BEAUFORT COUNTY
STORMWATER MANAGEMENT UTILITY BOARD AGENDA
Wednesday, November 9, 2016
2:00 p.m.
Executive Conference Room, Administration Building
Beaufort County Government Robert Smalls Complex
100 Ribaut Road, Beaufort, South Carolina
843.255.2805

In accordance with South Carolina Code of Laws, 1976, as amended, Section 30-4-80(d), all local media was duly notified of the time, date, place and agenda of this meeting.

1. CALL TO ORDER – 2:00 p.m.
   A. Approval of Agenda
   B. Approval of Minutes – September 14, 2016 (backup)
2. INTRODUCTIONS
3. PUBLIC COMMENT
4. REPORTS
   A. October Stormwater Manager's Report – Eric Larson, P.E. (backup)
   B. Utility Update – Eric Larson, P.E. (backup)
   C. Monitoring Update – Eric Larson, P.E. (backup)
   D. Stormwater Implementation Committee Report – Eric Larson, P.E. (backup)
   E. Stormwater Related Projects – Eric Larson, P.E. (backup)
   F. Upcoming Professional Contracts Report – Eric Larson, P.E. (backup)
   G. Regional Coordination – Eric Larson, P.E. (backup)
   H. Municipal Reports – Eric Larson, P.E. (backup)
   I. MS4 Update – Eric Larson, P.E. (backup)
   J. Maintenance Projects Report – David Wilhelm (backup)
5. UNFINISHED BUSINESS
6. NEW BUSINESS
   A. 2017 SWMU Board Calendar - Eric Larson, P.E. (backup)
   B. Hurricane Matthew Briefing (http://beaufortcountydisasterrecovery.net/) - Eric Larson, P.E.
   C. Special Presentation: Bluffton Gateway - Eric Larson, P.E. (backup)
7. PUBLIC COMMENT
8. NEXT MEETING AGENDA
   A. December 14, 2016 (backup)
9. ADJOURNMENT

Beaufort County Stormwater Management Utility Board (SWMU Board) Meeting Minutes

September 14, 2016 at 2:00 p.m. in Executive Conference Room, Administration Building, Beaufort County Government Robert Smalls Complex, 100 Ribaut Road, Beaufort, South Carolina
Draft Minutes 09/19/2016

Board Members		Ex-Officio Members	
Present	**Absent**	**Present**	**Absent**
Don Smith	Larry Meisner	Scott Liggett	Van Willis
Allyn Schneider	James Fargher	Andy Kinghorn	Kim Jones
Patrick Mitchell			
William Bruggeman			
Marc Feinberg			

Beaufort County Staff
Eric Larson
David Wilhelm
Rebecca Baker
Patricia Wilson
Chad Stanley

Visitors
Alan Warren, USCB
Kate Schaefer, Coastal Conservation League
Rikki Parker, Coastal Conservation League
Lamar Taylor, City of Beaufort

1. Meeting called to order – Don Smith

A. Agenda – Approved by adding Item C (Draft 2017 Stormwater Board Meeting Schedule and item D (Board Members' Reappointment Intent Letter Due October 12, 2016) under New Business Section 6.
B. August 10, 2016 - Approved.

2. Introductions – Completed.

3. Public Comment(s) – Mr. Eric Larson announced to the board that Mrs. Patricia (Patty) Wilson (the Stormwater Administrative Technician) will be transferring to the Engineering Department to become the Right of Way Manager. Mr. Larson added that Mrs. Wilson will also be the Easement Manager for Stormwater, but will be providing that support under the Engineering Department. The board thanked her for her service and wished her well.

4. Reports – Mr. Eric Larson, Mr. David Wilhelm, and Mrs. Rebecca Baker provided a written report which is included in the posted agenda and can be accessed at:
http://www.bcgov.net/departments/Administrative/beaufort-county-council/boards-and-commissions/council-appointed/board-list/stormwater-management-utility-board/agendas/2016/091416.pdf

Utility Update – Eric Larson
Mr. Larson reported to the board that Beaufort County Stormwater Utility was born by ordinance 15 years ago on September 10, 2001. The Board took a moment to reflect on the progress made in 15 years. Mr. Larson updated the board that County Council extended the tax run dead line to

October 15, 2016. Utility Staff is still in the middle of QA/QC and will submit the tax run data by September 23, 2016 or sooner. Mr. Larson added that the Utility is currently advertising for a replacement for Mrs. Wilson's position and Mrs. Carolyn Wallace will be providing support until a replacement is hired.

Monitoring Update – Eric Larson

Mr. Larson said that Mrs. Rebecca Baker will discuss monitoring updates under the MS4 Update. Dr. Alan Warren commented that USCB Lab staff is currently out in the field capturing wet weather samples around the field from sites that were previously sampled by GEL Engineering. Dry weather samples for the 3 month quarter have already been captured.

Stormwater Implementation Committee (SWIC) Report – Eric Larson

The SWIC met on September 7, 2016. Mr. Larson commented that the SWIC is in the process of strategic planning for education efforts and working on collaborating data management for monitoring requirements.

Stormwater Related Projects – Eric Larson

Mr. Larson thought he might need to bring a condemnation request before the board regarding the Salem Dr. East easement requests; however, the County Attorney is working on an alternative option. Easement requests for McTeer Drive have resulted in 2 recorded easements, 2 written denials, and 11 no responses out of 15 easements requested. He added that many of the property owners paid a private company to clean out the ditch and some owners are leery of granting easements due to possible damage to vegetation and trees within the ditch. Mr. Larson sought the board's input on pursuing the McTeer Drive easements and the consensus of the board is to not take further action on the easements at the moment.

Mr. Larson, Mr. David Wilhelm, and Mr. Chad Stanley are attending a community meeting September 14th at Jehovah Church of Christ on Saint Helena Island. This is a follow-up meeting to a previous Master Plan Public Meeting.

Professional Contracts Report – Eric Larson

Stormwater Management Plan (Master Plan) Update – ($475,000 Budget; $239,542 County portion) – Mr. Larson informed the board that a citizen group on Hilton Head Island set up an additional meeting on September 12th at Central Oak Baptist Church. The citizens wanted to voice their concerns about the Master Plan. Most comments were not Master Plan related but personal issues such as backyards flooding, ditches clogged, etc., which gave the citizens an opportunity to publicly voice their opinions.

Mint Farm Basin B Modification – ($8,000 Budget) – The engineer's estimate is about $30,000. The Utility is currently soliciting bids to install an overflow structure into the retention pond (has no outfall) to transform the pond into a detention pond. Informal bids are being requested due to time constraints and the minimal cost of the project.

SC 170 Widening Drainage – ($17,500 Budget with 50% of funding from the Stormwater Department) – Mr. Larson said that the consultant had difficulties scheduling interviews so a 30-day extension was granted in order to complete his third party evaluation of the project.

Regional Coordination
Hilton Head National Redevelopment – Mr. Larson is monitoring this project because of the size of the project and possible stormwater / environmental ramifications in the future. The planning commission has asked the applicant to consider revisions to their concept plan and proposal. Mr. Larson believes the plan is being rescaled.

Municipal Reports – Eric Larson
Town of Hilton Head Island – Mr. Scott Liggett informed the board that Brian McIlwee is now the Town of Bluffton's Director of Engineering. The Town of Hilton Head Island is looking for a replacement for his position. Mr. Larson has offered to his assistance to the Town of Hilton Head Island in the interim.
Town of Bluffton – Report was posted in the Agenda Packet.
City of Beaufort – Mr. Lamar Taylor reported that the Battery Creek Pond Funded by an EPA 319(h) Grant project partnership between the City of Beaufort and Beaufort County is about 80% constructed and the shelf is about 75% constructed. The City is going through the review of the Storm Ceptor BMP device, and considering other BMP products to select a device which requires less maintenance. The pond should be in operation around Christmas.
Town of Port Royal – Nothing was reported.

Municipal Separate Storm Sewer System (MS4 Update) – Rebecca Baker
Monitoring Update – Mrs. Rebecca Baker reported the monitoring subcommittee is working with Mr. Bates Rambow on implementing the data system the he reported on at the August 10, 2016 meeting. She added that E.coli and Copper are being added to the monitoring parameters.
Public Education - Mrs. Baker was happy to report that there is a strategic planning meeting scheduled for September 29th from 9:00 to 12:00 at the Port Royal Sound Maritime Center to discuss community educational needs based survey results. Invites were sent out and board members are encouraged to attend the meeting.
Plan Review – Mrs. Baker referenced a table from her report which lists all the plan reviews for August. She noted that Oyster Bluff Phase II was deferred again, but would likely be approved in the future.
BMP (Best Management Practices) Manual – Mr. Larson will provide an update under New Business.
SCASM (South Carolina Association of Stormwater Managers) – Mr. Larson and Mrs. Baker gave a presentation on the new BMP manual and volume control standards. Mrs. Baker also spoke about implementing a One-Stop-Shop process for permitting by utilizing the MUNIS system. The goal is to get all departments working through MUNIS.

Maintenance Projects Report – David Wilhelm
Mr. David Wilhelm reported on Hamrick Drive which improved 2,003 feet of various Stormwater drainage systems. It was an extensive effort with the total cost of $63,405.64. Mr. Larson pointed out that the cost of this project (repairing County owned infrastructure in the Town of Port Royal) was paid for by the CWI fees collected from the Town of Port Royal residents. Mr. Wilhelm also mentioned the Port Royal Island Bush Hogging project which improved 120,584 feet of drainage system and cost $65,187.66. Mr. Wilhelm added that $.50 per foot is the target cost per foot and

this project fell within the desired cost range. Mr. Wilhelm added that the Doe Drive project met the desired roadside drainage cost of $10.00 per foot with a total cost of $14,082.62 for 1,454 feet of ditch cleaning. Mr. Wilhelm finished his report by saying no Stormwater related complaints resulted from Tropical Storms Hermine and Julia.

Financial Report – Chanel Lewis
Ms. Chanel Lewis gave a financial update as of June 30, 2016. Ms. Lewis stated that collected revenues are at 94.5% which is 5.2 million. Operation expenses are 74.1% of the budget, Administrative expenses are 105.5% (due to an overage in professional services), and Regulatory expenses are 64.1%. Revenues exceeded expenditures by 1,082,000. Capital improvements had $104,000 transferred from the Stormwater Utility Fund. This year $118,000 was spent which include the Highway 278 Retrofit, Okatie West Land Purchase and Battery Creek Upper. Expenditures were $14,983 over revenues of $104,000. The current fund balance is $378,802.

Mr. Don Smith questioned nonpayment of the military bases and if recourse was possible. Mr. Marc Feinberg was assured that excess funds do not get transferred to other County Fund Accounts. Mr. Larson said that once the capital projects were up and running, the surplus funds will diminish.

5. Unfinished Business – None.

6. New Business – (backup)
Adoption of Revised BMP (Best Management and Design Practices) Manual - Mr. Eric Larson presented a power point that summarized the revised Best Management and Design Practices (BMP) Manual. He discussed how the BMP Manual was reformatted to correspond to the MS4 permit categories. He also discussed the necessity of adding regulatory requirements and technical details that were not included in previous manuals. Mr. Don Smith questioned who would perform the final Stormwater Inspection on permits and Mr. Larson replied that the building inspectors will provide the initial inspection and if necessary, Stormwater Inspectors will provide a thorough inspection.

Mr. Larson also discussed a supplement (backup) which clarifies technical issues and cleans up a couple of typos overlooked in the revised BMP manual. Mr. Patrick Mitchell questioned Mr. Larson about a comment an engineer presented to him. Mr. Larson replied that the comment was submitted after the September 1, 2016 deadline and would be a top consideration with the next manual revision.

A motion was made by the board to adopt the Revised BMP (Best Management and Design Practices) BMP Manual and the supplement presented by Mr. Larson. The motion was passed unanimously with a vote of 5:0.

Adoption of 2016 Stormwater Ordinance Revision – Mr. Larson
Mr. Larson discussed the necessary changes to the ordinance to incorporate the corresponding changes to the revised BMP manual. A motion was made and passed unanimously (5:0) to recommend the 2016 Stormwater Ordinance Revision Dated September 9, 2016 to the Natural Resources Committee.

Draft 2017 Stormwater Board Meeting Schedule – Mr. Larson informed the board that the schedule is informational only. Action will need to be taken at the October 12, 2016.
Board Members' Reappointment Intent Letter Due October 12, 2016 – Mr. Larson reminded the board that intent letters are due to the clerk to council by November 1, 2016. He added that now is the time if anyone is interested in joining the board to get their paperwork submitted in case a vacancy opens up.

7. Public Comment(s) – None.

8. Next Meeting Agenda – Approved by adding a presentation by Mr. Larson on the Bluffton Gateway Stormwater Design as New Business of the October 12, 2016 Agenda.

9. Meeting Adjourned

Manual

Beaufort County

Manual for Stormwater Best Management and Design Practices (BMP)

September 14, 2016

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Contents

Section 1
Introduction

1.1 Background and Purpose

Stormwater discharges from developed areas often have adverse impacts on receiving waters. Streambank erosion, flooding and excessive stormwater pollution loads are among the potential impacts of stormwater discharges.

Throughout the United States, stormwater management methods have evolved substantially over the last 30 years. Initially, stormwater management focused on moving the stormwater off the developed area as rapidly as possible, with little or no consideration of receiving water impacts. Then, stormwater management methods began to require the detention of stormwater to reduce the peak flows from development for purposes of flood control and streambank erosion control. Most recently, the detention of stormwater has been designed to reduce stormwater pollution loads as well as reducing flooding and erosion impacts.

Development in Beaufort County is subject to County and State stormwater management regulations that address both peak flow attenuation and flood control. State regulations require the attenuation of peak flows from the 2-year and 10-year design storm, and also require Best Management Practices (BMPs) such as ponds for stormwater pollution control on new developments of 5 acres or more. South Carolina's NPDES Stormwater Program requires that anyone engaged in clearing, grading, and/or excavating activities that disturb between 1.0 acres and 2.0 acres, including smaller sites in a Larger Common Plan of development or sale, to obtain coverage under the state's Construction General Permit (CGP) prior to beginning any land disturbing activities. All construction activities disturbing 1 to 2 acres shall submit a simplified stormwater management and sediment control plan meeting the requirements of R.72-300. Because the project is greater than one acre, a Stormwater Pollution Prevention Plan (SWPPP) is required. This SWPPP is a simplified version based on the 1-2 Acre SWPPP Template. Unless the project is in the Coastal Zone and within 0.5 mile from a coastal receiving water, the simplified SWPPP is not required to be completed by a qualified individual specified in 3.1.2.B of the 2012 Construction General Permit. The BMPs must provide a water quality storage volume specified in the State regulations.

Historically, Beaufort County regulations required the attenuation of peak flows from the 25-year design storm and, prior to 1998, did not require BMPs for stormwater pollution control. In most cases, a single stormwater facility (e.g., pond) can be designed for both peak flow attenuation and stormwater pollution control. There is now no acreage exclusion when BMPs are required.

In 1998, the Beaufort County Manual for Stormwater Best Management Practices was produced. The manual provided developers and stormwater managers with guidance regarding the selection and design of BMPs necessary to protect the high-quality waters within the County.

An updated manual, which was produced in 2003, incorporated specific changes or additions to the manual, include the following:

- Inclusion of several additional BMP types, including bioretention and commercially manufactured stormwater treatment technologies.
- Consideration of fecal coliform bacteria as a second "indicator pollutant" to determine whether a BMP plan sufficiently controls stormwater quality. As a result, two worksheets had to be completed—one for total phosphorus and one for bacteria.
- Addition of a new manual appendix containing forms that can be used to verify that proposed structural BMPs are sized in accordance with the criteria presented in Section 5 of the manual.
- Addition of a new manual appendix with a maintenance agreement form that assigns responsibility for maintaining stormwater BMPs following construction.
- The 2008 Phase 1 version of the manual built upon the 2003 version and included the following specific changes or additions to the manual:
    - Update of the summary of stormwater regulation to include discussion of erosion and sediment control requirements during construction (including inspection and reporting requirements under the National Pollutant Discharge Elimination System (NPDES) general stormwater permit).
    - Addition of an Appendix D (the Town of Bluffton's Stormwater Ordinance), which includes requirements that are applicable to new developments in the May River watershed.
    - Addition of low impact development BMPs that will be required for new construction.

The 2009 Phase 2 version addresses applicability of BMPs to redevelopment and adds the following specific addition to the manual:

- Consideration of total nitrogen (total N) as a third "indicator pollutant" to determine whether a BMP plan sufficiently controls stormwater quality. As a result, three worksheets must be completed—one for total phosphorus, one for fecal coliform, and one for total nitrogen.

In October 2009, the County Council adopted stormwater volume runoff control regulations. In response, the May 2010 BMP Manual was modified as follows:

- Appendix C was added to document the effectiveness of BMPs in controlling stormwater volume.
- The Appendix includes a worksheet that must be completed to determine the "effective imperviousness" of the development. The recommended goal set for new development is 10 percent effective imperviousness.

- The former Appendix C (Sediment Control Certification Form for Construction Sites) is now Appendix D.
- The former Appendix D (Town of Bluffton Stormwater Ordinance) has been removed because the town no longer has a stand-alone ordinance.

In 2012, modifications to the manual were made to reflect the following:

- Workshop with local engineers on reformatting the manual.
- Update of the Zoning and Design Standards Ordinance (ZDSO) to a new form-based code.
- Consideration of "Step 2" on-lot controls of stormwater runoff from lots in developments that were approved prior to stormwater volume controls.
- Response to comments on draft revised manual (September 2011).

This version of the manual was prepared in 2016. Modifications include the following:

- Update per municipal separate storm sewer system (MS4) permit requirements.
- Reorganize manual for better information flow.
- Update and clarify design requirements.
- Reconcile information with other documents including 2014 Community Development Code updates and a new standalone Stormwater Ordinance.
- Expand BMP Selection and provide Fact Sheets for Construction, Post Construction BMPs, and municipal facility good housekeeping.
- Clarify and provide for Violations and Enforcement policy.
- Clarify and provide for Operations and Maintenance (O&M) procedure.
- Respond to comments generated from public.

1.2 Contents of the Manual

For the purpose of this manual Administrator(s) shall mean "Administrators" means the County Engineer and Stormwater Manager and other individuals designated by the County Administrator, from time to time, to administer interpret and enforce this Ordinance. Stormwater Manager and Administrator are used interchangeably in the document.

Section 2 presents a summary of County stormwater management regulations. The summary provides a starting point for developing a comprehensive set of policies and standards for development in the County. The County regulations include details on drainage easements, flood control design criteria, general planning and design requirements, retention/detention facilities, open drainage system ditches and ponds, roadway drainage planning and design standards, and storm sewer design standards that were previously in the ZDSO, Division 4 (Stormwater Management Standards).

Section 3 presents regulation of non-stormwater discharges to the storm drainage system to the maximum extent practicable as required by Federal and State laws in order to protect the existing health, safety, and general welfare of the citizens of Beaufort County, South Carolina. This section will establish methods for controlling the introduction of pollutants into the MS4 in order to comply with requirements of the NPDES permit process.

Section 4 provides guidance to ensure all new developments and redevelopments are designed to meet current design requirements. All lot owners shall meet current Federal and State laws. Individual property owners and their contractors must have available the specific erosion control measures to be used for all lots under construction.

Section 5 provides recommended policies and standards for new development and redevelopment. This section includes all information required to determine if a development satisfied both the runoff volume control and water quality control. Also included in this section are the design guidelines for BMPs and worksheets to evaluate BMP sizing. This section also considers appropriate water quality storage volume requirements for BMPs. Computer simulation models, using long-term local rainfall data as input, were applied to determine the optimum storage volumes for Beaufort County BMPs. In all cases, the recommended storage volumes are as restrictive as, or more restrictive than, the State requirements.

Section 6 provides a Standard Operation Procedure (SOP) for all County-owned facilities to reduce and prevent stormwater pollution generated by municipal operations and conveyed into receiving waters and streams.

Section 7 delivers a clear and precise narrative of laws, regulations and enforcement procedures for violations to the County's MS4 permit requirements.

Appendix A presents a summary of Federal and State regulations and associated programs. The appendix includes a discussion of waterbody designated uses and water quality standards, evaluation of runoff volume control practices, expected pollution loads from various land use types, expected pollution removal capabilities of various structural BMPs, and suggested maintenance provision and water quality sampling requirements.

Appendix B contains a flow chart summarizing the permitting process, templates for easements and design checklists for residential and commercial development.

Appendix C contains forms, templates and notices of violation pertaining to illicit discharge to waterbodies, and a copy of the monitoring plan.

Appendix D contains forms for stormwater permits.

Appendix E includes worksheets for evaluating proposed BMP plans for antidegradation water quality goals and for BMP sizing.

Appendix F provides municipal spill prevention procedures.

Appendix G includes a brief interpretation of state law on stormwater runoff, enforcement of violations and a copy of the County Code of Ordinances Chapter 99: Stormwater Management.

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Section 2
Stormwater Design Criteria

2.1 General Planning and Design Requirements

2.1.1 General Standards

General planning and design requirements for stormwater management are as follows:

1. All development that creates runoff and/or discharge may adversely impact water quality in county streams, lakes and tidal waterbodies. Therefore, all proposed development and redevelopment shall be required to submit a Drainage Plan to show compliance with the peak attenuation, water quality, volume and construction pollution control requirements in this manual, with the following exceptions:

    a. Total disturbed area is under 5,000 square feet (sq ft). Disturbed area shall include all areas utilized for construction, access, and storage of materials that are disturbed.

    b. Any maintenance, alteration, renewal use or improvement to an existing drainage structure as approved by the stormwater manager that does not create adverse environmental or water quality impacts and does not increase the temperature, rate, quality, volume or location of stormwater runoff discharge.

    c. Site work on existing developed sites 1-acre or less, where impervious area is increased by less than 5,000 sq ft, and earthwork does not increase runoff and/or eliminate detention/retention facilities and/or stormwater storage or alter stormwater flow rates or discharge location(s).

    d. Agricultural activity not involving relocation of drainage canals.

    e. Work by agencies or property owners required to mitigate emergency flooding conditions. If possible, emergency work should be approved by the duly appointed officials in charge of emergency preparedness or emergency relief. Property owners performing emergency work will be responsible for any damage or injury to persons or property caused by their unauthorized actions. Property owners will restore the site of the emergency work to its approximate pre-emergency condition within a period of 60 days following the end of the emergency period.

    f. Golf courses are required to comply with all site runoff volume and water quality control and drainage planning and design requirements.

However, both golf courses and private lagoons shall be exempt from the peak attenuation requirements.

2. Compliance with this section shall be demonstrated by the submission of detailed plans and calculations showing compliance through the use of BMPs provided within this manual. Detailed hydraulic and hydrologic calculations will be provided in a written report showing methodology and inputs for required calculations. All calculations and plans must be signed and sealed by a qualified professional registered under the South Carolina Division of Professional and Occupational Licensing.

3. Priority wetlands or other significant wetlands identified on the official County conservation district maps, or the Federal National Wetlands Inventory should not be adversely impacted by the construction of BMP facilities in or near them, which deprives them of required runoff or lowers their normal water table elevations. Adjacent BMPs that benefit retention of normal wetland water table elevations are acceptable. If the BMP's proposed location is near a priority wetland, the applicant must provide data showing that impacts will not be detrimental to the wetland hydrology.

4. Measures used to collect and convey stormwater on any site ("stormwater management facilities") shall be designed to meet the following minimum performance standards:

    a. Prevent erosion damage and satisfactorily carry off or detain and control the rate of release of surface waters.

    b. Carry surface water to the nearest adequate street, storm drain, detention basin, natural watercourse, or drainage facility.

    c. Control/accommodate not only the anticipated peak discharge from the onsite disturbed area but also the existing runoff being contributed from all land at a higher elevation in the same watershed.

    d. No stormwater runoff or natural drainage shall be so diverted as to overload existing drainage systems or create flooding or the need for additional drainage structures on other private properties or public lands. Please see Appendix G regarding the Common Enemy Law.

    e. All stormwater management facilities shall be designed to satisfy the following requirements:

        i. They shall be capable of withstanding the discharge associated with the 100-year return rainfall event, without failing or resulting in damage to downstream areas. Some nondetention facilities may be designed to bypass stormwater discharges that are in excess of the appropriate design storm. In this case, conveyance must be provided to transport the 100-year surcharge flow to downstream facilities, a natural watercourse, or storm drainage system inlet.

ii. All infiltration devices shall be protected from sedimentation. Areas designated for recharge shall not receive runoff until the contributory drainage areas have achieved final stabilization.

5. No new stormwater discharge shall be permitted onto any beaches/shorelines.

6. Final landscape designs and plantings shall not adversely impact the stormwater runoff, volume and quality controls and drainage concepts approved as part of the development permit approval process. Landscape design and plantings should enhance opportunities for percolation, retention, detention, filtration and plant absorption of site-generated stormwater runoff.

7. Irrigation systems used for complying with these stormwater requirements must use of all available surface runoff or other retained or detained stormwater as the water supply source. No groundwater wells or use of potable water for irrigation of any kind will be permitted in developments or redevelopments unless it can be demonstrated that alternative sources of irrigation water are required beyond the amount needed to meet volume control standards in this manual, or other extenuating circumstances apply. Any use of potable water sources must be approved by the stormwater manager. In addition, the design standards outlined in the Fact sheet for Irrigation (PTP-10) shall apply to all irrigation systems. In the case of extenuating circumstances, the designer may present alternate design standards. These must be approved by the stormwater manager prior and calculations and backup data must be presented for review.

8. The developer shall provide adequate outfall ditches, pipes and easements downstream from the proposed discharge if adequate public or private drainage facilities do not exist to carry the proposed discharge. If the outfall ditches, pipes and easements required for adequate drainage are larger than those needed to carry the additional proposed discharge from the development sought by the applicant, the County may bear those incremental costs that are greater than those properly allocable to the development. The County shall have the authority, however, to condition use of such expanded system by subsequent users on contributions by such users for allocable portions of the cost borne by the County.

2.1.2 Direct Stormwater Discharge

Planning and design requirements for direct stormwater discharge are as follows:

1. Channeling runoff directly into natural waterbodies from swales, pipes, curbs, lined channels, hoses, impervious surfaces, rooftops or similar methods shall not be approved for new development or redevelopment unless the stormwater manager has approved a stormwater pollution control plan that does not allow

stormwater runoff to exceed predevelopment levels and complies with Section 5 of this manual.

2. Where specific site hardships require a modification to allow direct discharge into tidal areas without adequate stormwater pollution controls, prior approval by Ocean and Coastal Resource Management (OCRM), Department of Health and Environmental Control (DHEC), U.S. Army Corps of Engineers (USACE) and the South Carolina Water Resource Commission is required. Granting of a modification by the stormwater manager will be based upon unique site hardships and the use of best available technology to reduce the water quality impacts of stormwater discharges.

3. Dredging, clearing, deepening, widening, straightening, stabilizing or otherwise altering of natural waterbodies or canals may be permitted by the stormwater manager only when a positive benefit can be demonstrated. Such approval by the County does not obviate the need for State or Federal agency approvals where applicable.

4. Vegetative strips shall be retained or created along the banks or edges of all freshwater wetlands as part of the required setback distance. The following minimum setbacks and landscaping requirements shall be established (unless already established by the Beaufort County Community Development Code, or the OCRM Charleston, S.C. District, whichever is greater) for construction from the edge of all wetlands and waters:

   a. Single-family residential: 20 ft.

   b. Multifamily residential: 50 ft.

   c. Commercial or industrial: 50 ft.

   d. Impervious parking areas: 30 ft.

   Vegetative strips are areas completely pervious to the ground in nature and are intended to prevent polluted runoff from entering fragile wetland systems. For this purpose, they shall be a minimum of 15 ft in width and contain living plant material including but not limited to trees, shrubs, vines, ferns, mosses, flowers, grasses, herbs and ground cover. Slatted lawn furniture, accessories and decks are permitted in the vegetative strips. A modification may be granted by the stormwater manager if the specific project design provides for the drainage or channeling of runoff away from natural watercourses, marshes, wetlands or tidal areas and if such runoff is filtered through a vegetated strip. Vegetative strips shall be retained or created in a natural vegetated or grassed condition to allow for periodic flooding, provide drainage access to the waterbody, and to act as filter to trap sediment and other stormwater pollution.

2.1.3 Water Surface Elevations

Planning and design requirements for water surface elevations are as follows:

1. No developer will be permitted to construct, establish, maintain or alter the surface water elevation of any waterbody or wetland in such a way as to adversely affect the natural drainage from any upstream or to any downstream areas of the drainage basin on a permanent basis.

2. The stormwater manager shall review and approve any water surface elevations proposed for lagoons or waterbodies. The developer will submit sufficient groundwater and topographic elevation data around the proposed waterbody site to assist in establishing the water surface elevations and seasonal groundwater levels.

3. It may be required as a condition of drainage plan approval that adjustments be made to existing or approved water surface elevations if upstream or downstream areas require such adjustments to provide required drainage flows. The County may assist the developer in negotiating with the affected parties on an equitable distribution of cost under such conditions and, if necessary, initiate condemnation proceedings if the County council so deems appropriate and the developer pays all costs associated with any condemnation proceedings.

2.1.4 Runoff Calculation Methodology

1. Any stormwater runoff calculation involving drainage areas greater than 50 acres, including onsite and offsite areas, shall use a generally accepted calculation technique that is based on the Natural Resources Conservation Service (NRCS) soil cover complex method. It is assumed that all methods will be selected by the design professional based on the individual limitations and suitability of each method for a particular site.

2. All calculations consistent with this chapter using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms.

3. For purposes of predevelopment flow rate determination, undeveloped land shall be considered as "meadow, in good condition," unless the natural ground cover generates a lower curve number or rational "C" value.

4. All calculations using the rational method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from NRCS methodology. Time of concentration for overland flow (maximum 300 ft) and concentrated flow shall both be calculated using NRCS methodology. Times of concentration for channel and pipe flow shall be computed using Manning's equation or NRCS methodology.

5. Hydrologic analysis shall use an appropriate antecedent moisture condition for all irrigated ground cover.

6. The design of any stormwater facilities intended to meet the performance standards of this chapter shall be verified by routing the design storm hydrograph through these facilities using accepted methods of practice. The stormwater manager may approve the use of any generally accepted reservoir routing technique, which shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph. The computer routing program used must take into account the tailwater effect of the discharge pipe on the orifice design as well as the submergence of the discharge pipe outlet.

7. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this chapter using any generally accepted hydraulic analysis technique or method approved by the stormwater manager.

8. The design of stormwater management facilities should be based upon soil conditions. Design based on soils is as follows:

    a. In areas where soils have been classified under the Soil Conservation Service (SCS) Hydrologic Soil Classification System as Type A or B (pervious), the overall stormwater management strategy should be that of onsite retention and infiltration into the ground or other BMPs as outlined in the BMP Manual. Information documenting the permeability of these soils as well as the groundwater table elevations shall be provided as part of the design of the stormwater management system.

    b. In areas where the soils have been classified under the SCS Hydrologic Soils Classification as Types C and D (impervious) or A/D, B/D, and C/D (high groundwater table areas), the overall stormwater management system shall make use of retention/detention basins or other BMPs as outlined in Section 5 to attenuate peak and retain excess volume from the contributory drainage area and to settle solids washed off or eroded therefrom.

    c. Information documenting the permeability of these soils as well as the groundwater table elevations shall be provided as part of the design of the stormwater management system. Infiltration testing and soil profile information obtained from actual onsite testing shall be provided as part of the design. Testing shall be performed at the same elevation or within the same soil horizon as the proposed elevation of the bottom of the infiltration facility.

    d. Exfiltration systems shall be designed with a safety factor 1.5 (design using 75 percent of the permeability rate or 75 percent of the time for drawdown) and to comply with the water quality control requirements in Section 5 of this manual.

2.1.5 Fencing

1. Fences may be required for any stormwater management facility where conditions warrant, in the opinion of the stormwater manager.

    a. Unless otherwise approved by the stormwater manager, all fencing shall be 6-ft chain-link or access-proof fence, with a minimum 15-ft-wide double-gate opening conforming to South Carolina Department of Transportation (SCDOT) specifications.

    b. Conditions which may require fencing:

        i. Rapid stage changes that would make escape practically impossible for small children.

        ii. Dry bottom BMPs or channels where side slopes are steeper than 4:1 and the design high water elevation exceeds 2 ft.

        iii. Wet bottom BMPs or channels where the side slopes are steeper than 4:1 to 3 ft below the normal water level and 2:1 to pond bottom.

        iv. Any condition that would pose a threat to public safety, health or welfare in the opinion of the stormwater manager.

2.1.6 Clean Soil Certification

All material that is brought in from offsite and will be placed at elevations below the seasonal high water table or within 1ft above the seasonal high water table will be required to meet the following clean fill requirements. All fill soils in areas proposed for infiltration BMPs or under ditches will also be required to meet the following clean fill requirements.

Test offsite soils brought in for use as fill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Fill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 method 418.1. Determine BTEX concentrations by using EPA SW-846. 3-3 Method 5030/8020. Perform TCLP in accordance with TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Within 24 hours of conclusion of physical tests, submit 3 copies of test results, including calibration curves and results of calibration tests. Do not bring material on site until tests have been approved by the Stormwater Department.

2.2 Roadway Drainage Planning and Design Standards

Good roadway drainage design consists of the proper selection of grades, cross slopes, curb types, inlet location, etc., to remove the design storm rainfall from the pavement in a cost-effective manner while preserving the safety, traffic capacity and integrity of the highway and street system. These factors are generally considered to be satisfied, provided that excessive spreads of the water are removed from the vehicular traveled way and that siltation at pavement low points is not allowed to occur. All proposed development shall comply with the following standards:

1. The minimum allowable centerline grade for all streets shall be 0.5 percent, unless otherwise approved by the stormwater manager only under extenuating circumstances.

2. Minimum centerline elevation shall be 7.5 ft based on National Geodetic Vertical Datum of 1929 (NGVD 29) datum. Note that current technology and standards use North American Vertical Datum of 1988 (NAVD 88) datum. Appropriate conversion for datum must be applied.

3. Minimum cross slope for all streets shall be one-quarter inch per foot. All streets shall drain from the road centerline to curb and gutter or drainage ditches. Inverted crown roads shall not be permitted for roads intended for County acceptance and/or maintenance.

4. All drainage structures, unless specifically detailed in these guidelines, shall conform to the latest edition of the SCDOT standards and shall require approval by the stormwater manager.

5. All new streets shall be designed to provide a minimum clearance of 1 ft between the bottom of the base and the estimated seasonal high water table, or the artificial water table induced by an underdrain system. The following requirements and limitations apply to the design of underdrains:

   a. The underdrain trench bottom should not be placed below the seasonal low water table elevation.

   b. The distance between the bottom of the underdrain trench and the bottom of the roadway base shall not be less than 24 inches.

   c. The bottom of the base course of underdrains shall be placed more than 24 inches below the seasonal high water table elevation.

   d. The developer's design engineer shall provide the following design certification:

      This is to certify that the underdrain design for road, extending from station to station has been designed such that the separation between *the bottom of the base and the artificially induced wet season water table is no less than one foot for the entire width of pavement.*

e. The installation shall be inspected by the project design engineer, who shall then certify that the underdrain installation procedures and materials are in accordance with the approved plans.

f. The stormwater facilities shall be designed to accommodate expected flow contributed by the underdrain system.

g. The County shall inspect the underdrain system for compliance prior to the issuance of final approval.

6. Roadside Swales:

   a. Roadside swale drainage will be permitted only when the wet season water table is a minimum of 1 ft below the invert of the swale.

   b. Where swales are permitted, a positive outfall for the drainage may be required depending on the soil classification and topography.

   c. Roadside swales used for water quality control shall comply with Section 5 of this manual.

7. All roadway drainage not considered suitable for swale and/or ditch type drainage shall be designed as one of the following:

   a. Mountable curb-and-gutter section: maximum 600-ft run between inlets.

   b. Standard curb-and-gutter section: maximum 1,200-ft run between inlets.

   c. All inlet spacing must be substantiated with calculations, and shorter runs may be required to provide appropriate gutter spread or inlet capacity.

   d. The width of curb and gutter shall be a minimum of 18 inches and shall be either standard or mountable (residential subdivisions only) curb and gutter, depending upon flow to be handled.

   e. There shall be stabilized subgrade beneath all curbs and gutter for 1 ft beyond the back of curb.

   f. No new water valve boxes, meters, portions of manholes, or other appurtenances of any kind relating to any underground utilities shall be located in any portion of a curb-and-gutter section.

   g. The minimum allowable flow line grade of curbs and gutter shall be 0.5 percent, except in intersections, where flatter grades shall be allowable.

The tolerance for ponded water in curb construction is one-fourth inch maximum; if exceeded, the section of curb shall be removed and reconstructed.

h. Plastering shall not be permitted on the face of the curb.

i. Joints shall be sawed, unless an alternate equivalent method is used, at intervals of 10 ft, except where shorter intervals are required for closures, but in no case less than 4 ft.

j. After concrete has set sufficiently, but in no case later than 3 days after construction, the curbs shall be backfilled.

k. All cross-street valley gutters shall be constructed of concrete.

8. The flow in the gutter shall not create a spread into the travel lane of more than one-half the traveled lane width and a maximum total depth at the gutter of 4 inches for the design storm.

9. All inlets at low points (sumps) shall be designed to intercept 100 percent of the design flow without exceeding the allowable spread of water onto the traveled lanes as defined in this section. On collector roadways, in order to prevent siltation and to provide for a safety factor against clogging of single inlet in a sump location, it is required to construct multiple inlets at all sump locations or provide for other safety factors against clogging. Two inlets shall be constructed on each side of the roadway. Open bottom inlets are encouraged in soils with suitable infiltration.

2.3 Conveyance Systems

2.3.1 General

1. Storm sewers, swales, ditches, canals, culverts, bridges and related installations shall be provided:

    a. To permit unimpeded flow of natural watercourses and in such a manner as to protect the natural character of the watercourses and to provide regulated discharge;

    b. To ensure adequate drainage of all low points along the line of streets; and

    c. To intercept stormwater runoff along streets at intervals reasonably related to the extent and grade of the area drained and to prevent substantial flow of water across intersections.

2. All storm sewer system components shall conform to current SCDOT standards.

3. Design methodology shall use the rational method for flow calculation. The time of concentration, individual drainage areas and rainfall intensity amount shall be submitted as part of the drainage plans. A separate rational runoff coefficient (C) shall be determined for the specific contributing area to each device within the proposed system. A composite C value shall be computed for each contributing area based on an individual C value of 0.9 for the impervious portion area and an individual C value of 0.2 for the remaining pervious (grassed) portion of the area.

2.3.2 Design and Construction Requirements

1. Design Criteria

   a. All conveyance systems except bridges shall be designed to convey the 25-year storm. The system shall be designed to handle the flows from the contributory area within the proposed development and any offsite flows tributary to the facilities. The relative timing of the onsite and offsite flows may be utilized in determining the adequacy of the designed system.

   b. Bridges shall be designed to convey the 100-year storm.

   c. Runoff to proposed storm sewers and inlets shall be calculated using the rational method.

   d. The time of concentration shall be assumed to be 5 minutes for pipes under 30 inches. For pipes 30 inches or greater, the calculated time of concentration can be utilized.

   e. All storm sewer pipes at inlets in sump condition shall be designed to accommodate the 100-year storm.

   f. All storm sewer pipes and inlets intended to drain to peak attenuation facilities shall be designed to accommodate the 100-year storm if the bypass or overflow runoff will not reach the basin by overland flow. In cases where the bypass or overflow runoff will flow over land, a stable swale shall be constructed to accommodate the excess flow without causing flooding to any proposed or existing structures.

2. Pipe Size

   a. The minimum size of pipes shall be the following diameter (or equivalent elliptical) as follows:

      i. Pipes under roadways – 18 inches

      ii. Pipes used for driveway crossings – 12 inches

      iii. All Other Pipes – 15 inches

b. Box Culverts. Unless otherwise approved by the stormwater manager, box culverts shall be 3 ft by 3 ft minimum. Unless otherwise approved by the stormwater manager, increments of 1 ft in height or width should be used above this minimum.

3. Pipe grade

    a. All storm sewers shall be designed and constructed with a minimum 0.5 percent slope or to produce a minimum velocity of 2.0 feet per second (fps) when flowing full except for short length basin interconnection pipes designed to balance water levels or in tidally influenced systems.

    b. Pipes installed at less than a 0.5 percent slope shall have maintenance provided for in the required O&M agreement, per Section 5 of this manual.

    c. No storm sewer system or portion thereof will be designed to produce velocities in excess of 10 fps.

4. Pipe clearance – Unless otherwise authorized by the stormwater manager, the minimum clearance for all storm pipes shall be as follows:

    a. From bottom of roadway base to outside crown of pipe: 1.0 ft

    b. Utility crossing, outside edge to outside edge: 0.5 ft

5. Material Specifications

    a. Pipe

        i. All pipe material shall be designed to bear the appropriate loads and conditions for the application in accordance with applicable SCDOT, Federal, ASTM, and/or AASHTO standards.

            1. Reinforced concrete pipe shall conform to the latest edition of the SCDOT Standard Specifications for Highway Construction.

            2. Corrugated aluminum pipe shall conform to AASHTO M-196, M-197, and Federal specification WW 442-C. Aluminum pipe is not recommended in cases where salt water is present.

            3. Corrugated polyethylene pipe shall conform to AASHTO M-252, M-294, type S.

ii. All pipe shall have a minimum cover so as not to pose structural damage to the pipe and as per the manufacturer's technical specifications and recommendation.

iii. Reinforced concrete pipe is preferred for any roadway application, however, the stormwater manager may allow other materials with appropriate technical data and specifications supporting the suitability for the application.

b. Inlets, manholes, junction boxes and drainage structures

i. All materials used in the construction of inlets, manholes and junction boxes and drainage structures shall conform to the latest editions of the SCDOT Standard Specifications for Highway Construction.

ii. Riprap is not an acceptable material for drainage structure, but it can be used for erosion control.

c. Underdrains/exfiltration systems

i. All materials used in the construction of underdrains shall conform to the latest edition of the SCDOT Standard Specifications for Highway Construction.

ii. All materials used for construction of underdrains shall be designed for the application in accordance with applicable Federal, ASTM, and/or AASHTO standards.

iii. The following is a list of underdrain materials preferred for use in the County:

1. Perforated corrugated tubing – Corrugated, polyethylene tubing perforated throughout and meeting the requirements of AASHTO M-252 or M-294.

2. Perforated polyvinyl chloride (PVC) pipe – PVC pipe conforming to the requirements of ASTM D-3033. The perforations shall meet the requirements of ASTM C-508.

iv. Exfiltration pipe – The following is a list of pipe materials acceptable for use in exfiltration systems:

1. Aluminum pipe perforated 360 degrees, meeting the requirements of AASHTO M-196. Aluminum pipe is not recommended where salt water is present.

2. Perforated Class III reinforced concrete pipe with perforations meeting the requirements of ASTM C-444.

3. PVC pipe perforated 360 degrees, meeting the requirements of ASTM D-3033.

d. Coarse aggregate

   i. Clean stone containing no friable materials and a gradation equivalent to size number 56 or 57

e. Interference manholes

   i. Interference manholes shall be used only when there is no reasonable alternative design.

   ii. Where it is necessary to allow a sanitary line or other utility to pass through a manhole, inlet or junction box, the utility shall be ductile iron or another suitable material.

   iii. A minimum of 1-ft vertical clearance shall be required between the bottom of the manhole and face of utility pipe.

   iv. Interference manholes shall be oversized to accommodate the decreased maneuverability inside the structure and flow retardant.

f. Modification of specifications. These materials specifications may be modified by the stormwater manager based on new and/or proven technology, provided appropriate documentation supporting the application is submitted.

6. Maximum lengths of pipe

   a. The maximum length of a pipe run is dependent on the pipe size as follows:

      i. 15-inch and 18-inch diameter – 300 ft

      ii. 24-inch to 30-inch diameter – 400 ft

      iii. 42-inch diameter and larger – 500 ft

7. All storm sewer systems shall be analyzed for both inlet and outlet control (including tailwater effects) by using the following:

   a. Equations and nomographs as shown in the Federal Highway Administration (FHWA) Hydraulic Design Services (HDS) publication No. 5.

b. Computer programs that calculate the actual hydraulic grade line for the storm sewer system can be used, provided all losses (friction, bend, junction, etc.) are taken into account using the appropriate loss coefficient (K) values.

c. When a BMP is the receiving facility, the design tailwater level can be assumed to be the 25-year pond level corresponding to the time at which peak inflow occurs from the storm sewer into the pond or a tailwater estimate can be obtained by averaging the established 25-year design high water elevation for the pond and the pond bottom elevation for dry bottom ponds or the normal water elevation for wet bottom ponds.

d. Allowable headwater. The allowable headwater of a pipe or culvert under a roadway should be set by the designer to prevent flooding of upstream structures. When endwalls are used, the headwater shall not exceed the top of the endwall at the entrance for the design storm. If the top of the endwall is inundated during any storm less than the 100-year storm, special protection of the roadway embankment and/or ditch slope may be necessary for erosion protection.

2.3.3 Open Channel Drainage Systems, Swales and Ditches

1. Design Criteria

a. Areas adjacent to open drainageways and ponds shall be graded to preclude the entrance of stormwater except at planned locations.

b. The maximum slope embankments shall be 3:1.

c. Minimum width of channels shall be 2 ft.

d. Slope protection and appropriate vegetation will be provided within channels.

e. Freeboard shall be a minimum of 1 ft above the high water elevation in the channel for the design storm.

f. Where berms are constructed on fill, calculations supporting the stability of the fill berms are to be submitted by the design engineer. Where excess seepage may be expected through the berm, a clay core may be required per the requirements for retention/detention facilities in this section.

2.4 Water Quality Control

All proposed development and redevelopment shall comply with Section 5 of this manual.

2.5 Volume Control

All development will control and retain total volume by retention and other methods to the maximum extent technically feasible (METF) so that stormwater runoff levels will not exceed predevelopment levels for storm events up to the 95th percentile event, which is currently 1.95 inches. Upon approval from the stormwater manager, the design engineer may utilize other data or sources for calculating the 95th percentile event, such as NOAA Atlas 14 data; however, must submit supporting data and source information. All designs shall also comply to METF with volume control requirements related to antidegradation requirements using the Effective Impervious method found in Section 5 of this manual.

2.6 Retention/Detention Facilities

2.6.1 General Design Criteria

1. Peak attenuation

   The design storm criteria to be used in calculations for the sizing of peak attenuation and volume control BMPs is to limit the post-development runoff for multiple storm events including the 2-, 10-, 25-, 50 and 100-year/24-hour storms to the predevelopment rates. For Beaufort County the following rates from Appendix F of the South Carolina DHEC Storm Water Management BMP Handbook, July 31, 2005 are recommended. 4.5", 6.9", 8.4", 9.7", and 11.0" respectively for each storm event above, using an R factor of 400. Upon approval from the stormwater manager, the design engineer may utilize other data or sources for rainfall amounts, such as NOAA Atlas 14 data; however, must submit supporting data and source information.

2. Total retention

   Developments that are unable to secure a positive outfall for discharge shall retain all runoff resulting from the design storm up to 100-year storm event as computed for the developed condition.

3. Design criteria for redeveloped sites

   a. Redevelopment that has no increase or a net decrease in impervious area yet lacks evidence of a functioning retention/detention facility will be required by the stormwater manager to retrofit the site to current County standards for peak attenuation and stormwater volume and water quality controls, unless exempted by CDC 5.12.20.

   b. Redevelopment that has no increase or a net decrease in impervious area and contains a functioning retention/detention facility designed under current County standards will be required by the stormwater manager to provide calculations showing that peak attenuation, stormwater volume and water quality requirements are met, unless exempted by CDC 5.12.20.

4. Detention and retention ponds and other wet bottom BMPs shall be designed with relatively flat side slopes along the bank and with meandering banks where possible to increase the length of bank, thus offering more space for the growth of littoral vegetation for pollution control purposes.

5. Retention/detention facilities shall be designed to provide at a minimum of 1.0 ft. of vertical freeboard above the proposed design elevation to the crest of the emergency spillway. Major drainage canals shall not be used for storage where this may impact the storm hydrology upstream and downstream.

6. Where cleared site conditions exist around retention/detention facilities, the banks shall be sloped to the proposed dry weather water surface elevation and planted for stabilization purposes. Where slopes are not practical or desired, other methods of bank stabilization as approved by the stormwater manager can be used and must be fully designed and noted on plans submitted for final approval.

7. Retention/detention facilities shall be designed to facilitate regular landscape maintenance and/or mowing and periodic silt and debris removal.

8. The maximum slope embankments shall be 3:1.

9. Detention basins shall be designed so they drain within approximately 24 hours after termination of the storm up to the 25-year storm event, unless the stormwater manager finds that downstream conditions may warrant other design criteria for stormwater release.

10. The minimum top width of a basin berm shall be 10 ft. A cutoff trench (keyway) of relative impervious material shall be provided beneath all embankments requiring fill material. The keyway shall be a minimum 8 ft wide and minimum 3 ft deep and have 1:1 side slopes.

11. Anti-seep collars shall be installed around the pipe barrel within the normal saturation zone of the detention basin berms. The anti-seep collars and their connections to the pipe barrels shall be watertight. The anti-seep collars shall extend a minimum of 2 ft beyond the outside of the principal pipe barrel. The maximum spacing between collars shall be 14 times the minimum projection of the collar measured perpendicular to the pipe. A minimum of two anti-seep collars shall be installed on each outlet pipe.

12. All outlet pipes through the basin berm shall be designed to withstand the loading caused by a fully saturated berm and shall have watertight joints. The outlet pipe shall be backfilled with material similar to the core material (semi-impervious).

13. Energy dissipaters and/or level spreaders shall be installed at points where pipes or drainageways drain to or from the basin. Energy dissipaters shall comply with criteria in Hydraulic Engineering Circular No. 15, Design of Stable Channels with Flexible Linings published by the Federal Highway Administration or the U.S. Department of Transportation Engineering Field Manual for Conservation Practices.

14. Inlet and outlet structures shall be located at a maximum distance from one another in order to promote water quality benefits and avoid short circuiting of flow through the facility.

15. Use of innovative outlet structures, such as perforated riser pipe, underdrain in stone trench, or special graduated opening outlet control boxes, is encouraged as ways of reproducing predevelopment runoff conditions.

16. Where cleared site conditions exist around detention or retention areas, the banks shall be sloped to the proposed dry weather water surface elevation and planted for stabilization purposes. Where slopes are not practical or desired, other methods of bank stabilization will be used and noted on plans submitted for final approval.

17. Outfall – Unless otherwise approved by the stormwater manager, outfall structures shall be as simple as possible and shall employ fixed control elevations (i.e., no valves, removable weirs, etc.). Design criteria are as follows:

    a. Retention/detention facilities shall be required to have an outfall structure to meet peak attenuation and volume requirements of this chapter. To achieve water quality control, the location of the structure and the shape of the pond shall be designed to comply with the water quality control requirements in Section 5 of this manual.

    b. Emergency overflow facilities shall be provided for detention facilities to accommodate runoff in excess of design flows. All emergency spillways shall be constructed so that the detention basin berm is protected against erosion. The minimum capacity of all emergency spillways shall be the peak flow rate of the 100-year design storm after development. Emergency spillways shall provide a minimum of 6 inches of freeboard to the top of berm.

2.7 Drainage Easements

Drainage easements are utilized to provide for the protection and legal maintenance of stormwater management facilities not within a right-of-way. Drainage easements shall be required in subdivisions over any portion of a stormwater management facilities not within a right-of-way and necessary for the functioning of the system. Drainage easements for all facilities must be shown on construction drawings and approved by the stormwater manager. The easements shall be designated prior to issuance of a development permit and recorded in public records. The minimum allowable width of drainage easements shall be as shown in Table 2-1.

Table 2-1 Drainage Easements	
Stormwater Management Facility	Minimum Easement Width
Closed systems (storm sewers/pipes/culverts)	diameter + 4 ft + 2D(20-ft minimum)*
Open drainage systems	
Bottom width 20 ft or less	15 ft + BW + 2SD (30 ft minimum)**
Bottom width 20 ft to 40 ft	30 ft + BW + 2SD**
Bottom width greater than 40 ft	40 ft + BW + 2SD**
Retention/detention BMPs	20 ft around facility
*Where: D = Depth from grade to pipe invert **Where: BW = Bottom width S = Side slope D = Depth of opening	
Note: The minimum required width of drainage easements may be increased if deemed necessary by the stormwater manager for justifiable reasons.	

1. General requirements.

    a. Maintenance access.

        i. Maintenance access shall be designed, constructed and included within the above drainage easements.

        ii. The cross slopes of maintenance berms (aka work shelf) shall be 15:1.

    b. Location of drainage easements shall be as follows:

        i. Platted subdivisions – Drainage easements that are required within a platted subdivision shall be clearly identified on the face of the plat and included in the dedication of rights-of-way and easements. Stormwater management facilities within platted subdivisions shall be protected and platted as a separate tract of land dedicated to the entity responsible for its maintenance. If it is desired to place all or a portion of a stormwater management facility on a buildable lot, not more than 50 percent of the buildable lot can be used for this purpose, and the detention/retention pond shall be clearly marked on the recordable survey or plat of the lot indicating the location of the 25-year and 100-year storm. Public drainage facilities, which are located within a private subdivision, shall be granted a drainage easement by conveyance recorded in the official record books of the County.

ii. Unplatted land – Developments may contain drainage systems that traverse property not included in the plat. These may be adjacent lands that were not platted, future phases of the development to be platted at a later date, or may be part of an overall master plan. The drainage systems must be provided with an easement granted by conveyance recorded in the official record books of the County.

iii. Offsite – Developments may require offsite drainage improvements in order to ensure the proper functioning of the onsite system. Such offsite improvements shall be provided with a drainage easement granted by conveyance and recorded in the official record books of the County.

2.8 Drainage Plan Requirements

2.8.1 General Plan Information

The term Drainage Area Plan includes not only plans, but also required documentation and calculations to show compliance with the requirements set forth in this manual.

A plan set and report detailing a design complying with the requirements of this manual shall be submitted. The plan set shall be organized in an appropriate manner to adequately convey the required information below. The plan may require multiple sheets to adequately convey the information.

Required items in a Drainage Area Plan include the following (but additional material may be needed to provide proof of compliance with the requirements). Also, see conceptual and final stormwater plan checklists located in Appendix B.

1. The plan is to be prepared on a standard 24-inch by 36-inch sheet. Other sheet sizes must be approved by the stormwater manager.

2. The plan scale shall not to exceed 1 inch equals 80 ft. If the drainage area will not fit on the sheet, a larger scale may be used for the sheet(s) showing drainage areas, with the approval of the stormwater manager.

3. All existing and proposed features.

4. Sufficient topographical information with elevations to verify the location of all ridges, streams, etc., at 1-ft contour intervals.

5. Drainage area bounds, including all offsite areas draining to the proposed development and subdrainage area bounds sufficient to provide detail supporting the calculations.

6. High water data on existing structures upstream and downstream from the development.

7. Notes indicating sources of high water data.

8. Notes pertaining to existing standing water, areas of heavy seepage, or springs.

9. Existing drainage features (ditches, roadways, ponds, etc.), are to be shown a minimum of 1,000 ft downstream of the proposed development unless the ultimate outfall system is a lesser distance.

10. Stormwater management facilities including stormwater BMPs, inlets, pipes, swales, channels, and other information required to comply with Section 5 of this manual.

11. Ingress/egress areas required, dedicated natural open space boundaries.

12. Soils information according to the latest soil survey of the County or geotechnical report prepared for the project.

13. Locations of any infiltration testing and soils profiles performed to support the design.

14. Subsoil investigation: A subsoil report by a professional engineer may be required by the stormwater manager. A minimum of two locations per retention/detention area shall be delineated in order to determine the infiltration rates and location of groundwater elevation and/or soil conditions.

15. Flood hazard classification.

16. Description of current ground cover and/or land use.

17. Cross sections, profiles, and sufficient details for construction of stormwater management facilities, both conveyance and BMPs required for compliance with the requirements.

18. All driveway pipe size and inverts.

19. Drainage rights-of-way, or easements.

20. Typical fencing detail (if required by design).

21. A sediment and erosion control plan in accordance with State and/or Federal laws and in compliance with Section 4 of this manual. This plan shall require stormwater manager approval prior to any construction and permitting.

22. Proposed finished contour elevations for the entire development.

23. Proposed minimum first floor elevations of all proposed structures.

24. Plan shall be prepared by a professional engineer per section 2.8.4 and shall require approval by the stormwater manager.

2.8.2 Stormwater Calculations and Report

Stormwater calculations shall include but not be limited to the following (see Final Stormwater Plan Checklist found in Appendix B):

1. Executive summary showing compliance with peak attenuation, water quality and volume requirements.

2. Design calculations and routings supporting design.

3. Calculations showing compliance with volume requirements.

4. Calculations and worksheets showing compliance with water quality requirements.

5. Storm sewer calculations to prove compliance with the requirements (where applicable), showing:

    a. Types of structures.

    b. Types, diameter, and lengths of pipe.

    c. Drainage subarea tributary to each structure.

    d. Runoff coefficient per subarea.

    e. Time of concentration to structure.

    f. Hydraulic gradient for the design storm event.

    g. Tailwater elevation data with sources of information.

    h. Outlet and pipe velocities.

2.8.3 Offsite Improvements

Cross sections showing all existing and proposed topographic features within a right-of-way shall be plotted at 50-ft intervals or as approved by the stormwater manager and at all locations where the roadway features change significantly. Plotted centerline profile of the existing and proposed roadways shall also be required.

2.8.4 Planning and Design Certification

Planning and design certification is as follows:

1. Professional engineers, registered in the State, shall prepare a detailed drainage report and design plan and certify all subdivision grading, drainage, roads, parking lots, and water and sewer systems. Tier B land surveyors, registered in the State, may design and certify drainage systems as limited by State regulations. An as-built field survey shall be submitted to the stormwater manager showing controlling stormwater invert elevations and spillways and outlet structures of commercial and industrial developments and residential developments requiring drainage systems.

2. Landscape architects, registered in the State, shall certify drainage features pertinent to their landscape design drawings. Design engineers or landscape architects may perform, design and/or certify their plans in accordance with State rules and regulations governing their professions.

2.8.5 Duty to Consult

1. Pre-Application Meeting
   Before a Stormwater Management Plan application is completed, the Administrator shall require a pre-application meeting to discuss requirements and the stormwater management system to be proposed for the development project.

2. Stormwater Management Plan
   The stormwater management plan shall detail how development and pre- and post-development stormwater runoff will be controlled and managed and how the proposed project will meet the requirements of this ordinance. All such plans shall be prepared by a licensed South Carolina professional per Section 2.8.4.

3. Record Drawings and Final Compliance
   Upon completion of a project and before a Certificate of Compliance was granted, the applicant shall comply with the County's Ordinance or, if applicable, the relevant development agreement, concept plan, and/or approved masterplan.

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Section 3
Illicit Discharge Detection and Elimination

3.1 Purpose

The purpose of this section is to provide for the health, safety, and general welfare of the citizens of Beaufort County, South Carolina, through regulation of non-storm-water discharges to the storm drainage system to the maximum extent practicable as required by Federal and State law. This ordinance establishes methods for controlling the introduction of pollutants into the MS4 in order to comply with requirements of the NPDES permit process. The objectives of this ordinance are:

1. To regulate the contribution of pollutants to the MS4 by stormwater discharges by any user.

2. To prohibit illicit connections and discharges to the MS4.

3. To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this ordinance.

3.2 Program

The basic organization of this program is outlined below. The plan is developed around eight key components that are recommended by the U.S. Environmental Protection Agency (EPA) and the Center for Watershed Protection (CWP) for effective Illicit Discharge Detection and Elimination (IDDE) programs. These eight components are intended to help:

- Conduct an audit to understand community needs and capabilities
- Establish adequate legal authority
- Develop a tracking system to map outfalls and document reported illicit discharges
- Conduct desktop analyses to prioritize targets for illicit discharge control
- Conduct rapid reconnaissance of the stream corridor to find problem outfalls
- Apply new analytical and field methods to find and fix illicit discharges
- Educate municipal employees and the public to prevent discharges
- Estimate costs to run a program and conduct specific investigations

Technical information that addresses various aspects of the plan and references cited can be found in the following EPA sponsored publication produced by the CWP (http://www.cwp.org/index.html) and Robert Pitt from the University of Alabama:

Illicit Discharge Detection and Elimination:
A Guidance Manual for Program Development and Technical Assessments
October 2004

3.2.1 Ordinance

In 2016, the County adopted a revised stormwater ordinance that will prohibit illicit discharges along with the necessary enforcement capability. The County will review other potential codes and ordinances that may have potential links to IDDE and make necessary cross-references and statements of supersede as needed to establish consistency.

3.2.2 Reporting and Education

The County has a web application that will allow a person to report a suspecting IDDE to the County staff via the app. The app will allow the individual to provide the GPS location where the suspected discharge has occurred. Records are kept on each report, including the reporting mode (telephone, email, walk-in, etc.), location and nature of the problem, and any actions taken. Citizens can also call the stormwater department at 843.255.2805.

3.2.3 Monitoring

The County has established a dry weather screening program to proactively detect illicit discharge and eliminate them through sampling, testing and enforcement. The County has a separate monitoring plan document that can be found in Appendix C. Inspection protocol and enforcement actions are in the stormwater ordinance found in Appendix G.

3.3 Definition of Illicit Discharge

Illicit discharge is defined in Article V. of Chapter 99: Stormwater Ordinance. A copy of this ordinance is found in Appendix G.

Section 4 Construction Site Management for Stormwater

4.1 Erosion and Sediment Control

An erosion control form for new and redevelopments has been included in Appendix D of the manual. The County will require this form to be completed by a professional (engineer, land surveyor or landscape architect) for certification of erosion control on the development site during construction.

Residential subdivisions require erosion control features for infrastructure as well as for individual lot construction. Individual property owners shall follow these plans during construction or obtain approval of an individual plan in accordance with S.C. Reg. 72-300 et seq. and SCR300000. Individual property owners and their contractors must have available the specific erosion measures to be used for the lot under construction. If the County finds violations of these requirements in individual lot construction, it will require professional certifications by the contractor to continue construction.

4.1.1 Water Erosion

The rainfall erosion process begins when raindrops impact the soil surface and dislodge minute soil particles. These soil particles then become suspended in the water droplet. The sediment-laden water droplets accumulate on the soil surface until a sufficient quantity has developed to begin flowing under the forces of gravity.

The initial flow of sediment-laden water generally consists of a thin, slow-moving sheet, known as sheet flow. While sheet flow is generally not highly erosive on its own, it does begin the transport of previously suspended sediment. Due to irregularities in the soil surface and uneven topography, sheet flow will usually begin to concentrate into rivulets, where the flow picks up velocity and erosive energy increases as a result of gravitational forces.

The increasing erosive energy of water flowing in rivulets will cut small grooves, or rills, in the soil surface. Rill erosion of the soil surface tends to concentrate more flows, which then flow faster and gain erosive energy as a result of gravitational forces. In turn, the rills become deeper and larger, and join adjacent rills. Typically, rills run parallel with the slope and each other, are small enough to be stepped across, and are generally enlarged by direct erosion of the rill's sides and bottom by the action of flowing water.

The communion of several adjacent rills, or sufficient enlargement of a single rill, begins gully erosion. Gully erosion of the soil surface tends to concentrate more flows, which then flow faster and gain erosive energy as a result of gravity. Typically, gullies run parallel with the slope, may have one or more lateral branches, and are enlarged by four key actions. First, gullies often have a "head cut" at the upstream end which progresses its way upstream as water flowing into the gully erodes the lip of the head. This mechanism is similar to a waterfall working its way upstream. Second, the flow in a gully tends to undercut the banks. Once sufficiently undercut, the banks collapse into the gully where the loosened soil is then washed away. Third, when banks collapse into the gully, flowing water is diverted around the temporary blockage of soil. This temporary blockage increases velocities along one or both banks, which results in increased bank erosion. Fourth, the concentration of flows in the gully can result in scour of the gully floor until a stable slope is obtained.

4.1.2 Stream and Channel Erosion

One or more of the following factors that disrupt the delicate balance required for stable streams and channels generally precipitate erosion within streams and channels.

1. Disturbing the banks of streams and channels is often required during construction. Once vegetation or other bank protection measures are disturbed, flows may begin to erode the unprotected soil.

2. Disturbing the flow within a stream or channel is often necessary to facilitate construction activities. However, this should only be allowed when traversing banks, such as temporary stream crossing, culvert installation, bridge construction, etc. By diverting flows within the channel, velocities are increased in some areas to compensate for decreases in other areas. The increases in velocity may exceed those normally experienced by the channel, resulting in bank erosion and bottom scour.

3. Increasing the quantity and rate of flow to streams and channels often results from construction activities and construction of facilities that increase the quantity and rate of runoff as well as how runoff is conveyed to the discharge point. The increased quantity and rate of flow can cause bank erosion and bottom scour.

4.1.3 Factors Influencing Erosion

Site characteristics and contractor activities affect both the potential for erosion and contamination by other constituents used on the construction site. Before defining BMP objectives, the following factors should be considered carefully:

1. Site conditions that affect erosion and sedimentation including:
    a. Soil type, including underlying soil strata that are likely to be exposed to stormwater
    b. Natural terrain and slope
    c. Final slopes and grades
    d. Location of concentrated flows, storm drains, and streams
    e. Existing vegetation and ground cover
2. Climatic factors, which include:

   a. Seasonal rainfall patterns
   b. Appropriate design storm
      i. Quantity of rainfall
      ii. Intensity of rainfall
      iii. Duration of rainfall
3. Type of construction activity
4. Construction schedules, construction sequencing and phasing of construction
5. Size of construction project and area to be graded
6. Location of the construction activity relative to adjacent uses and public improvements
7. Cost-effectiveness considerations
8. Types of construction materials and potential pollutants present or that will be brought onsite
9. Floodplain, floodway, and buffer requirements

4.2 Selecting BMPs for Construction Site Management (Erosion Protection and Sediment BMP Selection Process (Sections SPD, EPP, SMP)

The manual presents a brief introduction to construction stormwater BMPs. The following types of BMPs are addressed: Erosion Prevention Practices (EPP); Sediment Management Practices (SMP); and Good Housekeeping Practices (GHP). The manual describes how BMPs can be selected and contains a series of fact sheets for each type of BMP to be used in the area. The intent of the Stormwater BMP Manual is to provide guidance on BMP selection, design, and implementation to plan submitters, reviewers, construction site operators, and site inspectors. There are also guidance materials for activities at commercial and industrial facilities.

The fact sheets are categorized, focused, and concise so that they may be used as quick references for design, inspection, and maintenance guidance. In this way, the fact sheets are designed to be stand-alone documents that may be distributed to facilitate discussion about design and/or implementation of the management practice. Many of the practices are considered structural practices in that they involve construction. However, several of the BMPs cover non-structural practices, where normal activities are performed in a different manner with stormwater quality in mind. The SCDHEC and SCDOT BMP manuals can also be used to ensure correct BMP application is used and maintained.

Certain contractor activities may cause pollution if not properly managed. Not all of the BMPs will apply to every construction site. However, all of the suggested BMPs should be considered, and those which are appropriate for the project at hand should be selected. Considerations for selecting BMPs for contractor activities include the following:

1. Is it expected to rain? BMPs may be different on rainy days versus dry days, winter versus. summer, etc. For instance, a material storage area may be covered with a tarp during the rainy season, but not in the summer. However, it should be noted that plans should be made for some amount of rain even if it is not expected to generate a rain event.

2. How much material is used? Less-intensive BMP implementation may be necessary if a "small" amount of pollutant-containing material is used (however, remember that different materials pollute in different amounts).

3. How much water is used? The more water used and wastewater generated, the more likely that pollutants transported by this water will reach the stormwater system or be transported offsite. Washing out one concrete truck on a flat area of the site may be sufficient (as long as the concrete is safely removed later), but a pit should be constructed if a number of trucks will be washed out at the same site.

4. What are the site conditions? BMPs selected will differ depending on whether the activity is conducted on a slope or flat ground, near a stormwater structure or watercourse, etc. Anticipating problems and conducting activities away from certain sensitive areas will reduce the cost and inconvenience of performing BMPs.

5. What about accidents? Pre-establishing a BMP for each conceivable pollutant discharge may be very costly and significantly disrupt construction. As a general rule, establish controls for common (daily or weekly) activities and be prepared to respond quickly to accidents. Define the difference; not everything can be called an accident and may be classified as negligent disregard of proper practices.

Therefore, keep in mind that the BMPs for contractor activities are suggested practices that may or may not apply in every case. Construction personnel should be instructed to develop additional or alternative BMPs that are more cost-effective for a particular project. The best BMP is a construction work force aware of the pollution potential of its activities and committed to a clean worksite.

Effective erosion prevention and sediment control (EPSC) management first minimizes erosion by keeping the soil protected (e.g., minimize disturbed areas) as long as possible by erosion prevention (EP) and second, directs runoff from disturbed areas to locations where suspended soil materials can be removed prior to discharge from the site by sediment control (SC). The use of source control BMPs to control erosion before its starts is the preferred method of long-term sediment control. However, on active construction areas, there may not be sufficient time for EP BMPs to become established to the point at which they are fully effective before the onset of erosive events. In these situations, SC BMPs can provide a more immediate level of protection by removing suspended sediment from flows before being transported. However, the best protection on active construction sites is generally obtained through simultaneous application of both EP BMPs and SC BMPs. This combination of controls is effective because it prevents most erosion before it starts and has the ability to capture sediments that become suspended before the transporting flows leave the construction site.

BMPs for erosion prevention and sediment control are selected to meet the BMP objectives based on specific site conditions, construction activities, and cost-effectiveness. Different BMPs may be needed at different times during construction since construction activities are constantly changing site conditions.

In most cases, permanent BMPs can be implemented most effectively when they can be integrated into other aspects of the project design. This requires that conceptual planning consider stormwater controls rather than as an afterthought to site design. The following should be considered early in the design process.

1. Is a detention/retention facility required for flood control? Often, facilities are required to maintain peak runoff at predevelopment levels to reduce downstream conveyance system damage and other costs associated with flooding. Most permanent BMPs can be incorporated into flood control detention/retention facilities with modest design refinements and limited increases in land area and cost.

2. Planned open space that will be relatively flat (e.g., final grade slopes less than 5 percent) may be merged with stormwater quality/quantity facilities. Such integrated, multi-use areas may achieve several objectives at a modest cost.

3. Infiltration BMPs may serve as groundwater recharge facilities, detention/retention areas may be created in landscaped areas of the project, and vegetated swales/filters may be used as roadside/median or parking lot median vegetated areas.

4.2.1 How to Use this Manual and Fact Sheets

The fact sheets are designed to be used to assist designers in the application of the requirements of this manual. Please note that some of the metrics used not applicable to some sections and, as such, are not included. The summary tables on the sheets should make it easy for the reader to quickly reference information such as symbols, cost and pollutants targeted by these BMPs. Specific design information, where included, is intended to be used by the designers in the creation of site and circumstance specific BMPs that will be installed with any plan. It is the responsibility of the designer to create constructible details and plans for any BMPs specified using these fact sheets and this manual.

4.2.2 Minimize Disturbed Areas

The first step for selecting BMPs is to compare the project layout and schedule with onsite management measures that, where appropriate, can limit the exposure of the project site to erosion and sedimentation. Scheduling and planning considerations are the least expensive way to limit the need for EPSC controls. Consider the following BMPs.

1. Do not disturb any portion of the site unless an improvement is to be constructed there.

2. The staging and timing of construction can minimize the size of exposed areas and the length of time the areas are exposed and subject to erosion.

3. The staging of grading operations should limit the amount of areas exposed to erosion at any one time. Only the areas that are actively involved in cut-and-fill operations or are otherwise being graded should be exposed. Exposed areas should be stabilized as soon as grading is complete in that area.

4. Retain existing vegetation and ground cover where feasible, especially along watercourses and along the downstream perimeter of the site.

5. Do not clear any portion of the site until active construction begins.

6. Construct outfall detention or perimeter sedimentation control (with filter weirs/berms and temporary sedimentation control barriers first).

7. Quickly complete construction on each portion of the site.

8. Install cover landscaping and other improvements that permanently stabilize each part of the site immediately after the land has been graded to its final contour.

9. Minimize the amount of denuded areas and any new grading activities during the wet months of December through May.

10. Construct permanent stormwater control facilities (e.g., detention basins) early in the project to use for sediment trapping, slope stabilization, velocity reduction, etc. during the construction period.

4.2.3 Stabilize Disturbed Areas

The purpose of site stabilization BMPs is to prevent erosion by covering disturbed soil. This covering may be vegetative, chemical, or physical. Any exposed soil is subject to erosion – either by rainfall striking the ground, runoff flowing over the soil, wind blowing across the soil, and vehicles driving on the soil. Thus, all exposed soils should be stabilized except where active construction is in progress. Locations on a construction site that are particularly subject to erosion and should be stabilized as soon as possible include:

1. Slopes

2. Highly erosive soils

3. Construction entrances

4. Stream channels

5. Soil stockpiles

4.2.4 Site Perimeter

1. Disturbed areas or slopes that drain toward adjacent properties, storm drain inlets or receiving waters should be protected with temporary linear barriers (continuous berms, silt fences, sand bags, rolls, etc.) to reduce or prevent sediment discharge while construction in the area is active. In addition, the contractor should be prepared to stabilize those soils with EP measures prior to the onset of rain.

2. When grading has been completed, the areas should be protected with EP controls, such as mulching, seeding, planting, or emulsifiers. The combination of EP measures and SC measures should remain in place until the area is permanently stabilized.

3. Significant offsite flows (especially concentrated flows) that drain onto disturbed areas or slopes should be controlled through use of continuous berms, earth dikes, drainage swales, and lined ditches that will allow for controlled passage or containment of flows.

4. Concentrated flows that are discharged offsite should be controlled through outlet protection and velocity dissipation devices to prevent erosion of downstream areas.

5. Perimeter controls should be placed everywhere runoff enters or leaves the site. They are usually installed just before clearing, grubbing and rough grading begin. Perimeter controls for all but the smallest projects will become overloaded by both runoff and sediment. Additional controls within the interior of the construction site should supplement perimeter controls once rough grading is complete.

4.2.5 Internal Swales and Ditches

1. More often, flows are directed toward internal swales, curbs, and ditches. Until the permanent facilities are constructed, temporary stormwater facilities will be subjected to erosion from concentrated flows.

2. These facilities should be stabilized through temporary check dams, geotextile mats, and, under extreme erosive conditions, by lining with concrete.

3. Long or steep slopes should be terraced at regular intervals (per local requirements). Terraces will slow down the runoff and provide a place for small amounts of sediment to settle out.

4. Slope benches may be constructed with either ditches along them or back-sloped at a gentle angle toward the hill. These benches and ditches intercept runoff before it can reach an erosive velocity and divert it to a stable outlet.

5. Overland flow velocities can be reduced by creating a rough surface for runoff to cross (e.g., tall grass).

4.2.6 Internal Erosion

Once all other erosion and sediment control BMPs have been exhausted, excessive sediment should be removed from the stormwater both within and along the perimeter of the project site. The appropriate controls work on the same principle: the velocity of sediment-laden runoff is slowed by temporary barriers or traps that pond the stormwater to allow sediments to settle out. Appropriate strategies for implementing sedimentation controls include:

1. Direct sediment-laden stormwater to temporary sediment traps.

2. Locate sediment basins and traps at low points below disturbed areas.

3. Protect all existing or newly-installed storm drainage structures from sediment clogging by providing inlet protection for area drains and curb inlets.

4. Construct temporary sediment traps or ponds at the stormwater outfall(s) for the site.

5. Excavate permanent stormwater detention ponds early in the project, use them as sedimentation ponds during construction, remove accumulated sediment, and landscape the ponds when the upstream drainage area is stabilized.

6. Temporary sediment barriers such as:

    a. Continuous berms
    b. Silt fences
    c. Sand bag barriers
    d. Brush or rock filter

These barriers should only be used in areas where sheet flow runoff occurs. They are less effective or ineffective if the runoff is concentrated into rill or gully flow.

4.2.7 Stormwater Inlets and Outfalls

1. Stormwater inlets, including drop inlets and pipe inlets, should be protected from sediment intrusion if the area draining to the inlet has been disturbed.

2. Stormwater inlet protection can utilize sand bags, sediment traps, or other similar devices.

3. Internal outfalls must also be protected to reduce scour from high-velocity flows leaving pipes or other drainage facilities.

4.2.8 Construction BMP Design and Maintenance – Facts Sheets

1. All stormwater BMPs shall be designed in a manner to minimize the need for maintenance and reduce the chances of failure, while maintaining required function. The design performance requirement shall accommodate an 80 percent total suspended solid removal of particles from 2 millimeters (mm) (very coarse sand) to 0.125 mm (very fine sand). The average daily Turbidity discharge should not exceed 280 Nephelometric Turbidity Units (NTUs). Additionally, BMPs shall be designed to remove targeted pollutants based on land use (referred to as "hot spots") and typical pollutant for the land use. Hot spots including gas stations, automobile service/repair centers, parking lots over 200 spaces, and restaurants should meet or exceed 40 percent removal efficiency for oil/grease. Section 4 defines design and construction parameters of BMPs and effectiveness of removing pollutants for during construction activities. Section 5 of this manual addresses permanent Post Construction BMPs.

2. BMPs will be proposed by the developer early in the planning and design stage of a project. For most projects, there will be no single BMP that addresses all the stormwater quality problems. Instead, a multi-level strategy will be worked out with Beaufort County that incorporates source controls, a series of onsite treatment controls, and community-wide treatment controls.

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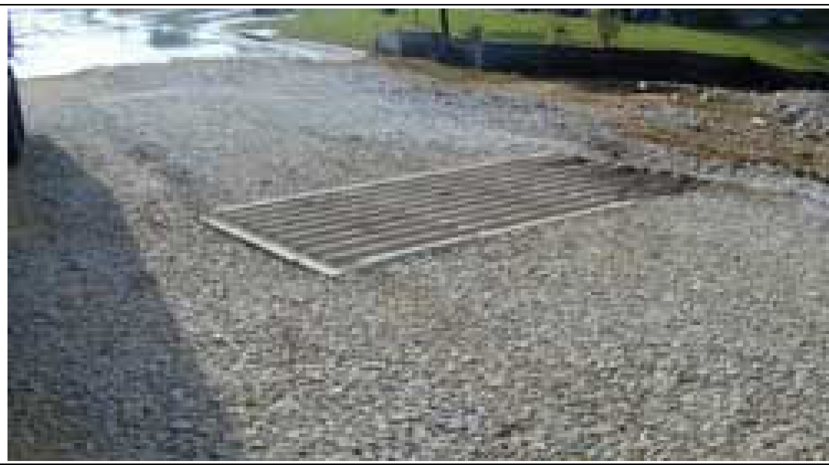
EPP-01 Tire Washing Facility

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Erosion Prevention Practices (EPPs)

EPP-01

Activity: Tire Washing Facility (TW)

Planning Considerations	
Design Life:	1 year
Acreage Needed:	Minimal
Estimated Unit Cost:	Moderate



TW

Target Pollutants

Significant ♦ Partial ◊ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

As a result of vehicular ingress and egress to the construction site, the facility would remove mud and dirt from vehicle tires and the undercarriage to prevent materials from depositing onto public roads. This application can be used in conjunction with the stabilized construction entrance, EPP-02.

Applicability

- Temporary construction traffic, phased construction projects and offsite road access.
- Typically used for large construction sites.

Approach

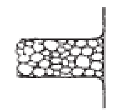
- Incorporate with the stabilized construction entrance, EPP-02.
- Construct wash rack on level ground when possible, on a pad of course aggregate.
- Design tire rack to withstand anticipated traffic loads and drain to a detention pond or swale. A typical wash rack has been shown in the standard details. However, wash rack design may consist of other materials or configuration as long as it provides the intended function.
- If a swale is required, then it shall provide sufficient grade, width, and depth to carry runoff.
- The swale shall carry runoff from the wash area to a sediment-trapping device such as a check dam.
- All employees, contractors, subcontractors, and others that leave the site with mud-caked tires and/or undercarriages shall use construction entrance.

Installation Procedures for Tire Washing Facility

- A geotextile underliner must be placed under the entire length and width of the stabilized entrance, but not under the wash rack.
- Place a layer of D50 diameter the full width of the exit and construct on level

	ground with a minimum thickness of 6 inches. ➢ The length of the stabilized entrance shall be as required based on the application, unless approved otherwise by the Stormwater Manager. ➢ The width of the pad shall be a minimum of 12-ft, unless approved otherwise by the Stormwater Manager. ➢ If a swale is required, then it shall meet specific requirements needed to carry the wash runoff to a sediment-trapping device.
Maintenance	➢ Remove accumulated sediment to maintain system performance, in the wash rack and/or sediment trap. ➢ Inspect at the end of each shift or workday for damage and repair as needed. ➢ Remove any mud tracked onto adjacent roadway by sweeping or scraping as necessary.
Inspection Checklist	❑ Vehicles are leaving the site through designated construction exit(s). ❑ Mud, dust or dirt is removed prior to exit onto the adjacent road. ❑ The construction exit is sufficiently maintained to prevent mud, dirt, fines and dust from being tracked offsite. ❑ Stones under wash rack have been maintained and are free of deleterious materials.

EPP-02 Stabilized Construction Entrance

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Erosion Prevention Practices (EPPs) Activity: Stabilized Construction Entrance (SCE)	EPP-02
Planning Considerations Design Life: 1 year Acreage Needed: Minimal Estimated Unit Cost: Low		 **SCE**

Target Pollutants

Significant ♦ Partial ◊ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

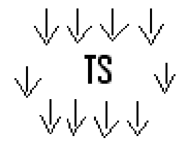
Description	The construction entrance practice receives all incoming and outgoing traffic of the construction site. By stabilizing the construction entrance there will be a significant reduction in the amount of sediment to and from public rights-of-way, streets, alleys, sidewalks or parking areas. The construction entrance practice is a stabilized pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving. This management practice is likely to create a significant reduction in sediment, nutrients, toxic materials, and oil and grease.
Applicability	➢ All points of construction ingress and egress. ➢ Unpaved areas where sediment tracking occurs from site onto paved or public roads
Approach	➢ Construct on level ground where possible. ➢ Stones should be sized as to remove mud from the construction site from tires. ➢ Provide ample turning radii as part of entrance. ➢ Should be used in conjunction with street sweeping on adjacent public right-of-way. ➢ Limit egress to the designated construction exit(s) by installing perimeter fencing. ➢ Wash rack may be included to increase efficiency of removing dirt from tires.
Installation Procedures	➢ A geotextile fabric must be used under the entire length and width of the stabilized entrance. ➢ Construct sediment barriers, such as check dams, to prevent sediment from entering into the stormwater sewer system, ditch, or waterway.

Maintenance	➢ Inspect weekly and after each rainfall. ➢ Periodically requires addition of stones for top; add gravel material when soil subgrade becomes visible. ➢ Remove all mud or sediment deposited on paved roadways as necessary. ➢ Stir aggregate with back-hoe on a weekly basis or as required based on construction activity.
Inspection Checklist	❑ Entrance/exits are exclusively used by all traffic. ❑ Construction exit is sufficiently maintained to prevent mud, dirt, and dust from being tracked offsite, and stone has been stirred with back-hoe.

EPP-03 Temporary Seeding

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Erosion Prevention Practices (EPPs)	EPP-03
	Activity: Temporary Seeding	

Planning Considerations	
Design Life:	1 year
Acreage Needed:	As needed
Estimated Unit Cost:	Low



Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description	Temporary seeding is used as a means of providing stabilization subject to erosion. This management practice is likely to create a significant reduction in sediment loss and a partial reduction in nutrients and toxic materials. Temporary seeding may also prevent costly maintenance operations on other erosion control systems and improve the visual resources of the construction area.
Applicability	➢ Apply to areas that are left in rough grade condition and will not be disturbed for 21 days or more.
Approach	Conventional Seeding ➢ Common methods of application include: disc, cultivator, broadcasting, and no-till drilling. Hydroseeding ➢ Hydroseeding uses a mixture of mulch, seed, and tactifier, which is sprayed over a disturbed area for coverage.

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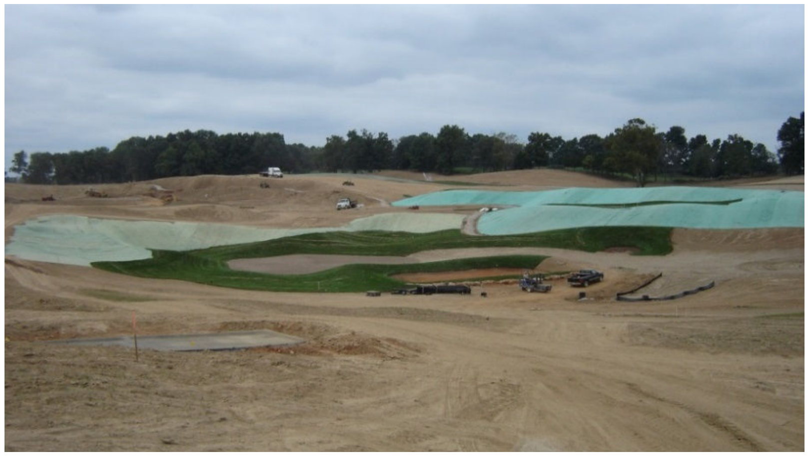
EPP-04 Sodding (SO)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Erosion Prevention Practices (EPPs)

EPP-04

Activity: Sodding (SO)

Planning Considerations	
Design Life:	Permanent
Acreage Needed:	As required
Estimated Unit Cost:	Moderate



SO

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

Sodding is a method used to quickly establish permanent grass stands. This practice can prove very effective in quickly stabilizing critical, erosion-prone areas.

Applicability

- Ditches or channels carrying intermittent flow.
- Areas around drop inlets in grass swales.
- Residential or commercial lawns that would be aesthetically enhanced by sodding.
- Other critical areas not previously described.

Approach

- Establish permanent grass stands quickly.
- Prevent erosion by stabilizing formerly denuded areas.
- Reduce the amount of airborne sediment, dust and mud leaving the project site.
- Stabilize channels where concentrated overland flow occurs.

Installation Procedures

Site Preparation

- Soil material should be capable of supporting permanent vegetation.
- In compacted areas, soil should be loosened to a depth of 6 to 8 inches.
- Stockpile unwanted topsoil to be used in other areas at the construction site.
- Grade and prepare the area for conventional construction equipment to be used for preparing the sod bed.

Sod Bed Preparation

- Soil should be analyzed for fertilizer and lime requirements.
- A 10-10-10 fertilizer shall be applied at a rate of 1,000 lb per acre, or as determined by soil testing.
- Work lime and fertilizer into the soil with disk harrow, springthooth harrow or

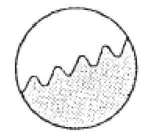
	like equipment to a depth of 4 inches. ➢ Clear vicinity of deleterious materials and stones greater than 4 inches in diameter prior to laying sod. ➢ Loosen the top 1 inch of soil prior to laying the sod pieces. Handling ➢ Sod should be kept moist and covered during transport and preparation. ➢ Sod should be free of noxious and secondary weeds and obtained from good, thick growing stands. ➢ Sod should be mowed to a height between 2 and 4 inches. Placement ➢ Do not place sod in freezing conditions (ambient temperatures less than 32° F.) ➢ Sod shall be placed and pressed together such that it will be continuous. ➢ The outer edges of the sod placed along curbing or sidewalks shall be sufficiently deep so that the surface water will flow over onto the top of the sod. ➢ In swales and ditches, lay sod strips perpendicularly to the centerline of the channel. ➢ In steep channels, wood stakes should be used to secure the sod strips. ➢ On slopes 3:1 or steeper, the sod shall be rolled or tamped, then secured with chicken wire or jute mesh over the sod for protection over critical areas. The stakes should secure the sod and the net and be spaced no further than 18 inches apart. The size of the stakes shall be approximately ½ inch x ¾ inch x 12 inches. The netting or mesh shall be stapled on the side of each stake within 2 inches of the top of the stake. The stake would then be driven flush with the top of the sod. ➢ The sod shall be tamped or rolled after placement and then watered.
Maintenance	➢ Sod should be kept moist for at least the first 3 weeks, until properly rooted. ➢ Sod areas where original placement does not establish or take root. ➢ Do not mow for the first 3 weeks. ➢ Once mowing begins, cutting height should be 3 inches or greater. ➢ Fertilize and mow grasses once established.
Inspection Checklist	❑ Sodded areas are properly watered and maintained. ❑ Heavy construction equipment has been prohibited from crossing sodded areas. ❑ Sodded areas are mowed once established.

EPP-05 Surface Roughening (SR)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Erosion Prevention Practices (EPPs)

EPP-05

Activity: Surface Roughening (SR)



SR

Planning Considerations	
Design Life:	1 year
Acreage Needed:	Minimal
Estimated Unit Cost:	Moderate

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

This BMP corrects the effects of runoff velocities, sediment trapping and sheet flow length by constructing small furrows across a slope, and utilizing construction equipment to track soil surface. The primary function of surface roughening is to temporarily stabilize a slope until it can receive permanent vegetation.

Applicability

- All exposed construction slopes.
- Exposed soils where seeding, planting, and mulching will benefit from surface roughening.
- Areas that have the potential for erosion of clay (smooth, hard surfaces), silt or sand-sized particles.

Approach

Roughening methods include:

- Fill slope roughening
- Grooving
- Roughening with tracked machinery

Factors to be considered in choosing a method are:

- Slope steepness
- Mowing requirements
- Soil type

Installation Procedures

Fill Slope Roughening

- Place fill slopes with a gradient steeper than 3:1 (H:V) in lifts not to exceed 8 inches, and make sure each lift is properly compacted.
- The face of the slope should consist of loose, uncompacted fill 4 to 6 inches deep.

	➢ Use grooving, furrowing, or tracking to roughen the face of the slopes, if necessary. ➢ Apply seed, fertilizer and mulch then track or punch in the mulch. See Sodding (EPP-04), Temporary Seeding (EPP-03), and Mulching (EPP-06) BMPs. ➢ Do not blade or scrape the final slope face. Grooving – Cuts, Fills, and Graded Areas ➢ Slopes that will be maintained by mowing should be no steeper than 3:1 (H:V). ➢ To roughen these areas, create shallow grooves by normal tilling, disking, harrowing, or use a cultipacker-seeder. Make the final pass of any such tillage on the contour. ➢ Make grooves formed by such implements close together, less than 10 inches apart and 3 inches deep. ➢ Excessive roughness is undesirable where mowing is planned. ➢ Practice should be used on slopes no longer than 200 ft. Furrowing ➢ Slope no greater than 3:1 (H:V) ➢ Use equipment to cut a 6-inch-deep furrow while placing cut material below furrow ➢ Cut furrows along the contour and at a minimum spacing of 50 ft. ➢ Practice should not be used on slope longer than 200 ft. Roughening with Tracked Machinery ➢ Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface. ➢ Operate tracked machinery up and down the slope to leave horizontal depressions in the soil, running with the contours of the slope. Do not back blade during the final grading operation. ➢ Seed and mulch roughened areas to obtain optimum seed germination and growth.
Maintenance	➢ Periodically check the seeded or planted slopes for rills and washes, particularly after significant storm events, greater than 0.5 inch. ➢ Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
Inspection Checklist	❑ Surface roughened areas inspected after recent wet weather events. ❑ Rills and washed areas have been re-roughened and re-seeded. ❑ Practice is maintained and properly functioning; other practices are not required.

EPP-06 Mulching (M)

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Erosion Prevention Practices (EPPs) Activity: Mulching (M)	EPP-06
Planning Considerations Design Life: 6-12 months Acreage Needed: None Estimated Unit Cost: Low Monthly Maintenance: 60% of installation		M M M M M M

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

To secure temporary or permanently seeded areas, mulching is used as a stabilizer. There are several types of mulches to be utilized, some of which include organic materials, straw, wood chips, and bark or other wood fibers. This management practice has the possibility to significantly reduce sediment and partially reduce of nutrients.

Applicability

- Temporary stabilization of freshly seeded and planted areas, sometimes during periods of unsuitable vegetative growth.
- Temporary stabilization of areas that cannot be seeded or planted (e.g., insufficient rain, steep slope, non-growth season).
- Areas which have been permanently seeded to assist in retaining moisture, and to hold seeding.
- On areas to increase the survival of temporary and/or permanent vegetative cover.
- As short-term, non-vegetative ground cover on steepened slopes to reduce rainfall impact, decrease the velocity of sheet flow, and settle out sediment.
- As ground cover around established plants, such as trees or shrubs, and on unprotected flat to minor slopes.
- Apply to planting areas where slopes are 2.5:1 (H:V) or less steep. Tacking agents or devices may be necessary for steeper slopes.
- Areas where climatic conditions require soil moisture retention aid to avoid cracking.

Approach

The term “mulch” is commonly used to describe a variety of materials, such as:

- Shredded tree bark and other woody materials, to protect trees and shrubs.
- Straw or hay, scattered across a slope or disturbed area.
- Peat mulch, used in planting trees and shrubs.

Table EPP-06-1 has a recommended application rate for various types of mulches.

Vegetative Fibers (Straw)

Loose hay or straw is the most common mulch materials used in conjunction with direct seeding of soil. Straw mulch is preferable over hay mulch, which may contain weeds and other objectionable material. Straw mulch is the short-term protection most commonly used with seeding. Wheat or oat straw is recommended from the current season's crop (less than 12 months old). Average fiber length should exceed 6 inches.

Straw mulch is applied immediately after seeding, whether by machine or by hand distribution. Anchor the mulch in place using a tacking agent, plastic netting, or punching into the soil mechanically. Plastic netting requires wire staples, wooden stakes, or plastic stakes. If the slopes are too steep for netting, then tacking agents should be selected on the basis of longevity and the ability to hold the fibers in place.

<u>Anchoring</u>

- Crimping, tracking, disking, or punching into soil
  - Small areas – Hand punch mulch 2 to 3 inches into the loose soil.
  - Larger areas – Use mulching tool on tractor to punch and anchor mulch 2 to 8 inches into the soil.
  - Tracking – Cut straw into soil by using a bulldozer with cleated tracks, placed such that the cleat marks are perpendicular to the runoff.
  - Typically used on slopes 3:1 or flatter for safe operation of equipment.

- Covering with netting or mat
  - Nettings or biodegradable paper, plastic or cotton netting can be used to cover straw mulch. The safety of animals (small birds, snakes and other wildlife) should be considered when selecting materials for this measure.

- Spraying tackifiers (Polymer or Organic)
  - Polymer tackifiers are typically applied at a rate of 40 to 60 lb/acre, or per manufacturer's recommendations.
  - Organic tackifiers are typically applied at a rate of 80 to 120 lb/acre, or per manufacturer's recommendations.

- Cellulose fiber mulch
  - Can be tacked at a rate of 750 lb/acre

Shredded Vegetation

"Green" mulch is produced by recycling of vegetation trimmings such as grass, shrubs, and trees. Methods of application are generally by hand, although pneumatic methods are currently being developed. It can be used as a temporary ground cover with or without seeding. The green mulch is held in place with a tacking agent on steep slopes and in areas where overland sheet flow is anticipated. The quality of

<table>
<tr><td></td><td>green mulch may vary, and there is a strong potential for establishing unwanted weeds and plants.
Table EPP-06-1
Recommended Rates for Mulching Materials
<table>
<tr><th>Mulch Product</th><th>Application Rate</th></tr>
<tr><td>Straw or Hay</td><td>1 ½ tons per acre</td></tr>
<tr><td>Wood Chips, Bark, Sawdust</td><td>5 - 8 tons per acre</td></tr>
<tr><td>Hydraulic mulches and soil binders</td><td>1 ½ - 2 tons per acre</td></tr>
</table></td></tr>
<tr><td>Maintenance</td><td>➢ Must be inspected weekly and after rain for damage or deterioration.
➢ Inspect after episodes of high winds.
➢ Maintain an unbroken, temporary mulched ground cover throughout the period of construction that the soils are not being reworked. Inspect before expected rainstorms and repair any damaged ground cover and re-mulch exposed areas of bare soil.</td></tr>
<tr><td>Inspection Checklist</td><td>❑ All disturbed areas are properly covered per plans and specifications.
❑ Straw mulch has been properly crimped.
❑ Mulch has been replaced following intense wet weather events or episodes of high winds.</td></tr>
</table>

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EPP-07 Geotextiles (G)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Erosion Prevention Practices (EPPs)

EPP-07

Activity: Geotextiles (G)

G

Planning Considerations	
Design Life:	N/A
Acreage Needed:	None
Estimated Unit Cost:	Low

Target Pollutants

Significant ♦ Partial ◊ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

Geotextiles are woven or non-woven fabrics, applied between surfaces or materials, to reduce flow velocities, release runoff as sheet flow, remove some sediment from runoff and are likely to create a significant reduction in sediment. Runoff and pollution caused by construction activities can be prevented or reduced with this BMP.

Applicability

- Construction sites desiring stability for disturbed soils.
- Sloppy area where anchoring must take place.
- Slopes steeper than 3:1 (H:V) and/or where erosion hazard is high.
- Slow growing vegetated areas.
- Critical slopes adjacent to sensitive areas (streams, wetlands, etc.).

Approach

Geotextiles provide stabilization, filtration, and separation properties. This BMP may be used when there is a need for separation between two materials or mediums that are likely to otherwise interfere with one another.

- Separating subsoil from aggregate within a subsurface drain.
- Separating subsoil from aggregate placed at the soil surface.
- Stabilizing of soil surface during temporary stream diversion.
- Preventing buildup of hydrostatic pressure behind gabions, decorative, or retaining walls.

