

Rhode Island Stormwater Design and Installations Standards Manual

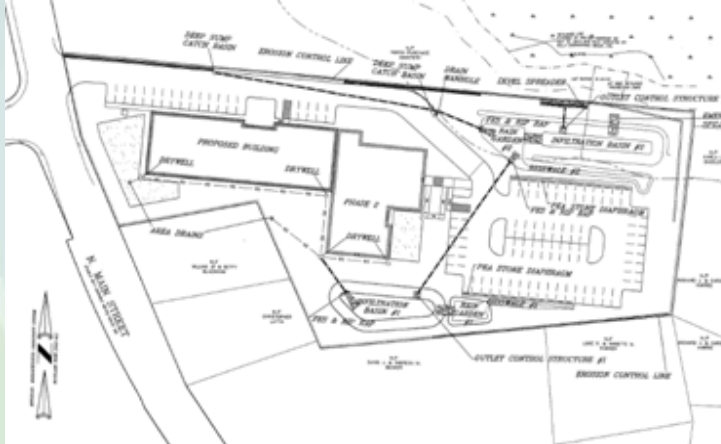


Public Workshop
How to Use the
Revised Manual
January 13, 2011



Who Should Use the Manual?

Designers



Municipal Officials



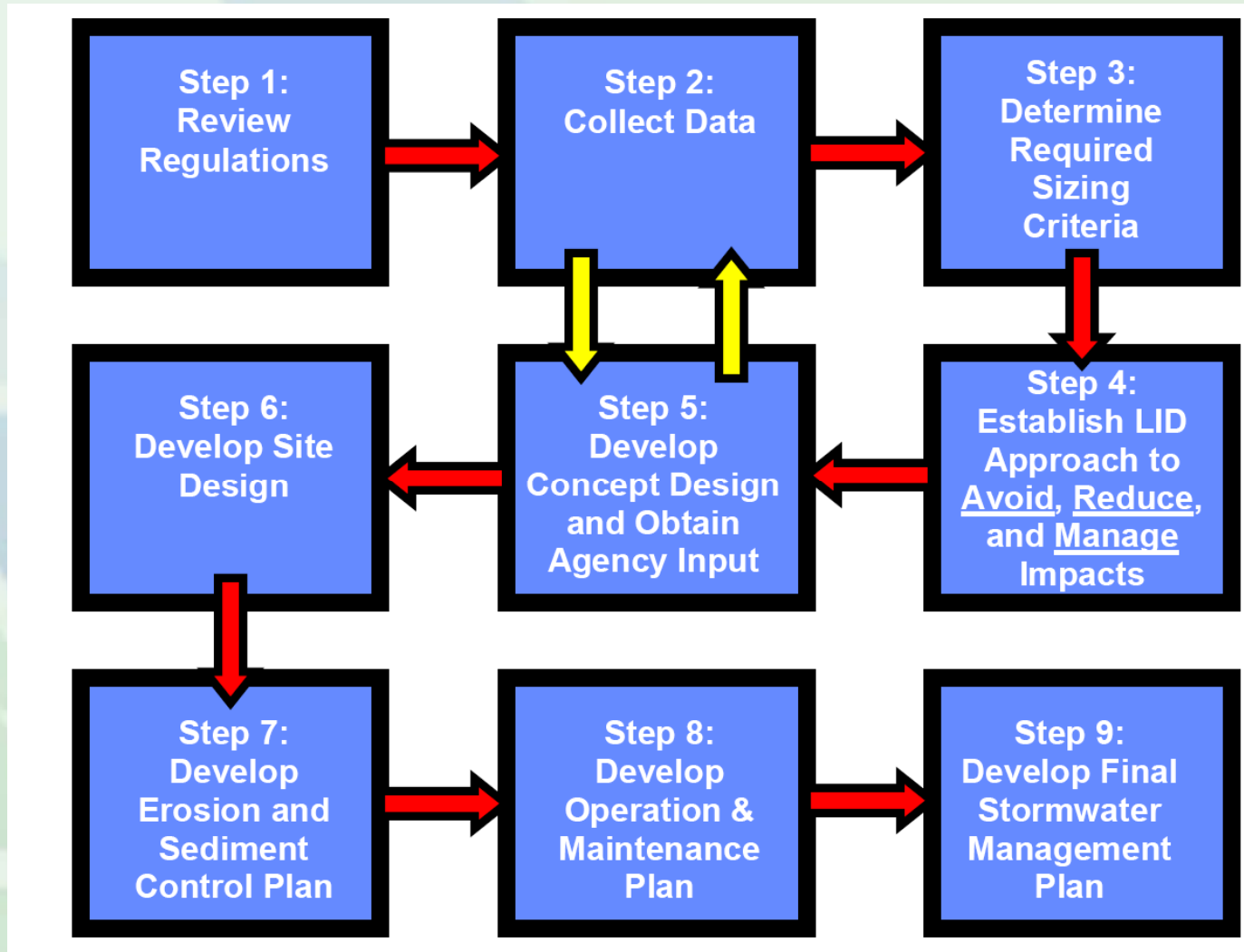
Property Owners



Regulatory Reviewers



Steps to Designing an Approvable Stormwater System



Steps 1 and 2

Step 1: Review Regulations

- What criteria are relevant to your project?
- Other local ordinances to consider?

Step 2: Collect Data

- Topography
- Drainage area delineations
- Soil, groundwater, geologic constraints
- Zoning restrictions



Steps 3 and 4

Step 3:
Determine
Required
Sizing
Criteria

- What volume requirements must be met? (Re_v , WQ_v , CP_v , Q_p)
- What BMPs can be used?

Step 4:
Establish LID
Approach to
Avoid, Reduce,
and Manage
Impacts

- Incorporate LID into your project at the initial design stages, before building layouts are finalized



Steps 5 and 6

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Step 5:
Develop
Concept Design
and Obtain
Agency Input

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Step 6:
Develop Site
Design

- Develop conceptual design
- Coordinate with review agencies
- Collect more data and revise as necessary
- Move forward with a design that meet standards 1-9



Important Sections of the Manual Relevant to Each Standard

- Standard 1 - refer to Chapt. 3.3.1, Chapt. 4, and Appendix A
- Standard 2 - refer to Chapt. 3.3.2, Chapt. 4.6 (SW Credit), Chapt. 5, App. F (specs) and App. H.1 (soil testing)
- Standard 3 - refer to Chapt. 3.3.3, Chapt. 4.6 (SW Credit), Chapt. 5, Chapt. 6, App. B (landscaping), App. F (specs), App. H.3 (pollutant loading analyses), and App. J (TAP)

