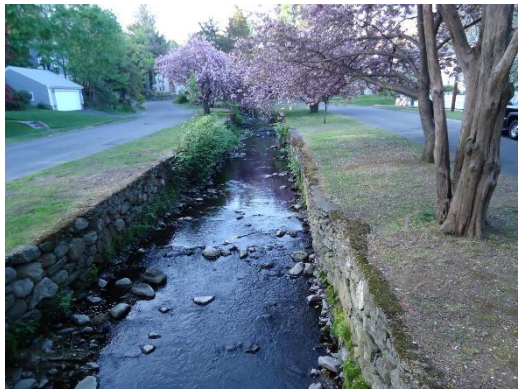
General Design Criteria

Design Storm Frequency

- **All drainage systems shall be designed for Type III, 24-hour storm events**

Facility	South of Merritt Parkway	North of Merritt Parkway
Local Streets and Parking Lots	25-Year	10-Year
Collector and Major Roads	25-Year	25-Year
Watercourse Channels	50-Year	50-Year
Major Culverts	50-Year	50-Year
Bridges	100-Year	100-Year



Design Storm Rainfall Amounts

NOAA's National Weather Service
Hydrometeorological Design Studies Center
Precipitation Frequency Data Server (PFDS)

Home | Site Map | News | Organization | Search | NWS

General Information
Homepage
Progress Reports
FAQ
Glossary

Precipitation Frequency
Data Server
GIS Grids
Maps
Time Series
Temporals
Documents

Probable Maximum Precipitation
Documents

Miscellaneous
Publications
Storm Analysis
Record Precipitation

Contact Us
Inquiries

USA.gov

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CT

Data description

Data type: Precipitation depth | Units: English | Time series type: Partial duration

Select location

1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station (list of CT stations): Select station

2) Us

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.365 (0.281-0.465)	0.425 (0.327-0.542)	0.524 (0.402-0.671)	0.605 (0.462-0.779)	0.718 (0.531-0.954)	0.803 (0.582-1.09)	0.891 (0.628-1.24)	0.987 (0.663-1.40)	1.12 (0.726-1.64)	1.23 (0.778-1.83)
10-min	0.517 (0.398-0.659)	0.602 (0.463-0.768)	0.741 (0.569-0.948)	0.857 (0.654-1.10)	1.02 (0.752-1.35)	1.14 (0.825-1.54)	1.26 (0.889-1.76)	1.40 (0.940-1.99)	1.59 (1.03-2.33)	1.74 (1.10-2.59)
15-min	0.608 (0.468-0.775)	0.708 (0.545-0.904)	0.872 (0.669-1.12)	1.01 (0.770-1.30)	1.20 (0.885-1.59)	1.34 (0.970-1.81)	1.49 (1.05-2.07)	1.65 (1.11-2.34)	1.87 (1.21-2.74)	2.05 (1.30-3.05)
30-min	0.850 (0.655-1.08)	0.992 (0.763-1.26)	1.22 (0.938-1.57)	1.42 (1.08-1.82)	1.68 (1.24-2.23)	1.88 (1.36-2.54)	2.09 (1.47-2.90)	2.31 (1.55-3.28)	2.61 (1.69-3.82)	2.85 (1.80-4.24)
60-min	1.09 (0.841-1.39)	1.27 (0.981-1.63)	1.57 (1.21-2.01)	1.82 (1.39-2.34)	2.16 (1.60-2.87)	2.42 (1.75-3.27)	2.69 (1.89-3.73)	2.97 (1.99-4.22)	3.35 (2.17-4.90)	3.64 (2.31-5.43)
2-hr	1.42 (1.10-1.79)	1.67 (1.29-2.11)	2.07 (1.60-2.64)	2.41 (1.85-3.08)	2.88 (2.14-3.81)	3.24 (2.36-4.35)	3.60 (2.55-4.98)	4.00 (2.70-5.65)	4.55 (2.96-6.62)	4.99 (3.17-7.39)
3-hr	1.63 (1.27-2.06)	1.93 (1.50-2.44)	2.42 (1.87-3.06)	2.82 (2.17-3.59)	3.37 (2.52-4.45)	3.79 (2.78-5.09)	4.23 (3.01-5.84)	4.71 (3.18-6.63)	5.39 (3.51-7.81)	5.94 (3.78-8.75)
6-hr	2.06 (1.61-2.58)	2.44 (1.91-3.07)	3.08 (2.40-3.88)	3.61 (2.80-4.56)	4.34 (3.26-5.69)	4.88 (3.60-6.52)	5.46 (3.91-7.51)	6.11 (4.14-8.54)	7.03 (4.59-10.1)	7.80 (4.97-11.4)
12-hr	2.53 (1.99-3.15)	3.03 (2.38-3.77)	3.84 (3.01-4.80)	4.51 (3.52-5.66)	5.44 (4.11-7.09)	6.13 (4.54-8.14)	6.86 (4.95-9.41)	7.71 (5.25-10.7)	8.93 (5.85-12.8)	9.95 (6.37-14.5)
24-hr	2.96 (2.35-3.66)	3.58 (2.84-4.43)	4.60 (3.63-5.71)	5.44 (4.27-6.79)	6.60 (5.02-8.57)	7.47 (5.57-9.87)	8.39 (6.09-11.5)	9.48 (6.47-13.1)	11.1 (7.29-15.8)	12.5 (7.99-18.0)
2-day	3.31 (2.64-4.06)	4.07 (3.24-5.00)	5.31 (4.22-6.55)	6.34 (5.01-7.86)	7.76 (5.95-10.0)	8.82 (6.63-11.6)	9.95 (7.29-13.6)	11.3 (7.76-15.5)	13.4 (8.84-18.9)	15.2 (9.78-21.8)
3-day	3.57 (2.86-4.37)	4.40 (3.53-5.40)	5.77 (4.60-7.09)	6.90 (5.47-8.51)	8.45 (6.50-10.9)	9.60 (7.24-12.6)	10.8 (7.97-14.8)	12.4 (8.49-16.9)	14.7 (9.67-20.6)	16.6 (10.7-23.8)