This BMP does not require design or selection by a professional experienced in geotextile applications. However, if hydrostatic pressure becomes a concern for stability of a retaining wall, then a professional should be consulted.

	Geotextiles should be selected based on the standard specifications detailed by AASHTO
Installation Procedures	Geotextiles should be non-toxic to vegetation, and inert to soil chemicals. The materials selected should meet or exceed requirements of strength, resistance to distortion, permittivity, and resistance to ultraviolet degradation. **Geotextiles should be installed according to the specifications of the manufacturer.** ➢ Site preparation should include removal of rocks, clods, debris greater than 1 inch and any voids. ➢ The material should be loosely placed with no wrinkles, folds or distortions. ➢ The fabric should be in direct contact with the soil. ➢ Overlap sheets by placing the next consecutive sheet upstream on top of the downstream sheet. ➢ Fabric may require field joining with stakes or staples. ➢ Do not dump aggregate onto fabric from height greater than 5 ft. Aggregate should be placed to prevent damage. Damaged section may be repaired by placing a piece that overlaps the damaged area by at least 1 ft.
Maintenance	➢ Inspection to occur periodically, if any portion of the material is damaged, immediate correction is required. ➢ Inspections may occur prior to any anticipated wet weather events. ➢ Inspection to occur after significant rain storms to check for erosion and undermining. ➢ Repairs to the slope and re-installation should occur as a result of wash-out or breakage. ➢ Perform maintenance as required by the manufacturer.
Inspection Checklist	❑ Site is adequately prepared (grading or shaping, rocks, vegetation and debris removal, etc.). ❑ Seeding meets geotextile requirements. ❑ Anchoring is established at an acceptable depth. ❑ Anchoring trenches are used at the top and bottom of slopes. ❑ Trenches start, join and terminate geotextiles placed in channels. ❑ Soil filling is even and flat.

SMP-01 Silt Fence (SF)

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Sediment Management Practices (SMPs)	SMP-01
	Activity: Silt Fence (SF)	

Planning Considerations Design Life: 6 months Acreage Needed: Minimal Estimated Unit Cost: Low		SF

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description	To detain sediment-laden water, silt fences are used to promote silt deposition behind the fence. These fences are made of filter fabric that has been entrenched, attached to support poles and occasionally supported by a wire fence. Silt fence is intended as a temporary sediment barrier and requires routine maintenance
Applicability	➢ Silt fence should be used in area accepting sheet flow conditions. ➢ Silt fence should **<u>not</u>** be used in ditch lines, streams, or other areas of concentrated flows. ➢ Silt fencing can be used along the downstream perimeter, below the toe of a cleared slope, upstream of sediment traps or basins, along streams and channels and around temporary spoil areas.
Approach	➢ Light Duty Silt Fence (SF-LD) Type A silt fence is 36 inches in height. This type silt fence can be used on project lasting 6 months or greater. ➢ Heavy Duty Silt Fence (SF-HD) Type C silt fence is 36 inches in height and has wire reinforcement. This type silt fence should be used when high velocities are encountered. See Table SMP-01-1.
Design Criteria	The design criteria for silt fence is as follows: ➢ Silt fencing should be installed along the contour. It should not be installed up and down slopes unless accompanied by measures such as "J" Hooks or other methods. ➢ The length of silt fence is determined by the amount of runoff area. The minimum area should not exceed 0.25 acre per 100 linear feet of silt fence. ➢ Spacing of silt fence is variable depending on the slope of land draining to the

<table>
<tr><td></td><td>fence. See Table SMP-01-1 for spacing requirements.

Table SMP-01-1
Silt Fence Spacing on Sloping Sites
<table>
<tr><td></td><td colspan="3">Soil Type</td></tr>
<tr><td>Slope Angle</td><td>Silty</td><td>Clays</td><td>Sandy</td></tr>
<tr><td>Very Steep (1:1)</td><td>50 ft</td><td>75 ft</td><td>100 ft</td></tr>
<tr><td>Steep (2:1)</td><td>75 ft</td><td>100 ft</td><td>125 ft</td></tr>
<tr><td>Moderate (4:1)</td><td>100 ft</td><td>125 ft</td><td>150 ft</td></tr>
<tr><td>Slight (10:1)</td><td>125 ft</td><td>150 ft</td><td>200 ft</td></tr>
</table></td></tr>
<tr><td>Installation Procedures</td><td>Silt fence installation procedure is as follows:
➢ Secure suitable fence materials meeting requirement set herein.
➢ Stake or mark silt fence location.
➢ Trench (6 inches by 6 inches) along proposed location.
➢ Place fence in the trench (most fence products have a colored line indicating the depth of burial). Drive post with spacing as specified by silt fence type. Attach fence material to post as specified.
➢ Backfill and compact trench anchoring fence material.
➢ When required, fence splicing should be conducted as is the method contained herein.
➢ Silt fence should turn uphill 6 ft at ends (at least 1-ft raise in elevation).</td></tr>
<tr><td>Maintenance</td><td>➢ Inspect after every rainfall.
➢ Repair/replace fence when damaged or deteriorated.
➢ Sediment height not to exceed one-half the height of the fence.
➢ Perform required maintenance before a storm event.
➢ Remove fence when vegetation is established.</td></tr>
<tr><td>Inspection Checklist</td><td>☐ Silt fence has proper placement.
☐ The last 6 ft of the silt fence is turned uphill and secured to the post.
☐ Color band of the anchor trench is not visible.
☐ Accumulated sediment does not exceed one-half the height of the fence.
☐ If washaround or underwash occurs, then fence should be reset.</td></tr>
</table>

SMP-02 Sediment Traps (ST)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Sediment Management Practices (SMPs)

SMP-02

Activity: Sediment Traps (ST)

ST

Planning Considerations	
Design Life:	1-1 ½ years
Acreage Needed:	Minimal
Estimated Unit Cost:	Low

Target Pollutants

Significant ♦ Partial ◊ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	♦	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

The sediment trap is a control measure that detains sediment-laden runoff from small disturbed areas in an earthen embankment that will allow ponding long enough to allow the sediment to settle within the depression.

Applicability

- Install detention areas below disturbed vicinities of less than 10 acres.
- Along the perimeter of the site at locations where sediment-laden runoff is discharged offsite or areas where runoff can enter stabilized areas or waterways.
- Temporary sediment traps shall **not** be used in live or continuously flowing streams. Sediment traps may kill nearby vegetation by excessive sediment or by long periods of submergence.
- Temporary sediment traps only remove coarse particles which settle quickly. Sediment traps are not effective for fine-grained soils such as silt or clay. Additional upstream erosion control measures are necessary.

Approach

- Prepare sediment traps prior to beginning of construction.
- Traps are to be located in areas by hollowing out areas across swales or low embankments, places where damages are excluded and areas needing maintenance to reduce sediment accumulation.
- Create larger traps to include a greater amount of sediment buildup.
- After stabilization of the construction area, the sediment trap may be removed and stabilize area as needed with vegetation or other cover.

Design Criteria

Volume

Minimum volume of a sediment trap shall be 67 cubic yards per acre for the total drainage area. The volume shall be measured at an elevation equivalent to the spillway invert.

Optimal design volume of sediment trap depends on type of soil, size and slope of drainage area, amount of land disturbance, desired sediment removal efficiency, and desired cleanout frequency. A recommended volume for temporary sediment trap in heavily disturbed areas is 134 cubic yards per acre, which equates to 1 inch of stormwater runoff. Optimal design of this type of sediment trap includes an upper zone of at least 67 cubic yards per acre (to be dewatered using one of the outlet design alternatives) and a lower wet zone for sediment storage and settling.

Shape

The designer should attempt to plan a basin that has a minimum 3:1 length-to-width ratio.

Slopes

Basin side slopes should be restricted to 4:1 or flatter. However, the permeable, filter portion should have a maximum cross section of 2:1.

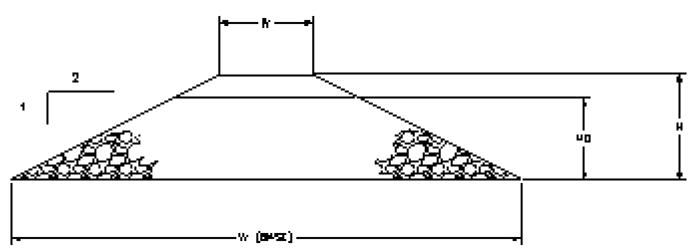
Emergency Spillway

The emergency overflow outlet of the temporary sediment trap must be stabilized with rock, riprap, geotextile, vegetation or another suitable material which is resistant to erosion. A stable emergency spillway must be installed to safely convey stormwater runoff for the 10-year storm event.

An emergency overflow weir should be provided at an elevation of at least 1.5 ft below the top of embankment, with a minimum freeboard of 1 ft. The minimum bottom width of a trapezoidal section for an emergency overflow weir should be:

4 ft	-	1 acre (total drainage area)
6 ft	-	2 acres (total drainage area)
8 ft	-	3 acres (total drainage area)
10 ft	-	4 acres (total drainage area)
12 ft	-	5 acres (total drainage area)

*Drainage areas over 5 acres as designed



H	*HO*	*W*	*W (BASE)*
2.0	1.0	5.0	9.0
2.5	1.0	5.5	10.5
3.0	1.5	6.0	12.0
3.5	2.0	6.5	13.5
4.0	2.5	7.0	15.0
4.5	3.0	7.5	16.5
5.0	3.5	8.0	18.0

Units: Feet

Installation Procedures

Contractors should construct temporary sediment traps near the beginning of a construction project, after establishing the perimeter erosion control measures and before any clearing or grading operations. This practice will be useful in the early stages of the construction process as it will negate the detrimental characteristics of grading, earthwork, trenching and other land-disturbing activities.

- Use perimeter erosion control measures in the vicinity adjacent to the sediment trap location. Areas under embankments should be cleared and grubbed. Grade and/or excavate to construct the required volume and to provide fill material for any embankments.
- Use clay for fill materials that is free of roots, large rocks, and organic material. Place fill and compact with a sheeps foot roller or other vibratory equipment in 6-inch layers.
- Install outlet structures such as rock outlet berm, or an emergency overflow weir. Prevent outlet failure by installing geotextile fabric and wire fencing. Baffles should be used to maximize stormwater residence time within the sediment trap.
- Stabilize slopes using temporary vegetation, erosion control matting, mulch or other measures. Inspect final work for safety and function. Warning signs, barricades, perimeter fence or other measures necessary should be installed to protect.

Maintenance

- Inspect traps weekly and before and after heavy rainfall.
- Maintain traps to guarantee correct utilization.
- Remove sediment after it reaches one-third the height of the trap.

Inspection Checklist

- ☐ Constructed traps serve 10 acres or less.
- ☐ Type of outlet structure used matches SWPP plan.
- ☐ Structure is stabilized to prevent erosion.
- ☐ Gage is visible and correctly indicates the depth of the trap.
- ☐ Sediment accumulation does not exceed one-third the height of trap.
- ☐ Trap is constructed in such a way that no damage occurs to life or property.
- ☐ Trap is maintained.

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SMP-03 Temporary Diversions, Drains and Swales (TD)

<table>
<tr><td rowspan="2"></td><td>Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Sediment Management Practices (SMPs)</td><td rowspan="2">SMP-03</td></tr>
<tr><td>Activity: Temporary Diversions, Drains and Swales (TD)</td></tr>
<tr><td>Planning Considerations
Design Life:
Short term
Acreage Needed:
Minimal
Estimated Unit Cost:
Moderate</td><td></td><td>→ TD → TD →

TD</td></tr>
</table>

<table>
<tr><td colspan="6">Target Pollutants</td></tr>
<tr><td colspan="6">Significant ♦ Partial ◈ Low or Unknown ◊</td></tr>
<tr><td>♦</td><td>Sediment</td><td>♦</td><td>Oxygen Demanding Substances</td><td>◊</td><td>Bacteria & Viruses</td></tr>
<tr><td>♦</td><td>Heavy Metals</td><td>◊</td><td>Toxic Materials</td><td>◈</td><td>Floatable Materials</td></tr>
<tr><td>♦</td><td>Nutrients</td><td>♦</td><td>Oil& Grease</td><td>◊</td><td>Construction Waste</td></tr>
</table>

<table>
<tr><td>Description</td><td>These temporary drains offer features such as conveyance for runoff down cut or fill slopes, subsurface drains that drain off excessive soil saturation, minimization of sheet flow over slope surfaces and reduced sedimentation. Once stabilized, diversions require relatively little maintenance.</td></tr>
<tr><td>Applicability</td><td>➢ Provide drains to prevent slope failures, damage to adjacent property, erosion and sediment control and removes excess water from soil.
➢ Diversions to catch runoff at the end of an undisturbed slope before entering a bared area, direct runoff, preserve stable conveyance and prevent overflow.</td></tr>
<tr><td>Approach</td><td>➢ Prepare sediment traps prior to beginning of construction.
➢ Traps are to be located in areas by hollowing out areas across swales or low embankments, places where damages are excluded and areas needing maintenance to reduce sediment accumulation.
➢ Create larger traps to include a greater amount of sediment buildup.
➢ After stabilization of the construction area, the sediment trap may be removed and stabilize area as needed with vegetation or other cover.</td></tr>
<tr><td>Installation Procedures</td><td>A diversion prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversions should not adversely impact adjacent properties and must conform to local floodplain management regulations. This practice should not be used in areas with slopes steeper than 10%. The advantages of the temporary earth dike include the ability to handle flows from large tributary areas. Additionally, they are relatively inexpensive</td></tr>
</table>

to install since the soil material required for construction may be available onsite, and can be constructed as part of the initial grading operations, while the equipment is onsite.

Temporary swales will effectively convey runoff and avoid erosion if constructed and maintained properly:

- Size temporary swales in the same manner as a permanent channel.
- A permanent channel must be designed by a licensed professional civil engineer.
- At a minimum, the swale should conform to predevelopment flow patterns and capacities.
- Construct the swale with an uninterrupted, positive grade to a stabilized outlet.

Drains

Diversion drains are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost-effective diversion.

- Can be placed on or buried underneath the slope surface.
- Should be anchored at regular intervals of 50 to 100 ft.
- If a slope drain conveys sediment-laden water, direct flows to a sediment trap or basin.
- When using slope drains, limit tributary area to 2 acres per pipe. For larger areas, use a rock-lined channel or a series of pipes.
- Maximum slope generally limited to 2:1 (H:V), as energy dissipation below steeper slopes is difficult.
- Drain or swale should be laid at a minimum grade of 1%, but not more than 15%.
- The swale must not be overtopped by the 10-year, 24-hour storm, meeting or exceeding the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use riprap or sod for swales with a slope between 5 and 15 percent.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Direct surface runoff to slope drains with diversion swales, dikes and berms.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.
  - Compact soil around and under entrance, outlet, and length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.
  - Check to ensure that pipe connections are watertight.
  - Protect inlet and outlet of slope drains: use standard flared end section at entrance for pipe slope drains 12 inches and larger.
  - Protect area around inlet with filter cloth.
  - Protect outlet with geosynthetics and riprap or other energy dissipation device. For high-energy discharges, reinforce riprap.

	Diversions ➢ Select design flows and safety factor based on careful evaluation of risks due to erosion of the measure, over topping, flow backups, or washout. ➢ High flow velocities may require the use of a lined ditch, or other methods of stabilization. ➢ When installing diversion ditches and berms: ▪ Protect outlets from erosion. ▪ Utilize planned permanent ditches/berms early in construction phase when practicable. ➢ All dikes and berms should be compacted by earth-moving equipment. ➢ All dikes should have positive flow to a stabilized outlet. ➢ Top width may be wider and side slopes may be flatter at crossings for construction traffic. ➢ Dikes should direct sediment-laden runoff into a sediment-trapping device. ➢ Dikes should be stabilized with vegetation, chemicals, or physical devices. ➢ Compact any fills to prevent unequal settlement. ➢ Dikes should remain in place until disturbed areas are permanently stabilized. ➢ Examine the site for run-on from offsite sources (control offsite flows through or around site). ➢ Select flow velocity limit based on soil types and drainage flow patterns for each project site ➢ Establish a maximum flow velocity, shear stress or 3 to 5 fps, for using earth dikes and swales, above which a lined ditch must be used. ➢ Design an emergency overflow section or bypass area for larger storms that exceed the 10-year design storm. ➢ Conveyances must be lined or reinforced when velocities exceed allowable limits for soil. Consider use of geotextiles, engineering fabric, vegetation, riprap or concrete.
Maintenance	➢ Inspect drains before and after each storm event ➢ Inspect weekly until drainage area is stabilized ➢ Maintain drains and swales to eliminate erosion, accumulation of debris and sediment ➢ Check status of water ponding activities. Remove water if such activities occur ➢ Temporary conveyances should be removed when surroundings become stable or when the construction is complete
Inspection Checklist	❑ Routine visit after every heavy rain water event. ❑ No evidence of washout, accumulated debris and build up in ditches or berms.

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SMP-04 Riprap (RR)

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Sediment Management Practices (SMPs)	SMP-04
	Activity: Riprap (RR)	

Planning Considerations

Design Life:	Permanent
Acreage Needed:	Minimal
Estimated Unit Cost:	Moderate

— RR —

RR

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

Riprap is a permanent erosion-prohibiting ground cover that requires the placement of large, loose, angular stone with a geotextile or granular underlining. This BMP significantly reduces erosion and sediment movement.

Applicability

- Along a stream or within a ditch to provide an erosion-resistant lining.
- On waterfronts, or any other areas subject to wave harmonics.
- Surrounding culvert inlets and outlets to protect against scouring and undercutting
- In channels to reduce velocities, dissipate hydraulic energies and promote infiltration.
- On slopes that are not conducive to the establishment of ground cover.

Installation Procedures

- Riprap application and implementation for channel or slope stabilization should be designed by a professional familiar with drainage and stormwater conveyance measures.
- Riprap placement should be completed within a short time period (less than a week) to minimize potential damage resulting from stormwater runoff.
- The area should be cleared of trees and shrubs in order to provide sufficient access to the site for the construction equipment.
- When used as slope protection, riprap should be keyed into the slope toe by at least the greater of 6 inches or one half the designed riprap diameter.
- Riprap should not be placed until final subgrade elevation has been verified by the licensed engineer overseeing design and/or construction.
- Geotextile should be installed to maintain separation of rock material from the underlying soil. Geotextile should not be stretched or otherwise compromised.

Secure fabric with anchor trenches, stakes, staples or any other method recommended by the manufacturer.

- When subgrade filters are required, place a layer of aggregate or sand so that the layer is smoothly graded and well compacted.
- When subgrade filters are not required, the subgrade should be compacted as to prevent undercutting or slumping from occurring.

Rubble-Stone Riprap (Plain)

- Rubble-stone riprap should consist of at least 90% of the stone not less than 8 inches wide by 12 inches long by 12 inches deep and should be approximately rectangular in shape. Rubble-stone should be hand placed so that the stones are close together, are staggered at all joints as far as possible, and are placed so as to reduce the voids to a minimum. The main stone should be thoroughly "chinked" or anchored in place with 1-inch to 3-inch stones by throwing them over the surface in any manner that is practical for the smaller stones to fill the voids.
- The standard depth should be 24 inches. The average depth should not be less than the required depth and is determined from evaluation of a 25 sq ft surface area.
- When rubble-stone riprap is constructed in layers, the layers should be thoroughly tied together with large stones protruding from one layer into the other.

Rubble-Stone Riprap (Grouted)

- Stone placement for rubble-stone riprap (grouted) is the same as for rubble-stone riprap (plain). The grouting procedure is as follows:
- When grouting is used, care should be taken to prevent earth or sand from filling the spaces between the stones before the grout is poured. Grout should be composed of one part Portland cement and four parts of sand, measured by volume, and mixed thoroughly with sufficient water to a consistency that it will flow into and completely fill the voids.
- Immediately before pouring the grout, the stones should be wetted by sprinkling. Beginning at the lower portion of the riprap, the grout should be carefully poured into the voids between the stone and at a rate slow enough to prevent oozing to the surface. The pouring of the grout should be accomplished by the use of vessels, chutes, tubes, or hoses of adequate size and shape. Broadcasting, slopping, or spilling of grout from the vessels on the surface of the riprap is not allowed.
- As soon as any section of the grouted riprap has hardened sufficiently, it should be kept moist with water that is free from salt or alkali for a period of not less than 72 hours.

Sacked Sand-Cement Riprap

- Sand for sacked sand-cement riprap may be manufactured or natural but should conform to State regulations. The same is true for hydraulic cement. The sand and cement should be mixed dry, with a mechanical mixer, in the proportion of one bag (94 pounds) of cement to 5 cubic feet of dry sand, until the mixture is uniform in color. The sand-cement mix should be poured into sacks of approximately 1 cubic foot capacity until they are approximately three-quarters full. Sacks should be of either cotton or jute standard grade of cloth, which will hold the sand-cement mixture without leakage during handling and tamping. The

	sacks should then be securely fastened with hog rings, by sewing, or by other suitable methods that prohibit leakage of the mixture from the bags. ➢ The sacks of sand-cement should be bedded by hand on the prepared grade with all the fastened ends on the grade and with the joints broken. The completed riprap should have a minimum thickness of 10 inches with a tolerance of 3 inches. ➢ The sacks should be rammed and packed against each other in such a manner as to form close contact and secure a uniform surface. Immediately after tight placement, the sacks of sand-cement should be thoroughly soaked by sprinkling with water. Water should not be applied under high pressure. Sacks that are ripped or broken in placement should be removed and replaced before being soaked with water. Machined Riprap ➢ Machined riprap should be clean shot rock containing no sand, dust, or organic materials and should be the size designated for the class specified. The stone should be uniformly distributed throughout the size range.
Maintenance	➢ Riprap requires minimum maintenance ➢ Check after storm events for maintenance purposes, and replace any portion of the riprap that needs attention ➢ Check for brush growth, and remove the evidence that appears
Inspection Checklist	❑ Verify that displacement does not occur due to steep slopes or small riprap. ❑ Proper filter cloth is used. ❑ Riprap graded properly according to contract documents.

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GHP-01 Solid Waste Management (SWM)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Good Housekeeping Practices (GHPs)

GHP-01

Activity: Solid Waste Management (SWP)

Planning Considerations	
Design Life:	
Permanent	
Acreage Needed:	
Minimal	
Estimated Unit Cost:	
Moderate	

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◈	Toxic Materials	♦	Floatable Materials
◊	Nutrients	◊	Oil& Grease	♦	Construction Waste

Description

The management of waste in and out of a construction site reduces and, in some cases, prevents the discharge of pollutants to stormwater. This waste may be solid or construction waste and can be disposed of at designated waste collection areas and in containers. This management practice will significantly reduce the quantity of floatable materials and other construction waste materials from escaping from the construction site.

Approach

Solid waste is one of the major pollutants resulting from construction. Construction debris includes:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction.
- Packaging materials including wood, paper and plastic.
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products.
- Concrete, brick, and mortar.
- Pipe and electrical cuttings.
- Pavement planning or grinding and removal.
- Wood framing or false work.
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, and plastic wrappers, and cigarettes.

The following steps will help keep a clean site and reduce stormwater pollution:

	➢ Designate waste storage areas that are away from storm drain inlets, stormwater facilities, or watercourses. ➢ Provide containers in areas where employees congregate for breaks and lunch. ➢ Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks or open drain valves and repair any dumpster that is not watertight and tightly close the drain valve. ➢ Do not hose out dumpsters on the construction site. Leave dumpster cleaning to trash hauling contractor. ➢ Arrange for regular waste collection before containers overflow. ➢ If a container does spill, clean up immediately. ➢ Locate storage containers in a covered area and/or in secondary containment. ➢ Segregate potentially hazardous waste from non-hazardous construction site waste. ➢ Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy. ➢ Plan for additional containers and more frequent pickup during the demolition phase of construction. ➢ Collect site trash daily, especially during rainy and windy conditions. ➢ Erosion and sediment control devices tend to collect litter. Remove this solid waste promptly. ➢ Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris. ➢ Salvage or recycle any useful material. For example, trees and shrubs from land clearing can be used as a brush barrier or converted into wood chips, then used as mulch on graded areas. ➢ Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas. ➢ Train employees and subcontractors in proper solid waste management. ➢ Require that employees and subcontractors follow solid waste handling and storage procedures. For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet, GHP-05.
Maintenance	➢ Collect site trash daily. ➢ Inspect construction waste area regularly. ➢ Arrange for regular waste collection.
Inspection Checklist	❑ There are no major limitations to this best management practice.

GHP-02 Concrete Waste Management

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Good Housekeeping Practices (GHPs)	GHP-02
	Activity: Concrete Waste Management	

Planning Considerations	
Training:	
No	
Inspection Frequency:	
Weekly to Monthly	
Implementation Cost:	
Low	

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◈	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◈	Construction Waste

Description

Concrete waste management requires simple measures including offsite washouts, performing onsite washout in a designated area, and training employees and subcontractors. These procedures will help reduce concrete pollutant discharge to stormwater.

Approach

The following steps will help reduce stormwater pollution from concrete wastes:

- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete or cement onsite.
- Perform washout of concrete trucks offsite or in designated areas only – such as a specially designed soil mixing sump protected by a sediment trap.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated areas for onsite washout.
- Locate washout area at least 50 ft from storm drains, open ditches, or waterbodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste;
- Wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed of properly.
- Be sure the stormwater collection system is protected by means of a sediment trap or similar practice.
- When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water to a bermed or level area.

	➢ Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose of in the trash. ➢ Train employees and subcontractors in proper concrete waste management. ➢ For a quick reference on disposal alternatives for specific wastes, refer to the Employee/Subcontractor Training BMP fact sheet, Table GHP-05-1. ➢ Illicit dumping onsite or offsite without the property owner's knowledge and consent is unacceptable. ➢ Washout locations may be flagged with lath and surveyors tape or designated as necessary to ensure that truck drivers utilize proper areas. Education ➢ Instruct drivers and equipment operators on proper disposal and equipment washout practices. ➢ Educate employees, subcontractors, and suppliers on concrete waste storage and disposal procedures. ➢ Designate a foreman or supervisor to oversee and enforce concrete waste management procedures. Make supervisors aware of the potential environmental consequences of improperly handled concrete wastes. Demolition Practices ➢ Monitor weather and wind direction to ensure concrete dust is not entering storm drains, watercourses, or surface waters. ➢ Where appropriate, construct sediment traps or other types of sediment detention devices downstream of demolition activities.
Maintenance	➢ Educate to ensure that concrete wastes are being properly managed. ➢ If using a temporary pit, dispose hardened concrete on a regular basis that will prevent the pit from being more than half full. ➢ The foreman and/or construction supervisor shall monitor onsite concrete waste storage and disposal procedures at least weekly.
Inspection Checklist	❑ Concrete waste receptacles are maintained and emptied routinely. ❑ Onsite washout area is located at least 50 ft from storm drains, open ditches, or other waterbodies ❑ Onsite washout area is properly maintained and cleaned.

GHP-03 Sanitary/Septic Waste Management (S&SWM)

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Good Housekeeping Practices (GHPs)	GHP-03
	Activity: Sanitary/Septic Waste Management (S&SWM)	

Planning Considerations

Training:	Yes
Inspection Frequency:	Weekly
Implementation Cost:	Moderate
Monthly Maintenance:	Moderate

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

◊	Sediment	◊	Oxygen Demanding Substances	♦	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◈	Construction Waste

Description

Providing convenient well-maintained sanitary and septic waste facilities with regular service and disposal reduces or prevents discharge of pollutants to stormwater from sanitary/septic waste.

Approach

- Sanitary or septic wastes should be treated or disposed of in accordance with DHEC and local health department requirements.
- Locate sanitary facilities in a convenient location.
- Never discharge untreated or raw wastewater to a ditch, creek or other waterway, or bury onsite.
- Temporary septic systems should treat wastes to appropriate levels prior to discharging. DHEC should be consulted to determine appropriate levels.
- If using an onsite disposal system (OSDS), such as a septic system, comply with local health agency requirements.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected and inspected by the local sewer authority to avoid illicit discharges to the storm sewer system and other pertinent requirements.
- Privately held sanitary/septic facilities should be maintained in good working order by a licensed service.
- Arrange for regular waste collection by a licensed hauler before facilities overflow.
- For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet, Table GHP-05-1.

	➢ Anchor portable sanitary facilities, when needed, to prevent vandals from tipping them.
Maintenance	➢ Inspect facilities regularly. ➢ Arrange for regular waste collection.
Inspection Checklist	❑ There are no major limitations to this best management practice other than those that may be imposed by the local sewer authority.

GHP-04 Vehicle and Equipment Fueling (VEF)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Good Housekeeping Practices (GHPs)

GHP-04

Activity: Vehicle and Equipment Fueling (VEF)

Planning Considerations

Training:	No
Inspection Frequency:	Monthly
Implementation Cost:	Low
Monthly Maintenance:	Low

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

◊	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◈	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◈	Oil& Grease	◊	Construction Waste

Description

This BMP prevents fuel spills and leaks and their impact to stormwater by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

Approach

- Use offsite fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute stormwater. If fueling a large number of vehicles or pieces of equipment, consider using an offsite fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at the site.
- If onsite fueling cannot be avoided, designated areas, located away from drainage courses, can be used to prevent the run-on of stormwater and the runoff of spills.
- Educate employees and subcontractors not to "top-off" fuel tanks.
- When fueling, use secondary containment, such as a drain pan or drop cloth, to catch spills/leaks.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of it properly.
- Observe Federal and State requirements regarding stationary above-ground storage tanks, with special attention given to secondary containment.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should

	be able to travel to a designated area with little lost time. ➢ For a quick reference on disposal alternatives for specific wastes, see the table presented in the Employee/Subcontractor Training BMP fact sheet, Table GHP-05-1. ➢ Locate fueling areas on a paved surface where practical. ➢ Protect fueling areas with berms and/or dikes to prevent run-on, runoff, and to contain spills. ➢ Use vapor recovery nozzles to help control drips as well as air pollution if required by SCDHEC.
Maintenance	➢ Keep ample supplies of spill cleanup materials onsite. ➢ Inspect fueling areas and storage tanks on a regular schedule.
Inspection Checklist	❑ Secondary containment area is properly maintained and preventing petroleum products from runoff to streams and ditches. ❑ Construction site has proper materials for cleaning spills. ❑ Fueling tanks are working properly.

GHP-05 Employee/Subcontractor Training (EST)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Good Housekeeping Practices (GHPs)

GHP-05

Activity: Employee/Subcontractor Training (EST)

Planning Considerations	
Training:	Yes
Inspection Frequency:	None
Implementation Cost:	Moderate
Monthly Maintenance:	Low

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

◊	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

Employee or subcontractor training will determine the success of the stormwater pollution prevention program. This BMP will focus on approaches to assure that employees and subcontractors are familiar with the Beaufort County Stormwater Pollution Prevention Plan (SWPPP) and will turn the attention from an individualized source control into a comprehensive training program.

Applicability

Employee/subcontractor training should be based on four objectives:

1. Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater;
2. Identify solutions (BMPs);
3. Promote employee/subcontractor ownership of the problems and the solutions; and
4. Integrate employee/subcontractor feedback into training and BMP implementation.

Approach

- Integrate training regarding stormwater quality management with existing training programs that may be required for the business by other regulations such as the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120); and the Spill Prevention Control and Countermeasure (SPCC) Plan (40 CFR 112).
- Supervisors and inspectors should receive additional annual 8-hour refresher courses.
- Businesses, particularly smaller ones that may not be regulated by Federal, State, or local regulations, may use the information in this BMP Manual to develop a training program to reduce their potential to pollute stormwater.
- Use the quick reference on disposal alternatives (Table GHP-05-1) to train

	employee/ subcontractors in proper and consistent methods for disposal. ➢ Consider posting the quick reference table around the job site or in the onsite office trailer to reinforce training. ➢ Train employee/subcontractors in standard operating procedures and spill cleanup techniques described in the fact sheets. Employee/subcontractors trained in spill containment and cleanup should be present during the loading/unloading and handling of materials. ➢ Personnel who use pesticides should be trained in their use. ➢ Proper education of offsite contractors is often overlooked. The conscientious efforts of well-trained employee/subcontractors can be lost by unknowing offsite contractors, so make sure they are well informed about what they are expected to do onsite.
Maintenance	➢ Keep ample supplies of spill cleanup materials onsite. ➢ Inspect fueling areas and storage tanks on a regular schedule.
Inspection Checklist	❑ Secondary containment area is properly maintained and preventing petroleum products from runoff to streams and ditches. ❑ Construction site has proper materials for cleaning spills. ❑ Fueling tanks are working properly.
Quick Reference – Disposal Alternatives	All of the waste products on this chart are prohibited from discharge to the storm drain system. Use the following matrices to decide which alternative disposal strategies to use. **ALTERNATIVES ARE LISTED IN PRIORITY ORDER.** Key: HHW Household Hazardous Waste MWS Municipal Waste System NPDES National Pollutant Discharge Elimination System (NPDES) Office. POTW Publicly Owned Treatment Plant “Dispose to sanitary sewer” means dispose into sink, toilet, or sanitary sewer clean-out connection. “Dispose as trash” means dispose in dumpsters or trash containers for pickup and/or eventual disposal in landfill. “Dispose as hazardous waste” for business/commercial means contract with a hazardous waste hauler to remove and dispose.

Table GHP-05-1 Quick Reference – Disposal Alternatives			
General Construction and Painting: Street and Utility Maintenance			
DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL** **Disposal Priorities**	**Approval**	**RESIDENTIAL** **Disposal Priorities**
Excess paint (oil based)	1. Recycle/reuse. 2. Solidify and dispose as hazardous waste.		1. Recycle/reuse. 2. Take to HHW drop-off.
Excess paint (water based)	3. Recycle/reuse 4. Dry residue in cans, dispose as trash. 5. If volume is too much to dry, solidify and dispose as hazardous waste.		1. Recycle/reuse. 2. Dry residue in cans, dispose as trash. 3. If volume is too much to dry, take to HHW drop-off.
Paint cleanup (oil based)	1. Wipe paint out of brushes, then: 2. Filter & reuse thinners, solvents. 3. Solidify and dispose as hazardous waste.		1. Wipe paint out of brushes, then: 2. Filter & reuse thinners, solvents. 3. Take to HHW drop-off.
Paint cleanup (water-based)	1. Wipe paint out of brushes, then 2. Rinse to sanitary sewer.		1. Wipe paint out of brushes, then 2. Rinse to sanitary sewer.
Empty paint cans (dry)	1. Remove lids, dispose as trash.		1. Remove lids, dispose as trash.
Paint stripping (with solvent)	1. Dispose as hazardous waste.		1. Take to HHW drop-off.
Building exterior cleaning (high-pressure water)	1. Prevent entry into storm drain and remove offsite. 2. Wash onto dirt area, spade in. 3. Collect (e.g. mop up) and discharge to sanitary sewer.		
Cleaning of building exteriors which have **HAZARDOUS MATERIALS** (e.g. mercury, lead) in paints	1. Use dry cleaning methods. 2. Contain and dispose washwater as hazardous waste (Suggestion: dry material first to reduce volume).		
Non-hazardous paint scraping/sand blasting	1. Dry sweep, dispose as trash.		1. Dry sweep, dispose as trash.
HAZARDOUS paint scraping/sand blasting (e.g. marine paints or paints containing lead or tributyl tin)	1. Dry sweep, dispose as hazardous waste.		1. Dry sweep, take to HHW drop-off.

Table GHP-05-1 Quick Reference – Disposal Alternatives

General Construction and Painting: Street and Utility Maintenance

DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Soil from excavations during periods when storms are forecast	1. Should not be placed in street or on paved areas. 2. Remove from site or backfill by end of day. 3. Cover with tarpaulin or surround with silt fences, or use other runoff controls. 4. Place filter mat over storm drain. Note: Thoroughly sweep following removal of dirt in all four alternatives.		
Soil from excavations placed on paved surfaces during periods when storms are not forecast	1. Keep material out of storm conveyance systems and thoroughly remove via sweeping following removal of dirt.		
Cleaning streets in construction areas	1. Dry sweep and minimize tracking of mud. 2. Use silt ponds and/or similar pollutant reduction techniques when flushing pavement.		
Soil erosion, sediments	1. Cover disturbed soils, use erosion controls, block entry to storm drain. 2. Seed or plant immediately.		
Fresh cement, grout, mortar	1. Use/reuse excess 2. Dispose to trash		1. Use/reuse excess 2. Dispose to trash
Washwater from concrete/mortar (etc.) cleanup	1. Wash onto dirt area, spade in. 2. Pump and remove to appropriate disposal facility. 3. Settle, pump water to sanitary sewer.	POTW-MWS	1. Wash onto dirt area, spade in. 2. Pump and remove to appropriate disposal facility. 3. Settle, pump water to sanitary sewer.
Aggregate wash from driveway/patio construction	1. Wash onto dirt area, spade in. 2. Pump and remove to appropriate disposal facility. 3. Settle, pump water to sanitary sewer.	POTW-MWS	1. Wash onto dirt area, spade in. 2. Pump and remove to appropriate disposal facility. 3. Settle, pump water to sanitary sewer.

<table>
<tr><td colspan="4">Table GHP-05-1 Quick Reference – Disposal Alternatives</td></tr>
<tr><td colspan="4">General Construction and Painting: Street and Utility Maintenance</td></tr>
<tr><th>DISCHARGE/
ACTIVITY</th><th colspan="2">BUSINESS/COMMERCIAL
Disposal Priorities
Approval</th><th>RESIDENTIAL
Disposal Priorities</th></tr>
<tr><td>Rinsewater from concrete mixing trucks</td><td>1. Return truck to yard for rinsing into pond or dirt area.
2. At construction site, wash into pond or dirt area.</td><td></td><td></td></tr>
<tr><td>Leaks from garbage dumpsters</td><td>1. Collect, contain leaking material. Eliminate leak, keep covered, return to leasing company for immediate repair.
2. If dumpster is used for liquid waste, use plastic liner.</td><td></td><td></td></tr>
<tr><td>Leaks from construction debris bins</td><td>1. Insure that bins are used for dry nonhazardous materials only (Suggestion: Fencing, covering help prevent misuse).</td><td></td><td></td></tr>
<tr><td>Dumpster cleaning water</td><td>1. Clean at dumpster owner’s facility and discharge waste through grease interceptor to sanitary sewer.
2. Clean on site and discharge through grease interceptor to sanitary sewer.</td><td>POTW-MWS

POTW-MWS</td><td></td></tr>
<tr><td>Cleaning driveways, paved areas

(Special Focus = Restaurant alleys, grocery dumpster areas)</td><td>1. Sweep and dispose as trash (Dry cleaning only).
2. For vehicle leaks, restaurant/grocery alleys, follow this 3-step process:
a. Clean up leaks with rags or absorbents.
b. Sweep, using granular absorbent material (cat litter).
c. Mop and dispose of mop water to sanitary sewer (or collect rinsewater and pump to the sanitary sewer).
3. Same as 2 above, but with rinsewater (2c)(no soap) discharged to storm drain.</td><td></td><td>1. Sweep and dispose as trash (Dry cleaning only).
2. For vehicle leaks follow this 3-step process:
a. Clean up leaks with rags or absorbents; dispose as hazardous waste.
b. Sweep, using granular absorbent material (cat litter).
c. Mop and dispose of mop water to sanitary sewer.</td></tr>
</table>

Table GHP-05-1 Quick Reference – Disposal Alternatives			
General Construction and Painting: Street and Utility Maintenance			
DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Steam cleaning of sidewalks, plazas	1. Collect all water and pump to sanitary sewer. 2. Follow this 3-step process: a. Clean oil leaks with rags or adsorbents. b. Sweep (Use dry absorbent as needed). c. Use no soap, discharge to storm drain.		
Potable water/line flushing Hydrant testing	1. Deactivate chlorine by maximizing time water will travel before reaching creeks.		
Super-chlorinated (above 1 ppm) water from line flushing	1. Discharge to sanitary sewer. 2. Complete dechlorination required before discharge to storm drain.		

Table GHP-05-1 Quick Reference – Disposal Alternatives			
Landscape/Garden Maintenance			
DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Pesticides	1. Use up. Rinse containers, use rinsewater as product. Dispose rinsed containers as trash. 2. Dispose unused pesticide as hazardous waste.		1. Use up. Rinse containers, use rinsewater as pesticide. Dispose rinsed container as trash. 2. Take unused pesticide to HHW drop-off.
Garden clippings	1. Compost. 2. Take to Landfill.		1. Compost. 2. Dispose as trash.
Tree trimming	1. Chip if necessary, before composting or recycling.		1. Chip if necessary, before composting or recycling.
Swimming pool, spa, fountain water (emptying)	1. Do not use metal-based algaecides (i.e. Copper Sulfate). 2. Recycle/reuse (e.g., irrigation). 3. Determine chlorine residual = 0, wait 24 hours and then discharge to storm drain.	POTW-	1. Do no use metal-based algaecides (i.e. Copper Sulfate). 2. Recycle/reuse (e.g., irrigation). 3. Determine chlorine residual = 0, wait 24 hours and then

Table GHP-05-1 Quick Reference – Disposal Alternatives			
		MWS	discharge to storm drain.
Acid or other pool/spa/fountain cleaning	1. Neutralize and discharge to sanitary sewer.	POTW-MWS	
Swimming pool, spa filter backwash	1. Reuse for irrigation. 2. Dispose on dirt area. 3. Settle, dispose to sanitary sewer.		1. Use for landscape irrigation. 2. Dispose on dirt area. 3. Settle, dispose to sanitary sewer.

Table GHP-05-1 Quick Reference – Disposal Alternatives			
Vehicle Wastes			
DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Used motor oil	1. Use secondary containment while storing, send to recycler.		1. Put out for curbside recycling pickup where available. 2. Take to Recycling Facility or auto service facility with recycling program. 3. Take to HHW events accepting motor oil (i.e. car parts store).
Antifreeze	1. Use secondary containment while storing, send to recycler.		1. Take to Recycling Facility.
Other vehicle fluids and solvents	1. Dispose as hazardous waste.		1. Take to HHW event.
Automobile batteries	1. Send to auto battery recycler. 2. Take to Recycling Center.		1. Exchange at retail outlet. 2. Take to Recycling Facility or HHW event where batteries are accepted.
Motor home/ construction trailer waste	1. Use holding tank. Dispose to sanitary sewer.		1. Use holding tank, dispose to sanitary sewer.

Table GHP-05-1 Quick Reference – Disposal Alternatives

Vehicle Wastes

DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Vehicle washing	1. Recycle. 2. Discharge to sanitary sewer, never to storm drain.	POTW-MWS	1. Take to Commercial Car Wash. 2. Wash over lawn or dirt area. 3. If soap is used, use a bucket for soapy water and discharge remaining soapy water to sanitary sewer.
Mobile vehicle washing	1. Collect washwater & discharge to sanitary sewer.	POTW-MWS	
Rinsewater from dust removal at new car fleets	1. Discharge to sanitary sewer. 2. If rinsing dust from exterior surfaces for appearance purposes, use no soap (water only); discharge to storm drain.	POTW-MWS	
Vehicle leaks at Vehicle Repair Facilities	1. Follow this 3-step process: 2. Clean up leaks with rags or absorbents. 3. Sweep, using granular absorbent material (cat litter). 4. Mop and dispose of mop water to sanitary sewer.		

Table GHP-05-1 Quick Reference – Disposal Alternatives

Other Wastes

DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Carpet cleaning solutions & other mobile washing services	1. Dispose to sanitary sewer.	POTW-MWS	1. Dispose to sanitary sewer.
Roof drains	1. If roof is contaminated with industrial waste products, discharge to sanitary sewer. 2. If no contamination is present, discharge to storm drain.		

Table GHP-05-1 Quick Reference – Disposal Alternatives			
Other Wastes			
DISCHARGE/ ACTIVITY	**BUSINESS/COMMERCIAL Disposal Priorities**	**Approval**	**RESIDENTIAL Disposal Priorities**
Cooling water Air conditioning condensate	1. Recycle/reuse. 2. Discharge to sanitary sewer.	POTW-MWS	
Pumped groundwater, infiltration/foundation drainage (contaminated)	1. Recycle/reuse (landscaping, etc.) 2. Treat if necessary; discharge to sanitary sewer. 3. Treat and discharge to storm drain.	MDPW-NPDES POTW-MWS MDPW-NPDES	
Firefighting flows	If contamination is present, Fire Dept. will attempt to prevent flow to stream or storm drain.		
Kitchen Grease	1. Provide secondary containment, collect, send to recycler. 2. Provide secondary containment, collect, send to POTW via hauler.	POTW-MWS	1. Collect, solidify, dispose as trash.
Restaurant cleaning of floor mats, exhaust filters, etc.	1. Clean inside building with discharge through grease trap to sanitary sewer. 2. Clean outside in container or bermed area with discharge to sanitary sewer.		
Clean up wastewater from sewer back-up	1. Follow this procedure: a. Block storm drain, contain, collect, and return spilled material to the sanitary sewer. b. Block storm drain, rinse remaining material to collection point and pump to sanitary sewer (no rinsewater may flow to storm drain).		

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GHP-06 Pesticides, Herbicides and Fertilizer Use (PHF)

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Good Housekeeping Practices (GHPs)

GHP-06

Activity: Pesticides, Herbicides and Fertilizer Use (PHF)

Planning Considerations

Training:
No

Inspection Frequency:
Monthly

Implementation Cost:
Low

Monthly Maintenance:
Low

Target Pollutants

Significant ♦ Partial ◊ Low or Unknown ◊

◊	Sediment	♦	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	♦	Toxic Materials	◊	Floatable Materials
♦	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description

Fertilizers, herbicides and pesticides are potentially harmful chemicals that require safe and organized practices to assure that pollution does not enter into stormwater.

Approach

- Contractors/subcontractors should develop controls on the application of pesticides, onsite. Controls may include:
  - List of approved pesticides and selected uses
  - Product and application information for users
  - Equipment use and maintenance procedures
  - Record keeping and public notice procedures
  - Material Safety Data Sheets (MSDS)

The following discussion provides some general information on good housekeeping:

- Always use caution when handling any pesticide or fertilizer product. Many products contain toxic chemicals that can cause severe injury or death.
- Store pesticide or fertilizer products securely and away from children, pets, and sources of heat, sparks, and flames.
- Avoid contact with eyes and skin. Wear gloves and eye protection when using or handling hazardous substances. Do not wear contact lenses, which can absorb hazardous vapors.
- Work in only well ventilated areas if handling these materials indoors.
- Use up the entire product before disposing the container.
- Do not dispose of pesticide or fertilizer wastes:
  1. In trash
  2. Down storm drains or into creeks
  3. Onto the ground
  4. By burning

	➢ <u>Do</u> dispose of hazardous wastes at household hazardous waste collection events or facilities.
Maintenance	➢ Employee and subcontractor training, ➢ Contractor and subcontractor employees who handle potentially harmful materials should be trained in good housekeeping practices. Personnel who use pesticides must be trained in their use. ➢ The primary cost is for staff time as noted above.
Inspection Checklist	❑ Fertilizers, herbicides and pesticides are properly stored. ❑ Fertilizers, herbicides and pesticides are clearly marked for easy identification. ❑ Old or used fertilizers, herbicides and pesticides have been properly disposed. ❑ Storage unit is properly ventilated.

GHP-07 Dust Control and Tracking (DC)

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Good Housekeeping Practices (GHPs)	GHP-07
	Activity: Dust Control and Tracking	

Planning Considerations	
Training:	
No	
Inspection Frequency:	
As needed	
Implementation Cost:	
Moderate	
Monthly Maintenance: Low	

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◈	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◊	Construction Waste

Description	Dust control measures are used to stabilize soil from wind erosion and reduce dust generated by construction activities. This temporary measure, an intermediate treatment between disturbance in construction, paving, or vegetation, reduces the amount of eroded material exposed to stormwater runoff.
Approach	➢ Clearing and grading activities. ➢ Construction vehicle traffic on temporary or unpaved roads or construction site access paths. ➢ Drilling and blasting activities. ➢ Sediment tracking onto paved roads. ➢ Soil and debris storage piles. ➢ Batch drop from front end loaders. ➢ Areas with unstabilized soil. ➢ Final grading/site stabilization usually is sufficient to control post-construction dust sources. ➢ Dust control should be practiced at all construction sites by performing phased clearing and grading operations, using temporary stabilization methods, and/or placing undisturbed vegetative buffers of at least 50 ft (15 m) length between areas being graded and those areas to remain undeveloped. ➢ Dust control is particularly important in windy or wind-prone areas. ➢ Schedule construction activities to minimize exposed area by clearing only areas where phased construction is to take place. ➢ Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering.

- Identify and stabilize key access points prior to commencement of construction. See SMP-02 and SMP -03.
- Minimizing the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site.
- Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. Table GHP-07-1 shows which dust control BMPs apply to site conditions that cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel or asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching and sand fences can be employed for areas of occasional or no construction traffic.
- Preventive measures would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 miles per hour, and controlling the number and activity of vehicles on a site at any given time.
- Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid cleanup of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize unpaved haul roads, parking and staging areas. Reduce speed and trips on unpaved roads.
- Implement dust control measures for material stockpiles.
- Prevent drainage of sediment-laden stormwater onto paved surfaces.
- Stabilize abandoned construction sites using vegetation or chemical stabilization methods.
- Many products are available for chemically stabilizing gravel roadways and stockpiles. The types of chemicals available and recommendations for their use are tabulated in Table GHP-07-2, Commonly Used Chemicals for Dust Control.

Selection of Methods
Selection of dust control agents should be based primarily on cost-effectiveness and environmental hazards.

Chemical methods are dust suppressant or binding agents that are used on the soil surface to bind finer particles together. Chemical dust control agents must be environmentally benign, easily applied, easily maintained, economical and not significantly detrimental to traffic ability.

Approximately three-quarters of chemical dust control agents are inorganic compounds that are compatible with soil and biota. After application, the compounds dampen and penetrate into the soil; a hygroscopic reaction pulls moisture from the atmosphere into the surface and adheres fines to aggregate surface particles. The compounds may not penetrate soil surfaces made up primarily of silt and clay, so soil tests are required.

	Key factors in determining the method include the following: ➢ Soil types and surface materials – both fines and moisture content are key properties of surface materials. ➢ Properties of the agents – the five most important properties are penetration, evaporation, resistance to leaching, abrasion, and aging. ➢ Traffic volumes – the effectiveness and life span of dust control agents decreases as traffic increases. For high traffic areas, agents need to have strong penetrating and stabilizing capabilities. ➢ Climate – some hygroscopic agents lose their moisture-absorbing abilities with lower relative humidity, and some may lose resilience. Under rainy conditions, some agents may become slippery or even leach out of the soil. ➢ Environmental requirements – the primary environmental concern is the presence and concentration of heavy metals in the agent that may leach into the immediate ecosystem, depending on the soil properties. ➢ Frequencies of application – rates and frequencies of application are based on the type of agent selected, the degree of dust control required, subgrade conditions, surface type, traffic volumes, types of vehicles and their speeds, climate, and maintenance schedule. **Application of Methods** For dust control agents, once all factors have been considered, the untreated soil surface must first contain sufficient moisture to assist the agent in achieving uniform distribution (except when using a highly resinous adhesive agent). The following steps should be followed in general: ➢ Ideally, application should begin in late spring, after seasonal rains – not during or just before heavy rainfall – so that subgrade and surface materials will not have dried. ➢ If the surface has minimal natural moisture, the area to be protected must be pre-wetted so that the chemicals can uniformly penetrate the surface. ➢ In general, cooler and/or more humid periods result in decreased evaporation, increased surface moisture, and thus significant increase in control efficiency. However, chemical and organic agents should not be applied under frozen conditions, rainy conditions, or when the temperature is below 40^{o} F. Tar and bitumen agents should not be applied in fog or in rain or below 55^{o}F. More than one treatment with salts or organic compounds per year is often necessary, although the second treatment should probably be significantly diluted.
Maintenance	➢ Most dust control measures require frequent, often daily, attention. ➢ The primary maintenance requirement is the reapplication of the selected dust control agent at intervals appropriate to the agent type. High-traffic areas shall be inspected on a daily basis, and lower traffic areas shall be inspected on a weekly basis.
Inspection Checklist	❑ Water is applied daily to reduce dust. ❑ Trucks hauling soil or rock have dust covers over materials. ❑ Material stockpiles have fabric, mulch or ground cover to provide sediment control.

TABLE GHP-07-1 DUST CONTROL BMPs FOR GIVEN SITE CONDITIONS

Site Condition	DUST CONTROL BMPs								
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt Surfacing	Silt or Sand Fences	Temporary Gravel Construction Entrances/ Equipment Wash Down	Haul Truck Covers	Minimize Extent of Area Disturbed
Disturbed Areas Not Subject to Traffic	X	X	X	X	X				X
Disturbed Areas Subject to Traffic			X	X	X				X
Material Stock Pile Stabilization			X	X		X			X
Demolition			X				X	X	
Clearing/ Excavation			X	X					X
Truck Traffic on Unpaved Roads			X	X	X			X	
Mud/Dirt Carry-Out					X		X		

TABLE GHP-07-2 COMMONLY USED CHEMICALS FOR DUST CONTROL

	Salts	Organic, Non-Petroleum-Based	Petroleum-Based Products [1]
Chemical Types	Magnesium Chloride Natural Brines	Calcium Lignosulfonate Sodium Lignosulfonate Ammonium Lignosulfonate	Bunker Oil Asphalt Primer Emulsified Asphalt
Limitations	Can lose effectiveness in dry periods with low humidity. Leaches from road in heavy rain. Not recommended for gravel road surfaces with low fines. Recommended 10 to 20% fines.	Not affected by dry weather and low humidity. Leached from road in heavy rain if not sufficiently cured. Best performance on gravel roads with high surface fines (10-30%) and dense compact surface with loose gravel.	Generally effective regardless of climatic conditions may pothole in wet weather. Best performance on gravel roads with 5 to 10% fines.
Comments	Calcium Chloride is popular. May become slippery when wet on gravel surfaces with high fines.	Ineffective on gravel surfaces low in fines. May become slippery when wet on gravel surfaces with high fines content.	Creates a hardened crust.

1 Motor oils and oil treatments are not recommended due to adverse effects on plant life and groundwater. They should only be applied in areas that will soon be paved.

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4.3 Stormwater Pollution Prevention Plan (SWPPP)

4.3.1 Description

The Stormwater Pollution Prevention Plan (SWPPP) is a document required by stormwater regulation that includes site maps, identification of construction/contractor activities that could possibly lead to the introduction of pollutants into stormwater and descriptions of measures or practices to control these pollutants. BMP fact sheets and maintenance and inspection reports should be included, as well as a statement of Certification of Compliance with Federal, State and local regulations, including documentation detailing the EPSC-certified contractor responsible for the site.

There are two types of SWPPPs. A Comprehensive SWPPP includes calculations and is more detailed orientated. The Onsite SWPPP has additional certifications, records and logs. The SWPPP content is not all-inclusive; the document should be tailored to each site and expanded to cover necessary and pertinent materials for each location. A SWPPP is to be submitted to Beaufort County for review along with other necessary permit applications. A copy of the Onsite SWPP is to remain onsite and is to be kept current for the duration of the site's Notice of Intent (NOI).

4.3.2 Comprehensive Stormwater Pollution Prevention Plan (SWPPP) Check List

The following is a list of items that each SWPPP document (commonly referred to as the C-SWPPP) must address to be considered in compliance with the current Stormwater Construction General Permit (CGP):

- Project Narrative
- Stormwater Management and Sediment Control Plan
- Sequence of Construction
- Site Features and Sensitive Areas
- Buffer Zone Management
- Sources of Pollution
- Best Management Practices (BMPs)
- Site Maps (such as Vicinity, Topographic, Soils, etc.)
- Engineering Reports
- Numeric and Non-Numeric Effluent Limits
- Management of Non-Stormwater Discharges
- Total Maximum Daily Loads (TMDLs) and Impaired Waters Documentation

4.3.3 Onsite Stormwater Pollution Prevention Plan (SWPPP) Check List

The OS-SWPPP is a condense version of the Comprehensive SWPPP that includes various logs to track the construction activity, inspections, maintenance activities, rainfall, and other information pertinent to maintaining compliance with the current Stormwater Construction General Permit. The OS-SWPPP is created after approval of the C-SWPPP and then brought out to the construction site.

The OS-SWPPP should include all contents of the approved C-SWPPP except for the Engineering Reports. Additionally, the OS-SWPPP should include the following:

- A Copy or Link to the Current Stormwater Construction General Permit
- The Approve Notice of Intent
- The CGP Coverage Approval Letter
- Any Necessary Local Approvals to Conduct the Proposed Construction Activities
- Any Necessary USACE approvals
- Critical Area Permit Authorization
- Contractor Certifications
- Logs/Records to Track Site Progress and Rainfall
- Coastal Zone Consistency (CZC) Certifications

4.3.4 Tier I and Tier II SWPP

A Tier II SWPPP is defined above is for any construction site except a single family unit. Lots that are not part of a common plan development and must prepare a SWPPP for the construction of a single family home may use the "Tier I" SWPPP template in Appendix D.

Section 5
Post-Construction Best Management Practices for Stormwater

Since stormwater discharging from the built environment often has negative effects on receiving waters, BMPs were designed to help reduce the quantity of runoff water entering these receiving waters. These BMPs also reduce the pollutant and nutrient loads of the runoff through filtration, bioaccumulation, sedimentation, etc. However, for these post-construction stormwater management BMPs to work properly, the BMP structures must have correct sizing to be able to receive the volume of runoff expected for various design storms. The purpose of this section is to provide guidance on BMP design criteria to enhance the efficiency of their performance in volume control and pollutant reduction.

5.1 Volume Control: Effective Impervious

Meeting a retention volume for the 95th percentile storm event does not necessarily equate to achieving antidegradation load limits for indicator pollutants nitrogen, phosphorus, and fecal coliform. Further reduction of runoff volume may be needed.

For the purposes of the BMP Manual, the “effective” or “equivalent” imperviousness of an impervious surface on a post development site is a metric that measures how effectively impervious surface runoff is reduced relative to pre-development pervious surface runoff. An impervious surface that is not subject to any volume control feature (e.g., diversion of impervious surface runoff to adjoining pervious surface) has an “effective” or “equivalent” imperviousness of 100 percent. If an impervious surface is subject to volume control, the “effective” or “equivalent” imperviousness is the ratio of the increase in runoff with control (i.e., post-development controlled impervious surface runoff minus pre-development pervious surface runoff) to the increase in runoff without control (i.e., post-development uncontrolled impervious surface runoff minus pre-development pervious surface runoff). In a case where the post-development impervious surface runoff is reduced so that it is equivalent to the pre-development pervious surface runoff, the impervious surface would have an “effective” or ‘equivalent” imperviousness of 0 percent.

When applied to an entire site, the “effective” or “equivalent” imperviousness value represents the percentage of uncontrolled impervious surface which would, in conjunction with runoff from the remaining pervious surface, produce a volume of site runoff identical to the site with controlled impervious surface. For example, a site with an “effective” or “equivalent” imperviousness of 10 percent will generate the quantity of runoff that would be generated by a site with 10 percent uncontrolled impervious surface and 90 percent pervious surface, even though the actual impervious surface may be much greater than 10 percent of the site.

The appropriate volume control standard is a threshold of 10 percent effective impervious area. One advantage of this standard is that it remains consistent with the overall framework of the BMP reviews for water quality, which allow for antidegradation loads of total phosphorus (total P) and total nitrogen (total N) from proposed development up to the uncontrolled load expected from a 10 percent impervious development. The antidegradation load for fecal coliform allowed in this BMP Manual is based on an overall imperviousness of 5%. Therefore, meeting the standard of 10% effective impervious area and retention of the 95th percentile storm event does not preclude the requirement to size BMPs to meet the allowable fecal coliform load.

Table 5-1 shows an example of the “effective” imperviousness based on a hypothetical impervious area with volume control. In the example, the uncontrolled impervious area has a runoff of 50 inches per year and, with the volume control BMP, the impervious area runoff is limited to 25 inches per year. For soil group A, the expected runoff from pervious area is 2 inches per year. Consequently, the uncontrolled increase in runoff in going from pervious to uncontrolled impervious condition (i.e., 100 percent effective) is 48 inches per year. With the volume control BMP, the increase in runoff is 23 inches per year. In this case, the effective imperviousness of the impervious area is calculated as the ratio of controlled runoff increase to uncontrolled runoff increase, which equals 23/48, or 48 percent.

Table 5-1. Example of Effective Imperviousness Calculation

	Soil Group			
Runoff Parameter	A	B	C	D
Uncontrolled Impervious Runoff (inches)	50	50	50	50
Pervious Runoff (inches)	2	4	7	11
Controlled Impervious Runoff (inches)	25	25	25	25
Uncontrolled Increase (inches)	48	46	43	39
Controlled Increase (inches)	23	21	18	14
Effective Imperviousness	48%	46%	42%	36%

Tables 5-2 through 5-6 are provided for use in the determination of effective imperviousness. These include:

- Table 5-2: Green Roof
- Table 5-3: Flat Roof Evaporation
- Table 5-4: Stormwater Capture and Irrigation Use
- Table 5-5: Rain Garden
- Table 5-6: Disconnected Impervious Area and Roadside Swale

Each of these tables shows the estimated effective imperviousness based on the four soil groups (A, B, C and D) and various design criteria.

Table 5-2. Green Roof Effective Imperviousness

Soil Group A:

Roof Media Depth (inches)	Effective Imperviousness as Function of Roof Media Depth and Cistern Volume				
	Cistern Volume (inches)				
	0	1	2	3	4
3	65%	39%	30%	26%	23%
6	58%	37%	29%	25%	22%
9	50%	35%	28%	24%	22%
12	43%	31%	26%	23%	21%

Soil Group B:

Roof Media Depth (inches)	Effective Imperviousness as Function of Roof Media Depth and Cistern Volume				
	Cistern Volume (inches)				
	0	1	2	3	4
3	63%	37%	27%	22%	19%
6	56%	34%	26%	22%	19%
9	48%	32%	25%	21%	18%
12	40%	28%	23%	20%	17%

Soil Group C:

Roof Media Depth (inches)	Effective Imperviousness as Function of Roof Media Depth and Cistern Volume				
	Cistern Volume (inches)				
	0	1	2	3	4
3	61%	32%	22%	17%	14%
6	53%	30%	21%	16%	13%
9	45%	27%	20%	15%	13%
12	36%	23%	18%	14%	12%

Soil Group D:

Roof Media Depth (inches)	Effective Imperviousness as Function of Roof Media Depth and Cistern Volume				
	Cistern Volume (inches)				
	0	1	2	3	4
3	57%	26%	16%	10%	6%
6	49%	24%	14%	9%	6%
9	40%	20%	13%	8%	5%
12	30%	17%	10%	7%	4%

Table 5-3. Flat Roof Evaporation Effective Imperviousness

Soil Group A:

Roof Ponding Depth (inches)	Effective Imperviousness as Function of Roof Media Depth and Cistern Volume — Cistern Volume (inches)					
	0	0.2	1	2	3	4
0	100%	72%	39%	26%	20%	17%
2	26%	24%	20%	17%	14%	9%
4	17%	16%	14%	11%	9%	7%
6	11%	10%	9%	7%	6%	5%
8	7%	7%	6%	5%	4%	3%

Soil Group B:

Roof Ponding Depth (inches)	Effective Imperviousness as Function of Roof Media Depth and Cistern Volume — Cistern Volume (inches)					
	0	0.2	1	2	3	4
0	100%	71%	36%	23%	16%	13%
2	23%	21%	16%	13%	10%	5%
4	13%	12%	10%	8%	5%	3%
6	8%	7%	5%	3%	2%	1%
8	3%	3%	2%	1%	0%	-1%

Soil Group C:

Roof Ponding Depth (inches)	Effective Imperviousness as Function of Roof Ponding Depth and Cistern Volume — Cistern Volume (inches)					
	0	0.2	1	2	3	4
0	100%	69%	31%	17%	10%	7%
2	17%	15%	10%	7%	3%	-1%
4	7%	6%	3%	1%	-1%	-3%
6	1%	0%	-1%	-3%	-5%	-6%
8	-3%	-3%	-5%	-6%	-7%	-8%

Soil Group D:

Roof Ponding Depth (inches)	Effective Imperviousness as Function of Roof Ponding Depth and Cistern Volume — Cistern Volume (inches)					
	0	0.2	1	2	3	4
0	100%	66%	25%	10%	3%	-1%
2	10%	8%	3%	-1%	-5%	-10%
4	-1%	-3%	-5%	-8%	-10%	-13%
6	-8%	-9%	-10%	-13%	-14%	-15%
8	-13%	-13%	-14%	-15%	-16%	-18%

Table 5-4. Stormwater Capture and Irrigation Use Effective Imperviousness

Soil Group A:

Ratio of Irrigated Area to Impervious Area	Effective Imperviousness for Various Combinations of Irrigated Area to Impervious Area Ratio and Captured Volume				
	Captured Volume (inches)				
	0	1	2	3	4
0	100%	100%	100%	100%	100%
0.5	100%	69%	65%	64%	63%
1	100%	57%	46%	40%	36%
2	100%	55%	34%	24%	19%
3	100%	55%	33%	20%	13%
6	100%	55%	33%	19%	11%

Soil Group B:

Ratio of Irrigated Area to Impervious Area	Effective Imperviousness for Various Combinations of Irrigated Area to Impervious Area Ratio and Captured Volume				
	Captured Volume (inches)				
	0	1	2	3	4
0	100%	100%	100%	100%	100%
0.5	100%	67%	63%	62%	62%
1	100%	55%	43%	37%	34%
2	100%	53%	31%	21%	15%
3	100%	53%	30%	16%	9%
6	100%	53%	30%	16%	7%

Soil Group C:

Ratio of Irrigated Area to Impervious Area	Effective Imperviousness for Various Combinations of Irrigated Area to Impervious Area Ratio and Captured Volume				
	Captured Volume (inches)				
	0	1	2	3	4
0	100%	100%	100%	100%	100%
0.5	100%	65%	61%	60%	59%
1	100%	52%	39%	33%	29%
2	100%	50%	26%	15%	9%
3	100%	50%	25%	10%	3%
6	100%	50%	25%	10%	1%

Table 5-4. Stormwater Capture and Irrigation Use Effective Imperviousness (Continued)

Soil Group D:					
Ratio of Irrigated Area to Impervious Area	Effective Imperviousness for Various Combinations of Irrigated Area to Impervious Area Ratio and Captured Volume				
	Captured Volume (inches)				
	0	1	2	3	4
0	100%	100%	100%	100%	100%
0.5	100%	62%	57%	56%	56%
1	100%	48%	34%	27%	23%
2	100%	46%	19%	8%	1%
3	100%	46%	18%	2%	-6%
6	100%	46%	18%	2%	-8%

Table 5-5. Rain Garden Effective Imperviousness

Soil Group A:

Media Depth (feet)	Effective Imperviousness for Various Combinations of Media Depth and Surface Ponding	
	Surface Ponding (inches)	
	3	6
2	-2%	0%
3	0%	1%

Soil Group B:

Media Depth (feet)	Effective Imperviousness for Various Combinations of Media Depth and Surface Ponding	
	Surface Ponding (inches)	
	3	6
2	-1%	2%
3	2%	5%

Soil Group C:

Media Depth (feet)	Effective Imperviousness for Various Combinations of Media Depth and Surface Ponding	
	Surface Ponding (inches)	
	3	6
2	-1%	4%
3	3%	7%

Soil Group D:

Media Depth (feet)	Effective Imperviousness for Various Combinations of Media Depth and Surface Ponding	
	Surface Ponding (inches)	
	3	6
2	-2%	6%
3	4%	12%

NOTE: Values are based on BMP Manual design criteria of 0.5 inches per acre or 1.5 inches per impervious acre, whichever is greater.

Table 5-6. Disconnected Impervious Area and Roadside Swale

Ratio of Impervious to Pervious Area	Effective Imperviousness for Various Soil Groups and Ratio of Impervious Source Area to Adjacent Pervious Area			
	Soil Group			
	A	B	C	D
0.2	19%	31%	42%	54%
1	33%	50%	64%	70%
2	49%	65%	76%	80%
5	54%	85%	90%	93%

NOTE: For roadway with adjacent swale, use half of swale top width as the basis for the adjacent pervious area calculation.

To assess the effective impervious area for a new development, a worksheet has been developed and is presented as Figure E-1 in appendix E. The worksheet requires that the development is broken down into specific pervious and impervious land elements, and volumes controls applied to the impervious areas are identified. Based on the values in Tables 5-2 through 5-6 and the design criteria applied, the breakdown of traditional impervious area into "effective impervious area" and "developed pervious area" can be calculated. For example, if a volume control reduces parking lot effective imperviousness to 40 percent, then 40 percent of the parking lot area would be assigned to "effective impervious area" and 60 percent of the parking lot area would be assigned to "pervious developed area."

Based on the example presented in Appendix E, it also appears that the standard can be met with one or more volume control BMPs in a typical development.

5.2 Volume Control: Treatment Train

The methodology for assessing the volume control BMPs has been based on evaluating individual BMPs and the runoff volume reduction benefits of each BMP. This leads to a question of what the volume reduction benefits on BMPs in series will be, and how this can be incorporated into the proposed assessment methodology. In some cases, the interaction of upstream and downstream BMPs in series can be complex. In the absence of more detailed analysis and generation of numerous additional tables to account for all potential combinations of BMP types, a suggested approach is provided.

Table 5-7 lists the suggested approach for dealing with a traditional impervious area that is served by an upstream and downstream BMP. For each combination of upstream and downstream BMP, the table either indicates that the combination is not expected to occur (e.g., rooftop practices downstream of another BMP) or a method for estimating the effective imperviousness of the BMP combination.

The following notes are associated with the table.

- **Pervious pavement downstream of other BMP (Note 1)**: The suggested approach is to presume a 50 percent credit for effective impervious area associated with upstream impervious area and BMP, unless the impervious area is greater than the previous pavement area. For example, if the upstream impervious area is 1 acre and has an effective imperviousness of 40 percent because of an upstream BMP, then the effective imperviousness with the upstream BMP and pervious pavement would be 40 percent times 50 percent, which equals 20 percent, provided that the pervious pavement area is at least 1 acre (i.e., as great as the upstream impervious area). If, for example, the pervious pavement in this example is 0.5 acre, the ratio of impervious area to pervious pavement area would be 2, and the effective imperviousness would be 40%* (1 – 50%/2) = 40% * 75% = 30%.
- **Runoff capture and use for irrigation downstream of other BMP (Note 2)**: In this case, it was presumed that the capture would occur in a wet detention pond, which would irrigate pervious area such as residential lawns/landscaping, golf courses, or other areas. In this case, it was presumed that the highest maximum effective imperviousness would be equal to the minimum value of effective imperviousness for each individual BMP (i.e., no additional benefit for any other BMP in the series). The lowest conceivable value of effective imperviousness would be the product of the effective imperviousness values for the BMPs in series. The suggested effective imperviousness value is the average of those two calculated values. For example, if one BMP had an individual effective imperviousness of 40 percent and another had an individual effective imperviousness of 60 percent, the effective imperviousness of the BMPs in series would be expected to be somewhere between 40 percent (minimum value of individual BMPs) and 24 percent (= 40 percent * 60 percent). The suggested effective imperviousness value would then be the average of 40 percent and 24 percent, which is 32 percent.
- **Rain garden BMP as either upstream or downstream BMP in series (Note 3)**: Because the rain garden BMP typically achieves a very low effective imperviousness value, it is suggested that the rain garden BMP effectiveness be used regardless of whether it is the upstream or downstream BMP, unless another BMP in the series has a lower effective imperviousness value.
- **Disconnected impervious area downstream of other BMP (Note 4)**: It is expected that this BMP would be downstream of only the rooftop practice or runoff capture/irrigation (rooftop runoff capture in cistern) BMPs. The approach to estimating effective imperviousness in series is the same as in Note 2.

Table 5-7. Suggested Approach for Determining Effective Impervious Area with BMPs in Series

	Downstream BMP					
Upstream BMP	Rooftop Practices	Pervious Pavement	Runoff Capture and Use for irrigation	Disconnection of Impervious Area	Rain Garden	Swale
Rooftop Practices	No	See note 1 below	See note 2 below	See note 4 below	See note 3 below	See note 4 below
Pervious Pavement	No	No	No	No	No	No
Runoff Capture and Use for Irrigation	No	See note 1 below	No	See note 4 below	See note 3 below	See note 4 below
Disconnection of Impervious Area	No	No	See note 2 below	No	See note 3 below	See note 4 below
Rain Garden	No	No	See note 3 below	No	No	See note 4 below
Swale	No	No	See note 2 below	No	See note 3 below	No

NOTES:

1. Effective imperviousness in series = Upstream effective imperviousness * (1 - (50% * maximum (1, ratio of pervious pavement area to upstream impervious area)))
2. Downstream runoff capture and use for irrigation assumed to be associated with downstream wet detention pond.
   Effective imperviousness in series = average of :
   (a) Minimum effective imperviousness of the upstream and downstream BMP alone
   (b) Upstream BMP effective imperviousness * downstream BMP effective imperviousness
3. Whether rain garden BMP is upstream or downstream BMP, use the minimum effective imperviousness of either the upstream or downstream BMP
4. Effective imperviousness in series = average of :
   (a) Minimum effective imperviousness of the upstream and downstream BMP alone
   (b) Upstream BMP effective imperviousness * downstream BMP effective imperviousness

5.3 Step 2 On-Lot Volume Control

Beaufort County passed the On-Lot Volume Controls on June 13, 2011. This requires On-Lot Volume Control when constructing new homes in communities that do not meet current community-wide runoff volume control requirements. This section is applicable only for home lots of record platted but not yet developed. Worksheets are included in Appendix E and are also available in an online calculator format at http://stormwaterworksheet.createandsolve.com/.

5.3.1 Purpose

The purpose of this worksheet and web-based program is to help a homeowner or builder determine the amount of excess stormwater runoff that will come off the property after construction of the home.

It will also assist in selecting the controls necessary to control this excess runoff so that the County's water resources are not impacted. Scientists have determined that excess freshwater runoff into saltwater tidal waters can impact the area's fishery resources.

The worksheet and program will allow the user to print out a sheet that can be used to document satisfactory controls so a zoning permit can be obtained. This zoning permit is necessary for issuance of a building permit.

5.3.2 Step 1 – Lot Information

This information is used to compute the excess runoff after construction. If a homeowner is planning an irrigation system, (entered in Section 1), storage and reuse of stormwater from rooftop should be considered for a portion of the irrigation needs. Use of drinking water for irrigation is an expensive alternative for homeowners, and reduction of this can save money as well as reducing amount of water running off the parcel after construction. While this is recommended, storage and reuse is optional because of its initial cost.

5.3.3 Step 2 – Post Construction Stormwater Runoff Calculations

The amount of excess runoff in gallons can be computed using this web-based program. It will depend on whether the soil is sandy or clay (entered in Section 1). The rainfall event that is used to determine the amount of runoff to be controlled is a 1.95-inch rainfall (95^{th} percentile of average events in a year) in a 24-hour period. Before construction, on sandy soils, generally no runoff will occur with the 1.95-inch rainfall event. For clay soils, more than 0.5 inch of a 1.95 rainfall will runoff before construction. Taking this into account, the program will determine the runoff to be controlled, in gallons, after construction.

5.3.4 Step 3 – Application of Best Management Practices

This section takes the gallons determined in the Step above and guides the user through three steps that will reduce these gallons until they are all being controlled. The first step is an optional **storage and reuse/infiltration practice.** This practice will utilize a holding facility of some size and then the water can be utilized for reuse or infiltrated at a slow rate from the storage facility.

When storage is utilized, it will control a certain amount of rooftop impervious surface. The maximum storage allowed for credit is limited to the rooftop impervious surface (in square feet) times 1.15. Additional storage can be added but credit is limited to 1.15 gallon per square foot of rooftop surface. When storage is used, it decreases the amount of impervious surface that needs to be handled by the other practices. This is called unaddressed impervious surface.

The second practice is **disconnected impervious surface**. It can utilize the natural infiltration capacity of the lot to control water running off unaddressed impervious surfaces. It will require a determination of which way the water sheet flows across the lot. The program allows up to two directions to be selected. The user starts with an estimate of the impervious surfaces and pervious portion of the lot. If the lot flows in one direction, the estimate is easy. It would be the unaddressed impervious surface and the previous surface it flows over to the end of the lot. If the ratio of unaddressed impervious surface to pervious area is greater than 5, there will be no credit, and runoff is better controlled by the next step. Figures 5-1 and 5-2 provide examples of one- and two-direction calculations to help in determining input figures for this practice.

If after the employing the first two practices there is still excess runoff to be handled, **rain gardens and other practices** will be used to control the remaining runoff. This will be computed for the user, who will be given a square foot size of a standard rain garden.

This standard size rain garden is 3 ft deep and can have special soil or sand and rock mixture that will store runoff and allow it to infiltrate. There is some flexibility between storage and reuse and rain gardens. If less rain garden is desired, storage can be increased, and vice-versa.

There is an attached sheet at the end of this help sheet that provides examples of alternative practices under this step.

It should be remembered that impervious surface on the property causes the excess volume that needs to be controlled. The amount of controls can be reduced by decreasing the impervious surface on the property by considering pervious driveways and walks, reducing rooftop size (two story versus one story), and other practices.

5.3.5 Step 4 – Summary of Volume Reduction Practices

This section is computed for the user to show a summary. This program allows the user to print a one-page sheet that summarizes entry and practices being used. This sheet would be attached to zoning and building permits and will be checked at completion of the project.

Definitions:
Impervious surface – hard surface that allows rainfall to run off and not infiltrate the soil.
Rooftop impervious surface – horizontal surface area of rooftops including overhangs and other detached buildings/sheds.
Other impervious – generally hard surfaces on the ground like paved driveways, patios, walkways and sidewalks.
Pervious surface – surface that is not hard, such as grass, garden or forest area. This also includes gravel and dirt driveways.
Irrigated area is area that would be served by an installed irrigation system.
Unaddressed impervious surface – term used to determine amount of impervious surface or runoff gallons that had not been controlled by a previous practice.
Standard rain garden – rain garden that has 3 ft of fill material and a 6-inch maximum ponding depth. Different sizes can be constructed but then credits must be computed from Beaufort County BMP manual.

Conversions
Rainfall to gallons of runoff
Design storm is 1.95 inches, of which 1.85 inches is available to run off impervious surface. 1.85 inch on 1 sq ft of impervious surface is equivalent to 1.15 gallons of runoff
Preconstruction runoff
Clayey soils – 0.53 inches run off for a 1.95-inch storm. 0.53 inch on 1 sq ft is equivalent to 0.33 gallon of runoff.
Sandy soils – No runoff for a 1.95-inch storm
Storage and reuse – if irrigation is used on parcel then storage must be between 0.3 gallon/sq ft of rooftop impervious surface to maximum credit of 1.15 gallon/ sq ft of rooftop impervious surface. Storage can be larger but maximum credit is 1.15g/sq ft.

Rain garden
Square foot of impervious surface per square foot of standard rain garden
Clayey soils 4 sq ft of impervious surface to 1 sq ft of standard rain garden
Sandy soils 7 sq ft of impervious surface to 1 sq ft of standard rain garden
Disconnected imperviousness – is the practice of running uncontrolled stormwater flow from impervious surfaces over pervious surfaces to take advantage of natural infiltration of the soil. Credit is given in Table 5-8 based on ratio of impervious surface over pervious surface to compute a ratio.

Table 5-8 Credit Table for Disconnected Impervious Area

Disconnected Impervious Ratio	Runoff reduction (Gal/sq. ft-impervious area)	Runoff reduction (Gal/sq. ft-impervious area)
	Clayey	Sandy
0.1	.40	1.15
0.2	.40	1.12
0.4	.38	1.08
0.8	.33	1.01
1.0	.31	.98
2.0	.24	.84
3.0	.19	.74
4.0	.16	.67
5.0	.14	.60

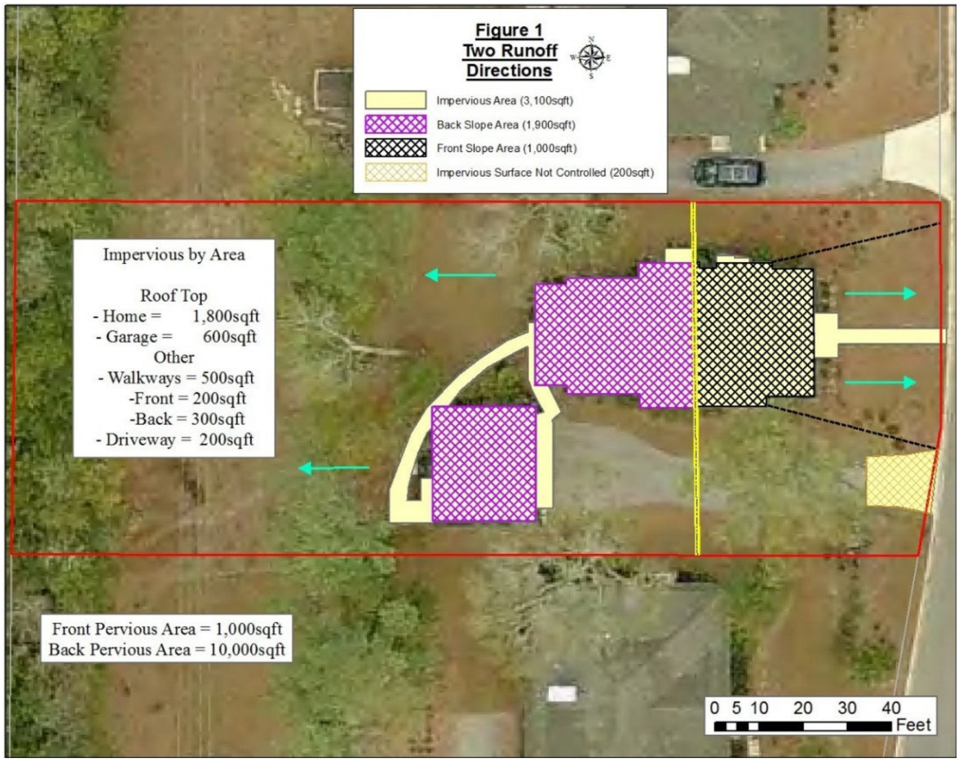

Figure 5-1
Example of a One-Direction Calculation for Disconnected Impervious Surface

This is a home on a 16,000 sq ft lot with about 2,500 sq ft of living space.

In this example, runoff from 1,000 sq ft of impervious surface flows towards the front of the house. It can be made to sheet flow over 1,000 sq ft of lawn (pervious surface). Therefore, on the worksheet or web program, enter 1,000 in impervious area and 1,000 in pervious area of the first direction.

The second direction is to the back of the home, and this 1,900 sq ft of rooftop and other impervious surface flow over 10,000 sq ft of lawn and forest area.

Therefore, enter in the second direction 1,900 sq ft in impervious area and 10,000 in pervious area.

In this example, there is 200 sq ft (paved portion of driveway) that cannot sheet flow over enough pervious area to receive a credit and would not be included in calculations

If storage and reuse/infiltration was used in the first step (say two 500 cisterns/tanks in front of house) then the unaddressed impervious surface would be computed by reducing the first direction impervious surface.

Therefore, the in first direction, enter 130 in impervious surface (reduced by 870 sq ft = 1000 gal/1.15 gal/sq ft) and still 1,000 in pervious surface. See program printout for this example (with storage) in Appendix E.3

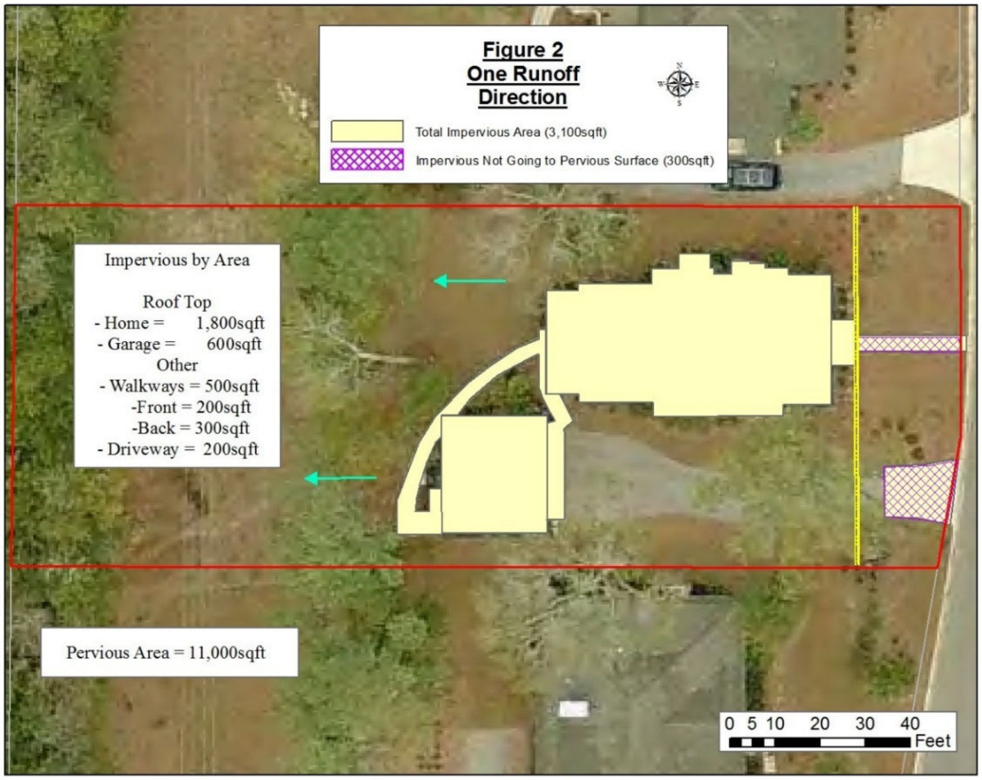

Figure 5-2
Example of a Two-Direction Calculation for Disconnected Impervious Surface

In this example, there would be 2,800 (3,100 to 300) sq ft of impervious surface sheet flowing over 11,000 sq ft of pervious surface out the back yard.

Therefore, enter 2,800 in the first impervious area and 11,000 in the pervious area. The second direction would have zero entered in both categories.

Again, if storage and reuse/infiltration was used, the impervious surface that included in the worksheet or web program would need to be reduced.

If, for example, two 500-gallon storage devices were used, the impervious surface needs to be reduced by 870 sq ft (1000 gal/1.15 gal/sq ft).

Therefore, enter 1,930 in first impervious area and 11,000 in pervious area. The second direction would have zero in both categories.

5.4 Water Quality

One of the major functions of post-construction BMPs is to improve the water quality of the discharging waters by reducing pollutant and nutrient loads. The efficiency of a BMP's pollutant and nutrient reduction can be estimated by specific design criteria based on the quantity of developed area and design storms. The developed area would include roads, buildings, lawns and parking lots, but would exclude open space areas such as parks, grassed rights-of-way, wetlands, ponds or other natural open space. If the primary BMP is not sufficient, then supplemental pre-treatment BMPs such as grassed swales can be added to the BMP plan, and the combined removal efficiency of the pre-treatment BMPs and primary BMP can be calculated. If the combination of pre-treatment and primary BMPs is not sufficient, then several options should be considered. These would include: (1) reducing the amount of impervious area on the site; (2) choosing more effective primary and/or pre-treatment BMPs; (3) increasing the percentage of developed area that is treated by the BMPs; and (4) providing additional natural open space on the site. The natural open space alternative is most effective if the natural open space is located on the part of the site that does not drain to the primary BMP. This effectively increases the percentage of developed area that drains to the BMP.

Worksheets (with examples completed) are provided in Appendix E to evaluate whether or not a proposed BMP plan for a development project will meet the recommended antidegradation water quality goals. The worksheets provide a step-by-step process for assessing the pollutant-removal efficiency of the planned BMPs, in comparison to pollutant removal required to meet the goal. In the worksheets, the required removal efficiency (based on imperviousness of the developed portion of the site) is compared to the removal efficiency provided by primary BMP coverage, which considers both the overall efficiency of the BMP and the percentage of developed area that is served by the BMP.

5.4.1 Nitrogen

The removal of nitrogen is required for all projects and worksheets, and examples are located in Appendix E.

5.4.2 Phosphorus

The removal of phosphorous is required for all projects, and worksheets and examples are located in Appendix E.

5.4.3 Bacteria

Bacteria (fecal coliform) removal is required for all projects, and worksheets and examples are located in Appendix E.

5.4.4 Other Stormwater Pollutants and Impacts

Other pollutants are occasionally considered for removal and may be added in the future based on specific MS4 requirements or issues within the watershed that make it necessary to control certain pollutants. These consist of nutrients, metals, oil, grease, fuel, other toxic substances, and miscellaneous wastes. The installation of the BMPs demonstrated in this section will contribute to removal of any of these substances and, therefore, there are some unquantifiable benefits to appropriate application of these techniques. The Stormwater Manager may request techniques such as manufactured treatment device BMP's for removal of additional substances if the watershed or a hot spot requires it.

5.4.5 Design Procedures for Impaired Waters and TMDL

Outstanding waters, impaired waters or waters with TMDL requirements may require additional BMPs or monitoring or buffers at the discretion of the stormwater manager. At a minimum, all DHEC TMDL and 303D list requirements for these areas must be meet, and additional permitting may be required

5.5 Project-Specific BMP Selection Criteria

All projects shall have in series BMPs and all stormwater management system designs shall contain at a minimum one wet detention BMP, one vegetation BMP and one filter or infiltration based BMP. These BMPs shall be selected based on site conditions to maximize their effectiveness. At a particular development site, a number of factors affect the suitability of different types of structural BMPs. Some of these considerations are presented as follows:

- **Drainage area size**. Some BMP types are limited to small drainage areas (1 to 10 acres), while other BMPs are more suitable to large drainage areas (greater than 10 acres). Wet detention ponds are generally limited to drainage areas of 10 acres or more, to provide a perennial source of water during dry weather. Infiltration trenches and vegetative measures such as swales are generally limited to drainage areas of 1 to 10 acres. Extended dry detention ponds can serve both small and large drainage areas.
- **Land use.** Some BMPs may not be considered compatible with particular land uses. For example, an infiltration BMP alone may not be considered appropriate for an industrial land use, where a spill may infiltrate into the soil and contaminate the groundwater. State regulations require that infiltration facilities treating runoff from impervious parking areas should be located a minimum of 150 ft from any public or private water supply well, and infiltration facilities more than 3 ft deep should be located at least 10 ft from basement walls.
- **Topography.** Steep slopes preclude the use of several BMPs, including swales and filter strips, which are effective only when flow velocities are low. In Beaufort County, the topography is relatively flat, so steep slopes will typically not be a concern. However, the flat topography may be a concern for BMPs such as sand filters, which require several feet of head to operate.
- **Soil permeability**. Wet ponds and extended dry detention ponds are generally effective in soils ranging from SCS Classification A (well-drained) to SCS Classification D (poorly drained). However, a Type A soil may cause problems in

maintaining a permanent pool of water. Infiltration measures such as trenches, basins and porous pavement generally are limited to Type A or B soils, due to the limited infiltration rate of Type C and D soils. State regulations specify that infiltration facilities should be limited to soils having an infiltration rate of at least 0.3 inch per hour and that the facilities shall be designed to drain completely in 72 hours. This manual recommends a minimum drawdown time of 24 to 48 hours.

- **Depth to Seasonal High Water Table**. This is generally a concern for infiltration and bioretention facilities. Sufficient distance between the bottom of the facility and the water table is required to provide ample opportunity for treatment as the water is infiltrating. Generally, recommended minimum separation ranges from 2 to 4 ft. By comparison, the State regulations require only a 0.5-ft separation between the bottom of an infiltration facility and the seasonal high water table. Infiltration in vegetative swales can also be limited by a high water table. In contrast, wet ponds and wetlands require a water table that is at or near the bottom of the facility.
- **Land availability**. Highly developed sites may have little available area for structural BMP facilities. However, the open space requirements of the current County ordinances and the recommended limitations on imperviousness should provide sufficient area for BMPs such as wet or extended dry detention ponds. Land availability may be an issue for infiltration trenches or basins if the developed area is highly impervious, particularly if the site soils have a relatively low infiltration rate. Because the infiltration facility should be designed to infiltrate the captured runoff in 24 to 48 hours, the maximum depth of the infiltration facility will be directly proportional to the infiltration rate (i.e., lower infiltration rates mean a lower maximum facility depth). In turn, a lower facility depth results in a greater minimum required surface area to capture the required runoff volume.
- **Stormwater quantity control requirements**. Typically, stormwater management facilities must meet stormwater quantity control requirements (e.g., County requirement of post-development peak flow less than or equal to the pre-development peak flow for the 25-year design storm) as well as water quality requirements. Wet ponds and extended dry detention ponds can usually be designed to meet both stormwater quality and quantity control requirements. However, infiltration facilities and bioretention facilities are typically designed to capture a given amount of runoff (1.0 to 1.5 inches per impervious acre of drainage, in Beaufort County), and runoff in excess of that amount is simply routed downstream with no attenuation. Consequently, infiltration trenches and bioretention facilities may only be able to meet quality requirements, and a second facility would be required to meet the quantity requirements. On the other hand, stormwater quantity control may not be necessary in some locations where peak shaving will provide little or no benefit, or may actually make flooding worse. The innovative constructed BMPs also do not provide peak-shaving benefit for large storms.

5.5.1 Structural Control BMP Design and Maintenance Guidelines – Fact Sheets

This section provides design guidelines for primary water quality control BMPs referenced in this manual. These design guidelines comply with the structural BMP requirements of the State's Coastal Zone Management Program and current local ordinances. The design criteria for water quality control measures presented in this section should be used in conjunction with other relevant sections of the County's Community Development Code, particularly if the BMP will also serve as a peak runoff control.

BMPs are required for any new and redevelopment within the County, and the County ordinance requires peak-shaving controls for new developments. Recommended BMP options for new and re-development are listed in Table 5-9. For situations where the primary BMP selected from Table 5-9 does not meet the anti-degradation water quality goal, the worksheets in Figures E-5 through E-8 in Appendix E may be used to calculate the required coverage of pretreatment BMPs (e.g., swales) and/or natural open space to achieve the required level of stormwater pollution control.

Table 5-9 BMP Technology Criteria Matrix – Beaufort County

<table>
<tr><th rowspan="2">Effective Impervious Cover (%) of Developed Area</th><th colspan="2">Total Developed Area</th></tr>
<tr><th>Less than 10 Acres</th><th>10 Acres or Greater</th></tr>
<tr><td>0 - 5%</td><td>No BMPs Required</td><td>No BMPs Required</td></tr>
<tr><td>6 - 10%</td><td>• Infiltration
• Biofiltration Swale*
• Grass Swale with Check Dams*
• Extended Dry Detention*
• Modified Extended Dry Detention
• Bioretention
• Innovative techniques**</td><td>• Wet Detention
• Extended Dry Detention*
• Modified Extended Dry Detention</td></tr>
<tr><td>11 - 22%</td><td>• Infiltration
• Grass Swale with Check Dams*
• Extended Dry Detention*
• Modified Extended Dry Detention*
• Bioretention
• Innovative techniques**</td><td>• Wet Detention
• Extended Dry Detention*
• Modified Extended Dry Detention*</td></tr>
<tr><td>23 - 30%</td><td>• Modified Extended Dry Detention*
• Infiltration
• Bioretention
• Innovative techniques**</td><td>• Wet Detention*
• Modified Extended Dry Detention*</td></tr>
<tr><td>31 - 40%</td><td>• Modified Extended Dry Detention*
• Infiltration
• Bioretention*
• Innovative techniques*</td><td>• Wet Detention*
• Modified Extended Dry Detention*</td></tr>
<tr><td>41 - 100%</td><td>• Modified Extended Dry Detention*
• Infiltration*
• Bioretention*
• Innovative techniques*</td><td>• Wet Detention*
• Modified Extended Dry Detention*</td></tr>
</table>

* Supplemental pre-treatment BMPs (such as grassed swales) and/or dedicated open space will be required to meet the antidegradation water quality goal.
** Supplemental pre-treatment BMPs and/or dedicated open space will be required to meet the antidegradation goal if the innovative techniques are swirl concentrators or sedimentation/media filtration devices. Sedimentation/constructed wetland devices can meet the antidegradation goal.

Design guidelines are presented for the following primary BMPs for use in Beaufort County:

Structural BMPs

- Wet Detention BMP
- Extended Dry Detention BMP
- Modified Extended Dry Detention BMP
- Infiltration BMPs
- Grass Swale with Check Dams BMP
- Rain Garden/Bioretention BMPs
- Biofiltration Swale BMP
- Sand Filters
- Porous Pavement
- Irrigation BMPs
- Green Roofs
- Blue Roofs
- Rain Barrel
- Innovative Technology BMP

Several of these BMPs (e.g., swales, extended dry detention) may also be used for pretreatment of runoff prior to treatment in a wet detention or infiltration BMP.

These BMP's can be classified in one or more of the following three categories below.

- Peak Attenuation / Volume Control (PEAK/VOL).
- Vegetative Practices (VEG.)
- Infiltration Practices (INFILT.)