Cont'd

- Standard 4 - refer to Chapt. 3.3.4, Chapt. 5 & 7, App. D (design exmp), App. H.4 (short-cut sizing), App. I (River/Stream Order), and App. K (H/H Modeling Guidance)
- Standard 5 - refer to Chapt. 3.3.5 and 3.3.6, Chapt. 5 & 7, App. D, App. I (River/Stream Order), and App. K (H/H Modeling Guidance)



Cont'd

- Standard 6 - refer to Chapt. 3.2.6, App. C (retrofit options)
- Standard 7 -App. G (Pollution prevention and source control)
- Standard 8 - refer to Tables 3-2 and 3-3, Chapt. 5
- Standard 9 -Chapt. 3.2.9

Steps 7 and 8



**Step 7:
Develop
Erosion and
Sediment
Control Plan**

**Step 8:
Develop
Operation &
Maintenance
Plan**

- Develop appropriate ESC plan to meet standard 10
- Develop appropriate O&M plan to meet standard 11
- Specific requirements in Chapters 5-7
- Add'l guidance in App. E



Step 9

Step 9: Develop Final Stormwater Management Plan

- Final Plan meeting all requirements

Refer to Appendix A throughout design process

APPENDIX A: STORMWATER MANAGEMENT CHECKLIST

The first thing that applicants and designers must do before beginning a project is to make sure they are familiar with the 11 minimum standards listed in Manual Chapter Three, as projects must meet all 11 standards. Next, designers should review the available LID site planning and design strategies and BMPs in Manual Chapters Four through Seven to determine which would work best at their site. This checklist serves as a guide for engineers and designers to refer to during all stages of a project to ensure that they are meeting all applicable requirements. In addition, designers must include a completed checklist with their final stormwater management plan.

