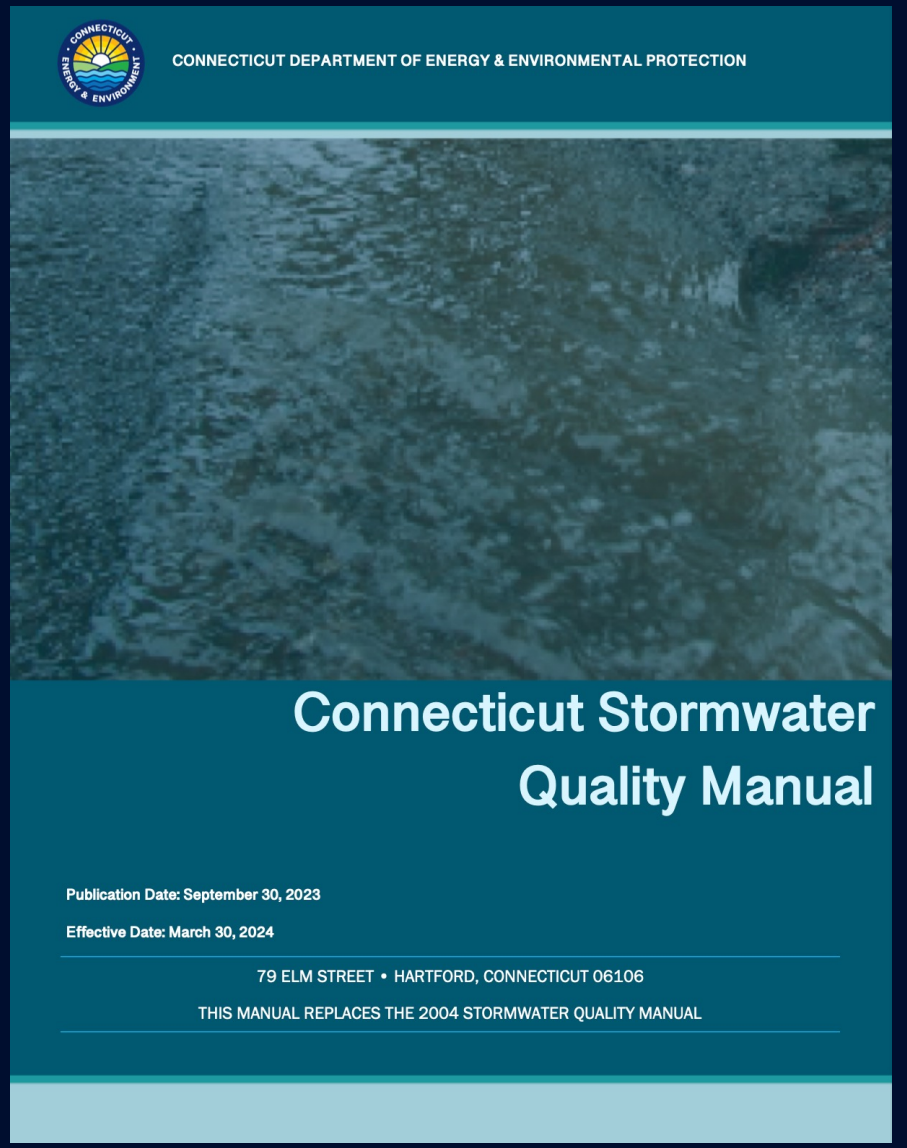
The New CT Stormwater Quality Manual:

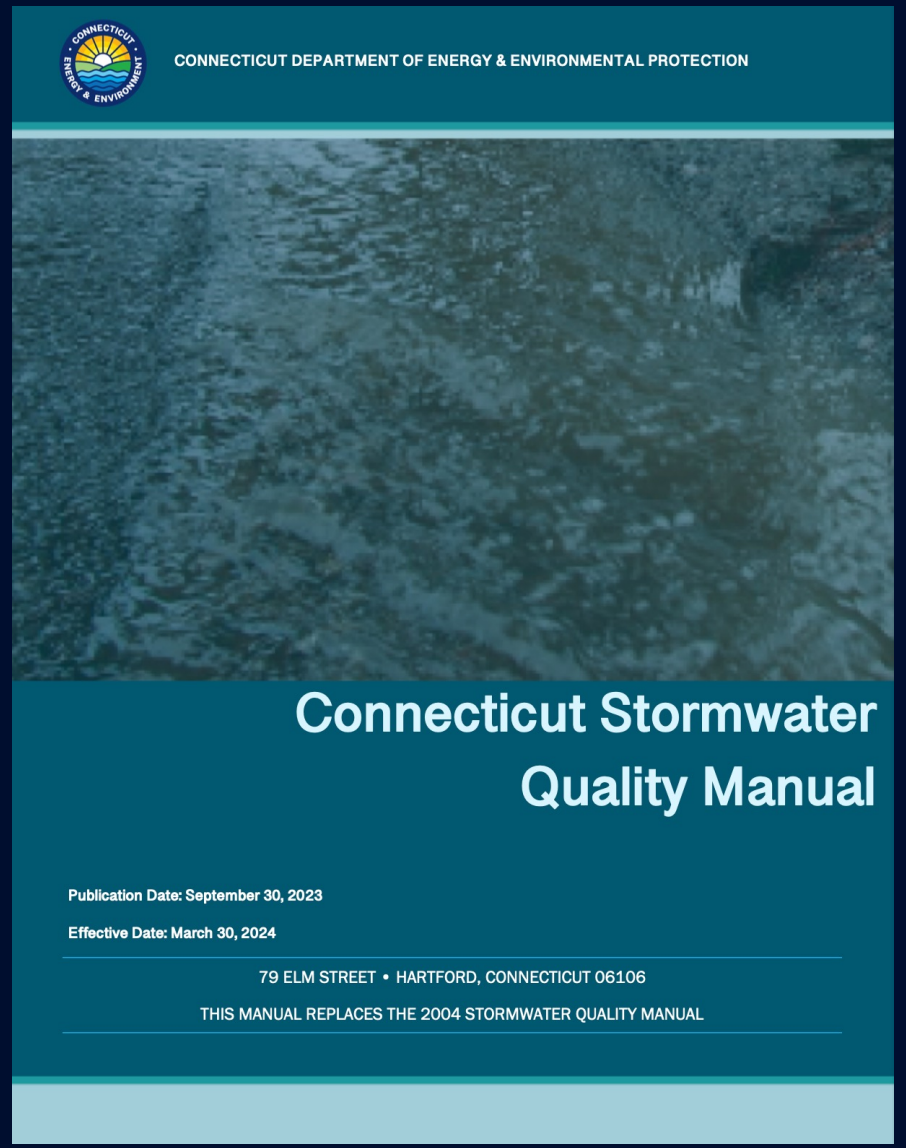
The Low Impact Development Process

Mary Looney, Dave Dickson
CT NEMO



Roadmap

- Overview of LID Focus
- Review of Standards (Ch. 4)
- LID Site Design
  - Avoid impacts
  - Reduce impacts
  - Manage at the source
- Choosing Structural BMPs (Ch. 8, 9, 13)



Adoption Timeline

9/30/23

Manual is published

- Get familiar with new Manual
- Update local regulations auth orities

3/31/24

Effective Date
(with grace period for projects which have completed preliminary design)

- Adopt updated guidance
- If grace period is applicable, communicate this to review authority. Permit must be completed before grace period ends.

9/30/24

Grace period ends

- Adopt updated guidance

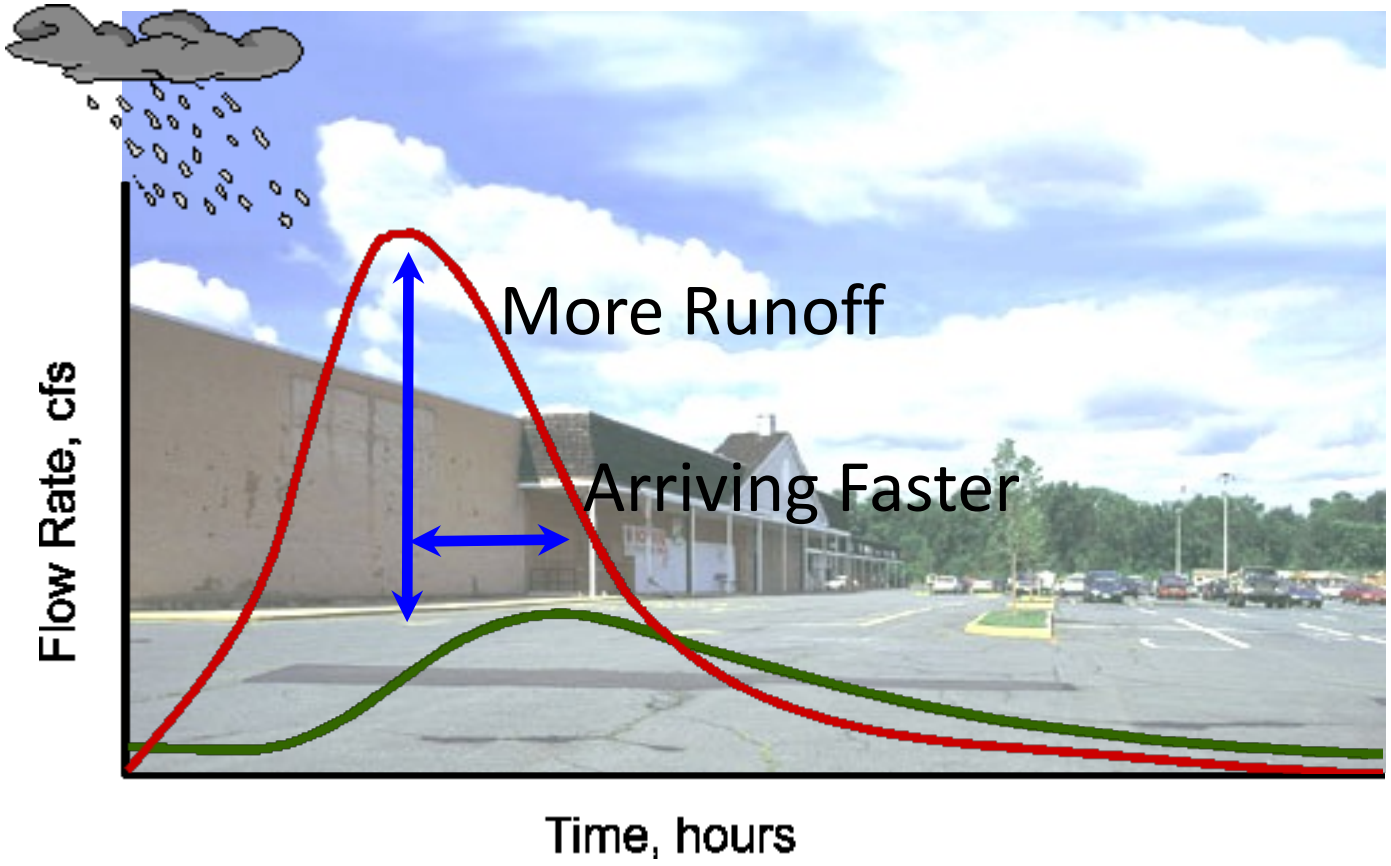
What is different about this manual?

- Low Impact Development (LID) as the new "industry standard," not just an amendment
- Updated standards to improve resilience in face of increased storm amounts and intensities

Why?

- Protect water quality
- Maintain groundwater recharge
- Prevent flooding/resilience

Why? Development and the water cycle



Effects of Urbanization: Pollution

A Toxic Tide Is Killing Florida Wildlife

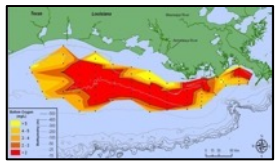
Dead fish, most likely killed by a toxic algal bloom, in Florida in 2016. The current outbreak has been going strong for about nine months. Jeffrey Greenberg/UIG, via Getty Images

U.S.