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PTP-01 Wet Detention Basin BMP

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)

PTP-01

Activity: Wet Detention Basin

Planning Considerations

Design Life:	Permanent
Acreage Needed:	Low to Moderate
Estimated Unit Cost:	Low
Maintenance:	Routine: At Least Annually
Non-Routine:	Every 10-15 years
BMP Type:	PEAK/VOL

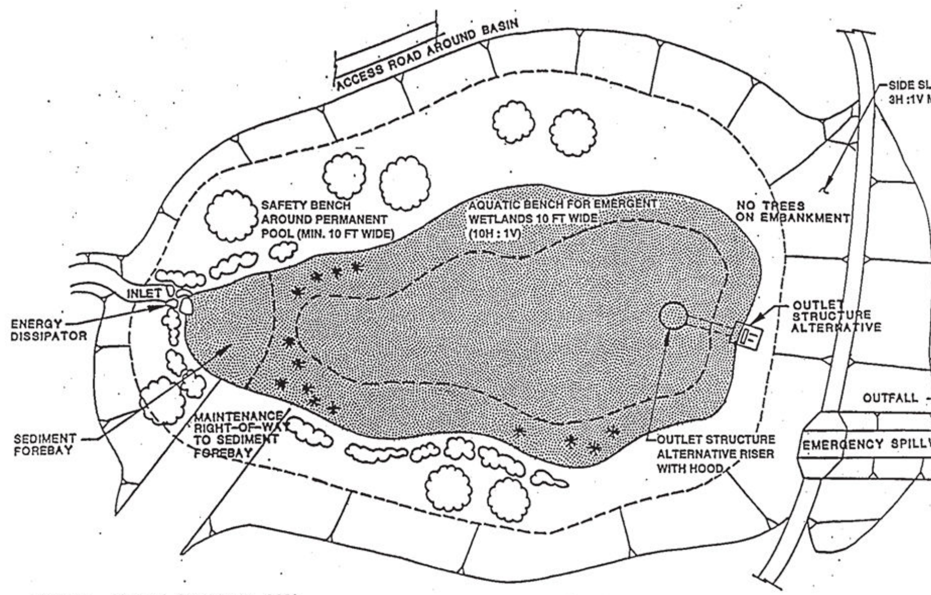
Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	♦	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◈	Floatable Materials
♦	Nutrients	◊	Oil& Grease	♦	Volume

Description

A wet detention basin is an impoundment formed by constructing a dam or embankment or by a combination of excavation and an embankment with an outlet structure to maintain a permanent pool and regulate the outflow of upstream stormwater discharges. In the general literature and State/Federal regulations for stormwater pollution control, a wet detention BMP is also sometimes referred to as a "wet pond" or a "retention basin." They can provide both water quality and erosion/flood control benefits. Wet detention basin(s) should be sited to control at least 80% of the development site area. Multiple detention basins may be required to achieve 80% coverage of large development sites. Supplemental pre-treatment BMPs and/or dedicated natural open space are required for developments exceeding 50% imperviousness, to meet the anti-degradation water quality goal.



Source: Adapted for HRPDC, 1991

Figure PTP 01-1

Schematic of a Wet Detention Basin BMP

Applicability	➢ Appropriate for both residential and nonresidential development. ➢ Restricted to sites with a minimum drainage area of 10 acres ➢ Applicability depends on site topography, drainage area, soil conditions, wetland constraints, space availability, accessibility, depth of bedrock, and the location of existing underground utilities. ➢ Basin should conform to existing topography with minimal excavation. ➢ Soils should not be highly permeable to facilitate the maintenance of a permanent pool.
Design Criteria	A. Permanent Pool Storage Volume and Dimensions 1. Storage Volume: 1.0 inch of runoff per acre or 3.0 inches of runoff per impervious acre, whichever is greater. Can be found by multiplying total impervious area (in acres) of development area by 0.25 ft, or by multiplying total development area by 0.083 ft, depending on which results in the greater pool volume. 2. Mean Depth: calculated by dividing the storage volume by the surface area. Should be small enough to minimize the risk of thermal stratification, yet large enough to ensure that algal blooms are not excessive and minimize the resuspension of settled pollutants during major storm events. Should be shallow enough to prevent significant thermal stratification, as this will help maintain aerobic bottom waters (minimize pollutant releases from bottom sediments). A mean depth of 3 ft to 7 ft should maintain an acceptable environment within the permanent pool. 3. Maximum Depth: No greater than 12 ft to minimize thermal stratification. 4. Length/Width Ratio: A minimum length/width ratio of 3:1 is recommended to help maximize plug flow conditions in order to enhance sedimentation, minimize short-circuiting, and also help prevent vertical stratification. The location of the outlet structure should maximize travel time from the inlet to the outlet.

5. Side Slopes along Shoreline: To promote shoreline wetland vegetation growth, the pond should have a littoral zone with side slopes no steeper than 10 H:1V (Horizontal:Vertical). For Beaufort County, the littoral shelf area requirement is 220 sq ft per acre, or 660 sq ft per impervious acre, whichever is greater. A safety bench with a minimum width of 10 ft should be provided around the permanent pool. Side slopes should also be top soiled, mucked, or planted from 1 or 2 ft below to 1 ft above the permanent pool elevation. Wetland vegetation along the shoreline help minimize the proliferation of free-floating algae, improve aesthetic qualities, and tend to trap most trash and debris along the shoreline for easier cleanup.

B. Peak Flow Storage: Storage capacity should be provided above the permanent pool for the control of post-development peak runoff from the stormwater management design storm(s) specified by the stormwater manager. The storage capacity and peak release rate should satisfy the peak runoff performance standard for the development site.

C. Embankment Cross-Section

1. Minimum Top Width: Minimum top width of 15 ft.
2. Side Slopes: No Steeper than 3H:1V, preferably flatter, and planted with turf-forming grass.
3. Freeboard: The elevation of the water surface in the basin with the emergency spillway flowing at design depth shall be at least 1.0 ft below the minimum elevation at the top of the settled embankment.

D. Outlet

1. Outlet Structures: Should consist of a solid (non-perforated), vertical riser pipe, box of corrugated metal or reinforced concrete joined by a watertight connection to a horizontal pipe (barrel) extending through the embankment and outletting beyond the downstream toe of the fill.
2. Crest Elevation: Should be set at the elevation required to maintain the permanent pool storage capacity.
3. Flow Capacity: Based on the performance standard for post-development peak runoff specified by the stormwater manager.
4. Base: Should be firmly anchored to prevent floatation.
5. Anti-Vortex Device/Trash Rack: Should be attached to the top of the outlet riser to improve the flow of water into the riser and to prevent floating debris from being carried out of the basin.
6. Anti-Seep Collars: Should be installed around the barrel of the horizontal outlet pipe.
7. Drain Pipe: Pipe with a suitable valve should be provided to completely drain the permanent pool for maintenance.

E. Emergency Spillway: The design storm for the emergency spillway design should be at least the 100-year storm event unless a less frequent design storm (i.e., return period greater than 100-years) is specified by the stormwater manager based upon embankment height, storage volume, or downstream flood hazard. Earthen emergency spillways should be trapezoidal in cross-section and designed for non-erosive velocities. The spillway should be constructed in such a manner as to prevent the discharge through the spillway from impinging on the toe of the dam or principal embankment structure.

F. Inflow/Outflow: At points of inflow to the wet detention basin, energy dissipaters such as riprap should be used to reduce the velocity of flow. The

	outflow channel below the horizontal pipe outfall should be designed to protect against erosion and scour from high velocities and turbulence. Riprap should be provided at the points of discharge as necessary. G. Forebay: A forebay should be located near the inlet to the permanent pool (space permitting) to trap coarse sediment particles as well as some of the trash and debris in stormwater discharges. Storage capacity should be 10% of the permanent pool storage volume to accommodate sediment accumulations over approximately a 20-year period. Access for mechanized equipment should be provided. H. Easement for Maintenance: A permanent easement which is at least 15 ft in width around the perimeter of the wet detention basin should be dedicated to the County to allow for maintenance. The easement should be measured from the top edge of the embankment slope. This easement should be at least 15 ft in width. The grading of access routes to the facility and around the facility should provide slopes that will safely accommodate maintenance and operating vehicles. The owner should retain easements for maintenance and access if maintenance is to be performed by the owner. I. Information/Warning Sign: Wet detention BMPs should be posted with an information/warning sign identifying the facility as a stormwater control and prohibiting swimming and other activities considered dangerous or inappropriate.
Maintenance	A. Routine Maintenance: Tasks performed at some regular basis during the year (at minimum, annually) and are viewed as preventive in nature and are intended to enhance the aesthetic quality of the facility. Examples: periodic site inspections, grass mowing, debris and trash removal, bank stabilization, weed control, insect or mosquito control, fence repair, and recordkeeping. B. Non-Routine Maintenance: Tasks performed once every specified number of years to correct problems that might reduce the detention facility's structural integrity or effectiveness. Examples of structural repairs, which will probably be required at 10 to 15 year intervals, on the average, include the replacement of outlet pipes and endwalls. Major cleanout operations to remove accumulated sediment and debris are typically required on the order of once every 15 to 20 years. A major clean-out is intended to maintain the required pollution removal efficiency, and also to eliminate the build-up of sediments. Clean-out operations typically include material removal from the forebay and permanent pool, stabilization of the detention facility, and offsite hauling for sediment disposal. The permanent pool should be evaluated every 5 years to assess the need for a major cleanout. The volume of the permanent pool should be determined based on a bathymetric survey of the pond bottom, and the pool volume will be compared to the design pool volume. If more than 20% of the design pool volume has been depleted by sediment accumulation, then a major cleanout shall be performed. C. Copper Application: Maintenance practices in Beaufort County include application of copper compounds for control of excessive algae growth. To minimize the potential for excessive copper discharge from ponds, a 48-hour holding period is required for ponds following application of copper compounds. No discharge is allowed during the holding period. See Appendix E for a worksheet to demonstrate adequate BMP sizing for a wet detention pond.

PTP-02 Extended Dry Detention BMP

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-02
	Activity: Extended Dry Detention Basin BMP	

Planning Considerations	
Design Life:	
Permanent	
Acreage Needed:	
Low to Moderate	
Estimated Unit Cost:	
Low	
Maintenance:	
Routine: At Least Annually	
Non-Routine: Every 10-15 years	Target Pollutants

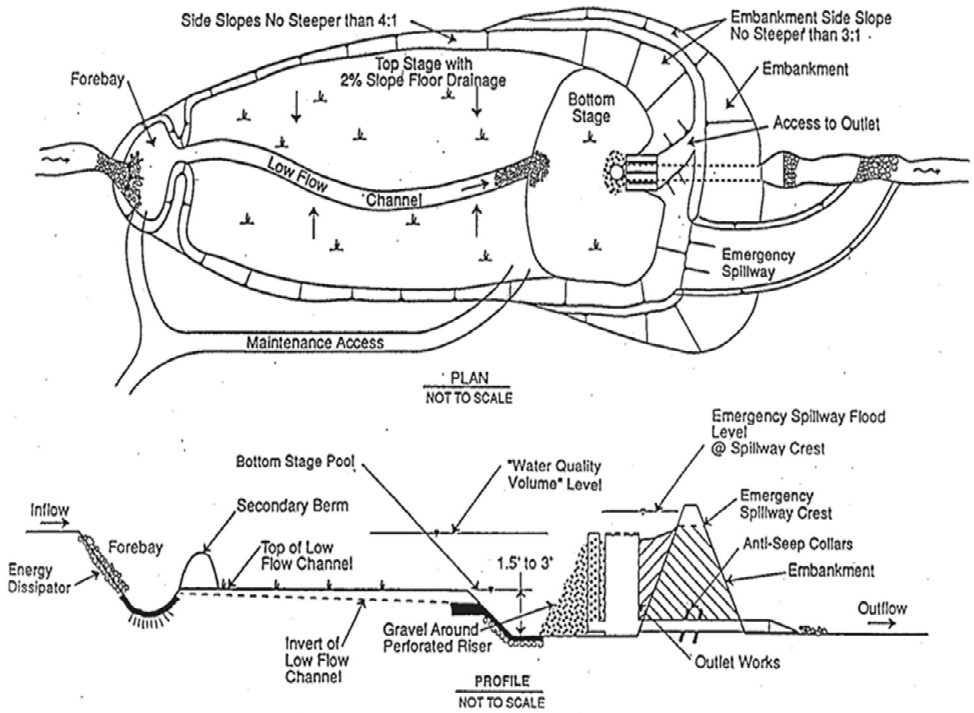
Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◈	Floatable Materials
♦	Nutrients	◊	Oil& Grease	◈	Volume

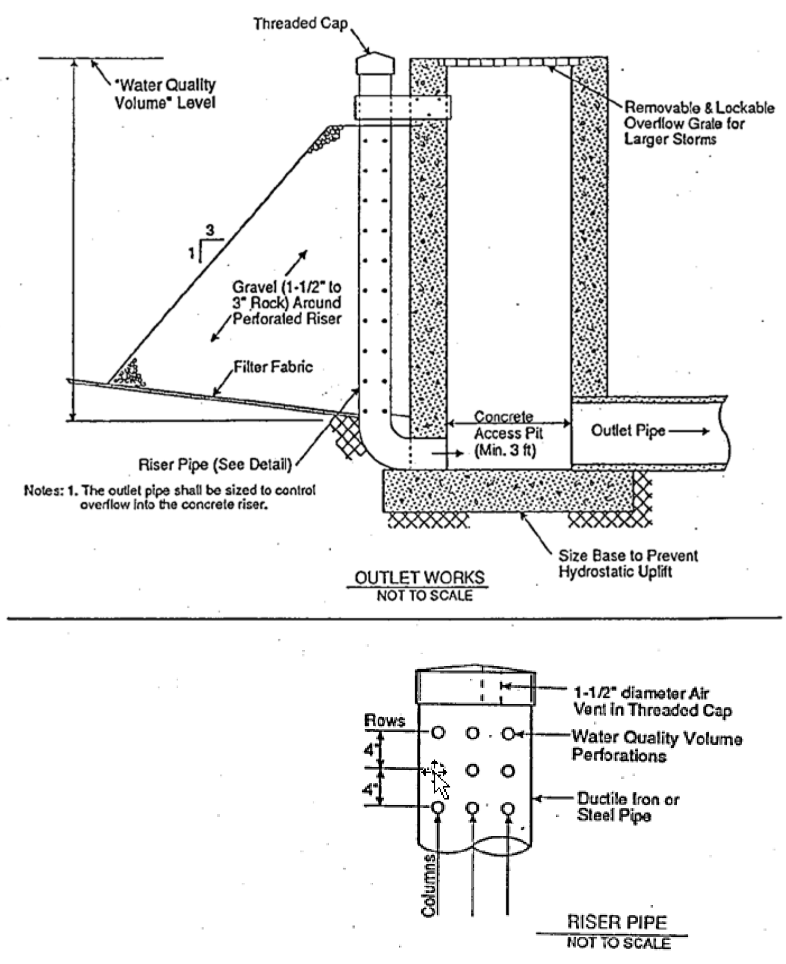
BMP Type: INFILT/PEAK VOL/VEG

Description

An extended dry detention basin is an impoundment formed by constructing a dam or embankment with an outlet structure to temporarily detain stormwater during and immediately following a storm event. Figure PTP 02-1 presents a schematic of an extended dry detention basin with a two-stage design that is described below. Pollutant removal is achieved primarily by sedimentation while the detention basin is being dewatered following the storm event. Extended detention basins can also provide peak-shaving control by regulating the outflow peak discharge and storing flood volumes within the detention basin. An emergency spillway is designed to pass peak flows from extreme flood events to protect the dam from damage due to overtopping. Extended dry detention basins can be sized to achieve both water quality and erosion/flood control benefits.

	 Figure PTP 02-1 Schematic of an Extended Dry Detention Basin BMP
Applicability	➢ Appropriate for developments of less than 10 acres if the development site's imperviousness is in the range of 5 to 20%. ➢ Can also be used as a pre-treatment BMP for the more effective primary BMPs. ➢ Applicability depends on site topography, drainage area, space availability, and accessibility. ➢ Generally, extended dry detention basins are preferred for sites where wetlands tend to restrict the use of wet detention ponds.
Design Criteria	A. Extended Detention Storage Volume and Dimensions 1. Storage Volume: 1.0 inch of runoff per acre or 1.5 inch of runoff per impervious acre, whichever is greater. Can be found by multiplying total impervious area (in acres) of development area by 0.125 ft, or by multiplying total development area by 0.083 ft, depending on which results in the greater pool volume. The recommended water quality volume is consistent with the volume required under current State regulations, which is 1 inch per acre of drainage regardless of the imperviousness of the development. Analyses results presented in Appendix E indicate that a water quality volume of 0.5 inch per acre of drainage is sufficient to capture and treat 90 percent or more of the long-term stormwater runoff. However, the manual will not recommend a County storage requirement that is less stringent than the State requirement. The water quality volume stored in the extended detention zone should be released over a period of 24 hours pursuant to the State Stormwater Management Regulations. To ensure a reasonable detention time for minor storm events that produce stormwater runoff volumes less than the design water quality volume, the

	basin outlet shall be designed to dewater the initial 50% of the water quality volume storage over a minimum period of 18 hours. 2. Length/Width Ratio: A minimum length/width ratio of 3:1 is recommended to help maximize plug flow conditions in order to enhance sedimentation, minimize short-circuiting, and also help prevent vertical stratification. Note that length is defined by the distance from the inflow point to the outflow point, and width is defined as the surface area divided by the length. The location of the outlet structure should maximize travel time from the inlet to the outlet. 3. Side Slopes: The side slopes of the detention basin should be no steeper than 4H:1V, and preferably flatter, in order to reduce erosion potential, minimize safety hazards, improve aesthetics, and facilitate maintenance access and activities. The floor of the basin should have a minimum slope of 2 percent toward the low flow channel. 4. Two-Stage Design: To improve appearance, a two-stage design is recommended where feasible. With a two-stage design (see Figure PTP 02-1), the majority of deposited materials will accumulate in the bottom stage, which can be sized to accept regular inundation from minor rain storms. The top stage is intended to be dry except for stormwater runoff from larger, infrequent storm events. The bottom stage typically can be 1.5 to 3 ft deeper than the top stage and should be sized to store up to 50% of the water quality volume (i.e., bottom stage should have a storage capacity of up to 0.75 inch of runoff per impervious acre or 0.50 inch of runoff per acre). A bottom stage storage volume equivalent to 50% of the water quality volume should capture stormwater discharges from more than 50% of the storm events each year, thus keeping the top stage dry most of the time. 5. Low Flow Channel: A paved low flow channel should be provided to carry runoff from minor storms through the top stage to the bottom stage (two-stage design) or through the upper end of the extended detention zone to the outlet works (single stage design). For a two-stage design, erosion protection should be provided at the location where the low flow channel discharges into the bottom stage. B. Peak Flow Storage: Additional storage capacity should be provided above the extended detention storage zone for the control of post-development peak runoff from the stormwater management design storm(s) specified by the stormwater manager. The necessary storage capacity and peak release rate shall satisfy the peak runoff performance standard for the development site. C. Embankment Cross-Section 1. Minimum Top Width: Minimum top width of 15 ft. 2. Side Slopes: No Steeper than 3H:1V, preferably flatter, and be planted with turf-forming grass. 3. Freeboard: The elevation of the water surface in the basin with the emergency spillway flowing at design depth shall be at least 1.0 ft below the minimum elevation at the top of the settled embankment. D. Outlet 1. Extended Dry Detention Outlet: The required dewatering period for the design storage volume can be achieved by a number of different outlet

	configurations based on adaptations to conventional outlets for peak-shaving detention basins Metropolitan Washington Council of Governments (MWCOG, 1987). Recent studies have found that vertical riser pipes that are perforated or slotted to achieve the required extended detention times exhibit less severe clogging problems than horizontal perforated outlets with a gravel jacket Metropolitan Washington Council of Governments (MWCOG, 1992). These studies have also concluded that the minimum diameter of riser perforations should be 0.75 inch to 1.0 inch to minimize clogging problems. Figure PTP 02-2 shows an example of a vertical perforated riser outlet structure that is used in conjunction with a weir box opening to achieve peak-shaving requirements for larger storms. As shown in Figure PTP 02-2, gravel (1.5-inch to 3-inch rock) should be packed in the shape of a cone around the vertical perforated/slotted riser to protect the extended dry detention outlet from clogging due to trash and debris. If the extended dry detention outlet is not protected by a gravel cone, a trash rack of sufficient size should be provided. Any outlet that satisfies requirements is acceptable, however, vertical perforated/slotted risers is preferred.  Source: Urban Drainage and Flood Control District, 1992 Figure PTP 02-2

Schematic of Perforated Riser Outlet for Extended Dry Detention Basin

2. Peak-Shaving Outlet: Peak-shaving outlets are required to release stormwater discharges that exceed the water quality volume and to satisfy the peak-shaving requirements specified by the stormwater manager. This outlet structure should consist of a vertical riser pipe, box of corrugated metal or reinforced concrete joined by a watertight connection to a horizontal pipe (barrel) extending through the embankment and outletting beyond the downstream toe of the fill. The riser pipe or box outlet may be the same outlet structure used to dewater the extended dry detention storage or a separate structure. The design elevation(s) of the peak-shaving outlet(s) should be set at the elevation(s) required to maintain the extended dry detention storage capacity and satisfy the peak-shaving performance standards.
3. Base: The base of the extended detention riser and the peak-shaving riser shall be firmly anchored to prevent floatation.
4. Anti-Vortex Device/Trash Rack: An anti-vortex device and trash rack should be attached to the top of the peak-shaving riser pipe or box outlet to improve the flow of water into the riser or box and to prevent floating debris from being carried out of the detention basin.
5. Anti-Seep Collars: Should be installed around the barrel of the horizontal outlet pipe.

E. Emergency Spillway: The design storm for the emergency spillway design should be at least the 100-year storm event unless a less frequent design storm (i.e., return period greater than 100-years) is specified by the stormwater manager based upon embankment height, storage volume, or downstream flood hazard. Earthen emergency spillways should be trapezoidal in cross-section and designed for non-erosive velocities. The spillway should be constructed in such a manner as to prevent the discharge through the spillway from impinging on the toe of the dam or principal embankment structure.

F. Inflow/Outflow: At points of inflow to the extended dry detention basin, energy dissipaters such as riprap should be used to reduce the velocity of flow. The outflow channel below the horizontal pipe outfall should be designed to protect against erosion and scour from high velocities and turbulence. Riprap should be provided at the points of discharge as necessary.

G. Forebay: If desired, a sediment forebay can be located near the inlet to the extended dry detention basin (space permitting) to trap coarse sediment particles as well as some of the trash and debris in stormwater discharges. The deposition of sediment near the inlet will reduce the frequency of major sediment clean-outs within the main basin, although major clean-outs will still be required. Where feasible, the forebay storage capacity should be at least 20% of the water quality volume to accommodate sediment accumulations over approximately a 15- to 20-year period.

H. Easement for Maintenance: A permanent easement around the perimeter of the wet detention basin should be dedicated to the County to allow for maintenance. The easement should be measured from the top edge of the embankment slope. The grading of access routes to the facility and around the facility should provide slopes that will safely accommodate maintenance and operating vehicles. The owner should retain easements for maintenance and

	access if maintenance is to be performed by the owner.
Maintenance	A. Routine Maintenance: Tasks performed at some regular basis during the year (at minimum, annually) and are viewed as preventive in nature and are intended to enhance the aesthetic quality of the facility. Examples: periodic site inspections, grass mowing, debris and trash removal, clearing around the extended detention outlet structure to prevent clogging, bank stabilization, weed control, insect or mosquito control, fence repair, and record-keeping. B. Non-Routine Maintenance: Tasks performed once every specified number of years to correct problems that might reduce the detention facility's structural integrity or effectiveness. Examples of structural repairs, which will probably be required at 10 to 15 year intervals, on the average, include the replacement of outlet pipes and endwalls. Major cleanout operations to remove accumulated sediment and debris are typically required on the order of once every 15 to 20 years. Major cleanouts are intended to maintain the required water quality storage capacity, and also to eliminate the buildup of accumulated sediments and debris that might significantly detract from the facility's appearance. Cleanout operations typically include material removal, stabilization of the detention facility, and offsite hauling for sediment disposal. The extended dry detention basin shall be evaluated every 2 years to assess the need for a major cleanout. The extended detention volume should be determined based on a survey of the pond, and the extended detention volume will be compared to the design volume. If more than 20% of the design volume has been depleted by sediment accumulation, than a major cleanout should be performed. Based on typical annual sediment loading rates in urban stormwater discharges, approximately 5 to 10 years will usually be required to deplete 20% of the water quality volume (assuming limited or no sediment removal in an upstream forebay). However, to keep the facility from becoming an eyesore and to minimize the risk of clogging the extended detention outlet structure, major cleanout operations may be required as frequently as every 3 to 5 years. See Appendix E for a worksheet to demonstrate adequate BMP sizing for an extended dry detention pond.

PTP-03 Modified Extended Dry Detention BMP

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-03
	Activity: Modified Extended Dry Detention Basin BMP	

Planning Considerations	
Design Life:	
Permanent	
Acreage Needed:	
Low to Moderate	
Estimated Unit Cost:	
Low	
Maintenance:	
Routine: At Least Annually	
Non-Routine: Every 10-15 years	Target Pollutants

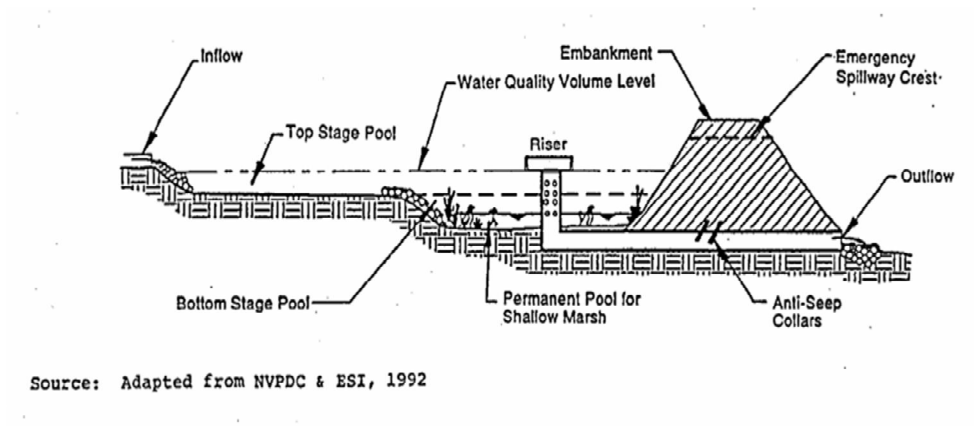
Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	◈	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◈	Floatable Materials
♦	Nutrients	◊	Oil& Grease	◈	Volume

BMP Type:
PEAK VOL/VEG

Description

This BMP consists of a two-stage extended dry detention basin with a shallow marsh in the bottom stage to achieve enhanced nutrient removal (see Figure PTP 03-1). The shallow marsh is supported by a permanent pool (maximum depth of approximately 18 inches) and an overlying extended dry detention zone (12 to 18 inches deep). In addition to removal of suspended pollutants by sedimentation, the shallow marsh should achieve removal of some dissolved nutrients. Like conventional extended dry detention basins, a modified extended dry detention basin can be designed to provide peak-shaving control by reducing the peak outflow and storing flood volumes within the detention basin. Modified extended dry detention basin(s) should be sited to control at least 80% of the development site area. Multiple detention basins may be required to achieve 80% coverage of large development sites. Supplemental pre-treatment BMPs and/or dedicated open space may be required in some cases to meet the anti-degradation water quality goal.

	 Figure PTP 03-1 Schematic of a Modified Extended Dry Detention Basin BMP
Applicability	➢ Appropriate for situations where conventional extended dry detention basins cannot achieve the anti-degradation water quality goal and the use of wet detention is constrained by factors such as existing wetlands or space limitations.
Design Criteria	In addition to the following general guidelines and criteria, design engineers are also referred to reference documents on stormwater wetlands system [Metropolitan Washington Council of Governments (MWCOG), October 1992; Strecker et al., 1992] for additional criteria and guidelines that may be useful in designing the shallow marsh component of this BMP. A. Storage Volume and Dimensions 1. Two-State Design: A two-stage design is required for a modified extended dry detention basin (see Figure PTP 03-1). The shallow marsh system is located within the bottom stage. The bottom stage can be approximately 3 ft deeper than the top stage and should be sized with an extended dry detention storage zone for approximately 50% of the water quality volume (i.e., dry detention storage capacity of 0.50 inch of runoff per acre or 0.75 inch of runoff per impervious acre, whichever is greater) plus a permanent pool storage zone for the shallow marsh vegetation (approximately 0.05 to 0.10 inch of runoff). The top stage is intended to be dry except for runoff from larger, infrequent storm events. Therefore, the majority of pollutant removal will occur in the bottom stage. The bottom stage's extended dry detention storage capacity (50% of the water quality volume) should capture stormwater discharges from more than 50% of the storm events each year. 2. Permanent Pool Bottom Stage: Based on criteria for stormwater wetlands BMPs in the Mid-Atlantic region (MWCOG, October 1992), the bottom stage should include a permanent pool with a "hi marsh" zone (from surface of permanent pool to depth of 6 inches) and a "lo marsh" zone (from 6 to 18 inches below the permanent pool). The hi marsh zone typically exhibits a greater diversity and density of emergent wetland plants. Guidelines for stormwater wetlands systems (MWCOG, October 1992) specify that: (a) the surface area of the permanent pool (i.e., shallow marsh wetlands system) should be at least 1% of the BMP drainage area; (b) the total surface area of the permanent pool should be equally distributed between hi marsh and lo marsh (i.e., AreaHI = AreaLO = 50% Permanent Pool Surface Area); and (c) the volume of the permanent pool in the lo marsh zone (6 to 18 inches of

inundation) should be approximately double the volume in the hi marsh zone (0 to 6 inches of inundation), which means that approximately two-thirds of the total volume should be in the lo marsh zone and one-third should be in the hi marsh zone. Based on these guidelines, the permanent pool should have a total storage volume of approximately 0.05 inch of runoff, a maximum depth of 1.5 ft, and a mean depth of approximately 0.4 ft. Table PTP 03-1 summarizes maximum water depths for emergent wetland plant species recommended for stormwater treatment systems in the eastern U.S. (MWCOG, October 1992).

Table PTP 03-1
Recommended Maximum Water Depths for Emergent Wetland Plant Species

Emergent Wetland Species	Maximum Depth (Inches)
A. Primary Species	
Duck potato	12
Common three square	6
Softstem bulrush	12
B. Secondary Species	
Sweet flag	3
Button bush	24
Rose mallow	3
Halberd-leaved rose mallow	3
Rice cutgrass	3
Spatterdock	60 (24 min)
Arrow-arum	12
Pickerel weed	12
Lizards tail	6
C. Exotic or Invasive Species	
Common reed	3
Common cattail	12-18
Narrow-leaved cattail	12

Notes
1. These depths can be tolerated, but plant growth and survival may decline under permanent inundation at these depths.
2. Primary species are rapid colonizers; secondary species do not spread as rapidly.
Source: MWCOG, October 1992

3. Extended Dry Detention Storage: The total storage capacity of the extended detention storage zone, referred to as the "water quality volume," should be the same as specified for extended dry detention. The requirement is either 1.0 inch of runoff per acre or 1.5 inch of runoff per impervious acre, whichever is greater. The required volume of the extended detention storage (in "acre-feet") may be calculated by multiplying the total developed area by 0.083 ft, or by multiplying the total impervious area (in "acres") by 0.125 ft, depending upon which results in the greater storage volume. Approximately 50% of the extended dry detention storage volume should be located within the bottom stage of the facility (i.e., storage capacity between surface of permanent pool and top rim of the bottom stage). The depth of the extended dry detention zone in the bottom stage should be approximately 1.0 to 2.0 ft, and in no case deeper than 3 ft. The depth of this zone must be limited because significant changes in water levels on a frequent basis can exert

severe physiological stress on the plant community in the extended dry detention zone. Plant species recommended for this zone include (MWCOG, October 1992): emergent wetland species such as soft-stem bulrush, sedges, switchgrass, and rice cutgrass; trees such as black willow, cypress, tupelo and river birch; and shrubs such as buttonbush and chokecherry. The water quality volume stored in the extended detention zone should be released over a period of 24 hours pursuant to the State Stormwater Management Regulations. To ensure a reasonable detention time for minor storm events that produce stormwater runoff volumes less than the design water quality volume, the basin outlet shall be designed to dewater the initial 50% of the water quality volume storage over a minimum period of 18 hours.

4. Length/Width Ratio: A minimum length/width ratio of 3:1 is recommended to help maximize plug flow conditions in order to enhance sedimentation, minimize short-circuiting, and also help prevent vertical stratification. Note that length is defined by the distance from the inflow point to the outflow point, and width is defined as the surface area divided by the length. The location of the outlet structure should maximize travel time from the inlet to the outlet. As a general rule, the length/width ratio in the shallow marsh system should be greater than or equal to one to prevent short-circuiting (MWCOG, October 1992). It is advisable to design the wetlands area to achieve a length/width ratio of 2:1 for the dry weather flow path. This can be achieved by placing wedges of hi marsh perpendicular to the flow path to maximize sinuosity (MWCOG, October 1992).
5. Side Slopes: The side slopes of the detention basin should be no steeper than 4H:1V, and preferably flatter, in order to reduce erosion potential, minimize safety hazards, improve aesthetics, and facilitate maintenance access and activities. The floor of the basin should have a minimum slope of 2 percent toward the low flow channel. The floor of the bottom stage should be graded to achieve the specified surface area and water volume distributions of lo marsh and hi marsh.
6. Low Flow Channel: A paved low flow channel should be provided to carry runoff from minor storms through the top stage to the bottom stage (two-stage design) or through the upper end of the extended detention zone to the outlet works (single-stage design). For a two-stage design, erosion protection should be provided at the location where the low flow channel discharges into the bottom stage.

B. Peak Flow Storage: Additional storage capacity should be provided above the extended detention storage zone for the control of post-development peak runoff from the stormwater management design storm(s) specified by the stormwater manager. The necessary storage capacity and peak release rate shall satisfy the peak runoff performance standard for the development site.

C. Embankment Cross-Section
1. Minimum Top Width: Minimum top width of 15 ft.
2. Side Slopes: No Steeper than 3H:1V, preferably flatter, and be planted with turf-forming grass.
3. Freeboard: The elevation of the water surface in the basin with the emergency spillway flowing at design depth shall be at least 1.0 ft below the minimum elevation at the top of the settled embankment.

D. Outlet
   1. Extended Dry Basin Outlet: The criteria and guidelines presented for an extended dry detention BMP also apply to this BMP. The major exception is that the outlet structure for a modified extended dry detention basin must also be designed to maintain a permanent pool for the shallow marsh system.
   2. Peak-Shaving Outlet: The modified extended dry detention basin should include an outlet to release stormwater discharges that exceed the water quality volume and to satisfy the peak-shaving requirements specified by the stormwater manager. This outlet structure shall consist of a vertical riser pipe or box of corrugated metal or reinforced concrete joined by a watertight connection to a horizontal pipe (barrel) extending through the embankment and outletting beyond the downstream toe of the fill. The riser pipe or box outlet may be the same outlet structure used to dewater the extended dry detention storage or a separate structure. The design elevation(s) of the peak-shaving outlet(s) shall be set at the elevation(s) required to maintain the extended dry detention storage capacity and satisfy the peak-shaving performance standards.
   3. Base: The base of the extended detention riser and the peak-shaving riser shall be firmly anchored to prevent floatation.
   4. Anti-Vortex Device/Trash Rack: An anti-vortex device and trash rack should be attached to the top of the peak-shaving riser pipe or box outlet to improve the flow of water into the riser or box and to prevent floating debris from being carried out of the detention basin.
   5. Anti-Seep Collars: Should be installed around the barrel of the horizontal outlet pipe.
   6. Drain Pipe: A pipe with a suitable valve should be provided to completely drain the permanent pool for maintenance.

E. Emergency Spillway: The design storm for the emergency spillway design should be at least the 100-year storm event unless a less frequent design storm (i.e., return period greater than 100-years) is specified by the stormwater manager based upon embankment height, storage volume, or downstream flood hazard. Earthen emergency spillways should be trapezoidal in cross-section and designed for non-erosive velocities. The spillway should be constructed in such a manner as to prevent the discharge through the spillway from impinging on the toe of the dam or principal embankment structure.

F. Inflow/Outflow: At points of inflow to the extended dry detention basin, energy dissipaters such as riprap should be used to reduce the velocity of flow. The outflow channel below the horizontal pipe outfall should be designed to protect against erosion and scour from high velocities and turbulence. Riprap should be provided at the points of discharge as necessary.

G. Forebay: If desired, a sediment forebay can be located near the inlet to the extended dry detention basin (space permitting) to trap coarse sediment particles as well as some of the trash and debris in stormwater discharges. The deposition of sediment near the inlet will reduce the frequency of major sediment cleanouts within the main basin, although major clean-outs will still be required. Where feasible, the forebay storage capacity should be at least 20% of the water quality volume to accommodate sediment accumulations over approximately a 15- to 20-year period.

H. Easement for Maintenance: A permanent easement that is at least 15 ft in width

	around the perimeter of the wet detention basin should be dedicated to the County to allow for maintenance. The easement should be measured from the top edge of the embankment slope. This easement should be at least 15 ft in width. The grading of access routes to the facility and around the facility should provide slopes which will safely accommodate maintenance and operating vehicles. The owner should retain easements for maintenance and access if maintenance is to be performed by the owner.

PTP-04 Infiltration BMPs

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-04

Activity: Infiltration BMPs

Planning Considerations	
Design Life:	
Permanent	
Acreage Needed:	
Low to Moderate	
Estimated Unit Cost:	
Low	
Maintenance:	
Every 2 years	

Target Pollutants

BMP Type: INFILT/PEAK VOL/VEG

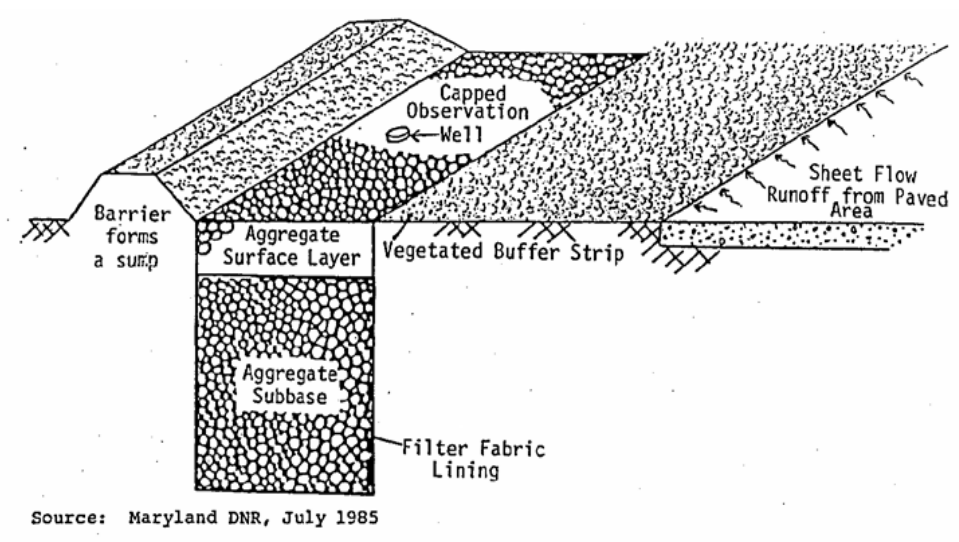
Significant ♦ Partial ◈ Low or Unknown ◊

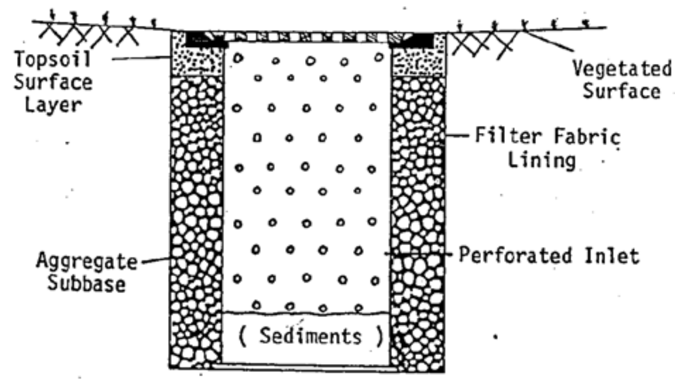
♦	Sediment	◊	Oxygen Demanding Substances	◈	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	♦	Floatable Materials
♦	Nutrients	◊	Oil& Grease	♦	Volume

Feasibility Test

Since infiltration BMPs are only suitable for sites with appropriate soils characteristics and water table conditions, the design engineer must demonstrate that the proposed BMP site satisfies the following feasibility tests before a development plan relying on infiltration BMPs will be approved:

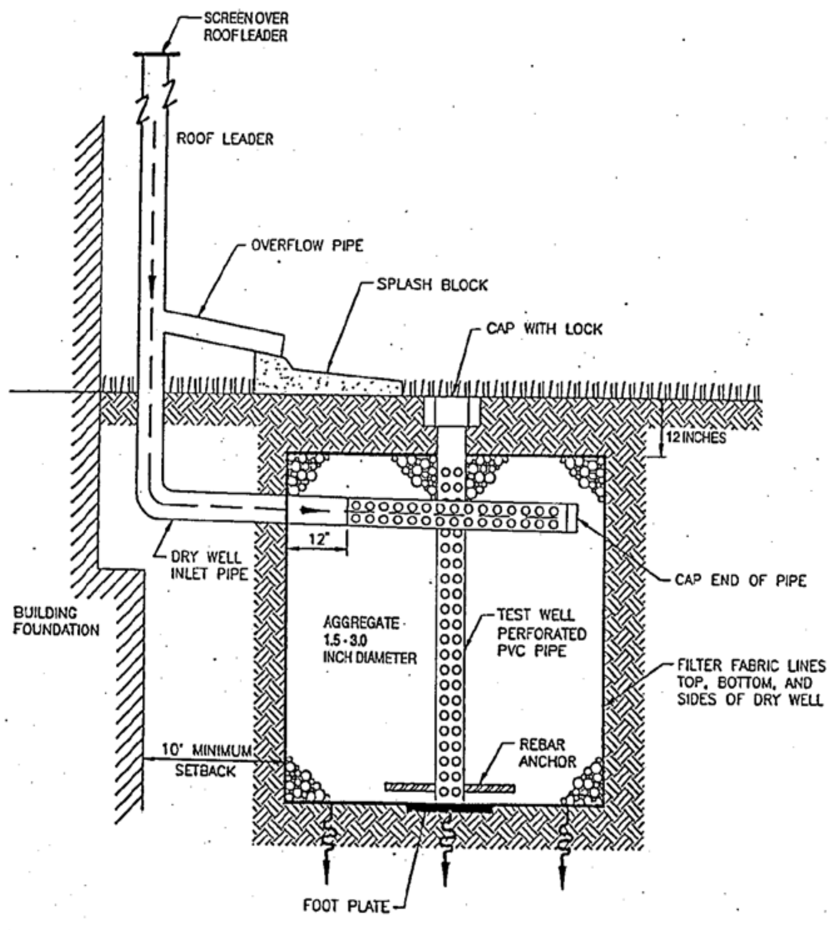
1. The soil beneath the infiltration facility shall exhibit minimum infiltration rates that permit adequate percolation of stored runoff. The minimum infiltration rate is the rate at which water percolates through the soil under saturated conditions. Soils with infiltration rates between approximately 0.5 inch per hour and 2.5 inches per hour are suitable for infiltration practices. This criterion restricts the use of infiltration BMPs to the following soil textures to ensure adequate minimum infiltration rates: loam (0.52 in/hr); sandy loam (1.02 in/hr); and loamy sand (2.4 in/hr).
2. The maximum allowable ponding or storage time within the infiltration facility shall be no more than 48 hours, assuming average antecedent conditions. The maximum design depth for infiltration facilities is a function of the soil infiltration rate, the 48-hour storage time, and the void ratio of the stone aggregate reservoir.
3. The invert of the infiltration facility must be at least 2 ft above the seasonally high groundwater table or bedrock.
4. The site topography should be considered in locating the infiltration facility, including slope, soils, and the proximity of building foundations. To prevent

	basement flooding, building foundations shall be at least 10 ft up-gradient from the infiltration facility. Failure of any of the four feasibility tests means that the proposed BMP site is not suitable for infiltration BMPs.
Description	An *infiltration trench* generally consists of a long, narrow excavation ranging from 3 to 12 ft in depth that is backfilled with stone aggregate to provide temporary storage of stormwater for subsequent infiltration into the soil (see Figure PTP 04-1). The inlet mechanism may consist of either a stone aggregate surface or a vegetated surface with grate inlets constructed flush with the ground surface (Figure PTP 04-2). A *dry well* is a small excavated pit that is backfilled with aggregate to provide storage for subsequent infiltration of stormwater to the soil. Figure PTP 04-2 shows a side view schematic of a dry well. Dry wells generally range from 3 to 10 ft in depth and are designed to accept piped inflow from a rooftop downspout. Infiltration facilities are primarily used as water quality controls for small development projects. It may not be cost-effective to use infiltration devices to achieve required flooding/erosion control performance standards because the facility must be sized to capture all design storm runoff up to, and for some period after, the time of peak flow. Whereas detention basins can be designed to limit most of the peak-shaving storage to periods around the time of peak flow, peak-shaving designs of infiltration devices require the provision of a considerable amount of storage to handle the entire rising limb (and portions of the falling limb) of the design storm hydrograph. The infiltration BMP should be sited to control at least 80% of the nonresidential development site area. Multiple facilities are likely to be required on a development site to achieve 80% coverage. Supplemental pre-treatment BMPs and/or dedicated natural open space may be required if the infiltration BMP facility(ies) alone cannot achieve the anti-degradation water quality goal.  Figure PTP 04-1 Typical Application of Infiltration Trench



Source: Maryland DNR, July 1985

Figure PTP 04-2
Gate and Perforated Inlet for Infiltration Trench
with Vegetated Surface



Source: Adapted from HRPDC, 1991(a)

Figure PTP 04-3
Schematic of Dry Well BMP

Applicability	➢ Appropriate for capturing sheet flow runoff (infiltration trench) and rooftop runoff (drywell) from areas up to about 5 acres in size. ➢ Restricted to non-residential development projects less than 5 acres. ➢ Must pass feasibility tests listed above.
Design Criteria	A. General Criteria: 1. Storage Capacity: The storage capacity of the trench or dry well, referred to herein as the water quality volume, should be sized to store either 0.5 inch of runoff from the total developed area, or 1.5 inches of runoff per impervious acre in the facility drainage area, whichever is greater. The captured runoff is stored within the voids in the aggregate backfill material (assume voids ratio of 0.4). 2. Maximum Storage Time: The infiltration facility must be sized to completely dewater the water quality volume within 24 to 48 hours, assuming average antecedent conditions. 3. Aggregate: Stone aggregate backfill material for the trench should have a maximum diameter of 3 inches and a minimum diameter of 1.5 inches. 4. Surface Area: The required total surface area (A) of the infiltration facility can be calculated as follows: A = (S)/((Vr)*(d)) A = infiltration BMP surface area, in ft^2 S = water quality volume, in ft^3 Vr = voids ratio = 0.4 d = infiltration facility depth, in ft For sites with multiple infiltration trenches or dry wells, the surface area should be calculated for the contributing drainage area of each facility. 5. Depth: Infiltration trenches and dry wells typically range from 2 to 10 ft in depth (Maryland DNR, 1984). The maximum depth (d) of the infiltration BMP storage zone, should be based upon the following relationship: d = (f)*(T)/(Vr) where: d = maximum depth of infiltration storage zone, in ft f = infiltration rate of underlying soil, in ft/hr T = maximum storage time = 24 to 48 hours Vr = void ratio = 0.4 The infiltration BMP depth based on the storage time should be checked against the criteria for minimum distance (2 ft) between the invert and water table/bedrock, and a smaller depth should be selected if necessary. In addition to the depth of the infiltration BMP storage zone, a dry well should be buried 12 inches below ground level. 6. Observation Well: An observation well of perforated PVC pipe 4 to 6 inches in diameter with a tamper-proof lockable cap shall be installed in every infiltration facility. 7. Overflow Channel: A non-erosive overland flow path shall be provided for surface runoff which exceeds the capacity of each infiltration trench. 8. Filter Fabric: Filter fabric shall be placed along the top, bottom, and sides of the

infiltration trench or dry well (see discussion of "Infiltration BMP Construction").

9. Peak Flow Control: Stormwater management facility(ies) must also be provided to control the post-development peak runoff from the stormwater management design storm(s) specified by the stormwater manager. The peak runoff performance standard can be met by expanding the infiltration facility(ies) and/or by providing additional detention storage facility(ies).
   More detailed design criteria and worksheets for infiltration trenches and dry wells are available in other sources (Maryland DNR, 1984; CDM, 1985).

B. Infiltration BMP Construction:
   Infiltration facilities tend to clog and require major cleanouts more frequently than other BMPs. In order to minimize the risk of premature clogging and eventual failure, the following construction methods are recommended (Maryland DNR, 1984).

   1. Excavation: Trenches should be excavated using a backhoe or a wheel or ladder type trencher. Front-end loaders or bulldozers shall not be used because the blades can smear the infiltration surface. In addition, these machines may cause undue compaction of the trench floor.

      Excavated materials should be placed a sufficient distance from the sides of the infiltration device to minimize the risk of sidewall cave-ins and also to prevent migration of soil particles back into the trench or dry well after the aggregate has been placed. Work should be scheduled so that the amount of trench or dry well excavated can be covered in one day in order to prevent windblown or waterborne sediment from entering the trench. An inspection by the owner shall be conducted upon the completion of infiltration facility excavation. At this time, the inspector shall also evaluate the quality and size of the aggregate, which shall be clean and should conform to design specifications indicated on the approved site plan. Materials used in the trench or dry well (e.g., filter fabric, PVC pipe) shall be clean and free from defects.

   2. Filter Fabric Laydown: When excavation and the subsequent inspection of the trench or dry well are complete, a filter fabric layer shall be placed along the bottom and sides of the facility with sufficient length left on top to overlap 6 inches or more after the aggregate has been placed. The filter fabric shall be free of large holes. Overlaps between rolls shall be a minimum of 2 ft, with the upstream roll atop the downstream roll.

      Filter fabrics are very sensitive to long-term exposure to ultraviolet light. Therefore, they should not be left in the sun for any significant period of time. Some filter fabrics are affected by alkalis, acidic materials, asphalt components, and fuel oils. The selected fabric should also have a water permeability rate more rapid than that of the natural soil.

   3. Aggregate Placement: Once the filter fabric lining has been placed, the aggregate shall be laid in the infiltration trench by a backhoe or front-end loader

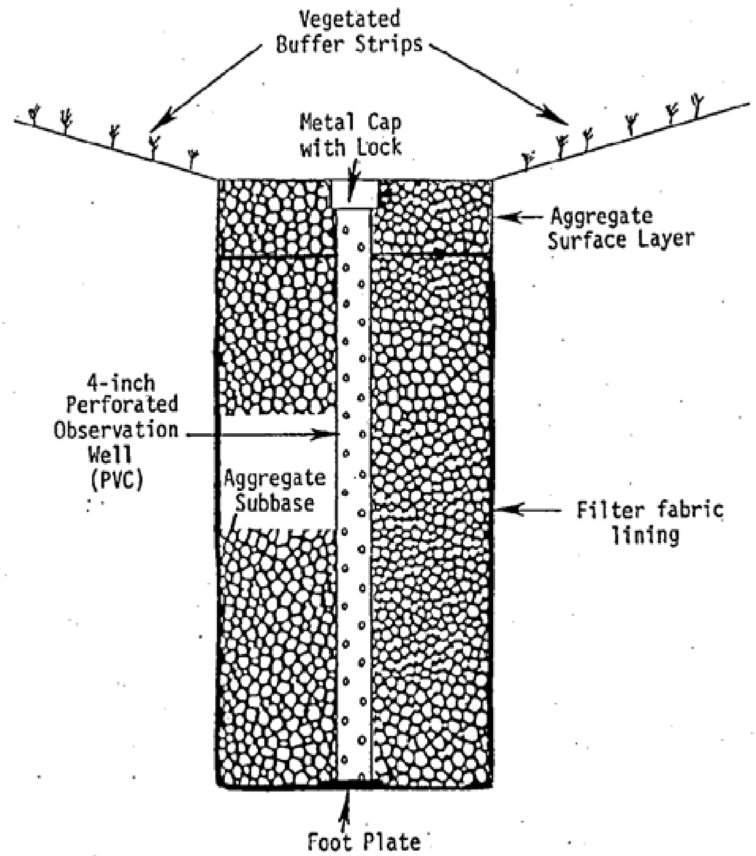
rather than dumped in by a truck. This can be accomplished from the sides of the trench. For both dry wells and infiltration trenches, the aggregate shall be placed in loose lifts 12 inches thick (maximum) and compacted using plate compactors.

4. Observation Well: When the aggregate is being placed, an observation well consisting of a 4-inch PVC pipe shall be installed in the center of the trench (Figure PTP 04-4) or dry well. The bottom of the observation well shall be flush with finished grade of the trench or dry well bottom. The top of the well shall have a lockable cap to prevent tampering. The pipe shall be sufficiently perforated to allow water/sediment to freely flow in and out of it. A hole must be cut in the filter fabric before it is folded over the aggregate to allow passage of the observation well. This hole should be as small as possible to prevent the migration of fine soil particles into the aggregate storage reservoir. The top of the observation well shall be flush with the final design elevation of the aggregate or fill.

5. Inlet(s): The inlet mechanism of an infiltration trench is dependent upon the type of surface used:
   a. Trench with Aggregate Surface: An infiltration trench with an aggregate surface shall not have any direct inlets. Inflow into the trench will consist of both rainfall and sheet flow onto the aggregate surface and subsequent infiltration through the filter fabric layer and into the trench.
   b. Trench with Vegetated Surface: An infiltration trench with a vegetated surface shall have inlets that consist of grates covering 2- to 3-ft-diameter perforated inlet pipes. These inlets shall be placed at the beginning of aggregate backfill. The pipes shall seat firmly on the trench floor (filter fabric) and the grates shall be flush with the finished grade.

   For dry wells, rooftop runoff is typically delivered to the upper part of the aggregate reservoir via a roof leader. Screens should be placed at the top of the roof leader to prevent leaves, pine needles, and other debris from entering the dry well.

6. Fabric Overlap: A visual inspection shall be conducted after filter fabric laydown, aggregate and observation well placement, and surface inlet installation are complete, to ensure that the aggregate is filled to the proper elevation and that the filter cloth overlap and observation well and surface inlet placement conform to the approved design.



Source: Adapted from Maryland DNR, July 1985

Figure PTP 04-4
Cross-Section of Infiltration Trench with Observation Well Detail

7. Surface Layer: For an infiltration trench, the upper layer of aggregate shall be placed as follows after the filter fabric laydown has been completed and approved:
   a. Trench with Aggregate Surface: For trenches with aggregate cover, the aggregate shall be laid on top of the filter fabric until flush with finished grade.
   b. Trench with Vegetated Surface: For vegetated trenches with surface inlets, the fill shall be placed over the filter fabric to final grade. The portions of the observation well and the perforated inlets that are in contact with the fill should be wrapped with an impermeable cloth in order to prevent the migration of fine particles into the trench.

   Note that for either a vegetated trench or a rock-covered trench, the top of the observation well shall be flush with the surface of the trench.

   For dry wells, 12 inches of overburden (minimum) shall be placed on the filter fabric that covers the top of the aggregate reservoir to isolate the dry well from ground level runoff and sediment loads.

	8. Permanent Stabilization: Upon completion and approval of the infiltration facility construction, all vegetated areas (including buffer strips) shall be seeded and protected. The infiltration facility should not be activated until the entire drainage area has been stabilized.
Maintenance	Due to their significant potential for clogging, infiltration BMPs are likely to require more frequent major cleanouts than detention basin BMPs. For this reason, infiltration BMPs are only recommended for small non-residential sites where the owners can be held accountable for the required maintenance activities. *Routine maintenance* activities include debris removal, monitoring well inspections (at least quarterly following rainstorms), and record-keeping. For infiltration trenches, the major *non-routine maintenance* activity will be the elimination of clogging conditions by replacing the surface layer of aggregate and the filter fabric covering the top of the trench. The old aggregate should be removed and the filter fabric should be cut on either side of the trench and replaced with a new strip (minimum 1.0 ft overlap between the old and new filter fabric). Clean aggregate should then be laid on top of the new filter fabric until flush with the capped observation well. Based on typical operating experiences in the eastern U.S., surface cleanout operations and filter fabric replacement shall be done every 2 years (MWCOG, August 1992). At some point in time, the aggregate layers of the trench below the top layer of filter cloth are likely to exhibit clogging conditions. When this occurs, the entire trench should be rehabilitated, starting with excavation of all aggregate, removal of all filter cloth, and rescarification of the bottom and side of the trench. For dry wells, the major maintenance activity is the removal of vegetative litter and debris from the screens at the top of the roof leaders. If the dry well exhibits clogging problems, a complete rehabilitation of the facility (i.e., removal and replacement of filter fabric and aggregate) is likely to be required. See Appendix E for a worksheet to demonstrate adequate BMP sizing for the infiltration BMP.

PTP-05 Grass Swale with Check Dams

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-05
	Activity: Grass Swale with Check Dams	

Planning Considerations	
Design Life:	
Permanent	
Acreage Needed:	
Low to Moderate	
Estimated Unit Cost:	
Low	
Maintenance:	
Annually	

	Target Pollutants					
BMP Type: VEG	Significant ♦ Partial ◈ Low or Unknown ◇					
	♦	Sediment	◇	Oxygen Demanding Substances	◇	Bacteria & Viruses
	◇	Heavy Metals	◇	Toxic Materials	◈	Floatable Materials
	♦	Nutrients	◇	Oil& Grease	◇	Volume

Description	A grass swale with check dams is a natural or graded depression with small dams (6 to 12 inches in height) that are placed at specific intervals to create a series of temporary pools to induce infiltration. As the stormwater runoff overtops the check dams, it can be directed to flow through vegetated drainage swales with gentle slopes. The gentle slopes with vegetative cover provide non-erosive flow velocities. The combination of low velocities and vegetative cover provide opportunities for infiltration and for sediments to settle out. A schematic of a grass swale with check dams is provided in Figure PTP 05-1, and typical details are shown in Figures PTP 05-2 and PTP 05-3.

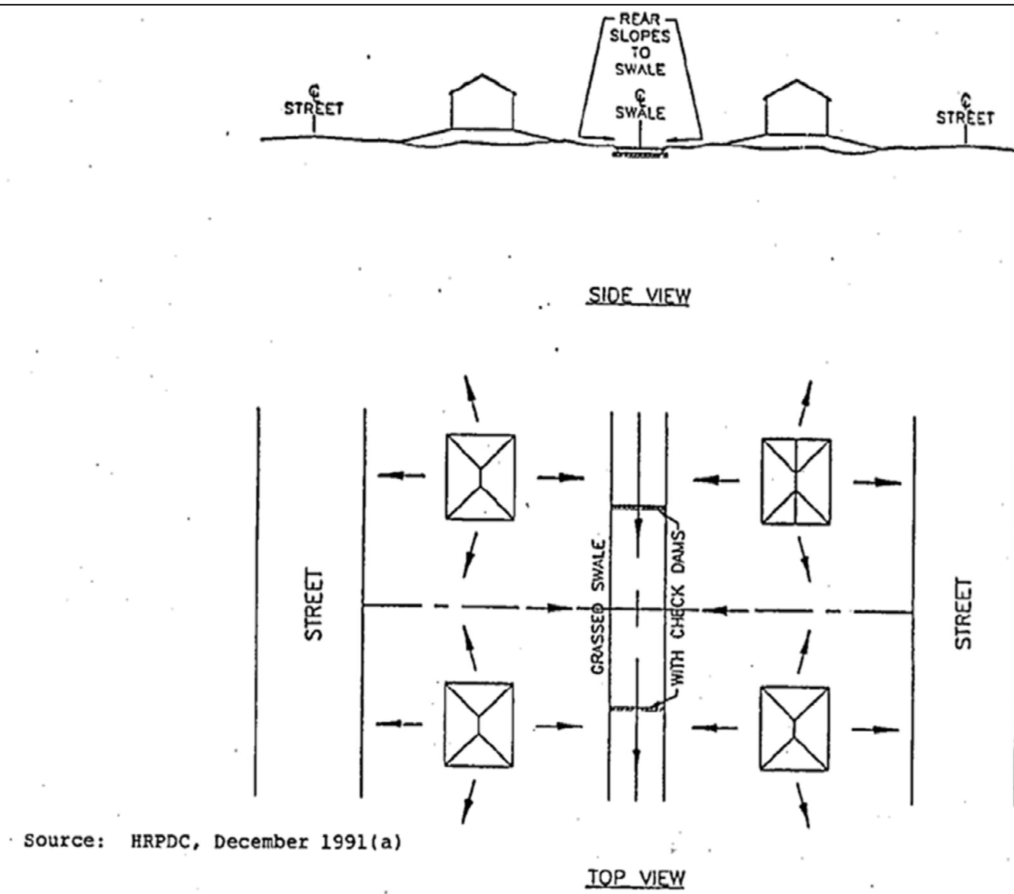


Figure PTP 05-1
Grassed Swale with Check Dams Schematic

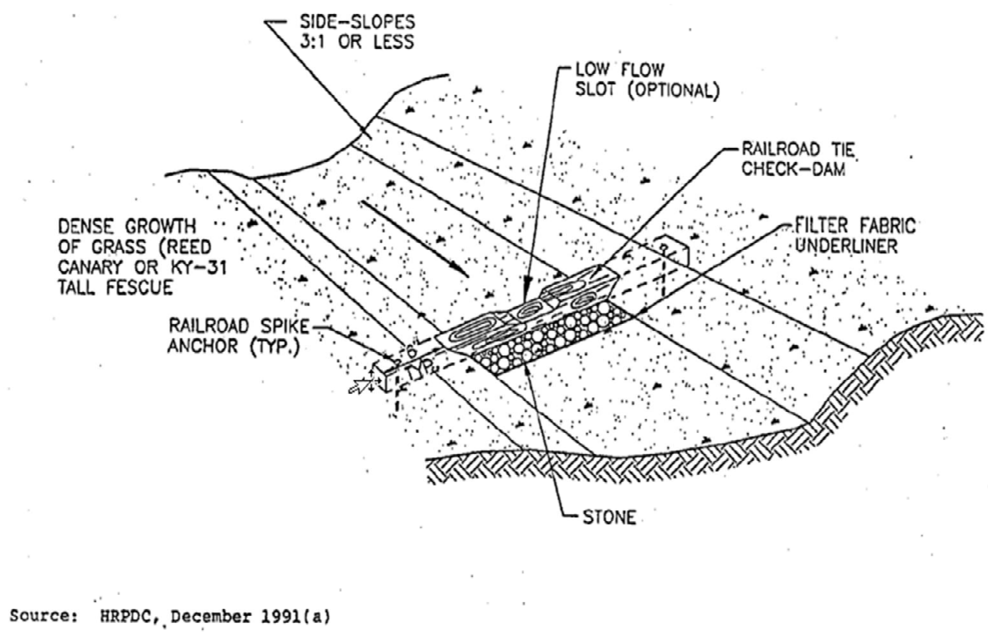


Figure PTP 05-2
Grassed Swale with Check Dams Detail

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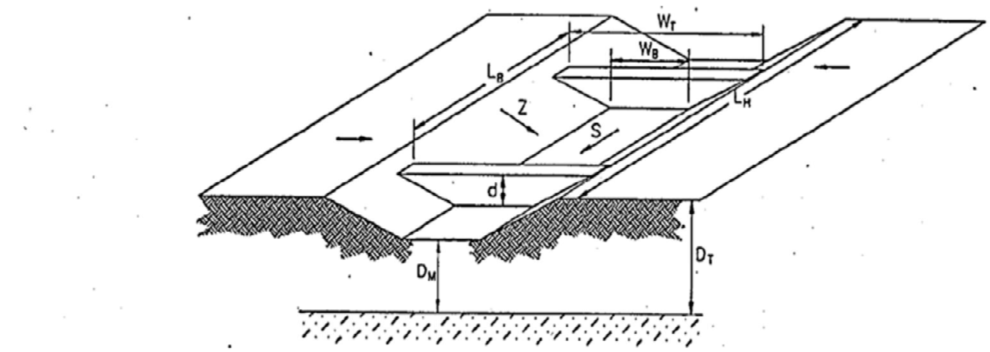

Source: HRPDC, December 1991(a)

Figure PTP 05-3
Grass Swale with Check Dams
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<td>Applicability</td>
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Most applicable as primary BMPs with relatively small drainage areas, such as along highways or in small residential development projects with low to moderate densities where the impervious cover is relatively small.
Maximum area served by an individual swale should be less than about 5 acres.
Most appropriate for small residential development projects (less than 10 acres) with low to moderate levels of impervious cover.
Also suitable as supplemental pre-treatment BMPs for primary BMPs such as wet detention, extended dry detention, and modified extended dry detention and infiltration.

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<td>Design Criteria</td>
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General Criteria:

Storage Volume: Grass swales with check dams can be designed to provide detention storage (upstream of the check dams) equivalent to the water quality volume recommended for infiltration facilities: 0.5 inch of runoff per acre or 1.5 inch of runoff per impervious acre in the contributing drainage area, whichever is greater.
Depth of Storage: Check dams that create the water quality storage pools in the grass swale should be a minimum of 6 inches in height. The maximum depth of storage should be 6 to 12 inches depending upon pedestrian and vehicular safety requirements.
Storage Time/Maximum Drainage Time: The design ponding time for swales with check dams should be no greater than 48 hours, assuming average antecedent conditions. The storage behind the check dams can be dewatered by infiltration, evaporation, and/or providing a small weep hole in the check dam. It is advisable to dewater the swale within 2 days after the storm ends to minimize potential public safety hazards and mosquito problems.
Permissible Velocity: If a large design storm (e.g., 25-year storm) is used to design the swale, the velocity of flow expected from the design storm should not exceed the permissible velocity for the type of vegetative lining used for the swale.

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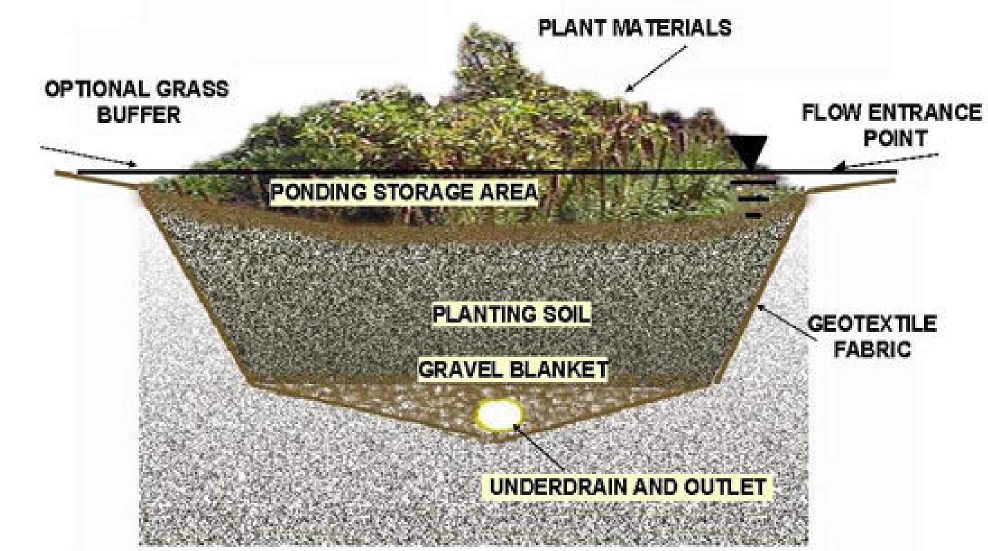
	5. Side Slope: The side slopes of the vegetated swale typically should be no steeper than 3H:1V, and no steeper than 2H:1V for swales lined with riprap. 6. Shape: Swale cross-sections can be trapezoidal, parabolic, or V-shaped. The trapezoidal swale shape is the preferred section due to its ease of construction. With time, trapezoidal shapes tend to become parabolic due to the growth of vegetation and settlement of solids. 7. Check Dams: The check dams must be permanent and made of non-erodible materials. The overflow must occur over the non-erodible material and not be allowed to scour around the area where the check dam meets the swale side slopes. Downstream scour must also be prevented.
Maintenance	Swale maintenance requirements are very minor if the swale is properly installed. An annual inspection of the site approximately 48 hours after a major storm event is recommended to assure that the swale is functioning properly. Swale maintenance consists mainly of keeping the vegetative cover dense and vigorous, and involves periodic mowing and reseeding of bare spots. Mowing of the swale too close to the ground (scalping) should be avoided. Vegetative cover should be maintained at a minimum height of 3 inches. Sediment deposits behind the check dams should be periodically removed. Water ponded in a swale more than 48 hours after a major storm has ended indicates that natural recharge rates have been reduced by compaction and/or accumulated sediment and debris, and that maintenance should be performed. Sediment removal can be performed by hand with a rake, shovel, and wheelbarrow. It is recommended that these sediment cleanout activities be undertaken at least once per year, preferably coinciding with other routine maintenance activities.

PTP-06 Rain Garden/Bioretention BMPs

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-06
	Activity: Bioretention/Rain Garden	

Planning Considerations
- Design Life: Permanent
- Acreage Needed: Low to Moderate
- Estimated Unit Cost: Low
- Maintenance: Annually



Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

BMP Type: INFILT/PEAK VOL/VEG

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◈	Heavy Metals	◊	Toxic Materials	♦	Floatable Materials
♦	Nutrients	◈	Oil& Grease	◈	Volume

Feasibility Test

Since bioretention BMPs are only suitable for sites with appropriate soils characteristics and water table conditions, the design engineer must demonstrate that the proposed BMP site satisfies the following feasibility tests before a development plan relying on bioretention BMPs will be approved:

1. The soil beneath the bioretention facility should exhibit minimum infiltration rates that permit adequate percolation of stored runoff. The minimum infiltration rate is the rate at which water percolates through the soil under saturated conditions. Soils with infiltration rates between approximately 0.5 inch per hour and 2.5 inches per hour are suitable for bioretention practices. This criterion restricts the use of bioretention BMPs to the following soil textures to ensure adequate minimum infiltration rates: loam (0.52 in/hr); sandy loam (1.02 in/hr); and loamy sand (2.4 in/hr). If the underlying soil does not have an adequate infiltration rate, the basin should be underlain with drainage pipes to carry percolating water away from the facility.
2. The maximum allowable drainage time for the bioretention basin surface shall be no more than 48 hours, assuming average antecedent conditions.
3. The invert of the bioretention facility must be at least 2 ft above the seasonally high groundwater table or bedrock.
4. The site topography should be considered in locating the bioretention facility, including slope, soils, and the proximity of building foundations. To

<table>
<tr><td></td><td>prevent basement flooding, building foundations shall be at least 10 ft up-gradient from the bioretention facility.

Failure of any of the four feasibility tests means that the proposed BMP site is not suitable for bioretention BMPs.</td></tr>
<tr><td>Description</td><td>A bioretention basin generally consists of a shallow, landscaped depressional area that provides temporary storage of stormwater for subsequent infiltration into the soil. The basin typically receives sheet flow runoff from adjacent developed areas. The terms bioretention basin and rain garden are often used interchangeably. However, while they perform the same functions, rain gardens are often described as smaller and less engineered as bioretention basins, which often have gravel underdrain systems and specialized outflows with hydraulic controls. See Figure PTP 06-1 for a depiction of a bioretention basin/rain garden.

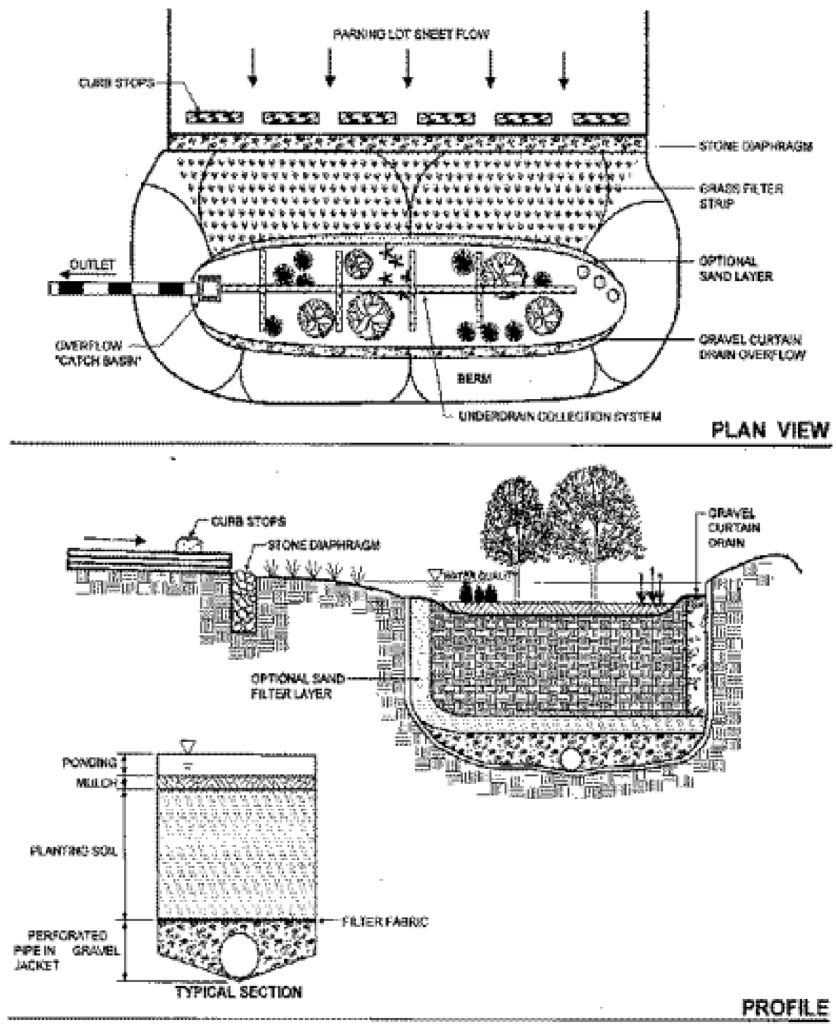


Figure PTP 06-1
Bioretention Schematic</td></tr>
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Applicability	➢ Designed to capture sheet flow runoff from areas up to about 5 acres in size. In Beaufort County, the use of bioretention BMPs shall be restricted to development projects less than 5 acres in size. ➢ The applicability of bioretention BMPs to a small development project will depend on whether the proposed BMP site passes the feasibility tests listed above. ➢ It may not be cost-effective to use these devices to achieve required flooding/erosion control performance standards because the facility must be sized to capture all design storm runoff up to, and for some period after, the time of peak flow. Whereas detention basins can be designed to limit most of the peak-shaving storage to periods around the time of peak flow, peak-shaving designs of bioretention devices require the provision of a considerable amount of storage to handle the entire rising limb (and portions of the falling limb) of the design storm hydrograph. ➢ The bioretention BMP should be sited to control at least 80% of the development site area. Multiple facilities are likely to be required on a development site to achieve 80% coverage. Supplemental pre-treatment BMPs and/or dedicated natural open space may be required if the BMP facility(ies) alone cannot achieve the anti-degradation water quality goal.

Design Criteria	A. General Criteria: 1. Storage Capacity: The storage capacity of the bioretention basin, referred to herein as the water quality volume, shall be sized to store either 0.5 inch of runoff from the total developed area, or 1.5 inches of runoff per impervious acre in the facility drainage area, whichever is greater. The available storage volume includes the surface ponding volume, plus subsurface storage in the planting soil, assuming average antecedent conditions. 2. Planting Soil: The planting soil media shall be a mixture of 50% sand, 30% leaf compost (fully composted) and 20% topsoil. The topsoil shall be sandy loam or loamy sand of uniform composition. This mixture should provide sufficient infiltration capacity, as well as providing organic material to enhance plant growth and pollutant removal. 3. Ponding Depth: The maximum allowable ponding depth at the bioretention basin surface is 6 inches (0.5 ft). 4. Planting Soil Depth: The minimum depth of the planting soil shall be 3 ft, or 4 inches deeper than the bottom of the largest root ball, whichever is greater. This depth should provide sufficient soil for establishing plant root systems and preventing plant damage due to severe wind, and sufficient depth for filtering pollutants. Surface Area: The required surface area (A) of the bioretention basin can be calculated as follows: $A = (S)/(D_p + R_s * D_s)$ Where, A = bioretention BMP surface area (ft^2) S = water quality volume (ft^3) D_p = ponding depth (ft) R_s = fraction of planting soil available for water storage under average antecedent conditions (assume = 0.2 for recommended soil mixture) D_s = planting soil depth (feet) 5. Maximum Storage Time: The bioretention facility must be sized to dewater the ponded surface water within 24 to 48 hours, assuming average antecedent conditions. Given the maximum ponding depth of 6 inches, infiltration rates of 0.13 to 0.25 inch per hour would be sufficient to dewater the pooled area. The recommended soil mix with its relatively high sand content will have infiltration rates that exceed those required. 6. Overflow Channel: A non-erosive overland flow path shall be provided for surface runoff that exceeds the capacity of each bioretention basin. 7. Mulch: A mulch layer should be provided on top of the planting soil. The mulch layer shall be 2 to 3 inches in depth, consisting of standard landscape fine shredded hardwood mulch or shredded hardwood chips. 8. Peak Flow Control: Stormwater management facility(ies) must also be provided to control the post-development peak runoff from the stormwater management design storm(s) specified by the stormwater manager. The peak runoff performance standard can be met by expanding the bioretention facility(ies) and/or by providing additional detention storage facility(ies).

B. Bioretention Landscaping:
The bioretention basin should be vegetated to resemble a terrestrial forest community ecosystem, including a mixture of trees, shrubs and herbaceous ground cover.

1. Plant Selection: Table PTP 06-1 lists examples of trees and shrubs suitable for bioretention landscaping. Native species that are tolerant to pollution loadings and wet/dry conditions are most desirable. A minimum of three species of trees and three species of shrubs should be selected for diversity.
2. Plant Placement: On average, 1,000 trees and shrubs should be planted per acre of bioretention BMP surface. These should be placed by a landscape professional to simulate natural conditions. Two to three shrubs should be planted for each tree (i.e., ratio of shrubs to trees should be 2:1 to 3:1).
3. Plant Layout: Trees should be planted primarily on the perimeter of the basin, to maximize the shading and wind protection afforded by the trees. This will limit extremes of summer solar radiation and winter freezes and winds.

Table PTP 06-1 Listing of Shrubs and Tress Potential Used in Rain Gardens/Bioretention Areas

Latin Name	Common Name	Size/Form
Acer negundo	Box elder	Small tree
Acer rubrum	Red maple	Medium tree
Aronia arbutifolia	Red chokeberry	Medium shrub
Cercis canadensis	Redbud	Large shrub
Clethra alnifolia	Sweet pepperbush	Medium shrub
Cornus sericea ssp.	Redosier dogwood	Medium-small shrub
Cyrilla racemiflora	Ti-ti	Large shrub (semi-
Diospyros virginiana	Persimmon	Small-medium tree
Euonymus americana	Strawberry bush	Small shrub
Fraxinus pennsylvanica	Green ash	Medium tree
Hypericum frondosum	St. John's wort	Ground cover/herbaceous
Ilex vomitoria	Dwarf yaupon	Small shrub (evergreen)
Juniperus virginiana	Grey owl red cedar	Shrub (evergreen)
Magnolia virginiana	Sweetbay	Small tree (evergreen)
Myrica cerifera	Wax myrtle	Large shrub (evergreen)
Pinus palustris	Longleaf pine	Tall tree (evergreen)
Pinus taeda	Loblolly pine	Medium tree (evergreen)
Quercus pagoda	Cherrybark oak	Large tree
Sambucus canadensis	American elderberry	Medium shrub
Scuttellaria integrifolia	Skull cap	Ground cover

Maintenance	Routine maintenance activities include debris removal, erosion inspection (at least quarterly following rainstorms), adding mulch, removal and replacement of dead and dying vegetation, treatment of diseased trees and shrubs, and record-keeping. Because bioretention facilities are a relatively new BMP technology, it is difficult to evaluate the potential for non-routine maintenance. It is possible that the facility surface may clog due to sediment accumulation. Cultivation, core aeration or other procedures may be necessary to maintain surface infiltration capacity. In addition, accumulation of toxics from stormwater may impair plant health and growth, and replacement of the planting soil media would be required. A worksheet to demonstrate adequate BMP sizing for bioretention BMPs can be found in Appendix E.

PTP-07 Bioretention Swale

Beaufort County, South Carolina
Stormwater Best Management Practices (BMPs)
Post-Construction Control Practices (PTPs)

PTP-07

Activity: Biofiltration Swale

Planning Considerations	
Design Life:	
Permanent	
Acreage Needed:	
Low to Moderate	
Estimated Unit Cost:	
Low	
Maintenance:	
Annually	

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

BMP Type: INFILT/PEAK VOL/VEG

♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◈	Heavy Metals	◊	Toxic Materials	♦	Floatable Materials
♦	Nutrients	◈	Oil& Grease	◈	Volume

Description

A biofiltration swale is a BMP that treats stormwater runoff by direct contact with the soil and vegetation. It generally is an excavated shallow surface depression planted with selected native vegetation. The stormwater runoff can be ponded in an area containing emergent wetland plants, but this approach can result in maintenance problems (e.g., citizen complaints about mosquitoes and trash). Unlike the swale BMP described in PTP-05, a biofiltration swale does not include check dams. In a biofiltration swale, pollutants such as sediments, nutrients, and metals can be reduced by biological uptake and infiltration through the soil. By providing sufficient residence time for the stormwater runoff, some pollutant removal through sedimentation and infiltration can be accomplished. A schematic of a biofiltration swale is shown in Figure PTP 07-1.

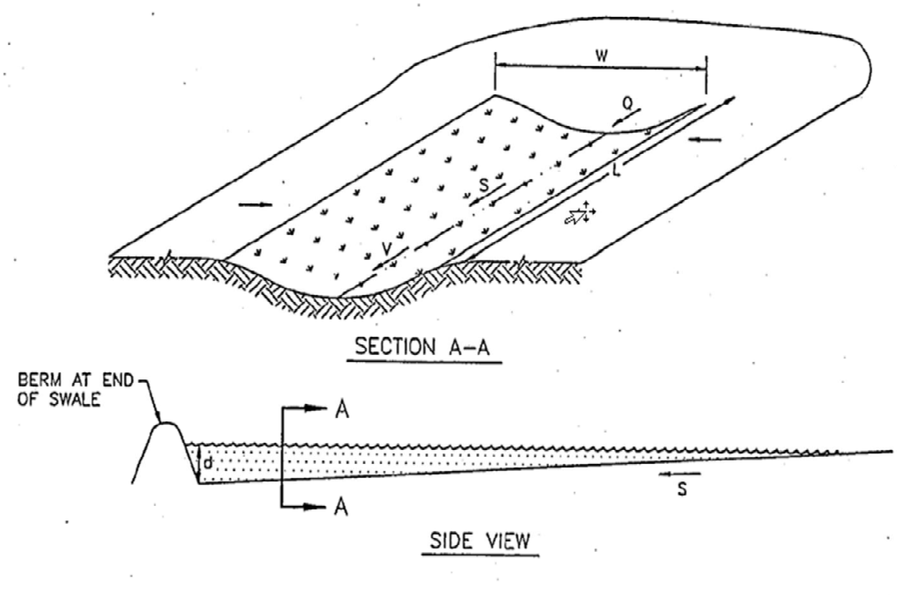
Bioretention can be integrated into a site with a high degree of flexibility and can balance nicely with other structural management systems, including porous asphalt parking lots, infiltration trenches, as well as non-structural stormwater BMPs.

The vegetation serves to filter (water quality) and transpire (water quantity) runoff, and the root systems can enhance infiltration. The plants take up pollutants; the soil medium filters out pollutants and allows storage and infiltration of stormwater runoff; and the bed provides additional volume control. Properly designed bioretention techniques mimic natural ecosystems through species diversity, density and distribution of vegetation, and the use of native species, resulting in a system that is resistant to insects, disease, pollution, and climatic stresses.

Table PTP 07-1 Permissible Velocities for Various Ground Covers

No.	Cover	Slope Range Percent (%)	Permissible Velocity	
			Erosion Resistant Soil	Easily Eroded Soils
1	Bermuda grass (*Bynodon Dactylon*)	0-5	8	6
2	Kentucky 31 Tall Fescue (*Festuca Arundinacea*)	0-5	7	5
3	Grass-legume mixture	0-5	4	3
4	Red Fescue Redtop (*Agrostis Alba*) *Lespedeza Servicea* Alfalfa	0-5	3.5	2.5
5	Annuals* Common Lespedeza Sudan Grass Small Grain Ryegrass	0-5	3	2
6	Rock Riprap Section (for temporary construction)	5-10	8	6.5

*Annuals are used on mild slopes (less than three (3) percent) or as temporary protection until permanent covers are established. Use on slopes steeper than five (5) percent is not recommended. Source: State of Maryland Standards and Specifications



Source: HRPDC, December 1991(a)

Figure PTP 07-1
Biofiltration Schematic

Applicability

- Used as a BMP for removing pollutants from stormwater runoff. It can be used in residential areas and adjacent to highways.
- Due to the greater maintenance requirements, the use of biofiltration in wetlands areas should be restricted to small systems that can be privately maintained by adjoining homeowners.
- Intended for use with relatively small drainage areas; maximum areas served by

	individual swale systems typically should be less than about 10 acres, otherwise the swale will become excessively large in cross-section. ➢ Swale BMPs are likely to be most feasible in single-family residential areas that exhibit manageable peak flows for a reasonable swale cross-section. ➢ Also be suitable as supplemental pre-treatment BMPs for primary BMPs including wet detention, extended dry detention, modified extended dry detention and infiltration. ➢ Recommended for soils having infiltration rates ranging from 1.0 inch per hour to 0.3 inch per hour. This range of infiltration rates is associated with the following soil textural groups: sandy loam, and silt loam. ➢ Seasonal high groundwater table should be at least 1 to 2 ft below the ground surface; a groundwater table high enough to provide moisture to the vegetation during the dry season but not high enough to create long periods of saturation. In areas with high saturation, emergent wetland plants can be planted.
Design Criteria	General Criteria: 1. Length: A biofiltration swale should have a hydraulic length of at least 600 ft. If the length is less than 600 ft, the width needs to be increased to provide the equivalent hydraulic residence time of approximately 10 minutes at the design depth of flow (Hartigan et al., 1989). Sufficient residence time is needed to allow sediments to be removed through the mechanism of settling and to maximize contact with the soil/vegetation surface. 2. Side Slopes: Side slopes should be as flat as possible and no steeper than 3H:1V. 3. Longitudinal Slope: Longitudinal slopes should be less than 4%. Slopes less than 2% can be used with underdrains to avoid persistent pooling of runoff. 4. Vegetation Cover: The type of vegetation selected depends on the type of underlying soil. Emergent wetlands can also be used in the bottom portion of the channel. Maintenance requirements should also be considered in selecting the type of vegetation. 5. Shape: A parabolic cross-section is preferred for biofiltration swales. Initially, the swale channel can be constructed as a trapezoid. With time, trapezoidal shapes tend to become parabolic due to the growth of vegetation and sedimentation. 6. Depth of Flow: The design depth of flow should be at least 2 inches less than the expected winter vegetation height. An earthen berm protected by stone can be installed at the end of the biofilter to ensure shallow ponding of the stormwater runoff in the biofiltration swale. The height of the berm should be the design depth of flow and freeboard. Stone protection of the berm should prevent erosion under overflow conditions. Provisions for dewatering the swale following a rain storm can also be made by providing a notch in the berm. 7. Velocity: Based on the slope parameters of the biofilter selected, the velocity of stormwater runoff within the swale at the design depth of flow should not exceed 1.0 ft per second. Maintaining relatively low velocities will assist with the removal of suspended solids through sedimentation. 8. Manning's n for Vegetative Cover: The following Manning's n values are recommended for the design of biofiltration swales:

<table>
<tr>
<td></td>
<td>
<table>
<tr><td colspan="2">Manning Roughness Coefficient for Vegetation</td></tr>
<tr><td>Height of Vegetation</td><td>n Value</td></tr>
<tr><td>Dense grass up to 6 inches tall</td><td>0.07</td></tr>
<tr><td>Dense grass 6-12 inches tall</td><td>0.10</td></tr>
<tr><td>Dense grass > 12 inches tall</td><td>0.20</td></tr>
<tr><td>Wetland Plants</td><td>0.07</td></tr>
</table>

9. Aesthetics: Swale BMPs should be planned and designed to fit into the surrounding vegetation and development. A well designed biofiltration swale should look like the surrounding natural vegetation.
</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintenance requirements of biofilters in grass swales are minimal, except for mowing and removal of sediments. Once the vegetation has been established, mowing should be performed on an as-needed basis, and the grass clippings should not be allowed to decay in the biofiltration facility. Sediments should be removed whenever the volume of the facility is determined to be inadequate and ponding occurs for an extended period following a rain storm. A swale that exhibits continuous ponding following a rainstorm may require mosquito control.

Proper inspection should be performed during the construction of the biofiltration swale. It should be inspected regularly during the period when vegetation is being established. After the vegetation has been established, an annual inspection should be sufficient.</td>
</tr>
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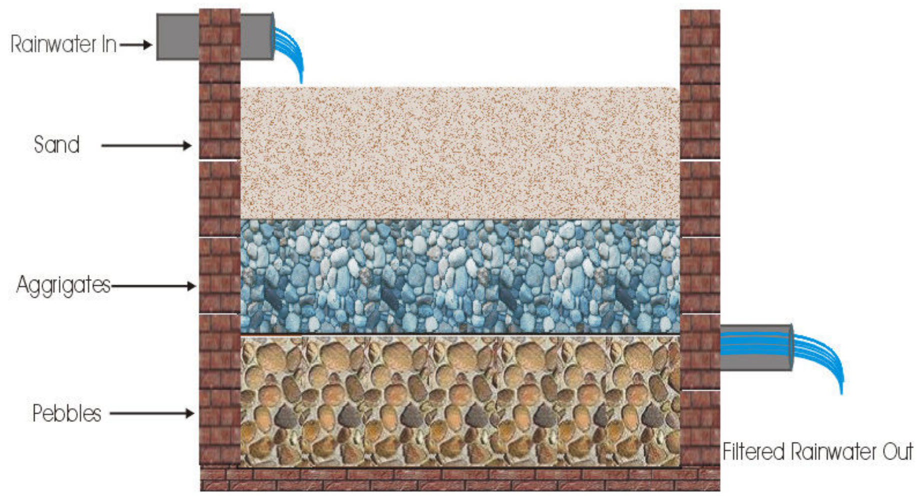
PTP-08 Sand Filters

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-08

Activity: Sand Filters

Planning Considerations

Design Life:	Semi-permanent
Acreage Needed:	Low to Moderate
Estimated Unit Cost:	Low
Maintenance:	Annually



BMP Type: INFILT/PEAK VOL

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◈	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	♦	Floatable Materials
♦	Nutrients	◈	Oil& Grease	◈	Volume

Description

Sand filters are usually two-chambered stormwater treatment practices; the first chamber is for settling, and the second is a filter bed filled with sand or another filtering media. Stormwater entering the sand filter is first conveyed through the pretreatment zone where trash, debris and coarse sediment are removed. It then passes through the treatment zone and out of the system through either an outlet pipe, in an underdrained system, or through the subsoil via infiltration. Pollutants in runoff are treated in sand filters through the processes of settling, filtration and adsorption.

There are several modifications of the basic sand filter design, including the surface sand filter, underground sand filter, perimeter sand filter, organic media filer, and the Multi-Chamber Treatment Train (MCTT). All of these filtering practices operate on the same basic principle. Modifications to the traditional surface sand filter were made primarily to fit sand filters into more challenging design sites (e.g., underground and perimeter filters) or to improve pollutant removal (e.g., organic media filter). The surface sand filter is the original sand filter design. In this practice both the filter bed and the sediment chamber are above ground. The surface sand filter is designed as an off-line practice, where only the water quality volume is directed to the filter. The surface sand filter is the least expensive filter option, and has been the most widely used (see Figure PTP 08-1). The underground sand filter is a modification of the surface sand filter, where all of the filter components are underground. Like the surface sand filter, this practice is an off-line system that receives only the smaller water quality events. Underground sand filters are expensive to construct, but consume very little space. They are well suited to highly urbanized areas (see Figure PTP 08-2). The perimeter also includes the basic design elements of a sediment chamber and a filter bed. In this design, however, flow enters the system through grates, usually at the edge of a parking lot. The perimeter sand filter is the only filtering option that is online, with all flows entering the system, but larger events bypassing treatment by entering an overflow chamber. One major advantage to the perimeter sand filter design is that it requires little hydraulic head, and thus is a good option in areas of low relief (See Figure PTP 08-3).