A.1 CHECKLIST FOR STORMWATER MANAGEMENT PLAN PREPARATION AND REVIEW

A.1.1 General Information

- Applicant name, mailing address, and telephone number
- Contact information for the licensed professional(s) responsible for site plans and stormwater management plan
- Common address and legal description of project site
- Vicinity map
- Existing zoning and land use at the project site
- Proposed land use – indicate if land use meets definition of a LUHPPL (see Manual Table 3-2)
- General Project Narrative
- Project type (new development or redevelopment)

A.1.2 Existing and Proposed Mapping and Plans

- Existing and proposed mapping and plans (scale not greater than 1" = 40') with North arrow that illustrate at a minimum:
 - Existing and proposed site topography (2-foot contours required). 10-foot contours accepted for off-site areas.
 - Existing and proposed drainage area delineations and drainage flow paths, mapped according to the DEM *Guidance for Preparation of Drainage Area Maps* (included in Appendix K). Drainage area boundaries need to be complete; include off-site areas in both mapping and analyses, as applicable.
 - Perennial and intermittent streams, in addition to areas subject to storm flowage (ASSFs)

- Mapping of predominant soils from USDA soil surveys, especially hydric soil groups as well as location of site-specific borings and/or test pits (on drainage area maps only – not site plans)
- Boundaries of existing predominant vegetation and proposed limits of clearing
- Location and field-verified boundaries of resource protection areas such as freshwater and coastal wetlands, lakes, ponds, coastal shoreline features and required setbacks (e.g., buffers, water supply wells, septic systems)
- Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties and drainages
- Location of existing and proposed roads, buildings, and other structures including limits of disturbance
- Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements
- Location of existing and proposed conveyance systems such as grass channels, swales, and storm drains
- Location and dimensions of channel modifications, such as bridge or culvert crossings
- Location, size, and limits of proposed LID planning and site design techniques (type of practice, depth, area). LID techniques should be labeled clearly on the plan and a key should be provided that corresponds to a tabular description.
- Location, size, and limits of disturbance of proposed stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) should be labeled with numbers that correspond to the table in Section A.1.5.
- Soils information from test pits or borings at the location of proposed stormwater management facilities, including but not limited to soil descriptions, depth to seasonal high groundwater, depth to bedrock, and estimated hydraulic conductivity. Soils information will be based on site test pits or borings logged by a DEM-licensed Class IV soil evaluator or RI-registered PE.
- 8.5 x 11 inch copy of site plan for public notice, as applicable.

A.1.3 Minimum Stormwater Management Standards

- Minimum Standard 1: LID Site Planning and Design Strategies**

Document specific LID site planning and design strategies and associated methods that were employed for the project in the following table:

LID Site Planning and Design Checklist

The applicant must document specific LID site planning and design strategies applied for the project (see Manual Chapter Four and the *RI Community LID Guidance Manual* for more details regarding each strategy). If a particular strategy was not used, a justification and description of proposed alternatives must be provided. If a strategy is not applicable (N/A), applicants must describe why a certain method is not applicable at their site. For example, preserving wetland buffers may be not applicable for sites located outside any jurisdictional wetland buffers. In communities where conservation development or other low-impact development site planning and design processes exist, following the local community conservation development option may help a project achieve this standard.

1. Strategies to Avoid the Impacts

A. Preservation of Undisturbed Areas

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Limits of disturbance clearly marked on all construction plans.
- Mapped soils by Hydrologic Soil Group (HSG).
- Building envelopes avoid steep slopes, forest stands, riparian corridors, HSG D soils, and floodplains.
- New lots, to the extent practicable, have been kept out of freshwater and coastal wetland jurisdictional areas.
- Important natural areas (i.e., undisturbed forest, riparian corridors, and wetlands) identified and protected with permanent conservation easement.
- Percent of natural open space calculation is provided.
- Other (describe):

Explain constraints when a strategy is applied and/or proposed alternatives in space below:

