: ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

45. Have standards been adopted for runoff treatment, infiltration, or volume reduction that are more protective than the *Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)*? TOPIC RR

- ○ Yes – Please specify applicability to any of the following:
  - ☐ Drinking water/groundwater protection
  - ☐ Cold water streams
  - ☐ Impaired waters
  - ☐ Substandard lots/drainage/water quality issues
  - ☐ Avoid increased runoff to adjacent properties
  - ☐ Avoid stormwater discharge to CSO
  - ☐ Other: _____
- ○ No

Action: ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

46. Have standards been adopted for redevelopment that are either more protective or have lower thresholds for applicability than the *Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)*? TOPIC AA

○ Yes (fill in local threshold/criteria): _____ *Action:* ○ Leave as is ○ To be revised

○ No

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

47. Are open section vegetated channels required where density, topography, soils, and slope permit? TOPIC Y

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

48. Have you amended regulations to require that development of single residential lots apply the LID techniques in the *RI Stormwater Management Guidance for Individual Single Family Residential Lot Development*? TOPIC RR

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

49. Does the municipality have a policy or capital improvement plan to incorporate LID in municipal projects?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

A. If yes, does this address retrofitting municipal roads, parking lots, and other property using LID when repaving or reconstruction is planned, even if not required by DEM? TOPIC Z

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

50. Have standards been adopted to encourage or require retrofitting of privately owned parking lots to incorporate LID practices when repaving or other modification is planned?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

DISCONNECT FLOW

Objective VIII: *Break up or disconnect the flow of runoff over impervious surfaces.*

51. Have you amended regulations to encourage or require runoff from rooftops and other surfaces to be diverted, where appropriate, to pervious surfaces, rain gardens, above ground planters, vegetated swales, and/or storage tanks, in order to foster: infiltration, runoff reduction, and pollutant removal?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

52. Do local plumbing codes allow harvested rainwater for exterior uses such as irrigation and non-potable interior uses such as toilet flushing?

○ Yes ○ No ○ Not addressed *Action:* ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

POLLUTION PREVENTION

TOPIC RR

Objective IX: *Provide source controls to prevent or minimize pollutants in stormwater.*

53. Do your regulations require the applicant to plan for and incorporate pollution prevention measures during project application review and approval that are appropriate to the type of activities that the development will generate?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

PROJECT REVIEW, INSTALLATION AND MAINTENANCE

Objective X: *Ensure LID is addressed in application review and that practices are properly installed and maintained.*

54. Do ordinances and regulations provide for consideration of LID concepts at all stages of review, including pre-application?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

55. Do your regulations and application submittal checklist require that the conceptual stormwater design and the conceptual landscaping be designed together or shown on the same plan so that the final stormwater design and landscaping design is integrated?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

56. Is offsite mitigation allowed or required for reforestation or siting of other LID practice where on-site improvements are not possible?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

57. Do your regulations require the applicant to meet with the municipal staff or planning board for applicable projects to review and ensure local Low Impact Development and zoning requirements are met prior to submitting an application for a State permit?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

58. Are applicants encouraged to meet with DEM and municipal staff for guidance on project design to fully implement LID at all stages of review and meet all *RI Stormwater Manual* standards?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

59. Are the project designer and landscape architect required to coordinate with the site owner and/or municipal maintenance staff in the early design to ensure ease of maintenance based on available staff and equipment?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

60. Do your regulations require inspections by "qualified personnel" to ensure proper installation and maintenance of all SESC measures and post-construction stormwater BMPs?

◯ Yes for SESC ◯ No for SESC *Action:* ◯ Leave as is ◯ To be revised

◯ Yes for BMPs ◯ No for BMPS *Action:* ◯ Leave as is ◯ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes: _____

61. Are pre-construction meetings required with owners and contractors to ensure all SESC measures and post-construction practices will be properly installed and maintained?

◯ Yes ◯ No *Action:* ◯ Leave as is ◯ To be revised

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

62. Is proof of training in proper installation and maintenance of SESC measures and post-construction stormwater practices required for contractors and field staff before construction begins?

○ Yes for SESC ○ No for SESC *Action:* ○ Leave as is ○ To be revised

○ Yes for BMPs ○ No for BMPS *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

63. Are performance bonds and periodic inspections required to ensure proper installation of stormwater practices based on the approved plans?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

64. Are as-built plans and designers' certifications required to ensure that structures were properly installed and will function as intended?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* _____ *Section name & number:* _____

Notes:

DON'T FORGET TO SAVE YOUR WORK!

MORE INFO...

65. Do your regulations require the following legal documents to be submitted for review and recording in the Land Evidence Records?

Water quality BMP, runoff reduction practice, and QPA (qualifying pervious area) easements

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Stormwater Ownership and Maintenance Agreements

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Conservation or No Cut easement for undisturbed natural areas

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Deed Restriction for limited lawn area

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

Ordinance: ☐ *ZO* ☐ *LDSR* ☐ *SESC* ☐ *SW* ☐ *Other:* *Section name & number:*

Notes:

66. Does your comprehensive plan include LID goals and objectives?

○ Yes ○ No *Action:* ○ Leave as is ○ To be revised

DON'T FORGET TO SAVE YOUR WORK!

CONSERVATION DEVELOPMENT — TOPIC A

Conservation Development is a creative site design technique that provides the flexibility for a community to guide siting of new roads and structures to the most appropriate areas within a parcel of land. The goal is to avoid impacts to natural resources, reduce runoff, retain the character-defining features of the property, and preserve at least 50% of the development site as protected open space. The number of lots allowed is the same as a conventional subdivision, but the individual lots are smaller in exchange for the common open space. In contrast, conventional developments must follow rigid lot size, building setback requirements, and frontage requirements, resulting in extensive site disturbance, longer roads, and loss of the special features of the property.

Cluster Development is similar but does not provide the same degree of design flexibility and attention to site analysis.

LEFT: Compared to the conventional development in yellow, the conservation development in white has about half the road pavement as the narrow lot frontages reduce road length (RIDEM Environmental Resource Map & South Kingstown Web GIS). It also retains mature trees on lots and in the cul-de-sac, and preserves more than 10 acres of forest as open space. CENTER & RIGHT: This conservation development in North Kingstown retains mature trees and the view of the meadow and stone walls from the road as protected open space.

Conservation Development overview from RIDEM – http://www.dem.ri.gov/programs/water/sustainablewatersheds/planning/condev.php

*Return to **Objective I**, **question 1**.*

LIMITS OF DISTURBANCE — TOPIC B

The limit of disturbance (LOD) is a physical barrier that delineates the boundary of the areas to be protected during development, either at the perimeter of the construction site, or within the construction site, such as groups of trees or individual trees. The *RI SESC Handbook* uses the term "Limit of Work and Site Access Control" and emphasizes that the area delineated by the boundary shall not be touched.

