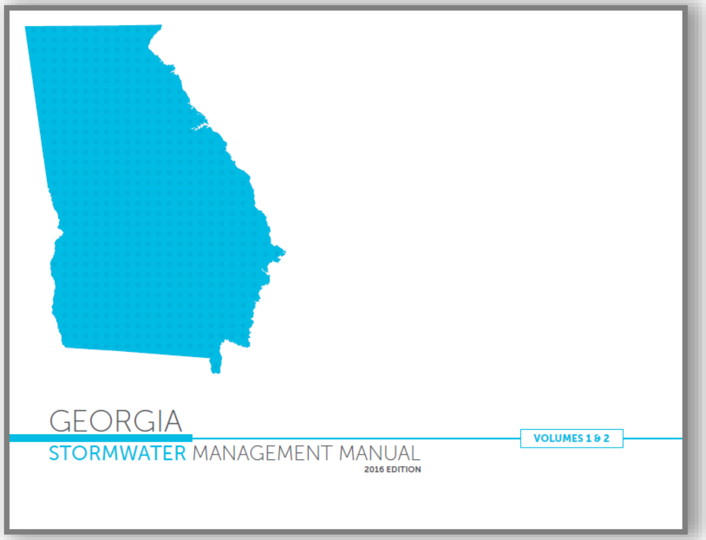
What's New with the Georgia Stormwater Management Manual?

Date: ______



What is the “Blue Book”?

Design manual for designers, developers, planners, government officials, and other stormwater practitioners to design Best Management Practices:

- Volume 1: Stormwater Policy Guidebook – A policy document design to provide guidance on the basic principles of effective stormwater management for Georgia communities.
- Volume 2: Technical Handbook – A technical handbook for design professionals on sustainable site design and stormwater management practices for land development.
- Volume 3: Pollution Prevention Guidebook – a compendium of stormwater pollution prevention practices for use by local jurisdictions, businesses and industry, and local citizens.

Brief Background

- Why update the "Blue Book"?
  - Original GSMM ~ 15 yrs. old
  - New and Better Information
  - Approaches have Changed
  - State Water Plan Update
  - Stakeholder Request

What are the Major Changes?

- Comprehensive Stormwater Management Approach
- Recommended Runoff Reduction Performance Standard
- Revised Better Site Design Credits
- New Format
- Additional Details/Corrections

What are the Major Changes?

- New/Updated BMP Sections
- Digital Design Details
- Operations & Maintenance Guidance Document
- Landscaping & Aesthetics Guide
- Revised BMP Calculator Tool
- Corrected Technical Errors with New Information

Comprehensive Stormwater Management Approach

Communities are encouraged to apply:

- Natural Resource Inventory
- Green Infrastructure (GI)
- Low Impact Development (LID)
- Better Site Design (BSD)
- Runoff Reduction

Comprehensive Stormwater Management Approach (cont'd)

Runoff reduction:

- Reduces post-construction stormwater runoff rates, volumes, and pollutant loads
- Reduces risk of flooding
- Eliminates stormwater runoff from a given volume (and the pollutants associated with it), rather than just treating and/or detaining runoff
- Provides economic benefits (additional jobs, increased property values, etc.)
- Maintains, mimics or replaces landscape hydrologic functions

Previous Performance Standards

- Regulated MS4 communities are required to adopt the performance standards listed in their permit.

Minimum Standard #1 – Use of Better Site Design Practices for Stormwater Management
Minimum Standard #2 – Stormwater Runoff Quality
Minimum Standard #3 – Stream Channel Protection
Minimum Standard #4 – Overbank Flood Protection
Minimum Standard #5 – Extreme Flood Protection
Minimum Standard #6 – Downstream Analysis
Minimum Standard #7 – Groundwater Recharge
Minimum Standard #8 – Construction Erosion and Sedimentation Control
Minimum Standard #9 – Stormwater Management System Operation and Maintenance
Minimum Standard #10 – Pollution Prevention
Minimum Standard #11 – Stormwater Management Site Plan

80% TSS removal from the 1.2-inch rainfall event

GSMM Coastal Stormwater Supplement (CSS) Performance Standards

Site Planning and Design Criteria

Criteria #1: Natural Resources Inventory

Criteria #2: Use of Green Infrastructure Practices

Criteria #3: Stormwater Management Concept Plan

Criteria #4: Stormwater Management Plan

Criteria #5: Downstream Analysis

Criteria #6: Stormwater Management System Inspection and Maintenance Plan

Criteria #7: Erosion and Sediment Control Plan

Criteria #8: Landscaping Plan

Criteria #9: Stormwater Pollution Prevention Plan

Post-Construction Stormwater Management Criteria

Criteria #1: Stormwater Runoff Reduction

Criteria #2: Stormwater Quality Protection

Criteria #3: Aquatic Resource Protection

Criteria #4: Overbank Flood Protection

Criteria #5: Extreme Flood Protection

Special Stormwater Management and Site Planning and Design Criteria (Shellfish harvesting areas)

Criteria #1: Increased Stormwater Runoff Reduction

Criteria #2: Enhanced Aquatic Resource Protection

GSMM Coastal Stormwater Supplement (CSS) Performance Standards

Runoff reduction of the 1.2-inch rainfall event

Post-Construction Stormwater Management Criteria

Criteria #1: Stormwater Runoff Reduction

Criteria #2: Stormwater Quality Protection

Criteria #3: Aquatic Resource Protection

Criteria #4: Overbank Flood Protection

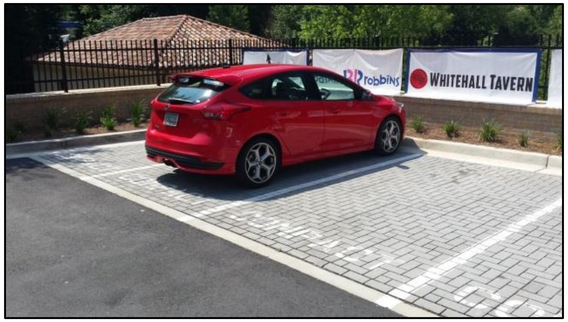
Criteria #5: Extreme Flood Protection

If any of the stormwater runoff generated by the 1.2 inch storm event cannot be reduced on a development site, reduce TSS load by at least 80% and reduce nitrogen and bacteria loads to the *maximum extent practical*.

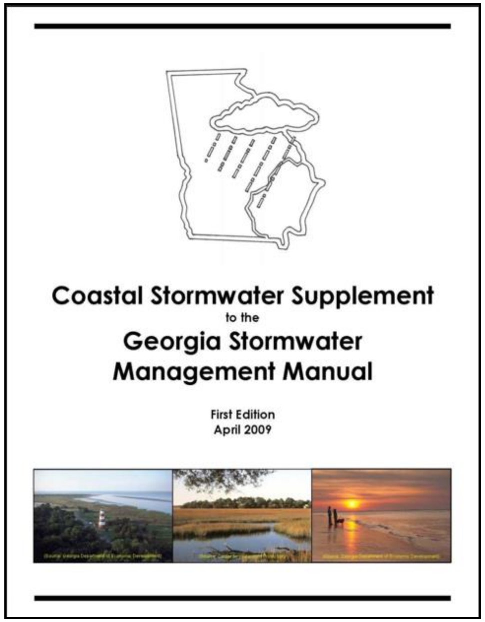
Previous GSMM WQ Performance Standard

- Only looked at TSS removal
- Did not account for the benefits of runoff reduction
- Did not coincide with the CSS

(Source: Center for Watershed Protection)



(Source: City of Atlanta)



New Recommended WQ Performance Standards

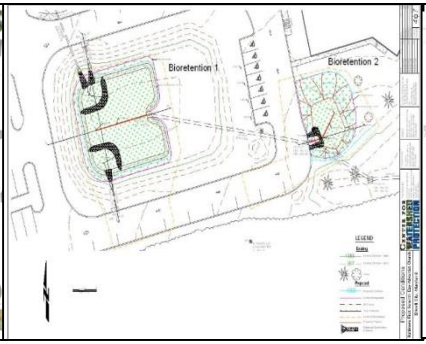
- While regulated MS4 communities do have to adopt the Blue Book, it provides <u>recommended</u>, not required, performance standards
- Includes a runoff reduction standard and a water quality treatment standard

KEY CONSIDERATIONS

The following twelve (12) standards are recommended performance requirements for new development or redevelopment sites:

- Standard #1 – Natural Resource Inventory
- Standard #2 – Better Site Design Practices for Stormwater Management
- Standard #3 – Runoff Reduction
- Standard #4 – Water Quality
- Standard #5 – Stream Channel Protection
- Standard #6 – Overbank Flood Protection
- Standard #7 – Extreme Flood Protection
- Standard #8 – Downstream Analysis
- Standard #9 – Construction Erosion and Sedimentation Control
- Standard#10 – Stormwater Management System Operation and Maintenance
- Standard #11 – Pollution Prevention
- Standard #12 – Stormwater Management Site Plan

New Recommended WQ Performance Standards



Standard #3 – Runoff Reduction

Runoff reduction practices should be sized and designed to retain the first 1.0 inch of rainfall on the site to the maximum extent practicable.

Standard #4 – Water Quality

Stormwater management systems should be designed to *retain or treat the runoff from 85% of the storms that occur in an average year [1.2 inches], and reduce average annual post-development total suspended solids loadings by 80%.*

New Recommended WQ Performance Standards

Standard #3 – Runoff Reduction

- Runoff reduction practices should be sized and designed to retain the first 1.0 inch of rainfall on the site, or to the maximum extent practicable.
- This standard is quantified and expressed in terms of engineering design criteria through the specification of the runoff reduction volume (RR_v).
- Runoff reduction practices inherently reduce TSS and other pollutants to provide water quality treatment (i.e. 100% pollutant removal for stormwater retention, infiltration, evaporation, transpiration, or rainwater harvesting and reuse).
- If the entire 1.0-inch runoff reduction standard cannot be achieved, the remaining runoff from the 1.2-inch rainfall event must be treated by BMPs to remove at least 80% of the calculated average annual post-development TSS loading from the site per Standard #4 Water Quality.

Standard #4 – Water Quality

- Stormwater runoff generated on the development site shall be retained and/or treated by BMPs to remove at least 80% of the calculated average annual post-development total suspended solids (TSS) loading from the site.
- This standard is quantified and expressed in terms of engineering design criteria through the specification of the water quality volume (WQ_v), which is equal to the runoff generated on a site from 1.2 inches of rainfall.
- This can be achieved through the use of BMPs that provide runoff reduction or BMPs that provide treatment.