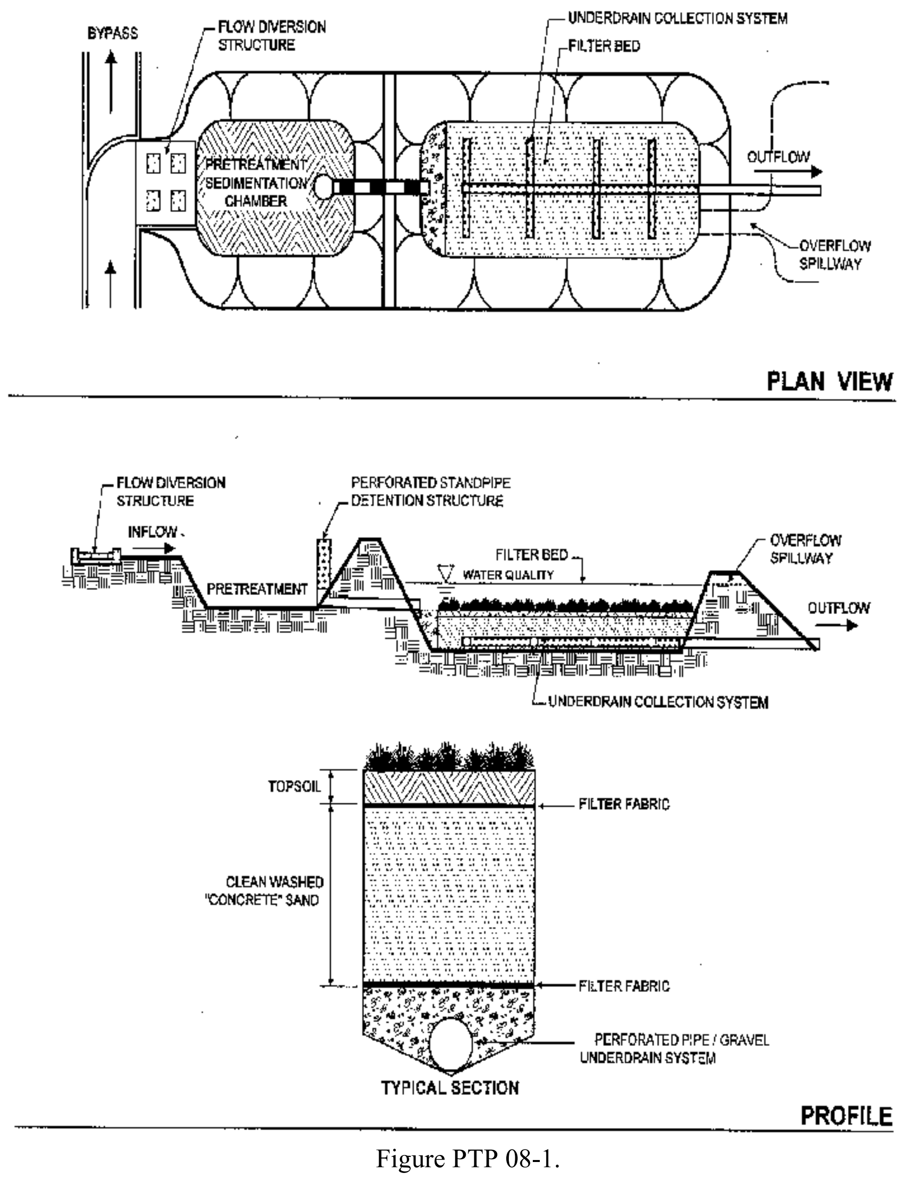


Figure PTP 08-1.
Surface Sand Filter

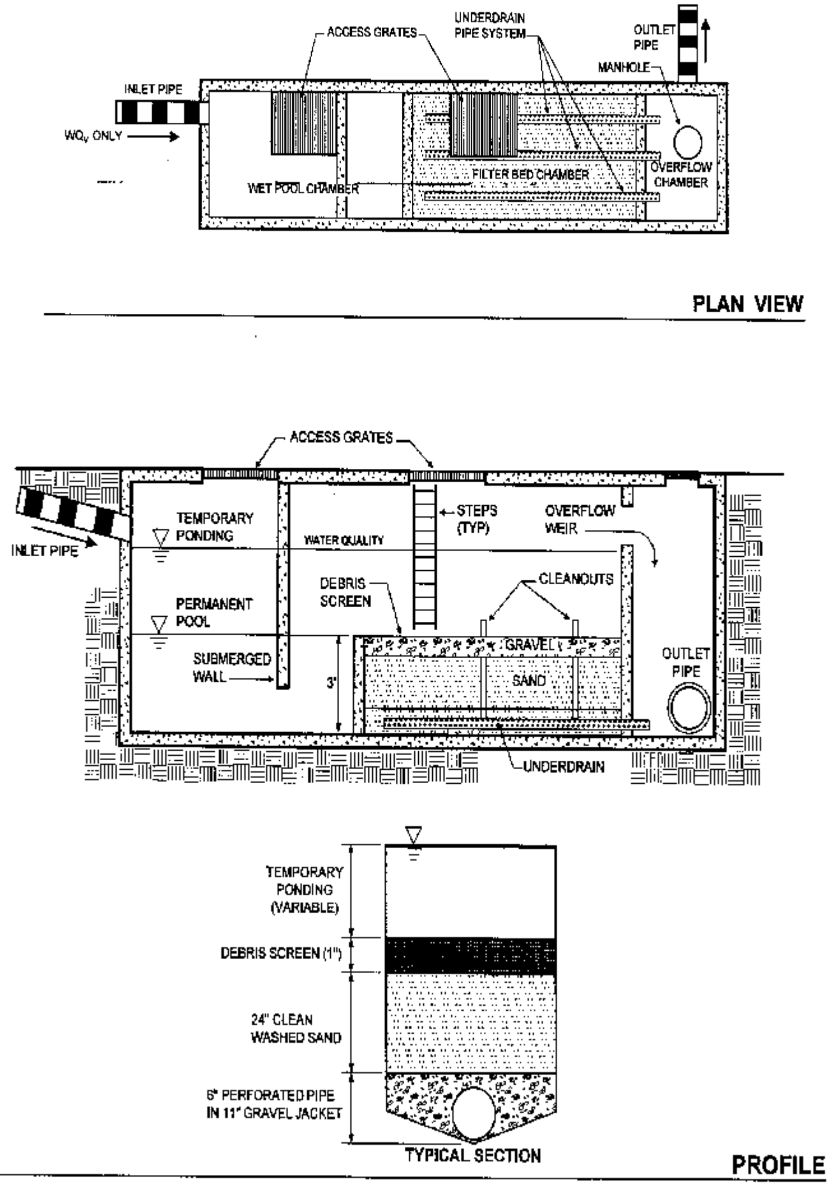


Figure PTP 08-2.
Underground Sand Filter

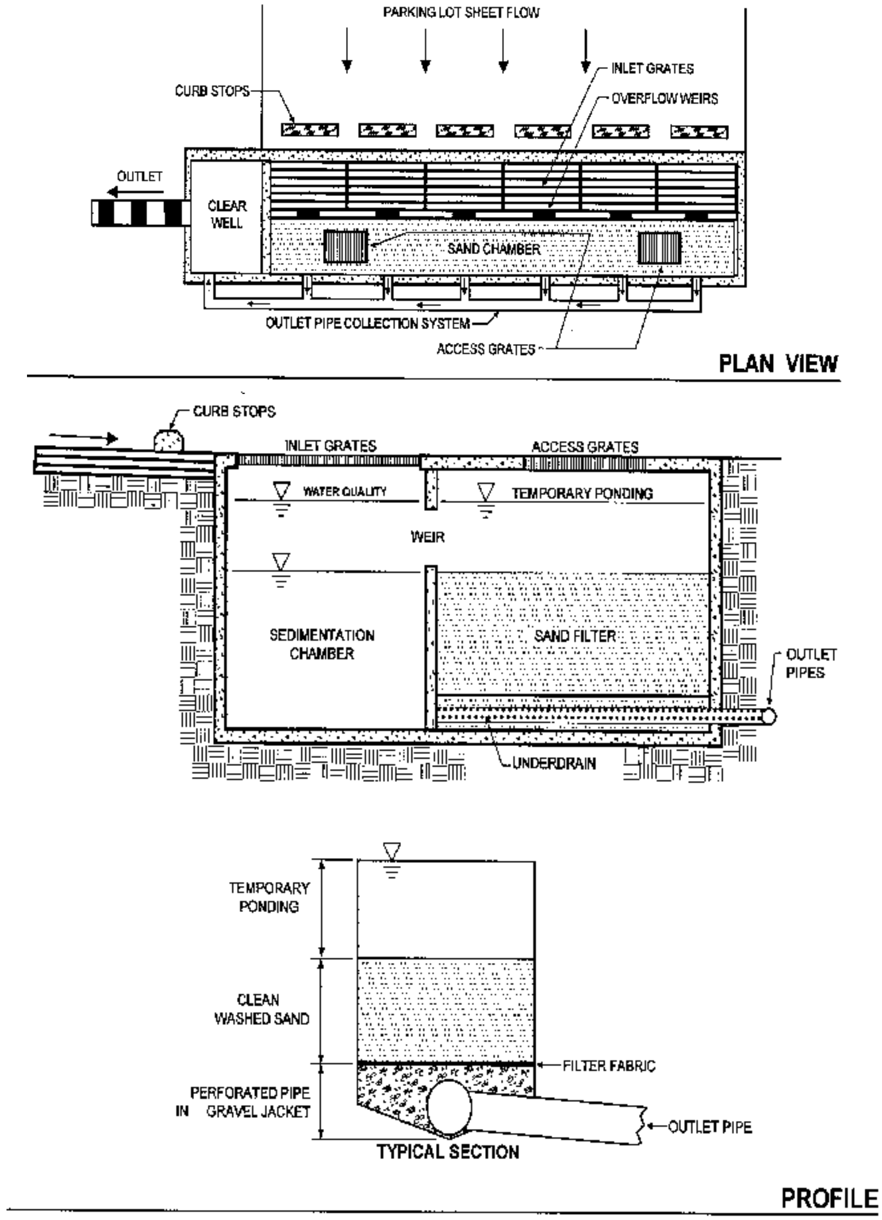


Figure PTP 08-3.
Perimeter Sand Filter

<table>
<tr><td>Applicability</td><td>

Well suited for impervious drainage areas with high total suspended solids, heavy metals and hydrocarbon loadings like roads, driveways, drive-up lanes, parking lots and urban areas.
Good options for ultra-urban areas and retrofit situations because they consume little space. Underground and perimeter sand filters are particularly well suited for ultra-urban watersheds as they consume no surface space.
Excellent option to treat runoff from stormwater hotspots (such as commercial nurseries, auto recycle facilities, commercial parking lots, fueling stations, fleet storage areas, industrial rooftops, marinas, outdoor container storage of liquids, outdoor loading/unloading facilities, public works storage areas, hazardous materials generators, vehicle service and maintenance areas, and vehicle and equipment washing/steam cleaning facilities) because stormwater treated by sand filters has no interaction with, and thus no potential to contaminate groundwater.
Not recommended for use in pervious drainage areas where high sediment loads and organic material can clog the sand bed.
Cannot treat a very large drainage area.

</td></tr>
<tr><td>Design Criteria</td><td>
Designers need to carefully consider conditions at the site level before using a sand or organic filter and should incorporate design features to improve the longevity and performance, as well as minimizing their maintenance burden.
Siting Considerations
Important considerations when selecting a sand or organic filter are the drainage area that needs treatment, the slopes at the location of the filter and draining to it, soil and subsurface conditions, and the depth of the seasonably high groundwater table. Although sand filters are highly versatile, some constraints, such as available head, may limit their use at individual sites.

Drainage Area: Sand filters are best applied on small sites (maximum of 5 acres for surface sand filters, and maximum of 2 acres for perimeter or underground filters) (CWP, 1998). Filters have been used on larger drainage areas in the past (up to 100 acres), but these systems often clog.
Slope: Sand filters can be used on sites with up to about 6% slopes. It is difficult to use sand filters in extremely flat terrain, as they require a significant drop in elevation (or head, about 5 to 8 ft) to allow runoff flow through the filter. One exception is the perimeter sand filter, which can be applied with as little as 2 ft of head.
Soils/Topography: Sand filters can be used on almost any soil, because they rely on a "made" soil for runoff treatment. They can be designed so that stormwater never infiltrates into the soil or interacts with the groundwater.
Groundwater: Designers should provide at least 2 ft of separation between the bottom of the filter and the seasonally high groundwater table. This prevents both structural damage to the filter and possible, groundwater contamination.

</td></tr>
</table>

	Design Considerations Specific filter designs vary considerably, depending on site constraints or preferences of the designer or community. There are some features, however, that should be incorporated into most designs. These design features can be divided into five basic categories: *pretreatment, treatment*, *conveyance*, *maintenance reduction*, and *landscaping* (for more information, see the Manual Builder Category for more information). 1. Pretreatment: Pretreatment is a critical component of any stormwater treatment practice. In sand filters, pretreatment is achieved by a sedimentation chamber that precedes the filter bed. In this chamber, the coarsest sediment particles settle out before they reach the filter bed. Pretreatment reduces the maintenance burden of sand filters by reducing the potential for clogging of the filter bed surface. Designers should provide at least 25% of the water quality volume in a dry or wet sedimentation chamber as pretreatment. The water quality volume is the amount of runoff that will be treated for pollutant removal in the practice. Typical water quality volumes are the runoff from a 1inch storm or 0.5 inch of runoff over the entire drainage area to the practice. 2. Treatment: Treatment design features help enhance the ability of a stormwater treatment practice to remove pollutants. In filters, designers should incorporate the following features to improve the treatment ability of a practice. In filtering systems, designers should provide at least 75% of the water quality volume in the practice (including both the sand chamber and the sediment chamber). In sand filters, designers should select a medium sand as the filtering medium. 3. Conveyance: Conveyance of stormwater runoff into and through a stormwater treatment practice is a critical element of design. Stormwater should be conveyed to and from practices safely and to minimize erosion potential. Typically, filtering practices are designed as "off-line" systems, meaning that they only have the smaller water quality volume diverted to them during larger storms, using a flow splitter, which is a structure that bypasses larger flows to the storm drain system, or to a stabilized channel. One exception is the perimeter filter; in this design, all flows enter the system, but larger flows overflow to an outlet chamber, and are not treated by the practice. Most filtering practices are designed with an underdrain below the filtering bed. An underdrain is a perforated pipe system in a gravel bed, installed on the bottom of filtering practices, and used to collect and remove filtered runoff.
Maintenance	In addition to regular maintenance activities needed to maintain the function of stormwater practices, some design features can be incorporated to ease the maintenance burden of each practice. Designers should provide maintenance access to the filtering system. In underground sand filters, OSHA confined space rules need to be addressed. Landscaping Landscaping can add to both the aesthetic value and treatment ability of stormwater practices. In sand filters, little landscaping is generally used on the practice

	although surface sand filters and organic media filters may be designed with a grass cover on the surface of the filter. In all filters, designers need to ensure that the contributing drainage has dense vegetation to reduce sediment loads to the practice. Design Variations As mentioned previously in this fact sheet, there are four basic stormwater filter designs, including: surface sand filter, underground filter, perimeter filter (also known as the "Delaware" filter), and the organic media filter. Other design variations can incorporate design features to recharge groundwater, or meet the design challenges of cold or arid climates. For more information, see *Developments in Sand Filter Technology to Treat Stormwater Runoff*, Article 105 and *Stormwater Strategies for Arid and Semiarid Watersheds*, Article 381 in The Practice of Watershed Protection.
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PTP-09 Porous Pavement

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-09
	Activity: Porous Pavement	

Planning Considerations

Design Life:	Semi-permanent
Acreage Needed:	Low to Moderate
Estimated Unit Cost:	Low
Maintenance:	High

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◇

BMP Type: INFILT/PEAK VOL

◇	Sediment	◇	Oxygen Demanding Substances	◇	Bacteria & Viruses
◇	Heavy Metals	◇	Toxic Materials	◇	Floatable Materials
◇	Nutrients	◇	Oil& Grease	◈	Volume

Description

Porous pavement is a permeable pavement surface with an underlying stone reservoir that temporarily stores surface runoff before infiltrating into the subsoil. This porous surface replaces traditional pavement, allowing parking lot runoff to infiltrate directly into the soil and receive water quality treatment. There are several pavement options, including porous asphalt, pervious concrete, and grass pavers. Porous asphalt and pervious concrete appear the same as traditional pavement from the surface, but are manufactured without "fine" materials, and incorporate void spaces to allow infiltration. Grass pavers are concrete interlocking blocks or synthetic fibrous grid systems with open areas designed to allow grass to grow within the void areas. Other alternative paving surfaces can help reduce the runoff from paved areas but do not incorporate the stone trench for temporary storage below the pavement. While porous pavement has the potential to be a highly effective treatment practice, maintenance has been a concern in past applications of the practice.

Applicability

- The ideal application is to treat a low traffic or overflow parking area.
- Some application on highways as a surface layer to reduce hydroplaning.
- In cold climates, care must be taking when applying sand or salt, as sand can clog the surface material and chlorides from salt will migrate into the groundwater.
- Porous pavement should not be applied to stormwater hotspots (such as commercial nurseries, auto recycle facilities, commercial parking lots, fueling stations, fleet storage areas, industrial rooftops, marinas, outdoor container storage of liquids, outdoor loading/unloading facilities, public works storage

	areas, hazardous materials generators), vehicle service and maintenance areas, and vehicle and equipment washing/steam cleaning facilities) due to potential groundwater contamination. ➢ Porous pavement can help reduce the increased temperature commonly associated with increased impervious cover by allowing rapid infiltration of rainfall. This is particularly useful for temperature sensitive waterbodies.
Design Criteria	Porous pavement sites need to meet the following criteria: ➢ Soils need to have a permeability between 0.5 and 3.0 inches per hour. ➢ The bottom of the stone reservoir should be completely flat so that infiltrated runoff will be able to infiltrate through the entire surface. ➢ Porous pavement should be located at least 2 to 5 ft above the seasonally high groundwater table, and at least 100 ft away from drinking water wells. ➢ Porous pavement should be located only on low traffic or overflow parking areas, which are expected to be not sanded during wintertime conditions. Five basic features should be incorporated into all porous pavement practices: *pretreatment, treatment*, *conveyance*, and *landscaping.* Pretreatment In most porous pavement designs, the pavement itself acts as pretreatment to the stone reservoir below. Because the surface serves this purpose, frequent maintenance of the pavement surface is critical to prevent clogging. Another pretreatment element is a fine gravel layer above the coarse gravel treatment reservoir. The effectiveness of both of these pretreatment measures are marginal, which is one reason frequent vacuum sweeping is needed to keep the surface clean. One design option incorporates an "overflow edge," which is a trench surrounding the edge of the pavement. The trench connects to the stone reservoir below the surface of the pavement. Although this feature does not in itself reduce maintenance requirements, it acts as a backup in case the surface clogs. If the surface clogs, stormwater will flow over the surface and into the trench, where some infiltration and treatment will occur. Treatment The stone reservoir below the pavement surface should be composed of layers of small stone directly below the pavement surface, and the stone bed below the permeable surface should be sized to attenuate storm flows for the storm event to be treated. Typically, porous pavement is sized to treat a small event, such as the *water quality storm* (i.e., the storm that will be treated for pollutant removal), which can range from 0.5 inch to 1.5 inches. Conveyance Water is conveyed to the stone reservoir through the surface of the pavement, and infiltrates into the ground through the bottom of this stone reservoir. A geosynthetic liner and sand layer should be placed below the stone reservoir to prevent preferential flow paths and to maintain a flat bottom. Designs also need some method to convey larger storms to the storm drain system. One option is to set storm drain inlets slightly above the surface elevation of the pavement. This allows for

<table>
<tr><td></td><td>temporary ponding above the surface if the surface clogs, but bypasses larger flows that are too large to be treated by the system.

Landscaping

The most important landscaping objective for porous pavements is to ensure that its drainage area is fully stabilized, thereby preventing sediment loads from clogging the pavement.</td></tr>
<tr><td>Maintenance</td><td>Porous pavement requires extensive maintenance compared with other practices. The main reason porous pavement fails is lack of proper maintenance. Typical requirements are listed in Table PTP 09-1.

<table>
<tr><th colspan="2">Table PTP 09-1. Typical Maintenance Activities for Porous Pavement
(Source: WMI, 1997)</th></tr>
<tr><th>Activity</th><th>Schedule</th></tr>
<tr><td>• Avoid sealing or repaving with non-porous materials</td><td>N/A</td></tr>
<tr><td>• Ensure that paving area is clean of debris
• Ensure that paving dewaters between storms
• Ensure that the area is clean of sediments</td><td>Monthly</td></tr>
<tr><td>• Mow upland and adjacent areas, and seed bare areas
• Vacuum sweep frequently to keep the surface free of sediment
• (Typically three to four times per year)</td><td>As needed</td></tr>
<tr><td>• Inspect the surface for deterioration or spalling</td><td>Annual</td></tr>
</table>

Several studies indicate that, with proper maintenance, porous pavement can retain its permeability (e.g., Goforth et al., 1983; Gburek and Urban, 1980; Hossain and Scofield, 1991). However, when porous pavement has been implemented in communities, the failure rate has been as high as 75% over 2 years (Galli, 1992).</td></tr>
<tr><td>Cost Considerations</td><td>Porous pavement is significantly more expensive than traditional asphalt. While traditional asphalt is approximately 50¢ to $1.00 per square foot, porous pavement can range from $2 to $3 per square foot, depending on the design (CWP, 1998; Schueler, 1987). Subtracting the cost of traditional pavement, this amounts to approximately $45,000 and $100,000 per impervious acre treated. On the other hand, porous pavement can create savings in terms of storm drain costs and land consumption. In addition, the cost of vacuum sweeping may be substantial if a community does not already perform vacuum sweeping operations.</td></tr>
<tr><td>References</td><td>Cahill Associates. 1993. Stormwater Management Systems: Porous Pavement with Underground Recharge Beds. West Chester, PA

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Center for Watershed Protection (CWP). 1997. Stormwater BMP Design Supplement for Cold Climates. Prepared for: US EPA Office of Wetlands, Oceans and Watersheds. Washington, DC.</td></tr>
</table>

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PTP-10 Irrigation

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-10
	Activity: Irrigation and Soil Testing	

Planning Considerations	
Design Life:	Permanent
Acreage Needed:	Low to Moderate
Estimated Unit Cost:	Low
Maintenance:	Routine: At Least Annually
Non-Routine:	Every 10-15 years
BMP Type:	PEAK/VOL

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

♦	Sediment	◊	Oxygen Demanding Substances	♦	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	♦	Floatable Materials
♦	Nutrients	◊	Oil& Grease	♦	Volume

Description	Irrigation is defined as the usage of supplemental water to a landscape to support plant growth via supplying moisture as well as nutrient transport from soil to a plant. The practice of irrigation can become wasteful and impact waterbodies downstream if practiced imprudently, however, providing the proper amount of water needed by a plant at the correct time can conserve resources and reduce pollutant loading while optimizing plant growth. The purpose of irrigation BMPs is to utilize available stormwater runoff to avoid the use of potable sources, and to meet any required volume control or water quality standards. The best irrigation BMP for a given location is dependent on soil, rainfall and environmental characteristics, however all BMPs should help maintain healthy, functional landscapes and downstream water bodies.
Applicability	➢ Turf and landscaping. Make use of native landscape plants for the Low Country that are wet and dry tolerant. Agricultural practices.
Design	➢ Site specific (location, soils, landscape vegetation, water supply and quality). ➢ Must meet site's stormwater volume water requirements while remaining flexible enough to adapt to various water demands needs of the landscaping. ➢ Design operation pressure must not be greater than the source pressure and must account for peak use times and supply line pressures for entire planned system. ➢ Design for optimum uniform coverage. Generally, the first and last distribution device should not have more than a 10 percent

	difference in flow rate. ➢ Areas with different plant coverage should be zoned separately based on plant water requirements. ➢ Design package should come with an irrigation schedule with recommendations for local conditions. ➢ Design with rain shut-off devices and backflow prevention. ➢ Design water conveyance systems with thrust blocks and air release valves; flow velocity should be 5 ft. per second. ➢ Design pipes with appropriate pressure to maximize irrigation uniformity. ➢ Use pressure regulating or compensating equipment when pressure exceeds manufacturer's recommendations. ➢ Use check valves in low areas to prevent low head drainage. ➢ Avoid irrigation of non-planted areas. ➢ Metering Device to measure usage for reporting to the county. ➢ Irrigation systems should be used in conjunction with vegetated/filtration BMP's upstream and the remaining balance can then be dissipated through irrigation. ➢ No irrigation system shall be placed within 50 ft of a natural creek, marsh or estuary where soils and/or grade will allow such irrigation water to flow or migrate to such a natural creek, marsh or estuary. ➢ Appropriate soils testing including infiltration rates, profiles, presence of limiting zones or water tables, and ability of the soil to handle the design irrigation rates must be submitted with the design. Irrigation shall not be used as a primary control in areas where the soils have been classified under the SCS Hydrologic Soils Classification as Types C and D (impervious) or A/D, B/D, and C/D (high groundwater table areas). Application rate must not exceed soil retention ability during any one application. ➢ Total volume of detained stormwater for irrigation must be used within a 14-day period from the end of the rain event. ➢ Irrigation systems for both existing and future development on a site must be designed to show that the total volume of detained stormwater will be utilized within the required 14-day period by dividing the total ground area used for infiltration by the total volume of stormwater detained, and applying the infiltration rates from soils testing. ➢ Irrigation design will include proposed irrigation rate and specify number of days after a rain event before irrigation commences.
Installation & Maintenance	➢ Installation o Installed according to design specifications, codes and standards, and only by qualified specialists. o Construction must be consistent with design. o Get approval from designer before making design changes. o Construction and materials must meet standards and criteria. o Flag all underground cables, pipes and other obstacles. o As-built infiltration rates of soils as constructed must be determined to

	show compliance with design criteria. o Provide owner with copy of the as-built plans, operating manuals, warranties, and written instructions. o After construction, site must be cleaned of construction materials. o All irrigation systems must be automated and approved by Engineer of Record. ➢ Management and maintenance o Weekly, visual inspection to identify broken sprinklers heads, leaks and other malfunctions. o Replace worn and broken components and ensure replaced parts have same characteristics as original pieces. o Check application and distribution efficiencies annually. o Develop preventative management plan to replace worn components before they cause water quality/use issues. o Monthly and Annual documentation of volumes of water used to demonstrate compliance with design volume criteria.

References:
Irrigation Association and American Society of Irrigation Consultants. 2014. 2014 Landscape Irrigation Best Management Practices. Obtained online from <https://www.irrigation.org/landscapebmps/>

Florida Department of Environmental Protection. 2002. Florida Green Industries: Best Management Practices for Protection of Water Resources in Florida. Obtained online from http://www.sfwmd.gov/portal/page/portal/xrepository/sfwmd_repository_pdf/fl_green_bmp.pdf

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PTP-11 Green Roofs

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-11
	Activity: Green Roofs	

Planning Considerations

- Design Life: Semi-permanent
- Acreage Needed: Low
- Estimated Unit Cost: High
- Maintenance: Low

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

BMP Type: PEAK VOL/VEG

◊	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◈	Floatable Materials
♦	Nutrients	◊	Oil& Grease	♦	Volume

Description

A green roof is a planted roof top that can provide the benefits of water harvesting, stormwater management, pollution abatement, energy conservation and aesthetic value. Green roofs vary in plant types, depth of growing media, infrastructure and intended use, however in general, they reduce total stormwater runoff, dampen peak flows, improve building insulation properties, reduce heat island effects and extend the expected life of the roof's base material.

Green roofs can be categorized into two group: extensive and intensive. Extensive green roofs have shallow growing media (<6-inch depth) and are lightweight (approximately 35 lb./ft^2) used to cover large rooftops. These require minimal maintenance. Intensive green roofs use deeper media (>6 inches) and often include small trees and shrubs, creating a "rooftop garden". These are often more expensive and require more maintenance. Their heavier weight (approximately 50-300 lb/ft^2) must be considered in the design.

Applicability

- Green roofs are applicable to commercial, industrial and residential buildings alike.

Design Criteria

Extensive and intensive green roofs require a minimum slope of 2% to allow for proper drainage. Slopes less than 2% may need additional drainage measures to avoid water logging and root rot. Additional requirements, lightweight growth

	media, good waterproofing, additional structural support, optional rainwater harvesting and the use of drought/heat tolerant plants. Components of green roofs include: waterproofing membranes; insulation; root barrier to protect the membrane (made of gravel, impervious concrete, PVC, etc.); a drainage system; filter cloth (polyester fiber mats, polypropylene mats, etc.); growing medium consisting of inorganic matter (slate, pumice, vermiculite, volcanic rock, etc.), organic material (straw, peat, wood, grass, sawdust, etc.); and plants. Plants requiring minimal or no inputs (water, fertilizers) after their establishment should be selected for use. Plants preferring full sunlight, having shallow root systems and drought and cold tolerant should be selected, using native plants as much as possible. Succulents tend to do well, particularly the varieties of sedums.
Maintenance	Generally green roofs do not need much maintenance. Usually they will need annual or bi-annual check-ups to pull weeds and make sure plants are healthy. Except during the plant establishment period, extensive green roofs are not usually irrigated.
References	University of Florida (2008) Florida Field Guide to Low Impact Development: Green Roofs/Eco-Roofs. Program for resource Efficient Communities. Pennsylvania State University (2016) Green Roofs. PennState Extension.

PTP-12 Blue Roofs

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-12
	Activity: Blue Roofs	

Planning Considerations

Design Life:	Permanent
Acreage Needed:	Low
Estimated Unit Cost:	Low
Maintenance:	Low

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

BMP Type: PEAK/VOL

◊	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◊	Floatable Materials
◊	Nutrients	◊	Oil& Grease	◈	Volume

Description

Blue roofs, also known as rooftop detention systems, serve as a rooftop storage designed to reduce runoff peaks and volumes. Captured stormwater, up to the design depth, is held on the rooftop until the water either evaporates or is slowly metered out via flow restriction valves. With sufficient waterproofing, blue roofs can be implemented on existing structures, given that the roof and building are of sufficient structural integrity to support the weight for the ponded water. As blue roofs lack vegetation, they require significantly less maintenance than green or brown roofs. *Note: Blue roofs should not be designed to hold standing water longer than 96 hours in order to mitigate vector hazards.*

Applicability

- Blue roofs can be applied to multi-family residential, commercial, or institutional land uses such as rooftops and decks above building structures (e.g., parking structures, outdoor eating area roofs, or storage facilities).
- Building structure must be adequate to support the additional weight of the retained water.
- Roof slope must be flat.

Design Criteria

- A licensed structural engineer should be consulted regarding the weight-bearing capacity of the structure prior to design. Retrofit may be required.
- Blue roof discharges must be treated by an acceptable biotreatment BMP.

	➢ A drain pipe (gutter) is required to convey runoff safely from the roof. ➢ A waterproof membrane, preventing the retained water from penetrating and damaging the roofing material, should be used. There are many materials available for this purpose; they come in various forms (i.e., rolls, sheets, liquid) and exhibit different characteristics (e.g., flexibility, strength, etc.). ➢ Unless covered, the maximum detention time should comply with all local, State, and Federal regulations. Maximum hold time is typically 72 hours to prevent the breeding of mosquitoes. ➢ Over time, rooftop vegetation may sprout by means of windblown sediment and seeds, especially in a dusty, windy environment. Roof drains should be inspected for clogging, as this may adversely affect downstream BMPs. ➢ Used as a first unit within a treatment train, the captured flows could be metered to a planter box, rain garden, infiltration gallery, or, if the site is not conducive for infiltration, potentially to a cistern or underground detention area for onsite rainwater use.

PTP-13 Rain Barrels

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-13
	Activity: Rain Barrels	

Planning Considerations
- Design Life: Semi-permanent
- Acreage Needed: Low
- Estimated Unit Cost: Low
- Maintenance: Low

Target Pollutants

Significant ♦ Partial ◈ Low or Unknown ◊

BMP Type: PEAK/VOL

◊	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
◊	Heavy Metals	◊	Toxic Materials	◈	Floatable Materials
◊	Nutrients	◊	Oil& Grease	♦	Volume

Description

Rain barrels are above-ground storage containers used to capture runoff from rooftops and temporarily store it for uses such as irrigation of lawns and gardens. Rain barrels are not for storing drinking water or water for use inside a home. By capturing water from downspouts that may otherwise discharge onto a paved surface, rain barrels can reduce the amount of runoff and pollutants reaching local streams. Typical components of a rain barrel include a hose connection at the outlet, a screen trap to filter out downspout debris at the inlet, and an overflow outlet. A range of materials, designs, and colors are available.

Using a rain barrel can provide a free water source for gardens and lawns, reducing use of potable water for exterior uses. The water can also be used for car washing. According to the Maryland Department of Natural Resources, rain barrels can save a homeowner 1,300 gallons of water during peak summer months. The collected water can be used any time, even during periods of city- or County-imposed water restrictions.

Rainwater is naturally soft, oxygenated, and devoid of chlorine, so it can help improve the health of gardens, lawns and trees. However, water collected in or draining from a rain barrel is not suitable for drinking because it may contain roof debris with high levels of bacteria or other pollutants. The collected rainwater can be used to water vegetable gardens, but fruits and vegetables must be washed with tap water before eating or cooking them.

Rainwater from downspouts often drains onto driveways, sidewalks, or other

	paved (impervious) surfaces and is not able to soak into the ground. Water rushing over these hard surfaces (runoff) picks up pollutants along the way. Eventually, the runoff flows into storm drains, which, in turn, empty directly into local streams. A surge of polluted water entering streams can cause flash flooding and erosion, lower water quality, and harm fish habitat. By installing one or several rain barrels, the amount of stormwater runoff from property can be reduced, allowing more of the water to soak into the ground. When homeowners install rain barrels, it can help replenish groundwater, minimize flash flooding, improve fish habitat, and reduce water pollution and stream erosion.
Applicability	➢ Rain barrels are a good option for homes and buildings with downspouts that discharge onto driveways, sidewalks, and other paved surfaces or steep slopes. ➢ They are also good for homes with lawns, gardens or other landscaping that requires frequent watering.
Design Criteria	The size and number of rain barrels needed for a particular downspout depends on the area (square footage) of the portion of the roof draining into the downspout. Roof area can be calculated by multiplying the length by the width. Note: The slope of the roof does not affect the calculation of roof area draining into a downspout. According to the Low Impact Development Center, rain barrel volume can be determined, for any given rainfall, using the following general equation: rain barrel volume (in gallons) = roof surface area (in square feet) x rainfall amount (in feet) x 0.90 x 7.5 gallons/cubic foot. A rain barrel calculator is available at www.tylertork.com/diyrainbarrels/calculator.html. Multiple rain barrels can be installed (in series) to a single downspout. A single rain barrel can be connected to several leaders draining different portions of a roof. Locate each rain barrel on a stable, flat surface near the downspout that will be connected to the rain barrel. The barrel should be elevated on cinder blocks or a platform, so that gravity can deliver flow to the area to be watered and to make hose attachment easier. When a rain barrel fills to capacity during large storms, it discharges through an overflow outlet. To prevent damage to the building foundation, the overflow outlet should be directed to a safe location away from the building foundation or to a drain pipe. Rain barrels work well with most other stormwater reduction techniques, such as rain gardens, green roofs, and urban tree canopies. But remember that placing a rain barrel at a downspout that empties into a rain garden may reduce the amount of water that is available to maintain the rain garden plant community.
Maintenance	Rain barrels require periodic maintenance. Drain them after each significant rainfall from April to November. As a general rule, empty the rain barrel every 5 to 7 days. Clean the rain barrel periodically and inspect it for clogs and leaks. If mosquitoes are suspected, a fine mesh screen fitted on the lid of the rain barrel will prevent mosquitoes from gaining access and laying eggs. Remove leaves and other debris from the filter screen and ensure that it is not damaged and is securely fastened. Unless designed for freezing temperatures, the rain barrel should be disconnected and drained in the fall or winter, before the first frost, and stored

	upside-down in a protected location to avoid damage.
Costs	Compared with some of the other stormwater reduction techniques, rain barrels are relatively inexpensive, ranging from less than $50 to as much as $250, depending on whether it is a unique creation or a commercially made barrel.
References	Department of Environmental Resources, Prince Georges County, Maryland.

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PTP-14 Innovative Technology BMPs

	Beaufort County, South Carolina Stormwater Best Management Practices (BMPs) Post-Construction Control Practices (PTPs)	PTP-14
	Activity: Innovative Technology BMPs	

Planning Considerations	
Design Life:	
Semi-permanent	
Acreage Needed:	
Low to Moderate	
Estimated Unit Cost:	
Low	
Maintenance:	
Annually	

	Target Pollutants					
BMP Type: VARIOUS	Significant ♦ Partial ◊ Low or Unknown ◊					
	♦	Sediment	◊	Oxygen Demanding Substances	◊	Bacteria & Viruses
	◊	Heavy Metals	◊	Toxic Materials	◆	Floatable Materials
	♦	Nutrients	◆	Oil& Grease	◊	Volume

Description	Innovative technology BMPs are commercially constructed BMPs that can be used to treat stormwater from relatively small development sites. Table PTP 14-1 lists some of the BMPs that are currently available. A more comprehensive list can be found at the EPA New England's Center for Environmental Industry and Technology (CEIT) website (http://www.epa.gov/region1/assistance/ceitts/stormwater/techs.html). The table includes manufacturer information that can be used to obtain further information on particular devices. The BMPs use varying methods to remove pollutants. Some strictly use swirl concentrator technology to remove only sediment and particulate pollutants. Others use filter media, or constructed wetlands to remove soluble as well as particulate pollutants.

Table PTP 14-1 List of Innovative Technology BMPs

Treatment System	Treatment Processes	Manufacturer/Company
Arkal Filtration System	2-stage filtration system	Zeta Technology Stuart, FL www.zetatechnology.com
Aqua-Filter Stormwater Filtration System	Swirl concentrator followed by media filtration	Aquashield, Inc. Hixton, TN www.aquashieldinc.com
Aqua-Swirl Concentrator	Swirl concentrator	Aquashield, Inc. Hixton, TN www.aquashieldinc.com
Baysaver	Gravity sedimentation and flotation	BaySaver Inc. Mount Airy, MD www.baysaver.com
Downstream Defender	Swirl concentrator	Hydro International Portland, ME www.hydro-international.biz
Filterra	Bioretention/Filtration System	Amercast Ashland, VA www.filterra.com
FloGard	Dual Vortex Hydrodynamic Separator	Kristar Enterprises, Inc. Santa Rosa, CA www.kristar.com
HydroKleen	Multi-media filtration	Hydro Compliance Management, Inc. Ann Arbor, MI
Stormceptor	Swirl concentrator	CSR New England Pipe Westfield, MA www.csrstormceptor.com
StormFilter	Mechanical filtration, ion exchange, adsorption	Stormwater Management, Inc. Portland, OR www.stormwaterinc.com
StormTreat	Sedimentation followed by filtration, adsorption and biochemical reactions in constructed wetland	StormTreat Systems Inc. Sandwich, MA www.stormtreat.com
UltraUrban Filter	Media filtration	UltraTech International, Inc. Jacksonville, FL www.spillcontainment.com
Vortechs Stormwater Treatment System	Swirl concentrator	Vortechnics, Inc. Scarborough, MA www.vortechnics.com
VB21 Stormwater Treatment System	Swirl concentrator	Environment 21, LLC East Pembroke, NY www.env21.com

Applicability

- Appropriate for developments of less than 10 acres.
- The swirl concentrator BMPs and sedimentation/media filtration devices will typically not meet the anti-degradation standard without supplemental pre-treatment BMPs and/or dedicated open space, because they are not effective at removing fecal coliform bacteria.
- The sedimentation/constructed wetland devices are capable of meeting the anti-degradation standard even at high levels of site imperviousness. However, multiple units will be required to treat site runoff because of the low treatment rate associated with the sedimentation/constructed wetland device.

	➢ In general, the only site constraint for the innovative technology BMPs is the head required between inflow and outflow. This is generally in the range of 1 ft to 3 ft. ➢ Innovative technique BMPs are exclusively used as water quality controls for small development projects. It would not be cost-effective to use these devices to achieve required flooding/erosion control performance standards. ➢ The innovative technique BMP should be sited to control at least 80% of the development site area. Multiple facilities are likely to be required on a development site to achieve 80% coverage. Supplemental pre-treatment BMPs and/or dedicated open space may be required if the facilities alone cannot achieve the anti-degradation water quality goal.
Design Criteria	Because the innovative technique BMPs are commercially constructed units, there is a limited number of design criteria. The key criteria for the units are the treatment rate and the required storage volume. For the swirl concentrator and sedimentation/filtration units, the units should be selected so that the treatment rate of the units is 260 gallons per minute (gpm) or more per impervious acre of drainage, which is equivalent to 0.6 cfs or more per impervious acre of drainage. No storage volume is required for a treatment rate of 260 gpm per impervious acre or more. For the sedimentation/constructed wetland unit, the minimum recommended treatment rate is 20 gpm per impervious acre of drainage.
Maintenance	In order to provide effective stormwater pollution control on a continuing basis, periodic maintenance of the innovative technique BMP is necessary. Routine maintenance requirements are typically specified by the manufacturer. Most of the manufacturers suggest annual removal of accumulated sediment and removal/replacement of filtration media as necessary, though actual maintenance frequency can be evaluated based on inspections in the initial year of operation. Non-routine maintenance would generally be limited to replacement of the units or unit components due to structural failure. Based on manufacturer information, the useful life of these units may be 30 to 100 years.

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5.6 Post-Construction Stormwater BMP Design Review Process

The Post Construction Stormwater Design Process will include review of all submitted documents, reports, plans, checklists and applications by the Stormwater manager for compliance with this manual and appropriate Stormwater Ordinances. Appendix B contains a flow chart defining this process.

Required documentation for a Post-Construction Stormwater Management Plan is outlined in the Checklists in Appendix B. These Checklists cover both an initial Conceptual Sketch of the property to work out initial requirements and permitting needed and a Final Design process to include all information and specifications required for construction, and all required easements and documentation for ongoing Operations and Maintenance of the designed BMPs.

The Stormwater Manager will set fees for this application and process, and they will be available in a Fee Schedule which will be revised from time to time. These fees cover completeness review and initial technical review of the plans. Review of the original submission and one revision is included in this fee. Should multiple revisions and resubmissions be required, additional fees may be charged. Current fees and application are located in Appendix D.

Upon approval and issuance of a Stormwater Permit, construction may begin. No construction is permitted until issuance of Stormwater Permit by the Stormwater Manager.

5.7 Permanent BMP Maintenance (Maintenance Agreement)

A sample BMP Maintenance Agreement is located in Appendix E. All projects will be required to execute an appropriate Permanent O&M Agreement. These will be recorded in the Register of Deeds office and be legal covenants attached to the land. The O&M agreement shall:

1. Require the owner or owners to maintain, repair and, if necessary, reconstruct the structural BMP.

2. State the terms, conditions, and schedule of maintenance for the structural BMP.

3. Grant to the County a right of entry in the event that the Stormwater Department has reasons to believe it has become necessary to inspect, monitor, maintain, repair, or reconstruct the structural BMP. However, in no case shall the right of entry, of itself, confer an obligation on the County to assume responsibility for the structural BMP.

4. Allow the County to recover from the property or homeowners association and its members any and all costs the County expends to maintain or repair the

structural BMPs or to correct any operational deficiencies. Failure to pay the County all of its expended costs, after forty-five (45) days written notice, shall constitute a breach of the agreement. The County shall thereafter be entitled to bring an action against the association and its members to pay, or foreclose upon the lien hereby authorized by the agreement against the property, or both, in case of a deficiency. Interest, collection costs, and attorney fees shall be added to the recovery.

5. Provide a statement that this agreement shall not obligate the County to maintain or repair any structural BMPs, and the County shall not be liable to any person for the condition or operation of structural BMPs.

6. Provide a statement that this agreement shall not in any way diminish, limit, or restrict the right of the County to enforce any of its ordinances as authorized by law.

7. Contain a provision indemnifying and holding harmless the County for any costs and injuries arising from or related to the structural BMPs, unless the County has agreed in writing to assume the maintenance responsibility for the structural BMPs and accepted dedication of all rights necessary to carry out that maintenance.

Section 6
Municipal Facilities Spill Prevention, Enforcement and Good Housekeeping

6.1 Introduction

This Standard Operation Procedure (SOP) for MS4 Minimal Control Measure (MCM) 6 Pollution Prevention and Good Housekeeping, documents the activities of the Beaufort County, South Carolina, to operate its MS4 program for:

- Prevention or reduction of the amount of stormwater pollution generated by municipal operations and conveyed into receiving waters and streams
- Training employees on how to incorporate pollution prevention/good housekeeping techniques into municipal operations
- Identification of appropriate control measures and measurable goals for preventing or reducing the amount of stormwater pollution generated by municipal operations.

The following plan provides information and guidance necessary to accomplish these tasks and document the actions of the County. All municipal employees working within these facilities shall read this management plan and be familiar with its contents and requirements.

6.2 Pollution Prevention/Good Housekeeping

To address the contents of the SCR300000 NPDES stormwater permit requirements, this MCM is divided into the following subsections:

- Training and Education
- Municipal Facility Inventory and Assessment
- Storm Drainage System Maintenance Activities
- Flood Management
- Contractor Requirements and Oversight
- Reduction of Pollutants Related to Landscape Maintenance

6.3 Training and Education

Permit Training Requirements. Beaufort County will meet training requirements and ensure that each employee whose job is related to any one of the activities listed in this SOP (and supplemental training documents, from EPA and others, located in the Appendix F) is provided the opportunity for training each year, by:

- Providing at least one training day each year to educate all employees about the contents of this manual
- Offering training several times per year to provide new employees, and anyone who missed a training date, at the earliest possible date
- Documenting, by signature, that each employee received the opportunity for the

6.4 Municipality Facility and Inventory and Assessment

6.4.1 Development of a Municipal Facility and Stormwater Control Inventory

The County owns and maintains many buildings, parking lots, roads and other facilities that create stormwater runoff that contains various pollutants to surface waters. The following are examples of municipal facilities:

- County Administration building and parking lot
- Public works yards, including materials, equipment, vehicle storage wash areas and maintenance yards
- Pesticide storage facilities
- Street repair and maintenance sites
- Solid waste handling and transfer facilities
- Public buildings such as police stations, fire stations, etc.
- Public parking lots
- Municipally owned and/or maintained structural stormwater controls
- Landscape maintenance on municipal property
- Park and Recreation buildings, ball fields and swimming pools
- Mosquito Control facility.

An inventory of MS4 facilities that the County is responsible for is located in the Appendix F.

6.4.2 Mapping

All municipally owned or operated facilities and stormwater controls must be identified on a map. The map must identify the stormwater outfalls corresponding to each of the facilities as well as the receiving waters to which these facilities discharge. The map must be maintained and updated regularly. Beaufort County maintains a “real time” GIS mapping system that can be accessed by the website.

6.4.3 Categories of Common Stormwater Pollutants, Sources and Impacts

Table 6-1 provides a comprehensive summary of the most obvious pollutants that the county must find and implement methods to reduce their impact on water quality. This will give employees a handy reference to the common pollutants and their impact.

Table 6-1
Categories of Common Stormwater Pollutants, Sources and Impacts

Pollutant	Source	Impact
Sediment	Construction sites; eroding stream banks and lakeshores; winter sand and salt application; vehicle washing; agricultural sites.	Destruction of plant and fish habitat; transportation of attached oils, nutrients and other pollutants; increased maintenance costs, flooding.
Nutrients (phosphorus, nitrogen)	Fertilizers; malfunctioning septic systems; livestock, bird & pet waste; vehicle washing; grey water; decaying grass and leaves; sewer overflows; leaking trash containers, leaking sewer lines.	Increased potential for nuisance or toxic algal blooms; low levels of dissolved oxygen which can kill aquatic organisms.
Hydrocarbons (petroleum compounds)	Vehicle and equipment leaks; vehicle and equipment emissions; pesticides; fuel spills; equipment maintenance / cleaning; improper fuel storage & disposal.	Toxic to humans and aquatic life at low levels.
Heavy Metals (zinc, cadmium, copper, chromium, arsenic, lead)	Vehicle brake and tire wear; vehicle / equipment exhaust; batteries; galvanized metal; paint and wood preservatives; batteries; fuels; pesticides; cleaners.	Toxic at low levels; drinking water contamination.
Pathogens (Bacteria)	Livestock, bird and pet wastes; malfunctioning septic systems; sewer overflows; damaged sanitary lines.	Risk to human health leading to closure of swimming areas; drinking water contamination.
Toxic Chemicals	Pesticides; dioxins; PCBs; spills, illegal discharges and leaks.	Toxic to human and aquatic life at low levels.
Debris/Litter	Improper waste disposal and storage; leaking rubbish containers; cigarette butts; littering.	Potential risk to human and aquatic life, aesthetically displeasing

6.4.4 Water Quality Issues

Multiple issues may be found at any site depending on the use of that site. Examples of selected issues and possible water quality improvements include:

- Downspouts from roofs
  - Install green roof
  - Direct roof flow to rainwater harvesting facility
  - Direct roof flow to infiltration to supplement groundwater
  - Direct roof flow away from paved or dirt areas and toward a filtration area
- Paved surfaces, parking lots, wash and maintenance areas
  - Install storm drain inserts at existing surface inlets
  - Provide routine maintenance on storm drain inserts
  - Install pervious pavement where possible
  - Direct vehicle washwater to a filtration unit/area or sanitary sewer
  - Maintain fleet vehicles to prevent leaks (i.e., oil, radiator, etc.)
  - Perform maintenance procedures in locations where water pollution will not occur, i.e., in a building or under cover where fluids will not seep into ground
  - Pick up trash on a routine basis
- General site maintenance – Types of water quality pollutants include oils, litter, bird feces, metals, antifreeze, and spilled solids.
  - Maintain lot with routine trash pickup
  - Keep all facilities neat and orderly, minimizing pollutant sources
  - Keep all pesticides, herbicides, fertilizers, oils and similar materials covered where feasible, away from locations where runoff may occur
  - Use environmentally friendly products, soaps, cleaners, etc.

6.4.5 Lead by Example

It is important to show other commercial businesses what the County is doing for water quality. Examples include:

- Use public facility water quality improvements as a demonstration site for local businesses. The ability to see the improvement will help business owners understand what may be asked of them on their sites
- Sponsor an open house to show off a new project to the public
- Invite local businesses to offer incentives (i.e., discount on oil changes) for employees

6.5 Storm Drainage System Maintenance Activities

6.5.1 Storm Drainage System

The complete drainage system begins on roads, sidewalks, parking lots, grass swales, etc. These facilities collect stormwater, pollutants, nutrients, debris and other materials and transport these unwanted materials into the streams and surface waters. The most effective way to reduce pollution is to collect and remove it before it becomes a nuisance. That is the reason all aspects of the collection system must be addressed. It is much easier getting the debris off the road, or nutrients out of the swale, before it gets into the surface waters.

6.5.1.1 General Actions

General actions to improve the storm drainage system include:

- Develop a set of pollution prevention measures that will reduce pollutant discharge, including:
  - Look around for the source of sediment or other pollution.
  - Are there remedies or actions to take that would eliminate the recurrence of the problem?
  - Replace materials with more environmentally benign materials or methods (i.e., use mechanical methods versus herbicides, or use water-based paints or thermoplastics rather than solvent-based paints for pavement striping).
  - Change operations to minimize the exposure of pollutants to surface waters (i.e., mulch or compost grass clippings).
  - Dewatered and disposed all debris collected from cleaning in a landfill. If the material is found to be hazardous, it must be disposed of accordingly.

6.5.1.2 Catch Basin Maintenance

Publicly maintained yard drains, curb inlets, parking lot drains, surface inlets, etc. must be identified and scheduled for inspection, cleaning and repair, if necessary. The following steps should be taken, as appropriate:

- Inspect each catch basin
- Clean basins as necessary
- Dispose of debris appropriately
- Complete any required repairs
- Complete a log of cleaning/repair activities using the storm drainage maintenance form in Appendix F.

6.5.1.3 Culvert / Pipe / Headwall Maintenance

Culverts, pipes, headwalls, trash grates and other structures must be identified and scheduled for inspection, cleaning and repair, if necessary. The following steps should be taken, as appropriate:

- Inspection of each structure
- Clean structure as necessary
- Dispose of debris appropriately
- Complete any required repairs
- Complete a log of cleaning / repair activities using the storm drainage maintenance form in Appendix F.

6.5.1.4 Right-of-Way / Swale Maintenance

Ditches and swales in public rights-of-way convey runoff in many locations. Sediment, sand, leaves, excess vegetation and other debris periodically impedes the proper function of these drainageways and should be removed on a regular basis, sometimes annually. Erosion problems may also arise due to blockage or excess runoff. The following steps should be taken, as appropriate:

- Inspection of problem, i.e., erosion, sediment, etc.
- If ditch cleaning is necessary, complete the activity during low water periods, minimizing the disturbance of existing vegetation
- If vegetation is removed, seed and mulch the slopes as soon as possible
- Do not clean perennial streams with heavy equipment
- Make other repairs as necessary
- Dispose of debris appropriately
- Make improvements to erosion problems
- Make necessary embankment improvements
- Stabilize construction areas with seeding and mulching as soon as possible
- Complete a log of repair activities using the stormwater maintenance form in Appendix F.
- Complete a log of inspections and maintenance performed using the stormwater maintenance form in Appendix F.

6.5.1.5 Long-Term Stormwater BMPs

In addition to catch basins, pipes and outfalls, long-term control structures such as detention ponds, vegetated filter strips, grassed swales, wet ponds and constructed wetlands must be inspected and maintained. Recommended maintenance requirements are summarized in Fact sheet 5.5.

6.5.1.6 Street Sweeping and Cleaning

Street sweeping is important because it can catch trash, grit, and other debris before the material gets into the storm sewer system where it can cause blockages and flooding. Several important points to maintain a comprehensive and complete street sweeping program include:

- Implement a sweeping schedule
- Where sweeping is infeasible, other trash/litter control measures must be implemented.
- Sweeping equipment must be efficient and be operated properly to pick up trash
- Develop a procedure to dewater and dispose of collected waste.
- Schedules should be established to pick up accumulations of materials from leaf and debris cleanup
- Streets with higher traffic flow should be swept more often than lesser volume streets
- Implement training for sweeper personnel
- Generate and maintain a map that shows the street frequency
- Generate a log of all street sweeping activities

6.5.1.7 Implementation

Develop a schedule to implement pollution prevention measures.

- Prioritize the pollution sources, including exposures and funds available
    - Frequency of cleaning required
    - Located in a 303(d) impaired streams list watershed
    - Land uses with significant water quality impact (factories, etc.)
    - Funds available
- Develop a schedule for funding and implementation
    - Annual schedule based on:
        - Flooding potential
        - Water quality impairment
- Complete a log of all activities performed, including any changes in stormwater management practices.

6.6 Flood Management

6.6.1 Flood Management Projects

For all new flood management projects undertaken by Beaufort County, the staff/consultant shall be required to assess the water quality impacts of the design proposed for the project. At a minimum, the assessment should include:

- Review watershed to identify flow patterns, erosion problems, nutrient or other conditions, conflicts with sanitary sewers or other utilities
- Determine how the project will affect these findings, both during and after construction
- If there are impacts, look at refining the proposed project to either mitigate the impacts or to avoid any further damage to the watershed
- Ensure that the design requirements include meeting the approved Water-Quality Treatment Standards for Beaufort County
- Measures to control project effects may be to provide a temporary bypass, sediment basins, or additional sediment control
- Measures to manage post-construction effects may be to provide extended detention, vegetated filter strips, grassed swales, wet ponds or wetlands
- Limit the disturbed site during construction, or stage construction to reduce the amount of disturbed areas at any one time
- Control vehicular access and egress to the site, provide adequately stabilized driveway entrances to eliminate erosion and tracking mud and dirt into public rights-of-way.
- Ensure project scheduling is streamlined to allow the seeding and stabilization process to be completed in a timely manner

6.7 Contractor Requirements and Oversight

6.7.1 Contractor Requirements

Any contractor hired by Beaufort County to perform municipal maintenance activities is really an extension of the county staff. As such, the contractor must comply with all of the stormwater control measures, good housekeeping practices, and any other SOPs that are developed for Beaufort County.

- Insert language in any contract signed by a contractor that will require compliance with the pollution prevention/good housekeeping requirements.
- If hired through a purchase order, the contractor must also comply with all pollution prevention/good housekeeping requirements

- Require a signature from the contractor before construction/maintenance begins that the contractor will comply with the requirements.

6.7.2 County Requirements

Beaufort County will provide oversight of contractor activities to ensure that the contractors are using appropriate control measures and SOPs.

- Regular inspections while contractor is working onsite
- Maintain a record of inspections and observations regarding the work
- Provide education to the contractor as required to ensure proper water quality protection.

6.8 Reduction of Pollutants Related to Landscape Management

6.8.1 Storage and Application

Storage and application of pesticides, herbicides and fertilizer must be managed to minimize exposures to surface waters. Practices to be encouraged include:

- Limit the application of materials if precipitation is forecasted within 24 hours or as specified in label instruction
- Limit the use or replace pesticide with less toxic product
- Limit or eliminate the use of fertilizers, or prohibit the use, within 5 ft of pavement, 25 ft of storm drain inlet or 50 ft of a waterbody
- Store and properly dispose of these materials as directed on the label of product

6.8.2 Landscape Management Practices

Landscape management practices that will reduce pollutant impacts on water quality include:

- Use native plants (reduces water usage and fertilization)
- Keep grass clippings and leaves away from waterways and out of the street using mulching, composting or landfilling
- Reduce mowing of grass to allow for greater pollutant removal, but not jeopardizing motorist safety

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6.9 Environmental Handbook – Fact Sheets

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GHP-08 Pesticide and Herbicide Delivery, Storage and Handling

Carefully pour chemicals directly into the sprayer tank and use a water supply with a backflow preventer to dilute to the needed concentration.

DO

- ✓ Place drums on pallets to move with a forklift.
- ✓ Store chemicals in the original container in a clean, dry location.
- ✓ Check spray equipment for leaks before use.
- ✓ Pump or pour chemicals directly into the spray tank of the sprayer unit.
- ✓ Use a water supply that has a backflow preventer to dilute chemicals to the needed concentration.
- ✓ Carefully watch the fill sight tube to avoid overfilling the spray tank.
- ✓ Rinse empty containers three times and pour rinse water into the spray tank.
- ✓ Apply all chemicals per label directions.
- ✓ Have a spill kit and an empty container available when chemicals are delivered or moved.
- ✓ Replace used spill kit materials promptly after use.

DON'T

- ✖ Don't accept leaking containers from delivery trucks.
- ✖ Don't overfill the spray tank.
- ✖ Don't reuse or burn empty chemical containers.

Tips and Tricks

- ! Park delivery vehicle on the uphill side of the tank to drain delivery hose easily.
- ! Contact BC Public Works for list of needed spill kit contents
- ! SCDHEC 843-525-7603

Materials & Waste Management

- ▲ Return refillable chemicals containers to the vendor if applicable.
- ▲ Store containers in a designated location to protect from damage, destruction or theft.
- ▲ Containers that cannot be returned or recycled will be punctured and sent to a solid waste landfill that has agreed to accept the containers.
- ▲ Do not dispose of absorbed materials and soils that contain chemicals and are hazardous. Contact Beaufort County Stormwater for assistance.

Facility Checklist

- ☐ Check ***EACH*** delivery shipment and do not accept leaking containers.
- ☐ Check chemical mixing and spraying operations ***WEEKLY.***
- ☐ Check equipment including sprayers and pumps ***WEEKLY*** during application season.
- ☐ Check chemicals spill kits ***MONTHLY*** and promptly restock after use.
- ☐ Check chemical storage location ***ANNUALLY.***
- ☐ Review chemical handling procedures ***ANNUALLY***, improve as needed.
- ☐ Ensure MSDS sheets are current and available ***ANNUALLY.***
- ☐ Ensure personnel handling and applying chemicals are trained and certified.

If…Then

- ➤ Quickly contain and clean up spills or leaks using absorptive devices from spill kits.
- ➤ Return spilled chemicals to the spray tank.
- ➤ Contain absorbed material from spills or leaks and distribute it at a target chemical application site.
- ➤ If absorbed chemical material cannot be used, conduct a waste determination. Cleanup from spilled materials that are found to be non-hazardous can be disposed in a solid waste landfill.
- ➤ Contact Beaufort County Stormwater for guidance regarding spills.
- ➤ Call 911 immediately for large spills

Training: 1 per Year **Season**: Spring

Relevant Environmental Programs	○ Air Quality ○ 401/404/WQC ● NPDES ● MS4	● GWPP ● Waste ● Pesticides ○ SPCC

GHP-08 Pesticide and Herbicide Delivery, Storage and Handling

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GHP-09 Turf Management

The drainage system works more efficiently when curbs and grates are clean. Pollutants entering the stormwater system are reduced, protecting water quality. Litter pick up improves the aesthetics of our campus.

DO

- ✓ Inspect equipment prior to use and maintain the mower as needed.
- ✓ Inspect area prior to mowing and remove any objects that could become a projectile (such as stones and woody debris).
- ✓ Pick up all litter (paper, cardboard) prior to mowing area.
- ✓ Separate unknown wastes and wastes requiring special management from lawn litter during pickup operations.
- ✓ To the extent possible, contain litter in bags to reduce weather exposure.
- ✓ Clean debris and litter from stormwater structures to improve drainage and reduce stormwater pollution.
- ✓ At the shop, litter should be placed in the solid waste dumpsters.
- ✓ After application of the proper rate of granular herbicide, pesticide, or fertilizer, all residues are to be blown or swept from all hardscape.
- ✓ Liquid products are to be applied in a manner to dry before a rain event.

DON'T

- ✖ Don't mix unknown wastes or wastes requiring special management with litter or dispose into drains or solid waste containers.
- ✖ Don't dispose of litter at any location other than a solid waste receptacle.
- ✖ Don't blow grass clipping, leaves, sticks, cigarette butts, or litter into storm drains or onto impervious areas.
- ✖ Don't mow over and shred litter.
- ✖ Do not blow granular chemicals into patios, sidewalks, curbs, parking lots, streets, or storm inlets.
- ✖ Wash equipment over or near a storm inlet.

Facility Checklist

- ☐ Ensure that wastes requiring special management are handled properly.
- ☐ Inspect equipment prior to use for fluid leaks.
- ☐ Inspect area prior to mowing and remove any objects that could become a projectile.

Tips and Tricks

- ! Since most litter is considered non-hazardous, it can be disposed of in the dumpster.
- ! Optimize productive mowing time by planning mowing routes to be near disposal areas when trash bags near capacity.
- ! Beaufort County Stormwater 843.255.2805

If…Then

- ➤ If you find debris that you consider different than "daily litter", then report it to your supervisor.
- ➤ If dumpsters are not available, tie trash bags closed and place them in a common area for pick up later. Secure them from blowing away in the wind.
- ➤ Ask the supervisor to contact Beaufort County Stormwater for assistance with potentially dangerous waste.
- ➤ If human fluids or waste are encountered, have the supervisor contact Beaufort County Stormwater immediately.

Training: 1 per Year **Season**: Summer

Relevant Environmental Programs	○ Air Quality ● NPDES ● MS4	○ SWPP ● Waste ● Pesticides

GHP-09 Turf Management

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GHP-10 Floor Drains and Oil-Water Separators

GHP-10 Floor Drains and Oil-Water Separators

Don't pour waste fluids into floor drains.

Materials & Waste Management

- ▲ Air dried sludge from floor drain may be disposed in a dumpster.
- ▲ Hazardous sludge from a spill must be managed by a hazardous waste vendor. Contact Beaufort County Stormwater for assistance.
- ▲ If the facility is connected to a sanitary sewer, the water (not the oil) from the oil/water separator may be discharged to the sanitary sewer system.
- ▲ An industrial cleaning service should be used to clean floor drains and oil/water separators at least annually or more often as needed.

DO

- ✓ Use floor drains to dispose of washwater only.
- ✓ Floor drains are required to have a grit collector and oil/water separator.
- ✓ Remove accumulated materials from the oil trap if spills enter the drain.
- ✓ Clean the floor drain at least annually.
- ✓ Promptly repair leaks to the floor drain sump.
- ✓ Determine if a floor drain is necessary. If not, fill the drain with a plumber's plug or concrete.
- ✓ Only floor drains connected to sanitary sewer are permitted.
- ✓ Oil removed from the oil/water separator shall be stored in approved drums for separate disposal and/or recycling.

DON'T

- ✖ Don't use the floor drain like a trash can.
- ✖ Don't pour waste oil, antifreeze, paint, cleaning fluids or other material into the floor drain.
- ✖ Don't allow spilled chemicals to get to the floor drain.
- ✖ Adding oil from the oil/water separator to the used oil tank is not recommended.

Facility Checklist

- ☐ Check the drain trap ***MONTHLY*** for oil accumulation and leaks.
- ☐ Check grit collector and oil/water separators ***ANNUALLY.***
- ☐ Check the floor drain ***MONTHLY*** for solids accumulation on the bottom and floating material on the surface.
- ☐ Check spill kit ***MONTHLY*** and promptly restock after use.

Tips and Tricks

- ! Contact Beaufort County Stormwater for list of needed spill kit contents.
- ! BC Stormwater 843.255.2805

If…Then

- ➤ If used oil from the oil/water separator is contaminated by solvents or due to a spill, conduct a hazardous waste determination. Contact Beaufort County Stormwater for assistance.
- ➤ **Training:** 1 per Year **Season**: Spring

Relevant Environmental Programs	○ Air Quality ● NPDES ● MS4	● GWPP ● Waste ○ Pesticides

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GHP-11 Used Oil and Oil Filters

This used oil tank is stored indoors, clearly labeled and the work area is orderly.

DO

- ✓ Maintain a 250- to 660-gallon used oil storage tank above ground**,** indoors protected from weather, in good condition, on an asphalt or concrete base and clearly labeled.
- ✓ Provide extra used oil storage containers.
- ✓ Provide a drum for used oil filters.
- ✓ Carefully pour used oil into the used oil containers without spilling.
- ✓ Waste fuel from fuel filters may be added if allowed by the recycling vendor.
- ✓ Drain oil filters on the drain rack for 24 hours and place in the used (waste) oil filter drum.
- ✓ Notify the superintendent when the tank reaches 80% full.
- ✓ Record the date and volume of waste removed, hauler and treatment facility receiving the waste.
- ✓ The superintendent will promptly request vendor removal.
- ✓ Label all used oil containers, filter racks, and collection vessels with the words “Used Oil”.

DON’T

- ✗ Don’t add other wastes such as cleaners, brake fluid or used antifreeze to used oil.
- ✗ Adding oil from the oil/water separator to the used oil tank is not recommended when the oil is part of a used oil furnace fuel supply.
- ✗ Don’t pour used oil in a storm drain, septic system, floor drain, dry well, sewer or on the ground for disposal, dust or weed control.
- ✗ Don’t add to storage tanks that are full.

Materials & Waste Management

- ▲ Drained used oil filters should be recycled.
- ▲ Small amounts of used absorbent materials can be sent to an approved solid waste landfill.
- ▲ Use an approved vendor to move used oil and oil filters to recycling facilities
- ▲ Hot drained oil filters may be sent to a solid waste landfill, with prior approval from the operator.

Facility Checklist

- ☐ Check for leaks, spills and housekeeping ***DAILY.***
- ☐ Check oil levels ***WEEKLY.***
- ☐ Check spill kits ***MONTHLY*** and promptly restock after use.
- ☐ Check waste tank level indicators ***MONTHLY***, and plan waste management accordingly.
- ☐ Check corrosion resistant tanks and pipes at the manufacturer’s recommended schedule.
- ☐ Visually check the secondary containment and tank area ***MONTHLY*** and report leaks, spills and maintenance issues to the Superintendent immediately.

Tips and Tricks

- ! Run equipment until operating temperature is reached (about 20 minutes) to completely drain oil.
- ! Crushing oil filters conserves space.
- ! The use of oil for dust control is prohibited.
- ! Motor oil, hydraulic oil, transmission and power steering fluid, gear and lube oil are “used oils”.
- ! If the facility is subject to SPCC requirements, follow the guidelines set forth in the Facility Plan.
- ! Contact Beaufort County Stormwater at 843.255.2805 for assistance on used oil filter recycling.

If…Then

- ➤ Contain and clean up spills and leaks immediately. Spilled material that are wastes or are suitable for use can be returned to the tank or similar container.

Training: 1 per Year **Season**: Winter

Relevant Environmental Programs	○ Air Quality ● NPDES ●MS4	● GWPP ● Waste ○ Pesticides ● SPCC

GHP-11 Used Oil and Oil Filters

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GHP-12 Vehicle and Equipment Cleaning and Maintenance

Clean trucks and equipment in the designated location.

DO

- ✓ Wash vehicles in the vehicle wash station that drains to a grit collector and oil/water separator.
- ✓ Outside washing areas must be in designated areas only. Designated area should be reviewed by BC Public Works and approved by the facility supervisor.
- ✓ Keep vehicles and equipment in clean and good working order.
- ✓ Repair leaks of oil, transmission and hydraulic fluid, radiators, etc., promptly.
- ✓ Collect waste wash water from degreasing and place it in containers for removal and proper disposal.

DON'T

- ✖ Wash trucks and equipment in outside areas that drain directly to storm drains.
- ✖ Don't allow pressure washer overspray to collect on building walls or doors.
- ✖ Don't allow spilled solvent or degreasing wastes to reach the floor drain.
- ✖ Don't use soaps or detergents for outdoor cleaning operations.

Materials & Waste Management

- ▲ Store collected drip pan waste in clearly labeled drums.
- ▲ Conduct a hazardous waste determination for collected degreasing wastes.
- ▲ Dispose of collected wastes using an industrial waste vendor.

Facility Checklist

- ☐ Check to ensure vehicle and equipment cleaning is being done in the designated location.

Tips and Tricks

- ☐ Grass areas are an acceptable alternative to wash down vehicles and equipment to clean them of dirt from typical road or mowing use.
- ☐ The supervisor will know where approved wash locations are located.

If…Then

- ➤ If solvents or degreasing wastes are spilled, contain the spill and clean up using a spill kit. Contact BC Stormwater for guidance for proper disposal.

Training: 1 per Year **Season**: Fall

Relevant Environmental Programs		
	○ Air Quality	● SWPP
	● NPDES	● Waste
	● MS4	○ Pesticides
		○ SPCC

GHP-12 Vehicle and Equipment Cleaning and Maintenance

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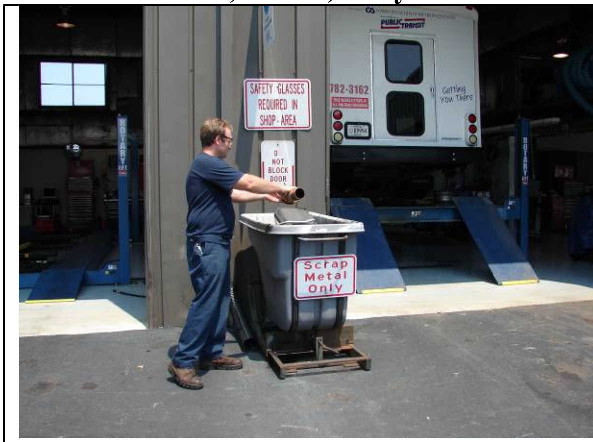
GHP-13 Reduce, Reuse, Recycle and Exchange



Beaufort County encourages facilities to reduce, reuse, recycle and exchange to reduce environmental concerns, improve safety and reduce costs.

DO

- ✓ Reduce, reuse, recycle and exchange as the first step in managing solid waste.
- ✓ ***Reduce*** the amount of wastes generated and toxicity of products used to the greatest extent possible.
- ✓ ***Reuse*** concrete, asphalt and soil for road repair.
- ✓ ***Recycle*** newspaper, cardboard, glass, plastic and metal containers and items, copper wire and tubing, rubber, and other items at local recycling facilities.
- ✓ ***Exchange*** vehicle batteries, water pumps, carburetors, alternators, pesticide containers, etc., with vendors or when local purchases are made.
- ✓ Use available recycling contracts.
- ✓ Store materials for recycling in a location that is consistent with the permit.
- ✓ Divert runoff from recycling storage locations.
- ✓ Always ask for a Material Safety Data Sheet (MSDS) before ordering any new product.
- ✓ Keep lids on all solvents and turn off solvent parts washer when not in use.
- ✓ Have qualified personnel service equipment that contains Freon.

DON'T

- ✖ Don't throw away items that can be reused, recycled or exchanged.
- ✖ Don't accumulate batteries; avoid regulation.

Materials & Waste Management

- ▲ Follow appropriate guidelines from recycling contracts, vendors or recycling centers for allowable items, materials management, separation and transportation arrangement.
- ▲ Double wrap broken or cracked vehicle batteries in heavy plastic and exchange promptly.
- ▲ Refer to Beaufort County Stormwater

Facility Checklist

- ☐ Check storage areas for recyclable materials to ensure that the handlers' conditions are being met.
- ☐ Check to ensure that materials are routinely transferred to a recycling vendor or facility.
- ☐ Assure all containers for recycling are properly labeled.

Tips and Tricks

- ! Containers that can be recycled: washer fluid, new oil, new anti-freeze, battery acid gas line anti-freeze, diesel conditioner, radiator cleaner, brake fluid, starting fluid, liquid soap, solvents, brake cleaner, carburetor cleaner, paints, toluene, hand cleaner, janitorial products, etc.
- ! Recycling contracts may be available for tires, batteries, anti-freeze, vehicle oils, oil filters, fuel filters, parts cleaning machine systems, etc.
- ! Recycling and exchanging materials is a good housekeeping practice and ensures compliance with hazardous waste and solid waste regulations and avoids costly penalties.
- ! Remember that "biodegradable" does not necessarily mean environmentally safe or that the product is exempt from regulations.
- ! Solvent losses due to evaporation, equipment leaks or spills and inappropriate usage can range from 25 to 40 percent

If…Then

- ➢ If you are not sure whether an item can be recycled, contact Beaufort County Stormwater 843.255.2805.

Training: 1 per Year **Season**: Winter

Relevant Environmental Programs		
	○ Air Quality ● NPDES ● MS4	○ GWPP ● Waste ○ Pesticides ○ SPCC

GPH-13 Reduce, Reuse, Recycle and Exchange

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GHP-14 Construction Waste Management and Materials Storage

Construction waste and materials handling is part of any Stormwater Pollution Prevention Plan (SWPPP).

DO

- ✓ Arrange for solid waste service that provides covered dumpsters.
- ✓ Place trash in dumpster and close the lids.
- ✓ Keep dumpsters closed from weather.
- ✓ Have damaged dumpsters replaced or repaired.
- ✓ Use plastic bags for litter patrols and other solid waste.
- ✓ Store potentially hazardous leftover products in a compatible, intact container.
- ✓ Keep water from running through stored solid waste.
- ✓ Have wastes hauled off before they overfill containers.
- ✓ Recycle as much material as feasible (cardboard, metals, glass, etc.) to keep it out of landfills.
- ✓ Staging areas shall have erosion control installed per the SWPPP plan
- ✓ Concrete washout areas shall be provided per the SWPPP plan.

DON'T

- ✗ Don't dispose of hazardous wastes in the dumpster.
- ✗ Don't dispose of whole tires, lead-acid batteries, liquids, large spill cleanup.
- ✗ Don't store solid wastes that are not in a dumpster onsite for more than 30 days.
- ✗ Don't place spill cleanup in the dumpster unless approved by waste handler.
- ✗ Wash out concrete trucks onto the ground.

Materials & Waste Management

- ▲ Waste from hazardous materials may or may not be hazardous wastes. Have these wastes evaluated. Contact Beaufort County Stormwater for assistance when needed.
- ▲ Solid waste landfills are the authority on what may or may not be disposed at their facility.

Facility Checklist

- ☐ Check solid waste storage areas per the SWPPP or at a minimum ***WEEKLY***.

Tips and Tricks

- ! Use of closed top containers avoids many spill concerns and are strongly encouraged.
- ! Most things that may go into the dumpster are empty containers and wastes that are not hazardous waste and wastes that do not have free liquids.
- ! Clean-p from small spills (one or two bags) of "un-used" oil may go into the dumpster.
- ! Cleanup waste of spills of any fluids from equipment must be contained and evaluated.
- ! Liquid wastes generally cannot drip to be accepted at the landfill.
- ! BC Stormwater 843.255.2805

If…Then

- ➢ Contain and clean up spills and leaks immediately. Spilled material that are wastes or are suitable for use can be returned to the storage container.

Training: 1 per Year **Season**: Winter

Relevant Environmental Programs	○ Air Quality	● GWPP
	● NPDES	● Waste
	● MS4	○ Pesticides
		○ SPCC

GHP-14 Construction Waste Management and Materials Storage

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GHP-15 Waste Tire Management

Covered storage for waste tires reduces mosquitoes that may carry disease. This tire storage container needs to be covered.

DO

- ✓ Facilities that handle more than 120 waste tires must be registered with the SCDHEC.61-107.3, Page 7. Size is not a factor when counting to determine if registration is required.
- ✓ Unregistered facilities may accumulate less than 120 waste tires and should plan for disposal when 90 waste tires have accumulated.
- ✓ Stack all tires neatly in a designated Tire Storage Area.
- ✓ Stack tires for salvage sale separately.
- ✓ Cover stacks of tires to prevent accumulation of water, which fosters breeding mosquitoes that may carry diseases.
- ✓ Registered facilities must store tires 30 ft from utility easement, property line or highway right-of-way and 250 ft from a residence, karst feature or stream, store tires where fire-fighting equipment will have access in case of a fire, obtain and keep receipts for disposal of tires for three years.

DON'T

- ✗ Don't allow more than 120 tires to accumulate at facilities that are not registered.
- ✗ Don't burn tires.
- ✗ Don't put waste tires in the dumpster or landfill. Landfills do not accept tires.

Materials & Waste Management

The two methods of waste tire management apply:

- ▲ *Salvage Sale.* Tires with street value may be removed from the waste pile for salvage sale. These tires must be covered to keep water from accumulating.
- ▲ *Used Tire Recycling.*

Facility Checklist

- ☐ Check the storage area ***MONTHLY*** to ensure runoff is diverted and tires are covered.
- ☐ Update the waste tire inventory count ***MONTHLY*** at facilities that are not registered.

Tips and Tricks

- ! Disposal of whole tires in a solid waste landfill is prohibited by law.
- ! Keeping tires covered to prevent water entrapment keeps environmental inspectors happy.
- ! Contact BC Stormwater for assistance, if needed 843.255.2805.

If…Then

- ➤ Notify the Superintendent immediately if more than 90 tires are being stored at an unregistered facility.

Training: 1 per Year **Season**: Winter

Relevant Environmental Programs	○ Air Quality ○ NPDES ○ MS4	○ GWPP ● Waste ○ Pesticides ○ SPCC

GHP-15 Waste Tire Management

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GHP-16 Hazardous and Non Hazardous Spill at the Facility

GHP-16 Hazardous and Non-Hazardous Spills at the Facility

The spill kit contains protective equipment and absorbent materials for emergency use. Place spill kits where materials are stored or used.

DO

- ✓ Treat spills of products or wastes that are flammable, toxic, reactive or corrosive as posing a risk to health and the environment.
- ✓ Refer to the Material Safety Data Sheet (MSDS) for spill response procedures and personal protective equipment needs.
- ✓ Isolate the area.
- ✓ Safely ***stop the release*** if possible and protect streams, sewers and other waterways.
- ✓ ***Report all releases*** above the reportable quantity to BC stormwater or call ***911 and*** National Environmental Response Team **1-800-424-8802.** If the spill exceeds reportable quantities on the "List of Lists" (40 CFR 302) or enters a Water of the State, call Beaufort County Stormwater for determination if DHEC Environmental Response Team and the National Response Center should be contacted.
- ✓ ***Clean up*** the spilled material.
- ✓ Use an environmental consultant to oversee cleanup of spills involving removal of soil.
- ✓ Store absorbent in drums and conduct a waste determination if a hazardous spill is known or suspected.
- ✓ Review emergency response actions after an incident to highlight appropriate responses and needed improvements.

If…Then

- ➢ If the materials can be reused, place them in a suitable container and label them.

DON'T

- ✖ Don't risk injury to yourself or co-workers.
- ✖ Don't panic – respond calmly and quickly.
- ✖ Don't stop the release if it is hazardous to do so.

Materials & Waste Management

- ▲ Store contaminated absorbent in drums until the results of a waste determination are available.
- ▲ Promptly manage spill cleanup waste with other hazardous wastes.

Facility Checklist

- ☐ Check product and waste storage areas for leaks, spills and housekeeping ***MONTHLY.***
- ☐ Check hazardous waste storage areas for leaks, spills and housekeeping ***MONTHLY.***
- ☐ Check spill kits ***MONTHLY*** and promptly restock after use.
- ☐ Check spill response and cleanup procedures ***ANNUALLY.***
- ☐ Check for the presence of copies of MSDS sheets for all products handled at the facility ***ANNUALLY***.

Tips and Tricks

- ! Reportable quantities are 25 gallons or more of a petroleum product within a 24-hour period and 75 gallons or more of diesel fuel in a 24-hour period or any amount that creates a visible sheen on surface waters.
- ! EPA's "List of Lists" document, which identifies reportable chemicals, can be downloaded from the National Environmental Response Team.
  Wring oil absorbent pads into a bucket to collect spilled material for reuse or disposal
- ! Contact Beaufort County Stormwater for list of needed spill kit contents.
- ! If granular absorbents are not available, use any material that can absorb or slow down runoff, such as clothes or soil.

Training: 1 per Year **Season**: Winter

Relevant Environmental Programs		
	○ Air Quality	○ GWPP
	● NPDES	● Waste
	● MS4	○ Pesticides
		● SPCC
		● CERCLA

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Section 7
Enforcement and Violations

Beaufort County is required to enforce and issue violations to property owners, contractors, subcontractors, developers etc. that have land disturbance or BMPs that are installed on property to ensure they are maintained and in compliance with the Stormwater Ordinance.

- Any deficiencies or non-compliance issues identified during a County inspection will be reported to the project contractor, on-site supervisor, and/or engineer for addressing. Some corrective measures may require immediate, 48-hr, 78-hr, or 7+ days' time frame depending on the nature of the violation.
- Measures that have frequent failures can be required to be replaced with alternative control methods. All changes should be communicated with the Stormwater Management Department and documentation in the OS-SWPPP.
- Failure to address concerns or implement and corrective measures may result in warnings, stop-work orders, or fines. To find out more information about the enforcement of the sediment and erosion control program, see Section 98.501 of the Stormwater ordinance.
- Sites with repeat violations may be subject to additional compliance actions, special schedules, inspections, or programs as determined and communicated by the Stormwater Management Division.

7.1 Enforcement

If the County determines that a project is in non-compliance with the County Stormwater Ordinance or BMP Manual then, the inspector may direct conformity by proceeding with the appropriate enforcement action. The types of enforcement tools available to the County include a Warning Notice, Notice of Violation (NOV), Stop Work Order and Civil/Criminal Penalties. The enforcement mechanism to be utilized will depend on the circumstances as described in the following sections.

7.2 Warning Notice

The stormwater manager will issue a Warning Notice for first offenses of non-compliance with the County Stormwater Ordinance. The purpose of the Warning Notice is to give notice of the deficiencies, identify expected corrective results and provide a reasonable timeframe to the contractor/land owner/developer prior to the County taking further action to ensure compliance. All Warning Notices, verbal or written, shall be issued per section 98.501 of the stormwater ordinance found in Appendix G and noted in the project file. A Warning Notice may be issued in such cases, but not be limited to, when there is:

1. Failure to comply with the approved stormwater design plans to include failure to have properly installed and/or maintained BMP measures, or

2. Failure to properly maintain permanent stormwater management structures, or

3. Failure to comply with any other provisions of the stormwater ordinance.

7.3 Notices of Violation

If a Warning Notice has been previously issued and there is either a subsequent non-compliance issue or failure to complete the items on the Warning Notice within a specified time period, then a Notice of Violation may be issued per section 99.502 of the stormwater ordinance found in appendix G. In addition, for violations that do not involve a safety issue or an imminent threat of serious damage to the environment and/or public or private property, a Notice of Violation may be issued for, but are not limited to, the following:

1. If construction activities have been initiated and no BMP measures are in place, or are not working to prevent sediment from leaving the site.

2. Failure to have work inspected and approved before restarting construction activities after a stoppage of work.

3. Failure to comply with any provisions of the stormwater ordinance.

7.4 Stop Work Order

A Stop Work Order may be issued per section 99.502 if of the stormwater ordinance found in appendix G for, but are not limited to, the following:

1. Construction activities are occurring without County permits and/or an approved (SWPPP).

2. Past enforcement actions taken by the County (Warning Notice, Notice of Violations) to remedy a situation(s) that have not been properly addressed with appropriate and prompt action to the satisfaction of the stormwater manager.

3. Non-compliance with the plans has resulted in a health or safety issue.

4. Offsite sedimentation resulting from non-compliance with the approved SWPPP has eliminated or severely degraded a use in a downstream waterbody or that such degradation is imminent.

5. Offsite sedimentation resulting from non-compliance with the approved SWPPP has caused severe damage to adjacent land. A Stop Work Order will cease all construction activities until violations are inspected or corrected for compliance. Failure to comply may result in the suspension or revocation of any remaining permits issued for the site and/or a notice to appear in court and civil penalties.

6. Failure to comply with any other provisions of the stormwater ordinance.

7.5 Employee Handbook

Employees found in violation of the contents of this manual, specifically but not limited to Section 6, are subject to discipline per the current version of the Beaufort County Personnel handbook.

7.6 Civil Penalties

Violations may subject the owner/operator to civil penalties as outlined in the Beaufort County Stormwater Ordinance (refer to Appendix G) for each violation. Each day a violation continues constitutes a new and separate violation.

7.7 Criminal Penalties

In addition to any applicable civil penalties, any person who negligently, willfully, or intentionally violates any provision of the Stormwater Ordinance (found in Appendix G) shall be guilty of a misdemeanor and shall be punished within the jurisdictional limits of the court. The stormwater manager may issue a notice to appear for a violation of this Ordinance. Fines imposed under the Warning Notice or Notice of Violation are outlined in the Beaufort County Stormwater Ordinance found in Appendix G. Each day a violation continues constitutes a new and separate violation.

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Appendix A
Content of the Manual – Expanded Discussion

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A.1 Summary of Federal Regulations

This section of the BMP manual summarizes the existing Federal, State and County regulations affecting stormwater runoff control in Beaufort County. In general, Federal regulations and legislation have been applied at the State level to regulate stormwater runoff quality, whereas County stormwater regulations focus on regulating peak stormwater runoff rates.

Federal regulations that directly affect stormwater runoff control include the Coastal Zone Management Act and the National Pollutant Discharge Elimination System (NPDES) stormwater regulations of the U.S. Environmental Protection Agency (EPA). The Coastal Zone Management Act was designed to encourage and assist coastal states to develop and implement management programs. The State of South Carolina developed its own Coastal Zone Management Act in 1977, to protect coastal resources and promote responsible development in Beaufort County and seven other coastal counties. This will be discussed further in the following section on State regulations. The EPA NPDES requirements are presented below.

The 1987 amendments to the Federal Clean Water Act define specific stormwater discharges as point source discharges subject to NPDES regulations. These amendments required EPA to promulgate regulations pertaining to stormwater discharges via a phased approach.

The initial phase, promulgated by EPA on November 16, 1990, became known as the Phase I Stormwater NPDES regulations. These final regulations created two broad classes of stormwater discharges under the NPDES program: (i) Municipal Separate Storm Sewer System (MS4) discharges; and (ii) Stormwater Discharges Associated with Industrial Activity. The MS4 Program was divided into three categories (large, medium, and small) based on U.S. Census Bureau population estimates, with Phase I regulations including only large and medium MS4 stormwater discharges. The Stormwater Discharges Associated with Industrial Activity program was divided into 11 categories of industrial activity. These included industrial manufacturing facilities, landfills, transportation facilities, construction (land clearing on 5 or more acres), etc., without consideration given to the type of facility owner or operator such that a publicly owned or operated facility could be included in one of the 11 categories.

On December 8, 1999, EPA adopted the Phase II stormwater regulations, which included small MS4 discharges located in an "Urbanized Area" per U.S. Census Bureau definitions and delineations. In addition, the land disturbance activity regulation with the threshold of 5 or more acres (as per the construction activity regulation) was reduced to 1 or more acres, with a provision that construction sites that disturb less than 1 acre could also be regulated if water quality concerns or problems related to the activity warrant permit coverage under the NPDES Program.

The State of South Carolina has been an EPA NPDES Program delegated authority for a number of years. The State agency that administers the Federal NPDES Program in

South Carolina is the Department of Health and Environmental Control (DHEC). As such, DHEC oversees all NPDES Program related permitting, monitoring, and enforcement issues in the State of South Carolina. However, EPA does have authority over DHEC on NPDES Program issues and may, at its discretion, conduct independent audits of a DHEC-issued NPDES permit

MS4 Program

Phase I of the NPDES Stormwater Program required large MS4s (with populations of 250,000 people or greater) and medium MS4s (with populations of 100,000 people or greater but less than 250,000) to apply for permit coverage in two parts. All permits issued under this phase were individual permits and required the development and implementation of a stormwater management program. At a minimum, this program had to address the following key elements:

1. Structural control maintenance
2. Areas of significant development and redevelopment
3. Roadway runoff management
4. Flood control related to water quality issues
5. Municipally owned operations, including landfills, wastewater treatment facilities, etc.
6. Hazardous waste treatment, storage or disposal sites, etc.
7. Application of pesticides, herbicides, and fertilizers
8. Illicit discharge detection and elimination
9. Regulation of sites classified as associated with industrial activity
10. Construction site and post-construction site runoff control
11. Public education and outreach

As of July 2007, the State of South Carolina has one large MS4 (South Carolina Department of Transportation) and four medium MS4s – the City of Columbia, Greenville County, Lexington County, and Richland County.

As of July 2007, there is a list of 70 regulated small MS4s, which did not specifically include Beaufort County. In 2014 this list was increased and additional communities were added, including Beaufort County. These small MS4s are required to begin running programs to address stormwater runoff from construction sites and post-construction activities. These activities are two of the six components of a stormwater management program as defined by the NPDES Phase II Final Rule, as listed below:

- Public education and outreach.
- Public participation/involvement.
- Illicit discharge detection and elimination.
- Construction site runoff control.
- Post-construction runoff control.
- Pollution prevention/good housekeeping.

Several of these items are addressed by this document and will fulfill part of the NPDES Phase II requirements.

<u>Industrial Activity Program</u>

The NPDES Phase I stormwater regulations created 11 categories of Stormwater Discharges Associated with Industrial Activity. Categories "i "through "ix" and category "xi" became part of the Industrial Program, while category "x" became part of the Construction Program. Thus the NPDES stormwater program is made up of three distinct program components: the MS4 Program, the Industrial Program, and the Construction Program. Although the Phase I included a provision for a no-exposure permit exemption to category "xi" (light industry) only, the Phase II regulations extended this no-exposure exemption to categories "i" through "ix."

The no-exposure exemption applied to facilities that had no stormwater runoff exposed to raw materials, byproducts, waste products, intermediate products, final products, etc. Activities within the Industrial Program and the Construction Program can have NPDES stormwater permits issued as either individual permits or general permits; however, due to the nature and number of facilities that must be issued NPDES stormwater permits, general permits are typically utilized. On rare occasions, when water quality concerns become a permit issue, DHEC may require an individual permit in lieu of granting general permit coverage. The general permit under the Industrial Program requires the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) for each covered facility and requires monitoring and/or inspections. Although only certain facilities require both, inspections are required of all facilities.

Under the Construction Program, the construction activity category is divided into two phases, Phase I (for large construction sites) and Phase II (for small construction sites). On a case-by-case basis, a permit may also be required when a construction activity involves the disturbance of less than 1 acre of land. Stormwater discharges from construction activities that disturb less than 5 acres of land are called "small construction activities." A Construction Activity permit can either be issued in the form of a general permit or an individual permit. Typically, the general permit is utilized unless specific water quality issues warrant the use of an individual permit. The general permit requires that a SWPPP be prepared and implemented for each construction site, but sampling of stormwater runoff from the site is not required.

Inspections must be conducted at all construction sites covered under the general permit. In addition, a provision in the MS4 program regulations requires that all regulated MS4s implement a program for controlling construction site runoff. This provision essentially requires that the construction site must receive a permit from the regulated MS4 in addition to having to be covered under an NPDES Stormwater Construction Activity permit.

It is important to note that with the March 10, 2003 initiation of the NPDES Phase II Stormwater Program implementation, considerable overlap exists between the Federal NPDES Stormwater Program and the State of South Carolina's Sediment, Erosion, and Stormwater Management Program as discussed below.

A.2 Summary of State Regulations

In addition to being an EPA NPDES Program delegated authority, the State of South Carolina also has its own relevant regulations. The South Carolina's Sediment, Erosion, and Stormwater Management Program was initiated in 1983, and required construction activities on State-owned and State-managed lands to control sediment and erosion. In 1991, via the South Carolina Stormwater Management and Sediment Reduction Act, the program was expanded to include all construction activities that disturbed more than 2 acres of land. Regulation 72-300, entitled "Standards for Stormwater Management and Sediment Reduction," describes the requirements for preparing a stormwater management and sediment and erosion control plan from land disturbance activities. Exemptions, Waivers, and Variances from the Law are explained in Section 72-302. The Bureau of Water of the Office of Environmental Quality Control (EQC) of DHEC is responsible for administering the Sediment, Erosion, and Stormwater Management Program, and by regulation the Office of Ocean and Coastal Resource management (OCRM) implements the program in the eight coastal county areas, including Beaufort County. A local government may become a State-delegated authority after submitting a request and receiving approval by the State. However, Federal, State, and local government and public school projects must be submitted to DHEC even if they are located within the jurisdiction of a State-delegated entity.

As indicated previously, the Federal NPDES Stormwater Construction Activity Program requires permit coverage for construction sites that disturb more than 1 acre of land and, on a case-by-case basis, even less than 1 acre of land. Consequently, an overlap exists currently between the State's Sediment, Erosion, and Stormwater Management Program and the NPDES Stormwater Construction Activity Program (that is, when more than 2 acres of land are disturbed due to a construction activity, permits must be secured under both programs). The State coordinates the various aspects of the two programs (i.e., permitting, compliance, monitoring, and enforcement) to minimize the overlapping responsibilities. The two programs are integrated into a comprehensive Stormwater Regulatory Program for the State of South Carolina.

The South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities (DHEC, 2003) includes all existing South Carolina stormwater management regulations required for individuals to submit a stormwater management and sediment reduction permit application to DHEC. Elements of the Federal NPDES Stormwater Program, Coastal Zone Management Program, and the State's Stormwater Management and Sediment Reduction regulations are included in the handbook.

Table A-1 summarizes the State regulatory requirements that are applicable to Beaufort County, as one of the eight counties included in the State of South Carolina's Coastal Zone Management Program. For land disturbance of 0.5 acre or less that is within 0.5 mile of a receiving waterbody in the coastal zone, Section R.72- 307H of the State Stormwater Management and Sediment Reduction Act of 1991 is applicable. Section R.72-307H is also applicable for land disturbance of less than 1 acre, at locations that are not within 0.5 mile of a coastal zone receiving water If the land disturbance is at least 1 acre, but less than 2 acres, the NPDES General Permit and Section R.72-307H apply. Development is highly impervious or is located directly adjacent to a critical area, the more stringent R.72-307I regulations are applicable; otherwise, the less stringent R.72-307H regulations are appropriate.

Table A-1 South Carolina Requirements for Land Development in Beaufort County

Extent of Land Disturbance (acres)	Applicable Regulatory Requirements
Less than 0.5 acre and within 0.5 acre of receiving waters	R.72-307H
Less than 1 acre and not within 0.5 acre of receiving waters	R.72-307H
At least 1 but less than 2 acres	R.72-307H, SCR100000
More than 2 and less than 5 acres	R.72-307I, SCR100000
5 acres or more	R.72-305, R.72-307, SCR100000

Section R.72-307I regulations are also applicable for developments of more than 2 and less than 5 acres. For developments of 5 acres or more, the applicable regulations include Sections R.72-305 and R.72-307 of the Stormwater Management and Sediment Reduction Act of 1991, plus the NPDES General Permit.

Features of the regulations highlighted in Table A-1 are presented in Table A-2. The regulations under Section R.72-307H provide for a simplified stormwater management and sediment control plan that does not require approval by DHEC and does not require preparation or certification by a registered engineer, landscape architect or Tier B land surveyor (SCDHEC, 1997). However, DHEC staff does have the authority to conduct site inspections to ensure compliance with the submitted plan. Under Section R.72-307I, the stormwater management and sediment control plan must be approved by DHEC, and requires preparation and certification by a registered engineer, landscape architect or Tier B land surveyor. The plan must also include BMPs to control erosion and sediment, and measures to control peak discharge rates and peak velocities of stormwater runoff from the site.

Table A-2 South Carolina Sediment, Erosion, and Stormwater Management Program Land Development Regulatory Requirement Details Applicable to Non-Coastal Counties

Plan Feature	Applicable Regulation(s)		
	R.72-307H	R.72-307I	R.72-305, R.72-307, SCR100000
Plan Approval by Implementing Agency	Not required	Required	Required
Plan Preparation / Certification by Registered Professional Engineers / Landscape Architects / Land Surveyors	Not required	Required	Required
BMPs to Control Erosion and Sediment	Not required	Required	Required
Measures to Control Stormwater Quantity	Not required	Required[1]	Required[1]
Measures to Control Stormwater Quality	Not required	Not required	Required[2]

1. Stormwater quantity control requirements include:
   a. Post-development peak discharge rates shall not exceed pre-development discharge rates for the 2- and 10-year frequency, 24-hour duration storm events. Implementing agencies may utilize a less frequent storm event (e.g., 25-year, 24-hour storm) to address existing or future stormwater quantity or quality problems.
   b. Discharge velocities shall be reduced to provide a non-erosive velocity flow from a structure, channel, or other control measure or the velocity of the 10-year, 24-hour storm runoff in the receiving waterway prior to the land disturbance activity, whichever is greater.
   c. Watersheds other than "designated watersheds" that have well documented water quantity problems may have more stringent, or modified, design criteria determined by the local government that is responsive to the needs of that watershed.
2. See Table A-3 for a summary of stormwater quality requirements.

The State regulation requires that post-development peak flows shall not exceed the pre-development peak flow rate for the 2-year/24-hour and 10-year/24-hour design storms. Developments of 5 acres or more must meet all of the requirements listed above, and must provide measures for stormwater quality control

The current NPDES general permit SCR100000 (effective September 1, 2006) includes requirements for inspections on construction sites. Once construction begins, these inspections must be conducted at least once every 7 calendar days, or at least once every 14 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater. The inspections must be conducted by qualified personnel (as defined in the permit) and an inspection report must be completed for each inspection. The report must be retained for at least 3 years from the date that permit coverage expires or is terminated. For construction activities disturbing 10 acres or more, a monthly report must also be submitted to DHEC. Monthly reports may also be required on a case-by-case basis.

Stormwater runoff quality control measures required for developments of 5 acres or more are presented in Table A-3. In general, the water quality storage requirements depend upon the type of BMP and, in some cases, the location of the development site.

TABLE A-3. SOUTH CAROLINA COASTAL ZONE MANAGEMENT PROGRAM STORMWATER QUALITY BMP REQUIREMENTS BEAUFORT COUNTY

	Water Quality Volume Requirements		
BMP Facility Type	General	Within 0.5 Miles of a Receiving Waterbody in the Coastal Zone	Within 1,000 Ft of Shellfish Beds
Water quality facility with permanent pool of water (e.g., wet detention pond)	Permanent pool volume of 0.5 inches of runoff per acre of drainage; storage above permanent pool of 0.5 inches of runoff per acre of drainage, required to bleed down over a 24-hour period	Permanent pool volume of 0.5 inches of runoff per acre of drainage <u>or</u> 1.0 inches of runoff per impervious acre of drainage, whichever is greater; same general storage requirement above permanent pool	Permanent pool volume of 0.5 inches of runoff per acre of drainage <u>or</u> 1.5 inches of runoff per impervious acre of drainage, whichever is greater; same general storage requirement above permanent pool
Water quality facility without permanent pool of water (e.g., extended dry detention pond)	Storage of 1.0 inches of runoff from the entire drainage area, required to bleed down over a 24-hour period	General requirements apply	Not applicable
Infiltration practices	Storage of 1.0 inches of runoff per impervious acre of drainage, required to drain completely in 72 hours	General requirements apply	Storage of 1.5 inches of runoff per impervious acre of drainage, required to drain completely in 72 hours

The basic water quality volume requirements vary based on the type of BMP. A water quality facility with a permanent pool of water (e.g., a wet detention pond) has a required permanent pool volume equivalent to 0.5 inch of runoff per acre of drainage, as well as another 0.5 inch of storage above the permanent pool. The storage above the permanent pool is required to bleed down over a 24-hour period. In contrast, a water quality facility without a permanent pool of water (e.g., an extended dry detention pond) has a required water quality storage volume equivalent to 1.0 inch of runoff per acre of drainage, and this volume is required to bleed down over a 24-hour period. Infiltration facilities, which capture runoff and then release the captured runoff through evapotranspiration and infiltration into the underlying soil, are required to provide water quality storage equivalent to 1.0 inches of runoff per impervious acre of drainage.

Under existing State regulations, water quality control facilities with a permanent pool of water may have more stringent requirements if the development is within 0.5 mile of a receiving waterbody in the coastal zone. In this case, the required permanent pool volume is the greater of: (a) 0.5 inch of runoff from the entire drainage area, or (b) 1.0 inch of runoff per impervious acre of drainage. The latter condition will apply for commercial, industrial and high-density residential land uses with an imperviousness of more than 50 percent. There are no special requirements for infiltration facilities and facilities without a permanent pool of water.

Special considerations also apply when the development is within 1,000 ft of shellfish beds (determined from State mapping or by site inspection). In this case, the regulations require that 1.5 inches of runoff per impervious acre of drainage must be retained. Of the three BMP types discussed above, only infiltration facilities are designed to retain runoff (i.e., captured runoff is depleted by storage through evapotranspiration and infiltration into the underlying soil, rather than released to a drainage channel or waterbody). In contrast, facilities such as ponds are designed to detain runoff (i.e., captured runoff is detained for treatment and is then released to a drainage channel or waterbody).