At a minimum wetlands, associated buffers, and areas designated for stormwater infiltration and onsite wastewater treatment drainfields must be protected from disturbance. Erodible soils, forest, specimen trees and other notable resources should be protected to the extent possible.

Prior to any clearing or site work, the LOD must be installed and maintained throughout construction. On the SESC plan, the LOD must be clearly shown and type of control measure specified, such as orange construction fence and signs. More substantial barriers, such as chain link fence, are needed for work near wetlands, other sensitive resources, and sites with tight space restrictions.



LEFT: Split rail fence establishes LOD while a straw wattle and silt fencing prevent sediment from clogging a permanent stormwater treatment BMP.
CENTER: The type of barriers used is based on the size of the site and proximity to valuable natural resources. In a large, open area plastic fencing is acceptable.
RIGHT: Chainlink fence offers the best protection for a site on the URI campus with very tight setbacks and lots of preserved trees.

RI SESC Handbook *See "Limit of Work and Site Access Control"* – http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/soil-erosion.php

Return to ***question 2***, ***question 3***, ***question 13***, ***question 14***.

LIMITS ON LAWN AREA — TOPIC C

Too often entire lots are cleared of native trees and shrubs and replaced by extensive high-maintenance lawns. Limiting lawn area allows for smaller building envelopes and larger areas of natural vegetation that can intercept and infiltrate stormwater much more effectively than mowed lawns. Smaller lawns have many other LID benefits:

- » maximize protection of wetland buffers;
- » reduce fertilizers and pesticides washing off as runoff or seeping into groundwater supplies;
- » direct stormwater to naturalized areas as "Qualified Pervious Areas" for treatment instead of constructed BMPS;
- » conserve water and minimize summer water shortages*;
- » reduce development costs by avoiding the need restore areas compacted by construction activities before seeding, as specified in the *RI SESC Handbook* and Topic K.

Recommendations: the RI LID Guidance Manual recommends limiting lawn to the lesser of 20% of the overall lot size or 5,000 square feet.

* The Town of North Kingstown has found that in neighborhoods with large lawns, summer water use triples due to lawn watering, leading to seasonal water bans that affect all residents.

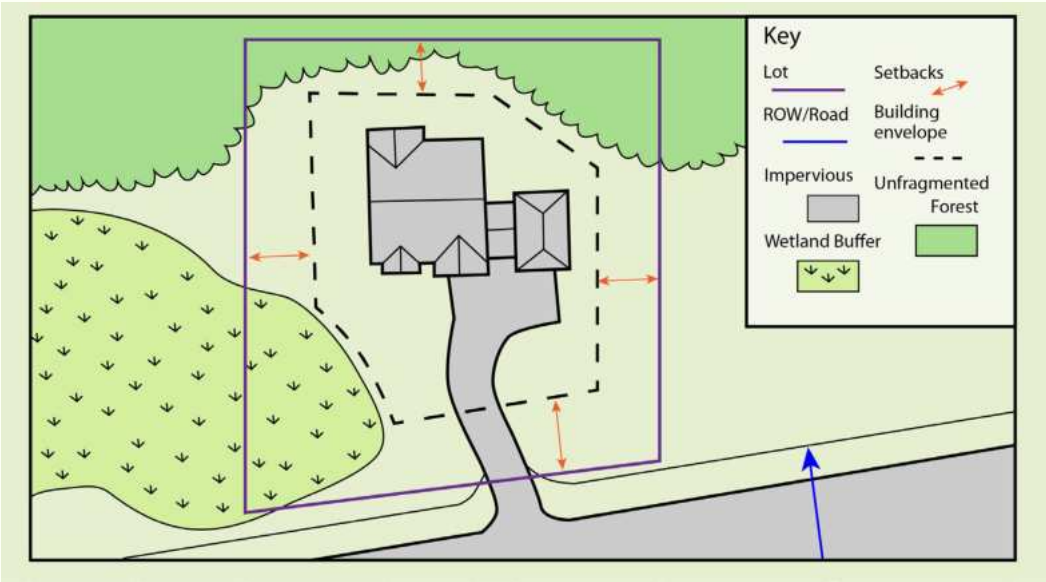
LEFT: CRMC consider a 25 feet setback to be sufficient for building construction and maintenance, and RIDEM Wetland BMP Manual *notes that as little as 10 -15 feet can be an adequat distance from a structure to a wetland buffer. CENTER: Low-maintenance gardens with native plants will better infiltrate and treat stormwater. RIGHT: Compare the lawn area of nine 1/2 acre lots of the conservation development in white with that of the nine 1 acre lots in the conventional development in yellow (RIDEM Environmental Resource Map & South Kingstown Web GIS).*

RI LID Planning and Design Guidance Manual *See Chapter 4 and Chapter 8* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

Return to ***question 4****.*

BUILDING ENVELOPES TOPIC D

Building envelopes are the area on a lot within which a structure may be built. This area primarily is defined by front, side, and rear building setbacks. LID encourages the use of small building envelopes because they minimize site disturbance and the likelihood of soil erosion, preserve forest and open space, and keep lawns small. LID building envelopes often exclude the following: wetland buffers, hydric soils and drainage ways, steep slopes, unfragmented forest, specimen trees or clusters of trees, and other unique site features.



LEFT: LID building envelopes (represented by a dotted line) are modified by unique site features like wetland buffers and unfragmented forest.
RIGHT: An example of a small building envelope on a residential lot.

*Return to **question 7**.*

COMMUNITY BUFFER PROGRAM — TOPIC E

"The preservation and restoration of natural wetland buffers is considered to be the single most important management practice to protect water resources" (*RI LID Planning and Design Guidance Manual*). At least 19 RI municipalities have wetland buffer ordinances to protect drinking water, control flooding and manage stormwater. Local buffers help avoid the need for State wetland permits and reduce impacts when buffer alteration is unavoidable on substandard lots. Local review is critical as municipalities can reduce impacts through LID design standards. It is much more difficult for DEM to require site design changes after municipal approval. Local review should extend to single family house lots as this is by far the most common project type that the DEM Wetland program reviews.

Site Design to protect wetlands:

- Allow flexibility in building setbacks to avoid wetlands.
- Require use of retaining walls or terracing to keep clearing and filling to a minimum.
- Set impervious cover limits based on lot size to ensure that the house footprint is reasonable for the size of the upland portion of the lot.
- Require revegetation of the wetland buffer (or restoration in urban areas) following construction.
- Establish tight limits of disturbance using robust fencing and conduct regular inspections to ensure these and other SESC measures are properly maintained.

BEFORE: This area in Roger Williams Park experienced erosion and nuisance geese feeding (B. Kuchar, HW). AFTER: The same spot has been revegetated with a wide variety of native species which discourage geese and filter the runoff from the road and sidewalk. RIGHT: A snowy owl rests on a sign at the edge of the buffer area at Field's Point in Providence. Permanent signage raises public and landowner awareness of buffer areas (J. Willis, RI CRMC).