New Recommended WQ Performance Standards

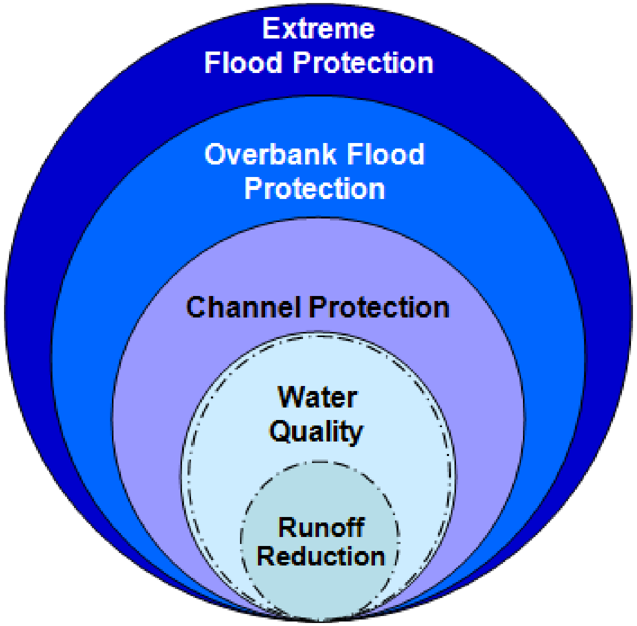
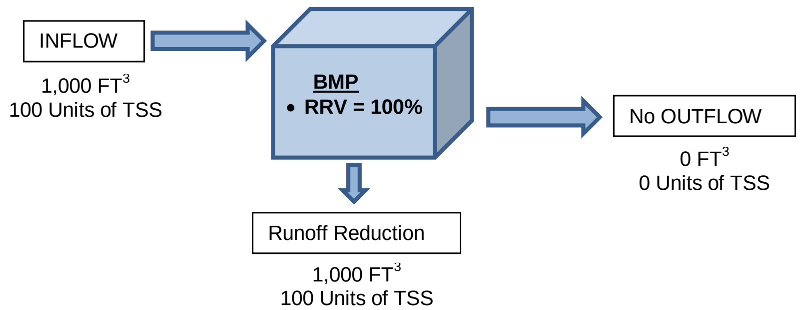


Figure 2.2.3-1 Representation of the Unified Stormwater Sizing Criteria

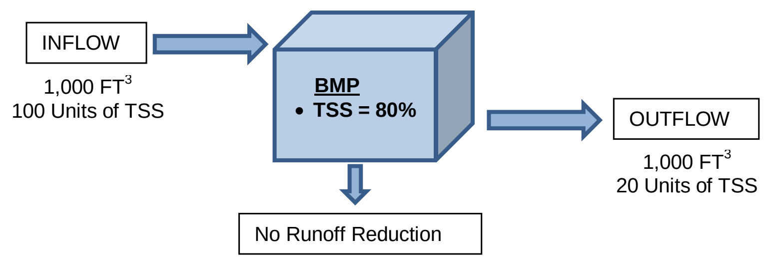
Given that an 80% TSS removal rate for the 1.2 inch rainfall event is the standard for addressing water quality, 100% TSS removal through volume reduction of the 1.0 inch rainfall event will address the same requirement. In another method of describing total TSS removal, 80% of 1.2 inches (0.96) approximately equates to 100% of 1.0 inches.

New Recommended WQ Performance Standards

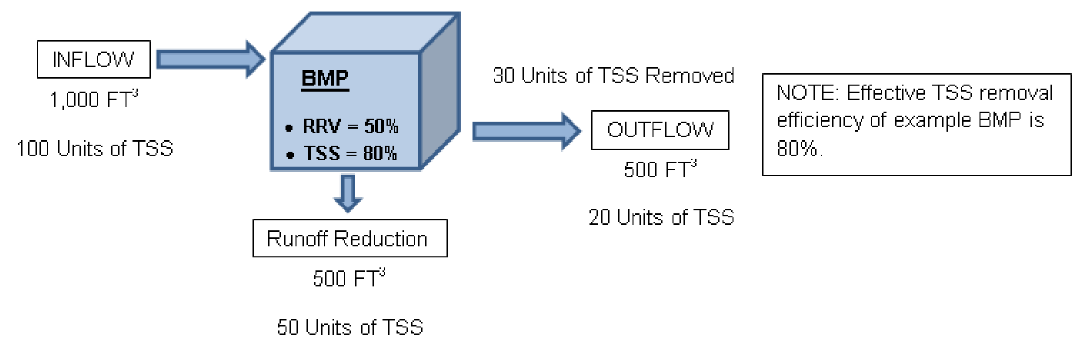
Runoff Reduction Approach



Traditional TSS Removal Approach



Partial Runoff Reduction Approach



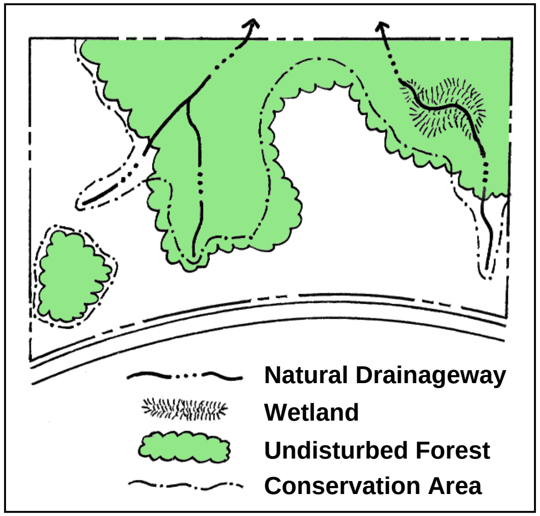
Better Site Design Credits

Better Site Design aims to **protect and conserve natural areas**, **reduce impervious cover**, and **integrate stormwater management** with site design.

- Five previous credits intended to be a bonus, but they go above and beyond what math and science say.
- More and better science is available to calculate benefits of new BMPs and runoff reduction practices.
- The following credits were removed:
    - Stream Buffers
    - Grass Channel
    - Overland Flow Infiltration and Groundwater Recharge
    - Environmentally Sensitive Large Lot Subdivisions
- Only remaining credit
    - Natural Area Conservation Credit

Natural Conservation Area Credit

- Subtract conservation areas from total site area when computing water quality and runoff reduction volume requirements.
- An added benefit will be that the post-development peak discharges will be smaller, and hence water quantity control volumes (CP_v, Q_{p25}, and Q_f) will be reduced due to lower post-development curve numbers.



Other Credits

- Site Reforestation/Revegetation
  - Subtract 50% of any *reforested/revegetated areas* from the total site area and re-calculate the runoff reduction volume (RR_v) and water quality volume (WQ_v) that applies to the development site.

- Soil Restoration
  - Subtract 50% of any *restored pervious areas* from the total site area and re-calculate the RR_v and WQ_v that applies to the development site.

- Site Reforestation/Revegetation & Soil Restoration
  - Subtract 100% of any *reforested/revegetated and restored pervious areas* from the total site area and re-calculate the RR_v and WQ_v that applies to the development site.

New Additions for Volume 1

- Discussion of Low Impact Development (Sect.1.5)
- Complete overhaul of Better Site Design chapter – more concrete guidance for local governments (Chap. 3)
- Discussion of site plan review (Sect. 4.3)
- Different development types (Sect. 4.4)
- Revised operation and maintenance discussion (Sect. 5.2)
- Funding alternatives for local governments (Sect. 5.5)
- Alternatives to on-site stormwater management (Sect. 5.7)


Introduction

- Identify flood prone areas in the community and address them by acquiring floodplain properties, restricting development in these watersheds, or requiring runoff volume reduction or greater stormwater detention in those areas.
- Prepare comprehensive plans and zoning that allow the community to choose where and how densely development should (and should not) occur, or where redevelopment will be encouraged/incentivized.
- Establish legal mechanisms and incentives to encourage preferable types of development, for example, cluster developments, conservation subdivisions, city centers and conservation easements, which will allow more of the land area to be left in a natural state and reduce the stormwater impacts of the developed area.

See Section 3.3.1 and Section 3.3.2 for more information on community- and site-level conservation approaches.

Key Principles for LID

Low Impact Development is more than an alternative set of stormwater BMPs. LID can best be achieved if viewed in the context of the larger design process. The Low Impact Development Manual for Michigan highlights the following principles and key components of an LID design approach:

- **Plan first.** To minimize stormwater impacts, stormwater management and LID should be integrated into the community planning and zoning process.
- **Prevent. Then mitigate.** A primary goal of LID is preventing stormwater runoff by incorporating nonstructural practices into the site development process. This can include preserving natural features, clustering development, and minimizing impervious surfaces. Once prevention as a design strategy is maximized, then the site design — using structural BMPs — can be prepared.
- **Minimize disturbance.** Limiting the disturbance of a site reduces the amount of stormwater runoff control needed to maintain the natural hydrology.
- **Manage stormwater as a resource — not a waste.** Approaching LID as part of a larger design process enables us to move away from the conventional concept of runoff as a disposal problem (and disposed of as rapidly as possible) to understanding that stormwater is a resource for groundwater recharge, stream base flow, lake and wetland health, water supply, and recreation.
- **Mimic the natural water cycle.** Stormwater management using LID includes mimicking the water cycle through careful control of peak rates as well as the volume of runoff and groundwater recharge, while protecting water quality. LID reflects an appreciation for management of both the largest storms, as well as the much more frequent, smaller storms.
- **Disconnect. Decentralize. Distribute.** An important element of LID is directing runoff to BMPs as close to the generation point as possible, in patterns that are decentralized and broadly distributed across the site.

systems. LID includes careful
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Other Environmental, Economic, and Social Benefits of Implementing LID

In addition to the significant stormwater and water quality benefits (reduced stormwater pollutant levels, improved aquatic biodiversity, increased stream base flows, groundwater recharge, reduced flooding, etc), implementation of LID strategies can provide many additional direct and indirect benefits for homeowners, developers, and communities.

HOME OWNERS

- Preserved mature trees can shade homes, which can reduce air conditioning needs and energy costs.
- Directing stormwater runoff to vegetated areas and utilizing native plants reduces irrigation needs.
- Treating stormwater runoff close to its source with a distributed system may reduce nuisance flooding problems.

DEVELOPERS

- Preserving natural features and vegetation reduces the cost of land clearing and grading.
- Minimizing impervious cover reduces the cost of infrastructure (sidewalks, curbs, streets, etc.).

As described in several of the studies highlighted below, incorporating LID into a e design can decrease overall stormwater nagement costs.

e trees and other vegetative amenities rease property values.

TIES

uced irrigation demands improve water supply reliability.

- Infiltrating LID BMPs contribute to groundwater recharge.
- Reduced impervious cover and increased evaporative cooling decreases the urban heat island effect.
- Runoff reduction decreases the magnitude and frequency of combined sewer overflow events.

Cost Effectiveness of LID

Cost issues are among the main objections to implementing LID. However, many studies have shown that properly applied LID approaches and BMPs can be more cost effective than more conventional stormwater management approaches. The list below includes case studies, research, recommendations, and site specific costs for implementing LID:

- "Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs" (US EPA, 2013) — This report seeks to educate stormwater professionals on the potential benefits of LID and Green Infrastructure (GI) programs using thirteen (13) case studies from a variety of communities around the country. http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf
- "Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices" (US EPA, 2007) — This document summarizes seventeen (17) case studies comparing the costs of LID methods to the costs of conventional development methods. In many cases, the LID methods proved to be both less costly and more

VOL 1
4

Detailed discussion of LID

Several Better Site Design case studies included in Ch. 3

CASE STUDY

Fox Hollow Development – James Island, SC

Located on James Island, South Carolina, Fox Hollow is a 2.65 acre low impact development that protected the trees, wetlands, and topography of the site. Unlike conventional development, where mass grading is common, at Fox Hollow the land has been highly conserved – only enough land for the 9 houses and roadway were cleared. Narrow streets and driveways reduce impervious cover in the development. Rather than relying on pipes, a bioswale system conveys stormwater and bioreten¬tion cells replace stormwater ponds. The site has a density of 4.22 homes/acre with 0.52 acres of open space consisting of park, bioretention and wetlands. Named "Best New Community of 2013" by the Charleston Homebuilders Association, Fox Hollow was specifically recognized for its low impact development approach (Ellis et al. 2014).

