

# NC STATE UNIVERSITY

## Annual Report



### **Stormwater Management**

Environmental Health and Public Safety Center

North Carolina State University

Campus Box 8007

2620 Wolf Village Way ♦ Raleigh, North Carolina ♦ 27695

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# Executive Summary

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## **Report Objective**

This report is prepared in compliance with the requirements of NPDES (National Pollution Discharge Elimination System) Permit No. NCS000376.

The purpose of this annual report is to summarize the University's Permit responsibilities and activities and track compliance requirements for the second year of the five-year term. The Permit identifies several key areas of responsibility with various objectives, management measures, and measurable goals designed to assist the University in improving the quality and quantity of stormwater run-off and discharges. This report will address how the University has met the second-year requirements and goals and describe future plans for maintaining compliance and improving the program.

Information contained in this report covers activities beginning May 1, 2006 and through June 30, 2007. The report will discuss program summary and assessment, the status of various management measures and goals, proposed changes to the stormwater management program or implementation schedule, and successes, failures and milestones or accomplishments of the management program.

## **Background**

North Carolina State University (University, NC State) currently holds a Permit to Discharge Stormwater under the National Pollutant Discharge Elimination System (NPDES). Permit Number NCS000376 was issued on April 18, 2005 with an effective date of May 1, 2005.

The University began implementation of the stormwater management programs to mitigate stormwater pollution impacts on local water quality in 1994, along with the preparation of NPDES Permit Application Parts 1 and 2. Program activities include: implementation of the Stormwater Management Plan and Sediment and Erosion Control Guidelines, installation and maintenance of various structural and non-structural best management practices, stormwater discharges and water quality monitoring, storm sewer system mapping and education, outreach and public involvement.

The University's Stormwater Management Program is developed and administered by Environmental Affairs, a division within the Environmental Health and Public Safety Center. Other University departments such as Facilities Operations, Transportation, Construction Management, Athletics, the Office of the University Architect, and Design and Construction Services work in cooperation with the Stormwater Program Manager to implement specific programs developed in accordance with the Permit requirements.

## **May 2006 – July 2007 Highlights**

Below is a summary of accomplishments by activity category.

<b>Table 1: Accomplishments</b>	
<b>Activity Category</b>	<b>Comments</b>
Education, Outreach and Public Involvement	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Developed a Plan to conduct educational training, workshops and seminars designed to promote, publicize and facilitate proper management of stormwater runoff</li> <li>• Developed awareness information in the form of articles, flyers, mailers, and brochures</li> <li>• Partnered with other agencies to provide training</li> <li>• Developed an educational website</li> <li>• Established a hotline</li> <li>• Participated in special events such as Earth Day</li> </ul>
Illicit Discharge Detection and Elimination	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Developed procedures for investigating and correcting reported illicit discharges.</li> <li>• Corrected five reported problems and currently working to eliminate two other discharges.</li> <li>• Developed a tracking form to better track the progress of investigation and corrective actions.</li> </ul>
Sediment & Erosion Control	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Site evaluations of all active construction sites</li> <li>• Continued implementation of Sediment and Erosion Control Guidelines</li> </ul>
Pre- & Post-Construction Stormwater Management	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Updated and implemented the Stormwater Management Plan Guidelines</li> </ul>
Pollution Prevention and Good Housekeeping	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Continued implementation of existing programs</li> <li>• Developed an "Environmental Concerns" report form available on the website for anyone to submit a concern, question or suggestion.</li> </ul>
Permanent BMPs Inspection & Maintenance	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Engaged in a study to identify, categorize and prioritize permanent BMPs on the campuses of NC State.</li> <li>• Implementing maintenance activities to ensure functionality of BMPs.</li> </ul>
Monitoring	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Developed a Stormwater Discharges and Water Quality Monitoring Plan</li> <li>• Contracted with an independent consultant to begin implementation of the Plan</li> <li>• Completed two sampling events</li> </ul>
Retrofits	<p>Activities:</p> <ul style="list-style-type: none"> <li>• Investigating retrofit locations, suggestions and proposals.</li> </ul>

# Education, Outreach and Public Involvement Program

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## A. Education, Outreach and Public Involvement

North Carolina State University believes an integral part of stormwater management involves the education of the campus community about our local water resources, how we affect water quality, and what we can do to minimize pollution and damage and lessen our impact on the environment. In this context, the University has developed an Education, Outreach & Public Involvement Program that includes the dissemination of stormwater awareness materials, water quality related publications, awareness training, an informational website, educational partnerships, public involvement activities and special events participation.