B. Preservation of Buffers and Floodplains

Not Applied or N/A. Use space below to explain why:

Select from the following:

- Applicable vegetated buffers of coastal and freshwater wetlands and perennial and intermittent streams have been preserved, where possible.
- Limits of disturbance included on all construction plans that protect applicable buffers
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

LID Site Planning and Design Checklist

C. Minimized Clearing and Grading

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Site fingerprinting to extent needed for building footprints, construction access and safety (i.e., clearing and grading limited to 15 feet beyond building pad or 5 feet beyond road bed/shoulder).
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

D. Locating Sites in Less Sensitive Areas

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- A site design process, such as conservation development, used to avoid or minimize impacts to sensitive resources such as floodplains, steep slopes, erodible soils, wetlands, hydric soils, surface waters, and their riparian buffers.
- Development located in areas with least hydrologic value (e.g., soil groups A and B)
- Development on steep slopes, grading and flattening of ridges has been avoided to the maximum extent practicable.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

E. Compact Development

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- A site design technique (e.g., conservation development) used to concentrate development to preserve as much undisturbed open space as practicable and reduce impervious cover.
- Reduced setbacks, frontages, and right-of-way widths have been used where practicable.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

LID Site Planning and Design Checklist

F. Work with the Natural Landscape Conditions, Hydrology, and Soils

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Stormwater management system mimics pre-development hydrology to retain and attenuate runoff in upland areas (e.g., cuts and fills limited and BMPs distributed throughout site; trees used for interception and uptake).
- The post-development time of concentration (t_c) should approximate pre-development t_c .
- Flow velocity in graded areas as low as practicable to avoid soil erosion (i.e., slope grade minimized). Velocities shall not exceed velocities in Appendix B, Table B-2.
- Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPAs) for better infiltration.
- Site designed to locate buildings, roadways and parking to minimize grading (cut and fill quantities)
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

2. Strategies to Reduce the Impacts

Reduce Impervious Cover

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Reduced roadway widths
- Reduce driveway areas
- Reduced building footprint
- Reduced sidewalk area
- Reduced cul-de-sacs
- Reduced parking lot area
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

3. Strategies to Manage the Impacts

A. Disconnecting Impervious Area

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Impervious surfaces have been disconnected to QPAs to the extent possible.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

LID Site Planning and Design Checklist

B. Mitigation of Runoff at the point of generation

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Roof runoff has been directed to a QPA, such as a yard or vegetated area.
- Roof runoff has been directed to a lower impact practice such as a rain barrel or cistern.
- A green roof has been designed to reduce runoff.
- Small-scale BMPs applied at source.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

C. Stream/Wetland Restoration

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Historic drainage patterns have been restored by removing closed drainage systems and/or restoring degraded stream channels and/or wetlands.
- Removal of invasive species.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

D. Reforestation

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Low maintenance, native vegetation has been proposed.
- Trees are proposed to be planted or conserved to reduce runoff volume, increase nutrient uptake, and provide shading and habitat.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

E. Source Control

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Source control techniques such as street sweeping or pet waste management have been proposed.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

Minimum Standard 2: Groundwater Recharge

Demonstrate that groundwater recharge criteria for the site have been met. Include:

- The required recharge volume (Re_v) in acre-feet (See Manual Section 3.3.2)
- LID Stormwater Credit from Checklist Section A.1.4 to be applied to recharge requirement, if applicable, with the following calculations (See Manual Section 4.6.1):
 - the recharge area (Re_a) in acres for the site
 - the site impervious area draining to QPAs
 - the new Re_v requirement
- Specific BMPs from Checklist Section A.1.5 that will be used to meet the recharge requirement. *Note: Only BMPs listed in Manual Table 3-5, List of BMPs Acceptable for Recharge may be used to meet the recharge requirement.*

Minimum Standard 3: Water Quality

Demonstrate that the water quality criteria for the site have been met. Include:

- Required water quality volume (WQ_v) in acre-feet or ft^3 (see Manual Section 3.3.3).
- LID Stormwater Credit from Checklist Section A.1.4 to be applied to water quality requirement, if applicable, with the following calculations (see Manual Section 4.6.1):
 - the new impervious area (in acres) for the site
 - the new WQ_v in acre-feet or ft^3
- Specific BMPs from Checklist Section A.1.5 that will be used to meet water quality volume requirement. *Note: Only BMPs listed in Manual Table 3-6, Acceptable BMPs for Water Quality Treatment may be used to meet the water quality requirement.*
- Specify any additional pollutant-specific requirements and/or pollutant removal efficiencies applicable to the site as the result of SAMP, TMDL, or other watershed-specific requirements.