Figure 3.3-12 Site plan for Fox Hollow (Ellis et al, 2014)

Key considerations are highlighted

Elements of Stormwater Management Programs

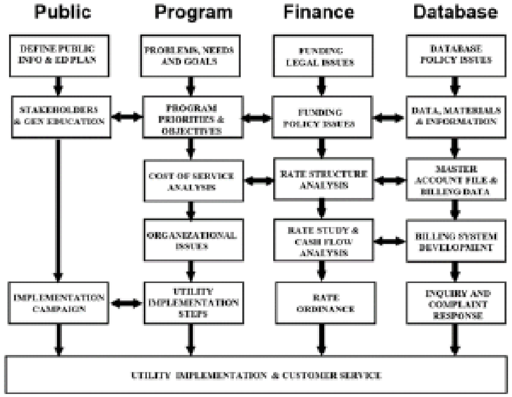
5.5 Funding

Description: Adequate funding is an essential part of a stormwater management program. While General Fund monies may be the most common funding approach, many other effective strategies exist.

KEY CONSIDERATIONS

Funding strategies covered in this section include:

- General Fund
- Stormwater Utilities
- Grant and Loan Programs
  - Clean Water State Revolving Fund (CWSRF)
  - Section 319(h) Georgia's Nonpoint Source Implementation Grant
  - Department of Community Affairs (DCA) Water First
  - National Flood Insurance Program (NFIP) Community Rating System (CRS)
  - Coastal Incentive Grant (CIG) Program
- Other Funding Sources
  - General Obligations Bonds
  - Development Impact Fees
  - Special Assessments/Tax Districts



Funding alternatives section

BMP Changes/Updates

- Updated existing BMP sections to current industry standards
- Included all CSS BMPs in (Vol. 2, Sect. 4)
- Added new BMP sections
  - Bioslope
  - Dry Extended Detention Basin (broken out from Dry Detention Bbasin section)
  - Regenerative Stormwater Conveyance
  - Porous Asphalt
- Removed BMP sections
  - Alum Treatment Systems
  - Rain Garden (incorporated in bioretention)

Bioslope

- Linear BMP that treats stormwater along an impervious area (such as roads, parking lots, etc.)
- Used to treat runoff close to the source
- Improves water quality by removing TSS, Phosphorus, Nitrogen, Fecal Coliform, and Metals
- Uses special permeable engineered soils to promote infiltration of water

Dry Extended Detention Basin

- Surface storage basin designed to provide water quality treatment
- Differ from dry detention basins by providing 24-hour detention of the channel protection volume
- Contributes to a sites overall perviousness and aesthetics
- Can be used for multiple purposes such as landscaped or recreational areas
- Improves water quality by removing TSS, Phosphorus, Nitrogen, Coliform, and Metals

Regenerative Stormwater Conveyance

- Provides treatment and conveyance through the combination of riffles, pools, vegetation, sand, and wood chips
- Designed to restore incised and eroded channels, ditches, and intermittent (ephemeral) streams

- Ideal in situation where the slope is greater than 5%
- When designed correctly, RSCs are safe, aesthetically pleasing, and may increase the natural value of the site

Porous Asphalt

- Increases void spaces to allow water to infiltrate into the subsoil below the paved surface
- Intended for low-traffic areas, or residential overflow parking applications
- Potential high failure rate if not adequately maintained or used in unstabilized areas
- Improves water quality by removing TSS, Phosphorus, Nitrogen, Metals, Coliform

Updated Key Considerations to assist designers determine what BMP to use

4.2 Bioretention Areas

Description: Shallow stormwater basin or landscaped area that utilizes engineered soils or native, well-draining soil and vegetation to capture and treat runoff.

LID/GI Consideration: Low land requirement, adaptable to many situations, and often a small BMP used to treat runoff close to the source.

Added LID/GI Considerations

New landscape format to make easier to read

KEY CONSIDERATIONS

DESIGN CRITERIA
- Maximum contributing drainage area of 5 acres
- Treatment area consists of ponding area, organic/mulch layer, planting media, and vegetation
- Requires landscaping plan
- Standing water has a maximum drain time of 24 hours
- Pretreatment recommended to prevent clogging of underdrains or native soil
- Ponding depth should be a maximum of 12 inches, preferably 9 inches

ADVANTAGES / BENEFITS
- Applicable to small drainage areas
- Effective pollutant removals
- Appropriate for small areas with high impervious cover, particularly parking lots
- Natural integration into landscaping for urban landscape enhancement
- Good retrofit capability
- Can be planned as an aesthetic feature and meet local planting requirements

DISADVANTAGES / LIMITATIONS
- Requires landscaping
- Not recommended for areas with steep slopes
- Medium to high capital cost
- Medium cost maintenance burden
- Soils may clog over time (may require cleaning or replacing)

MAINTENANCE REQUIREMENTS
- Inspect and repair or replace treatment area components such as mulch, plants, and scour protection, as needed
- Ensure bioretention area is draining properly so it does not become a breeding ground for mosquitos
- Remove trash and debris
- Ensure mulch is 3-4 inches thick in the practice
- Requires plant maintenance plan

POLLUTANT REMOVAL
- 85% Total Suspended Solids
- 95% Metals - Cadmium, Copper, Lead, and Zinc removal
- 80/60% Nutrients - Total Phosphorus / Total Nitrogen removal
- 90% Pathogens – Fecal Coliform

STORMWATER MANAGEMENT SUITABILITY
- ✓ Runoff Reduction
- ✓ Water Quality
- ★ Channel Protection
- ★ Overbank Flood Protection
- ★ Extreme Flood Protection

✓ suitable for this practice
★ may provide partial benefits

IMPLEMENTATION CONSIDERATIONS
- L Land Requirement
- M/H Capital Cost
- M Maintenance Burden

Residential Subdivision Use: *Yes*
High Density/Ultra-Urban: *Yes*
Roadway Projects: *Yes*

Soils: *Engineered soil media is composed of sand, fines, and organic matter*

Other Considerations: Use of native plants is recommended

L=Low M=Moderate H=High

RUNOFF REDUCTION CREDIT
- 100% of the runoff reduction volume provided (no underdrain)
- 75% of the runoff reduction volume provided (upturned underdrain system)
- 50% of the runoff reduction volume provided (underdrain)

Updated Runoff Reduction Credit

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4.2.5.2 GENERAL DESIGN

- A bioretention area consists of the following:
  1. A pretreatment area, usually consisting of a grass filter strip between the contributing drainage area and the ponding area or a forebay to ease maintenance of the mulch, sand, or soil layers.
  2. Ponding area c... engineered pla...
  3. Organic/mulch... media.
  4. Native soils to i... (see description of infiltration trenches, Section 4.12, for infiltration criteria).
  5. Where native soils have low infiltration rates include gravel and perforated pipe underdrain system to collect runoff that has filtered through the soil layers and pipe it to the storm sewer system. An upturned underdrain system can be used, however, the system should be 12-18" below the bottom of the planted area to reduce saturated conditions in root zone.
  6. Overflow, diversion or bypass structure to safely route larger storms through or around the bioretention area.
- A bioretention area design may include some of the following:
  - » Optional level spreader to spread and filter runoff.
  - » For curbed pavements use an inlet deflector to direct flow into the practice.
  - » A splash/erosion prevention pad at the inlet to the practice.

Updated physical specifications

See **Figure 4.2-5** and **Figure 4.2-6** for an overview of the various components of a bioretention area.

4.2.5.3 PHYSICAL SPECIFICATIONS/GEOMETRY

- Recommended minimum dimensions of a bioretention area are 3-6% of the total drainage area, though modeling is recommended to accurately size the area.
- The maximum recommended ponding depth of the bioretention areas is 12 inches.
- A grass filter strip or channel can be used for pretreatment. The length of the grass channel or width of the grass filter strip depends on the drainage area, land use, and channel slope. Design guidance on grass chan... for pretreatment can be found in Se...9 (Grass Channel... in Section 4.29... gravel diaphrag... used.
- The mulch laye... of triple-shredded hardwood mulch. This provides additional benefits such as removing sediment and metals and retaining soil moisture.
- If the native soils cannot suffice for the planting media used within the bioretention area planting beds, then an engineered soil mix should be provided that meets the following specifications:
  - » **Texture:** Sandy loam or loamy sand
  - » **Sand Content:** Soils should contain 35%-60% clean, washed sand

Updated specifications for the location of the BMP

Other Constraints / Considerations

- **Hot spots** – Do not use for hot spot runoff.
- **Damage to existing structures and facilities** – Consideration should be given to the impact of water exfiltrating the bioretention areas on nearby road bases.
- **Proximity** – The following is a list of specific setback requirements for the location of a bioretention area:
  - » 10 feet from building foundations
  - » 100 feet from private water supply wells
  - » 200 feet from public water supply reservoirs (measured from edge of water)
  - » 1,200 feet from public water supply wells
- **Trout Stream** – Evaluate for stream warming when an underdrain system is used.

In addition, careful consideration should be given to the potential of perched or raised groundwater levels. Provide adequate distance from building foundations or use impermeable liner on side of excavated area nearest to structure.

Challenges and Potential Solutions for Coastal Areas

- **Poorly Drained Soils**—This condition minimizes the ability of bioretention areas to reduce stormwater runoff rates and volumes. One solution would be to include an underdrain system. An alternative would be to use a small stormwater wetlands or wet swales to intercept and treat stormwater runoff.

BACK TO TOC

BACK TO TOC

4.2.6 Design Procedures

(Step 1) **Determine if the development site and conditions are appropriate for the use of a bioretention area.**
Consider the application and site feasibility criteria in this chapter. In addition, determine if site conditions are suitable for an bioretention area. Create a rough layout of the bioretention area dimensions taking into consideration existing trees, utility lines, and other obstructions.

(Step 2) **Determine the goals and primary function of the bioretention area.**
Consider whether the bioretention area is intended to:

- Meet a runoff reduction* target or water quality (treatment) target. For information on the sizing of a BMP utilizing the runoff reduction approach, see Step 3A. For information on the sizing of the BMP utilizing the water quality treatment approach, see Step 4A. **Note that minimum infiltration rates of the surrounding native soils must be acceptable and suitable when used in runoff reduction applications.*
- Be "oversized" to include partial credit for storage capacity for other stormwater requirements (Channel Protection Volume (Cp_v)
- Provide a possible solution to a drainage problem
- Enhance landscape and provide aesthetic qualities

Check with local officials and other agencies to determine if there are any additional restrictions and/or surface water or watershed requirements that may apply. In addition, consider if the best management practice has any special site-specific design conditions or criteria. List any restrictions or other requirements that may apply or affect the design.