Unwanted Record: Biggest Ever Dead Zone in Gulf of Mexico

By THE ASSOCIATED PRESS AUG. 2, 2017, 7:25 P.M. E.D.T.

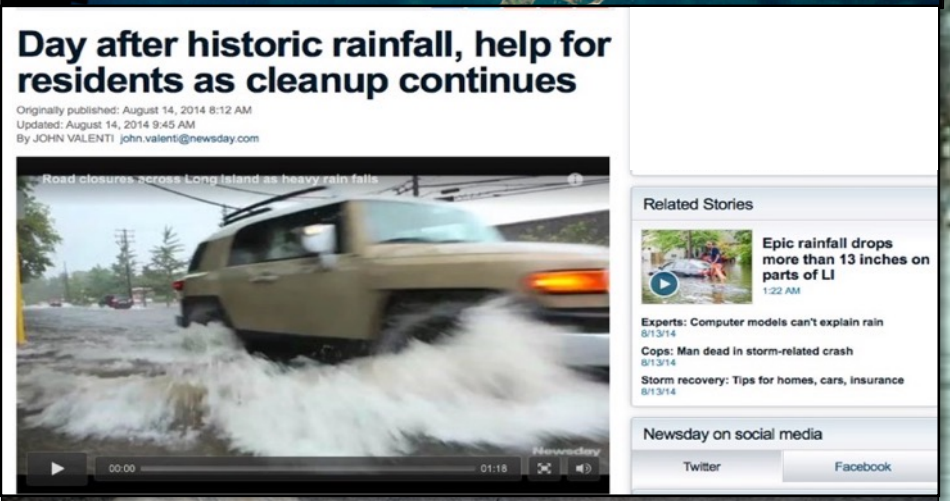
NEW ORLEANS — There's an unwanted record in the Gulf of Mexico: This year's "dead zone," a largely human-caused phenomenon where there's too little oxygen to support marine life, is the biggest ever measured.



The low-oxygen, or hypoxic, zone covers 8,776 square miles (22,720 square kilometers) — about the size of New Jersey, the National Oceanic and Atmospheric Administration said Wednesday. The area is more than 3 percent larger than the 2002 dead zone, the previous record.

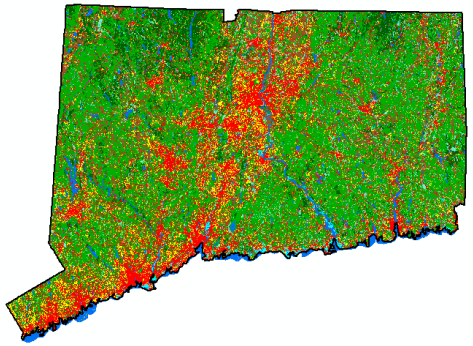
"We predicted it would be large, and it is large," said scientist Nancy

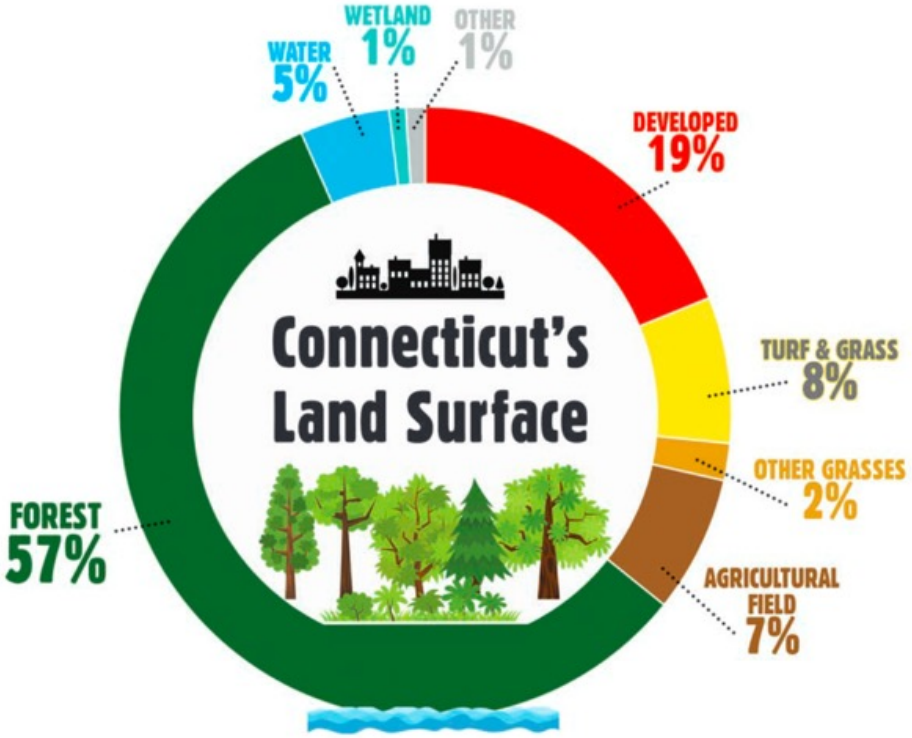
Effects of Urbanization: Flooding



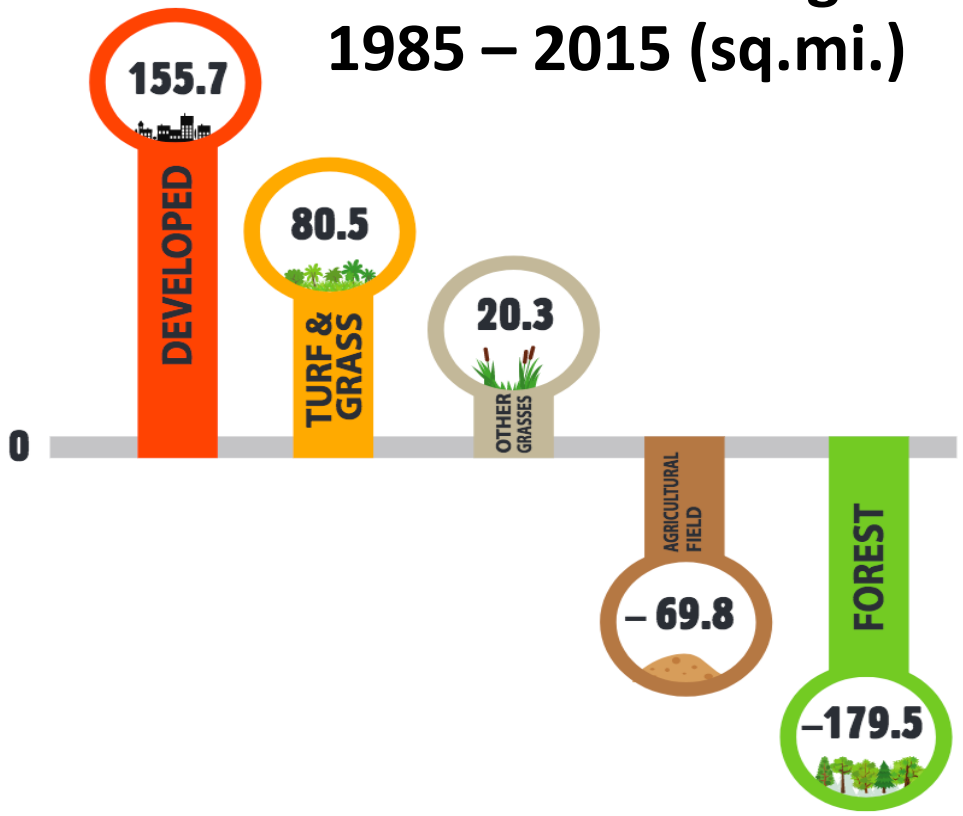
Providence, RI, March 2010

A Developing State





2015 Land Cover



Low Impact Development

Approach to site design & stormwater management that seeks to preserve pre-development hydrology and pollutant loads

Non-Structural LID

- Minimize site disturbance to natural features
- Protect natural drainage
- Minimize impervious surface
- Reduce need for pollutants
- Encourage infiltration

Structural LID(GSI)

- Promote infiltration, evapotranspiration, and storage and reuse
- Bioretention/Rain Gardens
- Pervious pavements
- Green roofs
- Tree box filters
- Rain barrels/cisterns

Benefits of LID (identified in the manual)

- Preserved site hydrology
- Reduced pollutant loads and improved water quality
- Preservation of natural systems
- Enhanced climate and community resilience
- Reduced consumption of land for stormwater management
- Reduced development costs
- Increased property values
- More aesthetically pleasing development
- Reduced maintenance

MANUAL DESIGN

Pathway of utilizing Low Impact Development (LID) site design first and foremost, followed by guidance and criteria for structural stormwater BMPs

Chapter 4:
Updated stormwater management ***standards and criteria*** *for all development & redevelopment*

→

Chapters 5/6:
Using ***LID site planning & design (non-structural)*** *first to reduce stormwater impacts and* ***source protections*** *prevent pollutants in stormwater*

→

Chapters 7/8:
Selection of ***structural stormwater BMPs*** *after non-structural LID has been implemented where possible*

→

Chapter 9:
Guidance on selecting stormwater BMPs for ***retrofitting sites*** *which are already developed*

Chapters 10/11:
Guidance on considering ***infiltration and pretreatment*** *stormwater BMPs*

→

Chapter 12:
Updated site ***Stormwater Management Plan*** *guidance/outline reflecting changes*

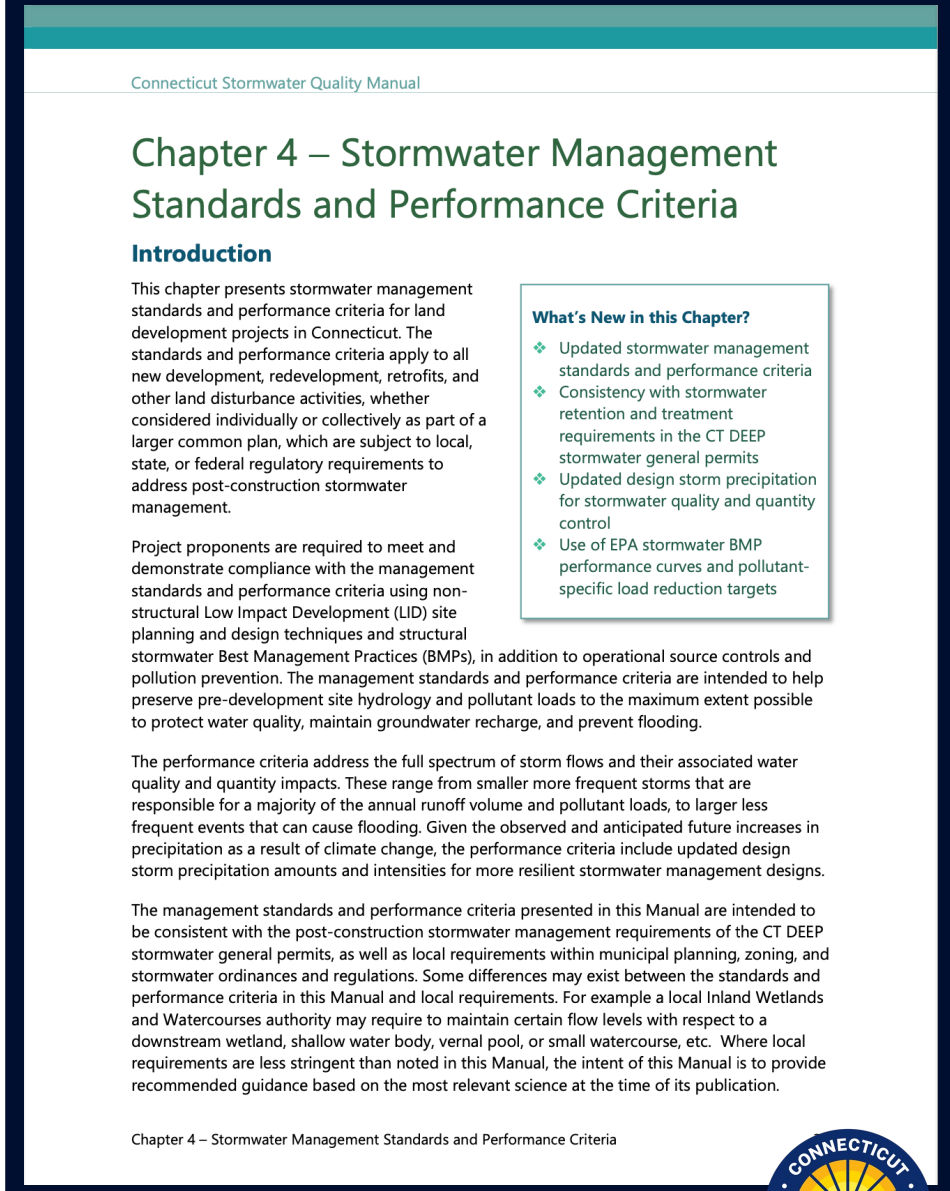
→

Chapter 13:
The 'nuts and bolts' of implementing a structural stormwater BMP – design, construction, maintenance, etc.