Minimum Standard 4: Conveyance and Natural Channel Protection

Demonstrate that the conveyance and natural channel protection criteria for the site have been met. Include:

- Justification for channel protection criterion waiver, if applicable (see Manual Section 3.3.4).
- Required channel protection volume (CP_v) (see Manual Section 3.3.4).
- Specific BMPs from Checklist Section A.1.5 that will be used to meet the channel protection requirement. Hydrologic and hydraulic site evaluation as described in Manual Section 3.3.4 should be included in Checklist Section A.1.5 for each channel protection BMP.

Minimum Standard 5: Overbank Flood Protection

Demonstrate that the overbank flood protection criteria for the site have been met. Include:

- Justification for overbank flood protection criterion waiver, if applicable (see Manual Section 3.3.5).
- Pre- and post-development peak discharge rates.
- Specific BMPs from Checklist Section A.1.5 that will be used to meet the overbank flood protection requirement. Hydrologic and hydraulic site evaluation as described in Manual Section 3.3.4 should be included in Checklist Section A.1.5 for each overbank flood protection BMP.

Minimum Standard 6: Redevelopment and Infill Projects

Demonstrate that criteria for redevelopment and/or infill projects have been met, if applicable. Include:

- Description of site that meets redevelopment/infill definition.
- Approved off-site location within watershed where stormwater management requirements will be met, if applicable (see Manual Section 3.2.6).
- Not Applicable.

Minimum Standard 7: Pollution Prevention

Demonstrate that the project meets the criteria for pollution prevention. Include:

- Stormwater pollution prevention plan

Minimum Standard 8: LUHPPLs

Demonstrate that the project meets the criteria for LUHPPLs, if applicable. Include:

- Description of any land use activities considered stormwater LUHPPL (see Manual Table 3-2).
- Specific BMPs listed in Checklist Section A.1.5 that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in Manual Table 3-3, "Acceptable BMPs for Use at LUHPPLs."
- Additional BMPs, if any, that meet RIPDES MSGP requirements.
- Not Applicable.

Minimum Standard 9: Illicit Discharges

Applicant asserts that no illicit discharges exist or are proposed to the stormwater management system in accordance with State regulations.

Minimum Standard 10: Construction Erosion and Sedimentation Control

Demonstrate that ESC practices will be used during the construction phase and land disturbing activities. Include:

- Description of temporary sediment trapping and conveyance practices, including sizing calculations and method of temporary and permanent stabilization (see Manual Section 3.2.9 and *the Rhode Island Soil Erosion and Sediment Control Handbook*).
- Description of sequence of construction. Activities should be phased to avoid compacting soil during construction, particularly in the location of infiltrating stormwater practices and qualifying pervious areas for stormwater credits.
- Location of construction staging and material stockpiling areas.

Minimum Standard 11: Stormwater Management System Operation and Maintenance

Provide a stormwater management system operation and maintenance plan that at a minimum includes:

- Name, address, and phone number of responsible parties for maintenance
- Description of annual maintenance tasks
- Description of applicable easements
- Description of funding source
- Minimum vegetative cover requirements
- Access and safety issues

A.1.4 LID Stormwater Credit

Describe stormwater credit, if applicable, for qualifying pervious areas (QPAs) on the site map, and document that all stormwater credit requirements listed in Section 4.6 are met. For each QPA, note the impervious area (in acres) that drains to it, and place a check in the appropriate box to demonstrate that it meets the following criteria:

	QPA 1	QPA 2	QPA 3	QPA 4
Impervious Area Draining to QPA (acres)				
QPA Criteria	Criterion Met?			
Construction vehicles shall not be allowed to drive over the QPA during construction. If the area becomes compacted, soil must be suitably amended, tilled, and revegetated once construction is complete to restore infiltration capacity.				
QPA infiltration area is at least 10ft from building foundation.				