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Hydrologic Design Criteria

USDA

United States Department of Agriculture

Natural Resources Conservation Service

Conservation Engineering Division

Technical Release 55

June 1986

Urban Hydrology for Small Watersheds

TR-55

2000 DRAINAGE MANUAL

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Flood Hazard Areas

- Limits of 100-year flood zone boundaries depicted on plans and subject to verification by licensed surveyor
- Connecticut Coastal Jurisdiction Line elevation (5.5 feet NAVD 88) to be used for stormwater design in tidally influenced areas

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Design of Drainage Facilities

Design of Drainage Facilities

- Chapter builds upon current City standards and details
- If no specific criteria is provided, conform to DOT Drainage Manual
- Written approval from Engineering Bureau for alternative design criteria

Catchments

Manholes

Storm Sewers

Culverts

Drainage Channels

Outlets

Bridges

Storage Facilities

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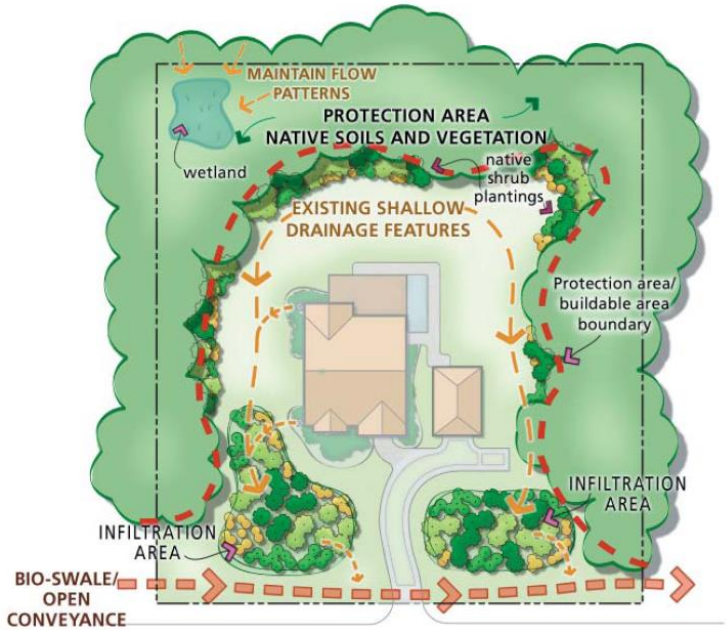
Stormwater Treatment Practices