Ch. 4: Stormwater Management Standards and Performance Criteria

- **Purpose / Overview**
  - Updated stormwater management standards for development and retrofits
  - Updated Water Quality Storm variable within Water Quality Volume equation
  - Updated Peak Runoff Attenuation standard
  - Process for demonstrating compliance with the stormwater management standards and criteria

- **How to apply it**
  - CT DEEP stormwater permits in relation to (re)development standards and ordinances, regulations, or policies



Connecticut Stormwater Quality Manual

Chapter 4 – Stormwater Management Standards and Performance Criteria

Introduction

This chapter presents stormwater management standards and performance criteria for land development projects in Connecticut. The standards and performance criteria apply to all new development, redevelopment, retrofits, and other land disturbance activities, whether considered individually or collectively as part of a larger common plan, which are subject to local, state, or federal regulatory requirements to address post-construction stormwater management.

What's New in this Chapter?

- Updated stormwater management standards and performance criteria
- Consistency with stormwater retention and treatment requirements in the CT DEEP stormwater general permits
- Updated design storm precipitation for stormwater quality and quantity control
- Use of EPA stormwater BMP performance curves and pollutant-specific load reduction targets

Project proponents are required to meet and demonstrate compliance with the management standards and performance criteria using non-structural Low Impact Development (LID) site planning and design techniques and structural stormwater Best Management Practices (BMPs), in addition to operational source controls and pollution prevention. The management standards and performance criteria are intended to help preserve pre-development site hydrology and pollutant loads to the maximum extent possible to protect water quality, maintain groundwater recharge, and prevent flooding.

The performance criteria address the full spectrum of storm flows and their associated water quality and quantity impacts. These range from smaller more frequent storms that are responsible for a majority of the annual runoff volume and pollutant loads, to larger less frequent events that can cause flooding. Given the observed and anticipated future increases in precipitation as a result of climate change, the performance criteria include updated design storm precipitation amounts and intensities for more resilient stormwater management designs.

The management standards and performance criteria presented in this Manual are intended to be consistent with the post-construction stormwater management requirements of the CT DEEP stormwater general permits, as well as local requirements within municipal planning, zoning, and stormwater ordinances and regulations. Some differences may exist between the standards and performance criteria in this Manual and local requirements. For example a local Inland Wetlands and Watercourses authority may require to maintain certain flow levels with respect to a downstream wetland, shallow water body, vernal pool, or small watercourse, etc. Where local requirements are less stringent than noted in this Manual, the intent of this Manual is to provide recommended guidance based on the most relevant science at the time of its publication.

Chapter 4 – Stormwater Management Standards and Performance Criteria

Ch. 4: Stormwater Management Standards and Performance Criteria

Standard 1: Runoff Volume and Pollutant Reduction

- New and Redevelopment with DCIA < 40% =
  - Retain 100% of WQV
- Redevelopment with DCIA > 40% =
  - Retain 50% of WQV

Type of Project or Activity	Required Retention Volume (RRV)[1]	Additional Treatment Volume Required[1]	
		If Volume Retained Meets or Exceeds RRV	If Volume Retained Does Not Meet RRV
➢ New development[2] ➢ Redevelopment[3] or retrofit of sites that are currently developed with existing DCIA[4] of less than 40% ➢ Any new stormwater discharges located within 500 feet of tidal wetlands, which are not fresh-tidal wetlands, to avoid dilution of the high marsh salinity and encouragement of the invasion of brackish or upland wetland species	100% of site's WQV	None	(100% of site's WQV) – (Volume Retained)
➢ Redevelopment or retrofit of sites that are currently developed with existing DCIA[4] of 40% or more	50% of site's WQV	None	(100% of site's WQV) – (Volume Retained)

Ch. 4: Stormwater Management Standards and Performance Criteria

Water Quality Volume (WQV):

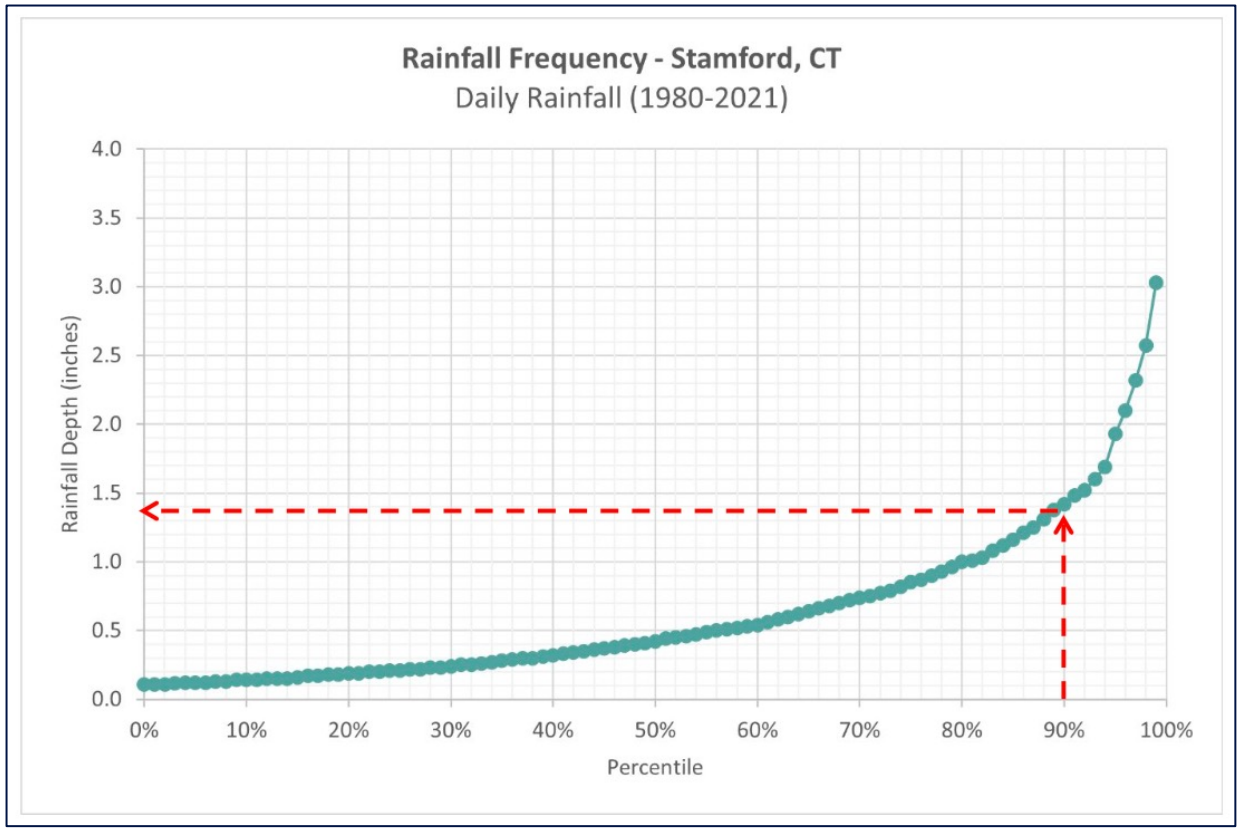
- Volume of runoff generated by Water Quality Storm
  - Calculated using the WQV equation
  - Determines how much retention is needed (standard to meet)
- "First Flush" principle
  - Assumes most pollutants in runoff are conveyed in initial portion of storm event
- Technically unchanged

VS.

Water Quality Storm (WQS):

- Used to generate the Water Quality Volume equation
  - 90th percentile rainfall volume = infiltration in natural condition
    - Amount that should be managed on-site to restore and maintain pre-development hydrology
- Increasing from 1" to 1.3"

Ch. 4: Stormwater Management Standards and Performance Criteria



CT average of past 40 years from National Weather Service data used to calculate new water quality storm. Stamford average shown above.

Water Quality Storm (WQS):

- Used to generate the Water Quality Volume equation
  - 90th percentile rainfall volume = infiltration in natural condition
    - Amount that should be managed on-site to restore and maintain pre-development hydrology
- Increasing from 1” to 1.3”

Ch. 4: Stormwater Management Standards and Performance Criteria

Peak Runoff Attenuation for Site Development\ Redevelopment

2,10,100-yr, 24-hr Storms

Control the 2-yr post development peak flow rate to 50% of predevelopment rate.

Control the 10-yr post development peak flow rate to pre-development rate.

Potentially Control the 100-year post development peak flow rate to pre-development rate, as required by review authority.

Conveyance Protection

10-yr, 24-hr Storm

For on-line structural stormwater BMPs, design the conveyance system leading to, from, and through the stormwater BMPs based on the 10-yr or larger storm event.

Design conveyance system based on peak flow rate of the largest storm for which peak runoff attenuation is provided (i.e., 10-yr storm or larger up to 100-year storm).

Emergency Outlet Sizing

100-yr, 24-hr Storm

For on-line stormwater quantity control BMPs, size the emergency outlet of stormwater quantity control structures to safely pass the post-development peak flow rate from the 100-year storm event or larger storm (at the discretion of the review authority) in a controlled manner without eroding the outlet and downstream drainage systems.