RI LID Planning and Design Guidance Manual *See Chapter 3* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf
RI Wetland BMP Manual *See Chapter 2, Single family lots* – http://www.dem.ri.gov/programs/water/permits/wetbmp.php

*Return to **question 8**.*

SESC CONTROL ORDINANCE — TOPIC F

Most communities in Rhode Island have recognized the destructive consequences of erosion and sedimentation from construction sites as well as the municipal cleanup and repair costs. While most Rhode Island municipalities have some type of erosion and sediment controls, often times the focus is on erosion issues after they occur. A more effective approach is to prevent excessive clearing and grading from the beginning of a development project during the site design process, and to ensure SESC measures are properly installed and maintained throughout construction municipalities can hire third-party inspectors to assist with site visits and compliance oversight.

LEFT: Sediment from this construction site has washed across the road, into the stormdrain, and then directly into the bay. CENTER: Simply covering bare soil with a thick layer of straw mulch can dramatically reduce erosion (Tetra Tech). RIGHT: This storm drain cover is stopping sediment before it can enter the catch basin (US EPA).

RI LID Planning and Design Guidance Manual *See Chapter 4 & Chapter 9* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

*Return to **question 10**.*

SESC HANDBOOK APPENDIX P — TOPIC G

The Soil Erosion and Sediment Control Plan Review Checklist provides a consistent format for municipal reviewers to determine that the proposed SESC plan is complete. It also requires the applicant to document how the proposed erosion and sediment control measure will meet the 15 Performance Criteria specified in the SESC Handbook and required by the RIDEM Stormwater Management, Design and Installation Rules.

LEFT: Dumpster properly covered with ends weighted down. CENTER: Sediment control blankets can be installed on slopes to prevent erosion before turf is established. RIGHT: Filter socks should be installed between construction and natural resources as shown with the wetland area above (RIDEM).

RI SESC Handbook *See Appendix P* – http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/soil-erosion.php

*Return to **question 10A**.*

AREA THRESHOLD OR APPLICABLE RESOURCE AREA — TOPIC H

Rhode Island municipalities must control construction site stormwater runoff for projects disturbing one acre or more. However, depending on site constraints and sensitivity of nearby water resources, far smaller areas of disturbance can have a significant impact. The Model Erosion and Sediment Control Ordinance found in Appendix B of the *RI SESC Handbook* identifies conditions where SESC controls for projects disturbing less than one acre may be necessary:

- Construction within 100 ft of a wetland or coastal feature
- Disturbance of slopes ten percent (10%) or greater
- Total area graded exceeds 2,000 square feet (The LID guide recommends 1,000 square feet.)
- Change in elevation (cuts and fills) > 2 ft at any point
- Displacement of soil within the site ≥ 50 cubic yards
- Total fill from offsite sources > 18 cubic yards

In addition, construction operators disturbing less than 1 acre must implement an SESC plan to comply with the RI Stormwater Rules. RIDEM has developed the RI Model SESC Plan Small Sites Template for residential lots with a simplified menu of control measures and user-friendly format to meet minimum standards. Muncipalities can encourage contractors to use this template.

LEFT: Cleared lot smaller than 1 acre with no SESC controls resulted in silty sediment washing into the stormdrain and directly into Bay eelgrass beds over many months. RIGHT: This template satisfies the RI Stormwater Design and Installation Standards Manual - *Minimum Standard 10: Construction Activity Soil Erosion, Runoff, Sedimentation, and Pollution Prevention Control Measure Requirements (RI Model SESC Plan Small Sites Brochure).*

RI SESC Handbook *See Appendix B* – http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/soil-erosion.php
RI Model SESC Plan for Small Sites Template & Brochure – http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/soil-erosion.php

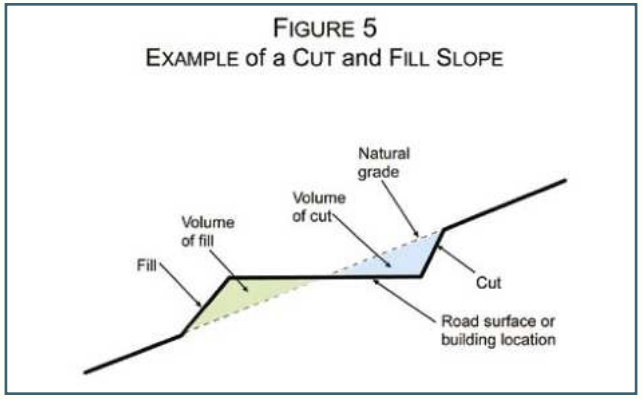
*Return to **question 10B**.*

GRADING LIMITATIONS TOPIC I

Clearing vegetation and grading a site is highly destructive, as soils are exposed to erosion, the site is compacted by heavy equipment, and natural hydrology is completely altered. Wholesale clearing and grading a site is often unnecessary but has been common practice because of individual preferences to: mobilize equipment and crew only once; market a site for sale as "construction ready"; and eliminate the inconvenience of working near forest edges or other resource protection areas.

LID practices to reduce clearing and grading include:

- » establishing clearing and grading requirements for land disturbance activities even when other permits are not necessary;
- » "site fingerprinting" (or "footprinting") to limit clearing to the minimum required for buildings and roadways;
- » limiting the total portion of the site that can be cleared;
- » using retaining walls and allowing variance or waiver, as applicable to slope criteria to avoid excessive side slopes and promote other innovative design solutions.



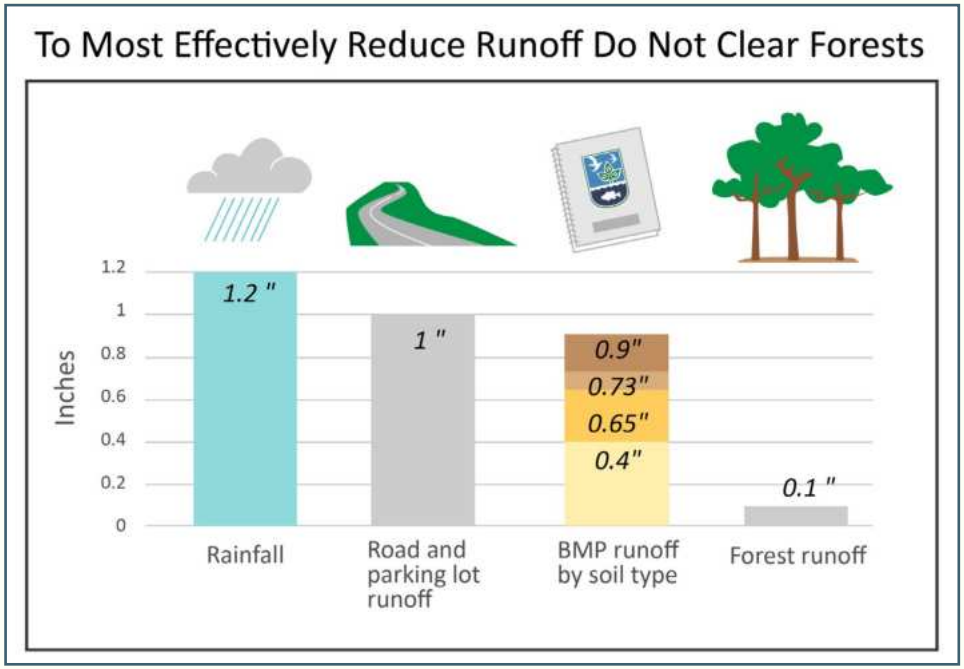
LEFT: Balanced cut and fills should be made in order to minimize extent of grading (Steep Slopes). RIGHT: The road into this development was cut into the slope and native vegetation preserved with the help of stone retaining walls.