Table A-3 shows how the shellfish bed regulation has been interpreted for this report. The requirement for infiltration facilities is 1.5 inches per impervious acre of drainage, which is 50 percent greater than the general requirements. For facilities with a permanent pool, it was presumed that the requirement would be met by providing a permanent pool volume equivalent to 1.5 inches of runoff per impervious acre. For storms producing runoff of 1.5 inches or less, the runoff will be stored in the permanent pool and an equal volume of water will be displaced from the pool and discharged to a drainage channel or waterbody. The table provides no interpretation of the shellfish bed requirements for other facilities without a permanent pool. Such a facility would actually be operating as an infiltration facility.

As mentioned previously, DHEC administers the Federal NPDES Program on behalf of EPA; therefore, along with having jurisdiction over the NPDES Construction Program, DHEC also has jurisdiction over the NPDES Industrial Program. Under the latter program, the general permit (SCR000000) covers all categories of stormwater discharges associated with industrial activity, except the construction activity, which is covered under the Construction Program. SCR00000 requires the development of a SWPPP, which identifies potential sources of stormwater pollution and describes practices to be implemented for reducing stormwater pollutant discharges. These practices may include structural BMPs (e.g., wet detention ponds), good housekeeping practices, spill prevention procedures, and employee training. Annual or semi-annual monitoring of stormwater discharge from the site is required for certain industrial facilities. The monitoring would include measurement of specific pollutants such as nutrients and metals, and acute whole effluent toxicity tests.

Information on the South Carolina Sediment, Erosion, and Stormwater Management Program can be found at: *http://www.scdhec.net/water/html/erfmain.html*.

Information on NPDES Stormwater Program Implementation in South Carolina can be found at: *http://www.scdhec.net/eqc/water/html/swnhistory.html*.

Appendix B
Permitting Flow Chart, Easement Templates and Design Checklists

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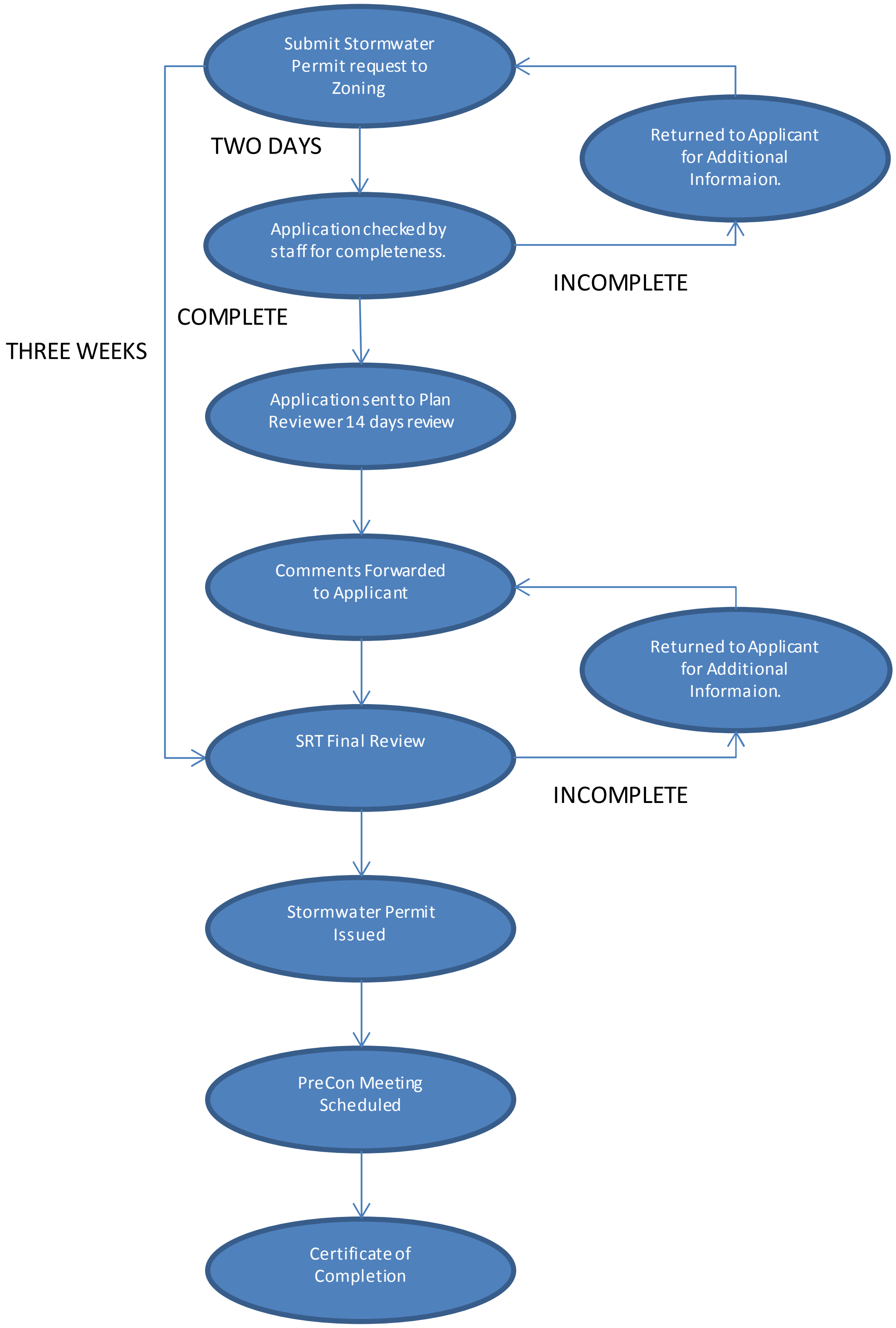
B.1 Permitting Flow Chart

PROCEDURES FOR FINAL RESIDENTIAL OR COMMERCIAL SUBDIVSION DEVELOPMENT REVIEW



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B.2 Easement Templates

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STATE OF SOUTH CAROLINA)
) DRAINAGE EASEMENT
COUNTY OF BEAUFORT)

For and in consideration of One Dollar ($1.00) and improvement of drainage on Grantor's land, the receipt whereof is hereby acknowledged**, JOHN DOE AND JANE DOE, 123 Main St., Beaufort, SC 29906 (**Grantor"). Grantor, does hereby grant and convey unto **Beaufort County** ("Grantee"), its successors and assigns, a non-exclusive easement, as shown on the drawing attached hereto as **Exhibit "A"** , in, over, and upon the property owned by Grantor known as R ___ ___ ____ ____ and situated on _*(general vicinity)*______, County of Beaufort, State of South Carolina.

For or in connection with the construction, operations, maintenance, and/or reconstruction, collectively known as "work" of a "storm sewer system", including but not limited to a ditch, berm, pipe, basin, and other best management practices, to improve the drainage on the above described lands, such activity to include excavation, widening, deepening, straightening, laying pipe, installing best management practices, etc. for or in connection with the work of such a storm sewer system.

1. This easement includes the right of ingress and egress at any time over and upon the above described land, for the purpose of work of the storm sewer system as referred to above.

2. There is reserved to the Grantee, Beaufort County, the right and privilege to use the above described land of the Grantor for the purposes of the work on the storm sewer system.

3. The Grantee is responsible for the work of the storm sewer system improvements herein described.

4. Special Provisions

    a. The Grantee shall have the right to clear and remove all brush and trees to a width necessary to perform work on the above mentioned storm sewer system. Provided, however, if the Grantor desires to salvage merchantable timber from the area to be cleared, he will do so prior to the time the contractor begins work. It is understood that the Grantee will advise the Grantor at least 10 days in advance of construction.

    b. Storm sewer systems will follow natural draws or present drainage ways as near as practical.

    c. If the Grantor desires to salvage levees, fences, culverts, or bridges that interfere with the work of the storm sewer system, he will have the opportunity to do so prior to the Grantee commencing work.

It is agreed that buildings, fences, signs or other obstructions will not be erected by Grantee, its successors, assigns, or administrators within the limits of the easement herein conveyed.

TO HAVE AND TO HOLD the aforesaid easement in, over and upon the above described land of the Grantor, with all the rights, privileges and appurtenances thereto belonging or in any wise appertaining, unto the Grantee, its successors and assigns, forever.

IN WITNESS WHEREOF, the Grantor has executed this instrument on the ________________day of _____________, 20_____.

Witnesses:

(2)________________________________
(Witness #1)

(1) Name:______________________
John Doe

(1) Name:______________________
Jane Doe

(3)___________________________________
(Witness #2) (Notary Public May Sign)

STATE OF SOUTH CAROLINA)
)
COUNTY OF BEAUFORT) ACKNOWLEDGEMENT

I, the undersigned, a Notary Public for South Carolina, do hereby certify that **John Doe and Jane Doe** personally appeared before me this day and, in the presence of the two witnesses above named, acknowledged the due execution of the foregoing instrument.

Witness my hand and seal this ____ day of _________________________, 20____.

(4)______________________________
Notary Public for ___________________
My Commission Expires:_____________

County Use Only:

Location: Beaufort County
Township: ___________________
Tax Map No. ___ Parcel No. _____

STATE OF SOUTH CAROLINA)
) TEMPORARY CONSTRUCTION EASEMENT
COUNTY OF BEAUFORT)

For and in consideration of One Dollar ($1.00) and improvement of drainage on Grantor's land, the receipt whereof is hereby acknowledged, **____________ HOMEOWNERS ASSOCIATION, _________, _______, SC** ________ (the "Grantor"). Grantor, does hereby grant and convey unto **Beaufort County** ("Grantee"), its successors and assigns, a non-exclusive temporary construction easement, as shown on the drawing attached hereto as **Exhibit "A"** , in, over, and across the property owned by Grantor known as parcel ___________________ on __________, County of Beaufort, State of South Carolina.

For or in connection with the construction, operations, maintenance, and/or reconstruction, collectively known as "work" of a "storm sewer system", including but not limited to a ditch, berm, pipe, basin, and other best management practices, to improve the drainage on the above described lands, such activity to include excavation, widening, deepening, straightening, laying pipe, installing best management practices, etc. for or in connection with the work of such a storm sewer system.

2. This easement includes the right of ingress and egress at any time over and upon the above described land, for the purpose of work of the storm sewer system as referred to above.

3. There is reserved to the Grantee, Beaufort County, the right and privilege to use the above described land of the Grantor for the purposes of the work on the storm sewer system.

4. The Grantee is responsible for the work of the storm sewer system improvements herein described.

5. Special Provisions

   a. The Grantee shall have the right to clear and remove all brush and trees to a width necessary to perform work on the above mentioned storm sewer system. Provided, however, if the Grantor desires to salvage merchantable timber from the area to be cleared, he will do so prior to the time the contractor begins work. It is understood that the Grantee will advise the Grantor at least 10 days in advance of construction.

   b. Storm sewer systems will follow natural draws or present drainage ways as near as practical.

   c. If the Grantor desires to salvage levees, fences, culverts, or bridges that interfere with the work of the storm sewer system, he will have the opportunity to do so prior to the Grantee commencing work.

IN WITNESS WHEREOF, the Grantor has executed this instrument on the _____ day of _______________________, 20__.

(2)________________________________ **(1)**___________________________________
(Witness #1) _______________**Homeowners Association, Qualified Agent or Owner**

(2)__________________________________
(Witness #2)

STATE OF ___________________)
)
COUNTY OF _________________)
ACKNOWLEDGEMENT

I, the undersigned, a Notary Public for South Carolina, does hereby certify that________________________ ___________________ **Homeowners Association Qualified Agent, or owner** personally appeared before me this day and, in the presence of the two witnesses above named, acknowledged the due execution of the foregoing instrument.

Witness my hand and seal this **(3)**____ day of ________________________, 20__.

(4)_________________
Notary Public for South Carolina
My Commission Expires:__________

County Use Only:

Location: ______________
Township: _____________
Map: ________ Parcel: _____

STATE OF SOUTH CAROLINA)
) ACCESS EASEMENT
COUNTY OF BEAUFORT)

For and in consideration of One Dollar ($1.00) and improvement of drainage on Grantor's land, the receipt whereof is hereby acknowledged**, John Doe, __________, ___________, SC ______(**Grantor"). Grantor, does hereby grant and convey unto **Beaufort County** ("Grantee"), its successors and assigns, a non-exclusive access easement, as shown on the drawing attached hereto as **Exhibit "A"** , in, over, and across the property owned by Grantor known as R___________ on ____________, County of Beaufort, State of South Carolina.

The Grantee acknowledges and agrees that the Grantor may apply to Beaufort County for a development permit which could potentially change the location and design of the access easement being granted and conveyed herein by Grantor in, over and across this property.

For or in connection with the drainage on the above described lands, such construction to include excavation, widening, deepening, or contouring, etc. for or in connection with the operation, maintenance, and inspection of the drainage.

1. This non-exclusive access easement includes the right of ingress and egress at any time on, over and across the above described land as is necessary for the sole, exclusive and limited purpose of constructing, inspecting and maintaining of the drainage, including the excavation, widening, deepening and contouring of the drainage.

2. There is reserved to the Grantee, Beaufort County, the right and privilege to use the above described land of the Grantor for the purposes of maintaining the drainage.

3. The Grantee is responsible for operating and maintaining the work of improvement herein described.

4. Special Provisions

   a. The Grantee shall have the right to clear and remove all brush and trees to a width necessary to excavate and/or improve the above drainage ditches. Provided, however, if the Grantor desires to salvage merchantable timber from the area to be cleared, he will do so prior to the time the contractor begins work. It is understood that the Grantee will advise the Grantor at least 10 days in advance of construction.

   b. If the Grantor desires to salvage levees, fences, culverts, or bridges that interfere with the construction or maintenance of drainage ditches, he will have the opportunity to do so prior to construction and maintenance work.

It is agreed that buildings, fences, signs or other obstructions will not be erected by Grantee, its successors, assigns, or administrators within the limits of the easement herein conveyed.

TO HAVE AND TO HOLD the aforesaid non-exclusive access easement in, over and across the above described land of the Grantor, with all the rights, privileges and appurtenances thereto belonging or in any wise appertaining, unto the Grantee, its successors and assigns, forever.

IN WITNESS WHEREOF, the Grantor has executed this instrument on the ______day of _____________, 2016.

Witnesses:

(2)________________________________ (1) Name: ______________________________
(Witness #1) **Owner**

(2)________________________________
(Witness #2)

STATE OF SOUTH CAROLINA)
)
COUNTY OF BEAUFORT) ACKNOWLEDGEMENT

I, the undersigned, a Notary Public for South Carolina, do hereby certify that ____________________ personally appeared before me this day and, in the presence of the two witnesses above named, acknowledged the due execution of the foregoing instrument.

Witness my hand and seal this ____ day of __________________________, 2016.

(4)________________________________
Notary Public for ____________________
My Commission Expires:_____________

County Use Only:

Location: _________________
Township: _________________
Tax Map No. ____ Parcel No. ____

B.3 Design Checklists

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Stormwater Plan
Conceptual Design Checklist for Residential and Commercial Developments.

REVISED 08/24/16

Please indicate the location and page number(s) where each item below can be found in your SWPPP or supporting calculations. If an item is not applicable, please put N/A. Beaufort County reserves the right to modify this checklist at any time. For stormwater questions please contact Public Works Stormwater Division at 843-255-2805.

Project Name: ____

Checklist Completed by:____.

Printed Name: ____

Signature: ____

Date: _____________

1. **CURRENT COMPLETED APPLICATION FORM/DHEC NOI**
- All items in the checklist should be submitted inserted in your final permit plans

2. **VICINITY MAP**
- Include North arrow and scale
- Outlined project location
- Road names
- Public or private Right of Way
- Location Map

3. **COVER SHEET**
- Project Name
- Engineer's Contact Information (name, mailing address, telephone, fax, email)
- Developer's Contact Information (name, mailing address, telephone, fax, email)

4. **SITE PLAN CHECKLIST**
- Size of plans should be 24" x 36"
- Plans to Scale and North Arrow
- Contours are to be tied to a known datum, no **assumed** elevations,
- Lot Layout
- Property lines, adjacent landowners' names
- Existing and proposed contours for entire parcel.
- Limits of disturbed area outlined on the plans.
- Road and Ditch profiles with existing and proposed ground elevations (if no contours are shown on the plans).
- Construction sequence (conceptual)
- Construction entrance/exit

5. **FLOODWAY MAPS/FEMA FLOOD INSURANCE MAP**
- Project boundary outlined, if in close proximity of floodplain/floodway

6. **WETLANDS/WATERS-OF-THE-STATE (WOS)**
- Delineation of all waters of the State (WoS), including wetlands, shown and labeled on plans (Delineation not required if a 100-ft buffer can be maintained between the WoS and all land disturbing activities)
- Additional, separate plan sheet that shows all WoS, on the site and the impacted areas with a description of the activity(s), whether it is permanently or temporary, and any other relevant

7. **TMDL/ 303d IMPAIRED WATERBODIES**
- List the nearest SCDHEC Water Quality Monitoring Station (WQMS) that the site's stormwater discharges drain to and the waterbody on which it is located.

8. **NAVIGABLE WATERS**
- Extra plan sheet showing impacts to navigable water and description of activity included if S.C. Navigable Waters (SCNW) crossing and separate SCNW permit has not been obtained for all activities

9. **DRAINAGE AREA MAPS**
- Provide drainage area map outlining the area draining to all erosion and sediment control BMPs on site. Show existing and proposed contours for the road layout and BMP placement.
- Pre drainage area map (site without proposed development)
- Post drainage area map (with proposed development)
- Include off-site drainage areas.

Stormwater Plan
Final Design Checklist for Residential and Commercial Developments.

REVISED 08/24/16

Please indicate the location and page number(s) where each item below can be found in your SWPPP or supporting calculations. If an item is not applicable, please put N/A. Beaufort County reserves the right to modify this checklist at any time. For stormwater questions please contact Public Works Stormwater Division at 843-255-2805.

Project Name: ____

Checklist Completed by____

Printed Name: ____

Signature: ____

Date: _______________

1. **CURRENT COMPLETED APPLICATION FORM/DHEC NOI**
- All items in the checklist should be submitted inserted in your final permit plans

2. **VICINITY MAP**
- Include North arrow and scale
- Outlined project location
- Road names
- Public or private Right of Way
- Location Map

3. **COVER SHEET**
- Project Name
- Engineer's Contact Information (name, mailing address, telephone, fax, email)
- Developer's Contact Information (name, mailing address, telephone, fax, email)
- Contractor's Contact Information (name, mailing address, telephone, fax, email)

4. **SITE PLAN CHECKLIST**
- Size of plans should be 24" x 36"
- Engineer stamp and signature in blue ink.
- Plans to Scale and North Arrow
- Contours are to be tied to a known datum, no **assumed** elevations,
- Lot Layout
- Property lines, adjacent landowners' names
- Existing and proposed contours for entire parcel.
- Limits of disturbed area outlined on the plans.
- Road and Ditch profiles with existing and proposed ground elevations (if no contours are shown on the plans).
- Construction entrance/exit
- Standard notes (See Item #15 of this checklist)
- Individual lot erosion control plan and contours (unless exempt)

5. **USGS TOPOGRAPHIC MAP**
- Project boundary outlined
- Route of runoff from site to nearest waterbody shown
- Critical areas downstream of site indicated

6. **SOILS INFORMATION**
- Predominate soil types found at the site identified on the plans or on a separate map

7. **FLOODWAY MAPS/FEMA FLOOD INSURANCE MAP**
- Project boundary outlined, if in close proximity of floodplain/floodway

8. **WETLANDS/WATERS-OF-THE-STATE (WOS)**
- Delineation of all waters of the State (WoS), including wetlands, shown and labeled on plans
(Delineation not required if a 100-ft buffer can be maintained between the WoS and all land disturbing activities)
- Additional, separate plan sheet that shows all WoS, on the site and the impacted areas with a description of the activity(s), whether it is permanently or temporary, and any other relevant

9. **PERMANENT STORMWATER MANAGEMENT STRUCTURE MAINTENANCE PLAN**
- Signed Maintenance Agreement from a responsible party accepting ownership and maintenance of the structure or BMP. This document needs to be recorded with the Beaufort County Register of Deeds.

10. **TMDL/ 303d IMPAIRED WATERBODIES**
- List the nearest SCDHEC Water Quality Monitoring Station (WQMS) that the site's stormwater discharges drain to and the waterbody on which it is located.

11. **NAVIGABLE WATERS**
- Extra plan sheet showing impacts to navigable water and description of activity included if S.C. Navigable Waters (SCNW) crossing and separate SCNW permit has not been obtained for all activities

12. **DRAINAGE AREA MAPS & REPORT**
- Provide drainage area map outlining the area draining to all erosion and sediment control BMPs on site. Show existing and proposed contours for the road layout and BMP placement.
- Place calculated design flows on each pipe and BMPs
- Time of concentrations
- Curve numbers for each drainage area.
- Routing hydrographs for the 2,5,10,25, and 100-year storm event
- Pipe capacities for the design storm
- Basin stage/storage and stage discharge calculations
- Pre drainage area map (site without proposed development)
- Post drainage area map (with proposed development)
- Include off-site drainage areas
- Label watershed areas within the drainage area map with (watershed identifier, CN, area, length, slope)

13. **AS-BUILTS**
- Submit 2 original asbuilt hard copies, signed and sealed by a South Carolina Licensed Land Survey or Engineer. Submit one digital copy of asbulits in GIS format .lyr, shp or gdb file with the coordinate system being state plane NAD_1983_StatePlane_South_Carolina_FIPS_3900_Feet_Intl

14. **STORMWATER POLLUTION PREVENTION PLAN (SWPPP)**
- Cover and title page
- Project and SWPPP contact information
- Site and activity description including site map
- Identification of potential pollution sources including but not limited to: trash, paint and concrete washout, vehicle maintenance practices, etc.
- Description of controls to reduce pollutants
- Construction sequence
- Time schedule for each activity on the construction sequence
- Maintenance and inspection procedures
- Records of maintenance activities and inspections
- SWPPP amendments
- SWPPP certifications

15. **STANDARD NOTES**:

1. If necessary, slopes which exceed eight (8) vertical feet should be stabilized with synthetic or vegetative mats, in addition to hydroseeding. It may be necessary to install temporary slope drains during construction.
2. Temporary berms may be needed until the slope is brought to grade.
3. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than fourteen (14) days after work has ceased, except as stated below.
4. Where stabilization by the 14th day is precluded by snow cover or frozen ground conditions stabilization measures must be initiated as soon as practicable.
5. Where construction activity on a portion of the Site is temporarily ceased, and earth-disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the Site.
6. All sediment and erosion control devices shall be inspected every seven (7) days. Damaged or ineffective devices shall be repaired or replaced, as necessary. OR
   All sediment and erosion control devices shall be inspected at least once every fourteen (14) calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater. Damaged or ineffective devices shall be repaired or replaced, as necessary.
7. Provide silt fence and/or other control devices, as may be required, to control soil erosion during utility construction. All disturbed areas shall be cleaned, graded, and stabilized with grassing immediately after the utility installation. Fill, cover, and temporary seeding at the end of each day are recommended. If water is encountered while trenching, the water should be filtered to remove any sediments before being pumped back into any waters of the State.
8. All erosion control devices shall be properly maintained during all phases of construction until the completion of all construction activities and all disturbed areas have been stabilized. Additional control devices may be required during

construction in order to control erosion and/or offsite sedimentation. All temporary control devices shall be removed once construction is complete and the site is stabilized.

9. The contractor must take necessary action to minimize the tracking of mud onto the paved roadway construction areas. The contractor shall daily remove mud/soil from pavement, as may be required.
10. All waters of the State (WoS), including wetlands, are to be flagged or otherwise clearly marked in the field. A double row of silt fence is to be installed in all areas where a 50-foot buffer can't be maintained between the disturbed area and all WoS. A 10-foot buffer should be maintained between the last row of silt fence and all WoS.
11. Litter, construction debris, oils, fuels, and building products with significant potential for impact (such as stockpiles of freshly treated lumber) and construction chemicals that could be exposed to storm water must be prevented from becoming a pollutant source in stormwater discharges.
12. Provide written proof that all off-site easements have been obtained. (include implementation of all stormwater and sediment controls in the first phase of construction).

16. **APPLICANT AND DEVELOPER CERTIFICATIONS**
- The following certifications must be signed on all final sets of plans

Applicant's Certification
I (We) hereby certify that all clearing, grading, construction, and/or development will be done pursuant to this plan and I (we) are responsible for the land disturbance and related maintenance thereof. Beaufort County authorities will be allowed to enter the project site for the purposed of on-site inspections.

____
Date Owner/Person Financially Responsible

____
Print Name of Owner/Person Financially Responsible

Designer's Certification
"I hereby certify that this plan is designed to contain soil on the property concerned to the maximum extent, to provide for the protection of the property and the proposed improvements thereon from the effects of flooding, to provide for the control of the runoff from the property, and that all the provisions for sediment control and storm drainage are in accordance with the Stormwater Best Management Practices and Stormwater Ordinance for Beaufort County, South Carolina."

____
Date Designer's Signature and Certification

____
Print Name of Designer

Appendix C
Illicit Discharge Screening Form and Examples of Notice of Violations and Fines and Monitoring Plan

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C.1 Forms

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Form A: Illicit Discharge Public Reporting

Public Hotline Reporting of a Suspected Illicit Discharge or 311 Application Tracking Form-A	
Incident ID (mmddyy-street name):	
Responder Information	
Call taken by:	Call date:
Call time:	Precipitation (inches) in past 72 hrs:
Reporter Information	
Incident time:	Incident date:
Caller contact information (*optional*):	
Suspected Incident Location *(complete one or more below)*	
Latitude and longitude:	
Stream address or outfall #:	
Closest street address:	
Nearby landmark or mile marker:	
Is the material in the storm drain or waterway? Yes No	
Is the material just on the highway? Yes No	
Or is the material both in the storm drain or waterway <u>and</u> on the highway? Yes No	
If the material is in the storm drain or waterway, then:	
Is the ID a known hazardous material? Yes No If yes, what material?	
Is the ID a known non-hazardous material? Yes No If yes, what material?	
Or is the ID an unknown and cannot be safely identified? Yes No	
Narrative description of location/directions to suspected illicit discharge provided by reporter:	
Narrative description of suspected illicit discharge provided by reporter:	

Problem Indicator Description		
Dumping	Oil/solvents/chemicals	Sewage
Washwater, suds, etc.	Other: ______________________________	

<table>
<tr><th colspan="6">Stream Corridor Problem Indicator Description</th></tr>
<tr><td rowspan="2">Odor</td><td colspan="2">None</td><td>Sewage</td><td>Rancid/Sour</td><td>Petroleum (gas)</td></tr>
<tr><td colspan="2">Sulfide (rotten eggs); natural gas</td><td colspan="3">Other: Describe in “Narrative” section</td></tr>
<tr><td rowspan="2">Appearan</td><td colspan="2">“Normal”</td><td>Oil sheen</td><td>Cloudy</td><td>Suds</td></tr>
<tr><td colspan="3">Color: ____________________</td><td colspan="2">Other: Describe in “Narrative” section</td></tr>
<tr><td rowspan="2">Floatables</td><td>None:</td><td colspan="2">Sewage (toilet paper, etc.)</td><td>Algae</td><td>Dead fish</td></tr>
<tr><td colspan="5">Other: Describe in “Narrative” section</td></tr>
<tr><td colspan="6">Narrative description of problem indicators:</td></tr>
<tr><td colspan="6">Suspected Source or Violator (name, personal or vehicle description, license plate #, nearby industries/businesses etc.):</td></tr>
<tr><th colspan="6">Illicit Discharge Referral</th></tr>
<tr><td colspan="6">Date Referred:</td></tr>
<tr><td colspan="6">Referred to (Contact name & agency):</td></tr>
<tr><th colspan="6">Response Follow-up</th></tr>
<tr><td colspan="6">Date Response action taken:</td></tr>
<tr><td colspan="6">Actions taken by response party (i.e. Dispatched HAZMAT team or other part to site, list of names of agency & response personnel that was contacted <u>or</u> reason no action was taken):</td></tr>
<tr><th colspan="6">Filing Information</th></tr>
<tr><td colspan="6">Date report filed:</td></tr>
<tr><td colspan="6">Report filed by (Name):</td></tr>
<tr><th colspan="6">Notes</th></tr>
<tr><td colspan="6"></td></tr>
</table>

FORM B: Illicit Discharge Internal Reporting

Beaufort County, South Carolina Internal Reporting of a Suspected Illicit Discharge	
Incident ID (mmddyy-streetname):	
Responder Information	
Call taken by:	Call date:
Call time:	Precipitation (inches) in past 72 hrs:
Reporter Information	
Incident time:	Incident date:
CDOT Staff contact information (mailing address, phone number and email address):	
Suspected Incident Location or Connection *(complete one or more below)*	
Latitude and longitude:	
Stream address or outfall #:	
Closest street address:	
Nearby landmark or mile marker:	
Is the material in the storm drain or waterway? Yes No	
Is the material just on the highway? Yes No	
Or is the material both in the storm drain or waterway <u>and</u> on the highway? Yes No	
If the material is in the storm drain or waterway, then:	
Is the ID a known hazardous material? Yes No If yes, what material?	
Is the ID a known non-hazardous material? Yes No If yes, what material?	
Or is the ID an unknown and cannot be safely identified? Yes No	
Narrative description of location/directions to suspected illicit discharge or connection provided by reporter:	
Narrative description of suspected illicit discharge or connection provided by reporter:	

Problem Indicator Description		
Illicit Connection	Dumping	Oil/solvents/chemicals
Sewage	Washwater, suds, etc.	Other: ____________________

Stream Corridor Problem Indicator Description				
Odor	None	Sewage	Rancid/Sour	Petroleum (gas)
	Sulfide (rotten eggs); natural	Other: Describe in "Narrative" section		
Appearance	"Normal"	Oil sheen	Cloudy	Suds
	Color: ______________		Other: Describe in "Narrative"	
Floatables	None:	Sewage (toilet paper, etc.)	Algae	Dead fish
	Other: Describe in "Narrative" section			
Narrative description of problem indicators:				
Suspected Source or Violator (name, personal or vehicle description, license plate #, nearby industries/businesses etc.):				
Actions Required				
Call BC Stormwater 843.255.2800				
Submit Copy of Field Sheet to BC Stormwater				
Illicit Discharge Referral				
Date Referred:				
Referred to (Contact name & agency):				
Report Submittal Information				
Date report submitted to Water Quality Manger:				
Report filed by (Name):				
Notes				

Example

Stormwater Department

WARNING NOTICE

Date: 8/24/16

John Doe
123 Main Street
Beaufort SC, 29906

Re: Situs Address
123 Main Street
Beaufort SC, 29906
PIN NO.: R000 000 000 0000 0000

Inspection # 0001

This warning notice serves as a warning concerning activities on your above-mentioned site.

This warning is based on the results of a Beaufort County inspection on___________.
A verbal warning was also given to________________at the time of the inspection. A copy of our inspection report detailing the deficiencies in enclosed with thiswarning.

You have until________________to correct the deficiencies noted on the inspection report. At that time our inspector will re-visit your site. Failure to comply with this warning is considered a violation of the Beaufort County Stormwater Ordinance and will result in the issuance of a **Notice of Violation and/or Stop Work Order**.

If you have any questions concerning this warning you may contact our office at 843.255.2805

Signed by: ______________________________

Inspector Name: John Smith

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Example

Stormwater Department

NOTICE OF VIOLATION

Date: 8/24/16

John Doe
123 Main Street
Beaufort SC, 29906

Re: Situs Address
123 Main Street
Beaufort SC, 29906
PIN NO.: R000 000 000 0000 0000

Inspection # 0001

You are hereby served notice that you are in violation of Beaufort County's Stormwater Management Ordinance at the above-mentioned site. Stormwater Management Ordinance Chapter 99 Article VI Section 99-500 to 99-504, authorizes the Stormwater Manager, or his/her designee, to issue a Notice of Violation (NOV) as a legal requirement to remove violation(s) of the Stormwater Management Ordinance.

This violation is due to failure to comply with a warning notice issued on ________and the results of a Beaufort County follow up inspection completed on _________. A copy of our inspection report is enclosed with this violation.

These deficiencies noted on the inspection report must be corrected within **3 working days** of the date of this letter. Failure to comply with this Notice of Violation will result in an immediate **Stop Work Order** issued for your site and/or a **civil penalty in the amount of $500.00/day for each deficiency.**

If you have questions concerning this violation, you can contact our office at 843.255.2805

Signed by: ________________________________

Inspector Name: John Smith

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Example

Stormwater Department

STOP WORK ORDER

Date: 8/24/16

John Doe
123 Main Street
Beaufort SC, 29906

Re: Situs Address
123 Main Street
Beaufort SC, 29906
PIN NO.: R000 000 000 0000 0000

Inspection # 0001

You are hereby served notice that you are in violation of Beaufort County's Stormwater Management Ordinance at the above mentioned site. A "**STOP WORK**" order is being posted on this property effective **IMMEDIATELY.**

This violation is due to failure to comply with a Notice of Violation and/or Warning Notice was issued on_________________and the results of a Beaufort County follow up inspection completed on____________________. A copy of our inspection report is enclosed with this violation.

Your site must be inspected by a Beaufort County Stormwater Management Inspector prior to resuming any construction activity. Any activity other than work leading to compliance with this Stop Work Order will result in the issuance of a civil penalty in the amount of **$500.00/day for each deficiency and/or 30 days in jail**.

If you have questions concerning this violation you can contact our office at 843.255.2805

Signed by: ____________________________________

Inspector Name: John Smith

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Example

Stormwater Department

CIVIL CITATION NOTICE

Date: 8/24/16

John Doe
123 Main Street
Beaufort SC, 29906

Re: Situs Address
123 Main Street
Beaufort SC, 29906
PIN NO.: R000 000 000 0000 0000

Inspection # 0001

You are hereby served notice that you are in violation of Beaufort County's Stormwater Management Ordinance. Stormwater Management Ordinance 06-10 Section 6-2 authorizes that any person in violation of this ordinance shall be subject to a civil penalty. **This site has been referred to code enforcement for issuance of a civil penalty in the amount of $500.00/day**.

This violation is due to failure to comply with a Notice of Violation and/or Stop Work Order issued on ____________________and the results of a Beaufort County follow up inspection completed on___________________. A copy of the Notice of Violation and/or Stop Work Order and our inspection report is enclosed with this notice.

No activity other than work leading to compliance with this Notice of Violation is allowed on the site. Your site must be inspected by a Beaufort County Stormwater Management Inspector prior to resuming any construction activity or the lifting of the civil penalty.

If you have questions concerning this violation you can contact our office at 843.255.2800.

Signed by: ____________________________________

Printed Name: _________________________________

Inspector Number: _________________________

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C.2 Monitoring Plan

To be developed by December 2017.

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Appendix D
Construction Stormwater Permits and Inspection Forms

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D.1 Stormwater Permit Application and Fee Schedule

BEAUFORT COUNTY

-STORMWATER PERMIT APPLICATION-

DATE ACCEPTED	RECEIVED BY	FILING FEE	RECIEPT#	PERMIT#	PIN#

PROJECT NAME:	PROJECT TYPE:
PROJECT LOCATION:	
APPLICANT/DEVELOPER NAME, ADDRESS, PHONE#	PROPERTY OWNER NAME, ADDRESS, PHONE#
EMAIL	EMAIL
SWPPP PREPARER NAME, ADDRESS, PHONE#	CONTRACTOR NAME, ADDRESS, PHONE#
EMAIL	EMAIL
QUALIFIED INSPECTOR NAME, ADDRESS, PHONE#	ADDITIONAL INFORMATION:
EMAIL	

CATEGORY A (Single Family Home)

- ☐ COPY OF TEIR I STORMWATER POLLUTION PREVENTION PLAN (SWPPP) – (See Appendix E)
- ☐ PLOT PLAN SHOWING, VACINITY MAP, NORTH ARROW, GRAPHIC SCALE, PROPOSED IMPROVEMENTS
- ☐ STEP II VOLUME CONTROL (See Section 5.3) (http://stormwaterworksheet.createandsolve.com)
- ☐ APPLICATION FEE

CATEGORY B (Non Residential and Attached Residential)

- ☐ COPY OF TEIR II STORMWATER POLLUTION PREVENTION PLAN (SWPPP) – (See Appendix E)
- ☐ POST CONSTRUCTION STORMWATER PLAN CHECKLIST WITH LOCATION OF ALL ITEMS INDICATED.
- ☐ SITE PLAN: VACINITY MAP, PROJECT LOCATION, NORTH ARROW, GRAPHIC SCALE, PROPOSED IMPROVEMENTS
- ☐ CONSTRUCTION PLANS
- ☐ DRAINAGE CALCULATIONS (See Section 5.3)
- ☐ APPLICATION FEE

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BEAUFORT COUNTY -STORMWATER PERMIT APPLICATION- FEE SCHEDULE
CATEGORY A (Single Family Home)
APPLICATION FEE: $25 ADDITIONAL REVIEWS: $10
CATEGORY B (Non Residential and Attached Residential)
APPLICATION FEE: $75 ADDITIONAL REVIEWS: $25

NOTES:

1. APPLICATION FEES INCLUDE COMPLETENESS REVIEW AND TECHNICAL REVIEW AND REVIEW OF ONE REVISION. ANY ADDITIONAL REVISIONS BEYOND THOSE INCLUDED IN FEES MAY BE CHARGED ADDITIONAL FEES PER REVIEW.
2. FEES MAY BE WAIVED FOR SPECIAL CIRCUMSTANCES AT THE DISCRETION OF THE STORMWATER MANAGER.
3. FEES ARE APPLICABLE TO THE INITIAL APPLICATION FOR DESIGN AND CONSTRUCTION REVIEW. APPLICATIONS TO ESTABLISH POST CONSTRUCTION BMP OPERATIONS AND ANNUAL INSPECTIONS ARE EXEMPT FROM FEES.

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Beaufort County, South Carolina

SWPPP TIER I EPSC PLAN LAND DISTURBANCE FORM

For Office use only:

PERMIT # ____________

This form can serve as the EPSC plan and utilized as part of the EPSC plan if the project disturbs greater than 5000 sq. ft. and less than 1 acre, and is not located within a critical area. Lots that are part of a common plan of development that currently has permit coverage under NPDES NOI may qualify to submit a TIER I SWPPP if the SWPPP plan for the common plan development has included single lot perimeter controls as part of the plan.

Allowable projects include single family and duplex developments; addition and/or alteration of existing structures covered by Building Permit.

Name and Address of Permittee:

____

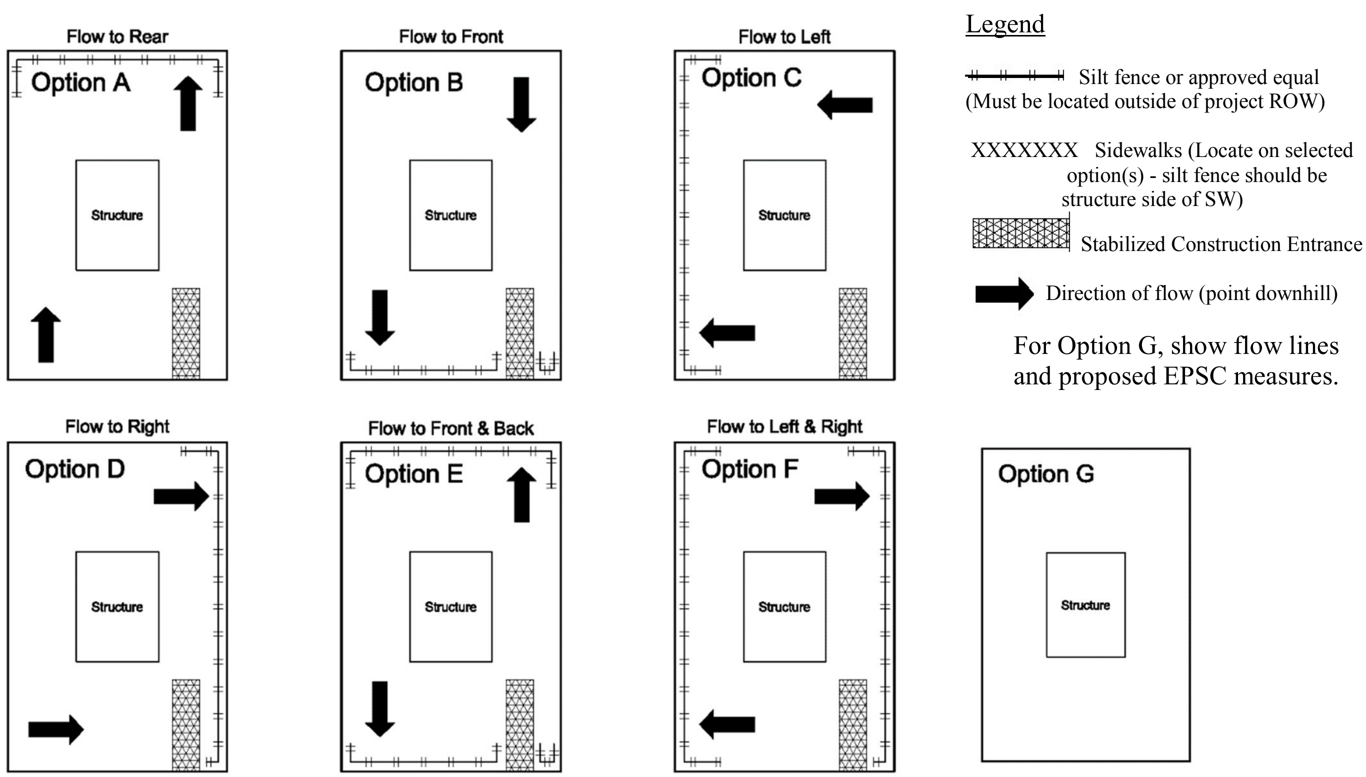
____

____

SWPPP. ATTACHED.

EPSC OPTIONS

INSTRUCTIONS: Identify one or any combination of letters for the EPSC schematic that best describes the measures that will be used on this property during construction to control surface runoff, reduce erosion, and retain sediment.



Please read and complete the previous section before providing the information below.
For EPSC schematics, choose one of the following options:
□ The most appropriate, from the options above, is option ____ or a combination of options ____ & ___.
□ The sedimentation control devices will be installed and maintained as drawn in Option G below.

Does the site have a drainage inlet, drainage easement, sinkhole, wetland, or stream? □ Yes □ No If yes, indicate additional measures on the appropriate Option selected below.

Will excavated materials or topsoil be stockpiled or used as fill or cover on site? □ Yes □ No If yes, show the location of the stockpiling or filling on the schematic below, with additional measures to protect adjacent properties or drainage features.

ANTICIPATED START DATE OF CONSTRUCTION:________________________

STANDARD CONDITIONS: The applicant will comply with the following conditions:

1. EPSC measures must be installed to minimize onsite erosion and prevent offsite sedimentation.
2. EPSC measures on this plan shall be adjusted according to the work being completed on the site in order to minimize the amount and time of disturbance.
3. Perimeter controls shall be in place prior to beginning construction.
4. All EPSC measures shall be installed and maintained as specified in the Beaufort County Stormwater Manual.
5. Existing topsoil must be removed, stockpiled, and placed on finished grade.
6. The contractor shall be responsible for keeping streets, drainage structures, streams and other properties free of sediment and other construction materials generated by this project.
7. Final stabilization practices are required within 14 days on those portions of the project where construction activities have permanently ceased. Temporary stabilization practices are required within 14 days of the date of cessation of construction activities.
8. Upon final stabilization (with at least 70% coverage), EPSC measures must be removed.

The undersigned hereby certifies that he/she will follow the EPSC Plan as described above and will protect all storm drainage structures on this lot. Furthermore, the undersigned will fully comply with the specifications in the Beaufort County Stormwater Manual and Ordinance. The undersigned will take all necessary actions to minimize onsite erosion and prevent offsite sedimentation from occurring. Once the building permit is issued, this document becomes an enforceable EPSC plan for the project site.

Applicant's Signature	Applicant's Printed Name	Date
Owner's Signature	Owner's Printed Name	Date
Developer's Signature	Developer's Printed Name	Date
Contractor's Signature	Contractor's Printed Name	Date

D.2 SWPPP Inspection Log

SWPPP Inspection Log			
Name of Construction Site	**Location of Construction Site**		
Date of Inspection	**Inspector's Name**	**Does Inspection Report Require Maintenance of Installed BMPs?**	
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**
		☐ **Yes**	☐ **No**

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D.3 Example SWPPP Inspection Form

INSPECTOR NAME John Smith DATE 08/16/2016 TIME

PROJECT TYPE: **RESIDENTIAL - NON DEVELOPMENT**

PROJECT NAME/ADDRESS: 123 Main Street **PERMIT** **10000**

CURRENT INSPECTION:
INSPECTION NO: 00001 LAST INSPECTION DATE: 08/16/2016 CURRENT WEATHER CONDITIONS:
LAST 24HR WEATHER CONDITIONS:

Pass	OS-SWPPP	Pass	SCDHEC Coverage Letter
Notes:		*Notes:* Comply By:	
Pass	Copy of CGP	Pass	Secondary Permitted Agreement
Notes:		*Notes:*	
Pass	NOI	Pass	Weekly Inspection Logs
Notes:		*Notes:*	
Pass	Log Book	Pass	Contractor Certifications
Notes:		*Notes:*	
Pass	Rain gauge		
Notes:			

Pass	Does OS-SWPPP match current site conditions and are all BMPs identified?
Notes:	
Pass	Have all areas of the site that are disturbed or used for storage of materials exposed to precipitation been inspected?
Notes::	
Pass	Is the construction following the phasing and sequence plan?
Notes:	

EROSION PREVENTION:

Pass	Are any Erosion Prevention BMPs installed?
Notes:	
Pass	Are Erosion Prevention BMPs located in the proper locations?
Notes:	
Pass	Are Erosion Prevention BMPs installed correctly?
Notes:	
Pass	Do any Erosion Prevention BMPs require maintenance? If yes, provide exact location and complete details in NOTES section below
Notes:	
Pass	Are drainage conveyances stabilized with vegetation and/or channel lining if applicable?
Notes:	
Pass	Are previously stabilized areas being maintained, if applicable?
Notes:	
Pass	Has activity on the site been temporarily ceased for 7 days or more?
Notes:	
Pass	If activity has ceased for 7 days or more have temporary stabilization measures been installed?
Notes:	

SEDIMENT CONTROL:

Pass	Are any Sediment Control BMPs installed?
Notes:	
Pass	Are Sediment Control BMPs located in the proper locations?

Notes:

Pass	Are Sediment Control BMPs installed correctly?
Notes:	
Pass	Are all soil stockpiles adequately contained?
Notes:	
Pass	Are Sediment Control measures protecting off site areas?
Notes:	
Pass	Do any Sediment Control BMPs require maintenance? If yes, provide exact location and complete in NOTES section below
Notes:	
Pass	Did any BMPs fail to operate as designed or prove inadequate? If yes, provide exact location and complete in NOTES section below
Notes:	
Pass	Are additional Erosion Prevention & Sediment Control BMPs needed? If yes, provide exact location and complete in NOTES section below
Notes:	
Pass	BMPs have been removed for landscaping?
Notes:	

OFFSITE IMPACTS:

Pass	Are there BMPs installed in streams or active channels? If Yes, have them removed unless specified on plans and check for permits
Notes:	
Pass	Have BMPs kept sediment and other pollutants out of Water of the State and US?
Notes:	
Pass	Is there evidence of work outside the limits of the approved plans?
Notes:	
Pass	Are sediment or other pollutants controlled from leaving the site?
Notes:	
Pass	Are stored materials protected from exposure to precipitation?
Notes:	

VEHICLE TRACKING:

Pass	Has a proper construction entrance been installed to minimize tracking on to public roads?
Notes:	

NON-STORMWATER POLLUTANT CONTROLS:

Pass	Are proper Concrete, Stucco, Paint (etc.) Washouts located, installed and maintained?
Notes:	
Pass	Are all trash, debris and hazardous materials properly managed?
Notes:	
Pass	Are portable toilets properly located and maintained?
Notes:	

ENFORCEMENT ACTIVITY:

Pass	Have the proper actions been taken regarding previous deficiencies or violations if applicable?
Notes:	

NOTICE TO COMPLY
Pass

Notes:		*Notes:*
STOP WORK ORDER	Pass	Forward to Code Enforcement
Notes:		*Notes:*

Appendix E
Post-Construction Stormwater

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E.1 Worksheet and Instructions for Step 2 On-Lot Stormwater Volume Control Calculations

Beaufort County
Stormwater Retention Worksheet for Single Family Lot

May 2011 (Applicant input in Red Italics)
Section 1 – Lot Information

Total Impervious Area to be created

Home (rooftop) __________ *sq. ft*

Other Impervious __________*sq. ft*
(walkways, driveways, patio etc.)

Total Impervious surface __________sq. ft

*Total Lot Size*___________________*sq ft*
Pervious surface on lot = lot size – impervious surface

Soil Type: Sandy Clay -- Area of lot to be irrigated sq ft

(will be equal or less to pervious surface)

Section 2 – Post Construction Stormwater Run-off Calculation:

New gallons of rainfall to be displaced by creation of new impervious areas
(Runoff expected from a 1.95 inch storm = 1.85 inch per sq ft of impervious surface)

For Sandy soils
_________ sq ft X 1.15 gals/sq ft =_________gallons
(total impervious surface)

Less pre-construction run-off for new impervious surface
(for sandy soils there would be no runoff and clayey would be .5 inch from 1.95 inch storm)

For Clay soils
______ sq ft X 0.82 gals/sq ft =______gallons
(1.15-0.33)

Section 3 – Application of Best Management Practices

Total excess runoff__________gallons (amount to be retained, infiltrated or reused on property)

Best Management Practices to be used: (apply in order, can use a combination of practices to control excess runoff.)

1. **Storage and infiltration or reuse on the property**
   This will utilize cistern or rain barrels to retain runoff from rooftops to be infiltrated or utilized between rainfall events according to notes and conditions. Note maximum and minimum credit.

Storage and Reuse Credit

a. Rainbarrel

___ number X___size of rainbarrel-gals =_____gallons of excess runoff controlled

b. Cistern

______ size of cistern-gals =___________gallons of excess runoff controlled

(credit size is limited to rooftop impervious surface X 1.15 gal/sq ft)

2. **Disconnected Impervious Area –**
   Allowance based on amount of impervious surface that sheet flows over pervious surface before leaving property.
   - Allowance also varies for soil type and amount of area runoff sheet flows over.
   - If storage and infiltration or reuse practice is used must only use unaddressed impervious surface
   - May have to do multiple calculations if water flows off- lot in more than one direction. Generally, front and back

First Runoff direction.

sq ft divided by sq ft = Disconnected Impervious ratio
(unaddressed impervious to pevious surface) (pervious sheet flow area)

Second Runoff direction *(if applicable)*

sq ft divided by sq ft = Disconnected Impervious ratio

(unaddressed impervious to pervious surface) (pervious sheet flowarea)

Credit Table for Disconnected Impervious Area

Disconnected Impervious Ratio	Runoff reduction Gal/sq ft-impervious area	Runoff reduction Gal/sq ft-impervious area
	Clayey	Sandy
0.1	.40	1.15
0.2	.40	1.12
0.4	.38	1.08
0.8	.33	1.01
1.0	.31	.98
2.0	.24	.84
3.0	.19	.74
4.0	.16	.67
5.0	.14	.60

Disconnected Impervious area credit
First Runoff Direction
___________ sq ft X_______gal/sq ft = ______gallons of excess runoff controlled
(Unaddressed impervious (from credit table) to pervious surface)

Second Runoff Direction
___________ sq ft X_______gal/sq ft = ______gallons of excess runoff controlled
(Unaddressed impervious (from credit table) to pervious surface)

Sum of Disconnected Impervious Area____plus_____=___gallons of excess runoff controlled (first direction) (2nd Dir)

Disconnected Impervious area credit
First Runoff Direction
_________ sq ft X _____ gal/sq ft = _________ gallons of excess runoff controlled
(Unaddressed impervious (from credit table) to pervious surface)

Second Runoff Direction
_________ sq ft X _____ gal/sq ft = _________ gallons of excess runoff controlled
(Unaddressed impervious (from credit table) to pervious surface)

Sum of Disconnected Impervious Area ______ plus _____ = ______ gallons of excess runoff controlled (first direction) (2nd Dir)

3. **Excess Runoff to Raingarden** Volume not controlled by the first two practices will be addressed by this last treatment train. Location will depend where uncontrolled volume is.
This will be for a standard designed raingarden of three foot planting media depth and a 6 inch maximum ponding depth. Raingardens will be used primarily for surface impervious surface but

can be used for rooftop impervious surface in small lots without sufficient pervious surface. BMP
manual requires storage in raingarden of 1.5 inch per impervious acre and suitable site (generally above water table)

Runoff to Raingarden
_____ gal of Excess Site Runoff - ____ gal of Storage - ____ gal of disconnected impervious area = _____ gal runoff to raingarden
(Conversion of gallons to impervious surface controlled as follows ____ gal of runoff to raingarden divided by 1.15gal/sq.ft. = ______ sq ft of impervious circle.)

Size of standard raingarden
____ sq.ft impervious surface divided by(7 for sandy and 4 for clayey soils) =
______ sq ft of standard raingarden
(impervious surface directed to raingarden)

Raingarden Credit
_____ sq. ft. impervious surface X 1.15 gals/sq.ft. = _____ gallons runoff controlled (unaddressed impervious surface directed to raingarden)

Section 4 – Summary of Volume Reduction Practices

Practice Reductions (from section 3)

Infiltration or Reuse	_______	gallons
Disconnected Drainage	_______	gallons
Raingarden	_______	gallons (used to treat remaining volume)
Total	_______	gallons
Total Required (from section 2)	_______	gallons

Section 5 – Notes and Conditions

1. Sandy Soils are considered A and B soils and Clayey soils are considered C and D soils. SCS soils map can be used to determine classification or utilize infiltration rates. Sandy soils have infiltration above .5 in/hr and clayey soils are below this.
2. Storage from rainbarrels and cisterns for reuse should be utilized between rainfall events and a minimum of 10 percent should be utilized for irrigation if it had not rained the previous day.
3. When in ground irrigation system is installed the recommended storage requirement should be above 0.3 gallon per square foot of rooftop impervious surface. The maximum allowed credit is 1.15 gallon per square foot. Storage can be greater to reduce irrigation needs or improve infiltration, but will not receive credit greater than 1.15 gallon per square foot.
4. When storage is utilized, the amount of rooftop impervious surface going to the disconnected impervious surface step is reduced by storage. Example: If rooftop square footage is 2500 and storage is 1,150 gallon then the impervious surface in the disconnected impervious surface step is reduced by 1000 square feet. The

unaddressed rooftop impervious surface is going to the disconnected impervious surface step is now 1,500 square feet.

5. Credits for non standard raingardens can be developed from criteria in Beaufort County BMP manual page 5-48

Definitions and Conversion explanations

Definitions

Impervious Surface – hard surface that allow rainfall to run off and not infiltrate into soil.
Rooftop impervious surface – horizontal surface area of rooftops including overhangs and other detached buildings/sheds.
Other impervious – generally hard surfaces on the ground like paved driveways, patios, walkways and sidewalks.
Pervious Surface – surface that is not hard, might be grass, garden or tree area. Also includes gravel and dirt driveways.
Irrigated area is area that would be served by an installed irrigation system.
Unaddressed impervious surface – term used to determine amount of impervious surface that had not been controlled by a previous practice.
Standard Raingarden/Bioretention – raingarden that has 3 ft of fill material and a 6 inch maximum ponding depth. Different sizes can be constructed but then credits must be computed from Beaufort County BMP manual. BMP manual requires storage of 1.5 inch per acre of impervious surface.

Conversions

Rainfall to gallons of Runoff
Design storm is 1.95 inch of which 1.85 inch is available to run off impervious surface. 1.85 inch on 1 square foot of impervious surface is equivalent to 1.15 gallon of runoff
Preconstruction Runoff
Clayey Soils – 0.53 inches run off for a 1.95 inch storm. 0.53 inch on 1 square foot is equivalent to 0.33 gallon of runoff.
Sandy Soils – No runoff for a 1.95 inch storm
Raingarden/Bioretention
Square foot of impervious surface per square foot of standard raingarden

- Clayey soils 4 sqft of impervious surface to 1 sqft of standard raingarden
- Sandy soils 7 sqft of impervious surface to 1 sqft of standard raingarden

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E.2 Worksheets for Evaluating Proposed BMP Plans for Antidegradation Water Quality Goals and BMP Sizing

Figure E-1 presents a worksheet to determine effective impervious. Figure E-2 presents an example worksheet application for calculating effective impervious for a hypothetical residential development. For this example, the total site area is 120 acres, with 40 acres of what would traditionally be considered impervious area. This would include rooftops, paved driveways, and paved streets. Soil group D is predominant on the site.

As shown in Figure E-2, the proposed volume control BMPs would include rain gardens to treat rooftop runoff, porous pavement for all driveway areas, and swales along all of the streets. For the rain gardens, a value of 12 percent effective imperviousness is provided from Table 5-5 for soil group D, ponding depth of 6 inches, and planting media depth of 3 ft. The porous pavement is treated as 0 percent effective imperviousness (100 percent developed pervious area). For the street runoff to swales, the value of 90 percent effective imperviousness is interpolated from values in Table 5-6 for soil group D and ratio of street impervious area to adjoining pervious area (one-half of total swale surface area as discussed earlier) equal to 4.3. Note that the rain garden and swale entries include notes suggesting how the rain garden and swale areas were established.

Overall, the volume control BMPs take the development from a 33 percent uncontrolled imperviousness to an effective imperviousness (Impervious Developed Area in the figure) of 10 percent.

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Figure E-1. Worksheet for Determining Effective Impervious

Site Element	Area (acres)	Volume Control BMP	Effective Imperviousness (%)	Impervious Developed area (acres)	Pervious Developed Area (acres)	Dedicated Open Space (acres)
Total Area (acres)		---	---			
% of Total Area	---	---	----			
Predominant Soil Group						

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Figure E-2. Example 1 - Worksheet Calculations for Residential Development with Volume Control BMPs

Site Element	Area (acres)	Volume Control BMP	Effective Impervious ness (%)	Impervious Developed area (acres)	Pervious Developed Area (acres)	Dedicated Open Space (acres)
Rooftop	25	Rain Garden Ponding depth = 6 in Media depth = 3 ft	12%	3	22	0
Driveway	5	Porous pavement	0%	0	5	0
Streets	10	Swale Ratio of impervious to pervious area = 4.3 (based on ½ swale topwidth)	90%	9	1	0
Urban Pervious Area (e.g., lawns)	56	---	---	0	56	0
Rain Garden	5	(Rain garden area is 20% of tributary impervious area)	---	0	0	5
Dedicated open space	8.3	---	---	0	0	8.3
Swales	4.7	(Ratio of street impervious area to full swale surface area = 2.15)	---	0	0	4.7
Wet detention pond	6	---	---	0	0	6
Total Area	120.0	---	---	12.0	84.0	24.0
% Total Area	---	---	---	10%	70%	20%
Predominant Soil Type	D					

A second example prepared for the same residential development is presented in Figure E-3. In this case, all of the volume control reduction is achieved by capturing impervious area runoff and using captured runoff for irrigation. This may require an alternative design of the proposed wet detention pond BMP to account for storage that will be depleted by irrigation use, or implementation of a separate wet detention pond designed specifically for runoff capture and irrigation use. An effective imperviousness value of 30 percent was selected from Table 5-4, based on a capture volume of 2 inches of runoff over the impervious tributary area, and a ratio of irrigated area to impervious area of 1.3. With 40 acres of traditional impervious area, the required area for irrigation is 52 acres. This is less than the available urban pervious area, so this should be an acceptable solution. The wet detention pond area is greater than the previous example to account for the required capture storage and for the fact that there are no onsite volume control BMPs to reduce pond inflows during design storm events. Again, the overall effect is to limit the effective imperviousness to 10 percent, compared to a traditional imperviousness of 33 percent.

Figure E-4 illustrates an example calculation for a commercial site. In this example, the total site of 32 acres includes 26.3 acres of traditional impervious area, or about 82 percent of the site. The proposed volume control BMPs include flat roof evaporation with cistern for the rooftops, a combination of porous pavement (50 percent) and rain garden volume control (50 percent) for the parking lot area, and no control for the street area. For the roof evaporation, a value of -8 percent is read from Table 5-5 for soil group D, roof ponding of 6 inches, and no cistern. The negative value indicates that the roof runoff with the storage will actually be less than the runoff expected from a pervious area with soil group D. For the rain garden, a value of 12 percent effective imperviousness is read from Table 5-5 for soil group D, ponding depth of 6 inches, and planting media depth of 3 ft. The porous pavement is treated as 0 percent effective imperviousness (100 percent developed pervious area). The rain garden entry includes a note suggesting how the rain garden area was established. Overall, the volume control BMPs take the development from an 82 percent uncontrolled imperviousness to an effective imperviousness (Impervious Developed Area in the figure) of 10 percent.

Figure E-5 provides worksheets to determine if a proposed BMP plan will meet the antidegradation water quality goal for total nitrogen.

Figure E-6 provides worksheets to determine if a proposed BMP plan will meet the antidegradation water quality goal for total phosphorus.

Figure E-7 provides worksheets to determine if a proposed BMP plan will meet the antidegradation water quality goal for total bacteria.

Figure E-3. Example 2 - Worksheet Calculations for Residential Development with Volume Control BMPs

Site Element	Area (acres)	Volume Control BMP	Effective Imperviousness (%)	Impervious Developed area (acres)	Pervious Developed Area (acres)	Dedicated Open Space (acres)
Rooftop	25	Stormwater Capture and Capture volume = 2.0 in Irrigated/impervious area ratio	30%	7.5	17.5	0
Driveway	5	Stormwater Capture and Capture volume = 2.0 in Irrigated/impervious area ratio	30%	1.5	3.5	0
Streets	10	Wtormwater Capture and Capture volume = 2.0 in Irrigated/impervious area ratio	30%	3	7	0
Urban Pervious Area (e.g., lawns)	58	(52 acres irrigated by captured stomrwater)	---	0	58	0
Dedicated open space	810	---	---	0	0	10
Wet detention pond	12	---	---	0	0	12
Total Area	120.0	---	---	12.0	86.0	22.0
% Total Area	---	---	---	10%	72%	18%
Predominant Soil Type	D					

Figure E-4. Example 3 - Worksheet Calculations for Commercial Development with Volume Control BMPs

Site Element	Area (acres)	Volume Control BMP	Effective Impervious ness (%)	Impervious Developed area (acres)	Pervious Developed Area (acres)	Dedicated Open Space (acres)
Rooftop	7	Rain Garden Ponding depth = 6 inches Media depth = 3 ft	-8%	-0.56	7.56	0
Parking Lot	8.25	Porous pavement	0%	0	8.25	0
Parking Lot	8.25	Rain garden Ponding depth = 6 in Media depth = 3 ft	12%	.99	7.26	
Streets	10	None	100%	2.8	0	0
Urban Pervious Area (e.g., lawns)	56	---	---	0	1	0
Rain Garden	5	(Rain garden area is 20% of tributary impervious area)	---	0	0	1.7
Wet detention pond	6	---	---	0	0	3
Total Area	32.0	---	---	3.2	24.1	4.7
% Total Area	---	---	---	10%	75%	15%
Predominant Soil Type	D					

Figure E-5a

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - TOTAL NITROGEN

Total Site Area (acres) __________ A_{site}

Impervious Developed Area (acres) * __________ A_{devimp}

includes all surfaces that significantly impedes or prevents natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface

Pervious Developed Area (acres) __________ $A_{devperv}$

includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement

Dedicated Open Space (acres) __________ A_{dedop}

includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)

NOTE: The total site area A_{site} should be equal to the sum of $A_{devimp} + A_{devperv} + A_{dedop}$ __________ A_{site}

Imperviousness of Developed Area (%) __________ I_{dev}

$I_{dev} = A_{devimp} / (A_{devimp} + A_{devperv}) * 100$

[1] Because fertilized sections of golf courses exhibit total N loads characteristics of medium density residential development, these areas should be treated as 25% impervious in the BMP worksheet calculations, even tough they are actually 0% impervious. Unfertilized golf course areas can be treated as 0% impervious.

[2] Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

[3] For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

[4] For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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Figure E-5b

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: NITROGEN REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** ________ R_{base}

(Using Total Nitrogen as Target Pollutant)
Based on total-N data in Figure 3-5,

R_{base} =	$(I_{dev} * 2.7) - 27$	if I_{dev} is 11-25% impervious
	$(I_{dev} * 0.96) + 16$	if I_{dev} is 26-50% impervious
	$(I_{dev} * 0.45) + 41$	if I_{dev} is 51-70% impervious
	$(I_{dev} * 0.27) + 54$	if I_{dev} is 71-100% impervious

Required Total Nitrogen Removal (%) ________ R_{req}

for Developed Area, Adjusted for Dedicated
Open Space Maintained On Site

$R_{req} = 100 - (100 - R_{base}) / ((A_{devimp} + A_{devperv}) / A_{site})$
(If $R_{req} < 0$, then enter 0)

Primary BMP Type Bioretention

Assumed Primary BMP Total Nitrogen Removal (%) ________ E_{pri}

Wet Detention	35%
Extended Dry Detention	15%
Mod. Ext. Dry Detention	25%
Grass Swale w/Check Dams:	20%
Biofiltration Swale:	10%
Infiltration:	55%
Bioretention:	45%
Innovative - Swirl Concentrator:	15%
Innovative - Settling/Filtration:	45%
Innovative - Settling/Wetland:	45%

Percent of Developed Area that is Served by Primary BMP ________ S_{pri}

Calculated Primary BMP Removal (%) ________ R_{pri}

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? ________

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Figure E-5c

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR NITROGEN CONTROL

Supplemental Pre-Treatment BMP Type ________

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ S_{sup}

Assumed Supplemental BMP Total Nitrogen Removal (%) ________ E_{sup}
(see total-P removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $R_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________ **Y/N**

<u>If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:</u>

1 Reduce the amount of impervious area (A_{devimp}), and increase the pervious area ($A_{devperv}$) and/or dedicated open space area (A_{dedop}) accordingly.

2 Choose more effective primary and/or pre-treatment BMPs.

3 Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).

4 Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{devperv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figure E-6a

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - TOTAL PHOSPHORUS

Total Site Area (acres) _________ A_{site}

Impervious Developed Area (acres) * _________ A_{devimp}

includes all surfaces that significantly impedes or prevents natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface

Pervious Developed Area (acres) _________ $A_{devperv}$

includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement

Dedicated Open Space (acres) _________ A_{dedop}

includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)

<u>NOTE:</u> The total site area A_{site} should be equal to the sum of $A_{devimp} + A_{devperv} + A_{dedop}$ _________ A_{site}

Imperviousness of Developed Area (%) _________ I_{dev}

$I_{dev} = A_{devimp} / (A_{devimp} + A_{devperv}) * 100$

[1] Because fertilized sections of golf courses exhibit total P loads characteristics of medium density residential development, these areas should be treated as 25% impervious in the BMP worksheet calculations, even tough they are actually 0% impervious. Unfertilized golf course areas can be treated as 0% impervious.

[2] Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

[3] For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

[4] For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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FIGURE E-6b

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: PHOSPHORUS REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** _________ **R_{base}**

(Using Total Phosphorus as Target Pollutant)

Based on total-P data in Figure 3-5,

$R_{base} =$ $(I_{dev} * 2.7) - 27$ if I_{dev} is 11-25% impervious
$(I_{dev} * 0.4) + 30$ if I_{dev} is 26-50% impervious
$(I_{dev} * 0.2) + 40$ if I_{dev} is 51-70% impervious
$(I_{dev} * 0.48) + 20$ if I_{dev} is 71-100% impervious

Required Total Phosphorus Removal (%) _________ **R** $_{req}$

for Developed Area, Adjusted for Dedicated

Open Space Maintained On Site

$R_{req} = 100 - (100- R_{base}) / ((A_{devimp} + A_{devperv}) / A_{site})$

(If $R_{req} < 0$, then enter 0)

Primary BMP Type

Assumed Primary BMP Total Phosphorus Removal (%) _________ **E** $_{pri}$

Wet Detention	60%
Extended Dry Detention	30%
Mod. Ext. Dry Detention	60%
Grass Swale w/Check Dams:	25%
Biofiltration Swale:	15%
Infiltration:	55%
Bioretention:	55%
Innovative - Swirl Concentrator:	30%
Innovative - Settling/Filtration:	60%
Innovative - Settling/Wetland:	60%

Percent of Developed Area that is
Served by Primary BMP _________ **S_{pri}**

Calculated Primary BMP Removal (%) _________ **R_{pri}**

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? _________

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Figure E-6c

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR PHOSPHORUS CONTROL

Supplemental Pre-Treatment BMP Type Infiltration (natural depressions)

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ $\mathbf{S_{sup}}$

Assumed Supplemental BMP Total Phosphorus Removal (%) ________ $\mathbf{E}_{sup}$
(see total-P removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $\mathbf{R}_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________

<u>If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:</u>

1. Reduce the amount of impervious area (A_{devimp}), and increase the pervious area ($A_{devperv}$) and/or dedicated open space area (A_{dedop}) accordingly.

2. Choose more effective primary and/or pre-treatment BMPs.

3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).

4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{devperv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figure E-7a

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - FECAL COLIFORM BACTERIA

Total Site Area (acres) __________ A_{site}

Impervious Developed Area (acres) * __________ A_{devimp}

includes all surfaces that significantly impedes or prevents natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface

Pervious Developed Area (acres) __________ $A_{devperv}$

includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement

Dedicated Open Space (acres) __________ A_{dedop}

includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)

NOTE: The total site area A_{site} should be equal to the sum of $A_{devimp} + A_{devperv} + A_{dedop}$ __________ A_{site}

Imperviousness of Developed Area (%) __________ I_{dev}

$I_{dev} = A_{devimp} / (A_{devimp} + A_{devperv}) * 100$

[1] For bacteria evaluation, treat golfcourses like any other land use (i.e., do not treat pervious golf courses as 25% impervious)

[2] Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

[3] For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

[4] For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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Figure E-7b

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: BACTERIA REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** ________ $\mathbf{R_{base}}$

(Using Fecal Coliform Bacteria as Target Pollutant)

Based on bacteria data in Figure 3-5,

R_{base} =	$(I_{dev} * 8.8) - 44$	if I_{dev} is 6-10% impervious
	$(I_{dev} * 1.5) + 29$	if I_{dev} is 11-25% impervious
	$(I_{dev} * 0.12) + 64$	if I_{dev} is 26-50% impervious
	70	if I_{dev} is 51-100% impervious

Required Bacterial Removal (%) ________ $\mathbf{R_{req}}$

for Developed Area, Adjusted for Dedicated
Open Space Maintained On Site

$R_{req} = 100 - (100 - R_{base}) / ((A_{devimp} + A_{devperv}) / A_{site})$

(If $R_{req} < 0$, then enter 0)

Primary BMP Type ________________

Assumed Primary BMP Total Bacteria Removal (%) ________ $\mathbf{E_{pri}}$

Wet Detention	80%
Extended Dry Detention	35%
Mod. Ext. Dry Detention	50%
Grass Swale w/Check Dams:	30%
Biofiltration Swale:	10%
Infiltration:	90%
Bioretention:	70%
Innovative - Swirl Concentrator:	10%
Innovative - Settling/Filtration:	35%
Innovative - Settling/Wetland:	70%

Percent of Developed Area that is
Served by Primary BMP ________ $\mathbf{S_{pri}}$

Calculated Primary BMP Removal (%) ________ $\mathbf{R_{pri}}$

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($\mathbf{R_{pri} > R_{req}}$)? ________

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Figure E-7c

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR BACTERIA CONTROL

Supplemental Pre-Treatment BMP Type ________

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ S_{sup}

Assumed Supplemental BMP Bacteria Removal (%) ________ E_{sup}
(see bacteria removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $R_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________

<u>If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:</u>

1. Reduce the amount of impervious area (A_{devimp}), and increase the pervious area ($A_{devperv}$) and/or dedicated open space area (A_{dedop}) accordingly.

2. Choose more effective primary and/or pre-treatment BMPs.

3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).

4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{devperv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figures E-8 through E-10 illustrate the use of the water quality worksheets to evaluate the example development project that was previously evaluated for volume control in Figure E-4. The example is a 32-acre site with 26.8 acres of site features that would typically be considered impervious area (e.g., rooftops, streets, parking lots). As shown in Figure E-4, implementation of features such as porous pavement, rooftop rain storage and evaporation, and rain gardens reduce the "effective" impervious area to 3.2 acres. Dedicated open space area of 4.7 acres included the wet detention pond and rain garden footprints, and the remaining area of 24.1 acres is designated as developed pervious area.

Figures E-8 and E-10 show that meeting the volume control requirement will also meet the water quality requirement for total phosphorus and total nitrogen. In both cases, the required removal for developed area is less than or equal to zero on Page 2 of the worksheets, and evaluation of the primary BMP is not necessary. This makes sense, given that the water quality target imperviousness for total phosphorus and total nitrogen is 10 percent, the same as for volume control.

Because the water quality imperviousness target for fecal coliform bacteria is 5 percent, Figure E-9 shows that volume control alone does not meet the water quality requirement, and the primary BMP calculations must be done. The calculations show that the wet detention pond BMP provided sufficient treatment to meet the water quality requirement, and secondary BMPs are not required.

Figures E-11 and E-12 are fecal coliform bacteria worksheets prepared for the example residential developments that were evaluated for volume control in Figures E-2 and E-3, respectively. Both examples included a 120-acre development with 40 acres of site features that would typically be considered impervious area (e.g., roof tops, streets, driveways). The two examples used different methods, but both achieved an "effective" imperviousness of 10 percent.

As in the previous example presented in Figures E-8 and E-10, the water quality calculations for the example residential developments demonstrated that the water quality requirements for total phosphorus and total nitrogen are met by limiting the effective imperviousness of the site to 10 percent. Consequently, these worksheets are not presented here.

The water quality calculations for the residential development examples show that limiting the effective site imperviousness to 10 percent does not meet the water quality requirement for fecal coliform bacteria. As discussed earlier, this is because the water quality imperviousness target is 5 percent. The worksheets in Figure E-11 and E-12 both show that the combination of site features to reduce effective imperviousness plus treatment in the wet detention pond BMP results in achievement of the water quality requirement.

Figures E-13 through E-17 are worksheets provided to evaluate sizing for various BMPs.

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Figure E-8a

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - TOTAL PHOSPHORUS

Total Site Area (acres) — 32.0 A_{site}

Impervious Developed Area (acres) * — 3.2 A_{devimp}

includes all surfaces that significantly impedes or prevents natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface

Pervious Developed Area (acres) — 24.1 $A_{devperv}$

includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement

Dedicated Open Space (acres) — 4.7 A_{dedop}

includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)

NOTE: The total site area A_{site} should be equal to the sum of $A_{devimp} + A_{devperv} + A_{dedop}$ — 32.0 A_{site}

Imperviousness of Developed Area (%) — 11.7 I_{dev}

$I_{dev} = A_{devimp} / (A_{devimp} + A_{devperv}) * 100$

[1] Because fertilized sections of golf courses exhibit total P loads characteristics of medium density residential development, these areas should be treated as 25% impervious in the BMP worksheet calculations, even tough they are actually 0% impervious. Unfertilized golf course areas can be treated as 0% impervious.

[2] Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

[3] For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

[4] For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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FIGURE E-8b

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: PHOSPHORUS REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** 4.60 $\mathbf{R_{base}}$

(Using Total Phosphorus as Target Pollutant)
Based on total-P data in Figure 3-5,

R_{base} =	$(I_{dev} * 2.7) - 27$	if I_{dev} is 11-25% impervious
	$(I_{dev} * 0.4) + 30$	if I_{dev} is 26-50% impervious
	$(I_{dev} * 0.2) + 40$	if I_{dev} is 51-70% impervious
	$(I_{dev} * 0.48) + 20$	if I_{dev} is 71-100% impervious

Required Total Phosphorus Removal (%) 0.00 $\mathbf{R_{req}}$

for Developed Area, Adjusted for Dedicated
Open Space Maintained On Site

$R_{req} = 100 - (100- R_{base}) / ((A_{devimp} + A_{devperv}) / A_{site})$
(If $R_{req} < 0$, then enter 0)

Primary BMP Type

Assumed Primary BMP Total Phosphorus Removal (%) ________ $\mathbf{E_{pri}}$

Wet Detention	60%
Extended Dry Detention	30%
Mod. Ext. Dry Detention	60%
Grass Swale w/Check Dams:	25%
Biofiltration Swale:	15%
Infiltration:	55%
Bioretention:	55%
Innovative - Swirl Concentrator:	30%
Innovative - Settling/Filtration:	60%
Innovative - Settling/Wetland:	60%

Percent of Developed Area that is
Served by Primary BMP ________ $\mathbf{S_{pri}}$

Calculated Primary BMP Removal (%) ________ $\mathbf{R_{pri}}$

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? ________

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Figure E-8c

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR PHOSPHORUS CONTROL

Supplemental Pre-Treatment BMP Type Infiltration (natural depressions)

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ **S_{sup}**

Assumed Supplemental BMP Total Phosphorus Removal (%) ________ **E** $_{sup}$
(see total-P removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ **R** $_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________

<u>If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:</u>

1. Reduce the amount of impervious area (A_{devimp}), and increase the pervious area ($A_{devperv}$) and/or dedicated open space area (A_{dedop}) accordingly.

2. Choose more effective primary and/or pre-treatment BMPs.

3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).

4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{devperv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figure E-9a

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - FECAL COLIFORM BACTERIA

Total Site Area (acres)	32.0	$\mathbf{A_{site}}$
Impervious Developed Area (acres) * includes all surfaces that significantly impedes or prevents natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface	3.2	$\mathbf{A_{dev\,imp}}$
Pervious Developed Area (acres) includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement	24.1	$\mathbf{A_{dev\,perv}}$
Dedicated Open Space (acres) includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)	4.7	$\mathbf{A_{dedop}}$
<u>NOTE:</u> The total site area A_{site} should be equal to the sum of $A_{dev\,imp} + A_{dev\,perv} + A_{dedop}$	32.0	$\mathbf{A_{site}}$
Imperviousness of Developed Area (%) $I_{dev} = A_{dev\,imp} / (A_{dev\,imp} + A_{dev\,perv}) * 100$	11.7	$\mathbf{I_{dev}}$

[1] For bacteria evaluation, treat golf courses like any other land use (i.e., do <u>not</u> treat pervious golf courses as 25% impervious)

[2] Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

[3] For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

[4] For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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Figure E-9b

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: BACTERIA REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** 47.00 R_{base}

(Using Fecal Coliform Bacteria as Target Pollutant)

Based on bacteria data in Figure 3-5,

R_{base} =	$(I_{dev} * 8.8) - 44$	if I_{dev} is 6-10% impervious
	$(I_{dev} * 1.5) + 29$	if I_{dev} is 11-25% impervious
	$(I_{dev} * 0.12) + 64$	if I_{dev} is 26-50% impervious
	70	if I_{dev} is 51-100% impervious

Required Bacterial Removal (%) 37.00 R_{req}

for Developed Area, Adjusted for Dedicated

Open Space Maintained On Site

$R_{req} = 100 - (100 - R_{base}) / ((A_{dev\,imp} + A_{dev\,perv}) / A_{site})$

(If $R_{req} < 0$, then enter 0)

Primary BMP Type Wet Detention

Assumed Primary BMP Total Bacteria Removal (%) 80.00 E_{pri}

Wet Detention	80%
Extended Dry Detention	35%
Mod. Ext. Dry Detention	50%
Grass Swale w/Check Dams:	30%
Biofiltration Swale:	10%
Infiltration:	90%
Bioretention:	70%
Innovative - Swirl Concentrator:	10%
Innovative - Settling/Filtration:	35%
Innovative - Settling/Wetland:	70%

Percent of Developed Area that is Served by Primary BMP 90.00 S_{pri}

Calculated Primary BMP Removal (%) 72.00 R_{pri}

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? No

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Figure E-9c

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR BACTERIA CONTROL

Supplemental Pre-Treatment BMP Type Not Required

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ S_{sup}

Assumed Supplemental BMP Bacteria Removal (%) ________ E_{sup}
(see bacteria removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $R_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________

If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:

1. Reduce the amount of impervious area ($A_{dev\,imp}$), and increase the pervious area ($A_{dev\,perv}$) and/or dedicated open space area (A_{dedop}) accordingly.
2. Choose more effective primary and/or pre-treatment BMPs.
3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).
4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{dev\,perv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figure E-10a

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - TOTAL NITROGEN

Total Site Area (acres) 32.00 $\mathbf{A}_{\mathbf{site}}$

Impervious Developed Area (acres) * 3.20 $\mathbf{A}_{\mathbf{dev\,imp}}$
includes all surfaces that significantly impede or prevent natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface

Pervious Developed Area (acres) 24.10 $\mathbf{A}_{\mathbf{dev\,perv}}$
includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement

Dedicated Open Space (acres) 4.70 $\mathbf{A}_{\mathbf{dedop}}$
includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)

<u>NOTE:</u> The total site area A_{site} should be equal to the sum of $A_{dev\,imp} + A_{dev\,perv} + A_{dedop}$ 32.00 $\mathbf{A}_{\mathbf{site}}$

Imperviousness of Developed Area (%) 11.70 $\mathbf{I}_{\mathbf{dev}}$
$I_{dev} = A_{dev\,imp} / (A_{dev\,imp} + A_{dev\,perv}) * 100$

1 Because fertilized sections of golf courses exhibit total P load characteristics of medium-density residential development, these areas should be treated as 25% impervious in the BMP worksheet calculations, even though they are actually 0% impervious. Unfertilized golf course areas can be treated as 0% impervious.

2 Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

3 For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

4 For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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Figure E-10b

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: NITROGEN REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** 4.60 $\mathbf{R_{base}}$

(Using Total Phosphorus as Target Pollutant)

Based on total-P data in Figure 3-5,

$R_{base} =$ $(I_{dev} * 2.7) - 27$ if I_{dev} is 11-25% impervious
$(I_{dev} * 0.4) + 30$ if I_{dev} is 26-50% impervious
$(I_{dev} * 0.2) + 40$ if I_{dev} is 51-70% impervious
$(I_{dev} * 0.48) + 20$ if I_{dev} is 71-100% impervious

Required Total Phosphorus Removal (%) 0.00 $\mathbf{R_{req}}$

for Developed Area, Adjusted for Dedicated
Open Space Maintained On Site

$R_{req} = 100 - (100- R_{base}) / ((A_{dev\,imp} + A_{dev\,perv}) / A_{site})$
(If $R_{req} < 0$, then enter 0)

Primary BMP Type ____________________

Assumed Primary BMP Total Phosphorus Removal (%) ________ $\mathbf{E_{pri}}$

Wet Detention	60%
Extended Dry Detention	30%
Mod. Ext. Dry Detention	60%
Grass Swale w/Check Dams:	25%
Biofiltration Swale:	15%
Infiltration:	55%
Bioretention:	55%
Innovative - Swirl Concentrator:	30%
Innovative - Settling/Filtration:	60%
Innovative - Settling/Wetland:	60%

Percent of Developed Area that is
Served by Primary BMP 0.00 $\mathbf{S_{pri}}$

Calculated Primary BMP Removal (%) 0.00 $\mathbf{R_{pri}}$

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? Yes

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Figure E-10c

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR NITROGEN CONTROL

Supplemental Pre-Treatment BMP Type ________

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ S_{sup}

Assumed Supplemental BMP Total Nitrogen Removal (%) ________ E_{sup}
(see total-P removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $R_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________ **Y/N**

If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:

1. Reduce the amount of impervious area ($A_{dev\,imp}$), and increase the pervious area ($A_{dev\,perv}$) and/or dedicated open space area (A_{dedop}) accordingly.
2. Choose more effective primary and/or pre-treatment BMPs.
3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).
4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{dev\,perv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figure E-11a

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - FECAL COLIFORM BACTERIA

Total Site Area (acres)	120.00	$\mathbf{A}_{\mathbf{site}}$
Impervious Developed Area (acres) * includes all surfaces that significantly impede or prevent natural infiltration of w ater into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface	12.00	$\mathbf{A}_{\mathbf{dev\,imp}}$
Pervious Developed Area (acres) includes improved areas such as law ns that do not impede natural infiltration of w ater into the soil, but may cause stormw ater pollution loads due to fertilization or application of pesticides; also includes porous pavement	84.00	$\mathbf{A}_{\mathbf{dev\,perv}}$
Dedicated Open Space (acres) includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormw ater management facilities (e.g., ponds, sw ales)	24.00	$\mathbf{A}_{\mathbf{dedop}}$
<u>NOTE:</u> The total site area A_{site} should be equal to the sum of $A_{dev\,imp} + A_{dev\,perv} + A_{dedop}$	120.00	$\mathbf{A}_{\mathbf{site}}$
Imperviousness of Developed Area (%) $I_{dev} = A_{dev\,imp} / (A_{dev\,imp} + A_{dev\,perv}) * 100$	12.50	$\mathbf{I}_{\mathbf{dev}}$

[1] For bacteria evaluation, treat golf courses like any other land use (i.e., do <u>not</u> treat pervious golf courses as 25% impervious)

[2] Area of structures w ith "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

[3] For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

[4] For impervious areas directing runoff to lot sw ales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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Figure E-11b

WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: BACTERIA REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** 47.00 R_{base}

(Using Fecal Coliform Bacteria as Target Pollutant)

Based on bacteria data in Figure 3-5,

R_{base} =	$(I_{dev} * 8.8) - 44$	if I_{dev} is 6-10% impervious
	$(I_{dev} * 1.5) + 29$	if I_{dev} is 11-25% impervious
	$(I_{dev} * 0.12) + 64$	if I_{dev} is 26-50% impervious
	70	if I_{dev} is 51-100% impervious

Required Bacterial Removal (%) 35.00 R_{req}

for Developed Area, Adjusted for Dedicated
Open Space Maintained On Site

$R_{req} = 100 - (100 - R_{base}) / ((A_{dev imp} + A_{dev perv}) / A_{site})$

(If $R_{req} < 0$, then enter 0)

Primary BMP Type Wet Detention

Assumed Primary BMP Total Bacteria Removal (%) 80.00 E_{pri}

Wet Detention	80%
Extended Dry Detention	35%
Mod. Ext. Dry Detention	50%
Grass Swale w/Check Dams:	30%
Biofiltration Swale:	10%
Infiltration:	90%
Bioretention:	70%
Innovative - Swirl Concentrator:	10%
Innovative - Settling/Filtration:	35%
Innovative - Settling/Wetland:	70%

Percent of Developed Area that is Served by Primary BMP 90.00 S_{pri}

Calculated Primary BMP Removal (%) 72.00 R_{pri}

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? Yes

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Figure E-11c

EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR BACTERIA CONTROL

Supplemental Pre-Treatment BMP Type ________

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ S_{sup}

Assumed Supplemental BMP Bacteria Removal (%) ________ E_{sup}
(see bacteria removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $R_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1\text{-}((1\text{-}S_{sup}/100*E_{sup}/100) * (1\text{-}R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________

<u>If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:</u>

1. Reduce the amount of impervious area ($A_{dev\,imp}$), and increase the pervious area ($A_{dev\,perv}$) and/or dedicated open space area (A_{dedop}) accordingly.

2. Choose more effective primary and/or pre-treatment BMPs.

3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).

4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{dev\,perv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of <u>developed area</u> that drains to the BMP.

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Figure E-12a

2ND EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 1: SITE CHARACTERIZATION - FECAL COLIFORM BACTERIA

Total Site Area (acres)	120.00	$\mathbf{A_{site}}$
Impervious Developed Area (acres) * includes all surfaces that significantly impede or prevent natural infiltration of water into the soil. Examples include roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface	12.00	$\mathbf{A_{dev\,imp}}$
Pervious Developed Area (acres) includes improved areas such as lawns that do not impede natural infiltration of water into the soil, but may cause stormwater pollution loads due to fertilization or application of pesticides; also includes porous pavement	86.00	$\mathbf{A_{dev\,perv}}$
Dedicated Open Space (acres) includes undisturbed common space, flood plain easement areas, conservation easement areas, vegetated stream buffers, and stormwater management facilities (e.g., ponds, swales)	22.00	$\mathbf{A_{dedop}}$
<u>NOTE:</u> The total site area A_{site} should be equal to the sum of $A_{dev\,imp} + A_{dev\,perv} + A_{dedop}$	120.00	$\mathbf{A_{site}}$
Imperviousness of Developed Area (%) $I_{dev} = A_{dev\,imp} / (A_{dev\,imp} + A_{dev\,perv}) * 100$	12.20	$\mathbf{I_{dev}}$

1 For bacteria evaluation, treat golf courses like any other land use (i.e., do <u>not</u> treat pervious golf courses as 25% impervious)

2 Area of structures with "green roofs" can be considered 50% impervious developed area and 50% pervious developed area

3 For impervious areas directing runoff to sheet flow over pervious area, Figure 3-6 should be used to determine the relative percentages of impervious developed and pervious developed area.

4 For impervious areas directing runoff to lot swales, sunken islands or disconnected drainage, Figure 3-7 should be used to determine the relative percentages of impervious developed and pervious developed area.

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Figure E-12b

2ND EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 2: BACTERIA REMOVAL REQUIREMENTS AND BMP PLAN EFFECTIVENESS

Base Required Pollutant Removal (%) **for Developed Area** 47.00 **R_{base}**

(Using Fecal Coliform Bacteria as Target Pollutant)
Based on bacteria data in Figure 3-5,

R_{base} =	$(I_{dev} * 8.8) - 44$	if I_{dev} is 6-10% impervious
	$(I_{dev} * 1.5) + 29$	if I_{dev} is 11-25% impervious
	$(I_{dev} * 0.12) + 64$	if I_{dev} is 26-50% impervious
	70	if I_{dev} is 51-100% impervious

Required Bacterial Removal (%) 36.00 **R_{req}**

for Developed Area, Adjusted for Dedicated
Open Space Maintained On Site

$R_{req} = 100 - (100 - R_{base}) / ((A_{dev imp} + A_{dev perv}) / A_{site})$
(If $R_{req} < 0$, then enter 0)

Primary BMP Type Wet Detention

Assumed Primary BMP Total Bacteria Removal (%) 80.00 **E_{pri}**

Wet Detention	80%
Extended Dry Detention	35%
Mod. Ext. Dry Detention	50%
Grass Swale w/Check Dams:	30%
Biofiltration Swale:	10%
Infiltration:	90%
Bioretention:	70%
Innovative - Swirl Concentrator:	10%
Innovative - Settling/Filtration:	35%
Innovative - Settling/Wetland:	70%

Percent of Developed Area that is
Served by Primary BMP 90.00 **S_{pri}**

Calculated Primary BMP Removal (%) 72.00 **R_{pri}**

$R_{pri} = E_{pri} * S_{pri} / 100$

If primary BMP removal does not satisfy the pollutant removal requirement
(i.e., if $R_{pri} < R_{req}$), then complete calculations on page 3.

Does primary BMP satisfy the pollutant removal requirement ($R_{pri} > R_{req}$)? Yes

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Figure E-12c

2ND EXAMPLE WORKSHEET TO EVALUATE PROPOSED BMP PLAN: ANTIDEGRADATION WATER QUALITY GOAL

PAGE 3: EVALUATION OF SUPPLEMENTAL BMPs FOR BACTERIA CONTROL

Supplemental Pre-Treatment BMP Type ________

Percent of Developed Area that is Served by Supplemental Pre-Treatment BMPs ________ S_{sup}

Assumed Supplemental BMP Bacteria Removal (%) ________ E_{sup}
(see bacteria removal efficiencies listed above for primary BMPs)

Calculated Removal by Primary and Pre-Treatment BMPs ________ $R_{pri\text{-}sup}$

$R_{pri\text{-}sup} = 100 * (1-((1-S_{sup}/100*E_{sup}/100) * (1-R_{pri}/100)))$

Do primary and pre-treatment BMPs satisfy the pollutant removal requirement ($R_{pri\text{-}sup} > R_{req}$)? ________

If primary BMP plus pre-treatment BMP removal does not satisfy the pollutant removal requirement (i.e., if $R_{pri\text{-}sup} < R_{req}$), then one or more of the following revisions is required:

1. Reduce the amount of impervious area ($A_{dev\,imp}$), and increase the pervious area ($A_{dev\,perv}$) and/or dedicated open space area (A_{dedop}) accordingly.
2. Choose more effective primary and/or pre-treatment BMPs.
3. Increase the percentage of developed area that is treated by the BMPs (S_{pri}, S_{sup}).
4. Increase the amount of dedicated open space (A_{dedop}), and reduce the amount of developed pervious area ($A_{dev\,perv}$) accordingly. This is most effective if the additional dedicated open space is located on the part of the site that does not drain to the primary BMP; this effectively increases the percentage of developed area that drains to the BMP.

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Figure E-13

WORKSHEET TO EVALUATE PROPOSED BMP SIZING: WET DETENTION POND

Pond Tributary Area (acres) ________ A_{trib}

Pond Impervious Tributary Area (acres) ________ $A_{imptrib}$

Permanent Pool Water Quality Volume (acre-feet) based on sizing criteria 1 ________ V_{sc1}
(3.0 inches * $A_{imptrib}$/12)

Permanent Pool Water Quality Volume (acre-feet) based on sizing criteria 2 ________ V_{sc2}
(1.0 inches * A_{trib}/12)

Required Permanent Pool Volume ________ V_{reqd}
(greater of V_{sc1} and V_{sc2})

Permanent Pool Surface Area (acres) ________ SA_{pool}

Permanent Pool Mean Depth (feet) ________ D_{pool}
(must be in the range of 3 - 7 feet)

Permanent Pool Volume (acres-feet) ________ V_{pool}
(SA_{pool} * D_{pool})

If permanent pool volume V_{pool} is less than the required pool volume V_{reqd}, then one or more of the following revisions is required:

1. Increase the surface area of the permanent SA_{pool}
2. Increase the permanent pool depth D_{pool}, while staying within 7 ft of the maximum mean depth

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Figure E-14

WORKSHEET TO EVALUATE PROPOSED BMP SIZING: EXTENDED DRY DETENTION POND

Pond Tributary Area (acres)	________	**A_{trib}**
Pond Impervious Tributary Area (acres)	________	**$A_{imptrib}$**
Extended Dry Detention Pool Water Quality Volume (acre-feet) based on sizing criteria 1 (1.5 inches*$A_{imptrib}$/12)	________	**V_{sc1}**
Extended Dry Detention Pool Water Quality Volume (acre-feet) based on sizing criteria 2 (1.0 inches * A_{trib}/12)	________	**V_{sc2}**
Required Extended Dry Detention Pool Water Quality Volume (greater of V_{sc1} and V_{sc2})	________	**V_{reqd}**
Extended Dry Detention Pool Surface Area (acres)	________	**SA_{pool}**
Extended Dry Detention Pool Mean Depth (feet)	________	**D_{pool}**
Extended Dry Detention Pool Volume (acres-feet) (SA_{pool} * D_{pool})	________	**V_{pool}**

If extended dry detention pool volume V_{pool} is less than the required pool volume V_{reqd}, then one or more of the following revisions is required:

1. Increase the surface area of the extended dry detention SA_{pool}
2. Increase the extended dry detention pool depth D_{pool}

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Figure E-15

WORKSHEET TO EVALUATE PROPOSED BMP SIZING:

MODIFIED EXTENDED DRY DETENTION POND

Pond Tributary Area (acres) ________ A_{trib}

Pond Impervious Tributary Area (acres) ________ $A_{imptrib}$

Extended Dry Detention Pool Water Quality Volume (acre-feet) based on sizing criteria 1 ________ $V_{sc1\text{-}xd}$
(1.5 inches*$A_{imptrib}$/12)

Extended Dry Detention Pool Water Quality Volume (acre-feet) based on sizing criteria 2 ________ $V_{sc2\text{-}xd}$
(1.0 inches * A_{trib}/12)

Required Extended Dry Detention Pool Water Quality Volume ________ $V_{reqd\text{-}xd}$
(greater of V_{sc1} and V_{sc2})

Required Permanent Pool Water Quality Volume ________ $V_{reqd\text{-}pp}$
(0.05 inches * A_{trib}/12)

Extended Dry Detention Pool Surface Area (acres) ________ $SA_{pool\text{-}xd}$

Extended Dry Detention Pool Mean Depth (feet) ________ $D_{pool\text{-}xd}$
(must be in the range of 3-7 feet)

Extended Dry Detention Pool Volume (acres-feet) ________ $V_{pool\text{-}xd}$
($SA_{pool\text{-}xd}$ * $D_{pool\text{-}xd}$)

Permanent Pool Surface Area (acres) ________ $SA_{pool\text{-}pp}$

Permanent Pool Mean Depth (feet) ________ $D_{pool\text{-}pp}$
(must be in the range of 3 - 7 feet)

Permanent Pool Volume (acres-feet) ________ $V_{pool\text{-}pp}$
($SA_{pool\text{-}pp}$ * $D_{pool\text{-}pp}$)

If extended dry detention pool volume $V_{pool\text{-}xd}$ is less than the required pool volume $V_{reqd\text{-}xd}$, then one or more of the following revisions is required:
1. Increase the surface area of the extended dry detention $SA_{pool\text{-}xd}$
2. Increase the extended dry detention pool depth $D_{pool\text{-}xd}$

If permanent pool volume $V_{pool\text{-}pp}$ is less than the required pool volume $V_{reqd\text{-}pp}$, then one or more of the following revisions is required:
1. Increase the surface area of the permanent $SA_{pool\text{-}pp}$
2. Increase the permanent pool depth $D_{pool\text{-}pp}$

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Figure E-16

WORKSHEET TO EVALUATE PROPOSED BMP SIZING:

INFILTRATION BMPs

Infiltration Facility Tributary Area (acres)	________	**A_{trib}**
Facility Impervious Tributary Area (acres)	________	**$A_{imptrib}$**
Maximum Storage Time (24-48 hours)	________	**T_{sto}**
Underlying Soil Infiltration Rate (inches/hour) (use 0.52 for loam, 1.02 for sandy loam, 2.4 for loamy sand)	________	**I_{soil}**
Facility Stone Vold Ratio (use 0.4)	0.40	**R_v**
Maximum Facility Depth	________	**D_{max}**
Design Facility Depth (feet)	________	**D_{des}**
Infiltration Facility Water Quality Volume (acre-feet) based on sizing criteria 1 (1.5 inches * $A_{imptrib}$)	________	**V_{sc1}**
Infiltration Facility Water Quality Volume (acre-feet) based on sizing criteria 2 (0.5 inches * A_{trib})	________	**V_{sc2}**
Required Infiltration Facility Water Quality Volume (greater of V_{sc1} and V_{sc2})	________	**V_{reqd}**
Required Facility Surface Area (acres) (V_{reqd} / (R_v * D_{des}))	________	**SA_{reqd}**
Design Surface Area (acres)	________	**SA_{des}**

If design facility surface area S_{des} is less than S_{reqd}, S_{des} must be changed to value greater than or equal to SA_{reqd}

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Figure E-17

WORKSHEET TO EVALUATE PROPOSED BMP SIZING:

BIORETENTION BMPs

Bioretention Facility Tributary Area (acres)	________	**A_{trib}**
Facility Impervious Tributary Area (acres)	________	**$A_{imptrib}$**
Bioretention Facility Water Quality Volume (acre-feet) based on sizing criteria 1 (1.5 inches*$A_{imptrib}$/12)	________	**V_{sc1}**
Bioretention Facility Water Quality Volume (acre-feet) based on sizing criteria 2 (1.0 inches * A_{trib}/12)	________	**V_{sc2}**
Required Bioretention Water Quality Volume (greater of V_{sc1} and V_{sc2})	________	**V_{reqd}**
Ponding Depth on Facility Surface (feet) (maximum depth = 0.5 ft.)	________	**D_{surf}**
Depth of Planting Soil (feet) (the larger of (a) 3 ft. or (b) 4 inches greater than largest rootball)	________	**D_{soil}**
Fraction of Soil Available for Water Storage (assume = 0.2)	0.20	**F_{soil}**
Design Surface Area (acres)	________	**SA_{des}**
Required Facility Surface Area (acres) (= V_{reqd} / (D_{surf} + F_{soil} * D_{soil}))	________	**SA_{reqd}**

If design facility surface area Sdes is less than Sreqd, Sdes must be changed to value greater than or equal to Sareqd

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E.3 Sample Maintenance Agreement

Stormwater BMP Maintenance Agreement

The undersigned, hereafter referred to as "Landowner", own the following real property located in Beaufort County, South Carolina:

____

____

The Landowner agrees to provide maintenance for the stormwater Best Management Practices (BMPs) on the property. The specific BMPs on the property are listed below:

____

____

The routine and non-routine maintenance provided for the BMPs will be in accordance with the current version of the Beaufort County Stormwater BMP Manual. The Landowner will also keep records of the maintenance activities.