The design of the BMP should be centered on the restrictions/requirements, goals, targets, and primary function(s) of the BMP, described in this section. By considering the primary function, as well as, topographic and soil conditions, the design elements of the practice can be determined (i.e. planting media, underdrain, inlet/outlet, overflow, etc.)

Complete Step 3A, 3B, and 3C for a runoff reduction approach, or skip Step 3 and complete Steps 4A and 4B for a water quality (treatment) approach. Refer to your local community's guidelines for any additional information or specific requirements regarding the use of either method.

(Step 3A) **Calculate the Stormwater Runoff Reduction Target Volume**
Calculate the Runoff Reduction Volume using the following formula:

$$RR_v = (P)(R_v)(A) / 12$$

Where:

RR_v = Runoff Reduction Target Volume (ft^3)
P = Target runoff reduction rainfall (inches)
R_v = Volumetric runoff coefficient which can be found by:

$$R_v = 0.05+0.009(I)$$

Where:

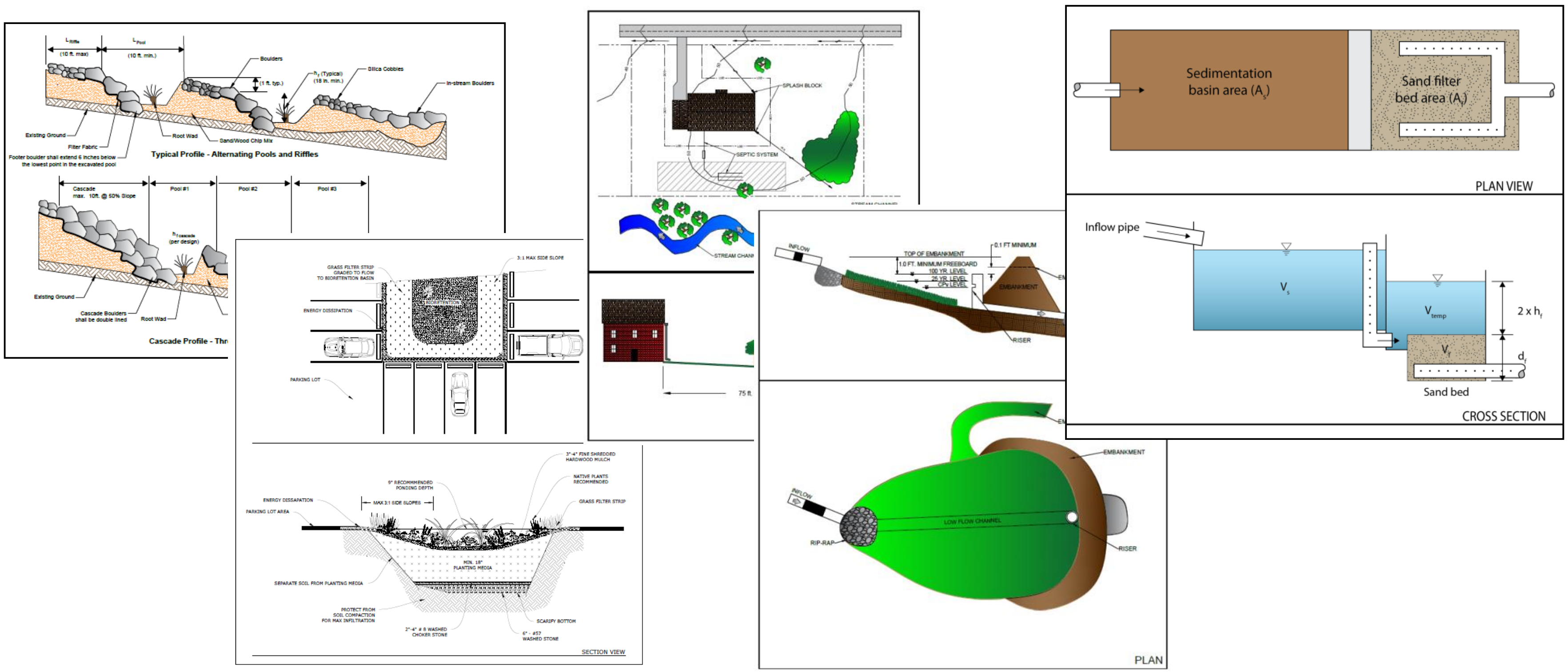
I = new impervious area of the contributing drainage area (%)

A = Area draining to this practice (ft^2)
12 = Unit conversion factor (in/ft)

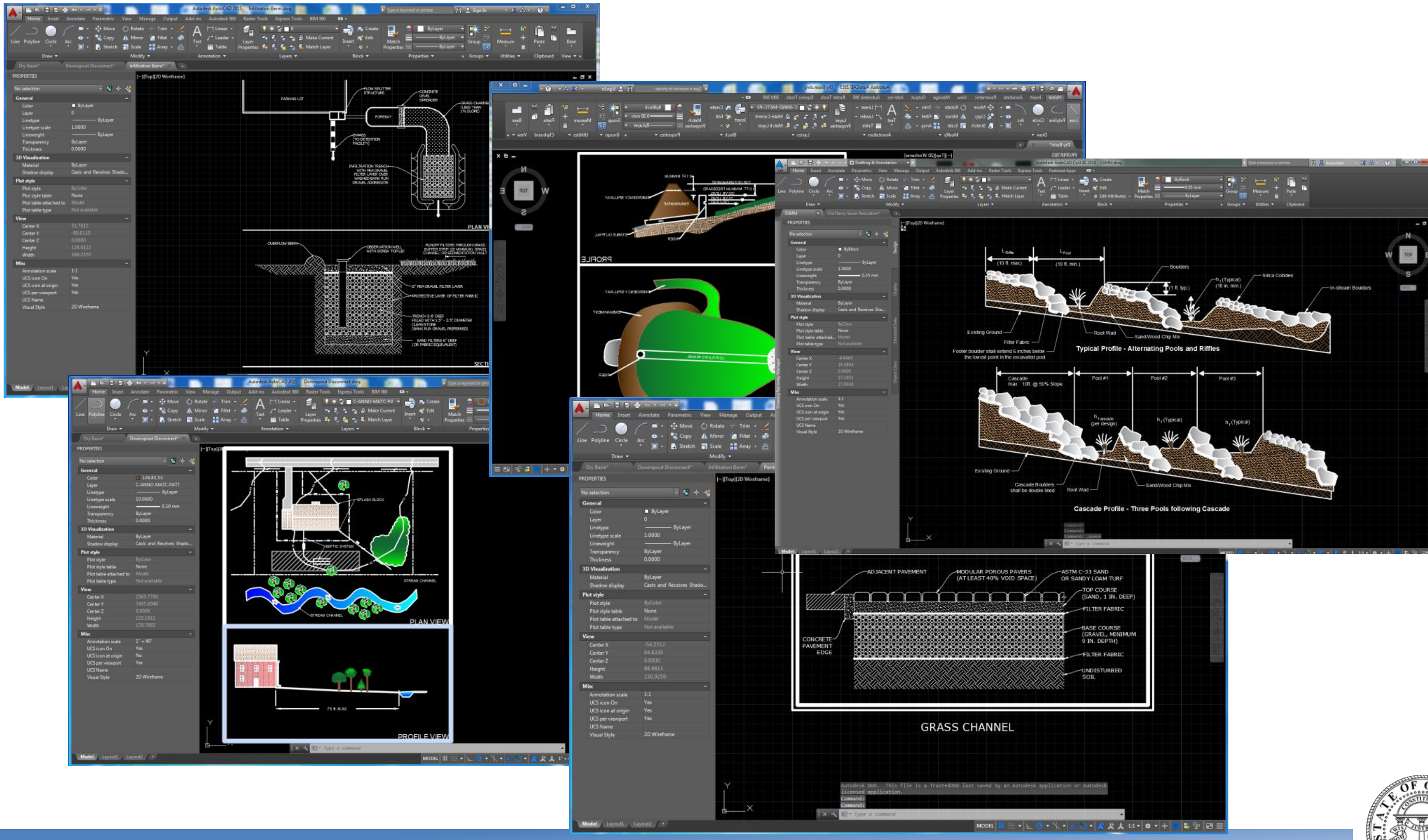
Updated design steps based on new research and incorporated runoff reduction calculations

Updated Graphics

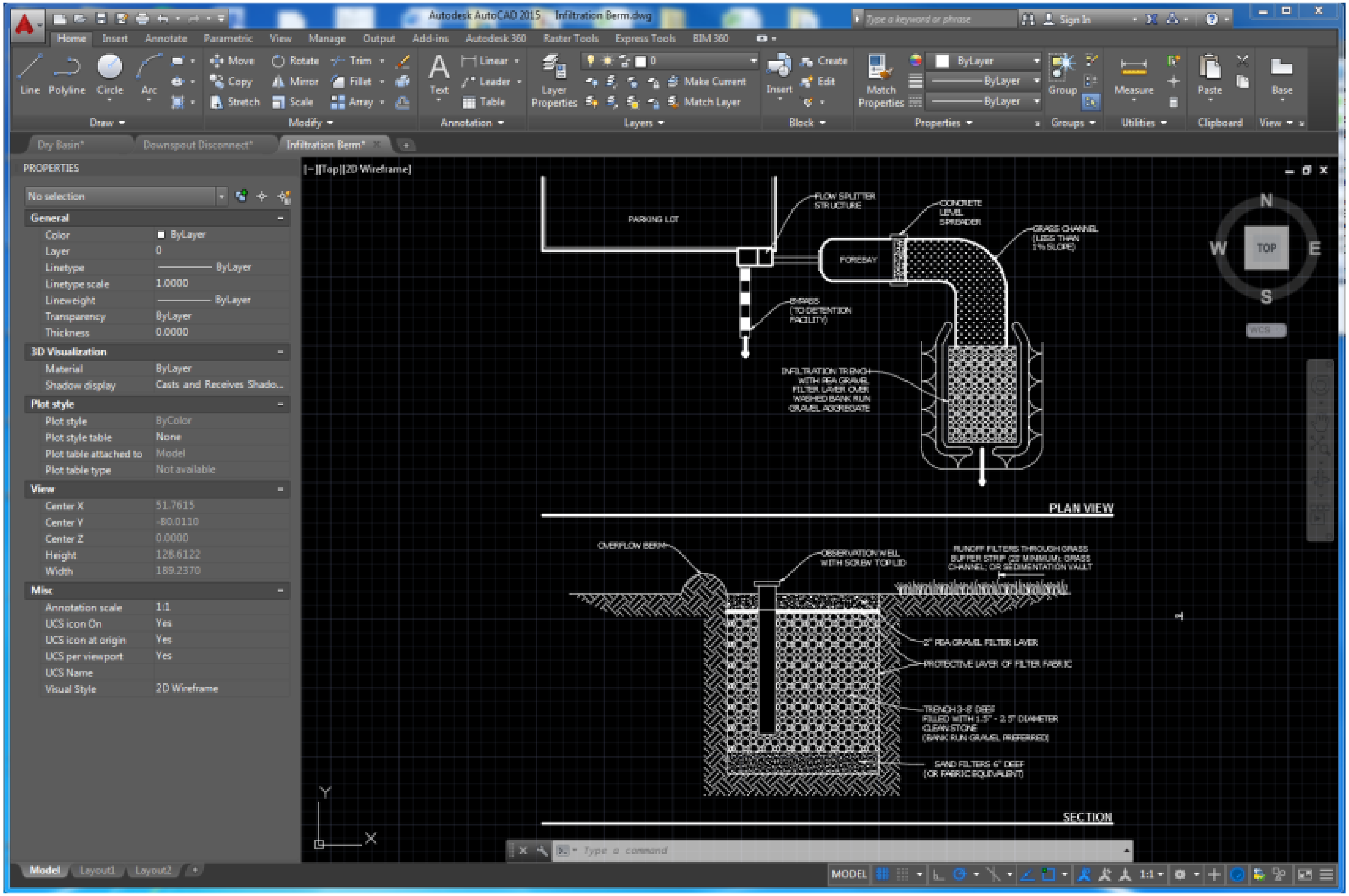
Graphics were updated based on new research for BMPs