RI LID Planning and Design Guidance Manual *See Chapter 4* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

*Return to **question 11**.*

TREE PRESERVATION STANDARDS — TOPIC J

Clearing and grading of forests, trees, and other native vegetation should be limited to the minimum amount needed to build lots and allow access. Every square foot of forest left undisturbed helps maintain pre-development hydrology and eliminates the need to clear and grade for treatment systems and large flood storage basins that are far less effective in reducing runoff. In addition, roof, road, and parking runoff may be directed to forest (as qualified pervious areas or QPAs) instead of constructed BMPs. Other ordinances that can be adapted to protect these areas include limits of disturbance in SESC plans and conservation development.



LEFT: Protecting natural areas and reducing impervious cover are essential to reduce runoff. Stormwater Best Management Practices are not enough – source: CWP and 250-RICR-150-10-8.8. CENTER: Permanent fencing and signage is recommended to protect common open space and wetlands buffers from disturbance even as property changes hands—for specifications, see the RIDEM Wetland BMP Manual. *RIGHT: A mature specimen tree is preserved and protected with robust fence out to dripline (CWP).*

RI LID Planning and Design Guidance Manual *See Chapter 4* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

RIDEM Wetland BMP Manual – http://www.dem.ri.gov/programs/water/permits/wetbmp.php

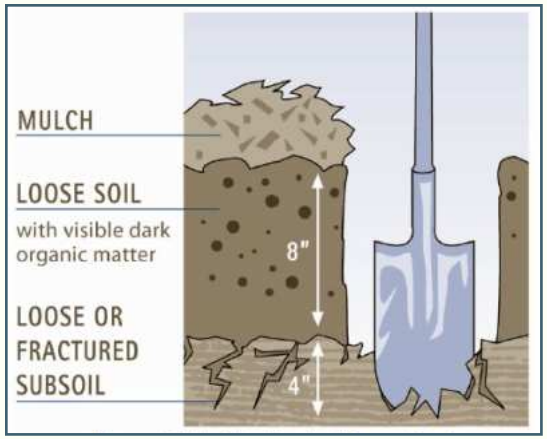
Return to ***question 12****.*

MINIMIZE SOIL COMPACTION AND RESTORE SOILS — TOPIC K

During construction soil will become compacted by heavy equipment, vehicles and stockpiles—often to the point where water and plant roots will not penetrate. If the soil is not de-compacted before spreading topsoil and seeding, the long term result will be poor water infiltration and unhealthy lawns. Landscape care professionals recognize that this frequently drives homeowners to overfertilize and overwater, further contributing to stormwater pollution (Jim Wilkinson, SeaScape, Inc.).

Soil erosion and sediment control plan notes must specify that soil compaction will be minimized and the soil properly prepared for seeding or planting through the following steps:

1. Maintain limits of disturbance and specify how compacted soils will be restored.
2. Preserve topsoil onsite for spreading over lawn and planting areas.
3. Loosen up the subsoil by discing, rototilling to a depth of at least 4 inches.
4. Test the topsoil to meet organic matter content of 5% -10% as specified in the SESC Handbook; amend with compost if needed to meet the standard. The minimum depth of soil to be applied at final grading is 4 inches (8 inches recommended).



LEFT: The silt fencing around this topsoil stockpile maintains the LOD. RIGHT TOP: Appropriately sized equipment can be procurred to decompact soils in a residential area (Building Soil). RIGHT BOTTOM: This cross section shows decompacted subsoil and proper depth of topsoil (SWMMWW).

RI Soil Erosion & Sediment Control Handbook – http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/soil-erosion.php

*Return to **question 15**.*

LOW-MAINTENANCE NATIVE LANDSCAPING TOPIC L

Low-impact landscaping makes use of native plants that protect water quality. Native plants minimize the need for watering, fertilizers, and pesticides because they are already acclimated to our climate, soils, and insects. Native plants can be arranged in formally designed gardens or planted as a more naturalized landscape, such as a no-mow meadow or layered use of shrubs, trees, and perennials for a woodland effect.

Where lawns are necessary, low-maintenance grasses that require less water and fertilizer should be specified. Consider a seed mix or a turf with microclover—which does not need any nitrogen fertilizer. The turf with microclover seen below was developed in Rhode Island for the New York City Parks Department, which operates with strict water and fertilizer limitations.




LEFT: The large bioretention area behind the Center for Biotechnology and Life Sciences at URI incorporates naturalized landscaping for a low-maintenance, natural look. CENTER LEFT: Native landscaping, which is perfectly suited for slopes like this one at URI, can be achieved with wildflower seed mixes that display a changing palette of colors throughout the year. CENTER RIGHT: Turf seed mixes with microclover require no nitrogen fertilizer (Turfgrass Technical Update). RIGHT: The Breast Health Center rain garden at Kent Hospital in Providence is planted with a diverse selection of native grasses, perennials, and shrubs. The rain garden does not require the use of pesticides.

Continue to next page for resources and to see a selection of attractive native plants appropriate for landscaping.

CHOOSE OUR NATIVE SPECIES

TOPIC L cont...

River Birch
Betula nigra (Pinelands)

Inland Seaoats
Chasmanthium latifolium
(Missouri Botanical Garden)

Blue Flag Iris
iris versicolor (Flickr user Mississippi WMO)

Softstem Bullrush
Schoenoplectus tabernaemontani
(LBJ Wildflower Center)

Black Tupelo
Nyssa sylvatica (Pinelands)

Swamp Milkweed
Asclepias incarnata (Flickr user Peganum, Flickr user Tony Spencer)

RI Native Plant Guide – https://web.uri.edu/rinativeplants/
Interactive Coastal Plant Database – http://cels.uri.edu/testsite/coastalPlants/CoastalPlantGuide.htm
RI Stormwater Design and Installation Standards Manual, See Appendix B – http://www.dem.ri.gov/pubs/regs/regs/water/swmanual15.pdf

*Return to **Objective V, question 16**.*

REVEGETATION OR REFORESTATION — TOPIC M

Landscaping plans typically submitted with development projects focus on street trees and landscaping in high-visibility areas. Reforestation and revegetation on a larger scale can have much greater benefits in restoring infiltration and reducing runoff. Native trees and plants should be selected, as they are well-adapted to local growing conditions and therefore low-maintenance, without need for fertilizer, pesticide, and long-term irrigation.