Beaufort County reserves the right to take the following actions:

- Enter the property and inspect the BMPs.
- Review the Landowner's maintenance records.
- Notify the Landowner of maintenance problems requiring correction, based on County inspection and review of maintenance records.
- Take whatever steps it deems necessary to maintain the BMPs, in the event that the Landowner fails to maintain the BMP facilities.
- Recover from the Landowner any costs incurred by the County in maintaining the BMPs on the Landowner's property.

This agreement will be binding upon any future owners of the property.

Landowner (print name)	County Representative (print name)
Signature of Landowner	Signature of County Representative
Witness	Witness

Dated this_________day of________________________20____

Stormwater BMP Designer

____

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Appendix F
Municipal Spill Prevention

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F.1 List of Facilities

Bluffton Fuel Site - 25 Benton Field Road, Bluffton

HHI Airport Terminal - Beach City Road

Lady's Island Airport Terminal - 41 Airport Circle

Mosquito Control-Chemical Storage - 84 Shanklin Road

PALS Office - 1514 Richmond Avenue, Port Royal

Public Works Building and Garage -120 Shanklin Road, Beaufort

Shanklin Convenience Center - 80 Shanklin Road

Gate Convenience Center - 130 Castle Rock Road

Hilton Head Convenience Center - 26 Summit Drive

Bluffton Convenience Center - 104 Simmonsville Road

Pritchardville Convenience Center - 270 Gibbet Road

Sheldon Convenience Center - 208 Johnson Road

Big Estate Convenience Center - 63 Big Estate Road

Lobeco Convenience Center - 6 Keans Neck Road

St. Helena Convenience Center - 639 Sea Island Parkway

Cuffy Convenience Center - 152 Cuffy Road

Coffin Point Convenience Center - 20 Cee Cee Road

Bluffton Convenience Center - 104 Simmonsville Road

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F.2 Maintenance and Inspection Forms

Storm Drainage System Maintenance Form

Used for catch basins, manholes, culverts, swales, detention basins and other related structures of the storm drainage system

Date	**Inspector**	**Activity**
		Location:______________________________
Structure	☐ Catch Basin ☐ Manhole ☐ Headwall ☐ Culvert ☐ Det. Basin ☐ Wet Pond ☐ Swale ☐ Roadside Ditch ☐ Other Other/Comment:______________________________ ______________________________	
Problem	☐ Blocked ☐ Debris ☐Sediment ☐ Oil sheen ☐ Erosion ☐Vegetation ☐Standing Water ☐ No problem observed Other/Comment:______________________________ ______________________________	
Action Taken	☐ Referred for Cleaning / Repair ☐ Cleaned ☐ Inlets/Outlets Clear ☐ Brush/vegetation cleared and removed ☐ Debris Disposed of properly ☐ Repaired Other/Comment:______________________________ ______________________________	

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Stormwater System Inspection and Maintenance Form

Beaufort County
Stormwater Department
NPDES MS4 Permit Stormwater Inspection
Municipal Facilities

Facility/Owner Name: «OWNER_NAME»
Facility Address: «LOCATION»
Facility PIN: «PARCEL»

«CHECKLIST_PASSFAIL1»	1. Business has a discharge point to the MS4.
«CHECKLIST_PASSFAIL2»	2. MSGP (NOI) (FDEP Form 62-621.300(5)(b)) submitted to FDEP.
«CHECKLIST_PASSFAIL3»	3. The (SWPPP) is on site and is being adhered to, as per the MSGP
«CHECKLIST_PASSFAIL4»	4. The SWPPP inspection and maintenance report are complete
«CHECKLIST_PASSFAIL5»	5. Materials/chemicals are stored, handled, or discarded properly
«CHECKLIST_PASSFAIL6»	6. Is spill kit on site?
«CHECKLIST_PASSFAIL7»	7. Outfalls, inlets, BMPs are free of debris/pollutants.
«CHECKLIST_PASSFAIL8»	8. Chemical storage tanks are clearly marked, properly contained
«CHECKLIST_PASSFAIL9»	9. Loading, unloading areas are neat and free of spills/debris/pollutants.
«CHECKLIST_PASSFAIL10»	10. Vehicle maintenance areas are properly maintained?
«CHECKLIST_PASSFAIL11»	11. Vehicle maintenance areas are draining SW BMP or SS line
«CHECKLIST_PASSFAIL12»	12. Outdoor areas are maintained and free of spills/debris/pollutants
«CHECKLIST_PASSFAIL13»	13. Outdoor stockpile/material areas are maintained?
«CHECKLIST_PASSFAIL14»	14. Trash and debris are protected from stormwater runoff
«CHECKLIST_PASSFAIL15»	15. Fueling stations are free of petroleum product spills/leaks
«CHECKLIST_PASSFAIL16»	16. Vehicle wash areas are draining to treatment system or SS line
«CHECKLIST_PASSFAIL17»	17. Visual observation of /illicit discharge to the MS4

Comments:
«INSPECTION_COMMENT»

Verbal/written Notification Given To:

Inspector Name: «INSPECTOR_NAME» **Date: «COMPLAINT_DATE»**

Inspection Date: ___________

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Appendix G
Common Enemy Law and Stormwater Management Ordinance

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G.1 Common Enemy Law

Common Enemy

South Carolina follows the common enemy rule with respect to the diversion of surface waters naturally flowing across land. Lucas v. Rawl Family Ltd P'ship, 359 S.C. 505, 509 (2004). This rule allows a landowner to treat surface water as a common enemy and dispose of it as he sees fit. Id.

The mere collection of surface water upon one's land, or causing the collection of it upon a neighbor's land, Is not alone actionable, even though injury could occur therefrom. Slater v. Price, 96 S.C. 245 (1913). A landowner can protect his property from the injury done him by surface water. If he does so by legitimate means, then he will not be responsible for injury that occurs to a neighbor's property. Id. If an upper property owner has no easement, then the lower property owner has a legal right to protect his property by casting the surface water back onto the upper property. Brandenburg v. Zeigler**,** 62 S.C. 18 (1901)**.**

Exceptions:

There are two exceptions to the common enemy rule. First, an individual may not obstruct or alter the flow of water to create a nuisance per se. Second, except by contractual or prescriptive right, it is an illegitimate means if disposal for an upper owner – via a ditch, impoundment, or other artificial structure- to collect surface water on his own land and cast it in concentrated form upon lower adjoining lands. Lucas v. Rawl family Ltd. P'ship, 509-10 (2004).

The rule subject to the general law of nuisance means a property owner cannot divert water if its accumulation has become a nuisance per se- when it has become dangerous, at all times and under all circumstances, to life health, or property. Baltzeger v. Carolina Midland Ry. Co., 54 S.C. 242 (1899).

An upper property owner can acquire the right to drain surface water onto his neighbors' land through artificial channels, such as ditches, by prescription. Brandenburg v. Zeigler**,** 62 S.C. 18 (1901)**.** An upper property owner must create a prescriptive easement through adverse passion. The use of drainage must be adverse in character and continuous for the requisite period. Slater v. Price, 245 (1913). Mere permissive use, even if for 20 years, does not create an easement. Id. Even should a ditch be used continuously without objection or hindrance, an upper property owner must show he attempted to drain his lands by trespass or the taking of the lower property owner's land.

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G.2 Stormwater Management Ordinance

DRAFT 9/9/16 AS RECOMMENED BY THE UTILITY BOARD 9/14/16

ORD. 2016 / ____, ___-___- 2016

AN ORDINANCE TO AMEND THE STORMWATER MANAGEMENT UTILITY ORDINANCE AS ADOPTED SEPTEMBER 26, 2016 TO PROVIDE FOR THE ADDITION OF ARTICLES III, IV, V, AND VI RELATED TO ADOPTION OF STORMWATER MANAGEMENT STANDARDS TO MEET MUNICIPAL SEPARATE STORMSEWER SYSTEM (MS4) PERMIT REQUIREMENTS

WHEREAS, Act 283 of 1975, The Home Rule Act, vested Beaufort County Council with the independent authority to control all acts and powers of local governmental authority that are not expressly prohibited by South Carolina law; and

WHEREAS, Chapter 99, Article II,"Stormwater Management Utility" was adopted on August 27, 2001 and was modified by Ordinance on August 22, 2005, September 28, 2015, and September 26, 2016; and

WHEREAS, Stormwater Management Utility was established for the purpose of managing, acquiring, constructing, protecting, operating, maintaining, enhancing, controlling, and regulating the use of stormwater drainage systems in the county;

WHEREAS, to meet the increasing demands on the Stormwater Management Utility in the areas of federally mandated municipal Separate Stormsewer Systems (MS4) permitting, capital project needs, and cost of service of operations and maintenance, as well as an evolving understanding of the impacts of the urban environment on water quality, the Stormwater Management Utility finds it necessary to amend the structure in which rates are determined and adjust the rates charged to the citizens of Beaufort County to meet said demands in a fair and equitable manner; and

WHEREAS, the administrative structure of the Stormwater Management Utility needs to be amended to reflect the organization of the current administration; and

WHEREAS, further amendments are needed to make adjustments to the rate structure to address the differences in taxation and billing for condominiums and parcels affected by standing water or tidal impacts; and

WHEREAS, pursuant to the requirements mandated by the Municipal Separate Stormsewer System (MS4) permit issued by the South Carolina Department of Health and Environmental Control (DHEC) on December 1, 2015, Beaufort County is required to adopt standards related to stormwater management and create an regulatory framework to enforce the same; and

WHEREAS, the Beaufort County Stormwater Utility Board has amended the Manual for Stormwater Best Management and Design Practices (BMP Manual) as the source of the technical stormwater standards used in the development of Stormwater Plans and adopted the same on September 14, 2016; and

WHEREAS, Beaufort County Council believes to best provide for the health, safety, and welfare of its citizens it is appropriate to amend Chapter 99 of the Beaufort County Code and to provide for additional terms to said Article; and

WHEREAS, text that is <u>underscored</u> shall be added text and text ~~lined through~~ shall be deleted text; and

NOW, THEREFORE, BE IT ORDAINED BY BEAUFORT COUNTY COUNCIL, that Chapter 99 of the Beaufort County Code is hereby amended and replaced with the following:

Chapter 99 - STORMWATER MANAGEMENT

ARTICLE I. - IN GENERAL

Secs. 99-1—99-100. - Reserved.

ARTICLE II. - STORMWATER MANAGEMENT UTILITY

Sec. 99-101. - Findings of fact.

The County Council of Beaufort County, South Carolina, makes the following findings of fact:

(a) The professional engineering and financial analyses conducted on behalf of and submitted to the county properly assesses and defines the stormwater management problems, needs, goals, program priorities, costs of service, need for interlocal cooperation, and funding opportunities of the county.

(b) Given the problems, needs, goals, program priorities, costs of service, needs for interlocal cooperation, and funding opportunities identified in the professional engineering and financial analyses submitted to the county, it is appropriate to authorize the establishment of a separate enterprise accounting unit which shall be dedicated specifically to the management, construction, maintenance, protection, control, regulation, use, and enhancement of stormwater systems and programs in Beaufort County in concert with other water resource management programs.

(c) Stormwater management is applicable and needed throughout the unincorporated portions of Beaufort County, but interlocal cooperation between the county and the incorporated cities and towns within the county is also essential to the efficient provision of stormwater programs, services, systems, and facilities. Intense urban development in some portions of the county has radically altered the natural hydrology of the area and the hydraulics of stormwater systems, with many natural elements having been replaced or augmented by man-made facilities. Other areas of the county remain very rural in character, with natural stormwater systems predominating except along roads where ditches and culverts have been installed. As a result, the specific program, service, system, and facility demands differ from area to area in the county. While the county manages, operates, and improves stormwater programs, services, systems and facilities in the rural as well as urban areas, the need for improved stormwater management is greatest in the urban areas and nearby, including areas within incorporated cities and towns. Therefore, a stormwater utility service area subject to stormwater service fees should encompass, in so far as possible through interlocal agreements, the entirety of Beaufort County and the stormwater management utility service fee rate structure should reflect the amount of impervious area on individual properties and the runoff impact from water quantity and water quality.

(d) The stormwater needs in Beaufort County include but are not limited to protecting the public health, safety, and welfare. Provision of stormwater management programs, services, systems, and facilities therefore renders and/or results in both service and benefit to individual properties, property owners, citizens, and residents of the county and to properties, property owners, citizens, and residents of the county concurrently in a variety of ways as identified in the professional engineering and financial analyses.

(e) The service and benefit rendered or resulting from the provision of stormwater management programs, services, systems, and facilities may differ over time depending on many factors and considerations, including but not limited to location, demands and impacts imposed on the stormwater programs, systems, and facilities, and risk exposure. It is not practical to allocate the cost of the county's stormwater management programs, services, systems, and facilities in direct and precise relationship to the services or benefits rendered to or received by individual properties or persons over a brief span of time, but it is both practical and equitable to allocate the cost of stormwater management among properties and persons in proportion to the long-term demands they impose on the county's stormwater programs, services, systems, and facilities which render or result in services and benefits.

(f) Beaufort County presently owns and operates stormwater management systems and facilities that have been developed, installed, and acquired through various mechanisms over many years. The future usefulness and value of the existing stormwater systems and facilities owned and operated by Beaufort County, and of future additions and improvements thereto, rests on the ability of the county to effectively manage, construct, protect, operate, maintain, control, regulate, use, and enhance the stormwater systems and facilities in the county, in concert with the management of other water resources in the county and in cooperation with the incorporated cities and towns. In order to do so, the county must have adequate and stable funding for its stormwater management program operating and capital investment needs.

(g) The county council finds, concludes, and determines that a stormwater management utility provides the most practical and appropriate means of properly delivering stormwater management services and benefits throughout the county, and the most equitable means to fund stormwater services in the county through stormwater service fees and other mechanisms as described in the professional engineering and financial analyses prepared for the county.

(h) The county council finds, concludes, and determines that a schedule of stormwater utility service fees be levied upon and collected from the owners of all lots, parcels of real estate, and buildings that discharge stormwater or subsurface waters, directly or indirectly, to the county stormwater management system and that the proceeds of such charges so derived be used for the stormwater management system.

(i) The county council finds that adjustments and credits against stormwater utility service fees are an appropriate means to grant properties providing stormwater management program services that would otherwise be provided by the county and will afford Beaufort County cost savings. These reductions will be developed by the Stormwater Manager and will be reviewed on an annual basis to allow for any modifications to practices required by Beaufort County.

The county council finds that both the total gross area and impervious area on each property-are the most important factors influencing the cost of stormwater management in Beaufort County and, the runoff impact from water quantity and water quality.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-102. - Establishment of a stormwater management utility and a utility enterprise fund.

There is hereby established within the Environmental Engineering Division of Beaufort County a stormwater management utility for the purpose of conducting the county's stormwater management program. The county administrator shall establish and maintain a stormwater management utility enterprise fund in the county budget and accounting system, which shall be and remain separate from other funds. All revenues of the utility shall be placed into the stormwater management utility enterprise fund and all expenses of the utility shall be paid from the fund, except that other revenues, receipts, and resources not accounted for in the stormwater management utility enterprise fund may be applied to stormwater management programs, services, systems, and facilities as deemed appropriate by the Beaufort County Council. The county administrator may designate within the stormwater management utility enterprise fund such sub-units as necessary for the purpose of accounting for the geographical generation of revenues and allocation of expenditures pursuant to interlocal governmental agreements with the cities and towns of Beaufort County.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-103. - Purpose and responsibility of the utility.

The Beaufort County Stormwater Management Utility is established for the purpose of managing, acquiring, constructing, protecting, operating, maintaining, enhancing, controlling, and regulating the use of stormwater drainage systems in the county. The utility shall, on behalf of the county and the citizens of the county: administer the stormwater management program; perform studies and analyses as required; collect service fees; system development fees, in-lieu of construction fees and other funding as allowed by law, and obtain and administer grants and loans as authorized by the county council; prepare capital improvement plans and designs; perform routine maintenance and remedial repair of the stormwater systems; acquire, construct, and improve stormwater systems; acquire necessary lands, easements, rights-of-way, rights-of-entry and use, and other means of access to properties to perform its duties; regulate the on-site control, conveyance, and discharge of stormwater from properties; obtain federal and state permits required to carry out its purpose; enter into operating agreements with other agencies; allocate funds pursuant to interlocal governmental agreements; educate and inform the public about stormwater management; and perform, without limitation except by law, any stormwater management functions and activities necessary to ensure the public safety, protect private and public properties and habitat, and enhance the natural environment and waters of the county.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-104. - Limitation of scope of responsibility.

The purpose and responsibility of the stormwater management utility shall be limited by the following legal and practical considerations.

(a) Beaufort County owns or has legal access for purposes of operation, maintenance, and improvement only to those stormwater systems and facilities which:

   (1) Are located within public streets, other rights-of-way, and easements;

   (2) Are subject to easements, rights-of-entry, rights-of-access, rights-of-use, or other permanent provisions for adequate access for operation, maintenance, monitoring, and/or improvement of systems and facilities; or

   (3) Are located on public lands to which the county has adequate access for operation, maintenance, and/or improvement of systems and facilities.

(b) Operation, maintenance, and/or improvement of stormwater systems and facilities which are located on private property or public property not owned by Beaufort County and for which there has been no public dedication of such systems and facilities for operation, maintenance, monitoring, and/or improvement of the systems and facilities shall be and remain the legal responsibility of the property owner, except as that responsibility may be otherwise affected by the laws of the State of South Carolina and the United States of America.

(c) It is the express intent of this article to protect the public health, safety, and welfare of all properties and persons in general, but not to create any special duty or relationship with any individual person or to any specific property within or outside the boundaries of the county. Beaufort County expressly reserves the right to assert all available immunities and defenses in any action seeking to impose monetary damages upon the county, its officers, employees and agents arising out of any alleged failure or breach of duty or relationship as may now exist or hereafter be created.

(d) To the extent any permit, plan approval, inspection or similar act is required by the county as a condition precedent to any activity or change upon property not owned by the county, pursuant to this or any other regulatory Ordinance, regulation, or rule of the county or under federal or state law, the issuance of such permit, plan approval, or inspection shall not be deemed to constitute a warranty, express or implied, nor shall it afford the basis for any action, including any action based on failure to permit or negligent issuance of a permit, seeking the imposition of money damages against the county, its officers, employees, or agents.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-105. - Boundaries and jurisdiction.

The boundaries and jurisdiction of the stormwater management utility shall encompass all those portions of unincorporated Beaufort County, as they may exist from time to time and such additional areas lying inside the corporate limits of those cities and towns in Beaufort County as shall be subject to interlocal agreements for stormwater management as approved by county council and participating municipal councils.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-106. - Definitions.

Unless the context specifically indicates otherwise, the meaning of words and terms used in this article shall be as set forth in S.C. Code § 48-14-20, and 26 S.C. Code Regulation 72-301, mutatis mutandis.

Abatement. Any action deemed necessary by the county or its officers or agents to remedy, correct, control, or eliminate a condition within, associated with, or impacting a stormwater drainage system or the water quality of receiving waters shall be deemed an abatement action.

Adjustments. Adjustments shall mean a change in the amount of a stormwater service fee predicated upon the determination reached by the Stormwater Manager and referenced to the Adjustments and Credit Manual.

Bill Class. Every property falls into one of several bill classes. The bill class determines the fee calculation of that property.

Condominiums. Properties with individual ownership of a particular dwelling unit in a building and the common right to share, with other co-owners, in the general and limited common elements of the real property.

Countywide Infrastructure Operation and Maintenance and Capital Projects. The County maintains some typically larger infrastructure within each of the four municipalities in addition to within the unincorporated area. The rate structure will allocate the costs for the County to maintain just the countywide drainage infrastructure across the entire rate base in all jurisdictions based on infrastructure linear feet per jurisdiction.

Customers of the stormwater management utility. Customers of the stormwater management utility shall be broadly defined to include all persons, properties, and entities served by and/or benefiting, directly and indirectly, from the utility's acquisition, management, construction, improvement, operation, maintenance, extension, and enhancement of the stormwater management programs, services, systems, and facilities in the county, and by its control and regulation of public and private stormwater systems, facilities, and activities related thereto.

Developed land. Developed land shall mean property altered from its natural state by construction or installation of improvements such as buildings, structures, or other impervious surfaces, or by other alteration of the property that results in a meaningful change in the hydrology of the property during and following rainfall events.

Exemption. Exemption shall mean not applying to or removing the application of the stormwater management utility service fee from a property. No permanent exemption shall be granted based on taxable or non-taxable status or economic status of the property owner.

Fixed costs. Costs associated with the public service provided equally to each property owner. These costs include, but are not limited to the following: billing and collections, data management and updating, programming, and customer support.

Gross Area. Gross area is the acreage of a parcel as identified by the Beaufort County Assessor records.

Hydrologic response. The hydrologic response of a property is the manner whereby stormwater collects, remains, infiltrates, and is conveyed from a property. It is dependent on several factors including but not limited to the size and overall intensity of development of each property, its impervious area, shape, topographic, vegetative, and geologic conditions, antecedent moisture conditions, and groundwater conditions and the nature of precipitation events. Extremely large undeveloped properties naturally attenuate but do not eliminate entirely the discharge of stormwater during and following rainfall events.

Jurisdictional Infrastructure Operations, Maintenance and Capital Projects. Each of the five jurisdictions maintains its own stormwater drainage infrastructure and funds those costs from utility revenue. Revenue from this fee component will be returned to the service provider, the individual jurisdiction.

Impervious surfaces. Impervious surfaces shall be a consideration in the determination of the development intensity factor. Impervious surfaces are those areas that prevent or impede the infiltration of stormwater into the soil as it entered in natural conditions prior to development. Common impervious surfaces include, but are not limited to, rooftops, sidewalks, walkways, patio areas, driveways, parking lots, storage areas, compacted gravel and soil surfaces, awnings and other fabric or plastic coverings, and other surfaces that prevent or impede the natural infiltration of stormwater runoff that existed prior to development.

Minimum Charge. A charge that reflects the minimum amount of demand a property will place on the service provider.

MS4 Permit. Each jurisdiction within Beaufort County will be subject to the federally mandated MS4 permit requirements. Compliance requirements include, but are not limited to monitoring, plan review, inspections, outreach and public education,

Nonresidential properties. Properties developed for uses other than permanent residential dwelling units and designated by the assigned land use code in the Beaufort County tax data system.

Other developed lands. Other developed lands shall mean, but not be limited to, mobile home parks, commercial and office buildings, public buildings and structures, industrial and manufacturing buildings, storage buildings and storage areas covered with impervious surfaces, parking lots, parks, recreation properties, public and private schools and universities, research facilities and stations, hospitals and convalescent centers, airports, agricultural uses covered by impervious surfaces, water and wastewater treatment plants, and lands in other uses which alter the hydrology of the property from that which would exist in a natural state. Properties that are used for other than single family residential use shall be deemed other developed lands for the purpose of calculating stormwater service fees.

Residential dwelling classifications. The following categories will identify the appropriate dwelling unit classifications to be utilized in applying the stormwater utility fee structure to the designations contained in the Beaufort County tax data system:

Single-family

Apartments

Townhouses

Condominiums

Mobile Home

Salt Water Marsh. Those parcels, typically contiguous to water, identified as inundated daily due to tidal action and unbuildable. These properties are 100% below mean high tide and/or beyond established critical line as defined by the South Carolina Department of Health and Environmental Control’s Office of Coastal Resource Management. (DHEC-OCRM). The County Tax Assessor’s Office shall make this determination based on best available data.

Stormwater management programs, services, systems and facilities. Stormwater management programs, services, systems and facilities are those administrative, engineering, operational, regulatory, and capital improvement activities and functions performed in the course of managing the stormwater systems of the county, plus all other activities and functions necessary to support the provision of such programs and services. Stormwater management systems and facilities are those natural and man-made channels, swales, ditches, swamps, rivers, streams, creeks, branches, reservoirs, ponds, drainage ways, inlets, catch basins, pipes, head walls, storm sewers, lakes, and other physical works, properties, and improvements which transfer, control, convey or otherwise influence the movement of stormwater runoff and its discharge to and impact upon receiving waters.

Stormwater service fees. Stormwater service fees shall mean the service fee imposed pursuant to this article for the purpose of funding costs related to stormwater programs, services, systems, and facilities. These fees will be calculated based upon the impervious and gross area at an 80/20 allocation; storm water service fee categories; any State agricultural exemptions or caps; an account administrative fee, countywide jurisdiction operation maintenance and capital project fees; and jurisdictional operation, maintenance and capital project fee.

Single-family unit (SFU). The single-family unit shall be defined as the impervious area measurements obtained from a statistically representative sample of all detached single-family structures within Beaufort County. The representative value will be 4,906 square feet.

Stormwater service fee categories. The appropriate categories for determining SFUs will be as follows:

	SFU Calculation (SFUs equal)
Tier 1 Single-family Unit (≤2,521 square feet)	Dwelling units x 0.5
Tier 2 Single-family Unit (2,522 to 7,265 square feet)	Dwelling units x 1
Tier 3 Single-family Unit (≥7,266 square feet)	Dwelling units x 1.5
Mobile Home	Dwelling units x 0.36
Apartments	Dwelling units x 0.39
Townhouses	Dwelling units x 0.60
Condominiums	Dwelling units x 0.27
Commercial	Impervious area x 4,906 sq. ft.*

*Commercial billed at a rate of 1 SFU per 4,906 square feet or a portion thereof

Submerged property. Those parcels, typically contiguous to water, identified as eroded due to tidal action and unbuildable. These properties are 100% below mean low tide and/or beyond established critical line as defined by the South Carolina Department of Health and Environmental Control's Office of Coastal Resource Management. (DHEC-OCRM). The County Tax Assessor's Office shall make this determination based on best available data.

Townhomes. See Condominiums.

Variable Costs. An impervious and gross area rate structure that allocates some cost to each of the two variables based on the amount of impervious surface and gross area.

(Ord. No. 2015/24, 9-28-2015; Ord. No. 2016/___, 09-26-2016)

Sec. 99-107. – Reserved

(a)

(Ord. No. 2015/24, 9-28-2015; Ord. No. 2016/___, __-___-2016)

Sec. 99-108. - General funding policy.

(a) It shall be the policy of Beaufort County that funding for the stormwater management utility program, services, systems, and facilities shall be equitably derived through methods which have a demonstrable relationship to the varied demands and impacts imposed on the stormwater program, services, systems, and facilities by individual properties or persons and/or the level of service rendered by or resulting from the provision of stormwater programs, systems and facilities. Stormwater service fee rates shall be structured so as to be fair and reasonable, and the resultant service fees shall bear a substantial relationship to the cost of providing services and facilities throughout the county. Similarly situated properties shall be charged similar rentals, rates, fees, or licenses. Service fee rates shall be structured to be consistent in their application and shall be coordinated with the use of any other funding methods employed for stormwater management within the county, whether wholly or partially within the unincorporated portions of the county or within the cities and towns. Plan review and inspection fees, special fees for services, fees in-lieu of regulatory requirements, impact fees, system development fees, special assessments, general obligation and revenue bonding, and other funding methods and mechanisms available to the county may be used in concert with stormwater service fees and shall be coordinated with such fees in their application to ensure a fair and reasonable service fee rate structure and overall allocation of the cost of services and facilities.

(b) The cost of stormwater management programs, systems, and facilities subject to stormwater service fees may include operating, capital investment, and non-operating expenses, prudent operational and emergency reserve expenses, and stormwater quality as well as stormwater quantity management programs, needs, and requirements.

(c) To the extent practicable, adjustments to the stormwater service fees will be calculated by the Beaufort County Stormwater Manager in accordance with the standards and procedures adopted by the Stormwater Manager's office.

(d) The stormwater service fee rate may be determined and modified from time to time by the Beaufort County Council so that the total revenue generated by said fees and any other sources of revenues or other resources allocated to stormwater management by the county council to the stormwater management utility shall be sufficient to meet the cost of stormwater management services, systems, and facilities, including, but not limited to, the payment of principle and interest on debt obligations, operating expense, capital outlays, nonoperating expense, provisions for prudent reserves, and other costs as deemed appropriate by the county council.

Beaufort County service fee rate will be based on impervious and gross area at an 80/20 allocation; storm water service fee categories; any State agricultural exemptions or caps; an account administrative fee, countywide jurisdiction operation maintenance and jurisdictional operation, maintenance and capital project fee. The rates are set by the Beaufort County Stormwater Rate Study dated August 18 and adopted August 24, 2015.

The gross area charge for all parcels, EXCEPT master account properties for condominiums, is calculated in equivalent units as follows:

First 2 acres	$X per acre
For every acres above 2 acres and up to 10	0.5 x $X

acres	
For every acre above 10 acres, and up to 100 acres	0.4 x $X
For very acre above 100 acres	0.3 x $X

Condominium accounts will receive a minimum gross area charge of 0.2 x $X. The master account associated with the condominium subdivision will not receive a gross area charge.

Each municipal jurisdiction may have a different fee predicated upon the municipal jurisdiction's revenue needs. The stormwater service fee rates shall be adopted by the municipal jurisdictions and may be amended from time to time by the individual governing body.

(Ord. No. 2015/24, 9-28-2015; Ord. No. 2016/___, 09-26-2016)

Sec. 99-109. - Exemptions and credits applicable to stormwater service fees.

Except as provided in this section, no public or private property shall be exempt from stormwater utility service fees. No exemption, credit, offset, or other reduction in stormwater service fees shall be granted based on the age, tax, or economic status, race, or religion of the customer, or other condition unrelated to the stormwater management utility's cost of providing stormwater programs, services, systems, and facilities. A stormwater management utility service fee credit manual shall be prepared by the Stormwater Manager specifying the design and performance standards of on-site stormwater services, systems, facilities, and activities that qualify for application of a service fee credit, and how such credits shall be calculated.

(a) Credits. The following types of credits against stormwater service fees shall be available:

(1) Freshwater wetlands. All properties except those classified as detached single-family dwelling units may receive a credit against the stormwater service fee applicable to the property based on granting and dedicating a perpetual conservation easement on those portions of the property that are classified as freshwater wetlands and as detailed in the stormwater management utility service fee credit manual. The conservation easement shall remove that portion of the subject property from any future development.

(2) Salt Water Marsh. All properties except those classified as detached single-family dwelling units may receive a credit against the stormwater service fee applicable to the property based on those portions of the property that are classified as salt water marsh and as detailed in the stormwater management utility service fee credit manual.

(3) Submerged properties. All properties may receive a credit against the stormwater service fee applicable to the property based on those portions of the property that are classified as submerged and as detailed in the stormwater management utility service fee credit manual.

(4) Those properties that apply for consideration of an adjustment shall satisfy the requirements established by the Beaufort County Stormwater Manager and approved reduced stormwater service fee.

(b) Exemptions. The following exemptions from the stormwater service fees shall be allowed:

(1) Improved public road rights-of-way that have been conveyed to and accepted for maintenance by the state department of transportation and are available for use in common for vehicular transportation by the general public.

(2) Improved public road rights-of-way that have been conveyed to and accepted for maintenance by Beaufort County and are available for use in common for vehicular transportation by the general public.

(3) Improved private roadways that are shown as a separate parcel of land on the most current Beaufort County tax maps and are used by more than one property owner to access their property.

(4) Railroad tracks shall be exempt from stormwater service fees. However, railroad stations, maintenance buildings, or other developed land used for railroad purposes shall not be exempt from stormwater service fees.

(5) Condominium boat slips shall be exempt from stormwater service fees.

(6) Properties determined by the Assessor having 100% of the gross area of the property submerged, salt water marsh, or freshwater wetland will not receive an administrative charge, if applicable in the utility rate structure, AFTER the applicable credit defined in paragraph (a) above has been applied to the account.

(Ord. No. 2015/24, 9-28-2015; Ord. No. 2016/___, 09-26-2016)

Sec. 99-110. - Stormwater service fee billing, delinquencies and collections.

(a) Method of billing. A stormwater service fee bill may be attached as a separate line item to the county's property tax billing or may be sent through the United States mail or by alternative means, notifying the customer of the amount of the bill, the date the fee is due (January 15), and the date when past due (March 17 - see Title 12, Section 45-180 of the South Carolina State Code). The stormwater service fee bill may be billed and collected along with other fees, including but not limited to the Beaufort County property tax billing, other Beaufort County utility bills, or assessments as deemed most effective and efficient by the Beaufort County Council. Failure to receive a bill is not justification for non-payment. Regardless of the party to whom the bill is initially directed, the owner of each parcel of land shall be ultimately obligated to pay such fees and any associated fines or penalties, including, but not limited to, interest on delinquent service fees. If a customer is under-billed or if no bill is sent for a particular property, Beaufort County may retroactively bill for a period of up to one-year, but shall not assess penalties for any delinquency during that previous unbilled period.

(b) Declaration of delinquency. A stormwater service fee shall be declared delinquent if not paid within 60 days of the date of billing or upon the date (March 17) of delinquency of the annual property tax billing if the stormwater service fee is placed upon the annual property tax billing or enclosed with or attached to the annual property tax billing.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-111. - Appeals.

Any customer who believes the provisions of this article have been applied in error may appeal in the following manner and sequence.

(a) An appeal of a stormwater service fee must be filed in writing with the Beaufort County Stormwater Manager or his/her designee within 30 days of the fee being mailed or delivered to the property owner and stating the reasons for the appeal. In the case of stormwater service fee appeals, the appeal shall include a survey prepared by a registered land surveyor or professional engineer containing information on the impervious surface area and any other feature or conditions that influence the development of the property and its hydrologic response to rainfall events.

(b) Using information provided by the appellant, the county Stormwater Manager (or his or her designee) shall conduct a technical review of the conditions on the property and respond to the appeal in writing within 30 days. In response to an appeal, the Stormwater Manager may adjust the stormwater service fee applicable to the property in conformance with the general purposes and intent of this article.

(c) A decision of the county Stormwater Manager that is adverse to an appellant may be further appealed to the county administrator or his designee within 30 days of the adverse decision. The appellant, stating the grounds for further appeal, shall deliver notice of the appeal to the county administrator or his designee. The county administrator or his designee shall issue a written decision on the appeal within 30 days. All decisions by the county administrator or his designee shall be served on the customer personally or by registered or certified mail, sent to the billing address of the customer. All decisions of the county administrator or his designee shall be final.

(d) The appeal process contained in this section shall be a condition precedent to an aggrieved customer seeking judicial relief. Any decisions of the county administrator or his designee may be reviewed upon application for writ of certiorari before a court of competent jurisdiction, filed within 30 days of the date of the service of the decision.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-112. - No suspension of due date.

No provision of this article allowing for an administrative appeal shall be deemed to suspend the due date of the service fee with payment in full. Any adjustment in the service fee for the person pursuing an appeal shall be made by refund of the amount due.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-113. - Enforcement and penalties.

Any person who violates any provision of this article may be subject to a civil penalty of not more than $1,000.00, or such additional maximum amount as may become authorized by state law, provided the owner or other person deemed to be in violation has been notified of a violation. Notice shall be deemed achieved when sent by regular United States mail to the last known address reflected on the county tax records, or such other address as has been provided by the person to the county. Each day of a continuing violation may be deemed a separate violation. If payment is not received or equitable settlement reached within 30 days after demand for payment is made, a civil action may be filed on behalf of the county in the circuit court to recover the full amount of the penalty. This provision on penalties shall be in addition to and not in lieu of other provisions on penalties, civil or criminal, remedies and enforcement that may otherwise apply.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-114. - Investment and reinvestment of funds and borrowing.

Funds generated for the stormwater management utility from service fees, fees, rentals, rates, bond issues, other borrowing, grants, loans, and other sources shall be utilized only for those purposes for which the utility has been established as specified in this article, including but not limited to: regulation; planning; acquisition of interests in land, including easements; design and construction of facilities; maintenance of the stormwater system; billing and administration; water quantity and water quality management, including monitoring, surveillance, private maintenance inspection, construction inspection; public information and education, and other activities which are reasonably required. such funds shall be invested and reinvested pursuant to the same procedures and practices established by Title 12, Section 45-70 of the South Carolina State Code for investment and reinvestment of funds. County council may use any form of borrowing authorized by the laws of the State of South Carolina to fund capital acquisitions or expenditures for the stormwater management utility. County council, in its discretion and pursuant to standard budgetary procedures, may supplement such funds with amounts from the general fund.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-115. - Responsibilities of the stormwater management utility.

The county stormwater management utility shall perform adequate studies throughout the area served by the utility to determine the following:

(1) Baseline study of water quality in the receiving waters;

(2) Identification of pollutants carried by stormwater runoff into the receiving waters;

(3) Recommended mitigation efforts to address pollutants carried by stormwater runoff into the receiving waters;

(4) Inventory of the existing drainage system;

(5) Recommended maintenance practices and standards of the existing drainage system;

(6) Identification of capital improvements to the system to include construction or installation of appropriate BMPs.

(7) A five-year spending plan.

(8) Ensure compliance with the federally mandated MS4 permit requirements

(9) Efficient utility administration including but not limited to billing, collection, defining rate structures, data management and customer support.

(Ord. No. 2015/24, 9-28-2015)

Sec. 99-116. - Stormwater utility management board.

(1) Purpose. In compliance with and under authority of Beaufort County Ordinance 2001/23, the Beaufort County Council hereby establishes the stormwater management utility board (hereinafter referred to as the "SWU board") to advise the council as follows:

(a) To determine appropriate levels of public stormwater management services for residential, commercial, industrial and governmental entities within Beaufort County;

(b) To recommend appropriate funding levels for provision of services in the aforementioned sectors;

(c) To advise the staff of the stormwater management utility on master planning efforts and cost of service/rate studies; and

(d) To support and promote sound stormwater management practices that mitigates non-point source pollution and enhances area drainage within Beaufort County.

Municipal councils are encouraged to organize similar boards to advise them on stormwater management programs and priorities within their boundaries.

In keeping with discussions held during the formation of the stormwater utility, it is anticipated that the municipalities will appoint staff professionals as their representative on the advisory board.

(2) Stormwater districts. Stormwater districts are hereby established as follows:

District 1 - City of Beaufort

District 2 - Town of Port Royal

District 3 - Town of Hilton Head Island

District 4 - Town of Bluffton

District 5 - Unincorporated Sheldon Township

District 6 - Unincorporated Port Royal Island

District 7 - Unincorporated Lady's Island

District 8 - Unincorporated St. Helena Island Islands East

District 9 - Unincorporated Bluffton Township and Daufuskie Island

(3) Membership.

(a) The SWU board is formed in accordance with Beaufort County Ordinance 92-28 and shall consist of a total of seven voting representatives from each of the following districts as noted below:

No. of Reps.	Stormwater District	Area
1	5	Unincorporated Sheldon Township
1	6	Unincorporated Port Royal Island
1	7	Unincorporated Lady's Island
1	8	Unincorporated St. Helena Island Islands East
2	9	Unincorporated Bluffton Township and Daufuskie Island
1	—	"At large"

All members of the SWU board will be appointed by county council and shall be residents of those districts or "at large" members from unincorporated Beaufort County.

(b) The SWU board shall also consist of one nonvoting (ex officio) representative from the following districts:

Stormwater District	Municipality
1	City of Beaufort
2	Town of Port Royal
3	Town of Hilton Head Island
4	Town of Bluffton

All ex officio members from municipalities shall be appointed by their respective municipal councils for four-year terms.

(c) All citizen members shall be appointed for a term of four years. The terms shall be staggered with one or two members appointed each year.

(d) While no other eligibility criteria is established, it is recommended that members possess experience in one or more of the following areas: Stormwater management (drainage and water quality) issues, strategic planning, budget and finance issues or established professional qualifications in engineering, construction, civil engineering, architectural experience, commercial contractor or similar professions.

(4) Officers.

(a) Officers. Selection of officers and their duties as follows:

1. Chairperson and vice-chair. At an annual organizational meeting, the members of the SWU board shall elect a chairperson and vice-chairperson from among its members. The chair's and vice-chair's terms shall be for one year with eligibility for reelection. The chair shall be in charge of all procedures before the SWU board, may administer oaths, may compel the attendance of witnesses, and shall take such action as shall be necessary to preserve order and the integrity of all proceedings before the SWU board. In the absence of the chair, the vice-chair shall act as chairperson.

2. Secretary. The county professional staff member shall appoint a secretary for the SWU board. The secretary shall keep minutes of all proceedings. The minutes shall contain a summary of all proceedings before the SWU board, which include the vote of all members upon every question, and its recommendations, resolutions, findings and determinations, and shall be attested to by the secretary. The minutes shall be approved by a majority of the SWU board members voting. In addition, the secretary shall maintain a public record of SWU board meetings, hearings, proceedings, and correspondence.

3. Staff. The Stormwater Manager shall be the SWU board's professional staff.

(b) Quorum and voting. Four SWU board members shall constitute a quorum of the SWU board necessary to take action and transact business. All actions shall require a simple majority of the number of SWU board members present.

(c) Removal from office. The county council, by a simple majority vote, shall terminate the appointment of any member of the SWU board and appoint a new member for the following reasons:

1. Absent from more than one-third of the SWU board meetings per annum, whether excused or unexcused;

2. Is no longer a resident of the county;

3. Is convicted of a felony; or

4. Violated conflict of interest rules according to the county-adopted template Ordinance.

Moreover, a member shall be removed automatically for failing to attend any three consecutive regular meetings.

(d) Vacancy. Whenever a vacancy occurs on the SWU board, the county council shall appoint a new member within 60 days of the vacancy, subject to the provisions of this section. A new member shall serve out the former member's term.

(e) Compensation. The SWU board members shall serve without compensation, but may be reimbursed for such travel, mileage and/or per diem expenses as may be authorized by the SWU board-approved budget.

(5) Responsibilities and duties.

(a) Review and recommend to the county council for approval, a comprehensive Beaufort County Stormwater Management Master Plan and appropriate utility rate study which is in accordance with the South Carolina Stormwater Management and Sediment Reduction Act; and

(b) Review and comment to the county administrator on the annual stormwater management utility enterprise fund budget; and

(c) Cooperate with the South Carolina Department of Health and Environmental Control (DHEC), Office of Coastal Resource Management (OCRM), the Oversight Committee of the Special Area Management Plan (SAMP), the Beaufort County Clean Water Task Force as well as other public and private agencies having programs directed toward stormwater management programs; and

(d) Review and make recommendations concerning development of a multiyear stormwater management capital improvement project (CIP) plan; and

(e) Review and advise on proposed stormwater management plans and procurement procedures; and

(f) Provide review and recommendations on studies conducted and/or funded by the utility; and

(g) Review and advise on actions and programs to comply with regulatory requirements, including permits issued under the State of South Carolina National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems (MS4).

(6) Meetings. Meetings of the SWU board shall be held as established by the SWU board on a monthly basis and a calendar will be prepared giving the date, time and location of such meetings. Additionally, meetings may be called by the chairperson or at the request of four SWU board members. The location of all SWU board meetings shall be held in a public building in a place accessible to the public. The following shall apply to the conduct of all meetings:

(a) Meeting records. The SWU board shall keep a record of meetings, resolutions, findings, and determinations. The SWU board may provide for transcription of such hearings and proceedings, or portions of hearings and proceedings, as may be deemed necessary.

(b) Open to public. All meetings and public hearings of the SWU board shall be open to the public.

(c) Recommendations or decisions. All recommendations shall be by show of hands of all members present. A tie vote or failure to take action shall constitute a denial recommendation. All recommendations shall be accompanied by a written summary of the action and recommendations.

(d) Notice and agenda. The SWU board must give written public notice of regular meetings at the beginning of each calendar year. The SWU board must post regular meeting agendas at the meeting place 24 hours before any meeting. Notices and agenda for call, special or rescheduled meetings must be posted at least 24 hours before such meetings. The SWU board must notify any persons, organizations and news media that request such notification of meetings.

(Ord. No. 2015/24, 9-28-2015)

Article III. – REGULATORY GENERAL PROVISIONS

Sec. 99-200. - Authority

This Ordinance is adopted pursuant to the authority conferred upon the Beaufort County (County) by the South Carolina Constitution, the South Carolina General Assembly and in accordance with Federal Clean Water Act, the South Carolina Pollution Control Act, and regulations promulgated there under.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-201. - Findings

The County Council makes the following findings:

(a) Beaufort County's Waters contain some of the few remaining pristine shellfish harvesting areas in the southern coastal counties of South Carolina many of its waters have been designated by the State of South Carolina as an Outstanding Resource Waters. This use has historical and traditional significance to the area. It is in the public interest that the condition of these areas be maintained and preserved for future generations. Uncontrolled stormwater runoff may have significant, adverse impact on the health, safety and general welfare of the County and the quality of life of its citizens by transporting pollutants into receiving waters and by causing erosion and/or flooding. Development and redevelopment may alter the hydrologic response of local watersheds and increases stormwater runoff rates and volumes, flooding, soil erosion, stream channel erosion, non-point pollution, and sediment transport and deposition, as well as reducing groundwater recharge. These changes in stormwater runoff may contribute to increased quantities of water-borne pollutants and alterations in hydrology which are harmful to public health, safety, and welfare, as well as to the natural environment.

(b) Point source pollution may have significant, adverse impact on the health, safety and general welfare of the County and the quality of life of its citizens by transporting pollutants into receiving waters. The allowance of discharge pipes and outfalls for non-stormwater discharges, illegal dumping, and improper handling of accidental spills and intentional disposals increase the quantities of water-borne pollutants which are harmful to public health, safety, and welfare, as well as to the natural environment.

(c) The effects of point and non-point source pollution, such as uncontrolled runoff, have shown evidence of degradation of the County's receiving waters; thereby adversely affecting the unique qualities of the County's receiving waters, its recreational opportunities and commercial, oystering, boating and fishing, the ecosystem's ability to naturally reproduce and thrive, and the general ability of the area to sustain its natural estuarine resources.

(d) These deleterious effects can be managed and minimized by applying proper design and well-planned controls to manage stormwater runoff from development and redevelopment sites, manage existing natural features that maintain hydrology and provide water quality control, and eliminate potential sources of pollution to receiving waters. Public education regarding the cause and effect of these types of pollutions and the implementation of the controls and management policies is key to fundamentally changing public behavior.

(e) This Ordinance is not in conflict with any development agreements to which the County is a party and does not prevent the development set forth in any development agreement unless impairments to the County's receiving waters is linked to this development.

(f) This Ordinance is essential to the public health, safety or welfare and shall apply to any development that is subject to a development agreement.

(g) Laws of general application throughout the County necessary to protect health, safety and welfare are anticipated and are provided for in development agreements.

(h) Substantial changes in developmental impacts have occurred since the time the development agreements were signed, which changes, if not addressed in this Ordinance would pose a threat to public health, safety or welfare.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-202. - Purpose

(a) It is the purpose of this Ordinance to guide development in Beaufort County to protect, maintain, and enhance the environment of the County and the short and long-term public health, safety, and general welfare of the citizens of the County by establishing requirements and procedures to control the potential adverse effects of increased stormwater runoff associated with both future development, re-development, and existing developed land. Proper management of stormwater runoff will minimize damage to public and private property, ensure a functional drainage system, reduce the effects of development on land and stream channel erosion, attain and maintain water quality standards, enhance the local environment associated with the drainage system, reduce local flooding, reduce pollutant loading to the maximum extent practicable and maintain to the extent practicable the pre-developed runoff characteristics of the area, and facilitate economic development while minimizing associated pollutant, flooding, and drainage impacts.

(b) This Ordinance specifically authorizes and enables the County to:

1. Prohibit Illicit Discharges to the Stormwater System and receiving waters.
2. Define procedures for site plan design, review, inspection, and enforcement relative to stormwater management.
3. Control the discharge of spills, dumping or disposal of materials other than stormwater to the Stormwater System and receiving waters.
4. Address specific categories of non-stormwater discharges and similar other incidental non-stormwater discharges.
5. Control importation of water that adversely impacts our receiving waters.
6. Require temporary erosion and sediment controls to protect water quality to the maximum extent practicable during construction activities, in accordance with current state regulations.
7. Define procedures for receipt and consideration of information submitted by the public.
8. Address runoff, particularly volume, rate, and quality through the control and treatment of stormwater with stormwater management facilities and/or Best Management Practices (BMPs).
9. Develop post-construction stormwater quality performance standards, through enforcement of minimum design standards for BMPs.
10. Ensure effective long-term operation and maintenance of BMPs.
11. Carry out all inspection, surveillance, monitoring, and enforcement procedures necessary to determine compliance and noncompliance with this Ordinance and stormwater permit conditions including the prohibition of Illicit Discharges to the County's Stormwater System and the protection of water quality of the receiving waters.
12. Development, implement, and enforce regulations any and all other programs or policies to comply with the Municipal Separate Stormsewer System (MS4) permit issued by South Carolina Department of Health and Environmental Control (DHEC)

(c) The Ordinance requires prudent site planning, including special considerations for the purposes of preserving natural drainage ways incorporating on-site stormwater detention and infiltration to minimize runoff from individual sites to receiving waters by use of effective runoff management, structural and non-structural BMPs, drainage structures, and stormwater facilities.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-203. - Definitions

The following definitions shall apply in Articles III, IV, V, and VI this Ordinance. Any term not herein defined shall be given the definition, if any, as is found elsewhere in the Code of Ordinances of Beaufort County, including the Community Development Code (CDC) Ordinance.

Administrators. The Director of Environmental Engineering and Land Management, the Stormwater Manager and other individuals designated by the County Administrator, from time to time, to administer interpret and enforce this Ordinance.

Best Management Practices ("BMP"). Stormwater management practices, either structural, non-structural or natural that has been demonstrated to effectively control movement of Stormwater, pollutants, prevent degradation of soil and water resources, and that are compatible with the planned land use.

BMP Manual. "The Manual for Stormwater Best Management and Design Practices (BMP)" establishes technical standards as referenced and incorporated into the CDC.

Clean Water Act. The Federal Water Pollution Control Act, as amended, codified at 33 U.S.C §1251 et. seq.

Community Development Code ("CDC"). A form based code to regulate zoning and development in Beaufort County.

County. The Beaufort County, South Carolina.

County Council. The publicly elected official of Beaufort County, South Carolina.

Department. The Stormwater Department, or any duly authorized representatives thereof as designated by the County Administrator.

Development. All project construction, modification, or use of any lot, parcel, building, or structure on land and on water.

Disconnected Impervious Areas or Disconnected Impervious Surfaces. Those non-contiguous impervious areas or impervious surfaces which produce stormwater runoff that discharges through or across a pervious area or surface (i.e. vegetated cover), of sufficient width to reduce or eliminate pollutants associated with stormwater runoff, prior to discharge to the Stormwater System.

Environment. The complex of physical, chemical, and biotic factors that act upon an ecological community and ultimately determine its form and survival.

Evapotranspiration. The sum of evaporation and plant transpiration from the Earth's land surface to atmosphere.

Excess Stormwater Volume. The additional volume of Stormwater runoff leaving the site over and above the runoff volume which existed pre-development.

Illicit Connection. A connection to the County's Stormwater System or receiving water which results in a discharge that is not composed entirely of stormwater runoff and has a detrimental effect on the Stormwater System or receiving water except those granted coverage by an active NPDES permit.

Illicit discharge. Any activity, which results in a discharge to the County's Stormwater System or receiving waters that is not composed entirely of stormwater except (a) discharge pursuant to an NPDES permit and (b) other allowable discharges as defined and exempted in this Ordinance.

Impervious Surface. As defined in the County's Best Management Practices (BMP) Manual.

Improper disposal. Any disposal through an Illicit Discharge, including, but not limited to the disposal of used oil and toxic materials resulting from the improper management of such substances.

Land Disturbance or Land Disturbing Activity. The use of land by any person that results in a change in the natural vegetated cover or topography, including clearing that may contribute to or alters the quantity and/or quality of stormwater runoff.

Maintenance. Any action necessary to preserve stormwater management facilities in proper working condition, in order to serve the intended purposes set forth in this Ordinance and to prevent structural failure of such facilities.

MS4. Municipal Separate Storm Sewer System.

NPDES. National Pollutant Discharge Elimination System (see “Clean Water Act.”)

Natural Resources. Land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources.

Outfall. The point where County’s Stormwater System discharges to waters of the United States or the State of South Carolina.

Person. Any and all persons, natural or artificial and includes any individual, association, firm, corporation, business trust, estate, trust, partnership, two or more persons having a joint or common interest, or an agent or employee thereof, or any other legal entity.

Pollutant. Those man-made or naturally occurring constituents that when introduced to a specific environment creates a deleterious effects. Typical pollutants found in stormwater include but are not limited to sediment (suspended and dissolved), nutrients (nitrogen and phosphorus, etc.), oxygen demanding organic matter, heavy metals (iron, lead, manganese, etc.), bacteria and other pathogens, oil and grease, household hazardous waste (insecticide, pesticide, solvents, paints, etc.) and Polycyclic Aromatic Hydrocarbons (PAHs).

Property Owner or Owner. The legal or equitable owner of land.

Receiving Waters. All natural water bodies, including oceans , salt and freshwater marsh areas, lakes, rivers, streams, ponds, wetlands, and groundwater which are located within the jurisdictional boundaries of County. Stormwater management ponds, man-made wetlands, ditches, and swales constructed for the sole purpose of controlling and treating stormwater are not considered Receiving Waters.

Record Drawings. A set of drawings prepared by and certified by a South Carolina registered professional engineer or landscape architect that accurately represents the actual final configuration of the stormwater and other related infrastructure constructed in a development.

Redevelopment. As defined in the County’s Best Management Practices (BMP) Manual.

Regulation. Any regulation, rule or requirement and promulgated by the County pursuant to this Ordinance.

Stormwater. Stormwater runoff, precipitation runoff, and surface runoff.

Stormwater management. The collection, conveyance, storage, treatment and disposal of Stormwater in a manner to meet the objectives of this Ordinance and its terms, including, but not limited to measures that control the increased volume and rate of stormwater runoff and water quality impacts caused by manmade changes to the land.

Stormwater Management Program, Services, Systems Facilities. Those administrative, engineering, operational, regulatory, and capital improvement activities and functions performed in the course of managing the Stormwater systems of the County, plus all services. Stormwater Management Systems and Facilities are those natural and manmade channels, swales, ditches, swamps, rivers, streams, creeks, branches, reservoirs, ponds, drainage ways, inlets, catch basins, pipes, head walls, storm sewers, lakes, and other physical works, properties, and improvements which transfer, control, convey or otherwise influence the movement of Stormwater runoff and it's discharge to and impact upon receiving waters.

Stormwater Management Plan or SWMP. The set of drawings and other documents that comprise all of the information and specifications for the programs, drainage systems, structures, BMPs, concepts, and techniques for the control of stormwater.

Stormwter Pollution Prevention Plan or SWPPP. Erosion Prevention and Sediment Control (EPSC). Also See "Stormwater Management Plan".

Stormwater System. The conveyance or system of conveyances (including roads with drainage systems, highways, right-of-way, private streets, catch basins, curbs, gutters, ditches, man-made channels, storm drains, detention ponds, and other stormwater facilities) which is designed or used for collecting or conveying Stormwater.

Structural Best Management Practices ("BMP"). A device designed and constructed to trap and filter pollutants from runoff.

Total Impervious Surface. All impervious surfaces on a site regardless if they are directly connected to another and that is not constructed using permeable pavement technology.

Utility. Beaufort County Stormwater Utility as established by County Ordinance Chapter 99 Article II.

Waiver. The modification of the minimum stormwater management requirements contained in these Articles and the BMP Manual for specific circumstances where strict adherence of the requirements would result in unnecessary hardship and not fulfill the intent of this Ordinance.

Water Quality. Those characteristics of stormwater runoff that relate to the physical, chemical, biological, or radiological integrity of water.

Water Quantity. Those characteristics of stormwater runoff that relate to the rate and volume of the stormwater runoff.

Wetlands. As defined by the Army Corps of Engineers and generally means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar type areas.

Working Day. Monday through Friday, excluding all County-observed holidays.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-204. - Applicability

Beginning with and subsequent to its effective date, this Ordinance shall be applicable to:

(a) All Development and Redevelopment

(b) Any illicit discharges
(c) The provisions of this Ordinance shall apply throughout the unincorporated areas of the County

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-205. - Regulations

The County Council, may, in its discretion, amend or change this Ordinance, or adopt additional regulations to implement this Ordinance in order to comply with the State regulations, administer the Stormwater Management Department, or to otherwise further the goal of protecting the quality of the receiving waters into which the Stormwater System discharges.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-206. - County Stormwater Management Administration

Stormwater Management will be administered by the Environmental Engineering and Land Management Division and the Stormwater Department to administer and implement the regulations of this Ordinance as set forth in the CDC and BMP Manual.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-207. - Administrators of Operations, Power and Duties

(a) The Administrators shall administer, implement, and enforce provisions of this Ordinance on behalf of the County.
(b) In addition to the powers and duties that may be conferred by other provisions of the County and other laws, the Administrators shall have the following powers and duties under this Ordinance:
   1. To create the BMP Manual.
   2. To review and approve, approve with conditions, or disapprove applications for approval of a Stormwater Management Plan pursuant to this Ordinance;
   3. To make determinations and render interpretations of this Ordinance;
   4. To establish application requirements, schedules and fees for submittal and review of applications and appeals, in accordance with the standards for County Development Permits and Stormwater Permits under the County's CDC Ordinance and this Ordinance;
   5. To review and make recommendations to the applications for development or redevelopment approvals;
   6. To enforce the provisions of this Ordinance in accordance with its enforcement provisions;
   7. To maintain records, maps, and official materials related enforcement, or administration of this Ordinance;
   8. To provide expertise and technical assistance;
   9. To take any other action necessary to administer the provisions of this Ordinance.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-208. - Coordination with Other Agencies

The Administrators will coordinate the County's activities with other federal, state, and local agencies, which manage and perform functions relating to the protection of receiving waters.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-209. - Cooperation with Other Governments

The County may enter into agreements with other governmental and private entities to carry out the purposes of this Ordinance. These agreements may include, but are not limited to enforcement, resolution of disputes, cooperative monitoring, and cooperative management of stormwater systems and cooperative implementation of stormwater management programs.
Nothing in this Ordinance or in this section shall be construed as limitation or repeal of any Ordinances of these local governments or of the powers granted to these local governments by the South Carolina Constitution or statues, including, without limitation, the power to require additional or more stringent stormwater management requirements within their jurisdictional boundaries.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-210. - Stormwater Management Standards

(a) *Reference to Best Management Practices (BMP) Manual*
The Administrators shall use the policy, criteria, and information, including technical specifications and standards, in the BMP Manual as the basis for decisions about stormwater plans and about the design, implementation and performance of structural and non-structural stormwater systems. The Stormwater Management Standards shall describe in detail how post-development stormwater runoff will be controlled and managed, the design of all stormwater facilities and practices, and how the proposed project will meet the requirements of this Ordinance. The BMP Manual includes a list of acceptable stormwater treatment practices, including the specific design criteria for each stormwater practice. These standards will be updated as technology improves.

(b) *Relationship of Stormwater Management Standards to Other Laws and Regulations.* If the specifications or guidelines of the Standards are more restrictive or apply a higher standard than other laws or regulations, that fact shall not prevent application of the specifications or guidelines in the Standards.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-211. - Review of Stormwater Management Plans

Stormwater Management Plans shall be reviewed as a component of the Development Plan review process by the Administrators. They will be reviewed for compliance with standards in this Ordinance and requirements in the CDC and BMP Manual. Procedures are outlined in BMP Manual. Requests for meetings and submission of plans will be submitted to Stormwater Department. The expected process will be as follows:

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-212. - Approvals

(a) *Effect of Approval*
Approval authorizes the applicant to go forward with only the specific plans and activity authorized in the plan. The approval shall not be construed to exempt the applicant from obtaining other applicable approvals from local, state, and federal authorities.

(b) *Time Limit/Expiration*
Time limit, expiration and extensions shall be in accordance with the County's CDC Ordinance.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-213. - Appeals

(a) *Scope of Appeal*
Any person aggrieved by a decision of the Administrators may appeal the same by filing an interim written notice of appeal, with the Administrators within thirty (30) days of the issuance of said decision or Notice of Violation. The interim notice of appeal must specify with reasonable practicality the grounds of the appeal and relief sought. Stormwater Utility Management Board (SWUB) will review and provide a decision within fifteen (15) day of the next Board Meeting following the appeal. The decision of the SWUB shall be final. Appeals to SWUB's decision shall be processed in accordance with State Law.

(b) Standards

1. The SWUB is limited to the following determinations for an administrative appeal:

    (a) The administrators made an error in reviewing whether a standard was met. The record must indicate that an error in judgment occurred or facts, plans, or regulations were misread in determining whether the particular standard was met.

    (b) Where conflicting evidence exists, the appeal is limited to determining what evidence or testimony bears the greatest credibility in terms of documentation and qualifications of those making the determination.

    (c) The administrators made the decision on standards not contained in this chapter or other county Ordinances, regulations, or state law, or a standard more strict or broad was applied. This chapter does not permit administrators to consider or create standards not officially adopted.

    (d) An error in applying a standard or measuring a standard was made.

2. The board, on an appeal, shall not hear any evidence or make any decision based on hardships or special conditions.

(Ord. No. 2016/____, ___-___-2016)

Article IV. – STORMWATER MANAGEMENT STANDARDS TO BE APPLIED

Sec. 99-300. - General Requirements

(a) All development and redevelopment, including highways, shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume and duration of flow.

(b) All development shall connect Impervious Surfaces to vegetative surfaces to the maximum extent practicable.

(c) Stormwater runoff shall be controlled in a manner that:

1. Promotes positive drainage from structures resulting from development.
2. Includes the use of vegetated conveyances, such as swales and existing natural channels to promote infiltration and evapotranspiration.
3. Reduces runoff velocities and maintains sheet flow condition to prevent erosion and promote infiltration.
4. Limits its interaction with potential pollutant sources that may become water-borne and create non-point source pollution.
5. Promotes reuse of excess stormwater volume to increase evapotranspiration.

(d) Natural vegetative buffers play an integral part in minimizing the volume of stormwater runoff by promoting infiltration and increasing evaportranspiration to reduce SW volume to receiving waters and acting as a first line of treatment of water quality pollution. Development shall observe the buffer requirements of the County's CDC Ordinance or if applicable the relevant development agreement, concept plan, and/or approved master plan.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-301. - Stormwater Design Requirements for Development

(a) Developments which incorporates engineered stormwater collection, conveyance, and storage systems shall be designed to the criteria established in the latest version of County's BMP Manual

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-302. - BMP Requirements

(a) Effectiveness of infiltration practices is dependant on the site conditions. The BMP manual outlines guidance for properly siting infiltration practices and shall be reviewed prior to the design phase.
(b) The owners of all new developments that receive a Stormwater Permit from the County shall be required to perform stormwater quantity monitoring at their expense to ensure compliance with the provisions of this Ordinance and ensure that volume reduction plans are operated as intended.
(c) All construction and implementation of erosion and sediment control BMPs shall comply with the requirements of the South Carolina Stormwater Management and Sediment Reduction Act and submit reports in accordance with the BMP manual.
(d) The County reserves the right to perform other monitoring as it deems appropriate to determine compliance with the State Sediment and Erosion Control Act.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-303. – Reserved.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-304. - Waiver

Individuals seeking a waiver in connection with a Stormwater Plan may submit to the Administrators a request for a waiver from the requirements of this Ordinance if exceptional circumstances applicable to a site exist such that adherence to the provisions of the Ordinance will result in unnecessary hardship and will not fulfill the intent of the Ordinance.

(a) *Request of Waiver at Staff Level*
A written request for a waiver is required and shall state the specific waiver sought and the reasons, with supporting data, a waiver should be granted. The request shall include all information necessary to evaluate the proposed waiver. Requests must outline the need for such a waiver, such as site constraints, soil characteristics, or similar engineering limitations. Cost shall not be considered cause for a waiver. The applicant will address the four areas of consideration for waiver approval as follows:
1. What exceptional circumstances to the site are evident?
2. What unnecessary hardship is being caused?
3. How will denial of the waiver be inconsistent with the intent of the Ordinance?
4. How will granting waiver comply with intent of Ordinance?
(b) *Review of Waivers*

The Administrators will conduct a review of the request and will issue a decision fifteen within (15) working days of receiving the request.

(c) *Appeal of Decision*
Any person aggrieved by the decision of the Administrators concerning a waiver request may appeal such decision in accordance with Section 99-213 above.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-305. – Maintenance: General Requirements

(a) *Function of BMPs as Intended*
The owner of each structural BMP installed pursuant to this Ordinance shall maintain and operate it to preserve and continue its function in controlling stormwater quality and quantity at the degree or amount of function for which the structural BMP was designed.

(b) *Right of County to Inspection*
Every Structural BMP installed pursuant to this Ordinance shall be made accessible for adequate inspection by the County.

(c) *Annual Maintenance Inspection and Report*
The person responsible for maintenance of any structural BMP installed pursuant to this Ordinance shall submit to the Administrator(s) an inspection report from a registered South Carolina Professional Engineer. The inspection report, at a minimum, shall contain all of the following:

1. The name and address of the land owner;
2. The recorded book and page number of the lot of each structural BMP or a digital representation of the geographic location of each structural BMP;
3. A statement that an inspection was made of all structural BMPs;
4. The date the inspection was made;
5. A statement that all inspected structural BMPs are performing properly and comply with the terms and conditions of the approved maintenance agreement required by this Ordinance;
6. The original signature and seal of the engineer inspecting the structural BMPs; and
7. Digital photographs of the structural BMPs and pertinent components integral to its operation, including but not limited to inlet/outlet control structures, downstream receiving channel/area, embankments and spillways, safety features, and vegetation.

All inspection reports shall be on forms supplied by the Administrators. An original inspection report shall be provided to the Administrators beginning one year from the date of record drawings certification and each year thereafter on or before the date of the record drawings certification.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-306. - Operation and Maintenance Agreement

(b) Prior to the conveyance or transfer of any lot or building site requiring a structural BMP pursuant to this Ordinance, the applicant or owner of the site must execute an operation and maintenance agreement (see BMP manual for form) that shall be binding on all subsequent owners of the site, portions of the site, and lots or parcels served by the structural BMP. Until the transference of all property, sites, or lots served by the structural BMP, the original owner or applicant shall have primary responsibility for carrying out the provisions of the maintenance agreement.

(b) The operation and maintenance agreement must be approved by the Administrators prior to plan approval, and it shall be referenced on the final plat and shall be recorded with the county Register of Deeds upon final plat approval. If no subdivision plat is recorded for the site, then the operations and maintenance agreement shall be recorded upon the approval of a certificate of completion with the county Register of Deeds to appear in the chain of title of all subsequent purchasers under generally accepted searching principles. A copy of the recorded maintenance agreement shall be given to the Administrators within fourteen (14) days following its recordation.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-307. - Deed Recordation and Indications on Plat

The applicable operations and maintenance agreement pertaining to every structural BMP shall be referenced on the final plat and in covenants and shall be recorded with the county Register of Deeds upon final plat approval.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-308. - Records of Installation and Maintenance Activities

The owner of each structural BMP shall keep records of inspections, maintenance, and repairs for at least five (5) years from the date of the record and shall submit the same upon reasonable request to the Administrator(s).

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-309. - Nuisance

The owner of each stormwater BMP shall maintain it so as not to create or result in a nuisance condition, such as but not limited to flooding, erosion, excessive algal growth, overgrown vegetation, mosquito breeding habitat, existence of unsightly debris, or impairments to public safety and health. Maintenance practices must not lead to discharges of harmful pollutants.

(Ord. No. 2016/____, ___-___-2016)

Article V. - ILLICIT DISCHARGES AND CONNECTIONS TO THE STORMWATER SYSTEM

Sec. 99-400. - Illicit Discharges

No person shall cause or allow the discharge, emission, disposal, pouring, or pumping directly or indirectly to any stormwater conveyance, receiving water, or upon the land in manner and amount that the substance is likely to reach a stormwater conveyance or the receiving waters, any liquid, solid, gas, or other substance(including animal waste), other than stormwater.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-401. - Non-Stormwater Discharges

(a) Non-Stormwater discharges associated with the following activities are allowed provided that acceptable BMPs are followed:
1. Water line and hydrant flushing;
2. Landscape irrigation, unless it leads to excess SW Volume discharge
3. Diverted stream flows;

4. Rising ground waters;
5. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
6. Uncontaminated pumped ground water;
7. Discharges from potable water sources (with dechlorination BMP utilized);
8. Foundation drains;
9. Air conditioning condensation;
10. Reuse water;
11. Springs;
12. Water from crawl space pumps;
13. Footing drains;
14. Individual residential car washing;
15. Flows from riparian habitats and wetlands;
16. Dechlorinated swimming pool discharges; typically less than one part per million.
17. Street wash water;
18. Other non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under EPA authority, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system;
19. Discharges specified in writing by the authorized enforcement agency as being necessary to protect public health and safety;
20. Dye testing is an allowable discharge, but requires a verbal notification to the authorized enforcement agency prior to the test; and
21. Firefighting.

(b) Prohibited substances include but are not limited to: oil, anti-freeze, chemicals, animal waste, paints, garbage, and litter.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-402. - Illicit Connections

(a) Connections to a receiving water and/or stormwater conveyance system that allow the discharge of non-stormwater, other than the exclusions described in Section 99-401 (a) above are unlawful. Prohibited connections include, but are not limited to floor drains, waste water from washing machines or sanitary sewers, wash water from commercial vehicle washing or steam cleaning, and waste water from septic systems.

(b) Where such connections exist in violation of this section and said connections were made prior to the adoption of this Ordinance or any other Ordinance prohibiting such connections, the property owner or the person using said connection shall remove or correct the connection.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-403. - Spills

(a) Spills or leaks of polluting substances released, discharged to, or having the potential to released or discharged to a receiving water or the stormwater conveyance system, shall be contained, controlled, collected, and properly disposed. All affected areas shall be restored to their preexisting condition.

(b) Persons in control of the polluting substances shall immediately report the release or discharge to persons owning the property on which the substances were released or discharged, shall within two (2) hours of such an event shall notify the nearest Fire Department (who will also notify the Administrators), and all required federal and state agencies of the release or discharge. Notification shall not relieve any person of any expenses related to the restoration, loss, damage, or any other liability which may be incurred as a result of said spill or leak, nor shall such notification relieve any person from other liability which may be imposed by State or other law.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-404. - Nuisance

Illicit discharges and illicit connections which exist within the unincorporated County are hereby found, deemed, and declared to be dangerous and prejudicial to the public health, and welfare, and are found, deemed, and declared to be public nuisances. Such public nuisances shall be abated in accordance with the procedures set forth in Section 99-503 (c) & (d).

Sec. 99-405. – Suspension of a MS4 discharge due to an illicit discharge.

a) Any person discharging to the MS4 in violation of this Ordinance may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The authorized enforcement agency will notify a violator of the proposed termination of its' MS4 access. The violator may petition the authorized enforcement agency for a reconsideration and hearing.

b) A person commits an offence if the person reinstates MS4 access to premises terminated pursuant to this section, without the prior approval of the authorized enforcement agency.

c) The Beaufort County, South Carolina staff may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge that presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or Waters of the United States. If the violator fails to comply with a suspension order issued in an emergency, the authorized enforcement agency may take such steps as deemed necessary to prevent or minimize damage to the MS4 or Waters of the United States, or to minimize danger to persons.

(Ord. No. 2016/____, ___-___-2016)

Article VI. - INSPECTION , ENFORCEMENT, AND CORRECTION

Sec. 99-500. - Inspections

The County will maintain the right to inspect any and all Stormwater Systems within it jurisdiction as outlined below:

(a) An Inspector designated by the Administrators, bearing proper credentials and identification, may enter and inspect all properties for regular inspections, periodic investigations, monitoring, observation measurement, enforcement, sampling and testing, to ensure compliance with the provisions of this Ordinance.

(b) Upon refusal by any property owner to permit an Inspector to enter or continue an inspection, the Inspector may terminate the inspection or confine the inspection to areas concerning which no objection is raised. The Inspector shall immediately report the refusal and the grounds to the Administrators. The Administrators will promptly seek the appropriate compulsory process.

(c) In the event that the Administrators or Inspector reasonably believes that discharges from the property into the County's Stormwater System or receiving waters may cause an imminent and substantial threat to human health or the environment, the inspection may take place at any time after an initial attempt to notify the owner of the property or a representative on site. The Inspector shall present proper credentials upon reasonable request by the owner or representative.

(d) The Beaufort County, South Carolina, staff shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the authorized enforcement agency to conduct monitoring and/or sampling of the facility's stormwater discharge.

(e) The Beaufort County, South Carolina, staff has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.

(f) Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the authorized enforcement agency and shall not be replaced. The costs of clearing such access shall be borne by the operator.

(g) Unreasonable delays in allowing the Beaufort County, South Carolina, staff access to a permitted facility is a violation of a stormwater discharge permit and of this Ordinance. A person who is the operator of a facility with a NPDES permit to discharge stormwater associated with industrial activity commits an offense if the person denies the authorized enforcement agency reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this Ordinance.

(h) Inspection reports will be maintained in a permanent file at the offices of the County.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-501. - Notice and Warning.

(a) Upon the County's attention to a violation of this Ordinance, the Administrators shall investigate the violation and prepare a report concerning the violation. If a violation exists, a warning notice shall be delivered within five (5) working days to any person occupying the property or linked to a discharge, whether the person is the owner, renter, or lessee. If the nature of the violation is not correctable, a stop work order shall be issued immediately. If no one is present or refuses to accept the notice, the Administrators shall post the warning notice on the residence or building entrance.

(b) The warning notice shall contain the following:

1. The address and legal description of the property.

2. The section of this chapter being violated.

3. The nature and location of the violation and the date by which such violation shall be removed or abated.

4. A notice of the penalty for failing to remove or abate the violation, stating that if the nuisance recurs by the same occupant, owner, or person in charge, a notice of violation, stop work order, or notice to appear will be issued without further notice.

5. The notice shall specify the number of days in which the violation shall be removed or abated, which time shall be not less than three (3) days nor more than ten (10) days, except in emergency cases.

(c) If the violation occurs where the residence or building is unoccupied, the property may be posted as provided in this section. If the property is unimproved, the notice may be placed on a tree or other such object as available.

(d) A written notice containing the same information as the warning notice shall be sent to the owner or any other person having control of the property at the last known address of the owner, or at the address of the person having control, by ordinary mail.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-502. - Recurring Violations.

Once a notice has been delivered pursuant to County CDC and the same violation recurs on the same lot or tract of land by the same person previously responsible, no further warning notice need be given. Each day a violation continues after the expiration of the warning period to abate such a violation shall constitute a separate offence. Thereafter, the County may issue a notice of violation, stop work order, or such person deemed responsible may be notified to appear in court to answer to the charge against such person.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-503. - Failure to Act Upon Warning Notice.

Upon neglect or failure to act upon the warning notice of violation, and/or stop work order given as provided in section 99-501 & 502, the County shall issue a notice to appear and shall follow the procedures as follows:

(a) *Service of notice to appear.* If a warning notice is given and, after the time for removal or abatement has lapsed, the property is reinspected and the County Official finds and determines the violation has not been removed or abated, the County Official shall fill out and sign, as the complainant, a complaint and information form or a notice to appear. The notice to appear shall include the following:

1. Name of the occupant, owner, or person in charge of the property.
2. The address or legal description of the property on which the violation is occurring.
3. This chapter section or other reference the action or condition violates.
4. The date on which the case will be on the court docket for hearing.
5. Any other information deemed pertinent by the County Official.

The original copy of the notice to appear shall be forwarded to the clerk of the court for inclusion on the court's docket for the date indicated on the notice to appear.

(b) *Notice to appear; delivery by mail.* If no one is found at the property to accept a notice to appear for failure to remove or abate a violation, the County Official shall fill out and sign the notice to appear as the complainant and deliver the original plus one copy to the Clerk of the Court. The Clerk shall verify or insert the date the case has been set for hearing before the Court. The Clerk shall mail the copy by certified mail to the person named in the notice to appear at that person's last known address.

(c) *Abatement by County; costs assessed to person responsible.* If the occupant, owner, or person in charge of the property for which a warning notice has been given fails to remove or abate the violation in the time specified in the notice, whether on public or private property, the County may, if severe conditions exist that affect health, welfare, safety or severe environmental degradation, remove the violation and thereby abate the violation. If necessary, the County may lawfully enter upon the property on which the violation remains unabated to remove or abate such violation at the cost of the person responsible for creating or maintaining the violation. The violation will be subject to civil fines reflecting the cost to the County, as prosecuted by the County Attorney.

(d) *Payment of costs; special tax bill or judgment.* All costs and expenses incurred by the County in removing or abating any violation on any private property may be assessed against the property as a lien on the property. Alternatively, the cost of removing or abating the violation may be made part of the judgment by the judge, in addition to any other penalties and costs imposed if the person charged either pleads or is found guilty of causing, creating, or maintaining a violation.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-504. - Penalty for Violation.

(a) Any person, group, firm, association or corporation violating any section of this chapter shall be guilty of a misdemeanor and, upon conviction thereof, shall pay such penalties as the court may decide, as prescribed by state law, not to exceed $500.00 or 30 days imprisonment for each violation. Each day during which such conduct shall continue shall subject the offender to the liability prescribed in this article.

(b) In addition to the penalties established and authorized in subsection (a) of this section, the County Attorney shall take other actions at law or in equity as may be required to halt, terminate, remove, or otherwise eliminate any violations of this chapter.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-505. - Interpretation

(a) *Meaning and Intent*
All provisions, terms, phrases, and expressions contained in this Ordinance shall be construed according to the general and specific purposes set forth in Section 99-202, Purpose. If a different or more specific meaning is given for a term defined elsewhere in County's Code of Ordinances or in an existing development agreement, the meaning and application of the term in this Ordinance shall control for purposes of application of this Ordinance.

(b) *Text Controls in Event of Conflict*
In the event of a conflict or inconsistency between the text of this Ordinance and any heading, caption, figure, illustration, table, or map, the text shall control.

(c) *Authority for Interpretation*
The Administrators have, after consultation with County Attorney, authority to determine the interpretation of this Ordinance. Any person may request an interpretation by submitting a written request to the Administrators who shall respond in writing within thirty (30) days. The Administrators shall keep on file a record of all written interpretations of this Ordinance.

(d) References to Statutes, Regulations, and Documents
Whenever reference is made to a resolution, Ordinance, statute, regulation, manual (including the BMP Manual), or document, it shall be construed as a reference to the most recent edition of such that has been finalized and published with due provision for notice and comment, unless otherwise specifically stated.

(e) *Delegation of Authority*
Any act authorized by this Ordinance to be carried out by the County Administrator may be carried out by his or her designee.

(f) *Usage*

1. Mandatory and Discretionary Terms
The words "shall," "must," and "will" are mandatory in nature, establishing an obligation or duty to comply with the particular provision. The words "may" and "should" are permissive in nature.
2. Conjunctions
Unless the context clearly indicates the contrary, conjunctions shall be interpreted as follows: The word "and" indicates that all connected items, conditions, provisions or events apply. The word "or" indicates that one or more of the connected items, conditions, provisions or events apply.
3. Tense, Plurals, and Gender Words used in the present tense include the future tense. Words used in the singular number include the plural number and the

plural number includes the singular number, unless the context of the particular usage clearly indicates otherwise. Words used in the masculine gender include the feminine gender, and vice versa.

(g) *Measurement and Computation*
Lot area refers to the amount of horizontal land area contained inside the lot lines of a lot or site.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-506. - Conflict of Laws

This Ordinance is not intended to modify or repeal any other Ordinance, rule, regulation or other provision of law. The requirements of this Ordinance are in addition to the requirements of any other Ordinance, rule, regulation or other provision of law, and where any provision of this Ordinance imposes restrictions different from those imposed by any other Ordinance, rule, regulation or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human or environmental health, safety, and welfare, shall control.

(Ord. No. 2016/____, ___-___-2016)

Sec. 99-507. - Severability

If the provisions of any section, subsection, paragraph, subdivision or clause of this Ordinance shall be adjudged invalid by a court of competent jurisdiction, such judgment shall not affect or invalidate the remainder of any section, subsection, paragraph, subdivision or clause of this Ordinance.

(Ord. No. 2016/____, ___-___-2016)

This Ordinance will become effective upon approval by Council Council.

Adopted this _____ day of ___________, 2016.

COUNTY COUNCIL OF BEAUFORT COUNTY

BY:_____________________________________

Paul Sommerville, Chairman

APPROVED AS TO FORM:

____

Thomas Keavney, County Attorney

ATTEST:

____

Suzanne M. Rainey, Clerk to Council

First Reading:

Second Reading:

Public Hearing:

Third and Final Reading:

(Ord. No. 2005/33, § 17, 8-22-2005; Ord. No. 2009/21, §§ I—VI, 5-26-2009; Ord. No. 2015/24, 9-28-2015; Ord. No. 2016/___, 09-26-2016; Ord. No. 2016/____, ___-___-2016)

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Beaufort County Manual for Best Management and Design Practices – September 14, 2016 supplement

Change #1
2.5 Volume Control (page 2-16) – reword as noted

~~In general, facility design criteria~~ All development will control and retain total volume by retention and other methods to the maximum extent technically feasible (METF) so that stormwater runoff levels will not exceed predevelopment levels for storm events up to the 95th percentile event, which is currently 1.95 inches. Upon approval from the stormwater manager, the design engineer may utilize other data or sources for calculating the 95th percentile event, such as NOAA Atlas 14 data; however, must submit supporting data and source information. All designs shall also comply to METF with volume control requirements related to antidegradation requirements using the Effective Impervious method found in Section 5 of this manual.

Change #2
5.1 Volume Control: Effective Impervious (Page 5-1) – add new 1st paragraph

Meeting a retention volume for the 95th percentile storm event does not necessarily equate to achieving antidegradation load limits for indicator pollutants nitrogen, phosphorus, and fecal coliform. Further reduction of runoff volume may be needed.

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Change #3
5.2 Volume Control: Treatment Train – Last paragraph, 1st and 2nd sentence (Page 5-9)
Move to **5.1 Volume Control: Effective Impervious** as 4th paragraph (Page 5-1) and reword as noted.

The appropriate volume control standard is a threshold of 10 percent effective impervious area. One advantage of this standard is that it remains consistent with the overall framework of the BMP reviews for water quality, which allow for anitdegradation loads of total phosphorus (total P) and total nitrogen (total N) from proposed development up to the uncontrolled load expected from a 10 percent impervious development. The antidegradation load for fecal coliform allowed in this BMP Manual is based on an overall imperviousness of 5%. Therefore, meeting the standard of 10% effective impervious area and retention of the 95th percentile storm event does not preclude the requirement to size BMPs to meet the allowable fecal coliform load.

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Change #4
5.2 Volume Control: Treatment Train – Last paragraph, last sentence (Page 5-9)
Move to **5.1 Volume Control: Effective Impervious** as last paragraph (Page 5-8)

Based on the example presented in Appendix E, it also appears that the standard can be met with one or more volume control BMPs in a typical development.

Change #5

2.6.1 General Design Criteria (Page 2-17) – reword as noted

5. Retention/detention facilities shall be designed to provide at a minimum of ~~6 inches~~ 1.0 ft. of vertical freeboard above the proposed design elevation to the crest of the emergency spillway. Major drainage canals shall not be used for storage where this may impact the storm hydrology upstream and downstream.

Change #6

2.6.1 General Design Criteria (Page 2-17) – reword as noted

9. Detention basins shall be designed so they drain within approximately 24 hours after termination of the storm up to the 25-year storm event, unless the stormwater manager finds that downstream conditions may warrant other design criteria for stormwater release.

Change #7

2.2 Roadway Drainage Planning and Design Standards (Page 2-8) – reword as noted

2. Minimum centerline elevation shall be 7.5 ft based on National Geodetic Vertical Datum of 1929 (NGVD 29) datum. Note that current technology and standards use North American Vertical Datum of ~~1983~~ 1988 (NAVD ~~83~~88) datum. Appropriate conversion for datum must be applied.

END OF SUPPLEMENT

BEAUFORT COUNTY
STORMWATER UTILITY
120 Shanklin Road
Beaufort, South Carolina 29906
Voice (843) 255-2801 Facsimile (843) 255-9478

October 12, 2016

Stormwater Manager's Report for the Stormwater Utility Board Meeting

Utility Update

1. The SWUB meeting for October 12, 2016 was canceled due to lack of urgent business and scheduled absence of staff. This report serves in place of a meeting agenda.
2. Tax Run for Tax Year 2016 (TY16) – Billing was delayed until October 15, 2016 by County Council action.
3. Submerged Properties, Marshlands, and Condominiums Rate Structure and Billing – The ordinance revision passed third and final reading on September 26, 2016.
4. Easement Manager – With Patricia Wilson's transfer to Engineering as the new Right-of-way Manager, the duties of Stormwater Easement acquisition will transfer to Engineering. Seth Stanbery, our GIS / Data Manager, will provide Patty with GIS support on both ROW and Stormwater easements.
5. Intergovernmental Agreements (IGAs) and Memorandums of Agreements (MOAs) for Fiscal Year 2017 (FY17) – The City of Beaufort agreements are still pending.
6. Eric Larson accepted an invitation to speak to the Governor's South Atlantic Alliance on Stormwater. The workshop is in December in North Myrtle Beach. I am speaking on our volume control standards.

Monitoring Update

1. Lab Update (From Dr. Alan Warren and Lab Manager Danielle Mickel) – No information was available at the time of this report.
2. I held a conference call with Dr. Eric Montie with USCB to discuss his continued research on salinity in headwaters. There is potential for incorporating his research into our monitoring program. Additional meetings are needed to finalize the plan, and this will be done as part of the development of the monitoring plan for the County.
3. Monitoring Plan Development – Subcommittee met to review current list of parameters and sampling programs. Below is a summary of each jurisdictions efforts:
   a) **Beaufort County** – Finalizing Stormwater Management Plan, Illicit Discharge and Monitoring Plan.

i. CIP Projects – once a week. Assays depend on project.
ii. MS4 – Bluffton currently sampling and providing results to the County. County conducts quarterly wet and dry weather sampling.
iii. TMDL (Okatie) – once a week for bacteria.

b) **City of Beaufort** –
  i. The County performs all sampling for the City using the same protocols as defined above.
  ii. Beaufort County staff will start sampling the Battery Creek Duck Pond once a week for fecal coliform and E. coli. This is a joint funded 319 grant project.

c) **Town of Bluffton** – Finished their SWMP and Dry weather monitoring plan.
  i. CIP program – once a week
  ii. MS4 program– quarterly
  iii. TMDL – once a week

d) **Town of HHI** – Working on Illicit discharge and wet weather monitoring plan. Renewing contract with GEL for sampling.

e) **Town of Port Royal** –
  i. The County performs all sampling for the City using the same protocols as defined above.
  ii. Wetland Project restoration. Doing one wet and one dry. USCB is testing for *E. coli*. TN, TP and in-situ.

Stormwater Implementation Committee (SWIC) Report

1. The SWIC meeting for October 5, 2016 was canceled due to lack of business.

Stormwater Related Projects

1. US 278 Retrofit Ponds ($356,000 Budget) – the 4th and final pond began clearing.
2. Okatie West / SC 170 Widening Retrofit (Design and Construction = $915,000 Budget) – Nothing new to report.
3. SC 170 Widening Pond #8 project (Design and Construction = $630,840) – Nothing new to report.
4. Easements – Staff is working on numerous easement requests. Significant locations are Salem Dr. East, Young Circle, Roseida / Glaze, and Gadwell Dr. East. The County attorney is pursuing an alternate means of easement acquisition for Salem Dr. East that may eliminate the need for condemnation.
5. Complaints and special requests – The Stormwater Infrastructure Operations crews are scheduling and prioritizing multiple projects created as a result of citizen requests, including those made during recent public meetings on St. Helena and Hilton Head Island.

Professional Contracts Report

1. Stormwater Management Plan (Master Plan) Update – ($475,000 Budget; $239,542 County portion) – work continues on the land use analysis and identification of pollutants of concern. A technical memo on these work products is due in November.
2. Mint Farm Basin B Modification – ($8,000 Budget) – Nothing new to report.
3. SC 170 Widening Drainage – ($17,500 Budget with 50% of funding from the Stormwater Department) – The 3rd party review report is still pending submittal. An additional extension was allowed to review as-built drawings that were not available until early October.

Regional Coordination

1. Factory Creek Watershed Regional Detention Basin "Phase I" & Academy Park Subdivision (cost is pending) – Nothing new to report.
2. Factory Creek Watershed Regional Detention Basin "Phase II" (Design Cost = $63,390, Tree Mitigation Cost is pending, Construction Cost by the Developer) – Nothing new to report.
3. Horne Development at Okatie Center in Jasper County – ATM has been given a Task Order to review Jasper County and City of Hardeeville stormwater standards and compare to our own.
4. Hilton Head National Redevelopment – Nothing new to report.
5. FEMA CRS five year update – Staff has been working with Hakim Bayyoud, County Floodplain Manager, to prepare the five year review application for the Community Rating System. With the recent changes to the BMP Manual, we anticipate an improved rating.

Municipal Reports

1. Town of Hilton Head Island (From Bates Rambow, SW Data Analyst)
   i. No information was available at the time of this report.

2. Town of Bluffton (From Kim Jones, Watershed Management Division Director)

   WATERSHED MANAGEMENT PROJECTS UPDATE:

   i. **Stoney Creek Wetlands Restoration: Data Collection & Analysis Phase**
      - Following receipt of the draft water budget including hydrology and hydraulics reports on 4/1/16, data collection in support of developing design alternatives was extended due to above average rainfall over the winter.
      - Data collection continued for approximately two months into the "dry" season to measure the effects on the water table. This activity is in support of

developing preliminary conceptual designs for property owner review/negotiations.
- Final Summary Memo including conceptual design options was received July 2016, staff provided review, final documents anticipated first week of October.
- Conceptual designs have been forwarded to the property owners for review.
- **Next Steps:**
  - Staff is coordinating with the property owners to review the conceptual designs. Date for meeting has not yet been set.

ii. **319 Grant Phase 2 (Pine Ridge): Construction Phase**

- Staff submitted a 319 Grant amendment request to extend the grant deadline to 1/30/17 and reallocate unspent funds. The remaining 319 Grant Phase 2 funds will be reallocated to purchase engineered bacteria removal media filter socks to be installed in the wetland ditch downstream from the New Riverside Pond to maintain bacteria removal efficiency, and to install littoral shelf plantings within ponds in the Pine Ridge Community.
- The grant amendment was approved by SCDHEC and the amended contract has been executed.
- Contractor will complete final inspection punch list items by the first week of October.
- **Next Steps:**
  - Purchase and install engineered bacteria removal filter socks.
  - Design and install littoral shelf plantings as needed.

iii. **319 Grant Phase 3 (May River Preserve Pond)**

- SCDHEC notified staff that the EPA has approved the grant application and the grant of $231,350 has been awarded.
- Grant package is under review by EPA prior to forwarding to SCDHEC and the Town for execution.
- After receiving property access approval, pre-project water quality and flow monitoring has commenced.
- **Next Steps:**
  - Execute grant contract with SCDHEC.
  - Obtain easement for construction and maintenance from property owner.

iv. **Stormwater Utility Management Plan Update**

- Beaufort County is the managing partner for this county-wide stormwater master plan update by Applied Technology & Management.
- A series of public meetings were held across the County to gather input for the Management Plan Update. The Bluffton meeting was held on 6/22/16.
- Following public input, staff is investigating with ATM if the May River Watershed Action Plan water quality model can be completed as part of the Management Plan Update. Contractor was to provide alternatives and cost-estimates to complete the Water Quality Model in August, but requested more data.

- Staff provided updated Best Management Practice locations throughout the watershed to the contractor to develop alternatives and cost estimates. Rough scope and budget estimates are anticipated the first week of October.
- **Next Steps:**
  - Staff will receive scope and budget estimates to complete the May River Watershed Water Quality Model from ATM and assess budget.
  - Staff will continue to participate in the county-wide effort to update the Beaufort County Stormwater Management Plan as needed.

Watershed Management Division/Staff Updates:

v. Plan reviews

- In support of the Development Review process staff performed:
  - 14 Development Plan Reviews
  - 4 Development Surety Reviews
  - 6 Certificate of Construction Compliance Inspections
  - 4 Pre-Construction Meetings
  - 4 Pre-Clearing Inspections
  - 1 Post-Construction BMP

vi. **September Data Collection –**

- Collected data from four monitoring stations at Stoney Crest Property.
- Collected data from two monitoring stations at Pine Ridge.
- Four in-stream flow/velocity measurements collected at our sampling locations in the headwaters of the May River.

vii. Watershed Management staff participated in the Stormwater Utility Board, Stormwater Implementation Committee, and MS4 and Water Quality Monitoring sub-committee meetings. These meetings allow the three MS4 permit holders/jurisdictions to partner on permit requirements including education and outreach and water quality monitoring.

viii. May River Watershed Management Plan Advisory Committee met 9/22/16.

ix. Watershed Management Division organized the Beach Sweep/River Sweep on 9/17/16.

x. Kim Jones, Beth Lewis, Andrea Berry and Matthew Carey passed their Clemson University Post-Construction BMP Inspector course and will receive certifications. They join Bill Baugher and Sam Connor as Post-Construction BMP Inspectors.

xi. Lewis and Berry provided a presentation to the Marsh Association, an organization of POA Managers, regarding local stormwater and Low Impact Design (LID) opportunities for our local communities.

xii. Watershed Management staff presented and held a Q&A with residents of The Haven community with regards to the HOA's Stormwater Detention Ponds.

xiii. Watershed Management staff attended the South Carolina Department of Natural Resources Communicating Climate Change Class on 9/7/16.

xiv. Watershed Management staff attended Town Finance training on grant procedures and project management procurement protocols.

3. City of Beaufort (From Neil Desai, Asst. Public Works Director)
   i. Battery Creek Pond Funded by an EPA 319 Grant ($132,609 Budget – County Portion) – Work continues. The selection of the mechanical pre-treatment device is complete.
   ii. No further information was available at the time of this report.

4. Town of Port Royal (From Van Willis, Town Manager)
   i. No information was available at the time of this report.

MS4 report

1. Plan review summary – 13 Plans Reviewed.

Projects Name	SRT Review Date	Review Type	Comments
Bluffton Dollar General	9/28/2016	Conceptual	Deferred
Ernest Mine Drive	9/28/2016	Conceptual	Deferred
Bluffton Dollar General	9/28/2016	Discussion	Deferred
Cat Island Lot 3A and 5A Waiver	9/21/2016	Waiver	Withdrawn
Spring Island Lot 14	9/21/2016	Waiver	Approved w conditions
Taylor Quality Landscaping	9/21/2016	Conceptual	Removed from agenda
Sommerset Pt. Lot 7	9/20/2016	Waiver	Removed from agenda
Fripp Island Lot 6 Blue Gill	9/14/2016	Waiver	Approved with conditions.
Fripp Island Lot 1B	9/14/2016	Waiver	Deffered w/condtions.
Harbor Island Lot 165	9/14/2016	Waiver	Approved
Oyster Bluff Phase II	9/14/2016	Conceptual	Defferred
St. James Pritchardville	9/14/2016	Conceptual	Defferred
8 Duck Pen Court	9/7/2016	Bulkhead	Approved

2. Inspection summary since last Board meeting (Danny Polk, Superintendent)
   Number of active permits = 25
   Number of inspections performed =47
   Number of drainage related complaints investigated =4

3. BMP Manual - BMP manual was approved last month and the Stormwater Ordinance is in the process of the third reading on October 24, 2016.