Peak Runoff Attenuation Standard

- Set permissible runoff standard for site
- Manage volume and timing of runoff
- New: 2 year storm = 50% of predevelopment runoff, AND
- 10 year = predevelopment runoff
- Consider: 100 year = predevelopment runoff

DESIGN

Pathway of utilizing Low Impact Development (LID) site design first and foremost, followed by guidance and criteria for structural stormwater BMPs

Chapter 4:
*Updated stormwater management **standards and criteria** for all development & redevelopment*

→

Chapters 5/6:
*Using **LID site planning & design (non-structural)** first to reduce stormwater impacts and **source protections** prevent pollutants in stormwater*

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Chapters 7/8:
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Chapter 12:
*Updated site **Stormwater Management Plan** guidance/outline reflecting changes*

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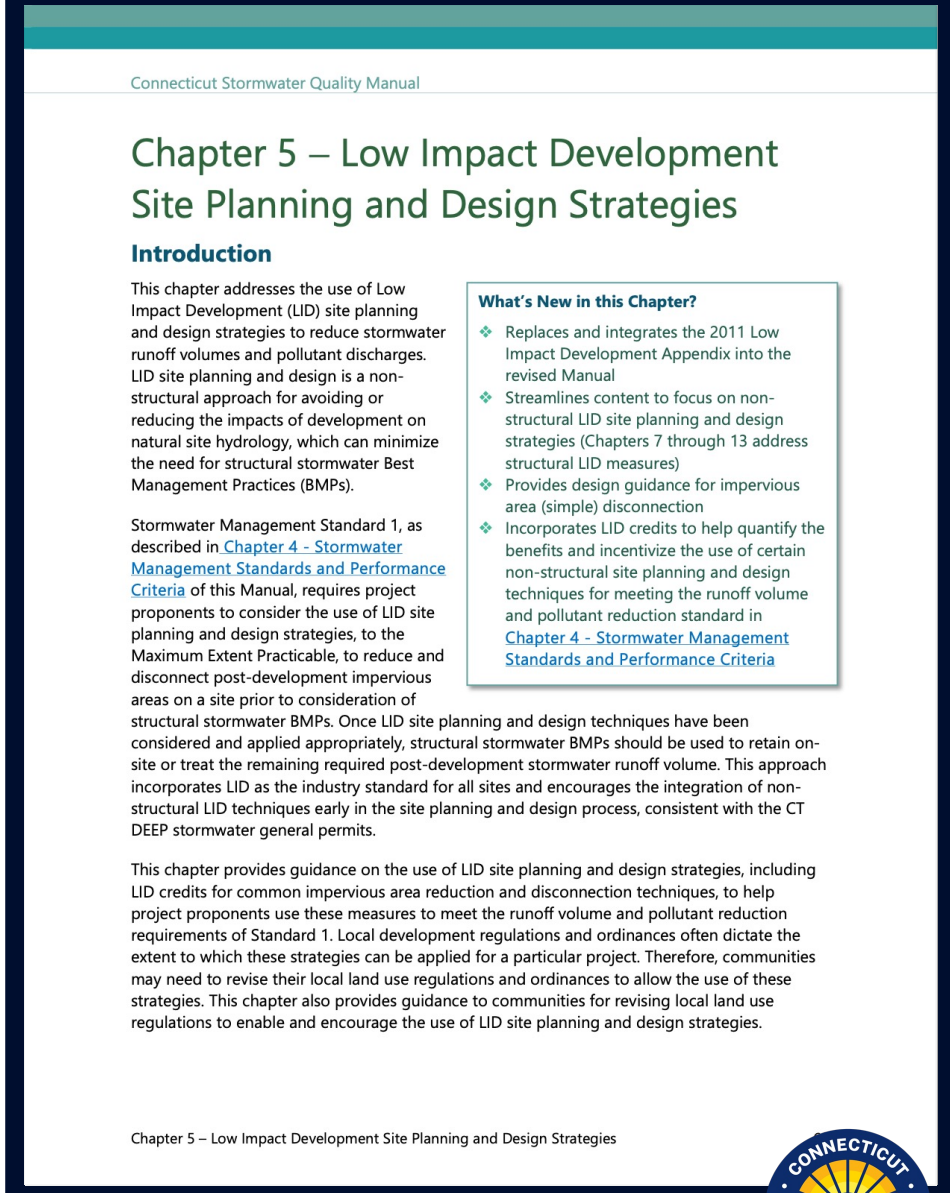
Chapter 13:
The 'nuts and bolts' of implementing a structural stormwater BMP – design, construction, maintenance, etc.

Ch. 5: Site Planning and Design Strategies

- **Purpose / Overview**
  - Non-structural LID site planning and design strategies and process
  - Criteria/credits for simple disconnection

- **How to apply it**
  - First 'step' in addressing stormwater management for site development
    - Retaining runoff on-site without the use of structural BMPs
  - Review of LID and key elements of implementation
    - Proper usage for avoiding / reducing negative impacts of stormwater runoff



Connecticut Stormwater Quality Manual

Chapter 5 – Low Impact Development Site Planning and Design Strategies

Introduction

This chapter addresses the use of Low Impact Development (LID) site planning and design strategies to reduce stormwater runoff volumes and pollutant discharges. LID site planning and design is a non-structural approach for avoiding or reducing the impacts of development on natural site hydrology, which can minimize the need for structural stormwater Best Management Practices (BMPs).

What's New in this Chapter?

- Replaces and integrates the 2011 Low Impact Development Appendix into the revised Manual
- Streamlines content to focus on non-structural LID site planning and design strategies (Chapters 7 through 13 address structural LID measures)
- Provides design guidance for impervious area (simple) disconnection
- Incorporates LID credits to help quantify the benefits and incentivize the use of certain non-structural site planning and design techniques for meeting the runoff volume and pollutant reduction standard in Chapter 4 - Stormwater Management Standards and Performance Criteria

Stormwater Management Standard 1, as described in Chapter 4 - Stormwater Management Standards and Performance Criteria of this Manual, requires project proponents to consider the use of LID site planning and design strategies, to the Maximum Extent Practicable, to reduce and disconnect post-development impervious areas on a site prior to consideration of structural stormwater BMPs. Once LID site planning and design techniques have been considered and applied appropriately, structural stormwater BMPs should be used to retain on-site or treat the remaining required post-development stormwater runoff volume. This approach incorporates LID as the industry standard for all sites and encourages the integration of non-structural LID techniques early in the site planning and design process, consistent with the CT DEEP stormwater general permits.

This chapter provides guidance on the use of LID site planning and design strategies, including LID credits for common impervious area reduction and disconnection techniques, to help project proponents use these measures to meet the runoff volume and pollutant reduction requirements of Standard 1. Local development regulations and ordinances often dictate the extent to which these strategies can be applied for a particular project. Therefore, communities may need to revise their local land use regulations and ordinances to allow the use of these strategies. This chapter also provides guidance to communities for revising local land use regulations to enable and encourage the use of LID site planning and design strategies.

Chapter 5 – Low Impact Development Site Planning and Design Strategies

Ch. 5: LID Site Planning and Design Strategies

Ch. 5: LID Site Planning and Design Strategies

LID Strategies – Avoid Impacts

What does it mean?

- Protect as much undisturbed open space as possible to maintain pre-development hydrology and allow natural infiltration of precipitation
- Maximize protection of natural drainage areas, waterbodies, and wetlands
- Minimize land disturbance and soil compaction to avoid erosion and increase infiltration
- Preserve natural water cycle

LID Strategies – Avoid Impacts

- Minimizing Soil Compaction and Site Disturbance
  - Healthy soils = better performance
    - Increased infiltration and absorption of nutrients
    - Healthy root environment and habitat
    - Reduced overall maintenance
- Techniques
  - ‘No disturbance areas’ during construction
  - Use lightest equipment possible / prohibit excavation on infiltration areas
  - Restore compacted soils

LID Strategies – Avoid Impacts

- Other areas of consideration:
  - Avoiding disturbance of steep slopes
  - Avoiding siting on highly erodible soils
  - Protecting natural flow pathways
  - Conservation and compact development
    - Smaller lot sizes to reduce overall impervious cover; provides more undisturbed open space
    - Concentrates density in one portion of site while preserving large percentage of site as open space

LID Strategies – Avoid Impacts

- Protect / Preserve Natural Areas and Buffers
  - Delineate and define sensitive natural areas before site layout and design
  - Minimum 100 ft. width buffer from edge; larger buffer for more critical resources
  - Disturbed areas replanted with native species or allow for regrowth of natural vegetation
  - Design site for runoff to enter buffer as sheet flow

Ch. 5: LID Site Planning and Design Strategies

LID Strategies – Reduce Impacts

What does it mean?

- Reduce impacts of land alteration:
  - Low-maintenance, native vegetation to encourage water retention and minimize lawns, fertilizers, and pesticides
  - Match pre-development / natural site runoff characteristics as closely as possible
- Reduce impervious surfaces:
  - Reduction in post-development stormwater runoff
  - Infiltration / evapotranspiration are increased

LID Strategies – Reduce Impacts

Roads

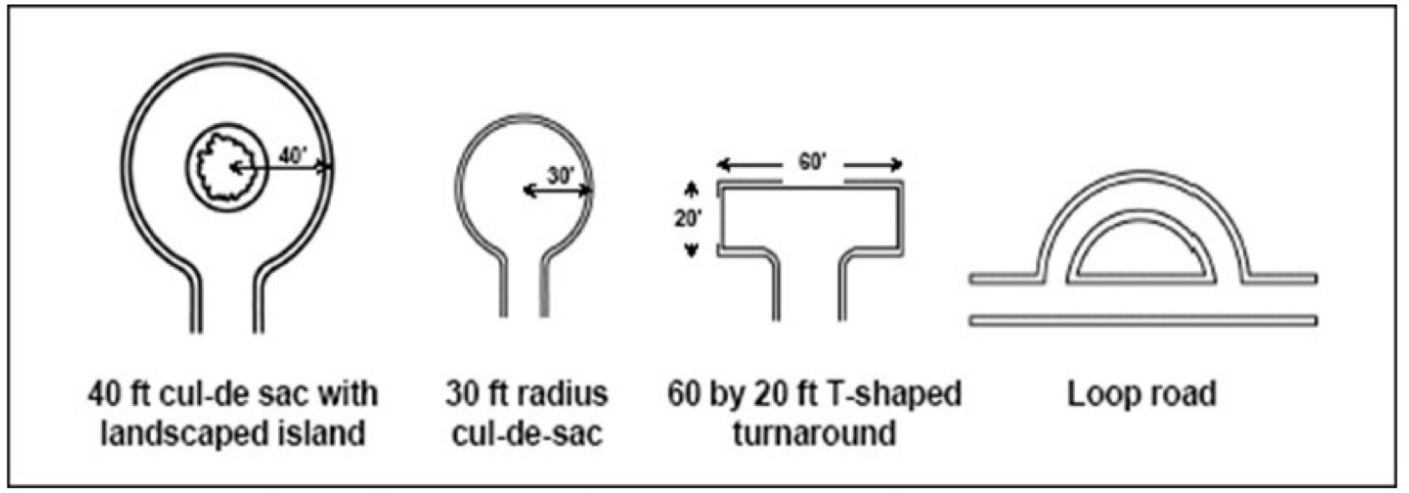
- Reducing widths and lengths
  - Reducing clearing and grading impacts
  - Reduced vehicle speeds
  - Lower maintenance costs
- Use alternative street layouts
- Elimination of curbs, curb extensions, roadside vegetated open channels

LID Strategies – Reduce Impacts

Cul-de-Sacs

- Minimize number of cul-de-sacs altogether
  - Use more T-shaped turnarounds and loop roads
- Reduce radius and size of turnaround
- Vegetated swale center island

Figure 5-1. Reduced Cul-de-Sac Radius and Alternative Turnaround Designs



Source: Adapted from Atlanta Regional Commission, 2001.[54]

LID Strategies – Reduce Impacts

Sidewalks

- Use flexible designs
- Reduce sidewalk width

Driveways

- Shared driveways
- Minimize driveway width

LID Strategies – Reduce Impacts

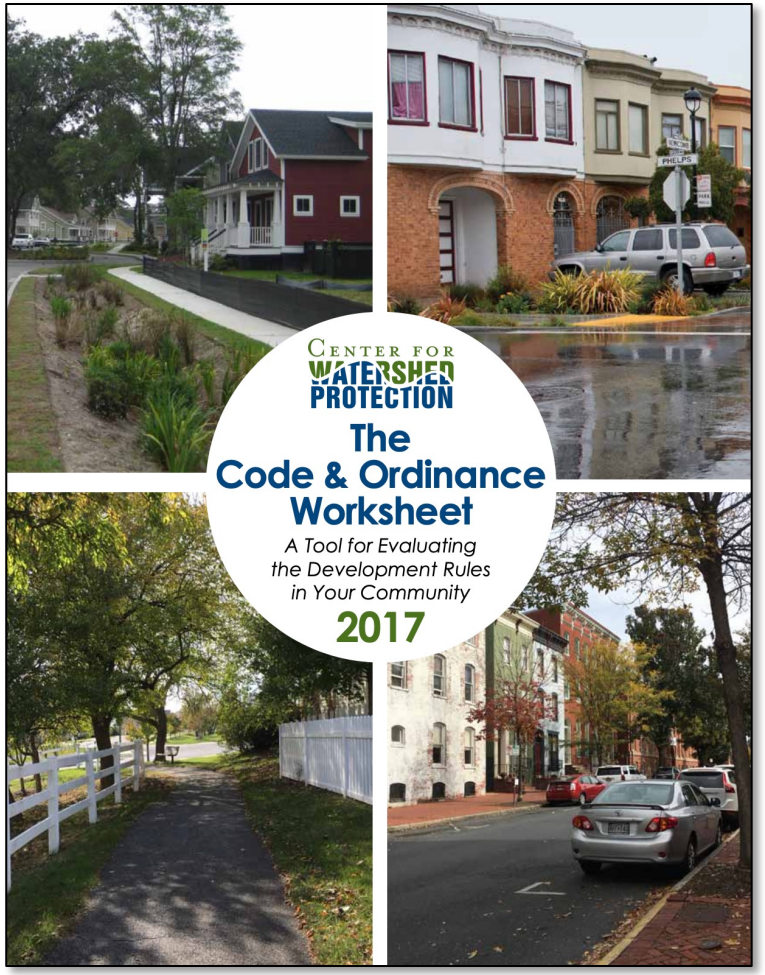
Parking Lots

- Parking Lot Landscaping
  - Minimum percentage of lot to be landscaped to collect stormwater
- Shared Parking
  - Spots serve multiple users / locations
- Parking Lot Materials
  - Pervious pavements / pervious materials