There are ways to incorporate reforestation and revegetation into development practices:

- Reforestation can be used to restore cleared areas following construction, or to provide off-site mitigation where the development site is not suitable.
- Trees can be planted within stormwater BMPs, such as open swales and detention basins. However, stormwater BMPs should not be sited within forests or wetland buffers as these areas already provide stormwater treatment benefits that exceed the constructed practices.
- Minimum vegetation standards can be used for urban redevelopment. For example, the CRMC Metro Bay SAMP requires 15% minimum vegetative cover for projects in the urban coastal greenway, which can be met through use of vegetated LID practices (650-RICR-20-00-5 - Metro Bay Region Special Area Management Plan).

LEFT: When reforesting and revegetating, plant shrubs and trees correctly and take precautions to protect them from pests (CWP). RIGHT: Tools like watering bags can help to keep trees and shrubs watered for the first three years after planting during the growing season as well as unseasonably warm and dry periods.

Open source specifications for planting trees and shrubs via Urban Tree Foundation – http://www.urbantree.org/details_specs.shtml

*Return to **question 12**, **question 17**.*

PLANTING AREA AND MINIMUM SOIL VOLUME — TOPIC N

Sizing calculations for planting areas that are intended to support trees must include an adequate soil volume for the tree. Available soil will greatly impact the size and health of trees. The planting trench should be at least six feet wide, and if planting a row of trees, the soil beds should be connected under paved areas.

Tree box filters offer very limited soil volume resulting in an average tree life span of 5-10 years (*Volume 2 Chapter 2: Structural BMP Specifications for the Massachusetts Stormwater Handbook*).

LEFT: The trunk of this tree will soon exceed the width that the tree box filter will allow. CENTER: Compare the growth of trees that have access to large areas of soil to those with very small planting areas (Casey Trees). RIGHT: These trees at the Christian Science Center in Boston are planted in suspended soil, with pavers placed over the top of large soil beds (Flickr user walkr).

Research shows that about 1000 cubic ft. of soil volume is needed to support a healthy tree that will grow to 16" diameter, with 35 ft canopy, and have it live 40-60 years or more (in comparison to the average lifespan of 10 yrs for most city trees and 5 years for a tree filter). – http://www.deeproot.com/blog/blog-entries/how-much-soil-do-you-need-to-grow-a-big-tree

Open source specifications for planting trees and shrubs via Urban Tree Foundation – http://www.urbantree.org/details_specs.shtml

*Return to **question 18**.*

MAXIMUM LOT IMPERVIOUS COVER LIMITS — TOPIC O

Impervious cover refers to any hard surfaces, such as asphalt, concrete, rooftops and compacted soil that prevent rainwater from soaking into the ground. Instead, it becomes stormwater runoff which pollutes surface waters and leads to flooding. Limiting impervious cover is one of the most effective methods to reinforce LID requirements provided it does not preclude compact mixed use or conservation development. Impervious cover limits are applicable to all zoning districts and all types of developments, but they should be customized based on land use density goals.

East Providence adds 20% to lot building cover, resulting in maximum lot impervious cover of 30% for residential lots 5,000-10,000 sf, and 42-72% impervious cover for all types of commercial and industrial districts.

Westerly simply re-defined building coverage as the Maximum % Impervious Surface, resulting in impervious cover of 22.5% - 60% for residential districts, 55-100% for downtown center areas, and 55-75% for business and industrial districts.

North Smithfield - To prevent impervious cover from exceeding an average of 10% in the Water Supply Protection Overlay District, the town used GIS analysis of existing % impervious cover of developed lots by zoning district then set maximum lot impervious to match. The resulting lot impervious cover ranges from 10% - 25% for residential lots 120,000 sf to 20,000 sf, and 35-40 % for all business and manufacturing districts.

Jamestown's High Groundwater Ordinance helps maintain groundwater recharge for wells and avoid increased runoff to roads and property in a densely developed area of substandard single family lots. Maximum lot impervious cover ranges from 8-15% based on lot size and water table depth.

LEFT: Many RI communities have adopted impervious limits to protect water quality, reduce runoff to stormdrains, avoid excessive paving of front yards for parking (as shown in the image), and provide greenspace for infiltration (urbanconservancy.org). RIGHT: The small footprint (650 sf) of this house on a 5,000 sf lot in the Jamestown High Groundwater District keeps lot impervious cover at 13%.

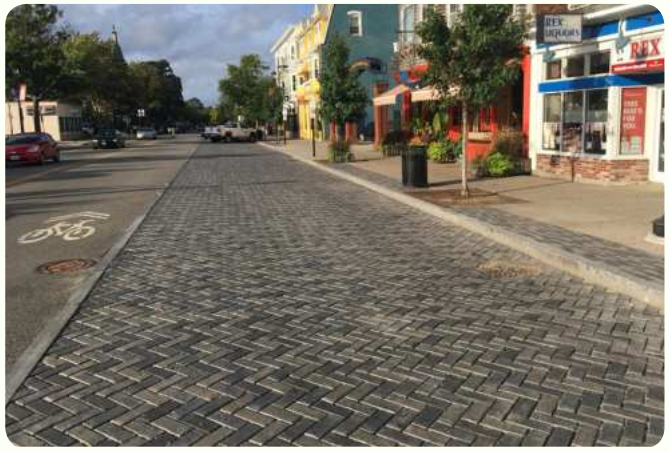
North Smithfield Zoning Ordinance. Section 6.19. Water Supply Protection Overlay District – *https://www.nsmithfieldri.org/town-charter-ordinances*

See Chapter 9 of RI LID Planning and Design Guidance Manual *and RIDEM's* The Need to Reduce Impervious Cover to Prevent Flooding and Protect Water Quality – *http://www.dem.ri.gov/programs/bpoladm/suswshed/pdfs/imperv.pdf*

Return to ***question 20****.*

PERMEABLE PAVEMENT — TOPIC P

A wide range of permeable materials exists as an alternative to conventional, impervious construction materials. When correctly installed and maintained, permeable pavements have proven to be practical, cost-effective, and environmentally sustainable due to their usefulness in reducing stormwater runoff. Where site conditions allow, alternative pervious materials should be considered for driveways. Pervious, or permeable, pavement options include: block pavers, plastic grid pavers, and porous asphalt.