4. Public Education - There was a strategic planning meeting held on September 29th from 9:00 to 12:00 at the Port Royal Sound Maritime Center. Ellen Comeau, the new Water Quality Agent for Clemson Extension in Beaufort County, will be working on summarizing the results of the meetings and presenting the strategic plan at a future Board meeting.

5. Annual reporting and the SWMP – Rebecca Baker is working on revisions to our Management Plan as part of the submittal for the annual report to DHEC. The reporting period ends on December 1, 2016 and the report is due in April.

6. Maintenance Project Report – Dave Wilhelm

MEMORANDUM

Date: October 12, 2016

To: Stormwater Management Utility Board

From: David Wilhelm, P. E., Public Works Director

Re: **Maintenance Project Report**

This report will cover one major and fourteen minor or routine projects. The Project Summary Reports are attached. (**Stormwater Summary Map by District**)

Major Projects – Storm Drainage System Improvements:

- **Pinewood Circle Subdivision – Port Royal Island – Stormwater Utility District (SWUD) 6:** This project consisted of improving 3,909 feet of roadside drainage ditches and jet cleaning 50 driveway pipes. The disturbed area was hydroseeded for erosion control. Work began August 4th and was completed August 29th. The total cost of the project was **$14,131.96.**

Minor or Routine Projects:

- **Salem Drive East – Port Royal Island (SWUD 6):** Work for this project consisted of installing an inlet drain connecting to an existing drainage pipe and also dewatering approximately 1,000 feet of existing channel. The total cost of the project was **$7,168.92.**
- **Lady's Island Vacuum Truck (SWUD 7):** This six month effort of vacuum cleaning work included cleaning out various drainage structures at multiple locations. The total cost of this effort was **$7,100.64.**
- **Fire Station Lane – Sheldon (SWUD 5):** This project consisted of replacing the driveway pipe at the Sheldon Fire Station. The total project cost was **$4,047.56.**
- **St. Helena Island Vacuum Truck (SWUD 8):** This vacuum cleaning work included cleaning out several drainage structures at multiple locations on St. Helena Island. The total cost of this project was **$3,541.59.**
- **Pin Oak Street – Town of Bluffton (SWUD 4):** This project consisted of jet cleaning 220 feet of roadside pipe and two catch basins. The total cost was **$3,377.55.**
- **Alljoy Area / Bluffton Township (SWUD 9):** Work consisted of cleaning out 623 feet of roadside ditch. The total cost was **$3,021.40.**
- **Port Royal Island Vacuum Truck (SWUD 6):** This vacuum cleaning work included cleaning out nine catch basins, five crossline pipes, and four driveway pipes. The total cost of this project was **$2,828.12.**
- **Bluebell Lane – Town of Hilton Head Island (SWUD 3):** Our crew installed one driveway pipe for a new residential home. The total cost was **$1,807.12.**

- **Rice Road – Port Royal Island (SWUD 6):** This project improved 305 feet of existing drainage swales. The total cost for this effort was **$1,796.79.**
- **Port Royal Island Tree Removal (SWUD 6):** Our crew removed fallen trees from the roadside ditch and workshelf. The total cost was **$1,589.06.**
- **Branford Circle – Sheldon (SWUD 5):** This project consisted of repairing a failed crossline pipe. The total cost of the work was **$1,512.41**.
- **Lonesome Court and Taylor Street – Port Royal Island (SWUD 6):** This project consisted of repairing washouts to two roadside ditches. The total cost was **$1,443.02**.
- **Sheldon Valley Drains (SWUD 5):** This project consisted of cleaning 9,336 feet of paved valley drains in the Sheldon area. The total cost was **$1,303.77.**
- **Floyd Road – Sheldon (SWUD 5):** This project consisted of one separated section of drainage pipe. The total cost was **$864.92.**

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Pinewood Circle Subdivision

Activity: Routine/Preventive Maintenance

Narrative Description of Project:

Duration: 8/4/16 - 8/29/16

Project improved 3,909 L.F. of drainage system. Cleaned out 3,909 L.F. of roadside ditch. Jetted (50) driveway pipes.
Hydroseeded for erosion control.

2017-513 / Pinewood Circle Subdivision	**Labor Hours**	**Labor Cost**	**Equipment Cost**	**Material Cost**	**Contractor Cost**	**Indirect Labor**	**Total Cost**
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
DPJT / Driveway Pipe - Jetted	46.0	$1,057.68	$199.64	$144.68	$0.00	$684.24	$2,086.24
HAUL / Hauling	49.0	$1,091.23	$461.58	$105.12	$0.00	$706.58	$2,364.51
RSDCL / Roadside Ditch - Cleanout	225.0	$4,979.90	$909.67	$596.22	$0.00	$3,158.10	$9,643.89
UTLOC / Utility locates	0.5	$12.35	$0.00	$0.00	$0.00	$6.62	$18.97
2017-513 / Pinewood Circle Subdivision Sub Total	**321.0**	**$7,152.91**	**$1,570.89**	**$846.02**	**$0.00**	**$4,562.15**	**$14,131.96**
Grand Total	**321.0**	**$7,152.91**	**$1,570.89**	**$846.02**	**$0.00**	**$4,562.15**	**$14,131.96**

Before

During

After

Project: Pinewood Circle

Activity: Routine/ Preventive Maintenance

Project #: 2017-513

Township/SW Dist: Port Royal Island/6

Completed: August 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 100 200 400 600 800 Feet

1 inch = 420 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Pinewood Circle_2017-513

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Salem Drive East

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Dewatered channel. Installed inlet drain.

Duration: 11/3/15 - 3/30/16

2016-554 / Salem Drive East	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
DC / Dewatered Channel	85.0	$1,905.89	$123.90	$40.75	$0.00	$1,215.55	$3,286.09
HAUL / Hauling	13.0	$294.67	$71.00	$29.93	$0.00	$189.55	$585.15
INLET DI / Inlet Drain Installed	20.0	$439.50	$48.11	$4.26	$0.00	$280.80	$772.67
NONPRO / Non-Professional Services	0.0	$0.00	$0.00	$0.00	$222.00	$0.00	$222.00
ONJV / Onsite Job Visit	27.0	$935.37	$95.98	$34.08	$0.00	$627.02	$1,692.45
PI / Project Inspection	3.0	$136.80	$10.86	$4.26	$0.00	$101.88	$253.80
PP / Project Preparation	1.0	$45.60	$3.62	$1.42	$0.00	$33.96	$84.60
SVCREQ / Service Request	3.0	$136.80	$10.86	$4.26	$0.00	$101.88	$253.80
2016-554 / Salem Drive East Sub Total	**152.5**	**$3,906.38**	**$364.33**	**$118.96**	**$222.00**	**$2,557.25**	**$7,168.92**
Grand Total	**152.5**	**$3,906.38**	**$364.33**	**$118.96**	**$222.00**	**$2,557.25**	**$7,168.92**

Before

During

After

Project: Salem Drive East

Activity: Routine/ Preventive Maintenance

Project #: 2016-554

Township/SW Dist: Port Royal Island/6

Completed: March 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 50 100 200 300 400 Feet

1 inch = 210 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Salem Drive East_2016-554

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Ladys Island Vacuum Truck - Judge Island Drive, Professional Villiage Circle, Reeds Road, Trotters Loop, Johnson Landing Road, Blythewood Road, Bent Oak Road, Wiggins Road, Faculty Drive, and Needlerush Court

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Project improved 8 L.F. of drainage system. Cleaned out (11) catch basins. Jetted (1) access pipe, (13) crossline pipes, (22) driveway pipes and 8 L.F. of channel pipe.

Duration: 11/24/15 - 5/25/16

2016-307A / Ladys Island Vacuum Truck	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	1.0	$23.49	$0.00	$0.00	$0.00	$13.23	$36.72
CBCO / Catch basin - clean out	70.0	$1,627.26	$318.88	$230.58	$0.00	$1,065.15	$3,241.87
CLPJT / Crossline Pipe - Jetted	18.0	$411.84	$78.12	$44.70	$0.00	$267.30	$801.96
DPJT / Driveway Pipe - Jetted	46.0	$1,103.48	$303.80	$170.98	$0.00	$729.12	$2,307.37
PRRECON / Project Reconnaissance	4.0	$91.52	$17.36	$6.60	$0.00	$59.40	$174.88
SD / Soft Digging	12.0	$274.56	$52.08	$33.00	$0.00	$178.20	$537.84
2016-307A / Ladys Island Vacuum Truck Sub Total	**151.0**	**$3,532.15**	**$770.24**	**$485.86**	**$0.00**	**$2,312.40**	**$7,100.64**
Grand Total	**151.0**	**$3,532.15**	**$770.24**	**$485.86**	**$0.00**	**$2,312.40**	**$7,100.64**

Before

After

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Fire Station Lane

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Replaced (1) driveway pipe.

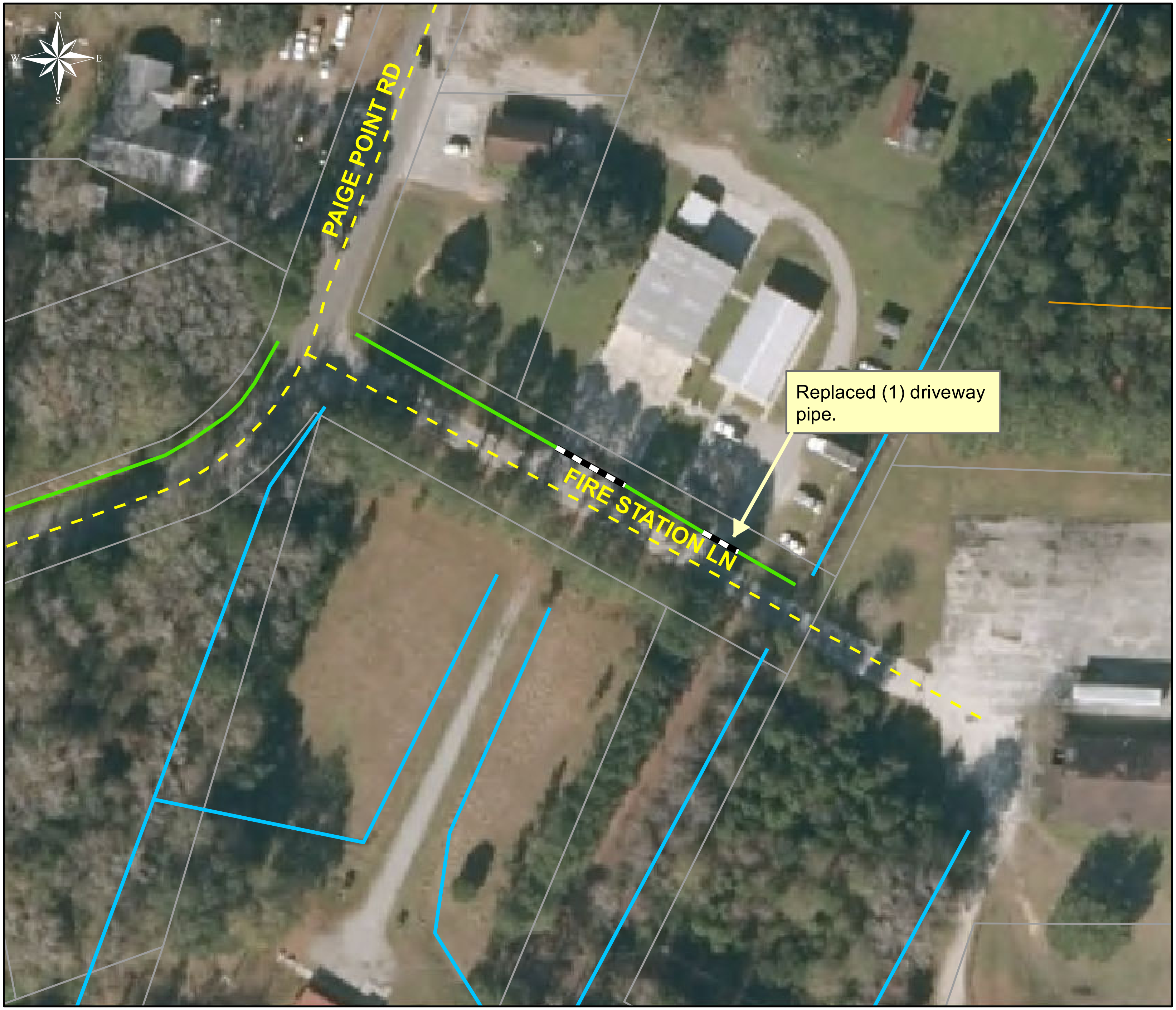
Duration: 8/4/16 - 8/9/16

2017-508 / Fire Station Lane	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
DPRPL / Driveway Pipe - Replaced	24.0	$556.00	$147.66	$186.84	$0.00	$353.28	$1,243.78
DWASPH / Driveway - Asphalt	20.0	$483.10	$64.78	$35.28	$0.00	$292.90	$876.06
HAUL / Hauling	19.0	$433.00	$171.83	$1,030.55	$0.00	$273.98	$1,909.36
2017-508 / Fire Station Lane Sub Total	**63.5**	**$1,483.85**	**$384.27**	**$1,252.67**	**$0.00**	**$926.77**	**$4,047.56**
Grand Total	**63.5**	**$1,483.85**	**$384.27**	**$1,252.67**	**$0.00**	**$926.77**	**$4,047.56**

Before

During

After



Project: Fire Station Lane

Activity: Routine/ Preventive Maintenance

Project #: 2017-508

Township/SW Dist: Sheldon/5

Completed: August 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Fire Station Lane_2017-508

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: St Helena Island Vacuum Truck - Shiney Road, Ragweed Circle, Simmons Road and Mosse Road

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Jetted (2) driveway pipes and (3) crossline pipes.

Duration: 1/19/16 - 6/8/16

2016-309A / St Helena Island Vacuum Truck	**Labor Hours**	**Labor Cost**	**Equipment Cost**	**Material Cost**	**Contractor Cost**	**Indirect Labor**	**Total Cost**
AUDIT / Audit Project	1.0	$23.49	$0.00	$0.00	$0.00	$13.23	$36.72
CLPJT / Crossline Pipe - Jetted	30.0	$698.60	$130.20	$63.57	$0.00	$457.40	$1,349.77
DPJT / Driveway Pipe - Jetted	34.0	$781.58	$147.56	$53.62	$0.00	$508.47	$1,491.23
ONJV / Onsite Job Visit	7.0	$262.10	$24.90	$18.40	$0.00	$190.27	$495.67
SVCREQ / Service Request	2.0	$91.20	$7.24	$1.84	$0.00	$67.92	$168.20
2016-309A / St Helena Island Vacuum Truck 2 Sub Total	**74.0**	**$1,856.97**	**$309.90**	**$137.43**	**$0.00**	**$1,237.29**	**$3,541.59**
Grand Total	**74.0**	**$1,856.97**	**$309.90**	**$137.43**	**$0.00**	**$1,237.29**	**$3,541.59**

Before

During

After

Project: St. Helena Island Vacuum Truck- Shiney Road Map #1

Activity: Routine/ Preventive Maintenance

Project #: 2016-309A

Township/SW Dist: St. Helena Island/8

Completed: June 2016

Legend

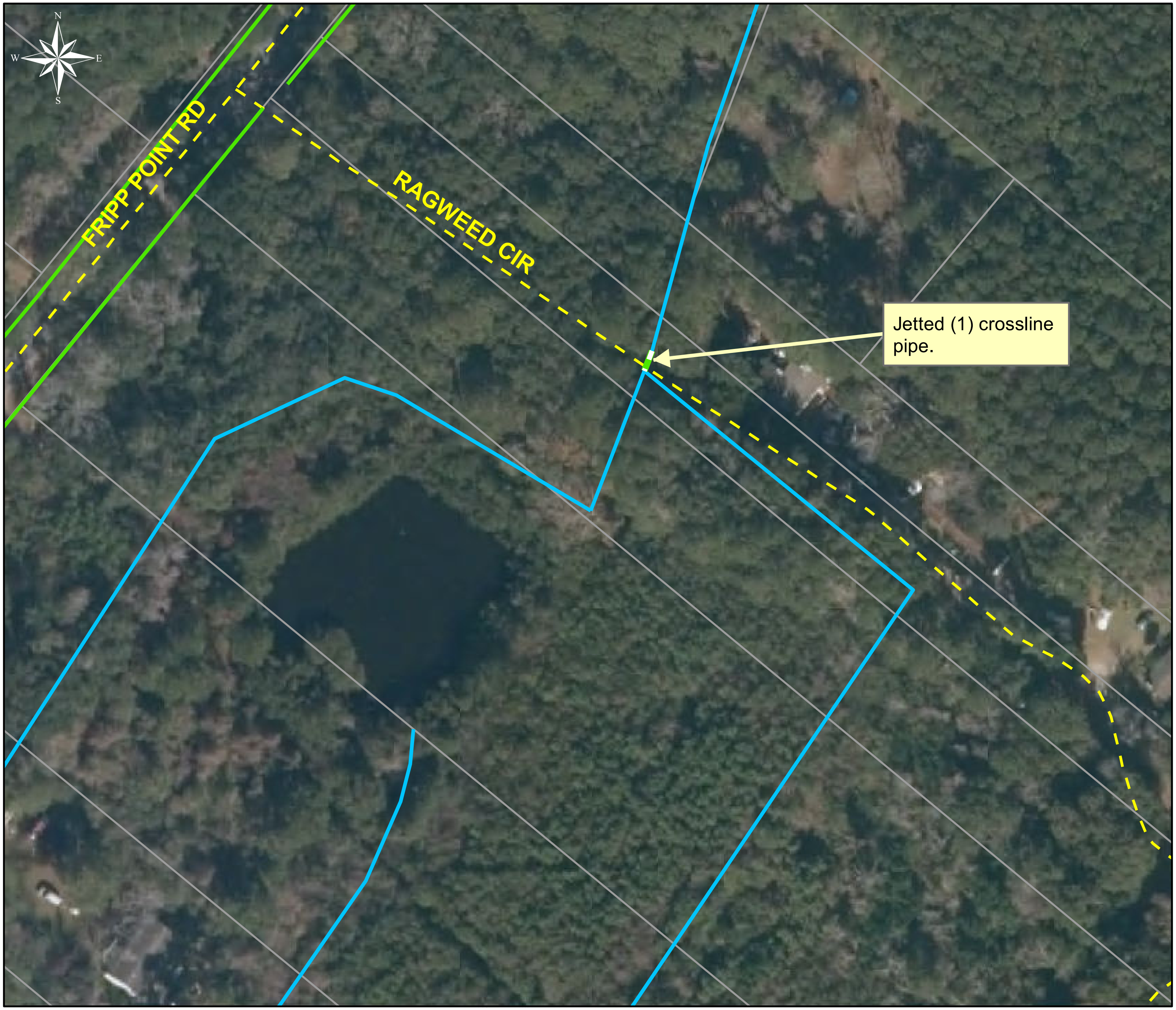
Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 100 200 400 600 800 Feet

1 inch = 420 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/27/2016
File:C:\project summaries map/St.Helena Island Vac Truck- Shiney Road Map1_2016-309A



Project: St. Helena Island Vacuum Truck- Ragweed Circle
Map #2

Activity: Routine/ Preventive Maintenance

Project #: 2016-309A

Township/SW Dist: St.Helena Island/8

Completed: June 2016

Legend

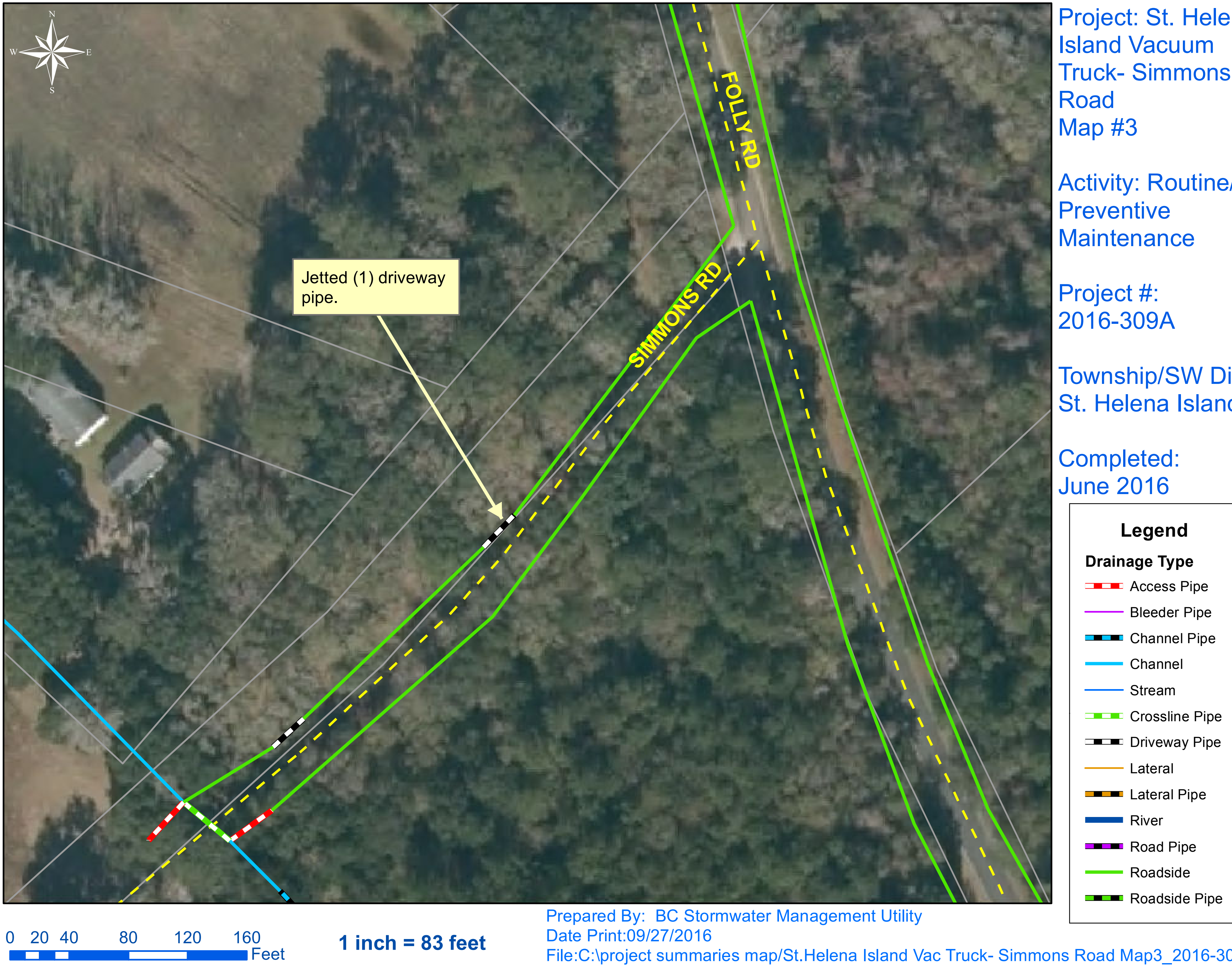
Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 25 50 100 150 200 Feet

1 inch = 100 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/27/16
File:C:\project summaries map/St. Heena Island Vacuum Truck-Ragweed Circle Map#2_2016-309A



Project: St. Helena Island Vacuum Truck- Simmons Road
Map #3

Activity: Routine/ Preventive Maintenance

Project #: 2016-309A

Township/SW Dist: St. Helena Island/8

Completed: June 2016

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/27/2016
File:C:\project summaries map/St.Helena Island Vac Truck- Simmons Road Map3_2016-309A

Project: St. Helena Island Vacuum Truck- Mosse Road
Map #4

Activity: Routine/ Preventive Maintenance

Project #: 2016-309A

Township/SW Dist: St.Helena Island/8

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 15 30 60 90 120 Feet

1 inch = 67 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/27/16
File:C:\project summaries map/St. Heena Island Vacuum Truck-Mosse Road Map#4_2016-309A

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Pin Oak Street

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Cleaned out (2) catch basins. Jetted 220 L.F. of roadside pipe.

Duration: 3/28/16 - 3/29/16

2016-609 / Pin Oak Street	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
CBCO / Catch basin - clean out	20.0	$457.60	$86.80	$40.67	$0.00	$297.00	$882.07
DEBREM / Debris Removal - Jobsite	30.0	$680.39	$0.00	$0.00	$0.00	$398.60	$1,078.99
ONJV / Onsite Job Visit	2.0	$91.20	$7.24	$4.26	$0.00	$67.92	$170.62
PCAM / Pole Camera System	10.0	$228.80	$82.60	$10.57	$0.00	$148.50	$470.47
TC / Traffic Control - Jobsite	20.0	$445.49	$17.70	$28.40	$0.00	$265.45	$757.04
2016-609 / Pin Oak Street Sub Total	**82.5**	**$1,915.23**	**$194.34**	**$83.90**	**$0.00**	**$1,184.08**	**$3,377.55**
Grand Total	**82.5**	**$1,915.23**	**$194.34**	**$83.90**	**$0.00**	**$1,184.08**	**$3,377.55**

Before

During

Project: Pin Oak Street

Activity: Routine/ Preventive Maintenance

Project #: 2016-609

Township/SW Dist: Town of Bluffton/4

Completed: March 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 15 30 60 90 120 Feet

1 inch = 67 feet

Prepared By: BC Stormwater Management Utility
Date Print:9/6/2016
File:C:\project summaries map/Pin Oak Street_2016-609

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Alljoy Area

Activity: Routine/Preventive Maintenance

Narrative Description of Project:

Duration: 6/13/16 - 7/7/16

Project improved 623 L.F. of drainage system. Cleaned out 623 L.F. of roadside ditch.

2015-553A / Alljoy Area	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
HAUL / Hauling	10.0	$222.80	$79.90	$68.40	$0.00	$144.20	$515.30
PP / Project Preparation	12.0	$277.14	$21.24	$20.79	$0.00	$184.32	$503.49
PRRECON / Project Reconnaissance	12.0	$272.43	$10.62	$9.00	$0.00	$169.11	$461.16
RSDCL / Roadside Ditch - Cleanout	27.0	$612.36	$527.80	$24.19	$0.00	$358.74	$1,523.09
2015-553A / Alljoy Area Sub Total	**61.5**	**$1,396.48**	**$639.56**	**$122.38**	**$0.00**	**$862.99**	**$3,021.40**
Grand Total	**61.5**	**$1,396.48**	**$639.56**	**$122.38**	**$0.00**	**$862.99**	**$3,021.40**

Before

During

After

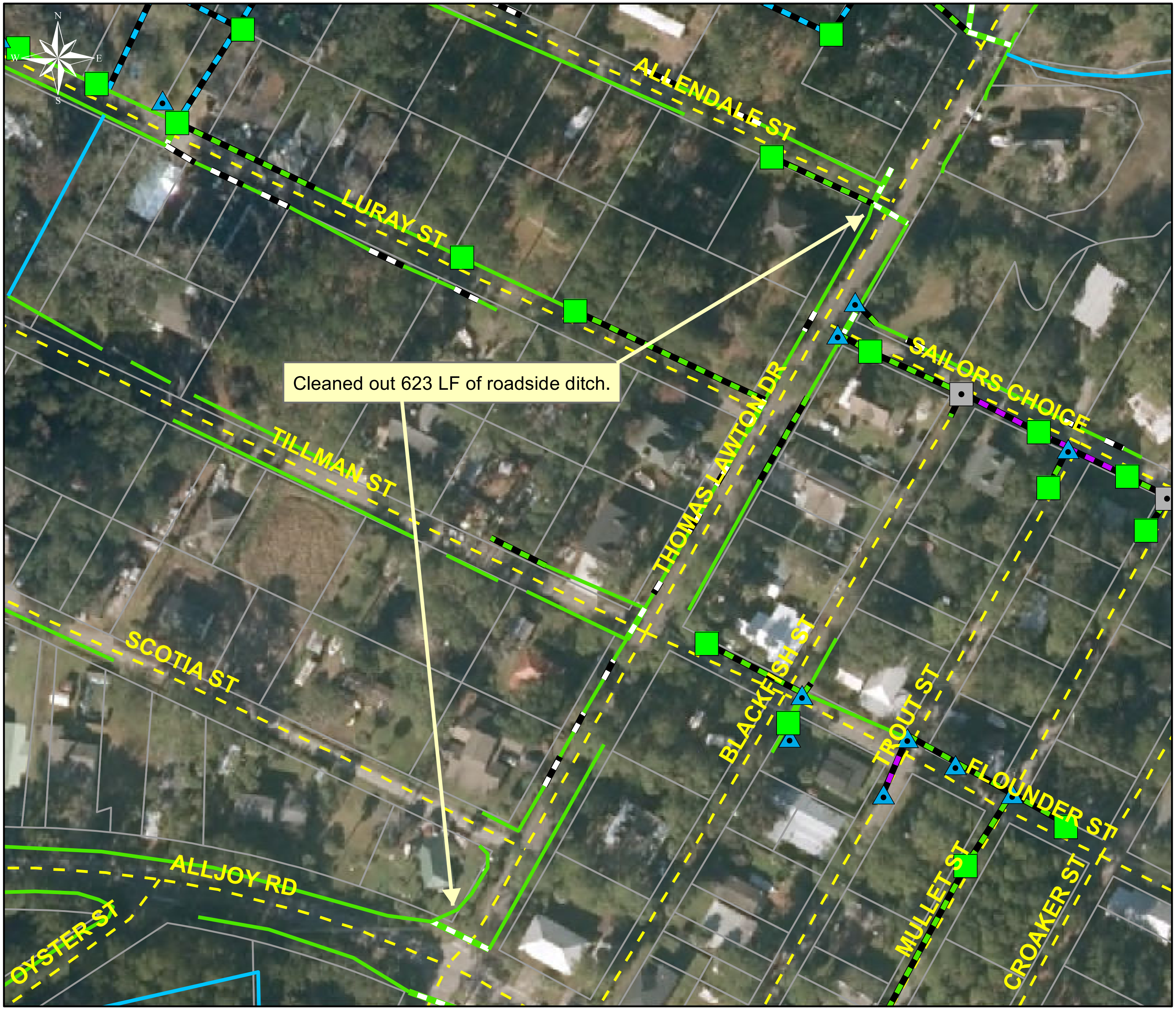
Project: Alljoy Area

Activity: Routine/ Preventive Maintenance

Project #: 2015-553A

Township/SW Dist: Bluffton/9

Completed: July 2016



Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 30 60 120 180 240 Feet

1 inch = 130 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Alljoy Area_2015-553A

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Port Royal Island Vacuum Truck - Shell Point Recreation Park, Campbell Road, Grays Hill Road, Moultrie Circle, Wintergreen Drive, Paukie Island Road and Tabby Road

Activity: Routine/Preventive Maintenance

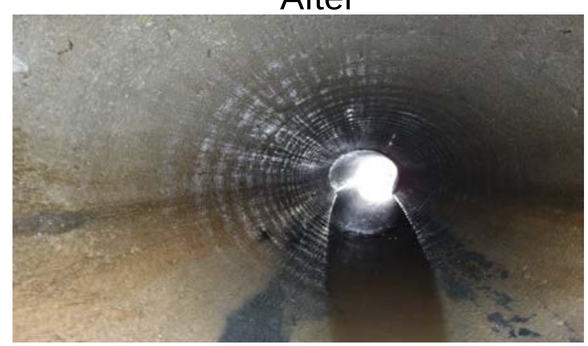
Narrative Description of Project:
Cleaned out (9) catch basins. Jetted (5) crossline pipes and (4) driveway pipes.

Duration: 1/9/16 - 5/16/16

2016-306A / PRI Vacuum Truck	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
CBCO / Catch basin - clean out	20.0	$457.60	$633.64	$35.15	$0.00	$297.00	$1,423.39
DPJT / Driveway Pipe - Jetted	16.0	$369.72	$78.12	$40.72	$0.00	$240.84	$729.40
PRRECON / Project Reconnaissance	2.0	$45.76	$8.68	$9.90	$0.00	$29.70	$94.04
SD / Soft Digging	12.0	$279.44	$52.08	$48.45	$0.00	$182.96	$562.93
2016-306A / PRI Vacuum Truck Sub Total	**50.5**	**$1,164.27**	**$772.52**	**$134.22**	**$0.00**	**$757.12**	**$2,828.12**
Grand Total	**50.5**	**$1,164.27**	**$772.52**	**$134.22**	**$0.00**	**$757.12**	**$2,828.12**

Before

After



Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Bluebell Lane

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Installed (1) driveway pipe.

Duration: 7/25/16 - 7/26/16

2017-506 / Bluebell Lane	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
DPINS / Driveway Pipe - Installed	20.0	$440.75	$67.83	$260.60	$0.00	$281.85	$1,051.03
HAUL / Hauling	7.0	$155.89	$65.94	$63.71	$0.00	$100.94	$386.48
STAGING / Staging Materials/Equipment	9.0	$190.32	$30.43	$10.80	$0.00	$119.70	$351.25
2017-506 / Bluebell Lane Sub Total	**36.5**	**$798.71**	**$164.20**	**$335.11**	**$0.00**	**$509.10**	**$1,807.12**
Grand Total	**36.5**	**$798.71**	**$164.20**	**$335.11**	**$0.00**	**$509.10**	**$1,807.12**

Before

During

After

Project: Bluebell Lane

Activity: Routine/ Preventive Maintenance

Project #: 2017-506

Township/SW Dist: Town of HHI/3

Completed: July 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 30 60 120 180 240 Feet

1 inch = 130 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Bluebell Lane_2017-506

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Rice Road

Activity: Routine/Preventive Maintenance

Narrative Description of Project:

Duration: 8/24/16

Project improved 305 L.F. of drainage system. Reconstructed 305 L.F. of swale.

2017-514 / Rice Road	**Labor Hours**	**Labor Cost**	**Equipment Cost**	**Material Cost**	**Contractor Cost**	**Indirect Labor**	**Total Cost**
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
HAUL / Hauling	10.0	$222.70	$94.20	$23.40	$0.00	$144.20	$484.50
SREC / Swale - Reconstructed	28.0	$615.23	$274.72	$18.00	$0.00	$385.98	$1,293.93
2017-514 / Rice Road Sub Total	**38.5**	**$849.68**	**$368.92**	**$41.40**	**$0.00**	**$536.80**	**$1,796.79**
Grand Total	**38.5**	**$849.68**	**$368.92**	**$41.40**	**$0.00**	**$536.80**	**$1,796.79**

(Pictures Not Available)

Project: Rice Road

Activity: Routine/ Preventive Maintenance

Project #: 2017-514

Township/SW Dist: Port Royal Island/6

Completed: August 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 40 80 160 240 320 Feet

1 inch = 170 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Rice Road_2017-514

Beafort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Port Royal Island Tree Removal - Chisholm Hill Road and Donaldson Drive

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Removed fallen trees from workshelf and roadside ditch.

Duration: 4/12/16 - 6/15/16

2016-506 / Port Royal Island Tree Removal	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
HAUL / Hauling	8.0	$178.16	$63.92	$54.05	$0.00	$115.36	$411.49
RMTR / Remove trees-roads	4.0	$94.84	$43.64	$7.21	$0.00	$58.58	$204.27
RMTRW / Remove trees - Workshelf	25.0	$535.85	$48.11	$39.38	$0.00	$331.60	$954.94
2016-506 / Port Royal Island Tree Removal Sub Total	**37.5**	**$820.60**	**$155.67**	**$100.64**	**$0.00**	**$512.15**	**$1,589.06**
Grand Total	**37.5**	**$820.60**	**$155.67**	**$100.64**	**$0.00**	**$512.15**	**$1,589.06**

Before

During

After

Project: Port Royal Island Tree Removal-Chisholm Hill Road
Map #1

Activity: Routine/ Preventive Maintenance

Project #: 2016-506

Township/SW Dist: Port Royal Island/6

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 50 100 200 300 400 Feet

1 inch = 210 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/PRI Tree Removal-Chisholm Hill Road Map1_2016-506

Project: Port Royal Island Tree Removal-Donaldson Drive Map #2

Activity: Routine/ Preventive Maintenance

Project #: 2016-506

Township/SW Dist: Port Royal Island/6

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 15 30 60 90 120 Feet

1 inch = 67 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/PRI Tree Removal-Donaldson Drive Map 2_2016-506

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Branford Circle

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Repaired crossline pipe.

Duration: 8/1/16

2017-511 / Branford Circle	**Labor Hours**	**Labor Cost**	**Equipment Cost**	**Material Cost**	**Contractor Cost**	**Indirect Labor**	**Total Cost**
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
CLPJT / Crossline Pipe - Jetted	6.0	$148.20	$52.08	$74.00	$0.00	$98.82	$373.10
CPREP / Crossline Pipe - Repaired	18.0	$417.00	$71.14	$37.01	$0.00	$264.96	$790.11
HAUL / Hauling	6.0	$148.20	$56.52	$39.60	$0.00	$86.52	$330.84
2017-511 / Branford Circle Sub Total	**30.5**	**$725.15**	**$179.74**	**$150.61**	**$0.00**	**$456.91**	**$1,512.41**
Grand Total	**30.5**	**$725.15**	**$179.74**	**$150.61**	**$0.00**	**$456.91**	**$1,512.41**

Before

During

After

Project: Branford Circle

Activity: Routine/ Preventive Maintenance

Project #: 2017-511

Township/SW Dist: Sheldon/5

Completed: August 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 30 60 120 180 240 Feet

1 inch = 130 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Branford Circle_2017-511

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Port Royal Island Washout Repairs - Lonesome Court and Taylor Street

Activity: Routine/Preventive Maintenance

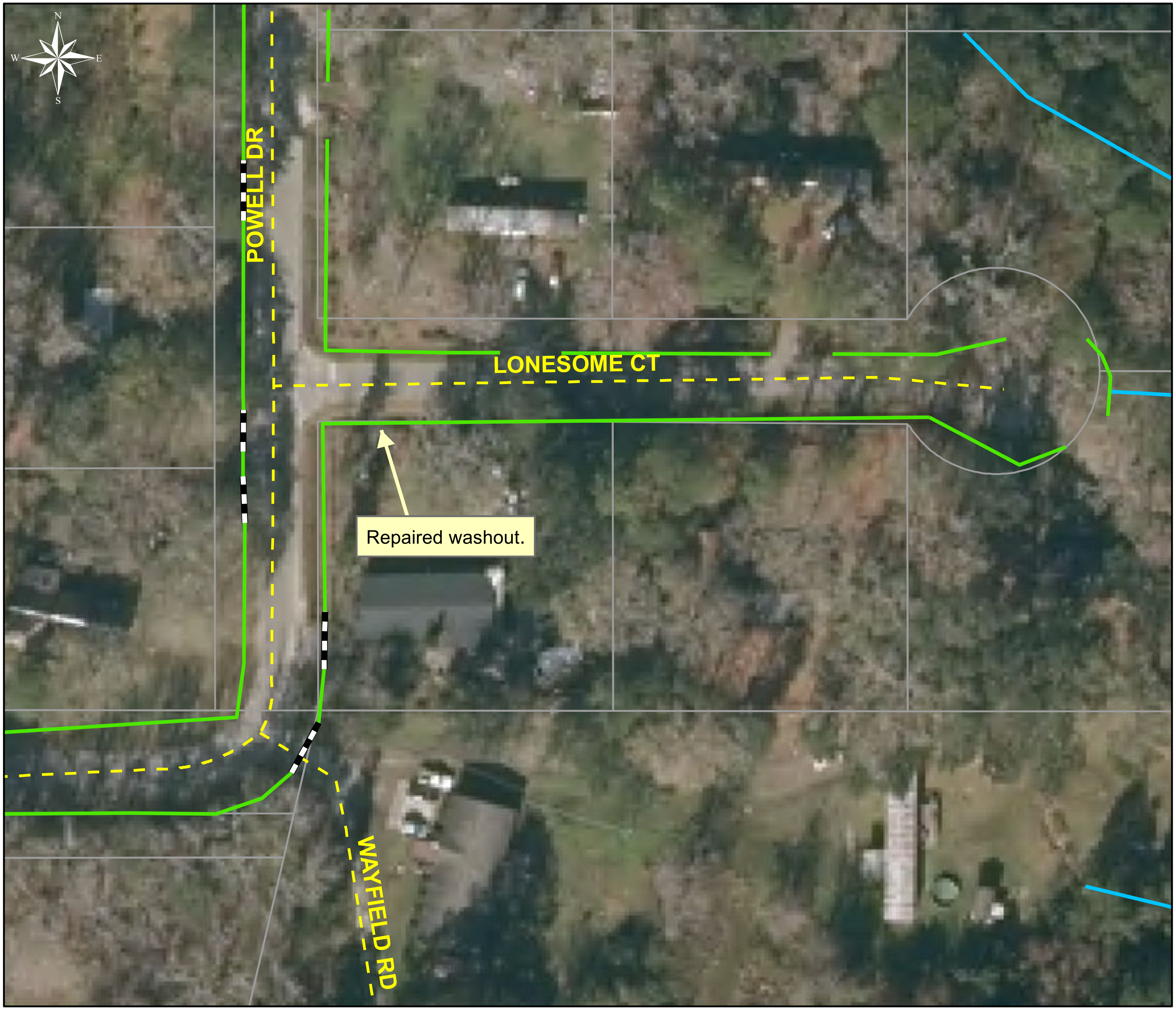
Narrative Description of Project:
Repaired washouts.

Duration: 7/20/16 - 9/22/16

2016-503 / Port Royal Island Washout Repairs	**Labor Hours**	**Labor Cost**	**Equipment Cost**	**Material Cost**	**Contractor Cost**	**Indirect Labor**	**Total Cost**
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
HAUL / Hauling	5.0	$111.35	$39.95	$2.66	$0.00	$72.10	$226.06
ONJV / Onsite Job Visit	4.0	$126.43	$10.62	$0.00	$0.00	$79.16	$216.21
RPWO / Repaired Washout	24.0	$537.82	$37.87	$71.73	$0.00	$334.98	$982.39
2016-503 / Port Royal Island Washout Repairs Sub Total	**33.5**	**$787.34**	**$88.44**	**$74.39**	**$0.00**	**$492.85**	**$1,443.02**
Grand Total	**33.5**	**$787.34**	**$88.44**	**$74.39**	**$0.00**	**$492.85**	**$1,443.02**

Before

After



Project: Port Royal Island Washout Repairs- Lonesome Court Map #1

Activity: Routine/ Preventive Maintenance

Project #: 2016-503

Township/SW Dist: Port Royal Island/6

Completed: September 2016

Legend

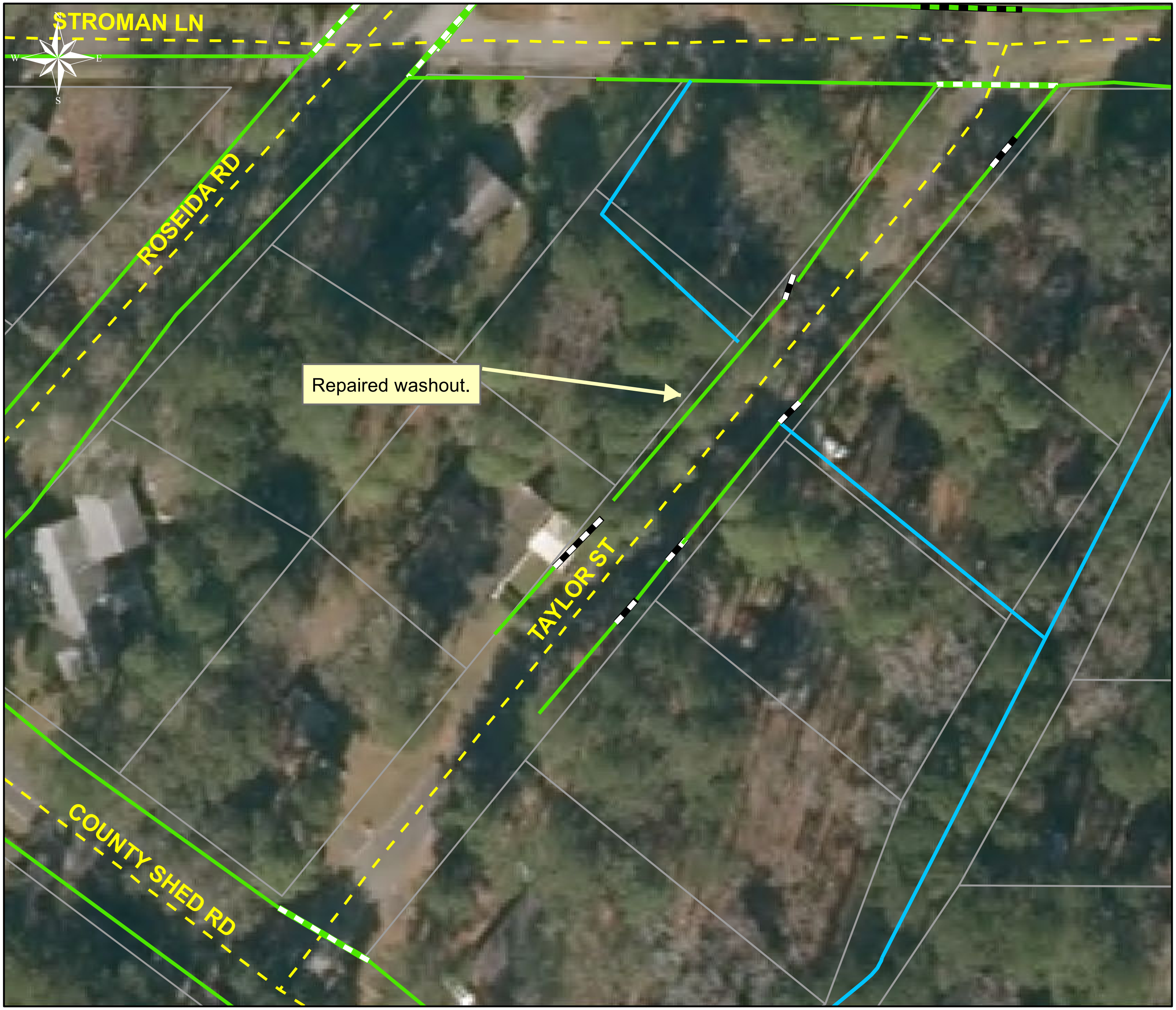
Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 15 30 60 90 120 Feet

1 inch = 67 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Port Royal Island Washout Repairs- Lonesome Court Map#1 2016-503



Project: Port Royal Island Washout Repairs- Taylor Street Map #2

Activity: Routine/ Preventive Maintenance

Project #: 2016-503

Township/SW Dist: Port Royal Island/6

Completed: September 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 15 30 60 90 120 Feet

1 inch = 67 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Port Royal Island Washout Repair-Taylor Street Map#2_2016-503

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Sheldon Valley Drains

Activity: Routine/Preventive Maintenance

Narrative Description of Project:

Duration: 1/19/16 - 1/27/16

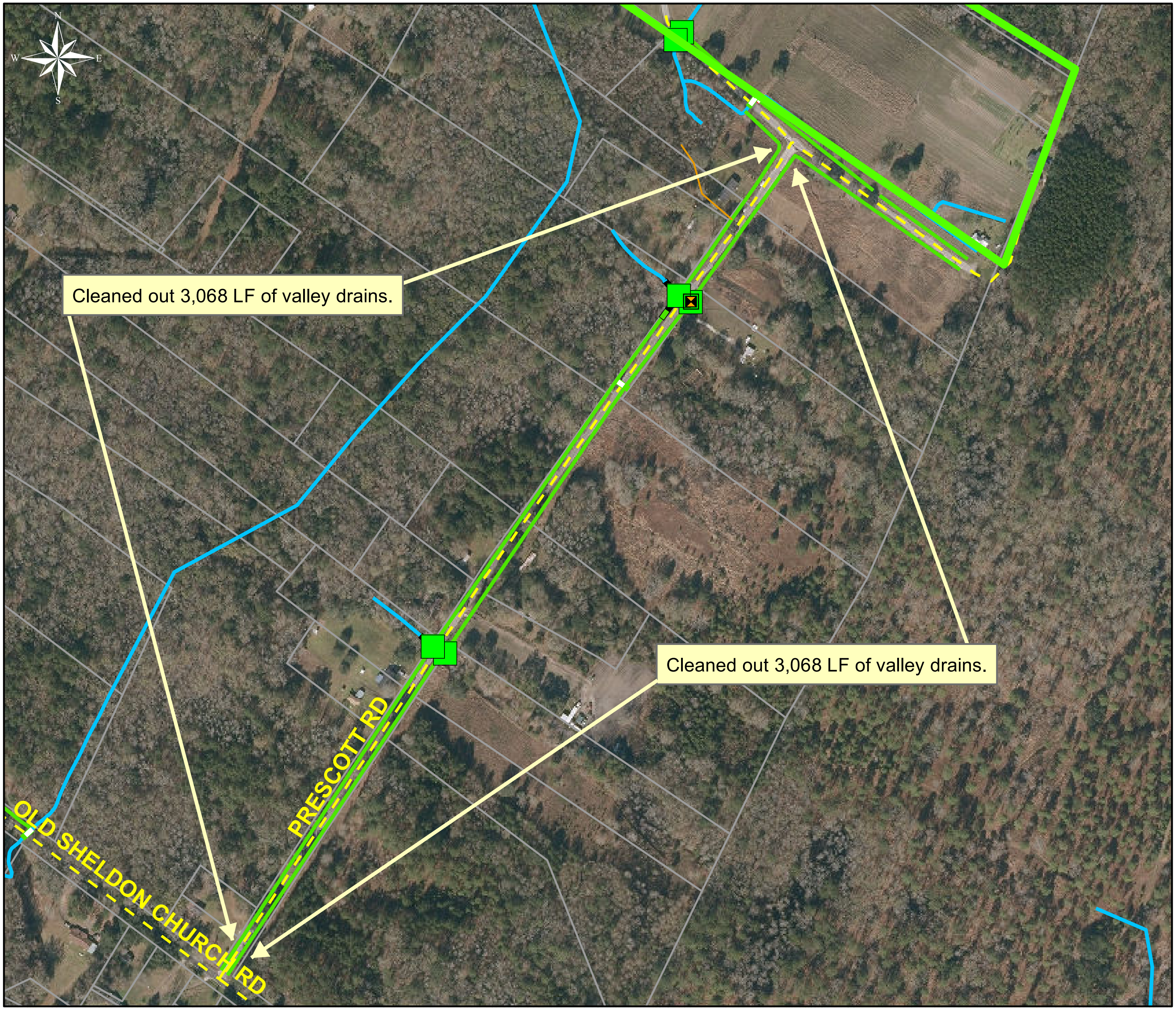
Project improved 9,336 L.F. of drainage system. Cleaned out 9,336 L.F. of valley drains. This project consisted of the following areas: Prescott Road (6,136 L.F.) and Solomon White Lane (3,200 L.F.)

2016-314 / Sheldon Valley Drains	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
COVD / Cleaned Out Valley Drains	20.0	$409.20	$181.64	$21.16	$0.00	$254.40	$866.40
HAUL / Hauling	3.0	$66.81	$23.97	$21.45	$0.00	$43.26	$155.49
LM / Loading Materials	4.0	$81.84	$49.48	$16.09	$0.00	$50.88	$198.29
ONJV / Onsite Job Visit	1.0	$34.18	$3.54	$3.04	$0.00	$24.47	$65.23
2016-314 / Sheldon Valley Drains Sub Total	**28.5**	**$603.78**	**$258.63**	**$61.74**	**$0.00**	**$379.62**	**$1,303.77**
Grand Total	**28.5**	**$603.78**	**$258.63**	**$61.74**	**$0.00**	**$379.62**	**$1,303.77**

Before

During

After



Project: Sheldon Valley Drains Map1

Activity: Routine/ Preventive Maintenance

Project #: 2016-314

Township/SW Dist: Sheldon/5

Completed: January 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 100 200 400 600 800 Feet

1 inch = 420 feet

Prepared By: BC Stormwater Management Utility
Date Print:9/6/2016
File:C:\project summaries map/Sheldon Valley Drains_2016-314

Project: Sheldon Valley Drains Map 2

Activity: Routine/ Preventive Maintenance

Project #: 2016-314

Township/SW Dist: Sheldon/5

Completed: January 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 60 120 240 360 480 Feet

1 inch = 250 feet

Prepared By: BC Stormwater Management Utility
Date Print:9/6/2016
File:C:\project summaries map/Sheldon Valley Drains Map 2_2016-314

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Floyd Road

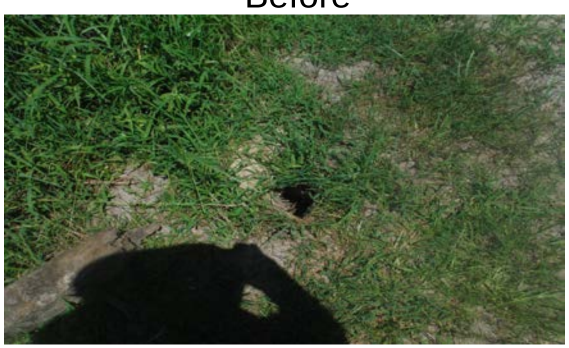
Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Replaced (1) separated joint.

Duration: 8/2/16

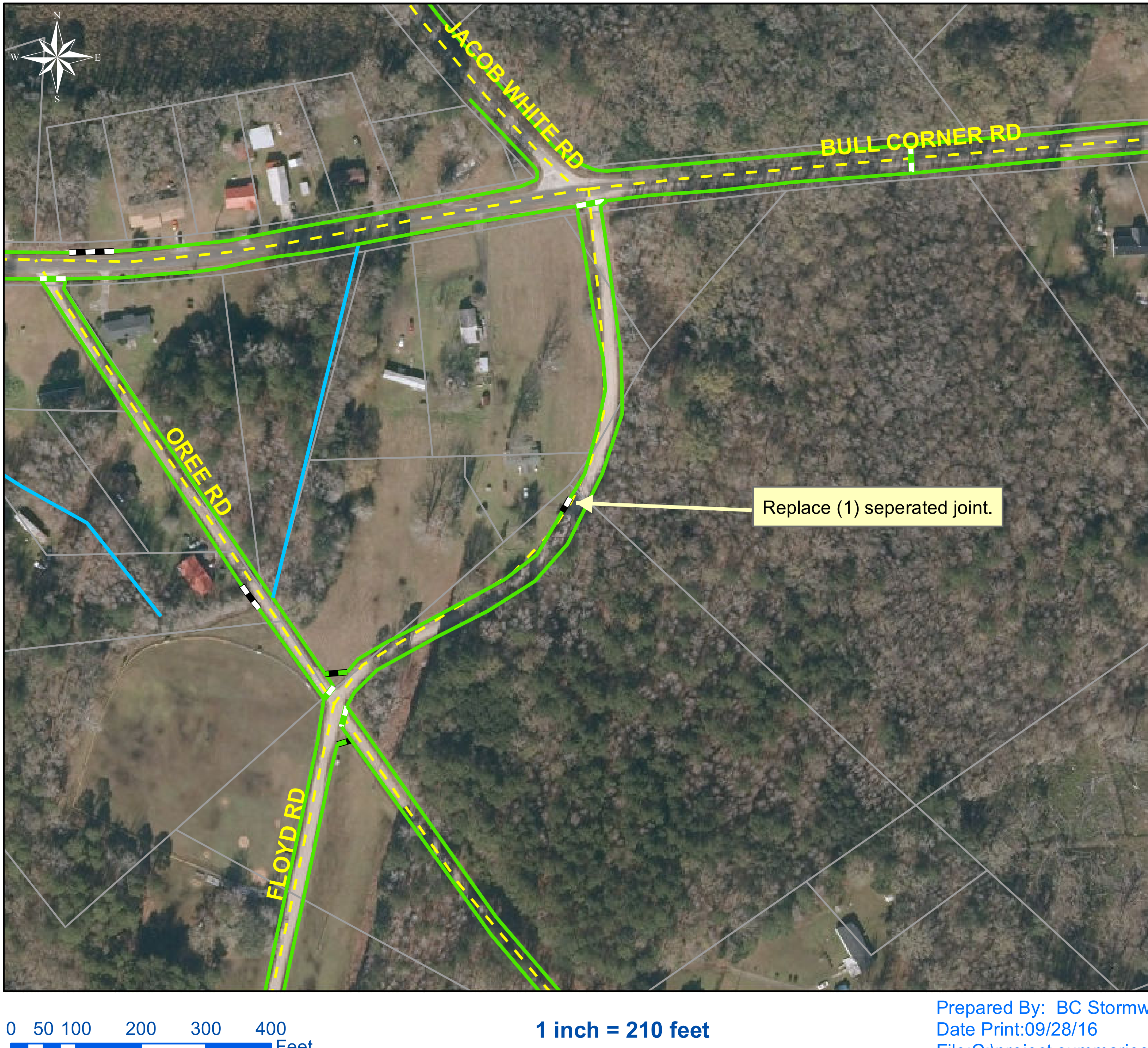
2017-510 / Floyd Road	**Labor Hours**	**Labor Cost**	**Equipment Cost**	**Material Cost**	**Contractor Cost**	**Indirect Labor**	**Total Cost**
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
DPRPL / Driveway Pipe - Replaced	12.0	$278.00	$63.23	$98.72	$0.00	$176.64	$616.59
HAUL / Hauling	4.0	$98.80	$37.68	$35.81	$0.00	$57.68	$229.97
2017-510 / Floyd Road Sub Total	**16.5**	**$388.55**	**$100.91**	**$134.53**	**$0.00**	**$240.94**	**$864.92**
Grand Total	**16.5**	**$388.55**	**$100.91**	**$134.53**	**$0.00**	**$240.94**	**$864.92**

Before



During

After



Project: Floyd Road

Activity: Routine/ Preventive Maintenance

Project #: 2017-510

Township/SW Dist: Sheldon/5

Completed: August 2016

1 inch = 210 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/28/16
File:C:\project summaries map/Floyd Road_2017-510

BEAUFORT COUNTY
STORMWATER UTILITY
120 Shanklin Road
Beaufort, South Carolina 29906
Voice (843) 255-2801 Facsimile (843) 255-9478

November 9, 2016

Stormwater Manager's Report for the Stormwater Utility Board Meeting

Utility Update

1. Tax Run for Tax Year 2016 (TY16) – Billing was delayed due to Hurricane Matthew. The current schedule is unknown.
2. Intergovernmental Agreements (IGAs) and Memorandums of Agreements (MOAs) for Fiscal Year 2017 (FY17) – The City of Beaufort agreements are still pending. Final drafts ready for signature have been sent to the City staff.
3. Fee inquiries – We have a complex SWU fee inquiry from the SC Port Authority related to the Port Royal Port. Hurricane response and recovery has delayed staff review.
4. Eric Larson, along with staff from our consultant Raftelis, spoke at the Annual Fall Conference of SESWA in Birmingham, AL about our recent Utility Rate Study. The session received the highest ratings of all the sessions by the attendees. The audience seemed very interested in the topic and had numerous questions that led to an impromptu breakout session in the hallway.
5. Hurricane Matthew Response and Recovery – During a declared emergency such as this, most of the Public Works, Grounds, Facilities, and Stormwater Department staff are reassigned to the Disaster Recovery Team. Recovery starts with deploying crews and equipment at various shelters in place locations so that we can respond and begin removing debris from the roads even before the contractors arrive on site. Our crews worked continuously for over a week without a break or even the ability to go home and check their own property and belongings. We are very proud of our performance during those first critical days. Gary Kubic also came out to the shop and visited the crews to express his appreciation.
6. Stormwater staff attended the bi-annual Charleston Pond Conference on November 3, conducted by the Ashley Cooper Consortium through Carolina Clear.

Monitoring Update

1. Lab Update (From Dr. Alan Warren and Lab Manager Danielle Mickel)
   a) Since the last USCB WQL update, the WQL has been working towards the additional certifications for the laboratory pure water requirements. These additional certifications include HPC (Heterotrophic

Plate Count), SpC (Specific Conductance), and TRC (Total Residual Chlorine) for drinking water. SCDHEC was scheduled to visit the lab for an on-site evaluation on October 17, but due to Hurricane Matthew this on-site evaluation was rescheduled to November 15, 2016.

b) An investigation of a suspected illicit discharge on Coosaw Island requested by Beaufort County Stormwater Department was performed by the WQL. This entailed Dr. Alan Warren meeting with Rebecca Baker to discuss specific details of an investigation prior to the WQL going into the field to investigate and collect/analyze suspected water samples.

c) Dr. Alan Warren has also provided to Rebecca Baker statistical and graphical analysis of BC weekly fecal data and wet weather BECY fecal data from a period 1/15 to present for fecal weekly and 10/15 to present for wet weather BECY fecal data.

d) USCB WQL has also collected and analyzed samples for the Town of Port Royal cypress wetland area on two occasions in September, one wet and one dry event.

2. Monitoring Plan Development – The County staff has discontinued participation in a monitoring sub-committee and is working to develop our monitoring plan with input from the USCB WQL. We are working with ToB to create a MOA that will formalize data sharing and sampling duties in the May, New, and Okatie watersheds.

Stormwater Implementation Committee (SWIC) Report

1. The SWIC committee met November 2, 2016. See attached meeting minutes. The main topic of discussion was the Management Plan update. See report under Professional Contracts. The SWIC also discussed the purpose, goal, and frequency of future meetings. An update on Public Education was presented by Ellen Comeau with Carolina Clear. Ellen provided a copy of the new Lowcountry Stormwater Partners email newsletter that contains a status report of current efforts. See attached.

Stormwater Related Projects

1. US 278 Retrofit Ponds ($356,000 Budget) – The 4th and final pond began clearing. Work has been delayed due to Hurricane Recovery.
2. Okatie West / SC 170 Widening Retrofit (Design and Construction = $915,000 Budget) – The geotechnical report is complete. Design is ongoing. Staff is considering the use of the excavated material at the Animal Services facility project on SC 170, that has a need for foundation fill dirt.
3. SC 170 Widening Pond #8 project (Design and Construction = $630,840) – Nothing new to report.
4. Easements – Staff is working on numerous easement requests. Significant locations are Salem Dr. East, Young Circle, Gadwell Dr. East and several on St. Helena Island. The County attorney has sent a notice of condemnation to one property owner on Salem Dr. East. A condemnation on Gadwell Dr. East is needed and the Engineering

department is pursuing this with the County Attorney's office.
5. Complaints and Hurricane Recovery – The storm created approx. 27 individual complaints within the first week after the storm. More complaints are continuing to be received daily. See the MS4 report below. Staff has begun inspecting our system looking for downed trees, clogged ditches and pipes, etc. for needed debris removal and damage. Staff is also pursuing grant funding options to help with the cost in addition to our plans to submit to FEMA for public assistance.

Professional Contracts Report

1. Stormwater Management Plan (Master Plan) Update – ($475,000 Budget; $239,542 County portion) – During the November SWIC meeting, ATM presented the results of the land use analysis and selection of the 7 priority watersheds for analysis. The group accepted the recommendations. See the attached presentation.
2. Mint Farm Basin B Modification – ($8,000 Budget) – Nothing new to report. Project is ready for construction. Materials on order. Work has been delayed due to Hurricane Recovery.
3. SC 170 Widening Drainage – ($17,500 Budget with 50% of funding from the Stormwater Department. Change order for additional $4,500 approved in October) – The 3rd party review report is complete and submitted to the County on November 1. Review and action on the report has been delayed due to Hurricane Recovery.

Regional Coordination

1. Factory Creek Watershed Regional Detention Basin "Phase I" & Academy Park Subdivision (cost is pending) – Nothing new to report.
2. Factory Creek Watershed Regional Detention Basin "Phase II" (Design Cost = $63,390, Tree Mitigation Cost is pending, Construction Cost by the Developer) – Nothing new to report. Excavation continues as material is sold by the Developer.
3. Horne Development at Okatie Center in Jasper County ($1,500) – ATM has been given a Task Order to review Jasper County and City of Hardeeville stormwater standards and compare to our own. Work has begun. Results are pending.
4. Hilton Head National Redevelopment – The applicant has asked for a postponement until the December 2016 Planning Commission meeting.
5. FEMA CRS five year update – Staff has been assisting to prepare the five year review application for the Community Rating System. We have responded to review comments from FEMA.
6. County Dirt Road Paving Contract #50 – Dave Wilhelm and Eric Larson have been participating in the design team for a grouping of County Roads scheduled to be paved. Our involvement is a new effort to provide input into the design to make a better constructed road and minimize any post construction issues. Of note is the need to understand the drainage of the road – where does it go? Is the outfall in good condition? Do we have easements for the drainage offsite? Engineering and Stormwater will work together to define the drainage and easement needs and acquire

easements and/or make ditch repairs during design and construction.

7. Central Drive causeway failure – A significant event from the Hurricane was the wash out of the pipe under Central Drive at the causeway to Red Bluff in northern Lady's Island. High tide and high velocity flow washed out the bedding around the pipe causing a road collapse and water line break. Stormwater crews responded and worked overnight and all weekend long to temporarily repair the causeway by removing the pipe and damming the marsh. Engineering has entered into an emergency repair design build contract with Andrews Engineering, J.H. Heirs, and O-Quinn Marine to repair the pipe and road.

Municipal Reports

1. Town of Hilton Head Island (From Bates Rambow, SW Data Analyst)
   i. No information was available at the time of this report.

2. Town of Bluffton (From Kim Jones, Watershed Management Division Director)
   i. No information was available at the time of this report.

3. City of Beaufort (From Neil Desai, Asst. Public Works Director)
   i. Battery Creek Pond Funded by an EPA 319 Grant ($132,609 Budget – County Portion) – Work continues. The City requested a time extension, which was granted by DHEC, due to the loss of time due to Hurricane Matthew.
   ii. No further information was available at the time of this report.

4. Town of Port Royal (From Van Willis, Town Manager)
   i. No information was available at the time of this report.

MS4 report

1. Plan review summary – 13 Plans Reviewed.

Name	Date	Type	Results
Palmetto Medical Group	10/26/2016	Final	Deferred
USCB 2016 Student Housing 63 Bed	10/26/2016	Conceptual	Deferred
Ernest Mine Drive	10/20/2016	Final	Approved with conditions.
Daufuskie Island	10/12/2016	Final	Approved
USCB Campus Center	10/26/2016	Final	Deferred
Lipmans Produce	10/26/2016	Conceptual	Deferred
Southern Fence	10/12/2016	Conceptual	Approved

1. Inspection summary for October 12, 2016 to November 1, 2016
   Number of active permits = 26
   Number of inspections performed = 25

Number of drainage related complaints investigated = 24

2. BMP Manual - The Stormwater Ordinance received a favorable third and final reading on October 24, 2016. The new ordinance is now in effect.

3. Public Education - There was a strategic planning meeting held on September 29th from 9:00 to 12:00 at the Port Royal Sound Maritime Center. Ellen Comeau, the new Water Quality Agent for Clemson Extension in Beaufort County, will be working on summarizing the results of the meetings and presenting the strategic plan at a future Board meeting. See attached email report.

4. Annual reporting and the SWMP – Rebecca Baker is working on revisions to our Management Plan as part of the submittal for the annual report to DHEC. The reporting period ends on December 1, 2016 and the report is due in April.

Larson, Eric

From: Larson, Eric
Sent: Thursday, November 3, 2016 11:10 AM
To: 'Rambow Bates'; jeff Buckalew; Kim Jones (kjones@townofbluffton.com); Baugher, William; Neil Desai; (LTaylor@cityofbeaufort.org); Van Willis (vwillis@portroyal.org); Anthony C. Maglione (TMaglione@appliedtm.com); 'Polk, Daniel (dpolk@bcgov.net)'; Baker, Rebecca (rbaker@bcgov.net); Wallace, Carolyn; Mina, Joseph; Ellen Virginia Comeau (ecomeau@clemson.edu)
Subject: corrected SWIC Mtg. 11/2/16 minutes

DRAFT Minutes
SWIC
November 2, 2016, 1:30 pm at BJWSA Community Room, Okatie, SC

Attendees:	Eric Larson, Bill Baugher, Bates Rambow, Van Willis, Ellen Comeau, & Joe Mina. Absent: Neil Desai

1. 1:30 pm meeting - call to order
2. Public Education - Ellen Comeau
   a. Email Newsletter - Quarterly or Monthly. Consensus was quarterly.
   b. BMP training for contractors - Ellen explained purpose of the program. Pilot class in Columbia at Sandhill. There is a grant program were landowners can apply for funds to get BMPs installed using the certified contractors in this program. She is looking to get the program into this area in the future.
   c. Strategic plan - draft being reviewed internally. Should be released to the SWIC 11/9/16. Finalized by December 1, 2016.
   d. Working on Lowcountry Stormwater Partners logo and website.
3. Master Plan - Land use evaluation and selection of priority watersheds. Joe Mina presented a second draft of the land use analysis. New 2016 land use data has been received and compared with the 2002 data used in the 2006 Management Plan. Joe noted need for additional data from each jurisdiction. He stated that the study will include a recommendation of water quality sampling locations and type of sampling needed at each location. Joe concluded with a summary of the remaining schedule.
   Larson asked that since the ToB has been doing quite a bit of analysis in the May River watershed, is it possible to do a eighth watershed without increasing the cost. The answer is no because the two work products are different and level of analysis is different.
   Larson asked if there will be preliminary capital projects by early spring in time for budgeting? He noted that ATM committed to the ToHHI elected officials to try to meet this deadline. The answer is yes but only draft form. Probably by January 2017. They will be compiling a list of projects from 2006 not done and update.
   Larson recommended the 7 watersheds as presented by ATM.
   Next Steps:
   Obtain 2002 GIS data
   Get BMP coverage information for HHI, BC, or CoB.
   Everyone send any data on outfalls to make sure they get studied.

Joe will email out PPT.

4. Monitoring - Data share with ToB written agreement. - Larson and Baugher agree to draft a MOA to share sampling locations and what is tested for, and allowing the USCB lab to share each others data.
5. MS4 year 1 implementation delay request - Bates sent copy of a letter to DHEC to extend a few sections of the permit due to the Hurricane. Focused on staff training. Asked for 90 days. DHEC says no extensions in permit but will consider reasonable requests and "work with us". After seeing the ToHHI request, ToB called for clarification and got a similar request. ToB and BC will not be asking for extension.
6. Utility Cloud software - Baugher described this cloud based asset management software. ToB bought the service. Uses smart phones. Collects data for sampling, has forms, etc. Also does asset management by pre-loading infrastructure and allowing for inspection and generate work orders. Set up for the ToB was about $8000 and a $5000 annual service fee. BC and ToHHI already have something. ToHHI had interviewed approx. 5 firms last year to find something.
7. NRCS / USDA assisting ToHHI - Emergency watershed protection program. Assistance in removing debris, repairing erosion, clogged road crossings, etc. from after the storm. They met with them last week and today. 75% grant. FEMA will not provide grant funding in PA if NRSC won't qualify the work. Contact is Stephen Henry, EWP coordinator for SC.
8. DHEC's Shakhlan Garane coming down to audit ToB EPSC program next Wednesday. ToB requested it. They did this in response to a complaint from D R Horton and claim that the Town not doing the program correctly.
9. SWIC - The future direction of the group - Eric Larson noted that, as he understood the purpose of the SWIC as defined in the IGA, is to serve as a body of staff to collaborate on stormwater related items. Most significantly, the utility billing and approval of the annual management budget. However, the IGA also gave the SWIC duties to find cost sharing partnerships on stormwater task, including a special emphasis on the MS4 permit program. While the SWIC has been able to achieve much success with the Public Education effort and cost sharing on the Management Plan update, Utility rate study, to a limited degree monitoring, and the occasional capital project, Larson feels as if the "vision and sprirt" of the IGA and SWIC is not being met. There are numerous examples of lost opportunities to partner on program development related to MS4. Subcommittee meetings set up to facilitate sharing of ideas and development of uniform standards, procedures, and policies have begun more of a presentation of the end product of individual efforts and an offer to share what was prepared independently. Additionally, attendance has been poor in recent months and the value of meeting together has been diminished.
   As a result, the County is recommending a suspension of regularly scheduled meetings. The 2017 schedule can remain intact if desired with meetings held only when needed to address milestones such as the annual budget, the Management Plan project, and/or public education. It may be possible to even do some of the meetings via conference call or email.
   Regardless of the decision made by the group today, the County staff will not be participating in any further sub-committees and plans on focusing on development of our program needs independently of input from the SWIC.
   Bill Baugher - Disagreed. Noted he has to do things a certain way to address their management's desire. He sees value in continuing to meet to share things that are happening, but not necessarily to develop common policy documents.
   Ellen suggested quarterly with focused topics each time.
   Bates agrees with Larson but thinks the SWIC is established by a reference in a 2008 Utility report and shouldn't be dissolved. Larson noted the SWIC formation is only by informal reference in Ordinance and the IGA but does not mandate frequency of meetings to the best of his knowledge.
   SWIC agreed to adopt the 2017 schedule. Further, all sub-committees are ended. The December meeting is canceled. January 2017 meeting will to be determined later. **A meeting in February is probably needed to review the annual Utility Management Fee Proposal for FY 18.**
10. Next Meeting? - Larson emailed the 2017 schedule and has reserved the BJWSA community room if needed.

11. Adjourn.

Larson, Eric

From: Lowcountry Stormwater Partners <ecomeau=clemson.edu@mail214.atl171.mcdlv.net> on behalf of Lowcountry Stormwater Partners <ecomeau@clemson.edu>
Sent: Friday, October 28, 2016 1:13 PM
To: Larson, Eric
Subject: Lowcountry Stormwater Partners Newsletter

View this email in your browser

HAPPY FALL!

With the weather starting to cool off, winter residents returning home, and the beginning of another tourist season, the lowcountry is bustling with activity! The Lowcountry Stormwater Partners are just as busy gearing up for the colder months and that means it's time for an update!

STRATEGIC EDUCATION PLAN UPDATE

As it stands now, Ellen will finish the rough draft on Friday, 10/28. She will then give it to Katie Buckley and Amy Scaroni for review on Monday, 10/31. After that, all three will meet to discuss and edit the plan. The first draft will then be circulated for feedback no later than Wednesday, 11/9. Once Ellen receives feedback, she will make the necessary changes and have it ready for submission BEFORE DHEC's deadline of 12/1.

LOGO COMING SOON!

Amy Manucy, of Amy Manucy Design Creative, is currently working on a Lowcountry Stormwater Partners logo! We expect to receive her rough designs within the next few weeks. Once received, it will be distributed to everyone and open for feedback. Ellen will gather the feedback into one document and send it to Amy who will create another draft. This process will repeat until the logo is finalized. Afterwards, Ellen will begin build the LSP

WHERE'S THE WEBSITE?

It's almost here! Clemson University is in the process of migrating its website and affiliated pages to a new format. This change is causing a delay in creating the Lowcountry Stormwater Partners' webpage. However, we should have the webpage up within 2-3 weeks!

EXTENSION AGENT UPDATE

Besides developing the education plan, Ellen has been doing:

Research

In order to write a comprehensive and effective education plan, she has read every lowcountry watershed plan, BMP design manual, SWMP, MS4 permit, and previous MS4 education report as well as the Blueprint for Clean Water. She has also read all of the Carolina Clear stormwater consortiums' strategic education plans and discussed them brand by creating a Lowcountry Stormwater Partners Facebook page and developing giveaways and merchandise.

with her fellow agents.

Partner Meetings

Over the past month Ellen met with many existing partners and several NEW organizations to discuss their needs and partnership opportunities. By having these meetings, she was able to brainstorm several unique programs and projects that will be included in the education plan! She will continue to attend similar meetings.

Programs

Ellen is auditing the Carolina Yards and Master Pond Manager courses to better understand the materials. She plan to promote and host these programs in Beaufort County as soon as possible. In fact, if all goes well, Beaufort County may be the host site for the Spring 2017 Master Pond Manager course!

MARK YOUR CALENDARS!

Pond Manager Conference (Nov. 3)

The 2016 Charleston Area Stormwater Pond Management Conference will provide a forum to give the latest information, resources, and tools on stormwater pond management for the Lowcountry community. 8:30am-4:00pm at Trident Technical College in Charleston. For more information, click here.

Port Royal Sound Foundation's Birthday Celebration (Nov. 12)
The Maritime Center is celebrating its second year with a day full of FREE fun activities and special guests. LCP and Clemson Extension will be there providing enviroscpae demonstrations, so come by and say hi! 10:00am-3:0pm at the Maritime Center in Okatie. For more information, click here.

Residential Stormwater BMPs: A Training for Contractors (Nov.15)
This workshop is intended for contractors and landscape professionals who want to learn how to install stormwater best management practices. This training will include a classroom portion followed by a hands-on installation. 9:00am-3:00pm at the Sandhill REC in Columbia. For more information, click here.

Clemson Extension Tree Giveaway (Dec. 4)
On Arbor Day, the Clemson Extension office will be handing out 500 native tree seedlings from 9:00am-2:00pm. More information will be forthcoming.

Questions, Comments, or Requests?
Contact your Water Resources Extension Agent:

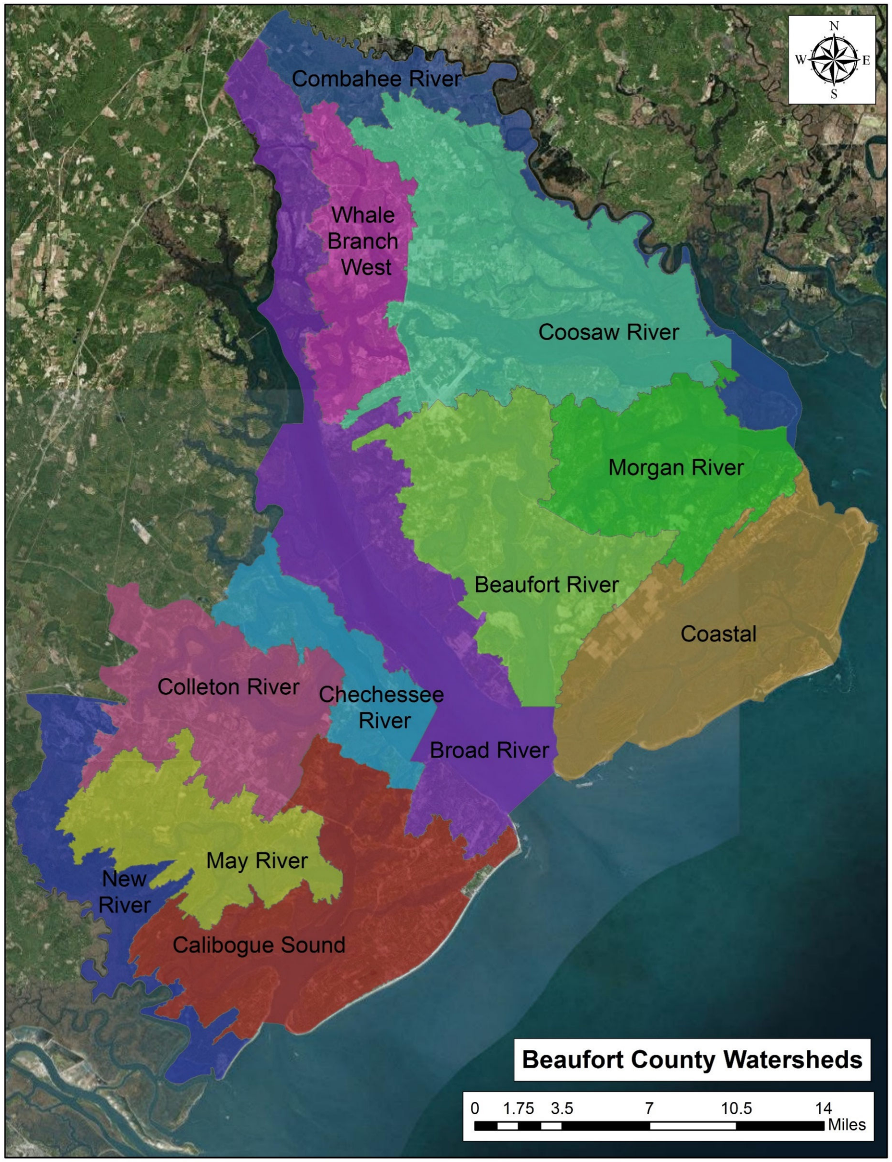
Ellen Comeau
ecomeau@clemson.edu
(843)-255-6060 ext 115
Lowcountry Stormwater Partners
102 Industrial Village Rd
Bldg 1
Beaufort, SC 29906

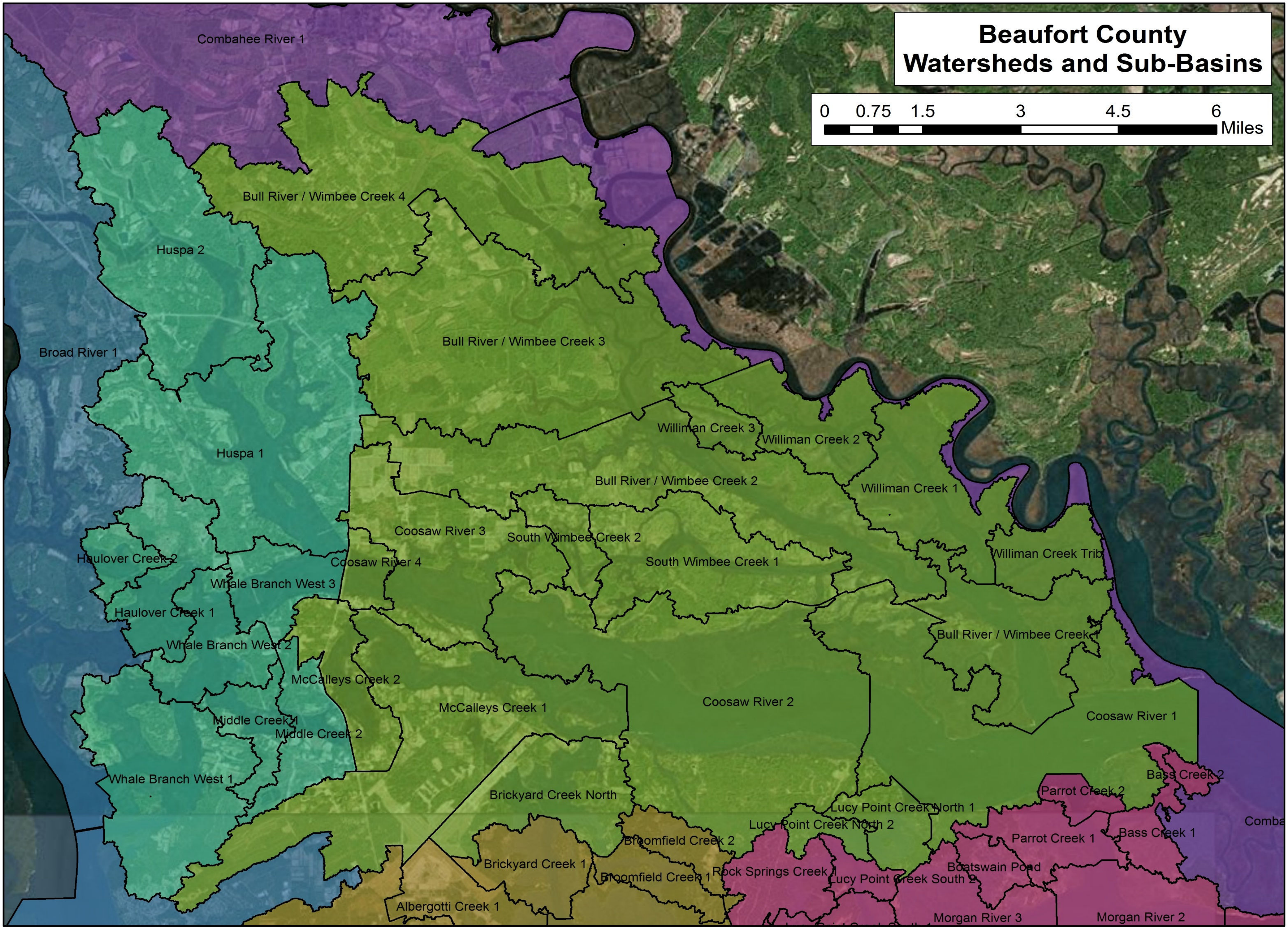
Add us to your address book

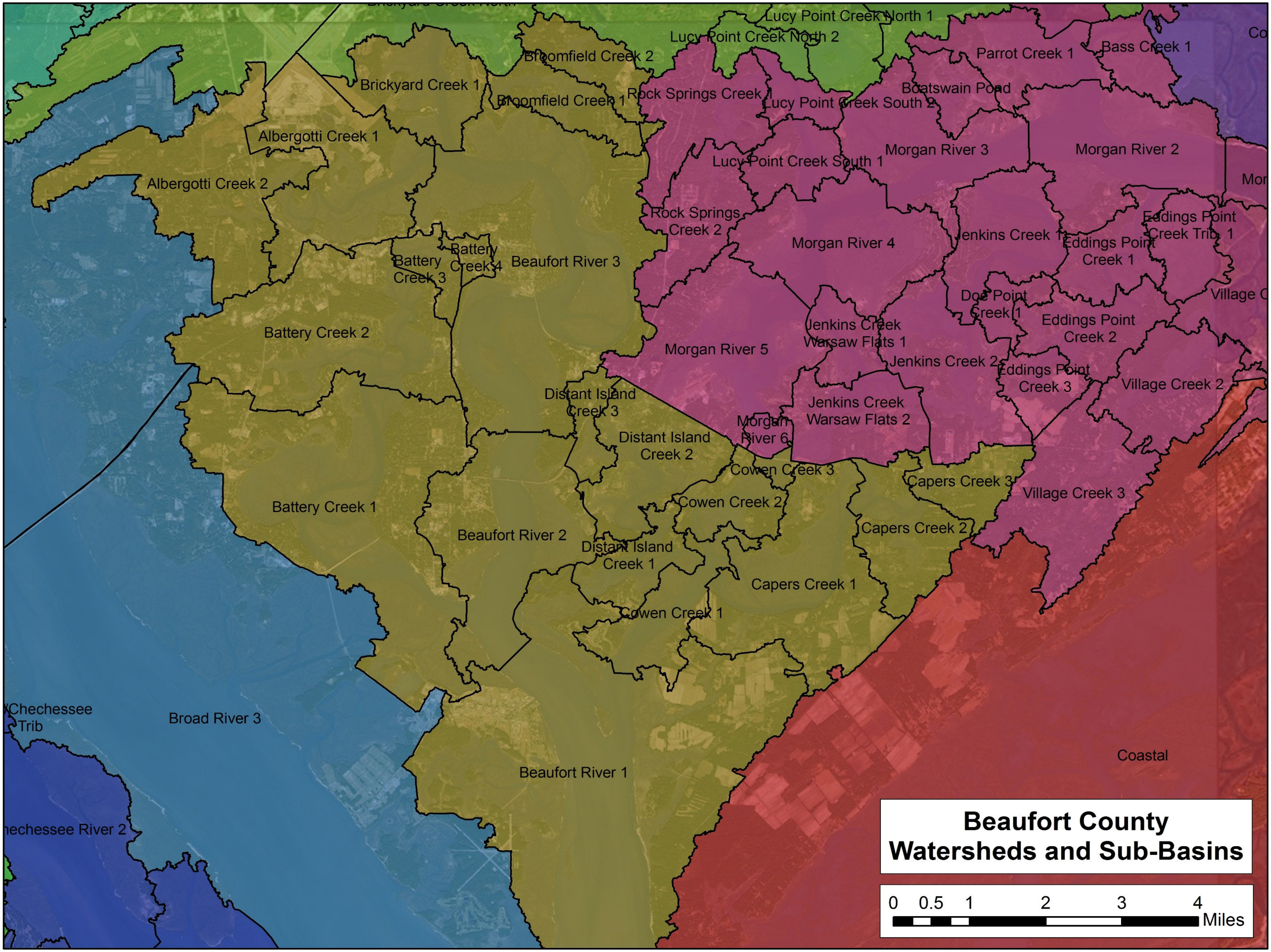
Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, gender, religion, national origin, disability, political beliefs, sexual orientation, marital or family status and is an equal opportunity employer.