Digital Design Details

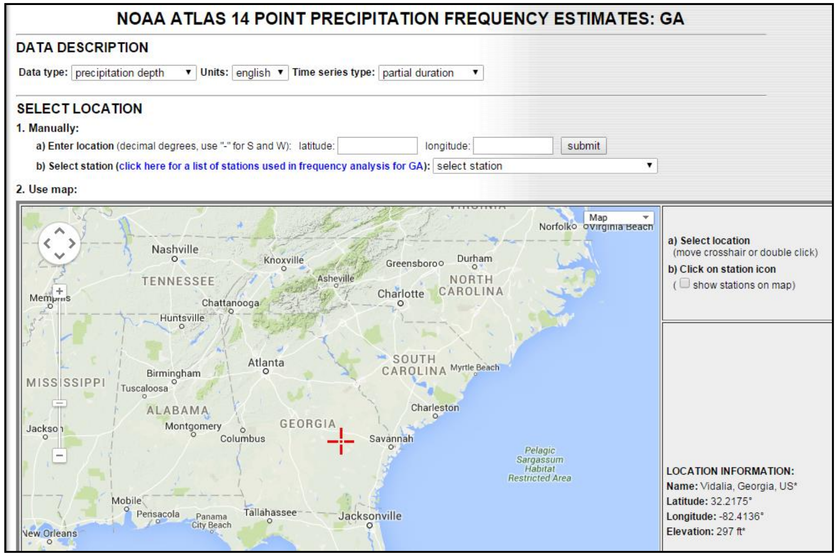


Digital Design Details



Updates to Appendices

- Added Reference to:
  - NOAA online rainfall data (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ga)
  - Soils Information for Georgia



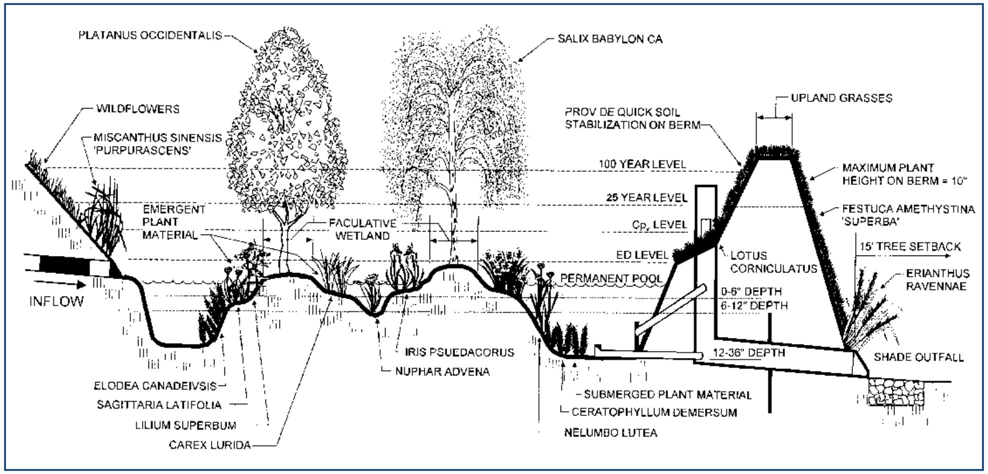
- Removed:
  - Computer Models
  - Georgia Safe Dams Act
  - Miscellaneous Specifications

Updates to Volume 2, Appendix D: Planting & Soil Guidance

- Consolidated plant list
- Additional information and characteristics on trees, shrubs, and plant selection
- Updates to soil tests, utilizing on-site soils, and utilizing a manufactured soil media.

Updates to Volume 2, Appendix D: Planting & Soil Guidance

- Includes planting media characteristics
- Requirements for landscape plans
- Examples of typical profiles for BMPs



- Additional information for establishing vegetation and maintenance
- Infiltration testing information

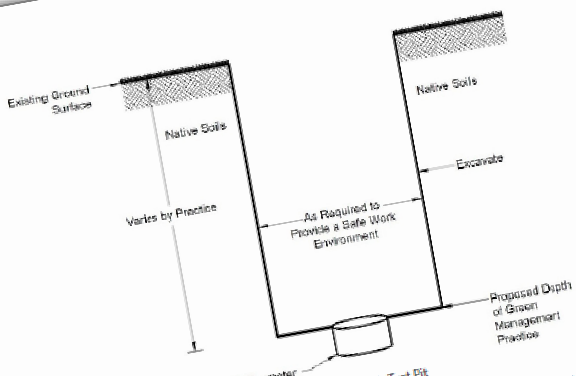


Figure D-1: Test Pit

D.2.2 Compaction, Construction and Soil

Areas that have recently been involved in construction as well as some native soils can become compacted so that plant roots cannot penetrate the soil. Seeds lying on the surface of compacted soils can be washed away or be eaten by birds. Soils should be loosened to a minimum depth of four inches, preferably to a six-inch depth. Hard soils may require a deeper depth. Loosening soils will improve seed contact with the soil, provide greater germination rates, and allow the roots to penetrate into the soil. Sod and other plantings will also benefit from loosened soil.

D.2.3 Soil Characteristics

The ability of the soil to store and release water and to provide plant establishment and plant growth can be limited by a number of different soil characteristics such as:

- Soil texture
- Soil Permeability
- pH -- whether acid, neutral, or alkali
- Nutrient levels -- nitrogen, phosphorus, potassium
- Minerals -- such as chelated iron, lime
- Salinity
- Toxicity

Soil texture: is determined by the percentage of sand, silt, and clay in the soil. The structure of a soil is influenced by soil texture and also by the combination of small soil particles into larger particles. The amount of aggregation in a soil is strongly influenced by the amount of organic matter present. Soils are made up of four basic ingredients: mineral elements, pore space, organic matter and other items consisting mainly of living organisms including fungi, bacteria, and nematodes. One classification of soils is based upon the mineral part of soil and consists of four sizes of particles. Clay particles are the smallest, followed by silt, sand, and gravel. The USDA has devised another system of classifying soil particles. In this system soil is divided into seven categories: clay, silt, and five sizes of sand.

Soil Permeability: Soil permeability is an important design factor in stormwater BMPs. It is advantageous and sometimes necessary to have high permeability in-situ soils for systems where infiltration may be desired (e.g. bioretention, infiltration practices, etc.). It is also advantageous and sometimes necessary to have low permeability in-situ soil for systems where permanent ponded water is required (e.g. stormwater wetlands, wet detention basins, etc.). In some BMP systems (e.g. sand filters, bioretention, etc.), high permeability media is required within the BMP, but since relatively small quantities are typically required, suitable soils can be imported to a site if necessary.

BACK TO TOC

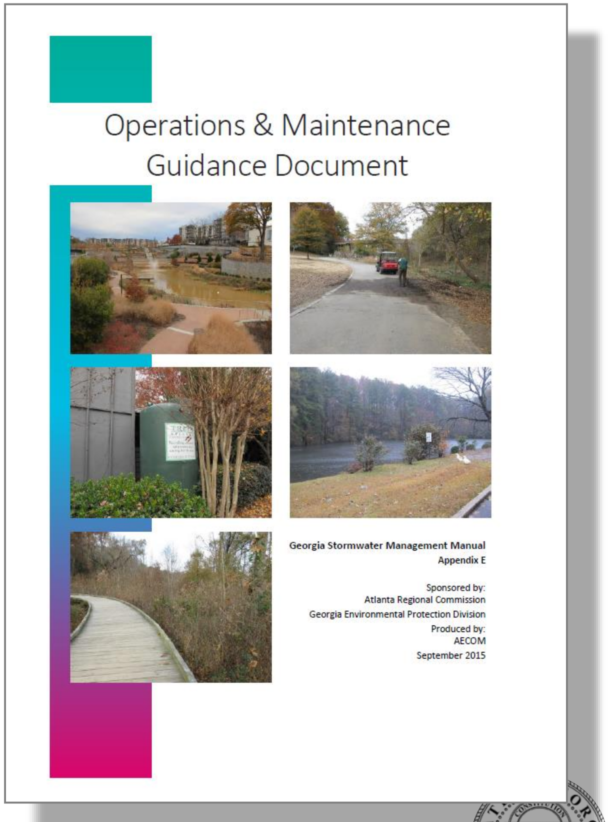
Georgia Native Plant List (continued)

Name	Common Name	Habit			H ZONE*	Hardiness
...ides	Eastern Cottonwood	Tree	Deciduous	Native	4,5	USDA Zone 3-9
...phylla	Swamp Cottonwood	Tree	Deciduous	Native	3,4,5	USDA Zone 7-8
	Wafer Ash	Tree	Deciduous	Native	5	USDA Zone 4-9
	Swamp White Oak	Tree	Deciduous	Native	3,4,5	USDA Zone 3-8
	Laurel Oak	Tree	Deciduous	Native	4,5	USDA Zone 7-9
	Overcup Oak	Tree	Deciduous	Native	3,4,5	USDA Zone 5-9
	Swamp Chestnut Oak	Tree	Deciduous	Native	4,5	USDA Zone 6-8
	Water Oak	Tree	Deciduous	Native	4,5	USDA Zone 5-9
	Cherrybark Oak	Tree	Deciduous	Native	4,5	USDA Zone 4-8
	Pin Oak	Tree	Deciduous	Native	4,5	USDA Zone 4-8
	Willow Oak	Tree	Deciduous	Native	3,4,5	USDA Zone 5-9
	Shumard Oak	Tree	Deciduous	Native	4,5	USDA Zone 5-9
	...oastal Plain Willow	Tree	Deciduous	Native	3,4,5	USDA Zone 7-8
	...ck Willow	Tree	Deciduous	Native	3,4,5	USDA Zone 2-8
	...ypress	Tree	Deciduous	Native	2,3,4	USDA Zone 4-9
	...press	Tree	Deciduous	Native	2,3,4	USDA Zone 4-9
	... Elm	Tree	Deciduous	Native	3,4,5	USDA Zone 2-9
	...m	Tree	Deciduous	Native	3,4,5	USDA Zone 3-9
	... Buckeye	Shrub	Deciduous	Native	3,4,5	USDA Zone 4-8
		Shrub	Deciduous	Native	3,4,5	USDA Zone 4-8
	...y	Shrub	Deciduous	Native	3,4,5	USDA Zone 5-8
	...bush	Shrub	Deciduous	Native	3,4,5	USDA Zone 4-9
	...sh	Shrub	Deciduous	Native	2,3,4	USDA Zone 5-9
		Shrub	Deciduous	Native	4,5	USDA Zone 3-7
		Shrub	Deciduous	Native	4,5	USDA Zone 5-8
		Shrub	Deciduous	Native	3,4,5	USDA Zone 3-8
		Shrub	Evergreen	Native	4,5	USDA Zone 5-9
		...hrub	Deciduous	Native	3,4,5	USDA Zone 4-9
		...rub	Deciduous	Native	2,3,4	USDA Zone 3-9
		...ub	Evergreen	Native	3,4,5	USDA Zone 5-9
		...b	Deciduous	Native	5	USDA Zone 3-9
					3,4,5	USDA Zone 4-9