LID Strategies – Reduce Impacts

Reviewing Local Ordinances

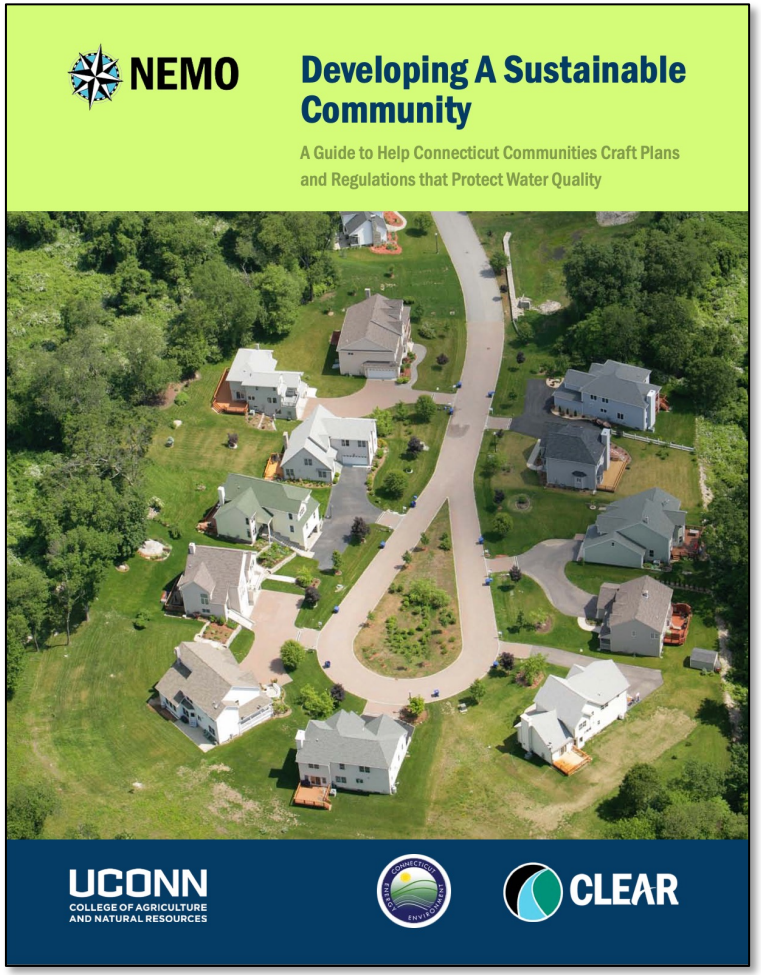
- Codes and Ordinance Worksheet (COW)
  - Center for Watershed Protection
  - Evaluation of local ordinances to 'grade' LID-friendliness
    - Minimize impervious cover
    - Conservation of natural areas
    - Runoff reduction practices



LID Strategies – Reduce Impacts

Reviewing Local Ordinances

- Developing a Sustainable Community
  - CT NEMO
  - Crafting regulations to promote LID practices
    - Residential streets and parking
    - Lot development practices
    - Conservation of natural areas



LID Strategies – Reduce Impacts

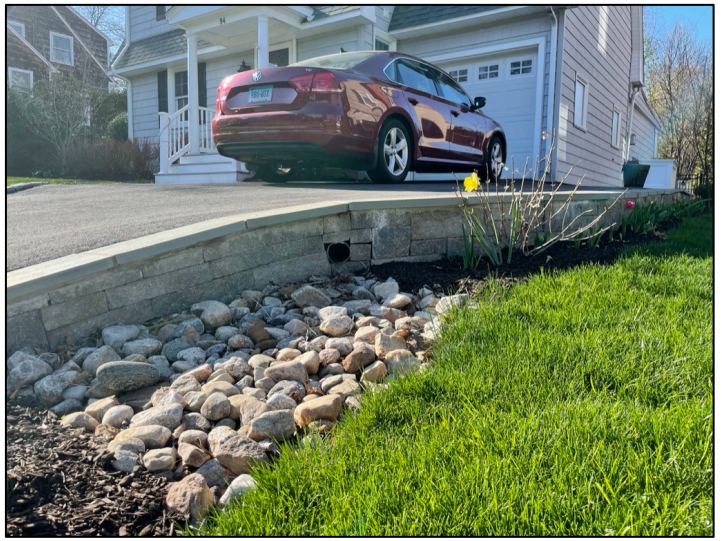
Colchester's pervious pavement

- Updated zoning regulations
  - No more than 75% of parking lots can be made up of impervious cover
    - Conserving the natural, pervious surfaces already on site
    - Pervious materials for parking stall surfaces, overflow parking, and snow storage space
  - More than 10 new private installations of pervious paving
  - 3 projects for local schools in the works

Ch. 5: LID Site Planning and Design Strategies

LID Strategies – Manage Impacts at Source

- Disconnection
  - Simple Disconnection
    - Non-structural
      - Directing stormwater onto natural pervious areas
    - Structural
      - GSI – rain gardens, pervious pavement, etc
  - Conversion
    - Impervious (pavement, buildings) to pervious (lawn, woods)
      - Restore pre-development infiltration rate and storage capacity



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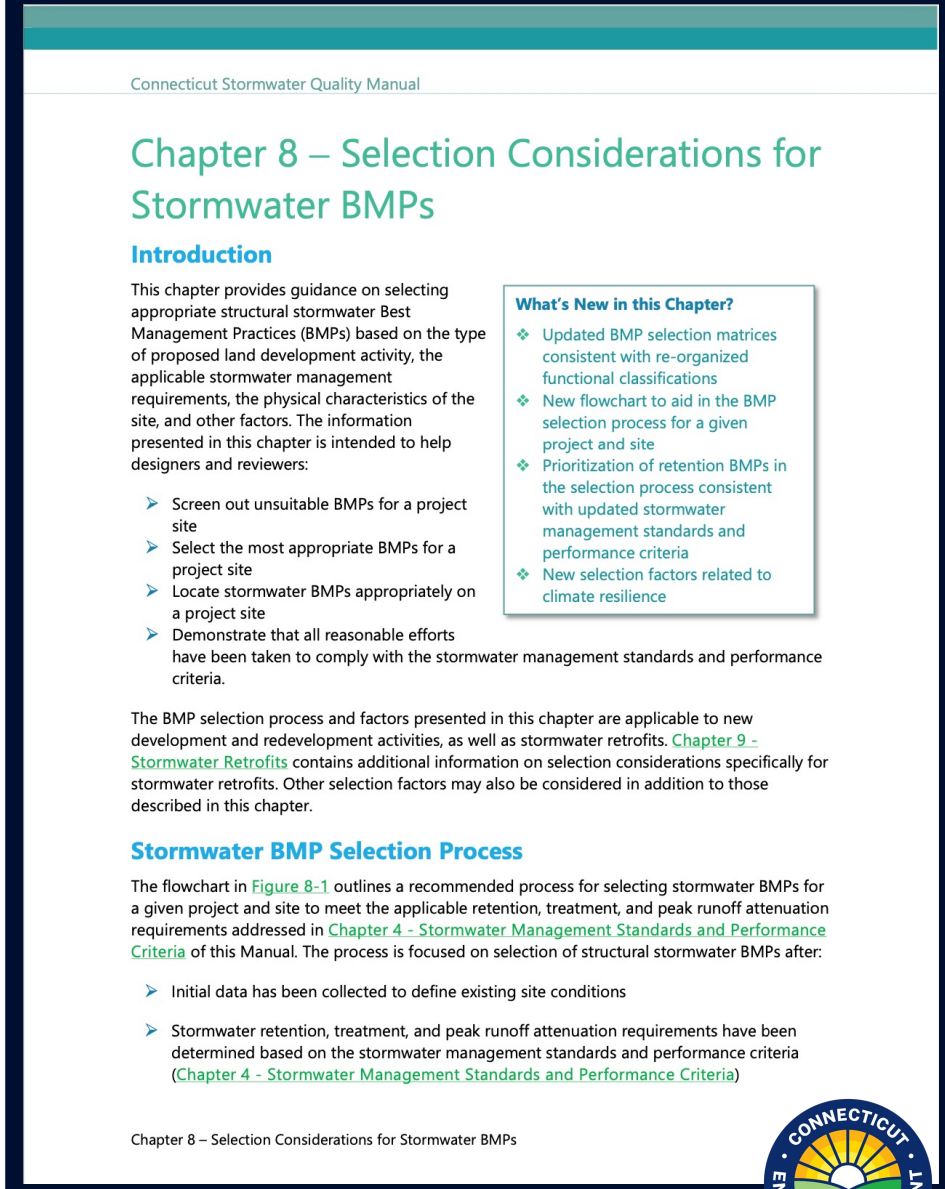
The 'nuts and bolts' of implementing a structural stormwater BMP – design, construction, maintenance, etc.

Types of Structural Stormwater BMPs (Ch. 7)

- Pretreatment
- Infiltration
- Filtering
- Stormwater Ponds and Wetlands
- Water Quality Conveyance
- Stormwater Reuse
- Proprietary BMPs
- Other

Ch. 8: Selection Considerations for Stormwater BMPs

- **Purpose / Overview**
  - Guidance on selecting appropriate structural stormwater BMPs for a development site based on the requirements and needs of the site
  - Includes an updated selection process and selection factors
- **How to apply it**
  - Breakdown and guidance when choosing stormwater BMPs



Connecticut Stormwater Quality Manual

Chapter 8 – Selection Considerations for Stormwater BMPs

Introduction

This chapter provides guidance on selecting appropriate structural stormwater Best Management Practices (BMPs) based on the type of proposed land development activity, the applicable stormwater management requirements, the physical characteristics of the site, and other factors. The information presented in this chapter is intended to help designers and reviewers:

- Screen out unsuitable BMPs for a project site
- Select the most appropriate BMPs for a project site
- Locate stormwater BMPs appropriately on a project site
- Demonstrate that all reasonable efforts have been taken to comply with the stormwater management standards and performance criteria.

What's New in this Chapter?

- Updated BMP selection matrices consistent with re-organized functional classifications
- New flowchart to aid in the BMP selection process for a given project and site
- Prioritization of retention BMPs in the selection process consistent with updated stormwater management standards and performance criteria
- New selection factors related to climate resilience

The BMP selection process and factors presented in this chapter are applicable to new development and redevelopment activities, as well as stormwater retrofits. Chapter 9 - Stormwater Retrofits contains additional information on selection considerations specifically for stormwater retrofits. Other selection factors may also be considered in addition to those described in this chapter.

