

Chapter 12 – Stormwater Management Plan

Introduction

A Stormwater Management Plan documents how the proposed stormwater management measures meet the stormwater management standards, performance criteria, and design guidelines contained in this Manual, as well as other local, state, and federal stormwater management requirements.

A Stormwater Management Plan is required as described in [Chapter 4 - Stormwater](#)

[Management Standards and Performance Criteria](#), a Stormwater Management Plan is required (Standard 5 – Stormwater Management Plan) for all new development, redevelopment, retrofits, and other land disturbance activities that require a local, state, or federal permit or approval. A Stormwater Management Plan is not required for retrofit projects that do not require review and approval, although designers are encouraged to document the design basis for all stormwater retrofits following good engineering/design practice. A Stormwater Management Plan should be prepared by the project proponent and designing qualified professional, as defined in the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities and submitted for review by the local or state reviewing authority.

The chapter presents the recommended minimum content for a Stormwater Management Plan. Many municipalities and state agencies have stormwater management submission requirements as specified by municipal land use regulations and state permit programs. The recommended Stormwater Management Plan presented in this chapter is provided as guidance only and does not replace other local and state submission requirements. Municipalities or state agencies may adopt this or similar Stormwater Management Plan requirements into future updates of municipal land use regulations and state permit programs.

Plan Content

A Stormwater Management Plan should include the following major elements:

- Stormwater Management Report (narrative)
- Design Calculations
- Design Drawings (plans)
- Soil Erosion and Sediment Control Plan
- Operation and Maintenance Plan
- Other Supporting Documents

What's New in this Chapter?

- ❖ Updated Stormwater Management Plan content consistent with revised stormwater management standards and performance criteria
- ❖ Updated Stormwater Management Plan Checklist ([Appendix E](#))

[Appendix E](#) contains a checklist that can be used in preparing or reviewing a Stormwater Management Plan.

Stormwater Management Report

The stormwater management report provides a written narrative of the project, including existing and proposed conditions, proposed stormwater management measures, and how the project meets the stormwater management standards and performance criteria contained in this Manual. The stormwater management report should include, but is not limited to, the following sections and information.

General Information

- Applicant's name, address, contact information (email & phone)
- Licensed professional engineer's name, address, contact information (email & phone)
- Street address of project site
- Site locus map
- Current use and zoning of property
- Proposed use of property

Project Summary

- Project description and purpose
- Project schedule and project phasing (if any)
- Applicable local, state, and federal regulatory permits, approvals, and associated regulatory requirements related to post-construction stormwater management
- Applicable regulatory authority(ies)

Existing (Pre-Development) Conditions Description (As Applicable)

- Site area, ground cover, vegetation, existing development features (roads, buildings, utilities, septic systems, etc.)
- Site topography (2-foot contours based on aerial or field survey), slopes, drainage patterns, drainage systems, drainage areas, and stormwater discharge locations
- Existing impervious area and existing Directly Connected Impervious Area (DCIA)
- On-site and adjacent waterbody information⁷⁴
 - Water quality classifications
 - Water quality impairments and Total Maximum Daily Loads (TMDLs)
- Site soils as identified by USDA NRCS mapping or soil scientist
 - Soil types
 - Hydrologic Soil Groups
- Soil evaluation results
 - Initial screening information

⁷⁴ The applicable waterbody information can be found at: [MS4 Map | CT NEMO Program \(uconn.edu\)](#)

- Test pits and soil borings results
- USDA soil textural class
- Depth to bedrock
- Depth to seasonal high groundwater
- Significant subsurface or geologic features
- Field infiltration testing results (if required)
- Other site constraints
 - Site contamination
- On-site and off-site critical resources
 - Inland wetlands and watercourses, tidal wetlands, and associated regulatory setbacks
 - Streams
 - Lakes/ponds
 - Vernal pools
 - Coastal waters including Connecticut Coastal Jurisdiction Line
 - Coldwater streams
 - Drinking water supply areas (wells, Aquifer Protection Areas, public drinking water supplies)
 - Tree canopy
 - Steep slopes (25% and greater)
 - Conservation easement areas
- Locations of 100-year floodplain, floodway, and flood elevations from current FEMA mapping
- Land uses and development adjacent to the site