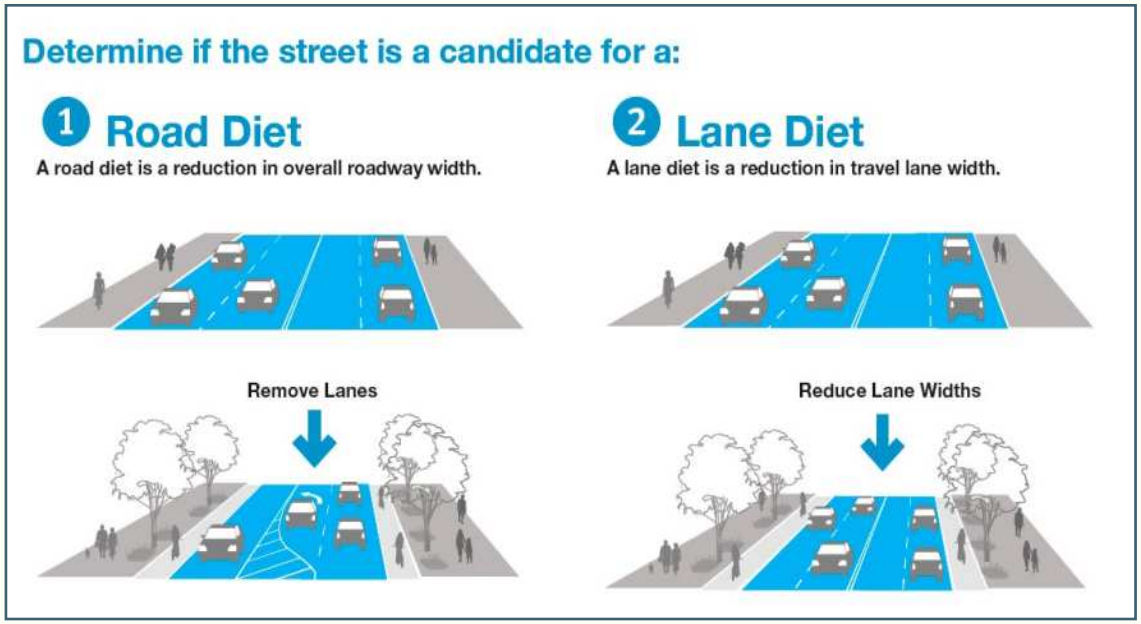
TOP RIGHT: Where site conditions allow, pervious options like this block paver driveway should be considered (Chesapeake Bay Program). LEFT: The pervious block paver onstreet parking lane on Broadway in Newport (S. Wheeler). CENTER: Reinforced turf overflow parking lot (Smart Growth / Smart Energy). RIGHT: Pervious asphalt parking spots on the right and conventional asphalt to the left at Cottages on Greene in East Greenwich (J. Ford).

See the Permeable Pavement Factsheet Series from RI Stormwater Solutions – https://web.uri.edu/riss/stormwater-managers/educational-materials/quick-easy-materials/factsheets/

*Return to **question 21**.*

STREET WIDTH — TOPIC Q

When setting minimums and maximums for street widths it's important to consider a variety of factors, such as traffic volumes and speeds, development density, local on-street parking conditions, emergency vehicle access, and the presence of travel lanes for bicycles or sidewalks for pedestrians. These factors create a complex context in which to consider pavement widths. However, the goal of reducing pavement widths is that it also reduces the amount of impervious cover in a community, and in turn, can reduce stormwater pollution and makes setting maximum pavement widths a worthwhile topic of consideration for every municipality.



LEFT: Space within the right-of-way not used for roadway can be reallocated for other purposes, such as wide soil beds to support street trees, sidewalks that accommodate vegetated stormwater BMPs, bike lanes and on-street parking (Boston Complete Streets). RIGHT: Curbless narrow roads are a good fit in residential or rural areas where traffic volumes are low and there is plenty of room for roadside swales (top image: Smart Growth / Smart Energy; bottom image: HW).

RI LID Planning and Design Guidance Manual *See Chapter 5* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

See also Complete Streets are Green Streets *by NACTO* – https://nacto.org/publication/urban-street-stormwater-guide/streets-are-ecosystems/complete-streets-green-streets/

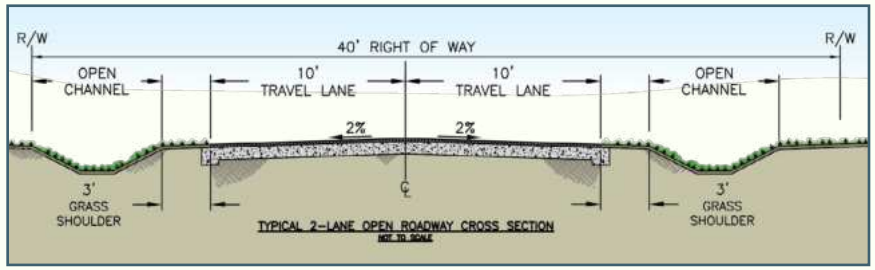
*Return to **question 22B**.*

RIGHT-OF-WAY WIDTHS — TOPIC R

Street right-of-way widths are often based on blanket application of high-volume street design standards. Rights-of-way should be the minimum width necessary to accommodate the pavement, sidewalk, street trees, and utilities. Rights-of-way that are narrower demand less clearing and can encourage more compact site design. The right-of-way can be narrowed by: placing utilities below the paved area, requiring sidewalks on only one side of the road, and basing street-width on density of development / # of trips per day.

A wide right-of-way can be used advantageously by placing planting strips between the sidewalk and the street as well as on median strips. Planted areas can be used for stormwater treatment such as bioretention or, provided there is enough soil volume available, be planted with large shade trees.

AT LEFT: Cross sloping, seen at left, may be appropriate for low density roads. The road is graded so that all water flows to one side; a level spreader is used to disperse the runoff into the vegetated area. This reduces the need for clearing trees and constructing grass channels (Penn State Center for Dirt and Gravel Studies).



LEFT: This multiple-use right-of-way minimizes the widths of lanes and includes large planting areas on the median, angled onstreet parking, bike lanes, and street trees between road and sidewalk. CENTER: On Wickeden Street in Providence, RI, planting areas in the median accept stormwater runoff and increase pedestrian safety. RIGHT BOTTOM: An example of how to design a 40-foot ROW appropriate for a suburban or rural area (HW).

RI LID Planning and Design Guidance Manual *See Chapter 5* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

See also Complete Streets are Green Streets *by NACTO* – https://nacto.org/publication/urban-street-stormwater-guide/streets-are-ecosystems/complete-streets-green-streets/

*Return to **question 23**.*

CUL-DE-SACS TOPIC S

Conventional cul-de-sacs add a significant amount impervious cover, much of which is not necessary for vehicle turn. LID practices include limiting the radius of a cul-de-sac to the minimum needed to allow for turns by emergency and maintenance vehicles, maintaining landscaped or pervious islands in the center of the cul-de-sac, and using alternative turnaround designs such as hammerheads, which result in far less impervious surface than conventional designs.