Stormwater BMP Selection Process

The flowchart in Figure 8-1 outlines a recommended process for selecting stormwater BMPs for a given project and site to meet the applicable retention, treatment, and peak runoff attenuation requirements addressed in Chapter 4 - Stormwater Management Standards and Performance Criteria of this Manual. The process is focused on selection of structural stormwater BMPs after:

- Initial data has been collected to define existing site conditions
- Stormwater retention, treatment, and peak runoff attenuation requirements have been determined based on the stormwater management standards and performance criteria (Chapter 4 - Stormwater Management Standards and Performance Criteria)

Chapter 8 – Selection Considerations for Stormwater BMPs

RETENTION

STEP 1. Ensure that the site plan accounts for maximizing the avoided impacts and LID, see Figure 4-1.

STEP 2. Review the list of stormwater BMPS suitable for providing retention via infiltration Table 8-1

STEP 3. Are these infiltration stormwater BMPs feasible: Infiltration BMPs, Filtering BMPs designed for infiltration, or dry water quality swales designed for infiltration?

Review Physical Feasibility Factors:
- Drainage Area Table 8-2
- Site Slope Table 8-3
- Hydrologic Soil Group Table 8-4
- Depth to Ground Water/Bedrock Table 8-5

Review High Risk Sites and Drinking Water Supply Area Factors Table 8-6

Review Receiving Water Factors Table 8-7

NO

YES

STEP 4. Can infiltration stormwater BMPS alone be sized (Chapter 10 and 13) to meet the retention criteria of standard 1? Chapter 4

NO

YES

STEP 5. Select the appropriate infiltration stormwater BMPS and document compliance with the retention criteria of Standard 1 Chapter 4

Non-Infiltration BMPs

STEP 6. Review the list of non-infiltration stormwater BMPs suitable for retention Table 8-1

STEP 7. Are any of these non-infiltration BMPs (e.g., Stormwater Reuse BMPs or green roofs) feasible? Table 8-2 , Table 8-6 & Table 8-7

NO

YES

STEP 8. Can these non-infiltration BMPs be sized to meet the retention criteria of Standard 1? Chapter 4

NO

YES

STEP 9. Select the appropriate non-infiltration BMPs and document compliance with the retention criteria of Standard 1 Chapter 4

Maximum Extent Achievable

Document why the Standard 1 retention criteria cannot be met and provide additional treatment without retention. Off-site mitigation may be needed.

TREATMENT (WITHOUT RETENTION)

STEP 10. Review the list of BMPs suitable for providing treatment without retention Table 8-1

STEP 11. Are these treatment stormwater BMPs feasible: Filtering BMPs, Stormwater Pond and Wetland BMPs, Water Quality Conveyance BMPs or Proprietary BMPs?

Review Physical Feasibility Factors:
- Drainage Area Table 8-2
- Site Slope Table 8-3
- Hydrologic Soil Group Table 8-4
- Depth to Ground water/Bedrock Table 8-5

Review High Risk Sites and Drinking Water Supply Area Factors Table 8-6

Review Receiving Water Factors Table 8-7

NO

YES

STEP 12. Can treatment BMPs be sized (Chapter 13) to meet the treatment (without retention) criteria of Standard 1? (Chapter 4)

NO

YES

STEP 13. Select the appropriate treatment BMPs and document compliance with the additional treatment criteria of Standard 1 (Chapter 4)

Maximum Extent Achievable

Document why Standard 1 additional treatment criteria cannot be met. Off-site mitigation may be needed.

PEAK RUNOFF ATTENUATION

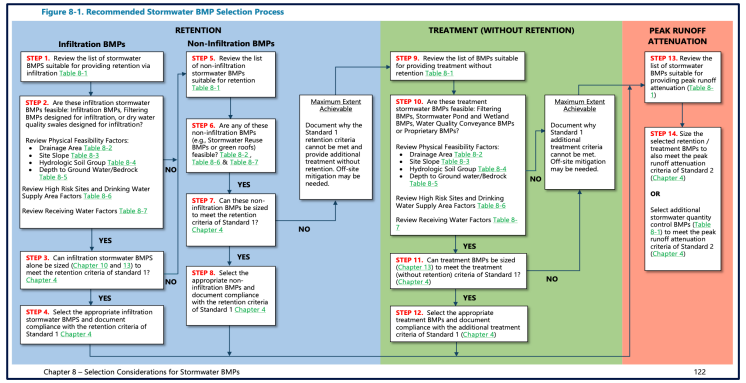
STEP 14. Review the list of stormwater BMPs suitable for providing peak runoff attenuation (Table 8-1)

STEP 15. Size the selected retention / treatment BMPs to also meet the peak runoff attenuation criteria of Standard 2 (Chapter 4)

OR

Select additional stormwater quantity control BMPs (Table 8-1) to meet the peak runoff attenuation criteria of Standard 2 (Chapter 4)

BMP Selection Process



Step 2: Review Infiltration BMPs (e.g., dry wells, infiltration trench, permeable pavement, bioretention, treebox filters, swales, etc.)

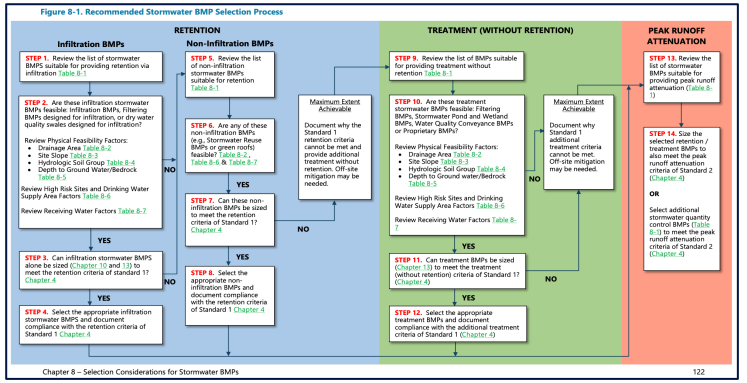
Step 3: Will infiltration practices work based on drainage area, slope, soils, depth to groundwater, etc.?

Step 4: If yes, determine if can be used to meet **WQV** retention standard fully or at least partially

Step 5: Select the infiltration practice

Step 6: If infiltration practices won't work or won't meet completely, THEN consider non-infiltrating BMPs (green roofs, rain barrels/cisterns)

BMP Selection Process



Step 7: Determine if non-infiltrating BMPs are feasible

Step 8: Can non-infiltrating BMPs meet **WQV** (standard 1)?

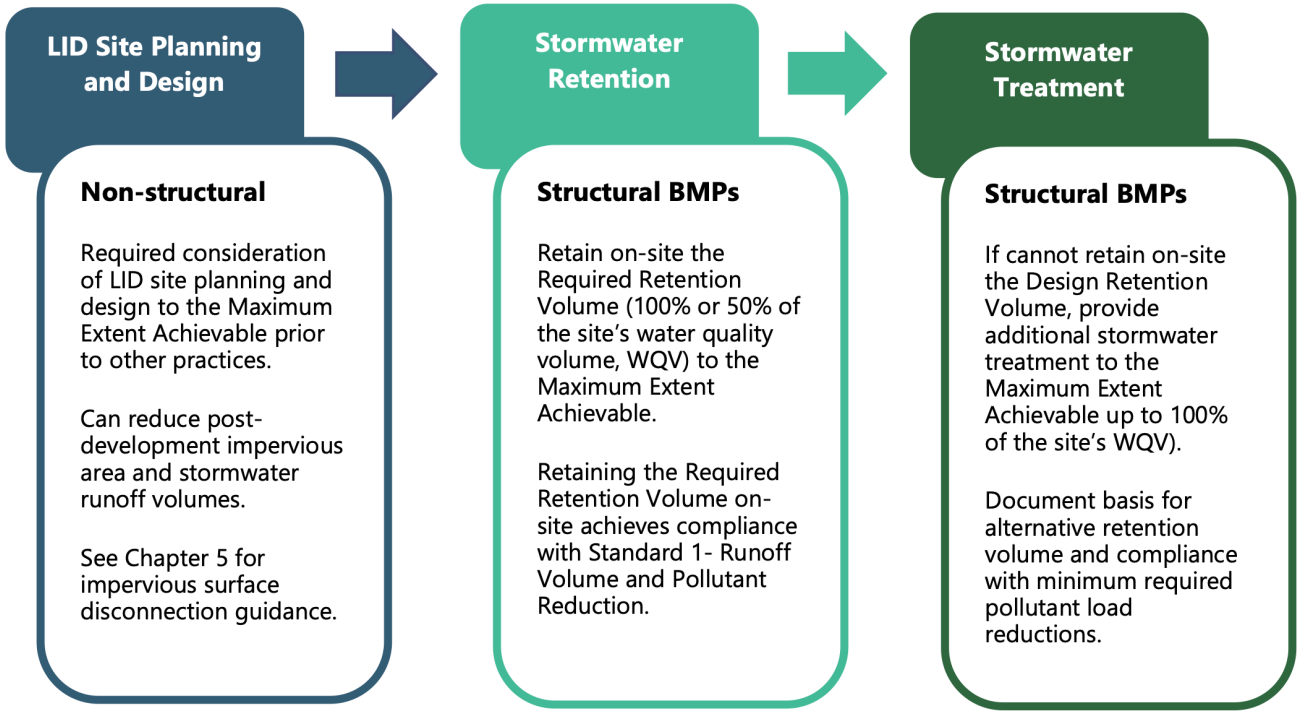
Step 9: If Yes, Select non-infiltrating BMPs and document compliance.

Step 10-12: If you can't full meet standard 1 with infiltrating and non-infiltrating BMPs, consider treatment practices without retention.

Step 13-14: Size BMPs to also meet **peak runoff attenuation** (standard 2)

BMP Selection Process – in Sum

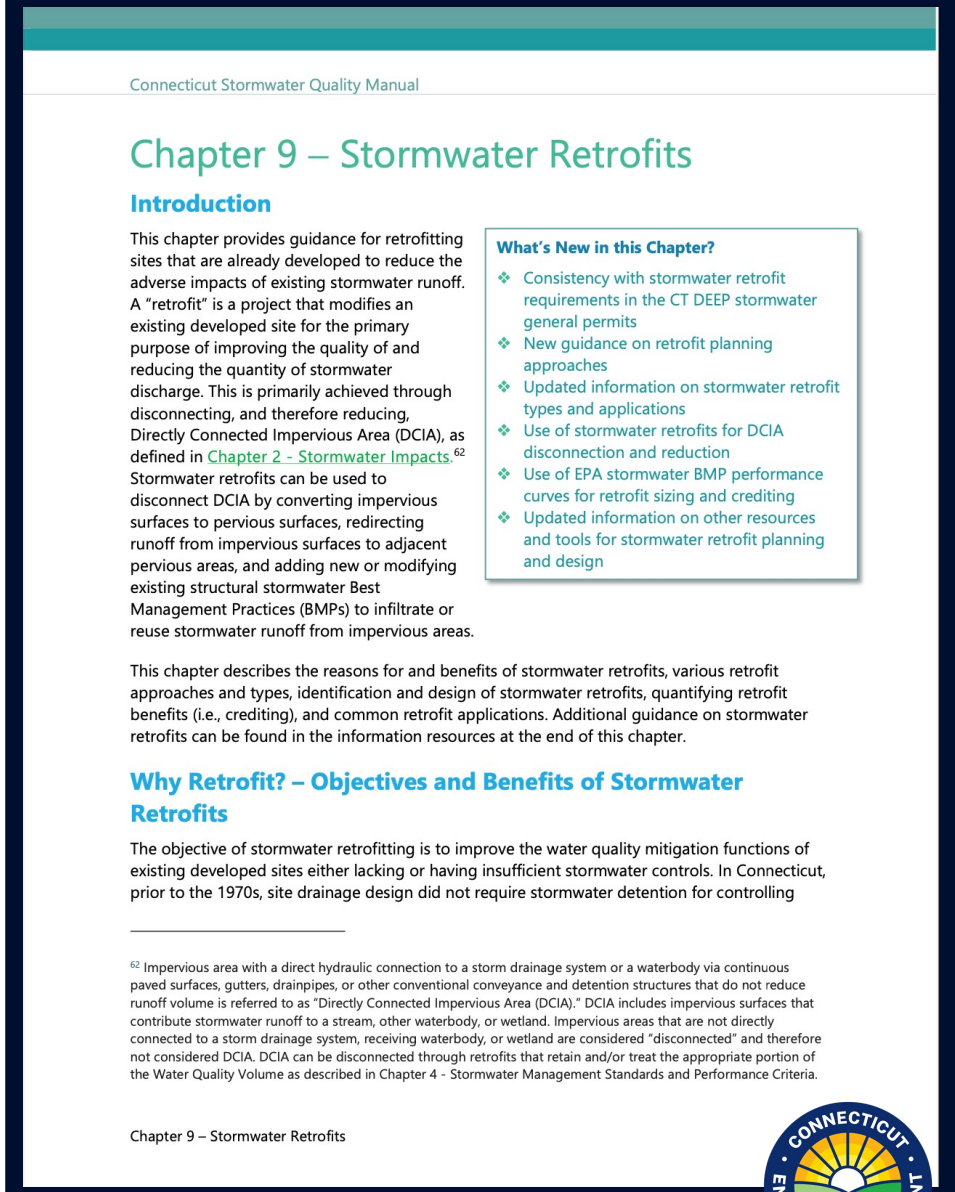
1. Consider & use **non- structural LID** design practices,
2. Consider & use **infiltration** practices
3. Consider & use non-infiltrating **retention** practices
4. If you can't meet required retention volume, consider & use **treatment** practices
5. Size for Peak Retention Standard