Proposed (Post-Development) Conditions Description (As Applicable)

- Type of project or activity (new development, redevelopment, linear project, retrofit)
- Proposed ground cover, vegetation, development features (roads, buildings, utilities, septic systems, etc.)
- Proposed drainage area boundaries and design points
- Proposed activities classified as Land Uses with Higher Potential Pollutant Loads (LUHPPLs)
- Proposed impervious area and DCIA
- Proposed area of land disturbance
- Coastal Jurisdiction Line (CJL) for properties fronting coastal, tidal, or navigable waters

Applicable Stormwater Management Standards and Performance Criteria

- Standard 1 – Runoff Volume and Pollutant Reduction
 - LID Site Planning and Design
 - Stormwater Retention and Treatment
- Standard 2 – Stormwater Runoff Quantity Control
 - Design Storm Rainfall Depth and Distribution
 - Peak Runoff Attenuation
 - Conveyance Protection

- Emergency Outlet Sizing

Proposed LID Site Planning and Design Strategies Description

- Avoid Impacts
 - Minimizing Soil Compaction
 - Minimizing Site Disturbance
 - Protecting Sensitive Natural Areas
 - Preserving Vegetated Buffers
 - Avoiding Disturbance of Steep Slopes
 - Siting on Permeable and Erodible Soils
 - Protecting Natural Flow Pathways
 - Conservation and Compact Development
- Reduce Impacts
 - Reducing Impervious Surfaces (Roads, Cul-de-sacs, Sidewalks, Driveways, Buildings, Parking Lots)
 - Preserving Pre-development Time of Concentration
 - Use of Low Maintenance Landscaping
- Manage Impacts at the Source
 - Disconnecting Impervious Surfaces - Impervious Area (Simple) Disconnection
 - Conversion of Impervious Areas to Pervious Areas
 - Source Controls

Proposed Structural Stormwater BMPs

- Description of proposed structural stormwater BMPs and why they were selected
 - Location, size, types by drainage area/design point
 - Design criteria

Summary of Compliance with Stormwater Management Standards and Criteria

Standard 1 – Runoff Volume and Pollutant Reduction (for each design point for Site Development and Redevelopment Projects)⁷⁵

- LID Site Planning and Design
 - LID Site Planning and Design Opportunities and Constraints Plan
 - Completed LID Site Planning and Design Checklist
 - Total LID Site Planning and Design credits and DCIA reduction

⁷⁵ Per the CTDOT MS4 Permit, linear projects have alternative standards and may take an alternative approach to address constraints that are different than those that affect traditional parcel development projects. These alternative linear project standards can be found in the CTDOT drainage manual, the CTDOT MS4 General Permit, the General Construction Permit and in the supporting materials that CTDOT has developed.

- Stormwater Retention and Treatment
 - Impervious area and Directly Connected Impervious Area (DCIA)
 - Retention and Treatment Required
 - Water Quality Volume and Water Quality Flow
 - Required Retention Volume
 - Retention and Treatment Provided including Maximum Extent Achievable Documentation, as applicable
 - Explanation of site limitations
 - Description of the stormwater retention practices implemented
 - Explanation of why this constitutes the Maximum Extent Achievable
 - Alternate retention volume
 - Description of measures used to provide additional stormwater treatment without retention
 - Use of EPA stormwater BMP performance curves to demonstrate compliance with required average annual pollutant load reductions

Standard 2 – Stormwater Runoff Quantity Control for Site Development and Redevelopment Projects (for each design point)⁷⁶

- Design Storm Rainfall Depth and Distribution
- Comparison of pre- and post-development
 - Runoff volume and peak flow rate
 - 2-year, 10-year, and potentially the 25-year and 100-year, 24-hour storms
- Downstream analysis
 - Comparison of pre- and post-development peak flows, velocities, and hydraulic effects at critical downstream locations (stream confluences, culverts, other channel constrictions, and flood-prone areas) to the confluence point where the 10 percent rule applies
- Conveyance Protection
- Emergency Outlet Sizing