Below, Table 1 outlines activities designed to raise awareness and educate the campus population about water quality, non-point source pollution and the effects of everyday activities on water quality and nutrient loading. In addition to these activities, NC State Stormwater Management will work in cooperation with other state agencies and organizations in an effort to provide quality education, outreach and public involvement opportunities.

<b>Table 1: Table of Activities</b>	
<b>Outreach &amp; Public Involvement</b>	<b>Awareness Materials</b>
NC Big Sweep	Fact Sheets
Storm Drain Stenciling	Brochures & Flyers
Stream Watch	Awareness Booth with Posters, Educational Information & "Freebies"
Technical Workshops	Informational Videos
Hotline for Reporting Environmental Concerns	Inserts in New Employee and New Student Orientation Packets
Public Speaking	Quarterly Articles <i>Technician</i> and <i>Aware</i> Newsletters
Quarterly Stormwater Committee Meeting	Web Page

## B. Awareness Training & Educational Workshops

NC State Stormwater Management training and technical workshops will specifically target University Project Managers from Design and Construction Services, as well as members of the development community such as engineers, architects, contractors, surveyors, and planners who propose to work on the campuses of NC State. Training and technical workshops will be designed to educate those involved with the design, construction and maintenance of University projects. Table 3 outlines the type of training available on an annual basis.

<b>Table 3: Training and Educational Workshops</b>	
<b>University Project Managers</b>	<b>Development Community</b>
Permitting Requirements <ul style="list-style-type: none"> <li>• Environmental Assessments/FONSI</li> <li>• Stormwater Management Plans</li> <li>• Sediment &amp; Erosion Control</li> <li>• 401/404 Permits &amp; Approvals</li> <li>• Air Permits</li> </ul>	Contractor's Meetings <ul style="list-style-type: none"> <li>• Review of Permit Conditions and Requirements</li> <li>• Review of Sediment and Erosion Control Guidelines</li> <li>• Review of Inspection Procedures</li> </ul>
Plan Submittal & Approval Protocol	Pre-Construction Meetings
Required Permits &/or Approvals	BMP Workshops
Other Applicable Environmental Documentation	Sediment and Erosion Control Workshops

Stormwater Management will also offer a variety of educational seminars and services to the campus and general population. These services and educational seminars will be made available to promote practices conducive to the reduction of pollution and improve awareness about the impacts polluted storm water runoff discharges can have on water quality. As individuals become more informed about the effects their activities have on the quality of the natural environment around them, they are more likely to support and comply with policies to protect the environment.

### **C. Stormwater Management Advisory Committee**

The purpose of the Stormwater Management Advisory Committee of North Carolina State University, herein referred to as the "Committee or SMAC", shall be to 1) provide professional and technical expertise to the campus population, 2) assist the Stormwater Program Manager in establishing and implementing new policies, programs and procedures, 3) provide recommendations to senior leadership, and 4) enforce established policies in accordance with the requirements of the University's National Pollution Discharge Elimination System (NPDES) Permit, the Stormwater Management Program Administrative Rules, University Guidelines and other applicable regulations.

The Committee shall:

- Conduct regular meetings, record minutes and when appropriate, submit findings and recommendations to the Vice Chancellor of Finance and Business.
- Evaluate the University's stormwater management activities, procedures and policies and make necessary updates, modification and/or amendments.
- Amend, if necessary activities, procedures and policies guiding design and development activities, safeguarding the campus population and protecting natural resources on University campuses.
- Enforcement of the University's stormwater management procedures and policies.
- Review and analyze, as appropriate, reports of environmental concerns on the campus and advise on protective, corrective measures.
- Identify opportunities to prevent possible and mitigate existing environmental concerns, issues and/or hazards.