Ch. 9: Stormwater Retrofits

- **Purpose / Overview**
  - Guidance for MS4 Permit disconnection requirements
  - Techniques for retrofitting existing developed sites
  - Conditions for which stormwater retrofits are appropriate

- **How to apply it**
  - Disconnection planning guidance
  - Guidance and clarification for retention standards for re- and new development
    - Clarification of what is considered 'disconnected'



Connecticut Stormwater Quality Manual

Chapter 9 – Stormwater Retrofits

Introduction

This chapter provides guidance for retrofitting sites that are already developed to reduce the adverse impacts of existing stormwater runoff. A "retrofit" is a project that modifies an existing developed site for the primary purpose of improving the quality of and reducing the quantity of stormwater discharge. This is primarily achieved through disconnecting, and therefore reducing, Directly Connected Impervious Area (DCIA), as defined in Chapter 2 - Stormwater Impacts.[62] Stormwater retrofits can be used to disconnect DCIA by converting impervious surfaces to pervious surfaces, redirecting runoff from impervious surfaces to adjacent pervious areas, and adding new or modifying existing structural stormwater Best Management Practices (BMPs) to infiltrate or reuse stormwater runoff from impervious areas.

What's New in this Chapter?

- Consistency with stormwater retrofit requirements in the CT DEEP stormwater general permits
- New guidance on retrofit planning approaches
- Updated information on stormwater retrofit types and applications
- Use of stormwater retrofits for DCIA disconnection and reduction
- Use of EPA stormwater BMP performance curves for retrofit sizing and crediting
- Updated information on other resources and tools for stormwater retrofit planning and design

This chapter describes the reasons for and benefits of stormwater retrofits, various retrofit approaches and types, identification and design of stormwater retrofits, quantifying retrofit benefits (i.e., crediting), and common retrofit applications. Additional guidance on stormwater retrofits can be found in the information resources at the end of this chapter.

Why Retrofit? – Objectives and Benefits of Stormwater Retrofits

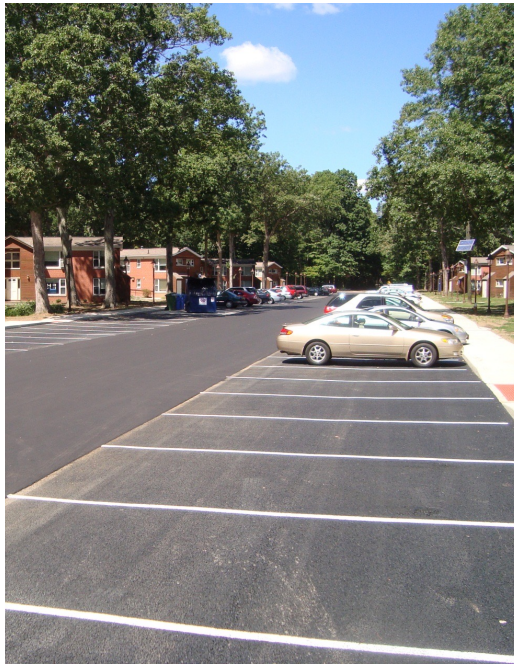
The objective of stormwater retrofitting is to improve the water quality mitigation functions of existing developed sites either lacking or having insufficient stormwater controls. In Connecticut, prior to the 1970s, site drainage design did not require stormwater detention for controlling

[62] Impervious area with a direct hydraulic connection to a storm drainage system or a waterbody via continuous paved surfaces, gutters, drainpipes, or other conventional conveyance and detention structures that do not reduce runoff volume is referred to as "Directly Connected Impervious Area (DCIA)." DCIA includes impervious surfaces that contribute stormwater runoff to a stream, other waterbody, or wetland. Impervious areas that are not directly connected to a storm drainage system, receiving waterbody, or wetland are considered "disconnected" and therefore not considered DCIA. DCIA can be disconnected through retrofits that retain and/or treat the appropriate portion of the Water Quality Volume as described in Chapter 4 - Stormwater Management Standards and Performance Criteria.

Chapter 9 – Stormwater Retrofits

Retrofit strategies

Impervious area Disconnection (simple)

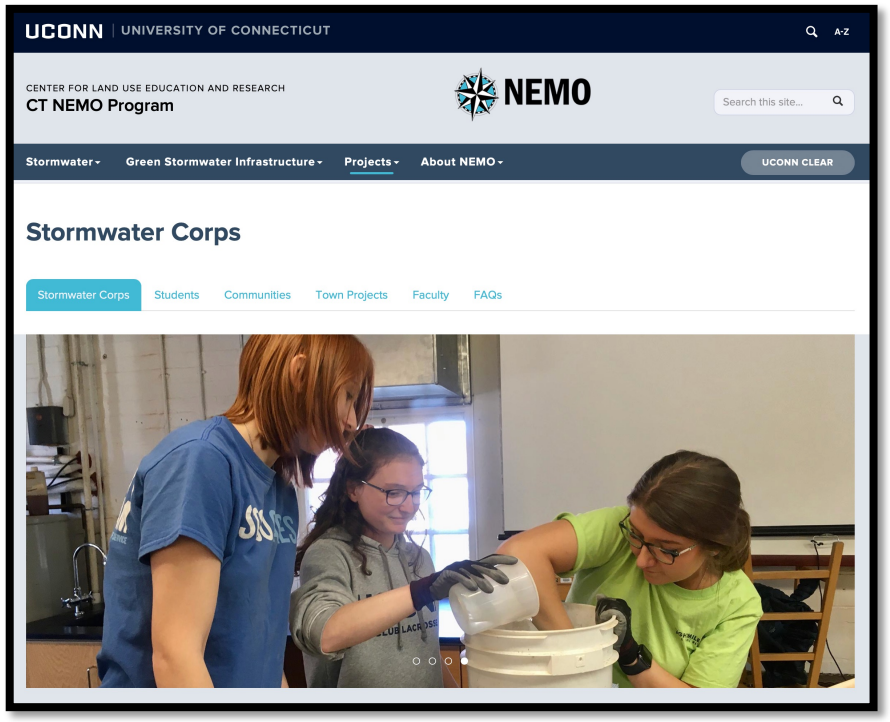


Impervious area conversion

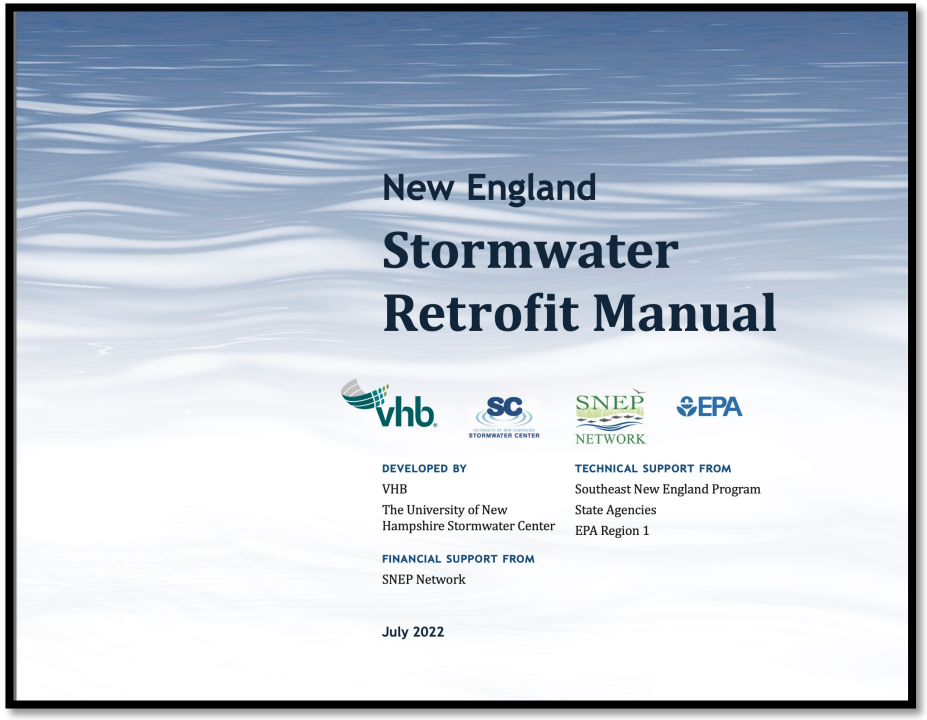
New Structural BMPs

Modified Structural BMPs

More help for LID retrofits



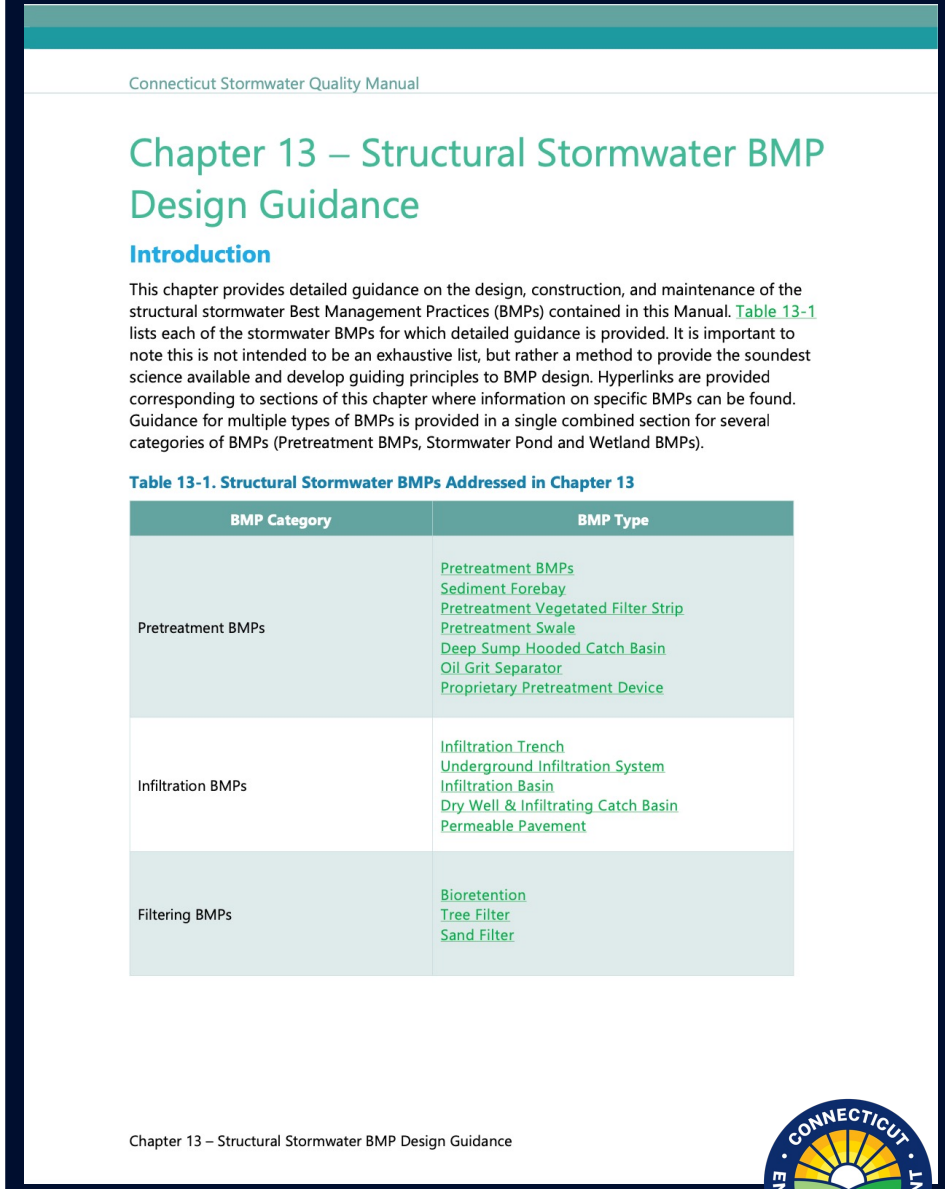
https://nemo.uconn.edu/stormwater-corps/