LEFT TOP: Preserving vegetation in the center of the cul-de-sac and allowing the area to receive stormwater runoff will offset some of the impacts of the impervious surface created. LEFT BOTTOM: The paved diameter of this conventional cul-de-sac in South Kingstown is 95 feet, most of which is never used for vehicle turning. CENTER TOP: This preserved specimen tree routes the roadway and sidewalk around it and effectively slows traffic (CWP). CENTER BOTTOM: This road in the densely developed village of Wakefield is 16 feet wide, terminates in a hammerhead turnaround, and serves six houses (RIDEM Environmental Map). RIGHT: In an urban area a vegetated island within a loop road supports a healthy street tree (NACTO).

*Return to **question 26**.*

ALTERNATIVE SIDEWALK DESIGNS — TOPIC T

Sidewalk design standards hinge upon many factors, including: the available right-of-way; expected pedestrian use; the density of the area the sidewalk serves; and the presence of utility poles, street signs, bus shelters, etc. ADA compliance (a minimum of 4 feet) and RIDOT standards for state-owned roads (a minimum of 5 feet) are additional important factors.

Nevertheless, it is possible to integrate LID principles and thoughtful stormwater management into sidewalk design by allowing flexible design standards. These standards provide for the safe movement of pedestrians, while also limiting impervious cover. For example, instead of uniformly requiring five-foot impervious sidewalks on both sides of a residential street, a community could allow a sidewalk on only one side of the street and consider the use of permeable materials.




*LEFT: Making space for trees in sidewalks in urban areas ensures a cooling canopy (*Boston Complete Streets*). SECOND-LEFT: In urban settings, street trees can form a barrier from the road encouraging use of sidewalk as seating for local restaurants (NACTO). SECOND-RIGHT: Planters with appropriate tree species can be designed to accept and retain stormwater runoff if the depressed area is also cordoned off with fencing for pedestrian safety (*Boston Complete Streets*). RIGHT: This unpaved footpath away from the road in a residential neighborhood replaces a conventional impervious sidewalk.*

RI LID Planning and Design Guidance Manual *See Chapter 5* – http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/lidplan.pdf

See also ***Topic N***.

Return to ***question 27D***, ***question 28***.

SETBACK DISTANCES — TOPIC U

Zoning standards dictate the setbacks and frontages. These standards directly affect impervious cover in a community because frontage width and side yard setbacks influence the length of roads and sidewalks. Setbacks also determine the length of driveways. By relaxing the minimum requirements on setbacks and frontages, site and development imperviousness can be reduced.

LEFT: The short setback from the road for this lot in South Kingston directly reduces the amount of pavement used for the driveway and increases the area behind the backyard that is preserved as open space. Narrow setbacks between lots allow for a shorter road length which also reduces impervious cover.

*Return to **question 30**.*

SHARED DRIVEWAYS — TOPIC V

Driveways are a source of impervious cover that can be reduced by setting limitations on maximum widths and lengths. Driveways shared between two or more homes can significantly reduce the amount of impervious surface area in a community. For shared driveways, design criteria must be adequate to allow vehicles to park without blocking a neighbor, and maintenance obligations must be outlined for homeowners by a legal entity such as a developer or homeowners' association.

*LEFT: This driveway shared between two homes reduced the amount of pavement needed by 1,000 linear feet and preserved a meadow (*RI LID Planning and Design Guidance Manual – *S. Millar).*
RIGHT: A safety benefit of shared driveways is the reduction of the number access points along a busy road, such as in this example from South Kingstown.

*Return to **question 31**.*

PARKING RATIO REQUIREMENTS — TOPIC W

Parking ratios often exceed local parking demand because they are based on another community's ordinance or do not take into account local factors. Parking ratios are frequently set as minimums, even when they are based on studies of peak parking demand, which results in requirements for more parking (and therefore more impervious surface) than is needed.

Parking ratio requirements should always be customized to local factors, such as the nature of the development, the location and uses around that development (especially density), and the transportation options nearby. For example, urban areas that offer public transport and shared parking require less parking.

Minimum parking requirements should either be reduced or changed to Maximum requirements, and balanced with requirements for flexible arrangements such as shared parking, spaces that can be held in landscaped reserves, or acknowledge credit for possible off-site parking.

ABOVE: This compact SUV takes advantage of spaces designated for compact vehicles in a retail lot (Flickr user Paul Sullivan).

Parking Schedule from Mass Smart Growth / Smart Energy Smart Parking Model Bylaw

Land Use	*Maximum*	*Minimum*
Bank	3	2
Large Scale Retail	4	2
Drive-Thru Restaurant	6	2
Free Standing Retail	3	1
General Office Building	4	2
Industrial Plant	2	1
Medical Office Building	8	2
Nursing Home	3	2
Restaurants	10	6
Shopping Centers	4	3
Bed and Breakfast	1.2 spaces per guest room	1 space per guest room
Personal Services	3	2
Day Care Centers	1 space per 4 children at maximum capacity	1 space per 8 children at maximum capacity
Churches and Place of Worship	1 space per 3 seats in portion of the building used for services	1 space per 5 seats in the portion of the building used for services
Museums and Libraries	2	1
Social Clubs and Organizations	4	3
Public and Private Educational Institutions	1 space per 3 seats in the classroom	1 space per 5 seats in the classroom

ABOVE: This parking schedule from a Massachusetts model ordinance is just one example of how to determine parking ratios by land use.

Chart Adapted from Smart Parking Model Bylaw *from Mass Smart Growth / Smart Energy –* https://www.mass.gov/service-details/smart-growth-smart-energy-toolkit-module-bylaws

See also RI LID Planning and Design Guidance Manual.

Return to ***question 32****.*

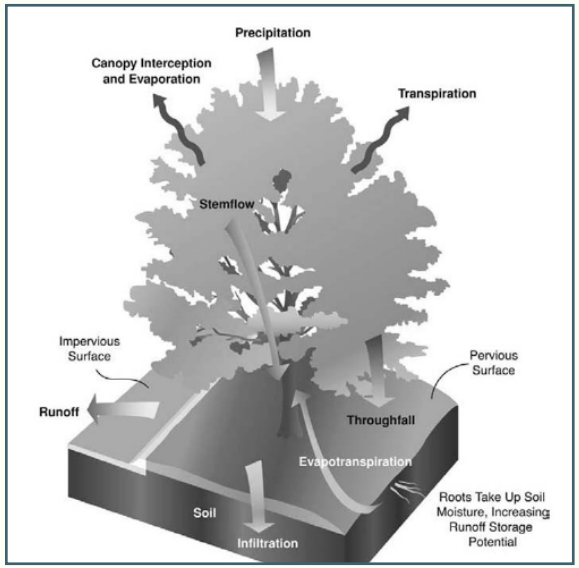
TREE CANOPY (25% - 30%) COVERAGE OVER PARKING LOTS — TOPIC X

Tree canopy coverage in parking lots reduce summer temperatures and large, mature trees can also intercept and take up a significant amount of stormwater runoff.