- Furnish consultation to administration, departments, faculty bodies and student organizations with respect to the resolution of environmental and safety concerns.
- Investigate resource availability and make recommendations for their use.

Regularly scheduled Committee meetings shall be open to the general public. The dates/times shall be posted on the Stormwater web page and advertised in campus newsprints.

#### **D. Educational Partnerships**

NC State Stormwater Management will work with University departments and Colleges and other affected communities to share and make use of existing education resources and to jointly conduct some of the education efforts. Working together will provide a more consistent education effort, reduce duplication of efforts as well as be an efficient use of resources.

#### **E. Special Events Participation**

NC State Stormwater Management is able to travel to festivals, fairs, workshops and other appropriate venues with an education booth designed to inform the public about the stormwater program at NC State University. Along with the display, many brochures, pamphlets, and other handouts discussing pollution prevention and water quality issues are available.

## Illicit Discharge Detection and Elimination Program

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### **A. Identifying and Removing Illicit Discharges & Illegal Connections**

Illicit discharges and illegal connections are handled on a case-by-case basis as they are reported or detected. Reports of potential illicit discharges/connections are submitted to the Stormwater Program Manager via a standard form accessible on the Stormwater Management webpage. Individual reports submitted to the Director of Facilities Operations by the Stormwater Program Manager. The Utility Distribution Shop, a division within Facilities Operations, is responsible for investigation of all reports of illicit discharges and illegal connections. Once a report has been investigated, the Utility Distribution Shop documents the findings and coordinates with Stormwater Management. Work orders are then entered into the Work Management System and the Utility Distribution Shop initiates appropriate corrective actions. The Shop submits appropriate response documentation to the Stormwater Program Manager, which is kept on file for a minimum of five (5) years. If an illicit discharge or connection is found to originate outside the University property boundaries, the Program Manager is responsible for notifying the City of Raleigh.

Samples of the Illicit Discharge Incident Tracking Form can be found in Appendix A.

In addition to the on-line report form, the University has established a hotline for reporting environmental concerns. The Safety Hotline was established to help maintain the safest possible environment at NC State University. Faculty, staff, students, and the general public are encouraged to report safety or environmental concerns, complaints, suggestions or comments via phone (515-5445) or fax (515-9804).

The Safety Hotline is available 24 hours a day. You can talk directly to the Safety Hotline Coordinator from 8 a.m. to 5 p.m., Monday through Friday. After these hours, callers are able to leave a message. Callers may remain anonymous.

Comments, concerns and/or suggestions can also be reported via phone call or e-mail transmission to any member of the Environmental Health & Safety Center (EHS). All inquiries will be thoroughly investigated by the appropriate personnel. A report form will be completed for each inquiry then investigated. If necessary, appropriate corrective actions will be taken and recorded. Records shall be kept on file and accessible for the duration of the permit.

The Hotline as well as EHS contact information is accessible through the EHS Webpage at the following address: <http://www.ncsu.edu/ehs> and will be published in all pollution prevention material.

Table 3 summarizes reports collected from January 2006 through August 2007.