Design Calculations

The Stormwater Management Plan should include the following design calculations to demonstrate that the proposed stormwater management measures meet the standards and performance criteria described in [Chapter 4 - Stormwater Management Standards and](#)

⁷⁶ Per the CTDOT MS4 Permit, linear projects have alternative standards and may take an alternative approach to address constraints that are different than those that affect traditional parcel development projects. These alternative linear project standards can be found in the CTDOT drainage manual, the CTDOT MS4 General Permit, the General Construction Permit and in the supporting materials that CTDOT has developed.

[Performance Criteria](#) and are designed in accordance with the guidance contained in this Manual.

- Standard 1 – Runoff Volume and Pollutant Reduction (for each design point)
 - LID Site Planning and Design Credit Calculations
 - Impervious area and Directly Connected Impervious Area (DCIA)
 - Water Quality Volume, Water Quality Flow, and Required Retention Volume
 - Structural Stormwater BMP Sizing Calculations
 - Static and dynamic sizing methods (infiltration systems)
 - Drain time and groundwater mounding analysis (infiltration systems)
 - Required versus provided design volumes
 - Pollutant specific load reductions (BMP performance curves) where Standard 1 cannot be met by retention alone

- Standard 2 – Stormwater Runoff Quantity Control (for each design point)
 - Stormwater Runoff Calculations for Pre-Development and Post-Development (with and without stormwater BMPs) Conditions
 - Design storm depth and duration, recurrence interval, and rainfall distribution
 - Runoff volume and peak flow rate (2-year, 10-year, and potentially the 25-year, 100-year, 24-hour storms)
 - Runoff Curve Number
 - Time of Concentration (and associated flow paths)
 - Routing analysis for proposed stormwater BMPs including drainage routing diagram
 - Conveyance protection (including flow velocity calculations and outlet protection sizing) and emergency outlet sizing calculations
 - Downstream analysis hydrograph routing calculations
 - Storm drain system conveyance calculations

Design Drawings

Design drawings should be prepared by designing qualified professional, as defined in the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. Design drawings should be signed and sealed by the appropriate design professionals (landscape architects and/or professional engineers) responsible for the project design and consistent with their areas of expertise, including LID site planning and design elements and structural stormwater BMPs. The following design drawings should be included with a Stormwater Management Plan.

- Existing (Pre-Development) Conditions Plan
 - Location of existing man-made features on or adjacent to the site, such as roads, buildings, driveways, parking areas, other impervious surfaces, drainage systems, utilities, easements, septic systems, etc.
 - Surveyed locations of property boundaries and easements

- Drainage systems and sanitary sewers should include rim and invert elevations of all structures and sizes and connectivity of all pipes
 - Vegetative communities on the site, including locations of tree canopy
 - Site topography (2-foot contours based on aerial or field survey), slopes, drainage patterns, conveyances systems (swales, storm drains, etc.), drainage area boundaries, flow paths, times of concentration
 - Locations of existing stormwater discharges
 - Areas of steep (25% or greater) slopes
 - Perennial and intermittent streams
 - Inland wetlands and watercourses (and associated regulatory setbacks) as defined by a soil scientist in the field and flags located by a licensed land surveyor
 - Locations of vernal pools
 - Locations of 100-year floodplain, floodway, and flood elevations from current FEMA mapping
 - Locations of soil types as identified by USDA NRCS mapping or soil scientist, test pit and soil boring locations, and field infiltration testing locations
 - Areas of site contamination
 - Location, size, type of existing structural stormwater BMPs and conveyance systems
 - Limits of developable area based on site development constraints
 - Coastal Jurisdiction Line (CJL) for properties fronting coastal, tidal, or navigable waters
- Proposed (Post-Development) Conditions Plan
- Location of proposed man-made features on or adjacent to the site such as roads, buildings, driveways, parking areas, other impervious surfaces, drainage systems, utilities, easements, septic systems, etc.
 - Surveyed locations of property boundaries and easements
 - Drainage systems and sanitary sewers should include rim and invert elevations of all structures and sizes and connectivity of all pipes
 - Vegetative communities on the site, including proposed limits of clearing and disturbance
 - Site topography (2-foot contours based on aerial or field survey), slopes, drainage patterns, conveyances systems (swales, storm drains, etc.), drainage area boundaries, flow paths, times of concentration
 - Locations of proposed stormwater discharges/design points
 - Perennial and intermittent streams
 - Inland wetlands and watercourses (and associated regulatory setbacks) as defined by a soil scientist in the field and flags located by a licensed land surveyor
 - Locations of vernal pools
 - Locations of 100-year floodplain, floodway, and flood elevations from current FEMA mapping