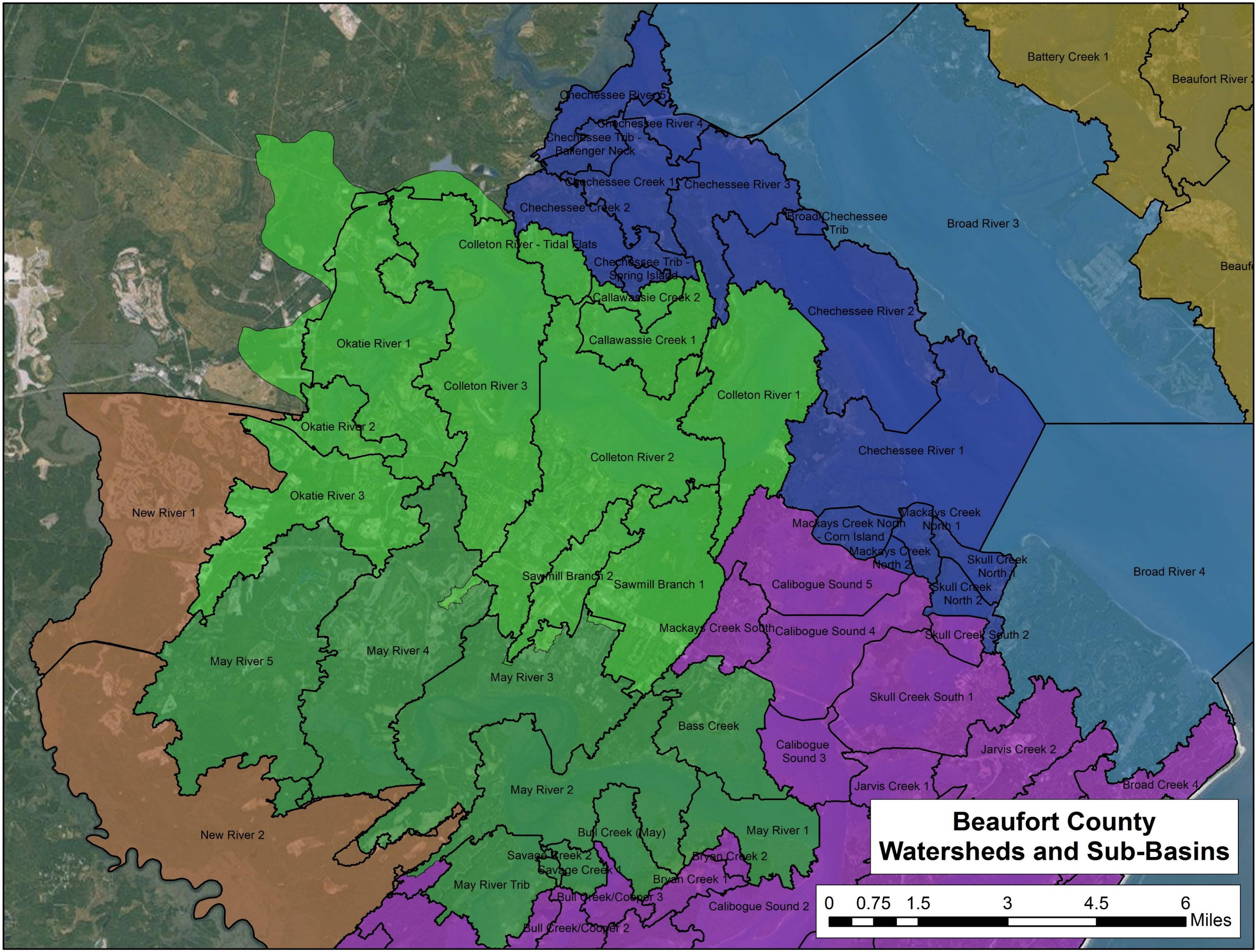
Based on Updated LULC from 2016 Aerials

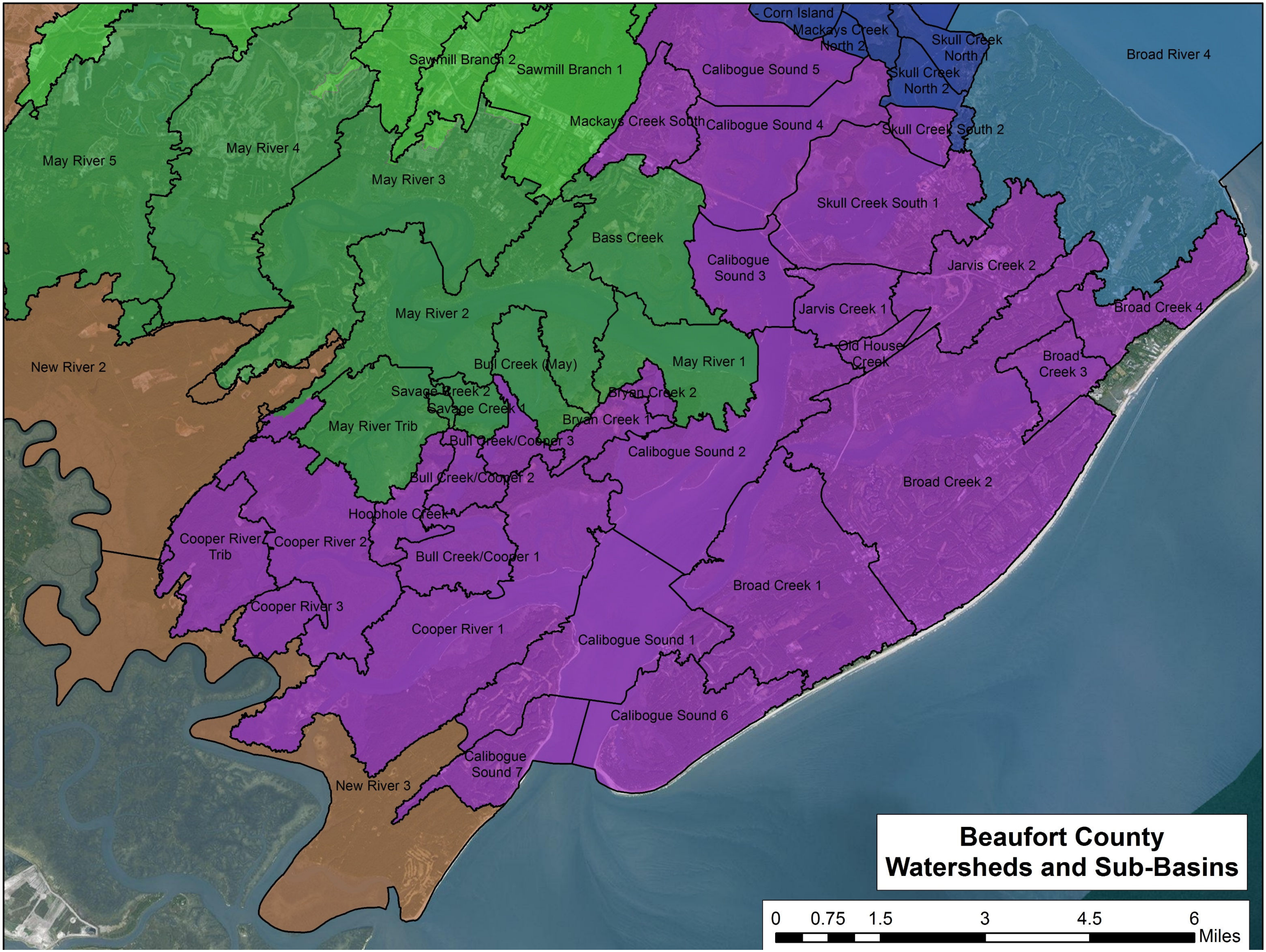
Comparison to 2002	% impervious 2016	Compiled WQ data for Fecal	Recommendation for modeling
1 May	1 Beaufort	1 May	1 May
2 New	2 Colleton	2 Beaufort	2 Beaufort
3 Colleton	3 Calibogue	3 Colleton	3 Colleton
4 Calibogue	4 May	4 Morgan	4 Morgan
5 Morgan	5 New	5 Calibogue	5 Calibogue
6 Beaufort	6 Broad	6 Coosaw	6 New
7 Coastal	7 Morgan	7 Broad	7 Coosaw
8 Broad	8 WBW	8 New	8 Broad
9 Chechessee	9 Coosaw	9 WBW	9 Coastal
10 WBW	10 Chechessee	10 Chechessee	10 WBW
11 Coosaw	11 Coastal	11 Costal	11 Chechessee
12 Combahee	12 Combahee	12	12 Combahee

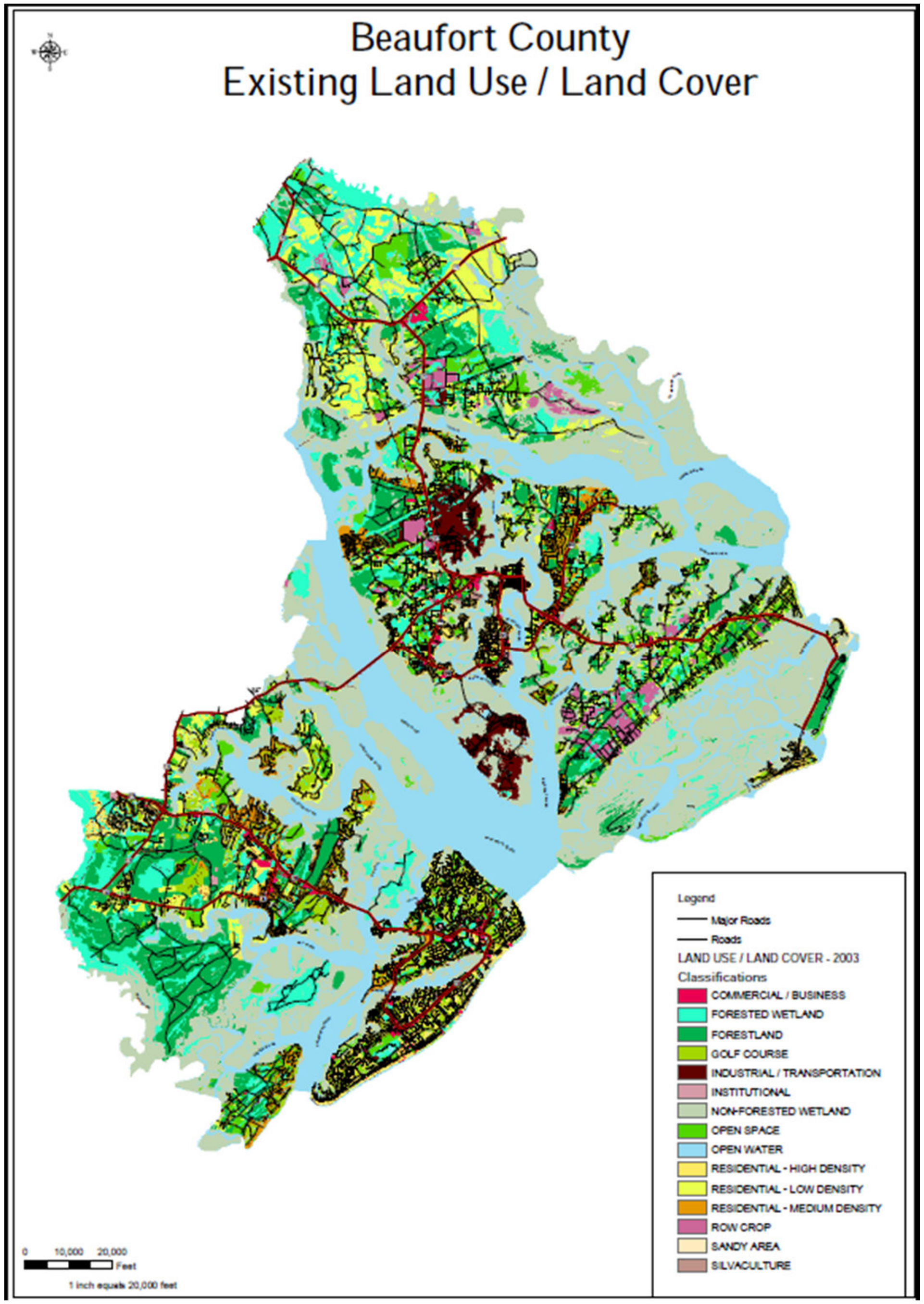



Beaufort County
Watersheds and Sub-Basins
0 0.75 1.5 3 4.5 6
Miles
Combahee River 1
Bull River / Wimbee Creek 4
Huspa 2
Bull River / Wimbee Creek 3
Broad River 1
Huspa 1
Williman Creek 3
Williman Creek 2
Bull River / Wimbee Creek 2
Williman Creek 1
Coosaw River 3
South Wimbee Creek 2
Haulover Creek 2
Coosaw River 4
South Wimbee Creek 1
Williman Creek Trib
Whale Branch West 3
Haulover Creek 1
Bull River / Wimbee Creek 1
Whale Branch West 2
McCalleys Creek 2
McCalleys Creek 1
Coosaw River 2
Coosaw River 1
Middle Creek 1
Middle Creek 2
Bass Creek 2
Whale Branch West 1
Brickyard Creek North
Parrot Creek 2
Lucy Point Creek North 1
Lucy Point Creek North 2
Bass Creek 1
Parrot Creek 1
Broomfield Creek 2
Brickyard Creek 1
Rock Springs Creek
Boatswain Pond
Broomfield Creek 1
Lucy Point Creek South 2
Albergotti Creek 1
Morgan River 3
Morgan River 2

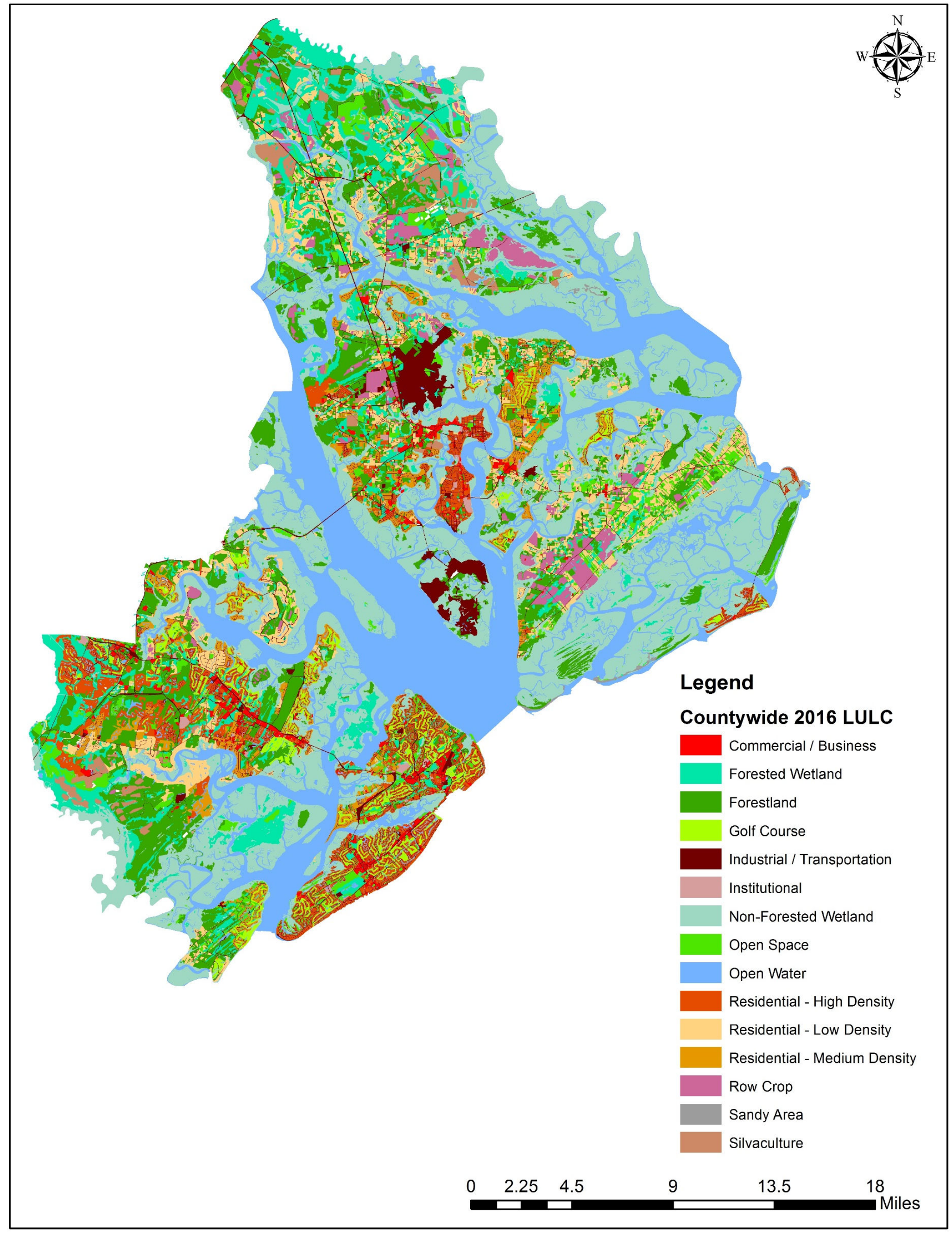

Beaufort County
Watersheds and Sub-Basins
Lucy Point Creek North 1
Lucy Point Creek North 2
Broomfield Creek 2
Parrot Creek 1
Bass Creek 1
Brickyard Creek 1
Broomfield Creek 1
Rock Springs Creek
Lucy Point Creek South 2
Boatswain Pond
Albergotti Creek 1
Morgan River 3
Morgan River 2
Lucy Point Creek South 1
Albergotti Creek 2
Rock Springs
Creek 2
Eddings Point
Creek Trib 1
Jenkins Creek 1
Eddings Point
Creek 1
Morgan River 4
Battery
Creek 4
Battery
Creek 3
Beaufort River 3
Village C
Doe Point
Creek 1
Eddings Point
Creek 2
Jenkins Creek
Warsaw Flats 1
Battery Creek 2
Morgan River 5
Jenkins Creek 2
Eddings Point
Creek 3
Village Creek 2
Distant Island
Creek 3
Jenkins Creek
Warsaw Flats 2
Morgan
River 6
Distant Island
Creek 2
Cowen Creek 3
Capers Creek 3
Village Creek 3
Cowen Creek 2
Battery Creek 1
Beaufort River 2
Capers Creek 2
Distant Island
Creek 1
Capers Creek 1
Cowen Creek 1
Chechessee
Trib
Broad River 3
Coastal
Beaufort River 1
hechessee River 2
0 0.5 1 2 3 4
Miles


Beaufort County
Watersheds and Sub-Basins
Battery Creek 1
Beaufort River 2
Beaufo
Broad River 3
Broad River 4
Chechessee River 5
Chechessee River 4
Chechessee Trib - Ballenger Neck
Chechessee Creek 1
Chechessee River 3
Chechessee Creek 2
Broad/Chechessee Trib
Colleton River - Tidal Flats
Chechessee Trib - Spring Island
Callawassie Creek 2
Chechessee River 2
Callawassie Creek 1
Okatie River 1
Colleton River 3
Colleton River 1
Okatie River 2
Colleton River 2
Chechessee River 1
Okatie River 3
New River 1
Mackays Creek North - Corn Island
Mackays Creek North 1
Mackays Creek North 2
Skull Creek North 1
Skull Creek North 2
Sawmill Branch 2
Sawmill Branch 1
Calibogue Sound 5
Mackays Creek South
Calibogue Sound 4
Skull Creek South 2
May River 5
May River 4
May River 3
Skull Creek South 1
Bass Creek
Calibogue Sound 3
Jarvis Creek 2
Jarvis Creek 1
Broad Creek 4
May River 2
New River 2
Bull Creek (May)
May River 1
Savage Creek 2
Bryan Creek 2
Savage Creek 1
May River Trib
Bryan Creek 1
Bull Creek/Cooper 3
Calibogue Sound 2
Bull Creek/Cooper 2
0
0.75
1.5
3
4.5
6
Miles


Corn Island
Mackays Creek North 2
Skull Creek North 1
Broad River 4
Sawmill Branch 2
Sawmill Branch 1
Calibogue Sound 5
Skull Creek North 2
Mackays Creek South
Calibogue Sound 4
Skull Creek South 2
May River 5
May River 4
May River 3
Skull Creek South 1
Bass Creek
Calibogue Sound 3
Jarvis Creek 2
May River 2
Jarvis Creek 1
Broad Creek 4
Old House Creek
New River 2
Bull Creek (May)
May River 1
Broad Creek 3
Savage Creek 2
Bryan Creek 2
Savage Creek 1
May River Trib
Bryan Creek 1
Bull Creek/Cooper 3
Calibogue Sound 2
Bull Creek/Cooper 2
Broad Creek 2
Hoophole Creek
Cooper River Trib
Cooper River 2
Bull Creek/Cooper 1
Broad Creek 1
Cooper River 3
Cooper River 1
Calibogue Sound 1
Calibogue Sound 6
Calibogue Sound 7
New River 3
Beaufort County
Watersheds and Sub-Basins
0 0.75 1.5 3 4.5 6
Miles

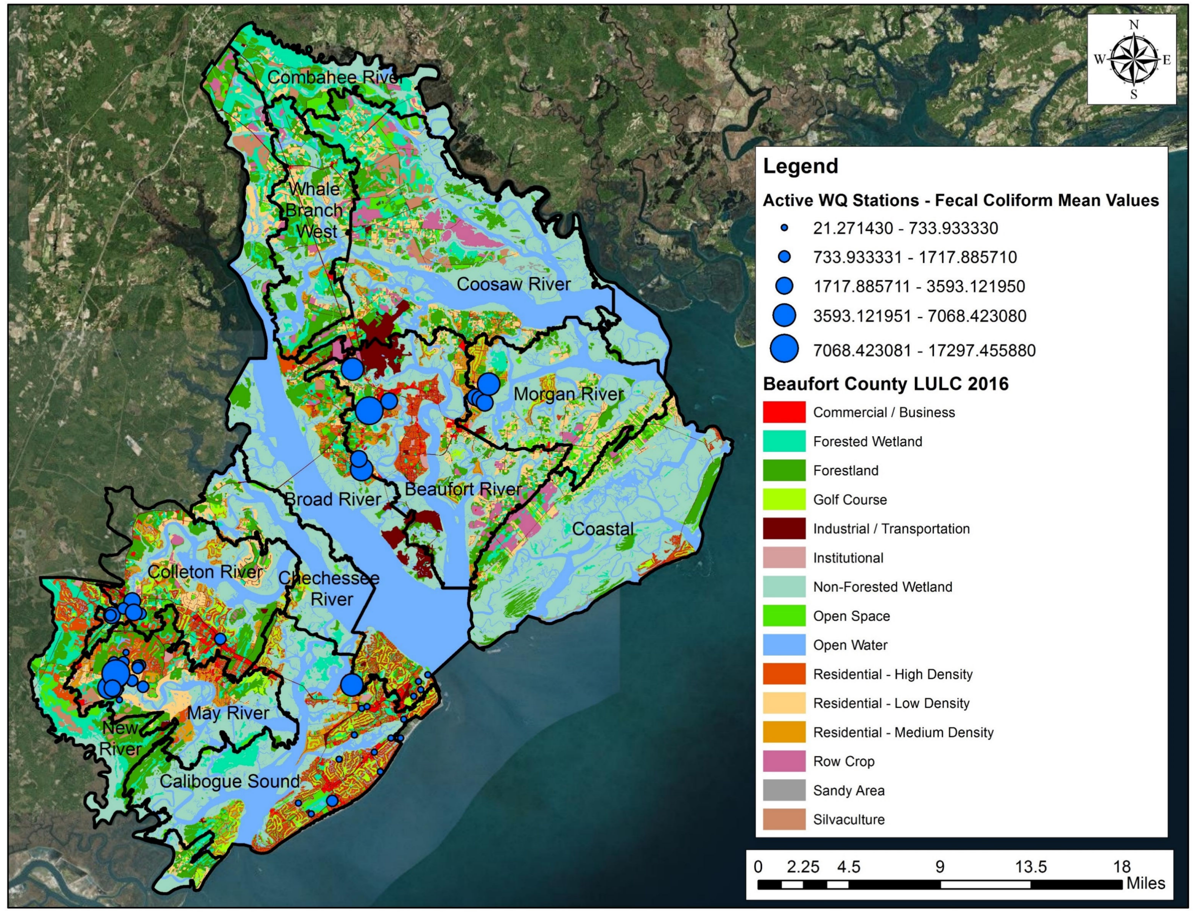


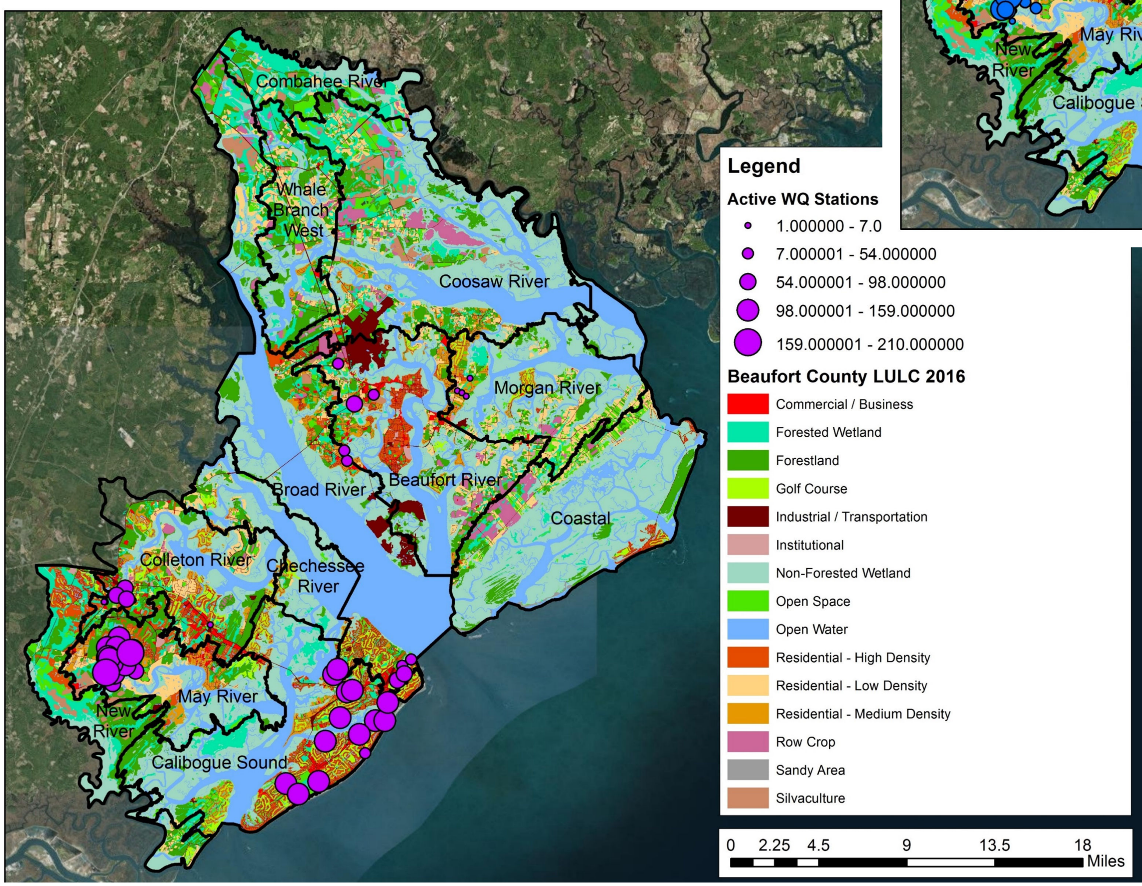
Beaufort County
Existing Land Use / Land Cover
Legend
Major Roads
Roads
LAND USE / LAND COVER - 2003
Classifications
COMMERCIAL / BUSINESS
FORESTED WETLAND
FORESTLAND
GOLF COURSE
INDUSTRIAL / TRANSPORTATION
INSTITUTIONAL
NON-FORESTED WETLAND
OPEN SPACE
OPEN WATER
RESIDENTIAL - HIGH DENSITY
RESIDENTIAL - LOW DENSITY
RESIDENTIAL - MEDIUM DENSITY
ROW CROP
SANDY AREA
SILVACULTURE
0 10,000 20,000
Feet
1 inch equals 20,000 feet



N
W
E
S
Legend
Countywide 2016 LULC
Commercial / Business
Forested Wetland
Forestland
Golf Course
Industrial / Transportation
Institutional
Non-Forested Wetland
Open Space
Open Water
Residential - High Density
Residential - Low Density
Residential - Medium Density
Row Crop
Sandy Area
Silvaculture
0 2.25 4.5 9 13.5 18
Miles

WS	area	imp	% imp
Beaufort	46234	6757	14.61%
Colleton	31953	4224	13.22%
Calibogue	50585	6389	12.63%
May	27893	3153	11.30%
New	22795	1865	8.18%
Broad	69774	5101	7.31%
Morgan	32586	1709	5.25%
Whale Branch West	24376	1240	5.09%
Coosaw	69391	2998	4.32%
Chechessee	19672	457	2.32%
Coastal	50650	1126	2.22%
Combahee	22537	347	1.54%





2002

Land Use Type	Beaufort (acres)	Broad (acres)	Calibogue (acres)	Chechessee (acres)	Coastal (acres)	Colleton (acres)	Combahee (acres)	Coosaw (acres)	May River (acres)	Morgan River (acres)	New River (acres)	Whale Branch West (acres)
Agricultural/Pasture	1348	591	0	7	1921	28	136	1906	0	307	0	509
Commercial	915	401	991	4	34	546	11	270	150	161	5	185
Forest/Rural Open	2491	4246	2851	900	4043	5558	1299	6583	8243	2454	7522	3586
Golf Course	363	965	2529	754	191	2426	0	64	1221	342	322	0
High Density Residential	3692	3333	4441	108	742	1095	0	14	669	24	1327	13
Industrial	5189	3497	2403	283	553	1570	287	3124	648	843	445	778
Institutional	586	190	154	13	6	102	0	97	139	111	73	23
Low Density Residential	2896	3375	76	882	1953	3193	3208	8503	2736	2986	451	5022
Medium Density Residential	1036	511	1786	376	90	2566	0	1263	779	1614	256	952
Open Water/Tidal	23017	43789	25700	15608	37391	11682	11941	36985	9381	19465	5635	8567
Silviculture	164	0	0	0	0	1067	0	0	0	0	4	0
Urban Open	2967	2524	2955	331	1965	2403	1024	4596	939	3146	914	1496
Wetland/Water	1631	5674	4225	514	1759	2465	4631	5969	2750	1134	5860	3248
TOTAL	46292	69095	48111	19780	50647	34701	22538	69375	27655	32586	22814	24379
Urban Imperviousness	7204	5146	5389	468	1099	3256	561	3820	1554	1563	1213	1529

2016

Land Use Type	Beaufort (acres)	Broad (acres)	Calibogue (acres)	Chechessee (acres)	Coastal (acres)	Colleton (acres)	Combahee (acres)	Coosaw (acres)	May River (acres)	Morgan River (acres)	New River (acres)	Whale Branch West (acres)
Agricultural/Pasture	1580	1418	0	0	2021	499	238	3854	8	394	27	746
Commercial	1325	729	1264	16	51	1098	13	130	442	149	71	134
Forest/Rural Open	4516	6724	2843	1211	4295	5634	2785	8304	5176	2510	4924	6131
Golf Course	367	964	3062	491	198	1657	0	59	537	511	472	0
High Density Residential	2302	2746	5505	16	752	2320	0	51	2431	95	2591	202
Industrial	4639	3338	2593	274	548	1678	280	2596	830	835	471	774
Institutional	467	109	221	13	6	57	0	92	178	134	77	14
Low Density Residential	3473	2306	115	928	2105	2813	924	4364	2835	3854	572	3094
Medium Density Residential	2162	1261	2054	479	67	2146	0	1355	2158	1765	22	296
Open Water/Tidal	22913	43347	26246	15479	37395	11450	11771	35976	10151	18993	5722	8275
Silviculture	254	1365	0	0	0	0	342	3298	864	0	925	233
Urban Open	705	1255	2678	340	1772	619	823	2748	811	2232	1396	802
Wetland/Water	1531	4212	4005	425	1441	1984	5360	6564	1472	1115	5524	3675
TOTAL	46234	69774	50585	19672	50650	31953	22537	69391	27893	32586	22795	24376
Urban Imperviousness	6757	5101	6389	457	1126	4224	347	2998	3153	1709	1865	1240

Difference

Land Use Type	Beaufort (acres)	Broad (acres)	Calibogue (acres)	Chechessee (acres)	Coastal (acres)	Colleton (acres)	Combahee (acres)	Coosaw (acres)	May River (acres)	Morgan River (acres)	New River (acres)	Whale Branch West (acres)
Agricultural/Pasture	232	827	0	-7	100	471	102	1948	8	87	27	237
Commercial	410	328	273	12	17	552	2	-140	292	-12	66	-51
Forest/Rural Open	2025	2478	-8	311	252	76	1486	1721	-3067	56	-2598	2545
Golf Course	4	-1	533	-263	7	-769	0	-5	-684	169	150	0
High Density Residential	-1390	-587	1064	-92	10	1225	0	37	1762	71	1264	189
Industrial	-550	-159	190	-9	-5	108	-7	-528	182	-8	26	-4
Institutional	-119	-81	67	0	0	-45	0	-5	39	23	4	-9
Low Density Residential	577	-1069	39	46	152	-380	-2284	-4139	99	868	121	-1928
Medium Density Residential	1126	750	268	103	-23	-420	0	92	1379	151	-234	-656
Open Water/Tidal	-104	-442	546	-129	4	-232	-170	-1009	770	-472	87	-292
Silviculture	90	1365	0	0	0	-1067	342	3298	864	0	921	233
Urban Open	-2262	-1269	-277	9	-193	-1784	-201	-1848	-128	-914	482	-694
Wetland/Water	-100	-1462	-220	-89	-318	-481	729	595	-1278	-19	-336	427
TOTAL	-58	679	2474	-108	3	-2748	-1	16	238	0	-19	-3
Urban Imperviousness	-448	-45	1000	-11	26	968	-214	-822	1599	147	652	-288

% Change

Land Use Type	Beaufort (acres)	Broad (acres)	Calibogue (acres)	Chechessee (acres)	Coastal (acres)	Colleton (acres)	Combahee (acres)	Coosaw (acres)	May River (acres)	Morgan River (acres)	New River (acres)	Whale Branch West (acres)
Agricultural/Pasture	17	140	0	- - -	5	1681	75	102	- - -	28	- - -	46
Commercial	45	82	28	306	49	101	15	-52	195	-8	1318	-28
Forest/Rural Open	81	58	0	35	6	1	114	26	-37	2	-35	71
Golf Course	1	0	21	-35	4	-32	0	-8	-56	49	47	0
High Density Residential	-38	-18	24	-86	1	112	0	264	263	295	95	1455
Industrial	-11	-5	8	-3	-1	7	-2	-17	28	-1	6	0
Institutional	-20	-43	44	2	0	-45	0	-5	28	21	5	-38
Low Density Residential	20	-32	51	5	8	-12	-71	-49	4	29	27	-38
Medium Density Residential	109	147	15	28	-25	-16	0	7	177	9	-91	-69
Open Water/Tidal	0	-1	2	-1	0	-2	-1	-3	8	-2	2	-3
Silviculture	55	- - -	0	0	0	- - -	- - -	- - -	- - -	0	23027	- - -
Urban Open	-76	-50	-9	3	-10	-74	-20	-40	-14	-29	53	-46
Wetland/Water	-6	-26	-5	-17	-18	-20	16	10	-46	-2	-6	13
TOTAL	0	1	5	-1	0	-8	0	0	1	0	0	0
Urban Imperviousness	-6	-1	19	-2	2	30	-38	-22	103	9	54	-19

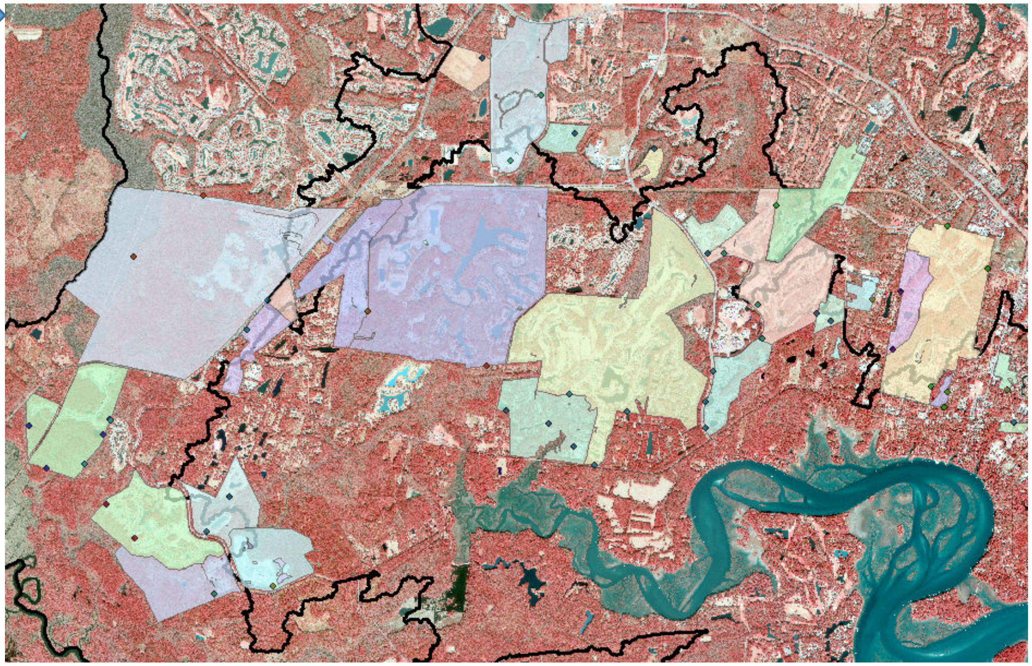
NEXT STEPS

1. Choose which 7 Watersheds to Model.
   a. Are more than 7 desired/needed?

2. Provide additional information to ATM so ATM can proceed with modeling.

ADDITIONAL INFORMATION AND DATA NEEDED TO CONTINUE WITH MODELING

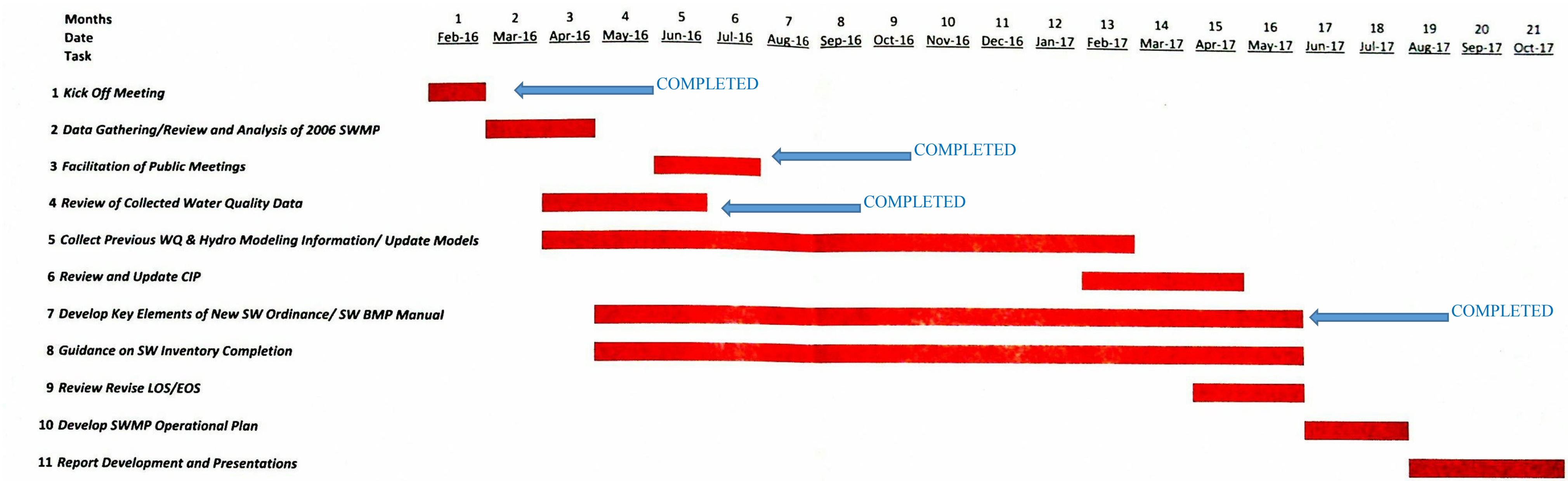
- **Need 2006 GIS or shapes used to create land use data.**
  - We do not have LULC from 2002 digitally. Data so far was taken from tables in pdf of 2006 SWMP.
- **BMP coverage**
  - We have this for Port Royal and Bluffton only.
  - Need location of BMPs and Areas treated.
  - Private and Publicly owned/maintained.
- **Updated Pipe/Drainage Structure inventory.**
  - We have this in parts but need additional info.
  - Data for upstream and downstream ends
    - Elevation, coordinates, slopes, flow direction.
- **Additional coordinates for monitoring stations.**
  - RDCP4
  - BECY.17a
  - BECY.1a
  - BECY.4a
  - BECY.11
  - BECY.10
  - BECY.5
  - BECY.4
  - BECY.6r



- **Verification of some sub-basin boundaries in GIS.**
  - Mostly in unincorporated county areas. Need to coord with GIS and/or Rebecca.
- **WQ Sampling locations to be determined as we model the watersheds**
  - Locations to be determined based on data and models in addition to locations where they aer most feasible.
  - Major outfalls.
  - Methodology and timing will be recommended. (Dry flow, storm intensity to sample, grab or continuous, etc.)
  - We don't have details yet, since we have not yet complted modeling other than initial calibrations and test runs and sime hot spot items as part of task 4. We

UPCOMING MILESTONES/SCHEDULE

❖ Original Schedule



❖ Anticipated Milestones

1. Current work product is approximately at 50-60%.
2. Draft of Modeling results available Mid January. Will meet with staff and review prior to presenting to SWIC. (at about 80% level)
3. Present final results of Modelling to SWIC in February 2017.
4. During modelling, and after (through June 2017) will work on SW Inventory and LOS/EOS task.
5. Anticipate presentation of updates to SWMP in final format in Fall 2017.

Larson, Eric

From:	Carolina Clear <ecomeau=clemson.edu@mail254.suw18.rsgsv.net> on behalf of Carolina Clear <ecomeau@clemson.edu>
Sent:	Tuesday, October 25, 2016 10:51 AM
To:	Larson, Eric
Subject:	Strategic Plan Meeting Minutes

Strategic Stormwater Outreach Planning Meeting Minutes

I hope that everyone made it through the storm unscathed! First of all, thank you to everyone who could attend the beginning of this important regional effort! Your input will be crucial to Carolina Clear as we develop the strategic education plan for the lowcountry. Below are the meeting minutes from Sept. 29th's planning session.

MS4 Presentations

Our objective was to identify the top three pollutants of concern.

Erik Larson (Beaufort County)

-- Adopted volume control to meet TMDLs

-- Sample for fecal coliform due to shellfish

-- Okatie River: Fecal coliform TMDL (303d)

-- Battery Creek: Impaired with bacteria

-- Beaufort River: TMDL for DO

Neil Desai (City of Beaufort)

-- Retrofitting detention pond with 319 funds

Kim Jones (Town of Bluffton)

-- New River: Enterococcus TMDL, increasing BOD, and pH (303d)

-- May River: Fecal coliform TMDL (303d)

-- Monitoring program used to help inform/defend development requirements and to determine the efficacy of BMPs

Local Perspectives Surveys

Our objectives were to ID behaviors that contribute to stormwater pollution as well as audiences that need more info about stormwater pollution prevention. The bonus objectives were to ID the where and how for education, involvement opportunities, and potential hurdles.

Residents were given a survey in 2015 and this combined with a Carolina Clear survey found the following:

-- Over 700 respondents (nearly 50% in gated communities)

-- 73% recognized that stormwater is not treated

-- There was some confusion between wastewater and stormwater

-- When asked who was at fault, there was lots of finger pointing

Bates Rambo (Town of Hilton Head Island)

-- One beach monitoring station added to 303d list for enterococcus

-- Monitoring samples for E. coli in freshwater, fecal coliform in saltwater, and for nutrients (TN, TP, Total Cu)

Tony Maglione (Town of Port Royal)

-- No current TMDLs

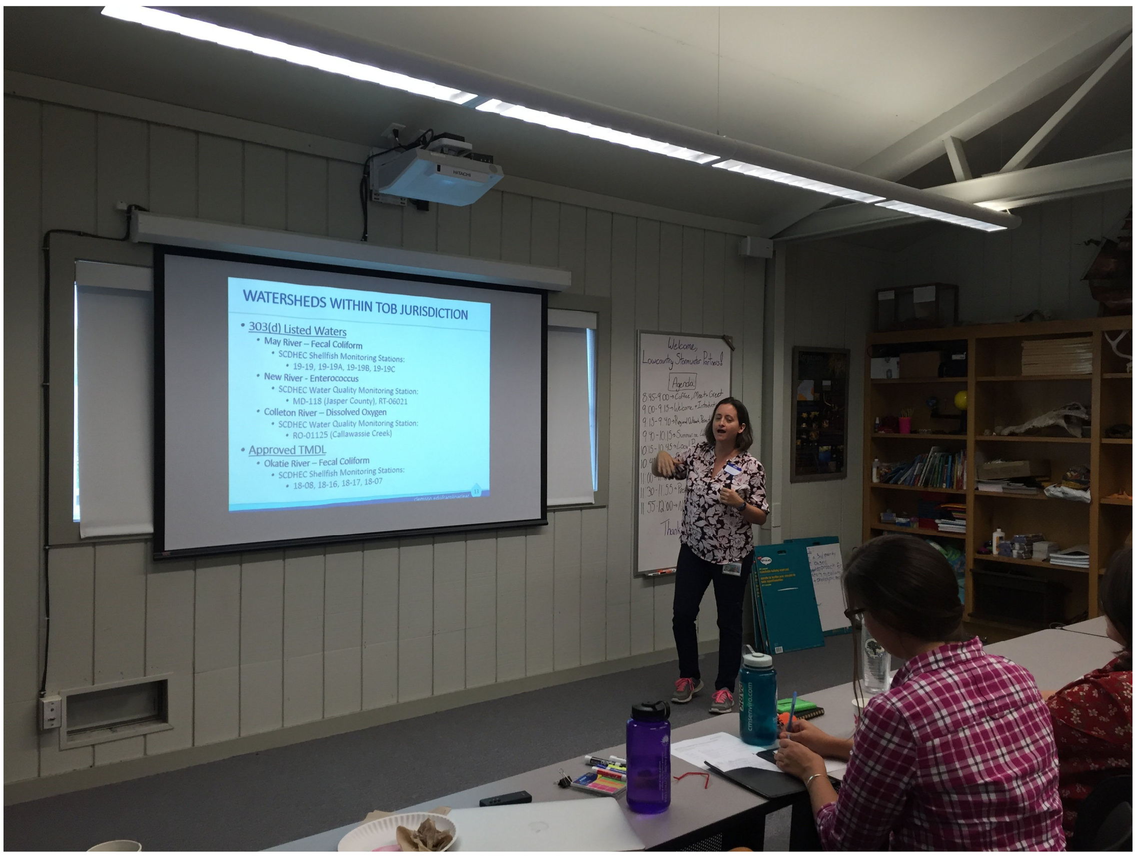
-- Cypress wetlands rehabbed into stormwater system

A survey was also given to area staff and found the following:

-- Target priority audiences are: developers, landscapers, contractors, landscapers, designers, HOA board members, and homeowners

-- Target pollutant priorities are: bacteria, sediment from construction sites, DO, contaminants, trash

--47% of staff witness an illegal discharge at least three times a year



Pollutant of Concern Audience Brainstorming Results

POC/BEHAVIOR	SPECIFICS	TOTAL VOTES	# OF MS4 VOTES
Post-Construction Maintenance	Ponds	15	9
Runoff Volume	Dilution of saltwater	14	6
Littering	Plastics, Microplastics	13	1
Bacteria	All sources, Fecal vs Entero	13	8
Fertilizer (Nutrients)	Timing, Directions, Everyone	10	5
Septic Tanks	Installation/Maintenance	7	5
Construction Runoff	All, Sediment	7	4
Failing Infrastructure	Maintenance, Knowing When to Call, Public vs Private	6	3
Linking Land Use Change to Natural Resources	Quality of Community	6	2
Illegal Dumping	Contractor and Residential, Disposal Practices	4	2
Lawn Debris	Grass Clippings	3	1
Infiltration	Site-Specific BMPs, Impervious Cover	2	0
Pesticides	Land	2	1
Sanitary Sewer Overflows	User Disposal Practices	2	1
Irrigation Practices	Timing	1	0
Copper	Pond Applications, Roads, Pesticides	1	1
Commercial Grease Trap	Maintenance	1	1
Boat/Dock/Marina Maintenance		1	0
Gas Stations	Maintenance and Runoff	0	0
Commercial Car Washes	Polluted runoff; Pop-up and Charity Car Washes	0	0
Pharmaceuticals	Improperly Disposal	0	0
Pool Discharge		0	0
Irrigation Source	Municipal Water vs Harvested Rainwater	0	0
Large Item Dumping	Not Going to Landfill	0	0

Small Group Discussions

Post-Construction Maintenance

-- *Problem*: Maintenance contracts on stormwater ponds and BMPs are not being fulfilled, leading to the BMP's failure and local governments having to acquire/maintain the BMP

-- *Target Audiences*: HOA mgmt, property mgmt, golf course mgmt, commercial property mgmt, county/municipal staff, developers, elected officials, waterfront residents, pond mgnt and landscape companies

-- *Messages*: the purpose of BMPs and their function, long-term/regular maintenance is required for BMP function, recognition of ownership and responsibilities (public vs private), what the stormwater fee is used for, benefits of maintenance

-- *Resources and Partners:* Lagoon committees, Marsh Association, pond

Runoff Volume

-- *Problem*: Large amount of freshwater runoff is harming local ecosystem and shellfish harvests

-- *Target Audiences*: court representatives (to set up comp plan for development impacts), developers and engineers (designing with LIDs), HOAs, residents (landscaping choices)

-- *Messages:* Freshwater as a conveyance for other pollutants, grassroots approach to drive political will, importance of local seafood, saltwater vs freshwater

-- *Program Ideas:* Programs to incentivize and facilitate BMP installation,

-- *Resources and Partners*: Eco-tours, DNR, Lowcountry Institute, local communities, Experience Green, Savannah River Keeper, native plant nurseries, existing presentations to HOA groups, existing LID presentations, Rain barrel giveaways, mgmt companies, DNR, PRSF, State/MS4 design manuals

Bacteria (Septic Tanks)

-- *Problem:* Lack of maintenance, infrastructure/design, water conservation, lack of knowledge, renters, driving on/using drain fields, garbage disposal behaviors, pipes leading straight to marshes

-- *Program Ideas:* Flyers/pamphlets, Coast-A-Syst, NRCS soil tunnel program, website, BJWA handing out educational materials, installer education, newspaper articles, community block grants

-- *Resources and Partners:* DHEC EQC, NRCS, Rural Development Conservation District, USCB (Dr. Warner), DNR, NERR, Installers, DHEC based providers

County credit program

Litter

-- *Problem*: Dumpster maintenance, marine debris, unsecured trash in vehicles, illegal dumping, tourist trash (chairs, flip-flops)

-- *Target Audiences*: tourists, boating community, motorists

-- *Messages:* prevent litter in the first place instead of picking it up all the time

-- *Program Ideas:* incentivize proper disposal (tarp giveaways at distribution centers), information at marinas, boating stores (Bulter Marine, WalMart boating section), rental agencies, and community drop-off centers

-- *Resources and Partners*: Palmetto Pride, Keep Beaufort County Beautiful, NOAA Marine Debris, Adopt-A-Highway, DOT environmental crime unit + app, Sea Grant Clean Marine program

Questions, Comments, or Requests?
Contact your Water Resources Extension Agent:

Ellen Comeau
ecomeau@clemson.edu
(843)-255-6060 ext 115

Our mailing address is:
Lowcountry Stormwater Partners

102 Industrial Village Rd
Bldg 1
Beaufort, SC 29906

Add us to your address book

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You can update your preferences or unsubscribe from this list

MEMORANDUM

Date: November 9, 2016

To: Stormwater Management Utility Board

From: David Wilhelm, P. E., Public Works Director

Re: **Maintenance Project Report**

This report will cover three minor or routine projects. The Project Summary Reports are attached. (**Stormwater Summary Map by District**)

Minor or Routine Projects:

- **Burton Wells Complex – Storm Water Utility District (SWUD 6):** This project improved the storm drainage system and storm water retention pond at the Burton Wells Complex. Work included clearing and grubbing around the pond, lowering the water elevation in the pond, replacing a short section of pipe, repairing the weir, and hydroseeding. The total cost of this project was **$14,693.06.**
- **Vacuum Truck – Bluffton area 2015 (SWUD 9):** Project scope included jet vac cleaning 433 feet of drainage system, including 19 catch basins, 3 driveway pipes, 12 crossline pipes, 40 feet of overflow pipe, 48 feet of roadside pipe and 345 feet of channel pipe. Work began 7/2/15 and was completed 11/17/15. The total cost was **$8,148.95.**
- **Vacuum Truck – Bluffton area 2016 (SWUD 9):** Project scope included jet vac cleaning 620 feet of drainage system, including 13 catch basins, 2 driveway pipes, 8 crossline pipes, 520 feet of roadside pipe and 100 feet of channel pipe. Work began 3/7/16 and was completed 6/30/16. The total cost was **$4,799.80.**

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Burton Wells Complex

Activity: Pond Maintenance

Narrative Description of Project:

Duration: 11/19/15 - 11/23/15

Project improved 10 L.F. of drainage system. Dewatered pond to safe elevation. Grubbed and cleared perimeter of pond. Repaired weir. Replaced 10 L.F. of channel pipe. Hydroseeded for erosion control.

2016-561 / Burton Wells Complex	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
DWP / Dewatered Pond	42.0	$958.97	$69.35	$10.86	$0.00	$597.60	$1,636.78
HAUL / Hauling	66.5	$1,506.66	$429.19	$350.27	$0.00	$969.38	$3,255.49
HYDR / Hydroseeding	73.0	$1,639.83	$353.54	$499.31	$0.00	$1,032.81	$3,525.49
ONJV / Onsite Job Visit	46.0	$1,516.19	$163.24	$25.50	$0.00	$967.15	$2,672.08
PGC / Pond - Grubb and Clear	40.0	$913.20	$194.44	$103.47	$0.00	$567.90	$1,779.01
PI / Project Inspection	1.0	$45.60	$3.62	$1.70	$0.00	$33.96	$84.88
PRRECON / Project Reconnaissance	3.0	$92.25	$10.62	$1.70	$0.00	$54.69	$159.26
RMTRW / Remove trees - Workshelf	15.0	$340.20	$60.10	$281.20	$0.00	$219.75	$901.25
SC / Sediment Control	6.0	$137.31	$10.62	$3.62	$0.00	$89.10	$240.65
WDR / Wash down road	10.0	$222.80	$43.40	$10.22	$0.00	$143.40	$419.82
2016-561 / Burton Wells Complex Sub Total	**303.0**	**$7,384.75**	**$1,338.12**	**$1,287.84**	**$0.00**	**$4,682.35**	**$14,693.06**
Grand Total	**303.0**	**$7,384.75**	**$1,338.12**	**$1,287.84**	**$0.00**	**$4,682.35**	**$14,693.06**

Before

During

After

Project: Burton Wells Complex

Activity: Pond Maintenance

Project #: 2016-561

Township/SW Dist: Port Royal Island/6

Completed: November 2015

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 25 50 100 150 200 Feet

1 inch = 100 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/29/16
File:C:\project summaries map/Burton Wells Complex_2016-561

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Bluffton Vacuum Truck - Kitty Road, Sailors Choice, Bluffton Parkway, Cherry Point Road, Bluffton Government Center and Sandy Pointe Drive

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Project improved 433 L.F. of drainage system. Cleaned out (19) catch basins. Jetted (3) driveway pipes, (12) crossline pipes, 40 L.F. of overflow pipe, 48 L.F. of roadside pipe and 345 L.F. of channel pipe.

Duration: 7/2/15 - 11/17/15

2016-310 / Bluffton Vacuum Truck	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	0.5	$11.75	$0.00	$0.00	$0.00	$6.62	$18.36
CBCO / Catch basin - clean out	107.0	$2,450.83	$464.38	$345.36	$0.00	$1,591.05	$4,851.61
CLPJT / Crossline Pipe - Jetted	22.0	$522.88	$95.48	$66.92	$0.00	$343.95	$1,029.23
CPJ / Channel Pipe - Jetted	40.0	$970.15	$136.16	$117.52	$0.00	$640.64	$1,864.47
DPJT / Driveway Pipe - Jetted	6.0	$137.30	$26.04	$26.10	$0.00	$89.10	$278.54
PI / Project Inspection	2.0	$61.50	$7.08	$1.70	$0.00	$36.46	$106.74
2016-310 / Bluffton Vacuum Truck Sub Total	**177.5**	**$4,154.40**	**$729.14**	**$557.60**	**$0.00**	**$2,707.81**	**$8,148.95**
Grand Total	**177.5**	**$4,154.40**	**$729.14**	**$557.60**	**$0.00**	**$2,707.81**	**$8,148.95**

Before

During

After

Project: Bluffton Vacuum Truck-Kitty Road Map #1

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/ SW Dist: Bluffton/9

Completed: November 2015

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 30 60 120 180 240 Feet

1 inch = 130 feet

Prepared By: BC Stormwater Management Utility
Date Print:11/23/15
File:C:\project summaries map/Bluffton Vacuum Truck-Kitty Road Map #1_2016-310

Project: Bluffton Vacuum Truck-Sailors Choice Map #2

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/SW Dist: Bluffton/9

Completed: November 2015

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 10 20 40 60 80 Feet

1 inch = 50 feet

Prepared By: BC Stormwater Management Utility
Date Print:08/19/2015
File:C:\project summaries map/Bluffton Vacuum Truck-Sailors Choice Map #2_2016-310

Project: Bluffton Vacuum Truck- Sandy Pointe Drive Map #3

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/SW Dist: Bluffton/9

Completed: November 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:11/23/15
File:C:\project summaries map/Bluffton Vacuum Truck- Sandy Pointe Drive Map #3_2016-310

Project:Bluffton Vacuum Truck- Sandy Pointe Drive
Map #4

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/SW Dist: Bluffton/9

Completed: November 2015

Legend

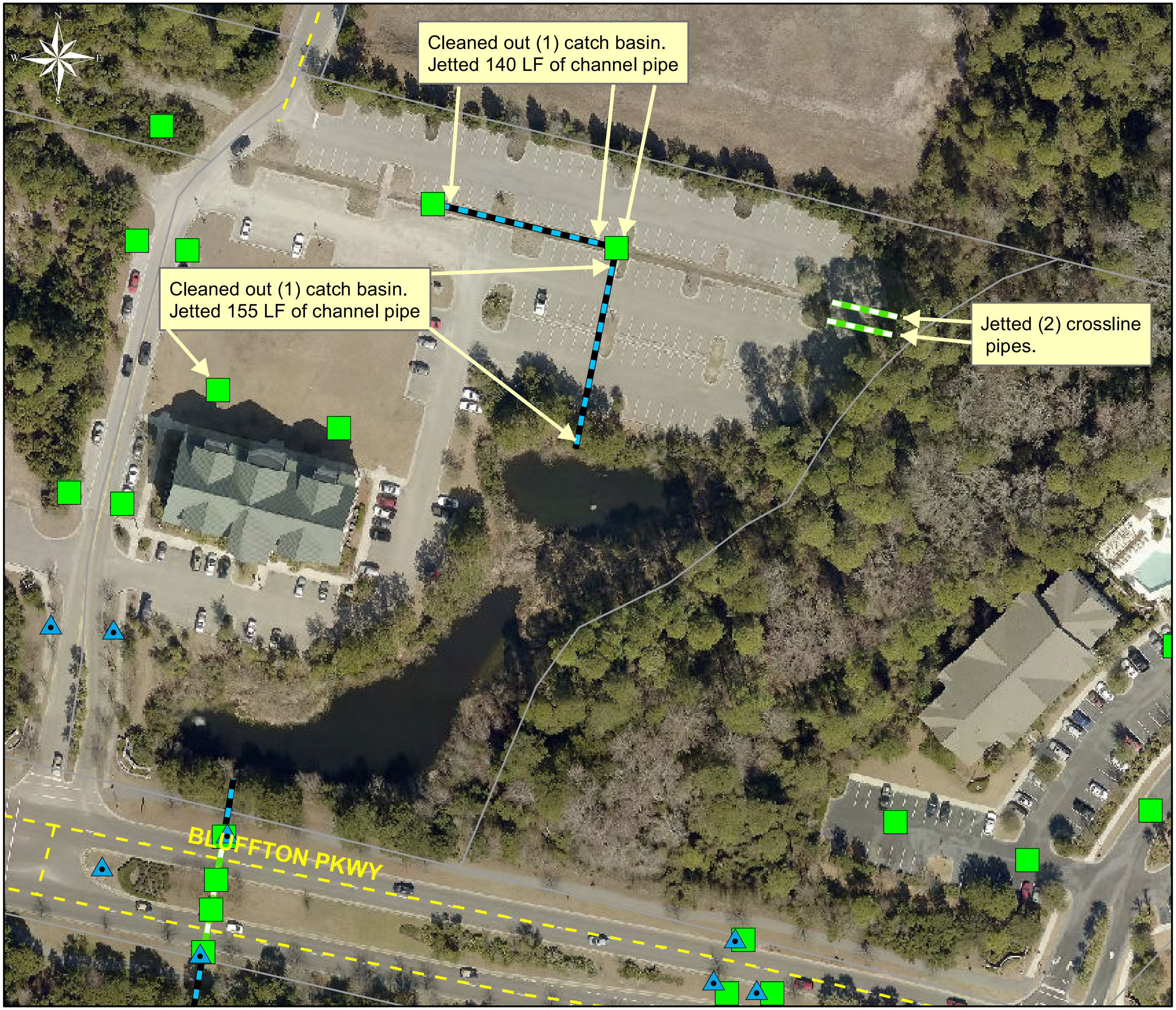
Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:11/1/16
File:C:\project summaries map/Bluffton Vacuum Truck- Sandy Pointe Drive Map#4 2016-310



Project:Bluffton Vacuum Truck- Government Center
Map #5

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/SW Dist: Bluffton/9

Completed: November 2015

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 25 50 100 150 200 Feet

1 inch = 100 feet

Prepared By: BC Stormwater Management Utility
Date Print:10/31/16
File:C:\project summaries map/Bluffton Vacuum Truck- Government Center_2016-310

Project: Bluffton Vacuum Truck- Cherry Point Road Map #6

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/ SW Dist: Bluffton/9

Completed: November 2015

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 40 80 160 240 320 Feet

1 inch = 170 feet

Prepared By: BC Stormwater Management Utility
Date Print:11/23/15
File:C:\project summaries map/Bluffton Vacuum Truck- Cherry Point Road Map #6_2016-310

Project: Bluffton Vacuum Truck- Bluffton Parkway Map #7

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/SW Dist: Bluffton/9

Completed: November 2016

Legend

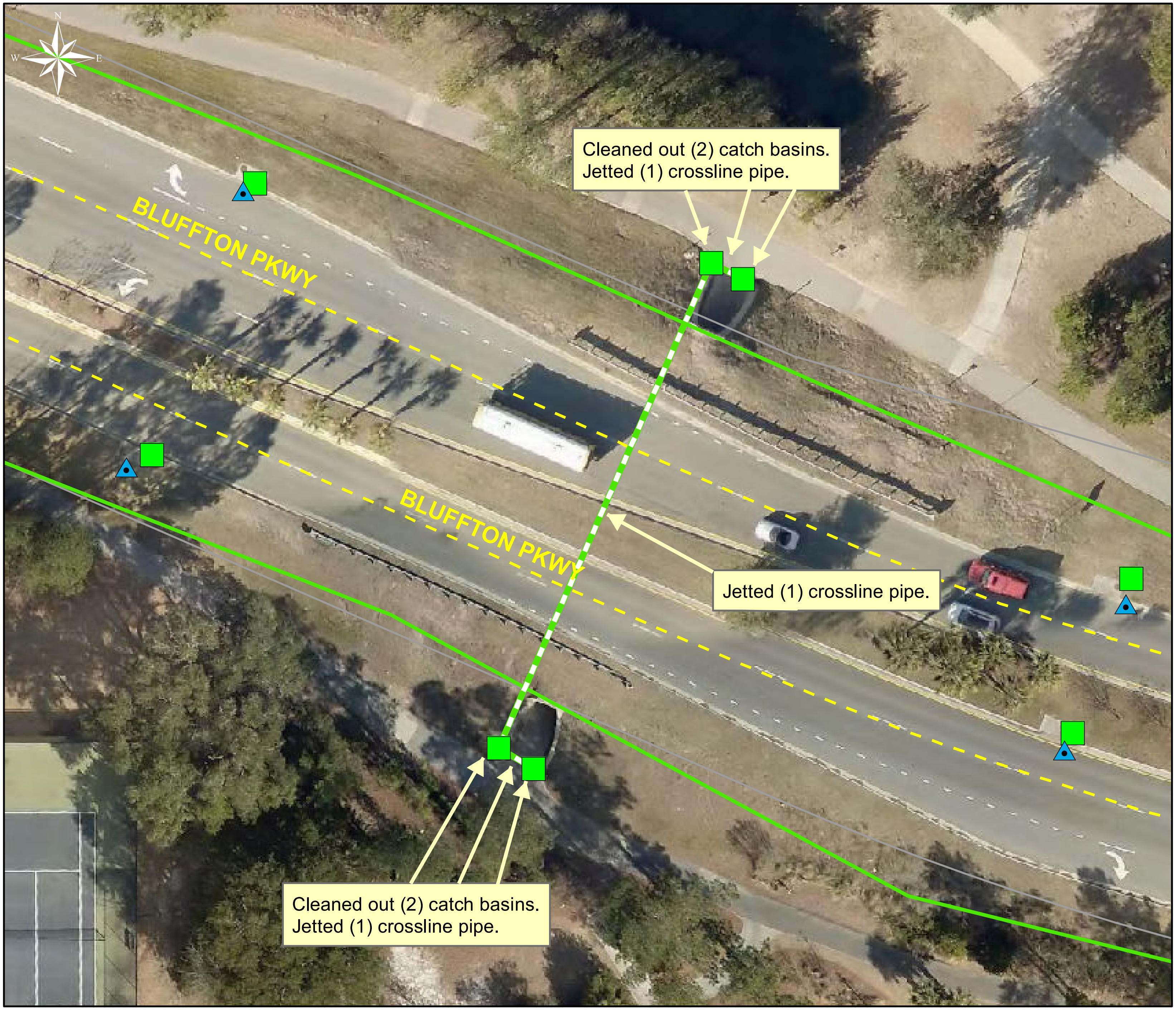
Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:11/23/15
File:C:\project summaries map/Bluffton Vacuum Truck- Bluffton Parkway Map #7_2016-310



Project: Bluffton Vacuum Truck- Bluffton Parkway Map #8

Activity: Routine/ Preventive Maintenance

Project #: 2016-310

Township/SW Dist: Bluffton/9

Completed: November 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 10 20 40 60 80 Feet

1 inch = 42 feet

Prepared By: BC Stormwater Management Utility
Date Print:11/23/15
File:C:\project summaries map/Bluffton Vacuum Truck- Bluffton Parkway Map #8_2016-310

Beaufort County
Public Works
Stormwater Infrastructure
Project Summary

Project Summary: Bluffton Vacuum Truck - Broadland Circle, Foreman Hill Road, Brunson Street, Lake Linden Drive, Camp St Marys Road, Ashepoo Drive, Rivers End Drive and Lemon Island Boat Ramp.

Activity: Routine/Preventive Maintenance

Narrative Description of Project:
Project improved 620 L.F. of drainage system. Cleaned out (13) catch basins. Jetted (8) crossline pipes, (2) driveway pipes, 100 L.F. of channel pipe and 520 L.F. of roadside pipe.

Duration: 3/7/16 - 6/30/16

2016-310A / Bluffton Vacuum Truck	Labor Hours	Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Indirect Labor	Total Cost
AUDIT / Audit Project	1.0	$23.49	$0.00	$0.00	$0.00	$13.23	$36.72
CBCO / Catch basin - clean out	20.0	$477.10	$86.80	$42.35	$0.00	$314.25	$920.50
CLPJT / Crossline Pipe - Jetted	20.0	$457.60	$86.80	$67.28	$0.00	$297.00	$908.68
CPJ / Channel Pipe - Jetted	14.0	$310.66	$43.40	$43.22	$0.00	$200.03	$597.31
DPJT / Driveway Pipe - Jetted	12.0	$281.88	$52.08	$36.85	$0.00	$185.34	$556.15
ONJV / Onsite Job Visit	2.0	$61.50	$7.08	$1.84	$0.00	$36.46	$106.88
PRRECON / Project Reconnaissance	8.0	$187.92	$34.72	$18.15	$0.00	$123.56	$364.35
RSPJ / Roadside Pipe - Jetted	18.0	$411.84	$78.12	$65.80	$0.00	$267.30	$823.06
SPSWI / Special Project - SWI	10.0	$239.74	$60.76	$27.10	$0.00	$158.55	$486.15
2016-310A / Bluffton Vacuum Truck Sub Total	**105.0**	**$2,451.73**	**$449.76**	**$302.59**	**$0.00**	**$1,595.72**	**$4,799.80**
Grand Total	**105.0**	**$2,451.73**	**$449.76**	**$302.59**	**$0.00**	**$1,595.72**	**$4,799.80**

Before

After

Project: Bluffton Vacuum Truck-Broadland Circle Map#1

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/29/16
File:C:\project summaries map/Bluffton Vac Truck-Broadland Circle Map 1_2016-310A

Project: Bluffton Vacuum Truck-Foreman Hill Road Map#2

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/29/16
File:C:\project summaries map/Bluffton Vac Truck-Foreman Hill Road Map 2_2016-310A

Project: Bluffton Vacuum Truck-Brunson Street Map#3

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:09/29/16
File:C:\project summaries map/Bluffton Vac Truck-Brunson Street Map 3_2016-310A

Project: Bluffton Vacuum Truck- Lake Linden Drive Map #4

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: October 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:10/24/16
File:C:\project summaries map/Bluffton Vac Truck- Lake Linden Dr Map #4 2016-310A

Project: Bluffton Vacuum Truck- Camp St. Marys Road
Map #5

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: June 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 30 60 120 180 240 Feet

1 inch = 130 feet

Prepared By: BC Stormwater Management Utility
Date Print:10/26/16
File:C:\project summaries map/Bluffton Vac Truck- Camp St. Marys Road_2016-310A

Project: Bluffton Vacuum Truck- Rivers End Drive & Ashepoo Drive Map #6

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: October 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 20 40 80 120 160 Feet

1 inch = 83 feet

Prepared By: BC Stormwater Management Utility
Date Print:10/24/16
File:C:\project summaries map/Bluffton Vac Truck- Rivers End Drive& Ashepoo Dr Map #6_2016-310A

Project: Bluffton Vacuum Truck- Lemon Island Boat Ramp Map #7

Activity: Routine/ Preventive Maintenance

Project #: 2016-310A

Township/SW Dist: Bluffton/9

Completed: October 2016

Legend

Drainage Type

- Access Pipe
- Bleeder Pipe
- Channel Pipe
- Channel
- Stream
- Crossline Pipe
- Driveway Pipe
- Lateral
- Lateral Pipe
- River
- Road Pipe
- Roadside
- Roadside Pipe

0 25 50 100 150 200 Feet

1 inch = 100 feet

Prepared By: BC Stormwater Management Utility
Date Print:10/24/16
File:C:\project summaries map/Bluffton Vac Truck- Lemon Island Boat Ramp Map #7_2016-310A

Draft 2017 Combined Schedule

SWIC Schedule	Stormwater Management Utility Board Schedule	Time	Location	NRC Schedule
December 7, 2016	December 14, 2016	2nd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, December 19, 2016 Tuesday, January 10, 2017
January 11, 2017	January 18, 2017	3rd Wed	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, February 06, 2017
February 8, 2017	February 15, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, March 06, 2017
March 8, 2017	March 15, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, April 03, 2017
April 12, 2017	April 19, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, May 01, 2017
May 10, 2017	May 17, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, June 05, 2017
June 14, 2016	June 21, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Summer break
July 12, 2017	July 19, 2017	3rd Wed	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, August 07, 2017
August 9, 2017	August 16, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Tuesday, September 05, 2017
September 13, 2017	September 20, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, October 02, 2017
October 11, 2017	October 18, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, November 06, 2017
November 8, 2017	November 15, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	Monday, December 04, 2017
December 8, 2017	December 20, 2017	3rd Wed 2:00PM	Executive Conference Room 170 100 Ribaut Road, Beaufort, SC	TBD

Beaufort County Stormwater Design

Explanation of the review process and its application on the Bluffton Gateway Development Plan

The Regulation

- Code of Ordinances
  - Chapter 106 – Community Development Code

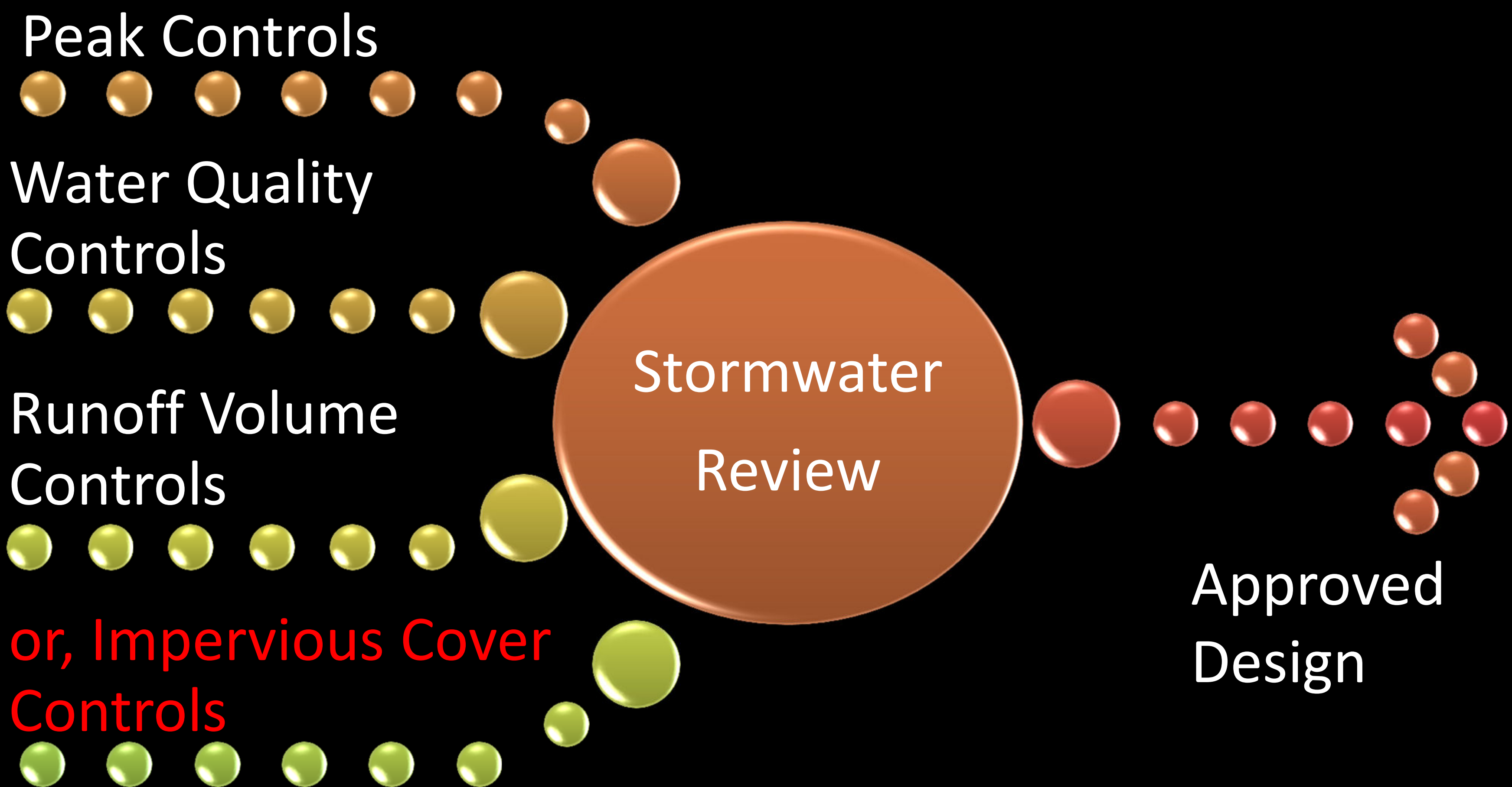
    Division 5.12.30 – Stormwater Stds.

    B. All these standards are to be achieved in accordance with the latest version of the County's **Manual for Stormwater Best Management and Design Practices (BMP)**, which is incorporated herein by reference.

The Regulation, cont.

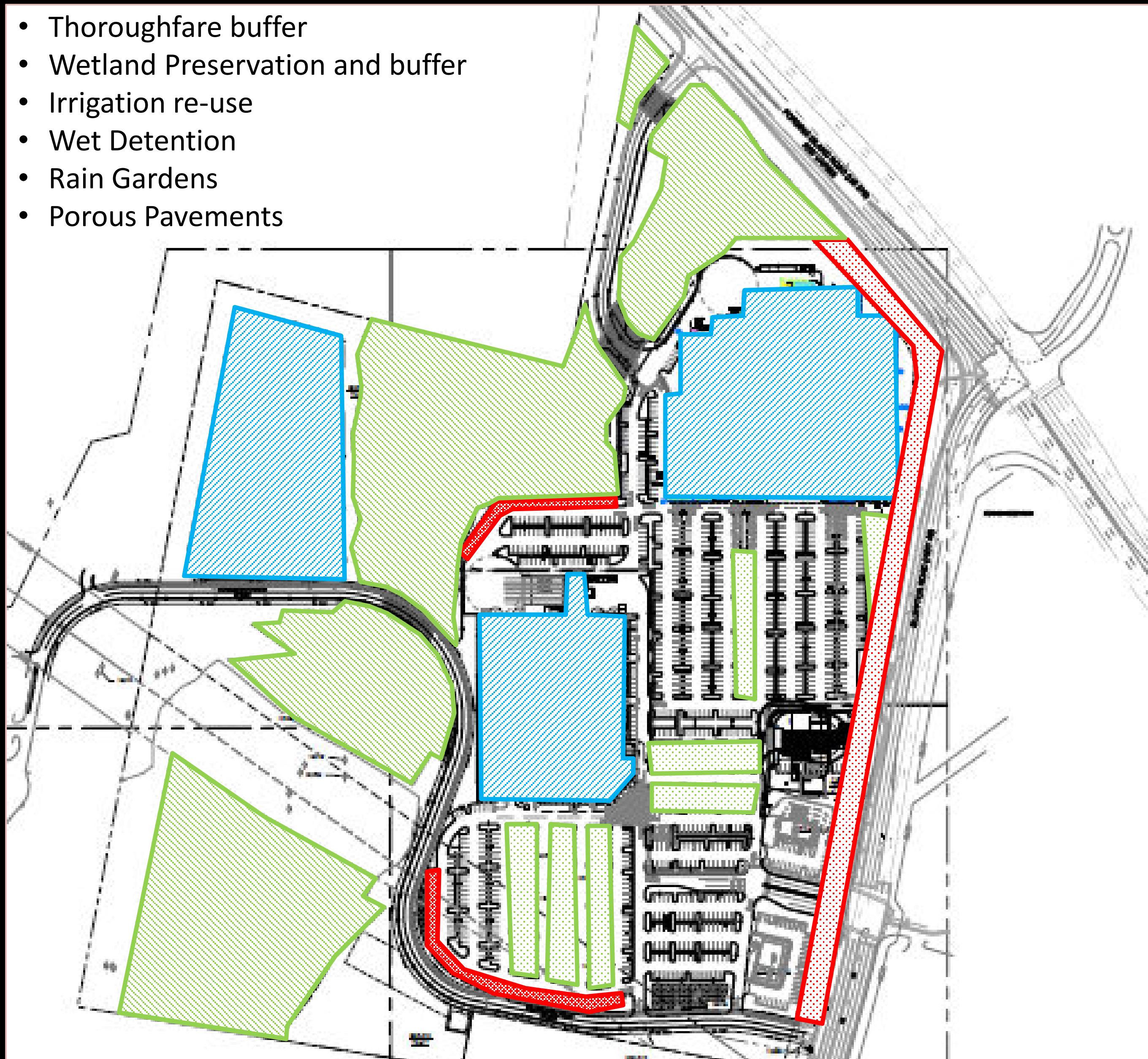
C. All development and redevelopment shall utilize and integrate Stormwater BMPs which are appropriate to their location and environment, and contribute to the overall character of a proposal. BMPs implemented at the development scale shall be integrated … to the maximum extent technically feasible … . BMPs may be designed as a singular practice or as part of various supplemental pre-treatment BMPs in series to achieve the runoff volume, runoff pollution load, and peak runoff rate control standards.

BMP Manual Principles



Site Plan

- Thoroughfare buffer
- Wetland Preservation and buffer
- Irrigation re-use
- Wet Detention
- Rain Gardens
- Porous Pavements



Note on Bluffton Gateway Design

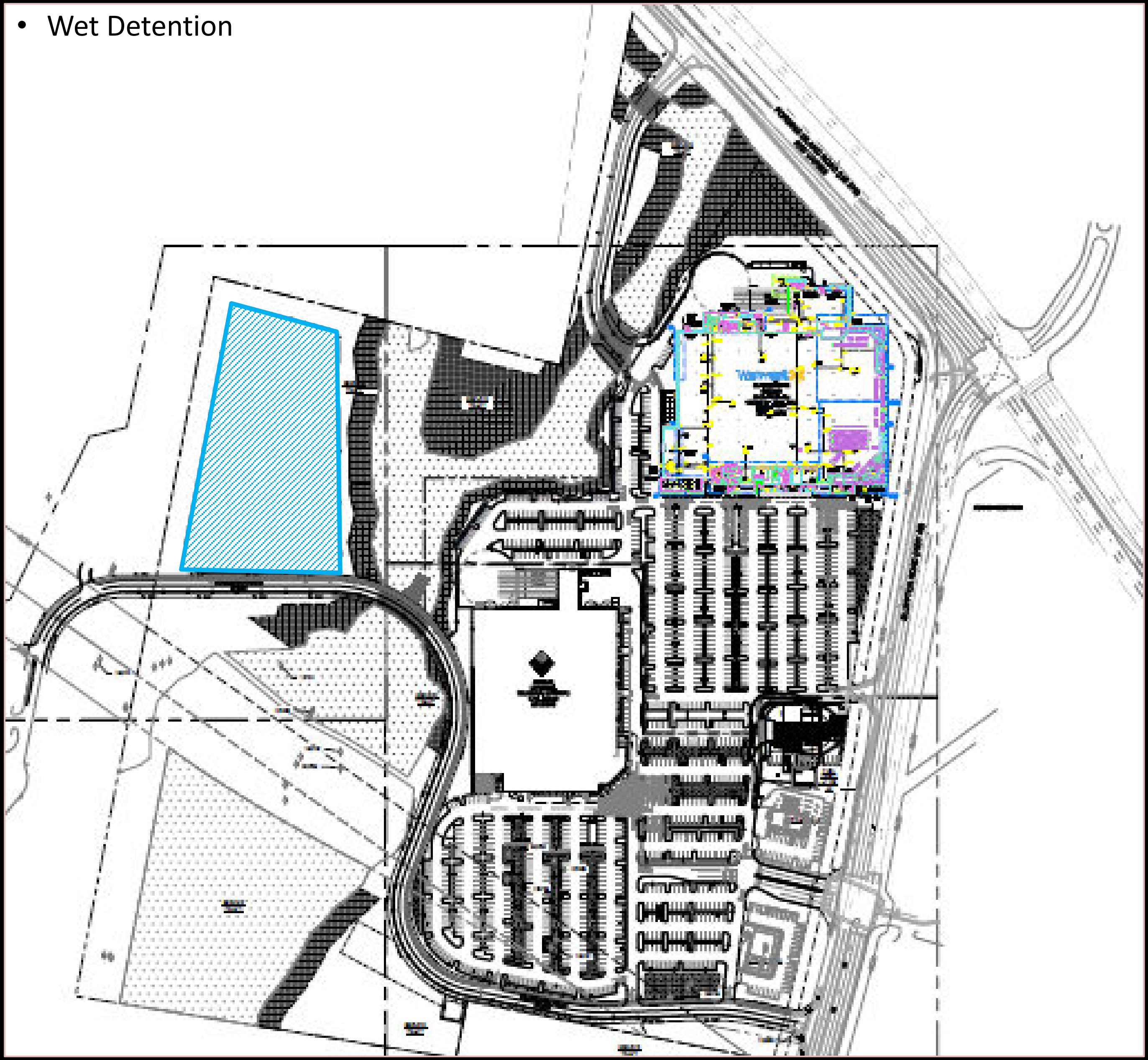
- The site design prepared by Kimley – Horn includes the buildings, parking areas, outparcels, and the proposed Connector Road to be built and dedicated to the County
- The stormwater design routes all runoff from the site and the road through the primary BMP, a Wet Detention Pond
- Therefore, County Road and outparcels runoff **are** accounted for in the Peak, Water Quality, and Volume Reduction Controls
- However, the County Road and outparcel surface area **are not** included in the Impervious Cover Control analysis

BMP Manual Guidelines

- Peak Controls
  - BMP Manual Section 2.6.1 - The design storm criteria to be used in calculations for the sizing of peak attenuation and volume control BMPs is to limit the post-development runoff for multiple storm events including the 2-, 10-, 25-, 50 and 100-year/24-hour storms to the predevelopment rates.

Peak Control

- Wet Detention



Bluffton Gateway - Peak Control

- Ordinance requires the 2-, 10-, 25-, 50 and 100-year/24-hour events to be considered
- Kimley – Horn Design exceeds our requirements

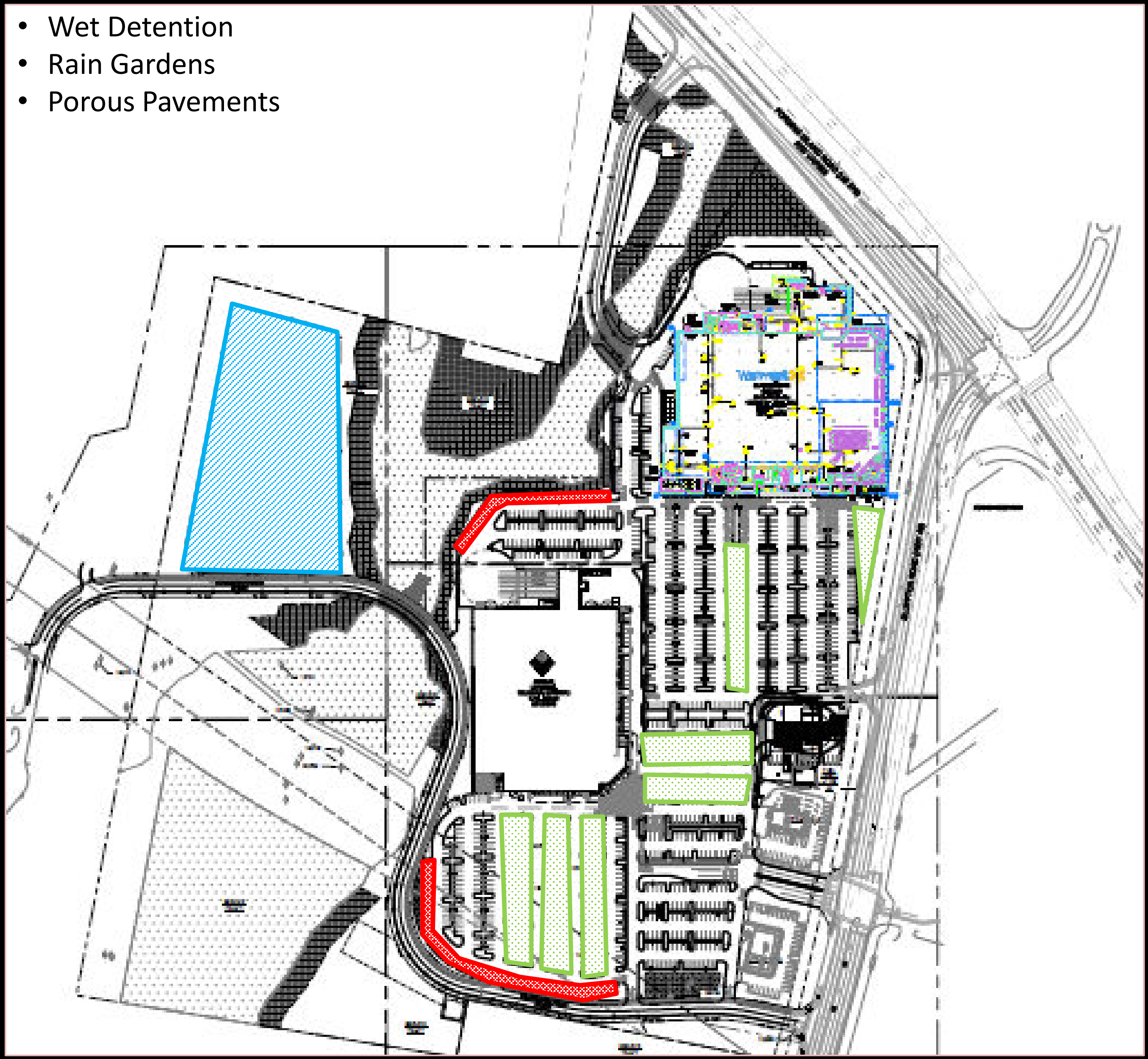
Storm Events	Pre Development Discharge (cfs)	Post Development Discharge (cfs)
2-Year, 24-Hour	18.45	16.04
10-Year, 24-Hour	42.39	41.98
25-Year, 24-Hour	66.91	61.12
50-Year, 24-Hour	92.68	92.10
100-Year, 24-Hour	122.02	138.04

BMP Manual Guidelines

- Water Quality Controls
  - BMP Manual Section 5.4 (paraphrased) – "Antidegradation" **goal** for total phosphorus and total nitrogen is based on annual average loads expected to be generated by land uses with an overall imperviousness of approximately 10%. The load **target** for fecal coliform bacteria should be based on an overall imperviousness of 5%. BMPs are selected based on removal efficiencies.

Water Quality Control

- Wet Detention
- Rain Gardens
- Porous Pavements



Bluffton Gateway - Water Quality Control

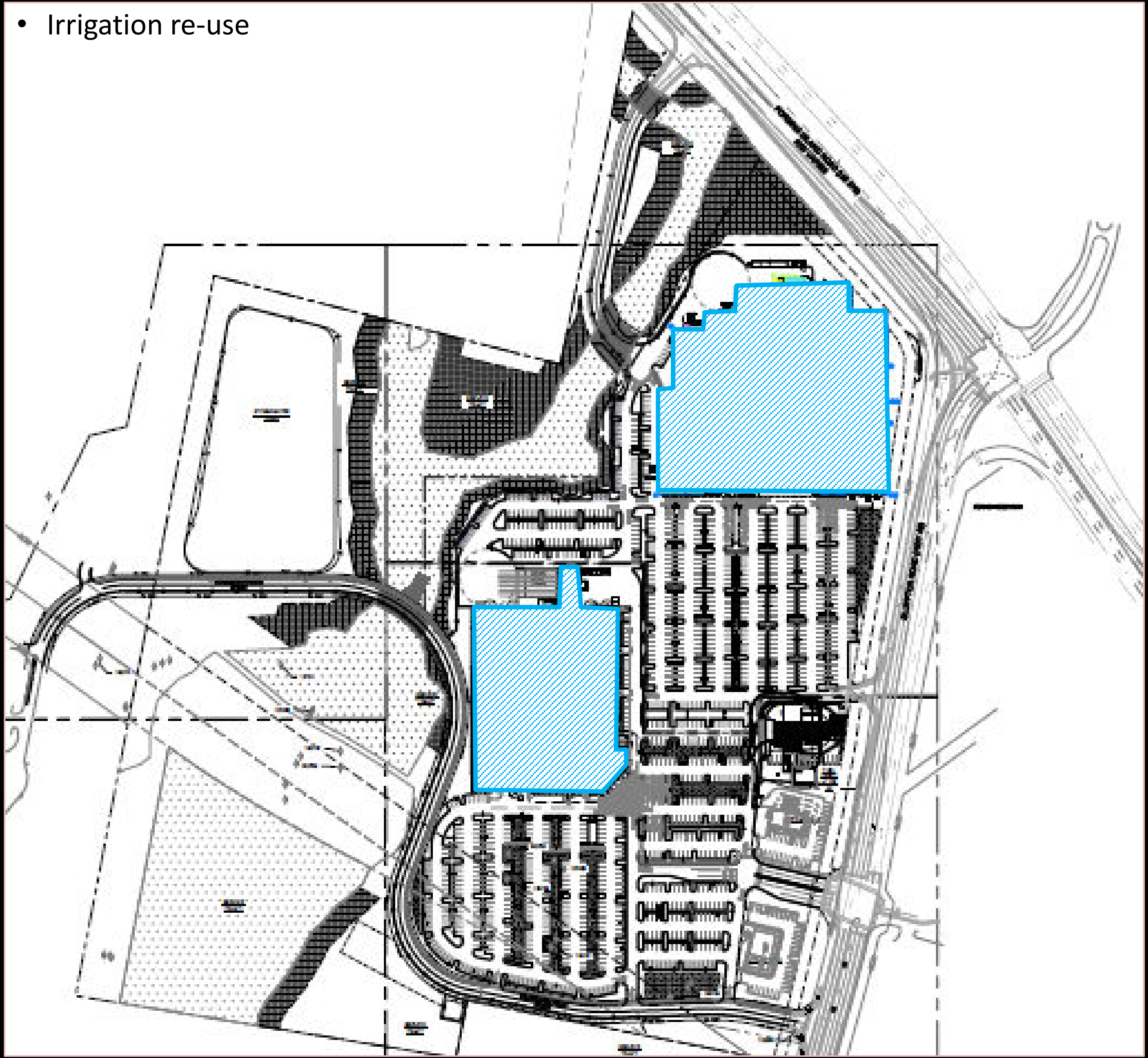
- Kimley – Horn Design utilizes a Wet Detention Pond as primary BMP for nutrient and bacteria removal
- This analysis considers % impervious cover
- Kimley-Horn submitted analyses for 10%, 14.4%, 15.2%, 19.8%, 24.5% effective impervious area
- Any level of effective impervious at or below 19.8% meet this criterion

BMP Manual Guidelines

- Runoff Volume Controls
  - BMP Manual Section 5 – All development will control and retain total volume by retention and other methods to the maximum extent technically feasible (METF) so that stormwater runoff levels will not exceed predevelopment levels for storm events up to the 95^{th} percentile event.

Runoff Volume Control

- Irrigation re-use



Bluffton Gateway - Runoff Volume Control

- Based on the 95th percentile design storm event, Kimley – Horn determined:
  - Pre-Development Volume = 24,189 CF
  - Post-Development Volume = 67,631 CF
  - Increase = 43,442 CF
- Irrigation capture and reuse BMP provides 156,233 CF storage
- Therefore, 100% of site runoff volume is captured

BMP Manual Guidelines

- Impervious Cover Controls
  - BMP Manual Section 5.1 (paraphrased) – Volume control **<u>target</u>** is a threshold of 10% effective impervious area. It is consistent with the overall framework of the BMP reviews for water quality, which allow for anti-degradation loads of total phosphorus (total P), total nitrogen (total N), and fecal coliform from proposed development up to the uncontrolled load expected from a 10 percent impervious development.

Impervious Cover Control

- Irrigation re-use
- Wet Detention
- Rain Gardens
- Porous Pavements

Bluffton Gateway - Impervious Cover Control

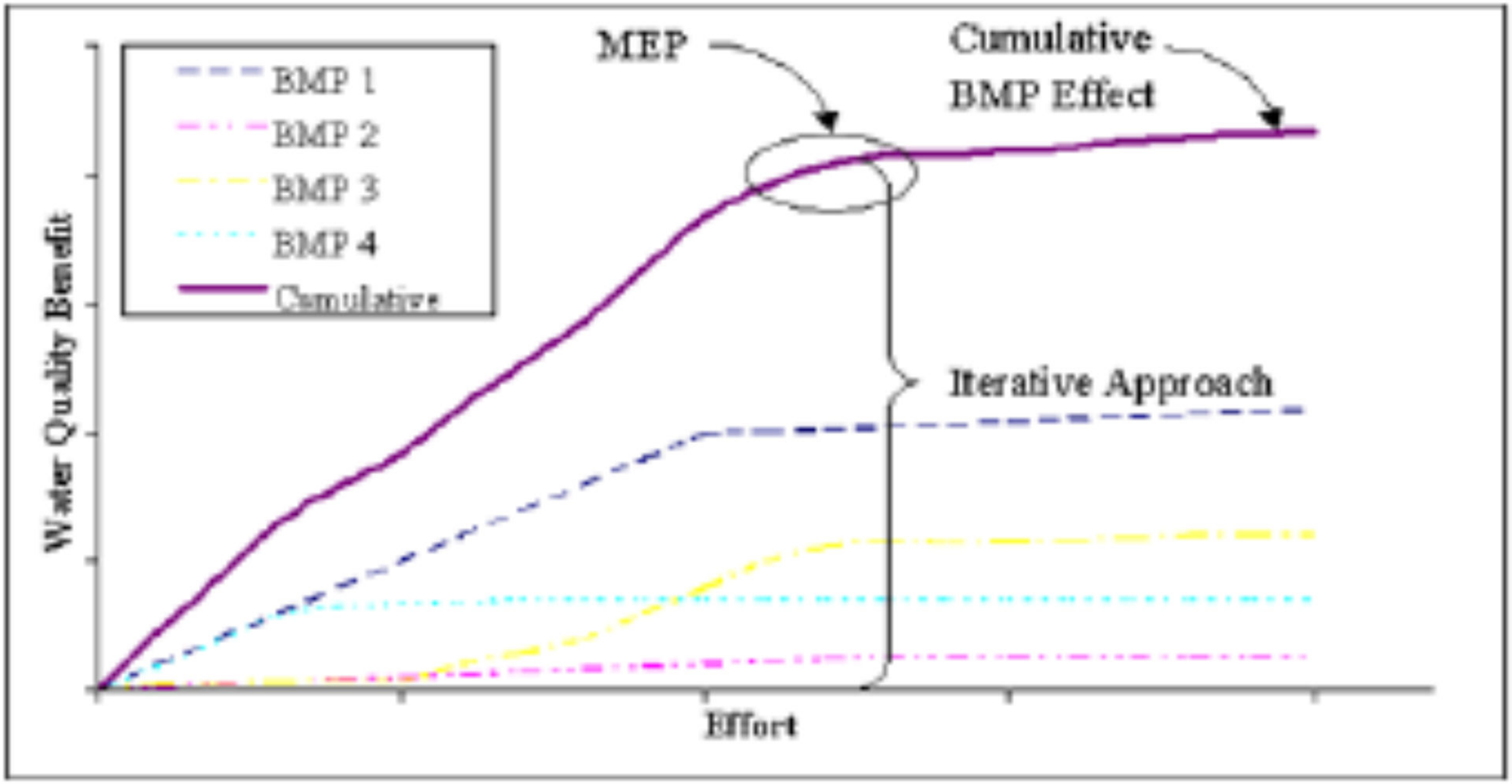
- Kimley-Horn submitted analyses for 10%, 14.4%, 15.2%, 19.8%, 24.5% effective impervious area
- Design utilizes these BMPs:
  - Wet Detention Pond
  - Bio-swales / Rain Gardens
  - Runoff capture and reuse for irrigation
  - Porous Pavement
- The range of values was intended to demonstrate Maximum Extent Practicable (MEP)

The Logic of the "10% Rule"

- …runoff volume controls (are) a different way to handle stormwater runoff and **not an additional set of controls**.
- …by utilizing volume controls, most water quality and some of the peak shaving requirements are also addressed.
- …in addressing a runoff volume requirement, volume quantity and quality **requirements can be integrated by utilization** of Equivalent (effective) Impervious Cover (method).

- D. Ahern, R. Wagner, R. Klink (2012)

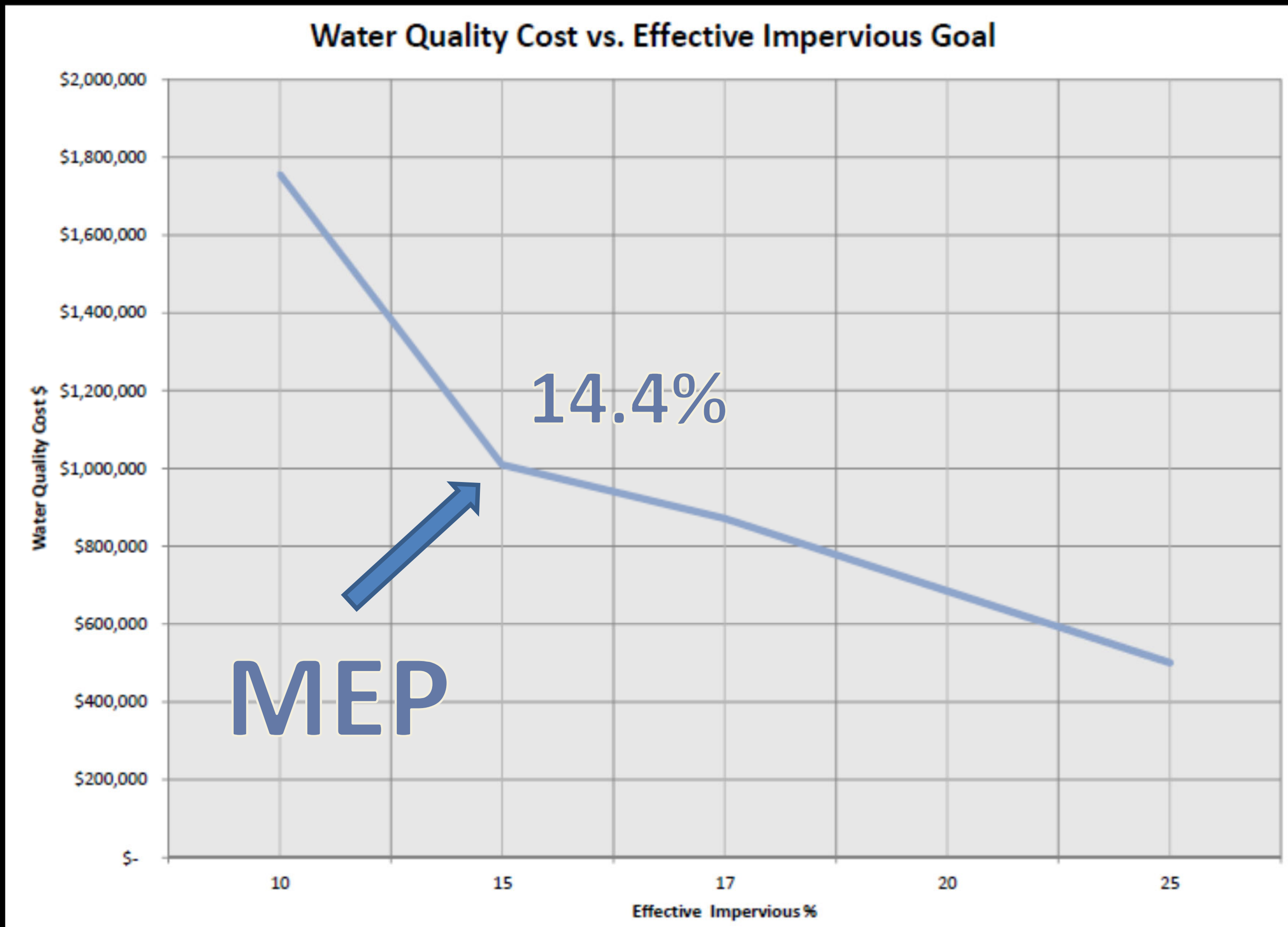
MEP defined



Courtesy of California Water Board

Provided by: SC-DHEC

MEP on Bluffton Gateway site



Conclusion

- 4 separate analyses, but
- Impervious Cover Control review has basis as an alternate approach to review the other three main components and applies a performance standard in those three components.
- The BMP Manual allows compliance with the three main components yet not meet the Impervious Cover Control approach.
- Section 5.1 Volume Control – "if post – development impervious surface runoff is equal or less than pre-development pervious surface runoff, then the effective impervious area is 0%.

Conclusion cont.

- The BMP Manual **does not** mandate the use of specific BMPs. Instead, it offers a variety of BMP alternatives that can be used on a project that have found to be effective in reducing volume and pollutants.
- All BMPs are engineered solutions that require maintenance to remain effective in reducing volume and pollutants.
- The BMP Manual **does not** prohibit the use of "engineered solutions" for BMPs.

BEAUFORT COUNTY
STORMWATER MANAGEMENT UTILITY BOARD AGENDA

Wednesday, December 14, 2016
2:00 p.m.
Executive Conference Room, Administration Building
Beaufort County Government Robert Smalls Complex
100 Ribaut Road, Beaufort, South Carolina
843.255.2805

In accordance with South Carolina Code of Laws, 1976, as amended, Section 30-4-80(d), all local media was duly notified of the time, date, place and agenda of this meeting.

1. CALL TO ORDER – 2:00 p.m.
   A. Approval of Agenda
   B. Approval of Minutes – November 9, 2016 (backup)
2. INTRODUCTIONS
3. PUBLIC COMMENT
4. REPORTS
   A. Utility Update – Eric Larson, P.E. (backup)
   B. Monitoring Update – Eric Larson, P.E. (backup)
   C. Stormwater Implementation Committee Report – Eric Larson, P.E. (backup)
   D. Stormwater Related Projects – Eric Larson, P.E. (backup)
   E. Upcoming Professional Contracts Report – Eric Larson, P.E. (backup)
   F. Regional Coordination – Eric Larson, P.E. (backup)
   G. Municipal Reports – Eric Larson, P.E. (backup)
   H. MS4 Update – Eric Larson, P.E. (backup)
   I. Maintenance Projects Report – David Wilhelm (backup)
   J. Financial Report –Chanel Lewis
5. UNFINISHED BUSINESS
6. NEW BUSINESS
   A. Battery Creek 319 Grant – Neil Desai, City of Beaufort
7. PUBLIC COMMENT
8. NEXT MEETING AGENDA
   A. TBD (backup)
9. ADJOURNMENT