https://snepnetwork.org/stormwater-retrofit-manual/

Ch. 13: Structural Stormwater BMP Design Guidance

- **Purpose / Overview**
  - Detailed technical design guidance for each of the structural stormwater BMPs
  - Guidance on the selection, design, construction, and maintenance
  - Advantages & limitations
  - Drawings & photos
- **How to apply it**
  - Technical design, construction and maintenance of individual stormwater BMPs



Connecticut Stormwater Quality Manual

Chapter 13 – Structural Stormwater BMP Design Guidance

Introduction

This chapter provides detailed guidance on the design, construction, and maintenance of the structural stormwater Best Management Practices (BMPs) contained in this Manual. Table 13-1 lists each of the stormwater BMPs for which detailed guidance is provided. It is important to note this is not intended to be an exhaustive list, but rather a method to provide the soundest science available and develop guiding principles to BMP design. Hyperlinks are provided corresponding to sections of this chapter where information on specific BMPs can be found. Guidance for multiple types of BMPs is provided in a single combined section for several categories of BMPs (Pretreatment BMPs, Stormwater Pond and Wetland BMPs).

Table 13-1. Structural Stormwater BMPs Addressed in Chapter 13

BMP Category	BMP Type
Pretreatment BMPs	Pretreatment BMPs Sediment Forebay Pretreatment Vegetated Filter Strip Pretreatment Swale Deep Sump Hooded Catch Basin Oil Grit Separator Proprietary Pretreatment Device
Infiltration BMPs	Infiltration Trench Underground Infiltration System Infiltration Basin Dry Well & Infiltrating Catch Basin Permeable Pavement
Filtering BMPs	Bioretention Tree Filter Sand Filter

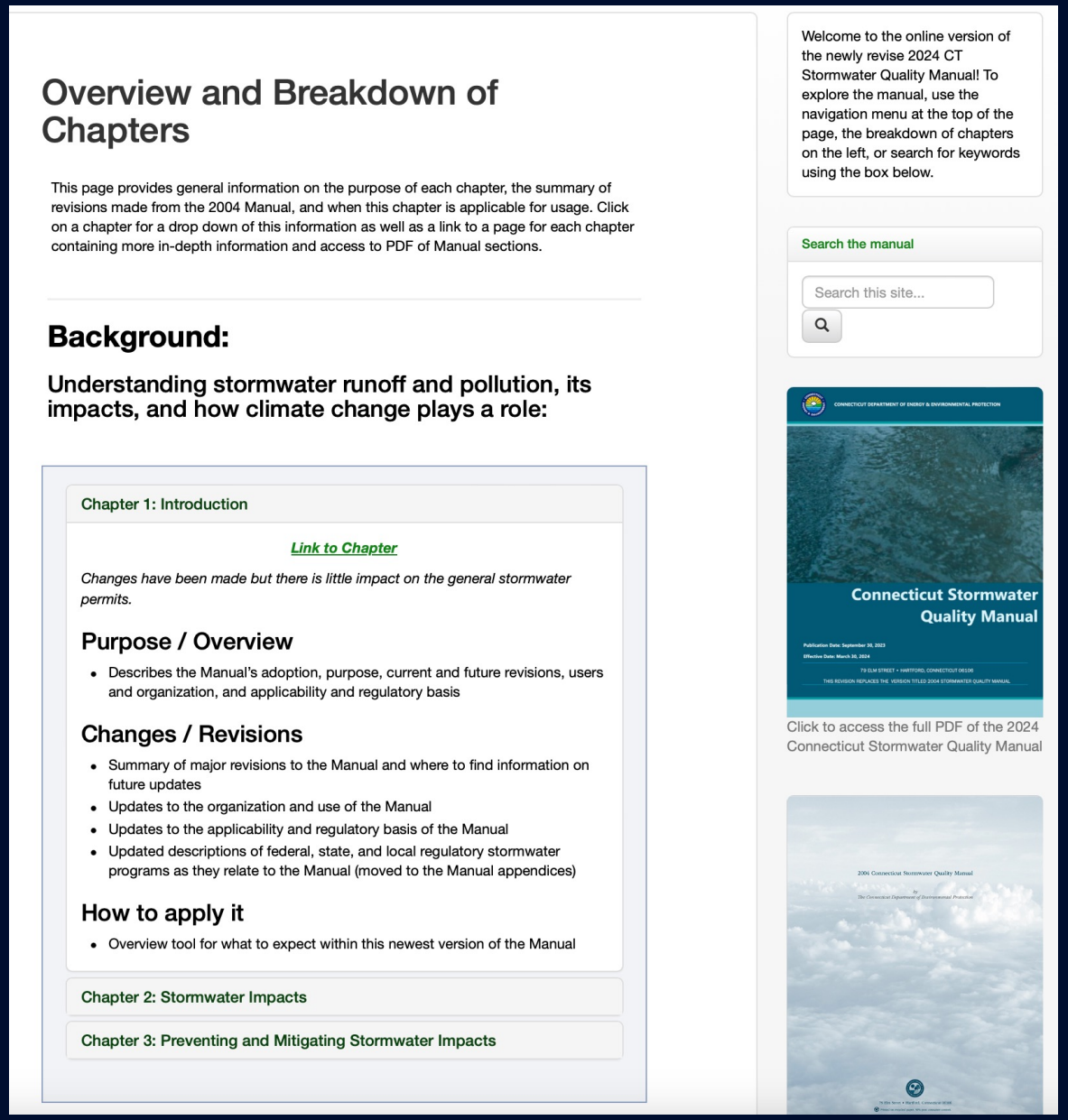
Chapter 13 – Structural Stormwater BMP Design Guidance

Navigating the Manual

Website

- Broken down by chapter and usage
- Breakdown of revisions and impacts

ctstormwatermanual.nemo.uconn.edu

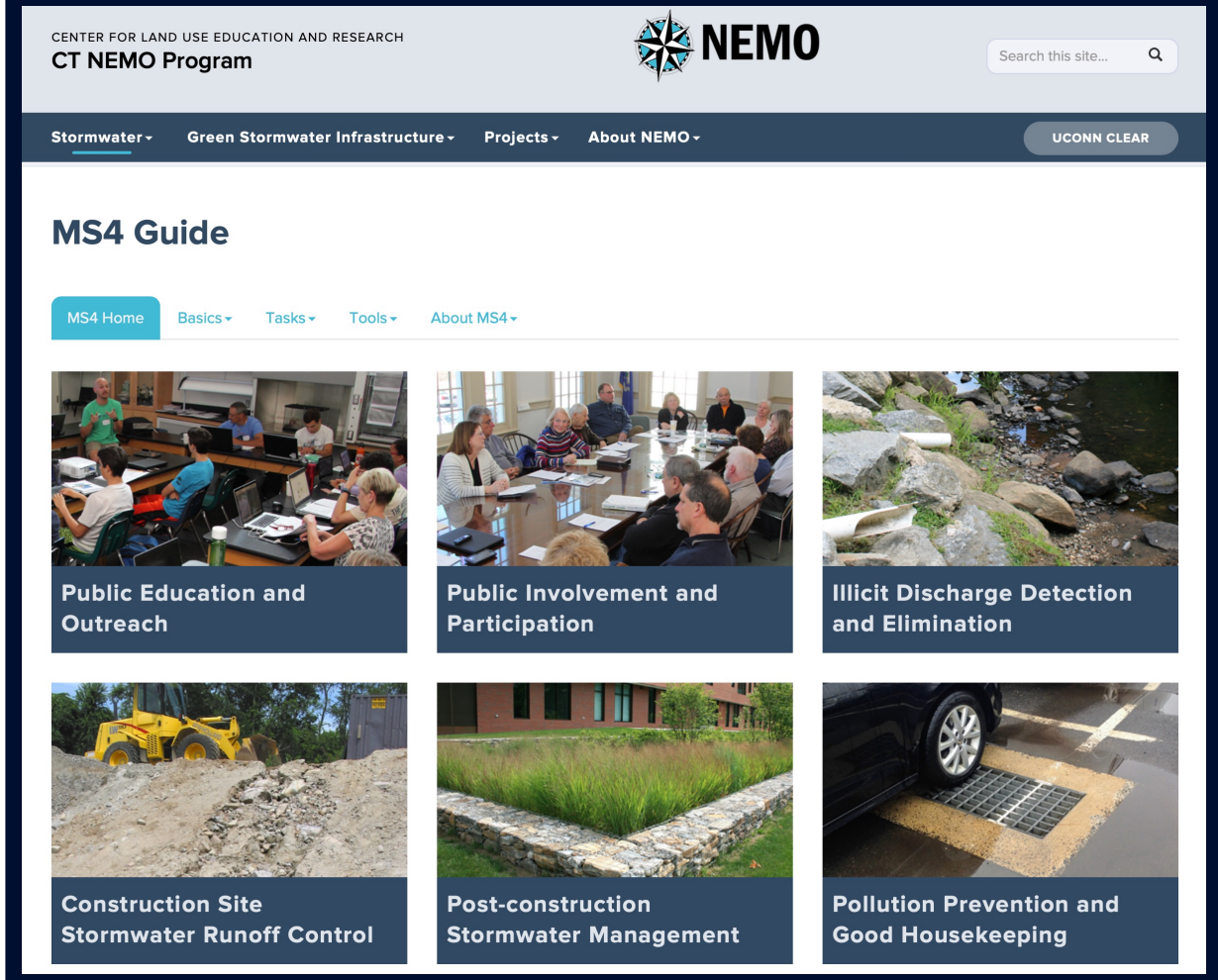


NEMO MS4 Guide

Post Construction Stormwater Management

- Disconnection workshop recordings
- Land use regulation guidance
- LID design templates

https://nemo.uconn.edu/ms4/



What's Coming

- **DEEP MS4 Renewal Listening Session**
  - Information on MS4 planned modifications and feedback from stakeholders
    - Thursday, January 25th, 2024; 10am-12pm

- **On the way: CLEAR Webinar 3 – What's Up and Coming in MS4 Land**
  - Lessons learned from the MS4 permit, the Stormwater Manual, and resources to assist with all things stormwater

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Let the questions begin!