- Locations and results of on-site soil evaluation (test pits/soil borings and field infiltration testing)
 - Areas of site contamination
 - Development envelope and areas of site preserved in natural condition
 - Location, size, type of proposed structural stormwater BMPs and conveyance systems. Structural BMPs should have rim, invert, and contour elevations and pipe sizes and construction material.
 - Locations of soil erosion and sedimentation controls
 - Locations of non-structural source controls
- LID Site Planning and Design Opportunities and Constraints Plan
 - Structural Stormwater BMP Design Details and Notes
 - Coastal Jurisdiction Line (CJL) for properties fronting coastal, tidal, or navigable waters

Soil Erosion and Sediment Control Plan

Consistent with Standard 3 of this Manual, project proponents must develop and implement a Soil Erosion and Sediment Control (SESC) Plan in accordance with local and/or state regulatory requirements, the [Connecticut Guidelines for Soil Erosion and Sediment Control Guidelines](#), as amended (Guidelines), and the requirements of the CTDEEP General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. The SESC Plan should, at a minimum, demonstrate the methods and designs to be utilized during construction and stabilization of the site following completion of construction activity. Erosion and sediment control measures should be included on the plans with sufficient detail to facilitate review of the design by the reviewing authority and proper construction of the measures.

Operation and Maintenance Plan

As required by Standard 4, project proponents must develop and implement a long-term Operation and Maintenance (O&M) Plan, which identifies required inspection and maintenance activities for structural stormwater BMPs. [Chapter 13 - Structural Stormwater BMP Design Guidance](#) of this Manual contains operation and maintenance guidelines and recommendations for each type of stormwater BMP. [Appendix B](#) contains maintenance inspection checklists.

Recommended elements of an O&M Plan include but are not limited to:

- Detailed inspection and maintenance requirements/tasks
- Inspection and maintenance schedules
- Parties legally responsible for maintenance (name, address, and telephone number)
- Provisions for financing of operation and maintenance activities
- As-built plans of completed structures
- Letter of compliance from the designer
- Post-construction documentation to demonstrate compliance with maintenance activities

Operational source control and pollution prevention measures for the site (see [Chapter 6 - Source Control Practices and Pollution Prevention](#)) should also be described in the O&M Plan.

Other Supporting Documents

Other information relevant to the design of the stormwater management measures for a project should be included (or referenced, if appropriate) in the Stormwater Management Plan.

Pertinent information may include but is not limited to:

- Completed Stormwater Management Plan Checklist
- LID Site Planning and Design Checklist (Chapter 5 – Low Impact Development Site Planning and Design Strategies)
- NRCS Soils Mapping
- Soil Evaluation Documentation (Test Pits/Soil Borings and Field Infiltration Testing Results)
- DCIA Tracking Worksheet required by the reviewing authority to satisfy MS4 Permit requirements
- Groundwater impacts for proposed infiltration structures
- Reports on wetlands and other surface waters (including available information such as Maximum Contaminant Levels [MCLs], Total Maximum Daily Loads [TMDLs], 303(d) or 305(b) impaired waters listings, etc.)
- Water quality impacts to receiving waters
- Impacts on biological populations/ecological communities including fish, wildlife (vertebrates and invertebrates), and vegetation, including the [Natural Diversity Database](#) evaluation.
- Flood study/calculations
- Other permits and approvals issued for the project.