<b>Table 3: Illicit Discharge Reports</b>			
<b>January 2006 – August 2007</b>			
<b>Case ID</b>	<b>Status</b>	<b>Comments</b>	<b>Findings</b>
NKNO2	Undetermined	Reported 1/17/06: Murky, foamy water to Rocky Branch	Possible Off-campus contribution - Contacted City of Raleigh. City cleaned boulder basins along Rocky Branch; however, the City does not believe the discharge was from a City source.
UMJ1J	Closed	Reported 2/01/06: Cooking oil spill at Clark Hall	Student was allowed to remove used cooking oil (stored in 55 g drums) used by Clark Hall Dining for alternative fuels graduate projects. The student spills contents. Standard Operating Procedures were developed and implemented by Clark Dining to prevent/reduce these types of incidents.
JKAVF	Closed	Reported 3/2/06: "White water" to Rocky Branch	Determined to be floor-cleaning wastewater from newly installed tile floor at Leazar Hall Renovations. Contractor instructed to dispose of wastewater in sanitary or other appropriate means.
UDCAD	Undetermined	Outfall #RBS14	Investigating the dry weather flow from the outfall. Clear, odorless "water".
HNMMT	Undetermined	Reported 4/27/06 and 6/28/07	Investigating a sudsy flush of discharge from a pipe under Morrill Drive culvert. Typically occurs between 2 and 3 PM.
VX5YC	OPEN	Reported 4/27/06	Sanitary waste to boulder basin of Rocky Branch near Pullen Road. Investigation found a cracked City of Raleigh sewer main. Currently, the City is working to replace pipe. Flow to that section has ceased.
EN3S3	Closed	Reported 4/27/06	Cross connection found by City of Raleigh. Contactor from the Rocky Branch Stream Restoration Project corrected the connection per City requirements.
9BJ5M	Closed	Reported 8/08/06	Dirty water discharge to Rocky Branch. Investigation determined that it was an off-campus contribution. City of Raleigh contacted.
XQ3DL	Closed	Reported 8/31/06	Utilities Distribution Shop located a large root blocking a section of the sanitary sewer. Removed root and improved area.
EEM0L	OPEN	Reported 5/30/07	Discharge upstream of boulder basins of Rocky Branch. Investigation found floor drains in Mann Hall are connected to the storm sewer system. Currently, the University is developing plans to correct the connection.
G4MIM	OPEN	Reported 8/21/07	Two manholes were clogged and overflowing. Lines were cleared and the University is in the process of hiring a company to vacuum the underground settling tank.

**B. Stormwater System Inventory and Prioritization Program**

In order to effectively implement the IDDE program, the University will be updating the current inventory and collecting specific information related to the storm sewer system. Updated and additional information will be collected using existing maps, a field screening process and visual observations. The information will be entered into the University's GIS system, which will allow for capturing, managing, analyzing, and displaying all forms of geographically referenced information. The GIS system is a static annual system, not a hydrologic (stormwater flow) model and will be used as a schematic representation as opposed to an engineering model. The GIS system will be used to generate new, updated maps showing the most current information.

The system capabilities include the following:

- Inventory of stormwater control devices, features and structures, including their characteristics and performance.
- Presentation of monitoring locations and data.
- Document that the University is meeting its nitrogen removal requirements for each developed parcel.
- Manage system maintenance data.

Table 4 highlights the various types of information that will be collected and entered into the system.

<b>Table 4: Campus-Wide Information</b>	
<ul style="list-style-type: none"> <li>• Locations of the all outfalls, ID numbers and size of outfall</li> </ul>	<ul style="list-style-type: none"> <li>• Location of sanitary sewers</li> </ul>
<ul style="list-style-type: none"> <li>• Waters that appear on the USDA B Natural Resources Conservation Service Soil Survey Maps and the US Geological Survey 1:24,000 scale topographic maps.</li> </ul>	<ul style="list-style-type: none"> <li>• Delineation of sub-watershed</li> </ul>
<ul style="list-style-type: none"> <li>• Existing land uses. Categories to be presented are; undeveloped, residential, commercial, agricultural, industrial, institutional, and publicly owned open space.</li> </ul>	<ul style="list-style-type: none"> <li>• Major stormwater structural controls (permanent BMPs)</li> </ul>
<ul style="list-style-type: none"> <li>• Currently operating storage and disposal facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Known NPDES permitted discharges to the stormwater collection system.</li> </ul>

Data retrieval and presentation will include the following:

- Parcel and precinct data that define the stormwater system, including regulatory information and surface water attributes.
- Planning model for Precinct and District levels.
- Calculate the combined effect of stormwater devices on water quality.
- Identification of future stormwater projects or general approaches, which provide most effective stormwater improvements at the best cost.