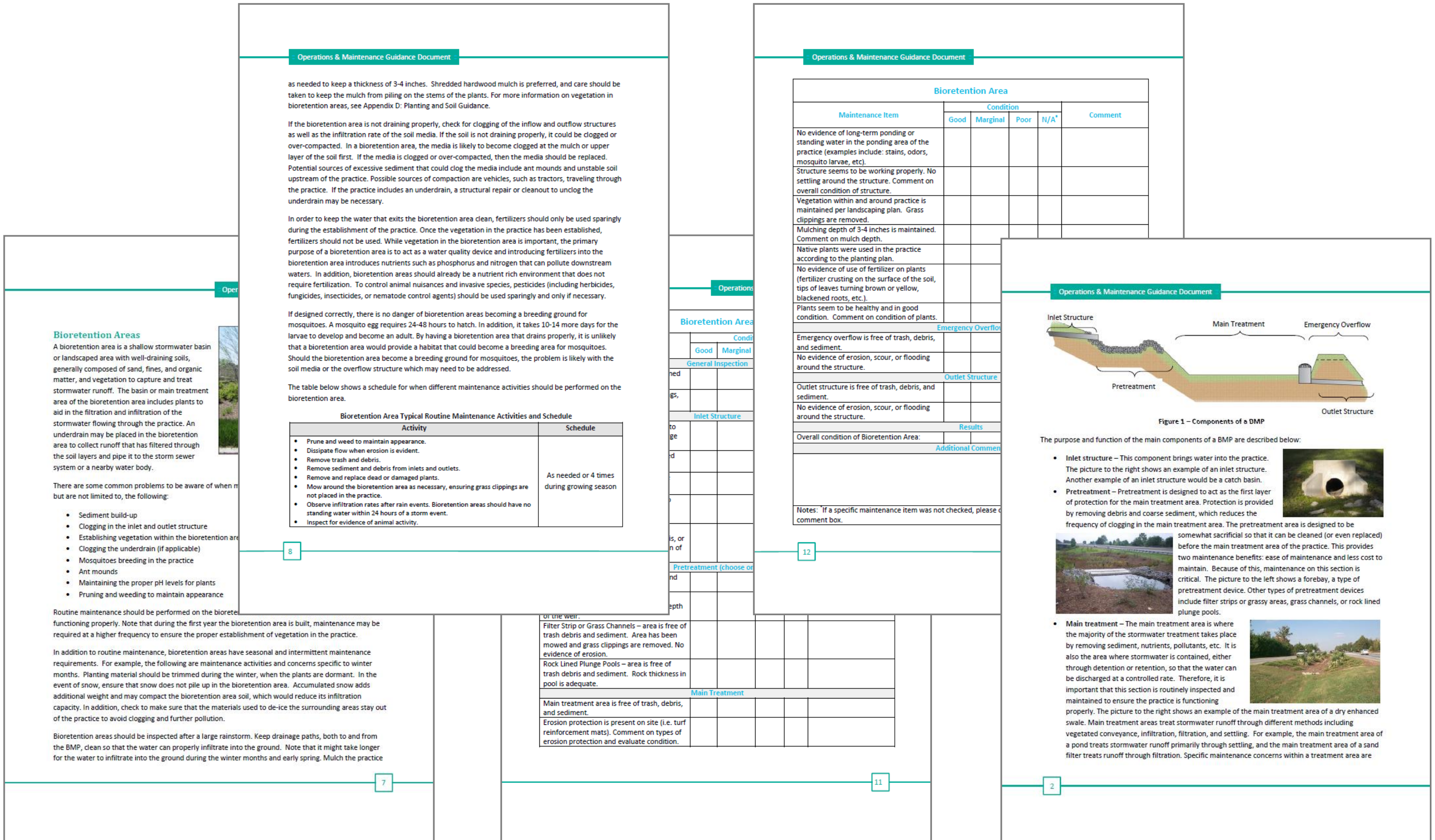
Appendix D: Planting & Soil Guidance

New Operations and Maintenance Guidance Document

- Reference for inspectors and maintenance workers detailing the following:
  - Key Components of a BMP
  - Importance of Inspecting a BMP
  - Maintenance Agreements
  - General Maintenance
  - Vegetation Maintenance
- Written in a more simplified language for use by a broader audience



New Operations and Maintenance Guidance Document


Operations & Maintenance Guidance Document

as needed to keep a thickness of 3-4 inches. Shredded hardwood mulch is preferred, and care should be taken to keep the mulch from piling on the stems of the plants. For more information on vegetation in bioretention areas, see Appendix D: Planting and Soil Guidance.

If the bioretention area is not draining properly, check for clogging of the inflow and outflow structures as well as the infiltration rate of the soil media. If the soil is not draining properly, it could be clogged or over-compacted. In a bioretention area, the media is likely to become clogged at the mulch or upper layer of the soil first. If the media is clogged or over-compacted, then the media should be replaced. Potential sources of excessive sediment that could clog the media include ant mounds and unstable soil upstream of the practice. Possible sources of compaction are vehicles, such as tractors, traveling through the practice. If the practice includes an underdrain, a structural repair or cleanout to unclog the underdrain may be necessary.

In order to keep the water that exits the bioretention area clean, fertilizers should only be used sparingly during the establishment of the practice. Once the vegetation in the practice has been established, fertilizers should not be used. While vegetation in the bioretention area is important, the primary purpose of a bioretention area is to act as a water quality device and introducing fertilizers into the bioretention area introduces nutrients such as phosphorus and nitrogen that can pollute downstream waters. In addition, bioretention areas should already be a nutrient rich environment that does not require fertilization. To control animal nuisances and invasive species, pesticides (including herbicides, fungicides, insecticides, or nematode control agents) should be used sparingly and only if necessary.

If designed correctly, there is no danger of bioretention areas becoming a breeding ground for mosquitoes. A mosquito egg requires 24-48 hours to hatch. In addition, it takes 10-14 more days for the larvae to develop and become an adult. By having a bioretention area that drains properly, it is unlikely that a bioretention area would provide a habitat that could become a breeding area for mosquitoes. Should the bioretention area become a breeding ground for mosquitoes, the problem is likely with the soil media or the overflow structure which may need to be addressed.

The table below shows a schedule for when different maintenance activities should be performed on the bioretention area.

Bioretention Area Typical Routine Maintenance Activities and Schedule

Activity	Schedule
• Prune and weed to maintain appearance. • Dissipate flow when erosion is evident. • Remove trash and debris. • Remove sediment and debris from inlets and outlets. • Remove and replace dead or damaged plants. • Mow around the bioretention area as necessary, ensuring grass clippings are not placed in the practice. • Observe infiltration rates after rain events. Bioretention areas should have no standing water within 24 hours of a storm event. • Inspect for evidence of animal activity.	As needed or 4 times during growing season

8

Bioretention Area

Maintenance Item	Good	Marginal	Poor	N/A*	Comment
No evidence of long-term ponding or standing water in the ponding area of the practice (examples include: stains, odors, mosquito larvae, etc).					
Structure seems to be working properly. No settling around the structure. Comment on overall condition of structure.					
Vegetation within and around practice is maintained per landscaping plan. Grass clippings are removed.					
Mulching depth of 3-4 inches is maintained. Comment on mulch depth.					
Native plants were used in the practice according to the planting plan.					
No evidence of use of fertilizer on plants (fertilizer crusting on the surface of the soil, tips of leaves turning brown or yellow, blackened roots, etc.).					
Plants seem to be healthy and in good condition. Comment on condition of plants.					
Emergency Overflow					
Emergency overflow is free of trash, debris, and sediment.					
No evidence of erosion, scour, or flooding around the structure.					
Outlet Structure					
Outlet structure is free of trash, debris, and sediment.					
No evidence of erosion, scour, or flooding around the structure.					
Results					
Overall condition of Bioretention Area:					
Additional Comments					

Notes: *If a specific maintenance item was not checked, please comment box.

12

Inlet Structure
Main Treatment
Emergency Overflow
Pretreatment
Outlet Structure

Figure 1 – Components of a BMP

The purpose and function of the main components of a BMP are described below:

- **Inlet structure** – This component brings water into the practice. The picture to the right shows an example of an inlet structure. Another example of an inlet structure would be a catch basin.
- **Pretreatment** – Pretreatment is designed to act as the first layer of protection for the main treatment area. Protection is provided by removing debris and coarse sediment, which reduces the frequency of clogging in the main treatment area. The pretreatment area is designed to be somewhat sacrificial so that it can be cleaned (or even replaced) before the main treatment area of the practice. This provides two maintenance benefits: ease of maintenance and less cost to maintain. Because of this, maintenance on this section is critical. The picture to the left shows a forebay, a type of pretreatment device. Other types of pretreatment devices include filter strips or grassy areas, grass channels, or rock lined plunge pools.
- **Main treatment** – The main treatment area is where the majority of the stormwater treatment takes place by removing sediment, nutrients, pollutants, etc. It is also the area where stormwater is contained, either through detention or retention, so that the water can be discharged at a controlled rate. Therefore, it is important that this section is routinely inspected and maintained to ensure the practice is functioning properly. The picture to the right shows an example of the main treatment area of a dry enhanced swale. Main treatment areas treat stormwater runoff through different methods including vegetated conveyance, infiltration, filtration, and settling. For example, the main treatment area of a pond treats stormwater runoff primarily through settling, and the main treatment area of a sand filter treats runoff through filtration. Specific maintenance concerns within a treatment area are

2

Bioretention Areas

A bioretention area is a shallow stormwater basin or landscaped area with well-draining soils, generally composed of sand, fines, and organic matter, and vegetation to capture and treat stormwater runoff. The basin or main treatment area of the bioretention area includes plants to aid in the filtration and infiltration of the stormwater flowing through the practice. An underdrain may be placed in the bioretention area to collect runoff that has filtered through the soil layers and pipe it to the storm sewer system or a nearby water body.