Achieving more tree canopy coverage means:

- » increasing the numbers of trees planted,
- » providing them with enough soil volume to grow to maturity,
- » watering intensely during the first three years,
- » and keeping roots from compaction by cars and foot traffic.

Increased tree canopy and tree height must be considered at the site-planning stage of construction in order to: minimize soil compaction where trees will be planted; avoid conflicts between the future height of trees, lighting, and signage; to be sure that the species are suitable for parking lots; and to allot appropriate resources for tree care.



LEFT: Twenty-five to thirty percent tree canopy coverage over parking lots reduces summer temperatures greatly increases the aesthetic value of the area (CWP). RIGHT: Tree canopy offsets stormwater runoff by interception and evaporation; tree roots improve capacity for runoff storage of throughfall in the pervious area below the canopy (RIDEM).

*Return to **question 43A**.*

OPEN-SECTION VEGETATED CHANNELS — TOPIC Y

Conventional gray stormwater systems use curbs and gutters along roadways to convey stormwater with no treatment to local waterways. Open-section vegetated channels that incorporate runoff reduction practices such as dry swales, bioretention, biofilters, or vegetated swales can be placed beside roads within the right-of-way if not prohibited by the subdivision codes. Open-section vegetated channels convey stormwater to another LID practice or capture and treat the stormwater directly.

LEFT: Open-section grassed swale in North Kingston. CENTER TOP: Infiltration trenches on each side of the road in North Kingstown recharge groundwater. CENTER BOTTOM: A grassed swale in a Massachusetts development planted with turf and clover (MASS Smart Guide Toolkit). RIGHT: Stormwater can move between the open-section swales on either side of this driveway in the low impact development Jordan's Cove, Connecticut (CT NEMO).

*Return to **question 47**.*

RETROFITTING FOR STORMWATER INFILTRATION

TOPIC Z

Stormwater retrofits are often necessary to improve stormwater management in locations where little or no prior stormwater controls have existed, particularly in urban areas. The Center for Watershed Protection recommends taking a watershed inventory, verifying feasible sites in the field, and using a well-defined set of objectives to guide the choices. Those objectives might include: capacity for pollutant removal, capacity to reduce runoff volume, ability to implement the project, and overall public benefit.

The design of retrofit projects requires special consideration of issues that might not affect BMP construction in new-development, such as avoiding existing utilities and minimizing existing wetland impacts. Maintenance must also be considered even more carefully for retrofits, as space is often at a premium and retrofit BMPs are often undersized. However, the UNH Stormwater Center has found that stormwater systems that are a fraction of the size of conventional designs performed remarkably well (for more, see page 6 of *Breaking Through, UNHSC 2016 Report*).

LEFT: This parking lot at Latham Park in Barrington was retrofitted in 2015 and includes a rain garden in the center island and a small buffer of native plants between the impervious surface and the open water (GRIP). TOP RIGHT: These vegetated areas retrofitted into a wide asphalt sidewalk in Providence accept runoff from the street. The Steel Yard collaborated with the Green Infrastructure Coalition to make the steel covers that protect the curb cuts from plows and the pedestrian safety fencing. BOTTOM RIGHT: The original large parking lot located in the Woonasquatucket River Watershed allowed stormwater to flow directly to the river (RIDEM Environmental Map). The retrofit design by Fuss & O'Neill will decrease impervious surface and catch stormwater in newly-installed bioretention areas, which will also be planted with trees (WRWC).

Breaking Through, UNHSC 2016 Report – https://www.unh.edu/unhsc/sites/default/files/media/unhsc_2016_report_final.pdf

*Return to **question 49A**.*

REDEVELOPMENT STANDARDS & THRESHOLDS — TOPIC AA

Redevelopment projects provide an ideal opportunity to incorporate LID site design and BMPS to reduce runoff. The RI Stormwater Rules establish criteria for redevelopment and infill projects but only projects disturbing more than 10,000 sf of impervious cover are regulated.

Municipalities can set their own thresholds for applicability of stormwater management standards with redevelopment. One example is the model stormwater standards created by the Southeast Watershed Alliance, working with the UNH Stormwater Center.

- The model recommends a trigger threshold of 5,000 sf of land disturbance which would require a new development or redevelopment to comply with the stormwater standards.
- Land disturbance is not limited to disturbance of impervious area but is defined as "any permanent alteration of the land surface or removal of vegetation or trees association with a development activity".
- The 5,000 sf threshold is based on statistics showing that 80% of existing commercial developments in Durham, NH would be subject to the regulation to reduce impacts of existing impervious cover.

Moran Shipping in Providence is an example of a redevelopment project incorporating bioretention areas next to parking area (HW).

Minimizing Environmental Impacts Through Stormwater Ordinance and Site Plan Regulation *and related documents* – *https://www.unh.edu/unhsc/news/minimizing-environmental-impacts-through-stormwater-ordinance-and-site-plan-regulation*

*Return to **question 46**.*

RULES, REGULATIONS, & GUIDANCE — TOPIC RR

The required minimum criteria for complying with the RI standards for stormwater management can be found in *Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)*. The *Rhode Island Stormwater Design and Installation Standards Manual* contains additional guidance.

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8): https://rules.sos.ri.gov/regulations/part/250-150-10-8
Rhode Island Stormwater Design and Installation Standards Manual: http://www.dem.ri.gov/pubs/regs/regs/water/swmanual15.pdf

*Return to **question 44**.*

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8): https://rules.sos.ri.gov/regulations/part/250-150-10-8

*Return to **question 45**.*

Municipalities should consider requiring the use of the standards in the *RI Stormwater Management Guidance for Individual Single-Family Residential Lot Development* for development of more than one acre regardless of proximity to critical resources and for less than one acre in areas adjacent to critical resources.

RI Stormwater Management Guidance for Individual Single-Family Residential Lot Development: http://www.crmc.ri.gov/stormwater/Single-Family-Lot-Guidance.pdf

*Return to **question 48**.*

For more on preventing pollution from a site after construction see Appendix G of the *Rhode Island Stormwater Design and Installation Standards Manual.*

Rhode Island Stormwater Design and Installation Standards Manual: http://www.dem.ri.gov/pubs/regs/regs/water/swmanual15.pdf

*Return to **Objective IX**.*

IMAGE REFERENCES

Images for the LID Site Planning and Design Techniques: A Municipal Self-Assessment *were selected from a variety of different resources which are cited in short form within the document and expanded upon here in order of appearance.*

Any image not otherwise cited was photographed or created by RI NEMO.

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