Non-Structural vs. Structural

Non-Structural Practices

- Manage runoff at source and do not require construction of a facility or device
- Reduce stormwater treatment requirement (WQV)
- CTDEEP Low Impact Development Appendix



Structural Practices

- Constructed facility or device, various types, uses, and functions
- Require regular inspections and maintenance
- CTDEEP Stormwater Quality Manual and Appendix B

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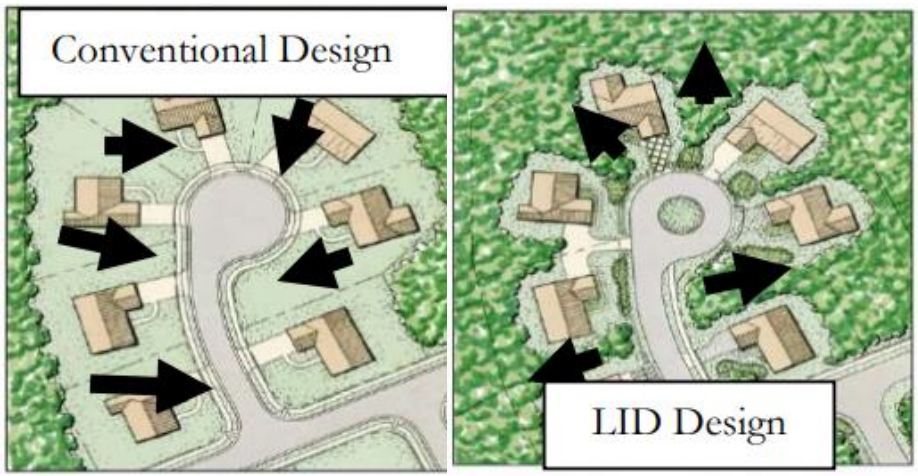
Non-Structural Practices

Types

- Limit clearing and grading and preserving natural areas
- Protecting riparian buffers
- Minimizing soil compaction
- Avoiding disturbance on steep slopes
- Reducing impervious surfaces
- Disconnecting stormwater and directing to vegetated areas



Benefits

- Reduces land clearing and grading costs
- Potentially reduces infrastructure costs (streets, curbs, gutters, sidewalks)
- Reduces stormwater management costs
- Potentially increases lot yields
- Improves site aesthetics
- Potentially increases property values
- Preserves integrity of ecological and biological systems
- Protects and preserves trees and natural vegetation

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Structural Practices - Types

Pretreatment BMPs

- Deep sump catch basins
- Oil grit separators
- Sediment forebays
- Vegetated filter strips

Filtration BMPs

- Bioretention, rain gardens, tree filters, curb extensions
- Sand filters, organic filters
- Dry detention basin, wet detention basin, constructed wetlands, gravel wetland