There are some common problems to be aware of when m... but are not limited to, the following:

- Sediment build-up
- Clogging in the inlet and outlet structure
- Establishing vegetation within the bioretention ar...
- Clogging the underdrain (if applicable)
- Mosquitoes breeding in the practice
- Ant mounds
- Maintaining the proper pH levels for plants
- Pruning and weeding to maintain appearance

Routine maintenance should be performed on the bioret... functioning properly. Note that during the first year the bioretention area is built, maintenance may be required at a higher frequency to ensure the proper establishment of vegetation in the practice.

In addition to routine maintenance, bioretention areas have seasonal and intermittent maintenance requirements. For example, the following are maintenance activities and concerns specific to winter months. Planting material should be trimmed during the winter, when the plants are dormant. In the event of snow, ensure that snow does not pile up in the bioretention area. Accumulated snow adds additional weight and may compact the bioretention area soil, which would reduce its infiltration capacity. In addition, check to make sure that the materials used to de-ice the surrounding areas stay out of the practice to avoid clogging and further pollution.

Bioretention areas should be inspected after a large rainstorm. Keep drainage paths, both to and from the BMP, clean so that the water can properly infiltrate into the ground. Note that it might take longer for the water to infiltrate into the ground during the winter months and early spring. Mulch the practice

7

Filter Strip or Grass Channels – area is free of trash debris and sediment. Area has been mowed and grass clippings are removed. No evidence of erosion.
Rock Lined Plunge Pools – area is free of trash debris and sediment. Rock thickness in pool is adequate.
Main Treatment
Main treatment area is free of trash, debris, and sediment.
Erosion protection is present on site (i.e. turf reinforcement mats). Comment on types of erosion protection and evaluate condition.

11

BMP Maintenance and Inspection Checklists

- Each BMP description in Vol. 2, Sect. 4 includes:
  - A description of how the BMP functions
  - A typical photo
  - Common maintenance issues
  - Key maintenance items
  - Typical routine maintenance activities and schedule
  - Inspection checklists

BMP Checklist Overview

Bioretention Area					
Maintenance Item	Condition				Comment
	Good	Marginal	Poor	N/A*	
General Inspection					
Access to the site is adequately maintained for inspection and maintenance.					
Area is clean (trash, debris, grass clippings, etc. removed).					
Inlet Structure					
Drainage ways (overland flow or pipes) to the practice are free of trash, debris, large branches, etc.					
Area around the inlet structure is mowed and grass clippings are removed.					
No evidence of gullies, rills, or excessive erosion around the inlet structure.					
Water is going through structure (i.e. no evidence of water going around the structure).					
Diversion structure (high flow bypass structure or other) is free of trash, debris, or sediment. Comment on overall condition of diversion structure and list type.					

Bioretention Area					
Maintenance Item	Condition				Comment
	Good	Marginal	Poor	N/A*	
General Inspection					
Access to the site is adequately maintained for inspection and maintenance.					
Area is clean (trash, debris, grass clippings, etc. removed).					
Inlet Structure					
Drainage ways (overland flow or pipes) to					

ent (choose one)

Treatment

BMP Checklist Overview

Bioretention Area					
Maintenance Item	Condition				Comment
	Good	Marginal	Poor	N/A*	
General Inspection					
Access to the site is adequately maintained for inspection and maintenance.					

Pretreatment (choose one)					
Forebay – area is free of trash, debris, and sediment.					
Weir – area is free of trash, debris, and sediment is less than 25% of the total depth of the weir.					
Filter Strip or Grass Channels – area is free of trash debris and sediment. Area has been mowed and grass clippings are removed. No evidence of erosion.					
Rock Lined Plunge Pools – area is free of trash debris and sediment. Rock thickness in pool is adequate.					
Main Treatment					
Main treatment area is free of trash, debris, and sediment.					
Erosion protection is present on site (i.e. turf reinforcement mats). Comment on types of erosion protection and evaluate condition.					

trash debris and sediment. Area has been mowed and grass clippings are removed. No evidence of erosion.					
Rock Lined Plunge Pools – area is free of trash debris and sediment. Rock thickness in pool is adequate.					
Main Treatment					
Main treatment area is free of trash, debris, and sediment.					
Erosion protection is present on site (i.e. turf reinforcement mats). Comment on types of erosion protection and evaluate condition.					

BMP Checklist Overview

Bioretention Area					
Maintenance Item	Condition				Comment
	Good	Marginal	Poor	N/A*	
No evidence of long-term ponding or standing water in the ponding area of the practice (examples include: stains, odors, mosquito larvae, etc).					
Structure seems to be working properly. No settling around the structure. Comment on overall condition of structure.					
Vegetation within and around practice is maintained per landscaping plan. Grass clippings are removed.					
Mulching depth of 3-4 inches is maintained. Comment on mulch depth.					
Native plants were used in the practice according to the planting plan.					
No evidence of use of fertilizer on plants (fertilizer crusting on the surface of the soil, tips of leaves turning brown or yellow, blackened roots, etc.).					
Plants seem to be healthy and in good condition. Comment on condition of plants.					

Bioretention Area					
Maintenance Item	Condition				Comment
	Good	Marginal	Poor	N/A*	
No evidence of long-term ponding or standing water in the ponding area of the practice (examples include: stains, odors, mosquito larvae, etc).					
Structure seems to be working properly. No settling around the structure. Comment on overall condition of structure.					
Vegetation within and around practice is maintained per landscaping plan. Grass clippings are removed.					
Mulching depth of 3-4 inches is maintained. Comment on mulch depth.					
Native plants were used in the practice [illegible]					
[illegible] plants [illegible] of the soil, [illegible] llow,					
[illegible] good [illegible] n of plants.					

Emergency Overflow					
[illegible] sh, debris,					
[illegible] flooding					
Outlet Structure					
[illegible] lebris, and					
[illegible] flooding					
Results					
[illegible] Area:					
Additional Comments					
[illegible] item was not checked, please check N/A and explain why in the appropriate					

BMP Checklist Overview

Maintenance Item	Good	Marginal	Poor	N/A*	Comment
Emergency Overflow					
Emergency overflow is free of trash, debris, and sediment.					
No evidence of erosion, scour, or flooding around the structure.					
Outlet Structure					
Outlet structure is free of trash, debris, and sediment.					
No evidence of erosion, scour, or flooding around the structure.					
Results					
Overall condition of Bioretention Area:					
Additional Comments					

Notes: *If a specific maintenance item was not checked, please check N/A and explain why in the appropriate comment box.

Bioretention Area

Maintenance Item	Condition				Comment
	Good	Marginal	Poor	N/A*	
No evidence of long-term ponding or standing water in the ponding area of the practice (examples include: stains, odors, mosquito larvae, etc).					
. No … t on					
is …					
ned.					
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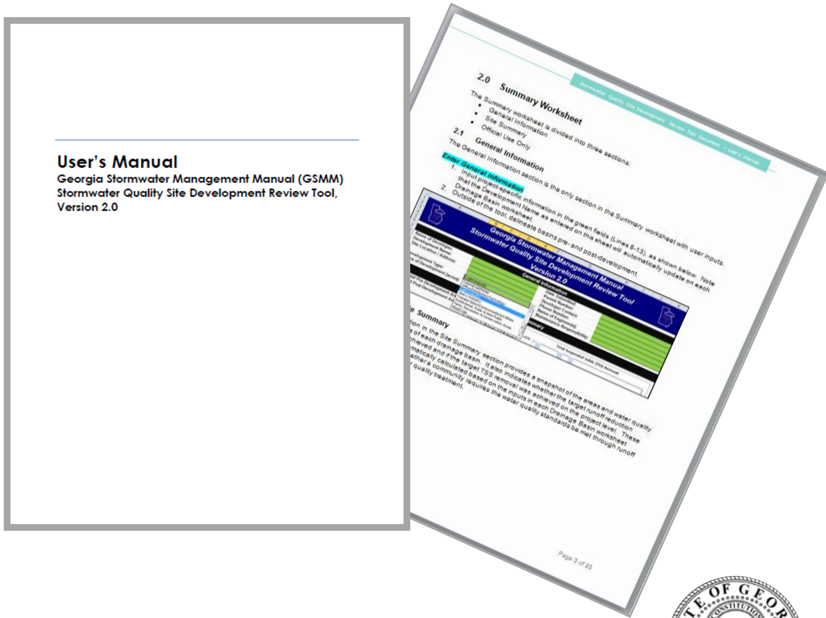
ants.					
Emergency Overflow					
bris,					
ng					
Outlet Structure					
and sediment.					
No evidence of erosion, scour, or flooding around the structure.					
Results					
Overall condition of Bioretention Area:					
Additional Comments					

Notes: *If a specific maintenance item was not checked, please check N/A and explain why in the appropriate comment box.

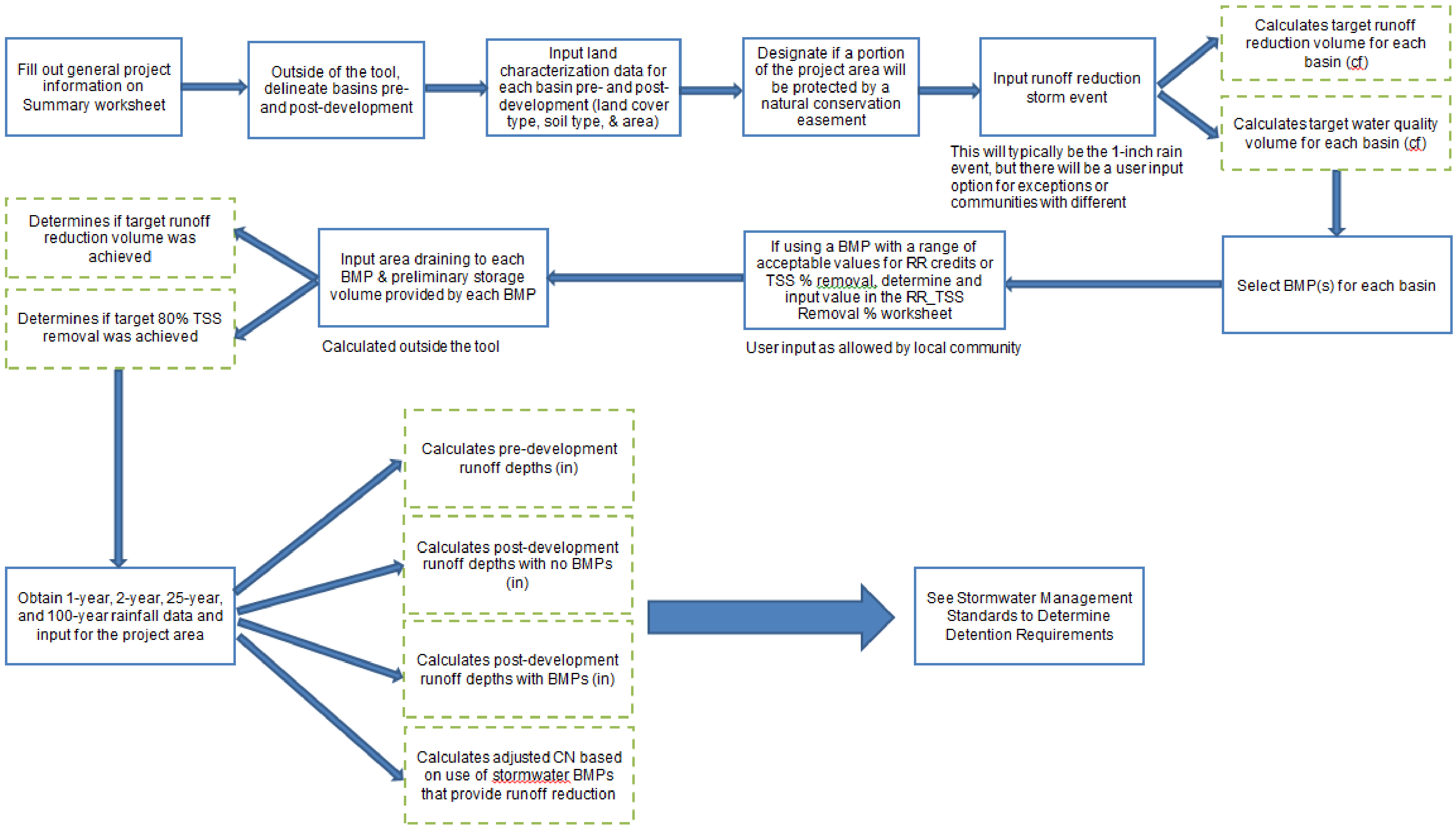
Updated BMP Calculator Tool

- Assists designers and developers to incorporate runoff reduction and water quality requirements into design plans
- Assists local jurisdictions with the review of design plans
- Provides a visual to show if the runoff reduction or water quality standard was met