QPA 1 QPA 2 QPA 3 QPA 4

Contributing impervious area does not exceed 1,000 ft ² .				
Length of QPA in feet is equal to or greater than the contributing rooftop area in ft ² divided by 13.3. The maximum contributing flow path from non-rooftop impervious areas is 75ft.				
QPA does not overlap any other QPA.				
Lot is greater than 6,000 ft ² .				
The slope of the QPA is less than or equal to 5.0%.				
Disconnected downspouts draining to QPA are at least 10 feet away from the nearest impervious surface.				
Runoff from rooftops without gutters / downspouts that drains to QPA flows away from the structure as low-velocity sheet flow.				
QPA is located on Hydrologic Soil Group (HSG) A or B soils.				
Depth to groundwater within QPA is 18 inches or greater (has been confirmed by evaluation by a DEM-licensed Class IV soil evaluator or RI-registered PE).				
Runoff is directed over soft shoulders, through curb cuts or level spreaders to QPA.				
Measures are employed at discharge point to prevent erosion and promote sheet flow.				
The flow path through the QPA complies with the setback requirements for structural infiltration BMPs.				
Rooftop runoff draining to QPA from LUHPPLs does not commingle with runoff from any paved surface or areas that may generate higher pollutant loads				
Inspection and maintenance of the QPA is included in the site Operation and Maintenance Plan (Minimum Standard 11).				
The QPA is owned or controlled by the property owner				
There is no history of groundwater seepage and / or basement flooding on the property				

A.1.5 Best Management Practices

Provide detailed information for all structural stormwater best management practices (BMPs) to be implemented. *Note: If a BMP cannot meet the required design criteria in Manual Chapters Five, Six, and Seven, a different BMP should be considered.*

Fill in the following table to document which proposed practices meet which requirement(s). Number each BMP and label them accordingly on the site map:

BMP No.	Type of BMP	Check the function provided by the BMP				
		Pretreatment	Re _v	WQ _v	CP _v	Q _p

In addition, for all structural components of stormwater system (e.g., storm drains, open channels, swales, stormwater BMPs, etc.) provide the following, if applicable:

- Hydrologic and hydraulic analysis, including:
 - Study design/analysis points. The existing and proposed condition analyses need to compare the same overall area; thus, common study points are needed for both existing and proposed conditions.

- Existing condition analysis for drainage area boundaries, curve numbers, times of concentration, runoff rates, volumes, velocities, and water surface elevations showing methodologies used and supporting calculations.
- Proposed condition analysis for drainage area boundaries, curve numbers, times of concentration, runoff rates, volumes, velocities, water surface elevations, and routing showing the methodologies used and supporting calculations.
- Downstream Analysis, where required (see Manual Section 3.3.6).
- Final sizing calculations for structural stormwater BMPs including, contributing drainage area, storage, and outlet configuration.
- Stage-discharge or outlet rating curves and inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).
- Dam breach analysis, where necessary, for earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and that is a significant or high hazard dam.
- Drainage Area Maps prepared in accordance with DEM's *Guidance for Preparation of Drainage Area Maps* (included in Appendix K).
- Representative cross-section and profile drawings, notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include:
 - Locations, cross sections, and profiles of all streams and drainage swales and their method of stabilization.
 - Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.).
 - Design water surface elevations.
 - Structural details of outlet structures, embankments, spillways, stilling basins, grade control structures, conveyance channels, etc.
 - Logs of borings and/or test pit investigations along with supporting soils/geotechnical report.
- Planting plans for structural stormwater BMPs, including:
 - Species, size, planting methods, and maintenance requirements of proposed planting.
- Structural calculations, where necessary.
- Applicable construction specifications.
- Identification of all anticipated applicable local and State permits.
- Identification of all anticipated legal agreements related to stormwater (e.g., off-site easements, deed restrictions, and covenants).