Conveyance BMPs

- Grass channels, wet water quality swales, dry water quality swales

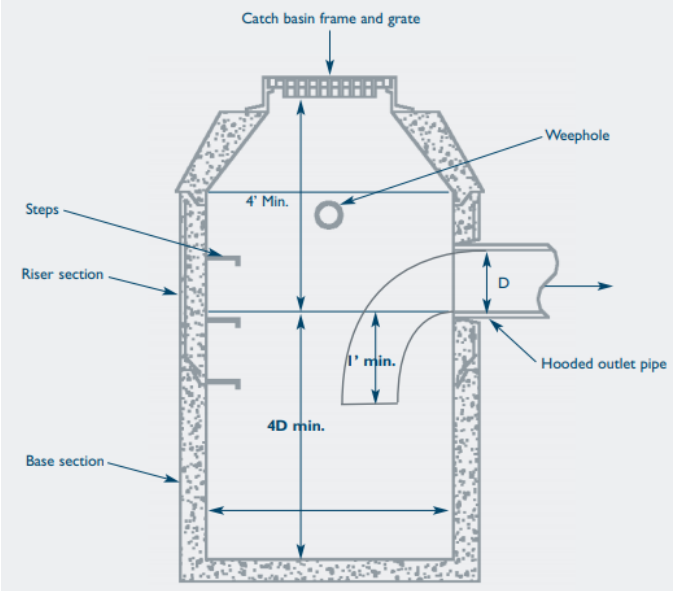
Infiltration BMPs

- Dry wells, leaching catch basins
- Surface infiltration basin, infiltration swale, infiltration trench
- Subsurface infiltration
- Filtration BMPs designed for infiltration, permeable pavement designed for infiltration

Other BMPs & Accessories

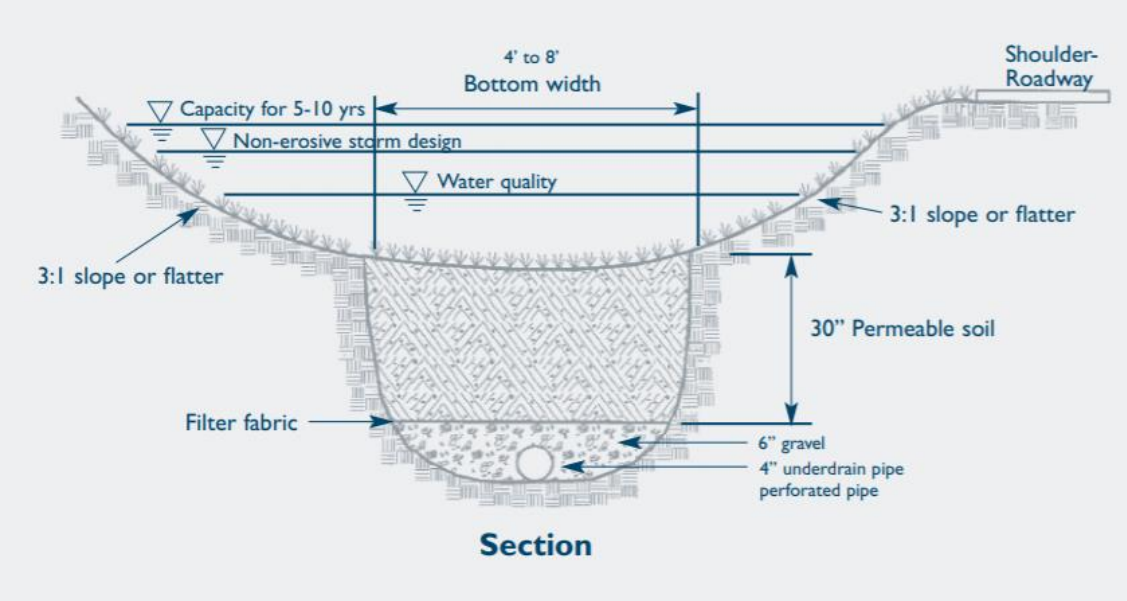
Proprietary BMPs

Pretreatment



Filtration BMPs

Conveyance BMPs



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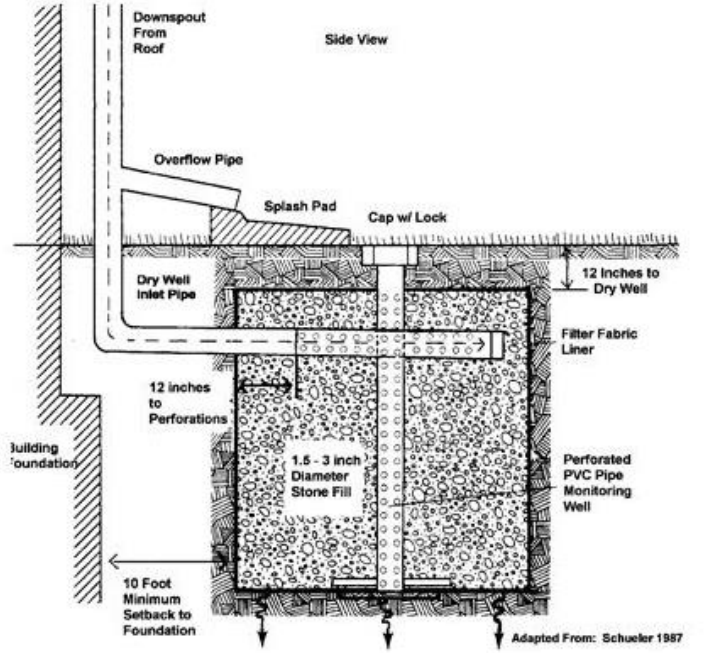
Infiltration BMPs