- A User's Manual was developed that explains how the Tool functions



Updated BMP Calculator Tool



Updated BMP Calculator Tool

Georgia Stormwater Management Manual
Stormwater Quality Site Development Review Tool
Version 2.0

General Information

Name of Developer:		Date Submitted:	
Development Name:		Permit Number:	
Site Location / Address:		Developer Contact:	
		Phone Number:	
		Name of Engineer(s):	
Development Type:		Maintenance Responsibility:	

Site Summary

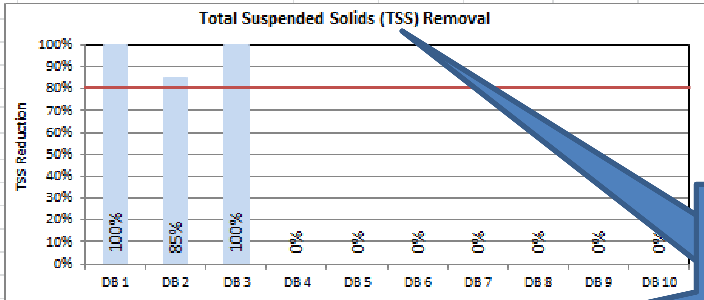
Total Pre-Development Area (ac):	11.00
Total Post-Development Area (ac):	11.00
Total Treated Area (ac):	11.00
Total Untreated Area (ac):	0.00

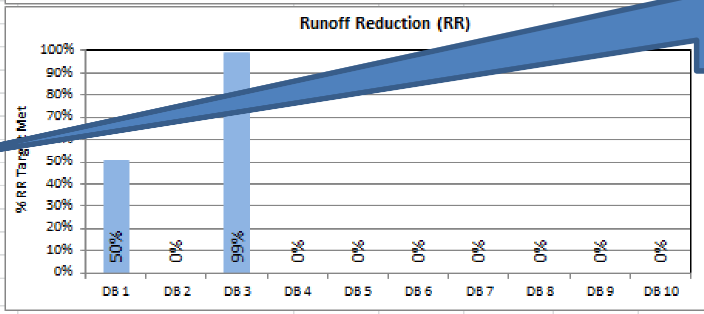
		I (ac)	P (ac)	CA (ac)
Drainage Basin 1	DB 1	1.90	0.60	0.50
Drainage Basin 2	DB 2	1.90	1.10	0.00
Drainage Basin 3	DB 3	0.00	5.00	0.00
Drainage Basin 4	DB 4	0.00	0.00	0.00
Drainage Basin 5	DB 5	0.00	0.00	0.00
Drainage Basin 6	DB 6	0.00	0.00	0.00
Drainage Basin 7	DB 7	0.00	0.00	0.00
Drainage Basin 8	DB 8	0.00	0.00	0.00
Drainage Basin 9	DB 9	0.00	0.00	0.00
Drainage Basin 10	DB 10	0.00	0.00	0.00
	TOTAL	3.80	6.70	0.50

I - Impervious Area, P - Pervious Area, CA - Conservation Area

Target Runoff Reduction Volume Achieved?	No
Target TSS Removal Achieved?	Yes

Total Target Runoff Reduction Volume (cf)	13,286
Runoff Reduction Volume Achieved (cf)	8,804
Total Target Water Quality Volume (cf)	15,943
% TSS Removal Achieved	95%





Shows water quality & runoff reduction achievements on the basin and project level

Official Use Only

Tracking #:		Conditions of Approval:	
Reviewed By:			
Date Approved:			

A RECORDED CONSERVATION EASEMENT OR SIMILAR FORM OF PROTECTION IS REQUIRED FOR THIS PROJECT

Updated BMP Calculator Tool

Site Data

Indicate Pre-Development Land Cover and Runoff Curve Numbers in the Site's Disturbed Area

Cover Type	HSG* A (acres)	CN	HSG B (acres)	CN	HSG C (acres)	CN	HSG D (acres)	CN	Total	% Cover
Woods - Good Condition		30		55	3.00	70		77	3.00	100%
Select a land cover type...		0		0		0		0	0.00	0%
Select a land cover type...		0		0		0		0	0.00	0%
Select a land cover type...		0		0		0		0	0.00	0%
Select a land cover type...		0		0		0		0	0.00	0%
Local Jurisdiction Input									0.00	0%
Other									0.00	0%
Total	0.00		0.00		3.00		0.00		3.00	100%

*HSG = hydrologic soil group

Impervious (ac)	0.00
Weighted CN	70
Potential Max Soil Retention, S_{pre} (in)	4.29

Indicate Post-Development Land Cover and Runoff Curve Numbers in the Site's Disturbed Area

Cover Type	HSG A (acres)	CN	HSG B (acres)	CN	HSG C (acres)	CN	HSG D (acres)	CN	Total	% Cover
Impervious		98		98	1.90	98		98	1.90	63%
Meadow - continuous grass, protected from grazing and generally mowed for hay		30		58	1.10	71		78	1.10	37%
Select a land cover type...		0		0		0		0	0.00	0%
Select a land cover type...		0		0		0		0	0.00	0%
Select a land cover type...		0		0		0		0	0.00	0%
Local Jurisdiction Input									0.00	0%
Other									0.00	[illegible]
Total	0.00		0.00		3.00		0.00		3.00	100%

Impervious (ac)	1.90
Rv	0.62
Weighted CN	88
Potential Max Soil Retention, S_{post} (in)	1.35

New look and feel

Allows flexibility for local requirements

	Runoff Reduction %	Effective TSS Removal %	Does the BMP provide storage for runoff	Drainage Area Restrictions	Units	Min/Max
Proprietary System						
Rainwater Harvesting			Storage			
Regenerative Stormwater Conveyance	0%	80%	Storage	50	acres	Max
Sand Filter	0%	80%	Storage	10	acres	Max
Site Reforestation/Revegetation	0%	0%	Convey	--	--	--
Soil Restoration (can be used to remediate C & D soils)	0%	0%	Convey	--	--	--
Stormwater Planter / Tree Box	50%	80%	Storage	2500	ft^2	Max
Stormwater Pond	0%	80%	Storage	10-25	acres	Min
Stormwater Wetlands - Level 1	0%	80%	Convey	5	acres	Min
Stormwater Wetlands - Level 2	0%	85%	Convey	5	acres	Min
Submerged Gravel Wetlands	0%	80%	Convey	5	acres	Min
Underground Detention	0%	0%	Convey	--	--	--
Vegetated Filter Strip (A & B hydrologic soils)	50%	60%	Convey	--	--	--
Vegetated Filter Strip (C & D hydrologic soils)	25%	60%	Convey	--	--	--
[User Input 1]						
[User Input 2]						
[User Input 3]						

Updated BMP Calculator Tool

Select BMPs for Runoff Reduction and Water Quality

		Area Draining to Each BMP			Storage Volume Provided by BMP (cf)	RR Conveyance Volume Provided by BMP (cf)	Down-stream BMP	Runoff Reduction Calculations						WQ Calculations	
		On-site Pervious Area (acres)	On-site Impervious Area (acres)	Offsite Area (acres)				RR Volume from Direct Drainage (cf)	RR Volume from Upstream Practices (cf)	Total RR Volume Received by BMP (cf)	Runoff Reduction %	RR Achieved (cf)	Remaining RR Volume (cf)	WQ. from Direct Drainage (cf)	Effective TSS Removal %
BMP 1	Downspout Disconnect (C & D hydrologic soils)	0.00	0.30	0.00		1,035	BMP 2	1,035	0	1,035	25%	259	776	1,241	80%
BMP 2	Bioretention Basin (w/ underdrain)	1.10	1.37		5,000			4,924	1,490	6,414	50%	2,500	3,914	5,909	85%
BMP 3	Grass Channel (C & D hydrologic soils)		0.23			793	BMP 2	793	0	793	10%	79	714	952	50%
BMP 4	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 5	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 6	Select a BMP…								0	0	N/A	0	0	0	N/A
BMP 7	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 8	Select a BMP…							0	0	0	N/A	0	0	0	N/A
BMP 9	Select a BMP…							0		0	N/A	0	0	0	N/A
BMP 10	Select a BMP…							0	0	0	N/A	0	0	0	N/A
	TOTAL	1.10	1.90	0.00				6,752				2,838		8,102	
	UNTREATED AREA (acres)	0.00	0.00												

Target Runoff Reduction Volume (cf)	6,752
Target Achieved?	No
Remaining Runoff Reduction Volume (cf)	3,914

Target Water Quality Volume (cf)	8,102
% TSS Removal Achieved	88%
Target Achieved?	Yes!
Remaining TSS Removal %	0%

Allows treatment trains or individual BMPs

Automatically calculates runoff reduction and TSS removal achieved

Updated BMP Calculator Tool

Channel and Flood Protection Calculations

	1-yr, 24-hr storm	2-yr, 24-hr storm	25-yr, 24-hr storm	100-yr, 24-hr storm
Target Rainfall Event (in)	3.40	4.20	7.90	9.80

	1-yr, 24-hr storm	2-yr, 24-hr storm	25-yr, 24-hr storm	100-yr, 24-hr storm
Pre-Development Runoff Volume (in)	0.95	1.46	4.38	6.05
Post Development Runoff Volume (in) with no BMPs	2.19	2.92	6.48	8.35
Post-Development Runoff Volume (in) with BMPs	1.93	2.66	6.22	8.09
Adjusted CN	**85**	**85**	**86**	**86**

*See Stormwater Management Standards to Determine Detention Requirements.

Calculates adjusted CN based on the runoff reduction achieved