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Other BMPs and Accessories

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Proprietary BMPs

- **Must have verified 80% TSS removal through a state verification program**
  - **Technology Acceptance Reciprocity Program (TARP)**
  - **Washington State Technology Assessment Protocol Ecology (TAPE)**
  - **New Jersey, Massachusetts, EPA**

Designing Infiltration BMPs

- Primary structural practices to meet retention requirements. Must follow key design criteria:
  - Soil infiltration rate > 0.2 in/hr based on soil evaluation
  - Cannot infiltrate into construction debris materials
  - Maximum 72 hour drawdown time
  - Minimum 12 inch (prefer 24 inches) separation to SHGW and bedrock
  - Additional requirements from higher pollutant load areas
  - Adequate pretreatment decreases maintenance and increases facility lifespan
- Infiltration BMPs shall be sized in accordance with "static" method, no exfiltration in model

Soil Evaluation

HSG A & B Soils

- NRCS soil textural analysis
- At layer where infiltration is proposed
- Use lowest value and don't composite samples

HSG C&D Soils

- Field infiltration testing required
- Septic percolation testing is not acceptable
- Use lowest value reduced by factor of 2

Table 5-1. Default Infiltration Rates for HSG A and B Soils

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	Field Testing Required
Sandy Clay Loam	C	Field Testing Required

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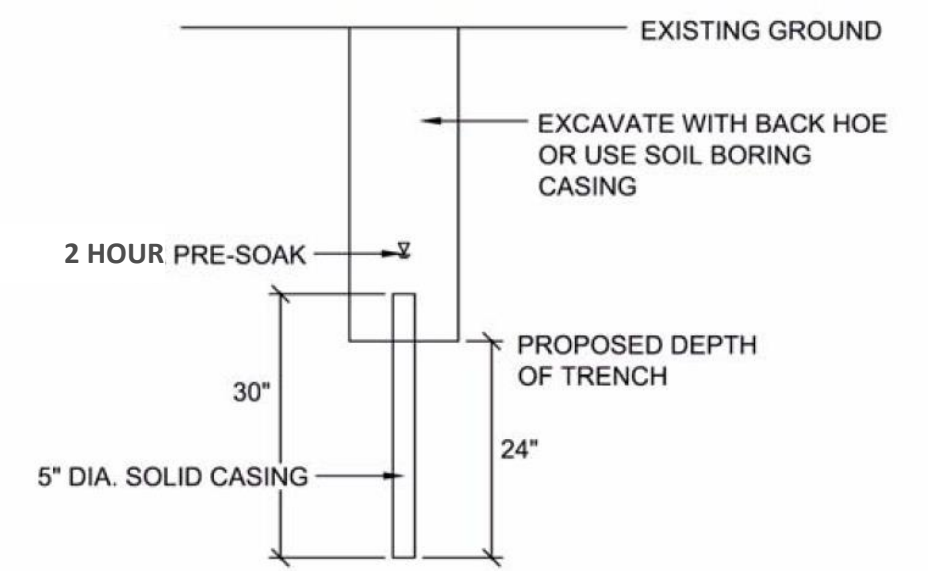
Field Infiltration Testing

Turf-Tec Infiltrometer Method

Borehole Infiltration Test



Design References

Structural Stormwater BMP Design References

Stormwater BMP	Design References
Vegetated Filter Strips  Source: Minnesota Stormwater Manual	**Primary Reference:** • Connecticut Stormwater Quality Manual (Vegetated Filter Strips/Level Spreaders) **Additional Information Sources** • Massachusetts Stormwater Handbook • Rhode Island Stormwater Design and Installation Standards Manual • Michigan LID Manual
Treatment BMPs	
Bioretention - Rain Gardens, Tree Filters, Stormwater Planters/Bioswales, and Curb Extensions  Source: Montgomery County Maryland DEP  Source: National Association of City Transportation Officals	**Primary Reference** • Connecticut Stormwater Quality Manual **Additional Information Sources:** • UNH Stormwater Center, Bioretention Soil Specifications • City of New Haven Bioswale Construction Standard Details • Niantic Treewell Detail, Town of East Lyme • Plainville, CT Low Impact Development and Stormwater Management Design Manual • Rhode Island Stormwater Design and Installation Standards Manual • New Hampshire Stormwater Management Manual (Tree Box Filters) • Minnesota Stormwater Manual

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Submittal Requirements

General Submittal Requirements

- All projects subject to Stormwater Management Standards must submit a stormwater management report for review and approval
- All submittals require:
  - Complete checklists
  - Existing conditions & construction plans
  - Report narrative & signed certification
  - Supporting calculations
  - Supporting mapping
  - DCIA tracking worksheet
  - Erosion and sediment control plan
  - Supporting documentation (Section 6.3)

“Lite” vs “Full” Stormwater Management Reports

“Lite” Stormwater Management Report

- Demonstrate compliance with Standards 2-5

Checklist for Stormwater Management Report

I. Project Report

A. Applicant / Site Information

	Applicant name, legal address, contact information (email & phone)
	Engineers name, legal address, contact information (email & phone)
	Site address and legal description
	Current / proposed zoning and land use
	Site vicinity map (8.5” x 11”)

B. Project Description and Purpose

	Project description including proposed project elements and anticipated construction schedule

C. Existing Conditions Description

	Site area, ground cover, vegetation, features (roads, buildings, utilities, etc.)
	Site topography, slopes, drainage patterns, conveyances systems (swales, storm drains, etc.), stormwater discharge locations
	Receiving waterbody information including stormwater impairments and TMDL information (See the most recent State of Connecticut Integrated Water Quality Report)
	Site soils information including soil types, hydrologic soil group, bedrock / outcroppings, groundwater elevation, significant geologic features
	Provide NRCS Soils Mapping
	Resource protection areas (wetlands, streams, lakes, etc.), buffers, floodplains, floodways

D. Summary of Applicable General Design Criteria

	Methodology, design storm frequency
	Hydrologic design criteria
	Hydraulic design criteria
	Flood hazard areas

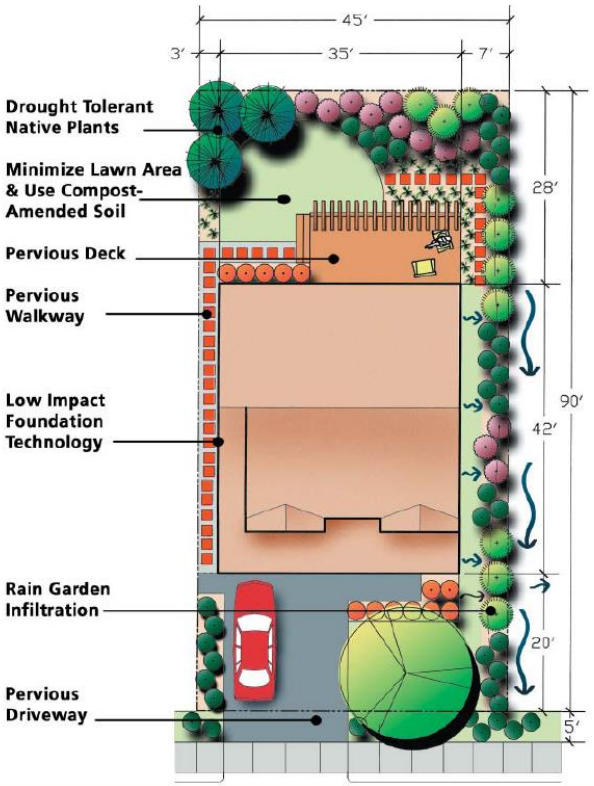
	Applying under “Lite” Stormwater Management: Skip to Section I (Refer to Flow Chart on page vii of the City of Stamford Stormwater Drainage Manual)

E. Project Type in Accordance with Standard 1 Definitions

	Area of disturbance, receiving waterbody classification (High Quality, Tidal Wetlands, Direct Waterfront)
	Project type (development, redevelopment, linear development)
	Pollutant reduction standard per flowchart Section 2.4

“Full” Stormwater Management Report

- Demonstrate compliance with Standards 1-5



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“Full” Stormwater Management Report

- Additional documentation of LID site constraints and opportunities
- Supporting calculations for retention / treatment, BMP design criteria, and BMP hydraulics
- Post-Development LID Review Map to provide documentation of assertions made in narrative

Post LID Review Map

TOTAL SITE AREA	XX	DISTURBED AREA	XX
PRE-DEVELOPMENT IMPERVIOUS	XX	POST-DEVELOPMENT IMPERVIOUS	XX
REQUIRED RETENTION / TREATMENT VOLUME	XX	PROVIDED RETENTION / TREATMENT VOLUME	XX
POST-DEVELOPMENT SCS	XX	POST-DEVELOPMENT SCS	XX
DIFFERENCE IN SCS		XX	

No.	DATE	DESCRIPTION	XX/XX DESIGNER	XX REVIEWER
1.				

SEAL | SEAL

SCALE: HORZ: NOT TO SCALE VERT:
DATUM: HORZ: VERT:
GRAPHIC SCALE

CITY OF STAMFORD
MODEL LID REVIEW SHEET
STORMWATER DRAINAGE MANUAL
STAMFORD CONNECTICUT

PROJ. No.
DATE

FIG. X

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DCIA Tracking

- Required as part of MS4 permit
- Submit with stormwater management report and final certifications
- Worksheet follows Manual flowcharts
- Must be signed and sealed by CT PE

Directly Connected Impervious Area Tracking Worksheet
City of Stamford Drainage Manual

Note to user: complete all cells of this color *only*

Part 1: General Information

Project Name	
Project Address	
Project Applicant	
Date of Submittal	
Tax Account Number	

Part 2: Project Details

1. What type of development is this? (choose from dropdown)		
2. What is the total area of the project site?		ft^2
3. What is the total area of land disturbance for this project?		ft^2
4. Does project site drain to High Quality Waters, a Direct Waterfront, or within 500 ft. of Tidal Wetlands? (Yes/No)		
5. What is the pre-development ***DCIA*** for the site?		ft^2
6. Will the proposed development increase ***DCIA*** (without consideration of proposed stormwater management)? (Yes/No)		
7. What is the proposed-development ***total impervious area*** for the site?		ft^2

Part 3: Water Quality Target Total

Does Standard 1 apply based on information above?		
Water Quality Volume (WQV)		ft^3
Standard 1 requirement		
Required treatment/retention volume		ft^3
Provided treatment/retention volume for proposed development		ft^3

Part 4: Proposed DCIA Tracking

Pre-development ***total impervious area***		ft^2
Pre-development ***DCIA***		ft^2
Proposed-development ***total impervious area***		ft^2
Proposed-development ***DCIA*** (after stormwater management)		ft^2
Net change in ***DCIA*** from pre-development to proposed-development		ft^2

Part 5: Post-Development (As-Built Certified) DCIA Tracking

Post-development (per as-built) ***total impervious area***		ft^2
Post-development (per as-built) ***DCIA*** (after stormwater management)		ft^2
Net change in ***DCIA*** from pre-development to post-development		ft^2

Certification Statement

I hereby certify that the information contained in this worksheet is true and correct.

Engineer's Signature _____ Date _____ Engineer's Seal _____

Worksheet Version 1 July 2019

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