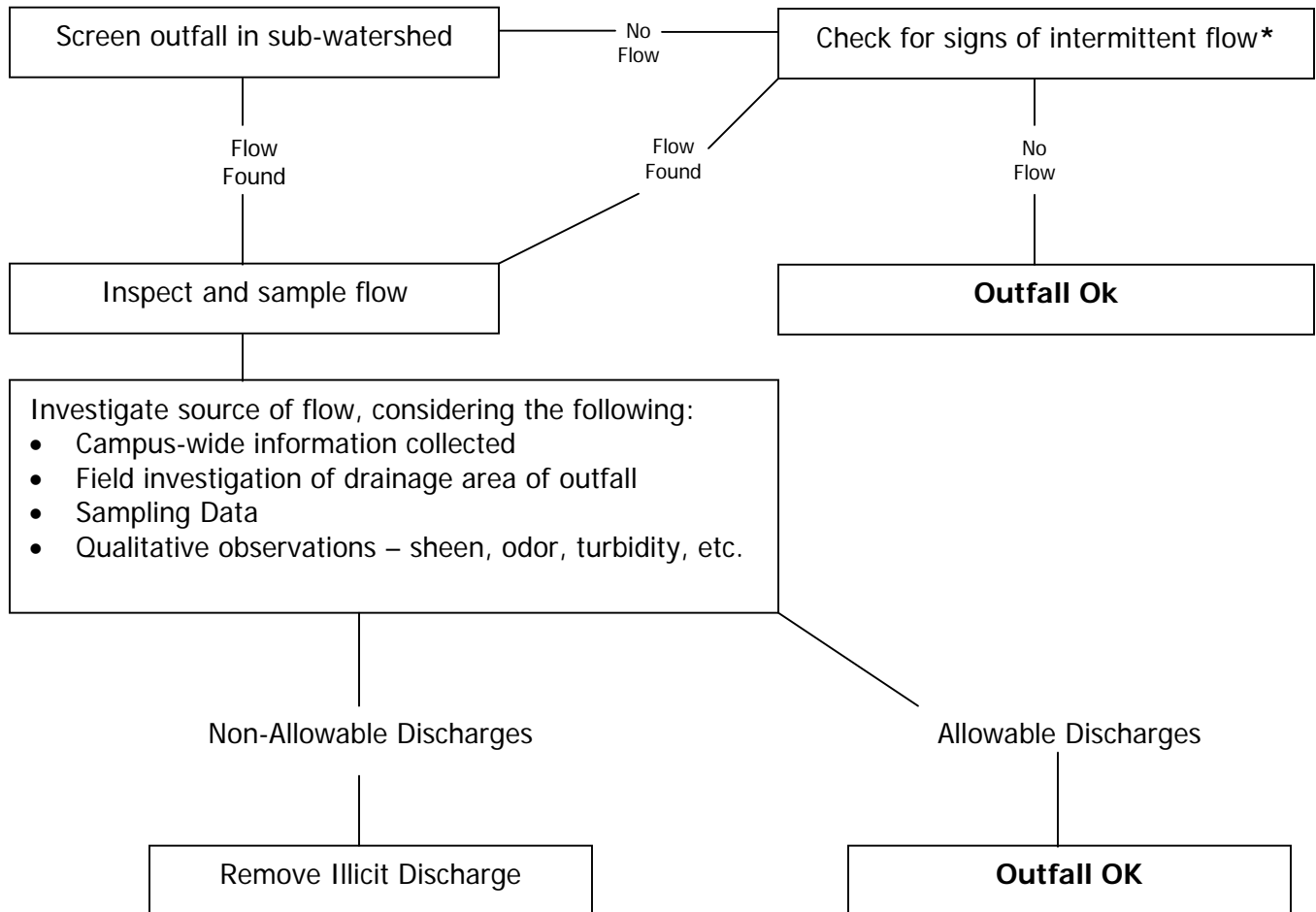
**C. Mapping and Field Screening for High Priority Areas**

The University has developed a field screening process used to identify high priority areas within its property boundaries. Using the new GIS system and updated maps, the campuses will be delineated according to sub-watershed areas. Within each sub-watershed, outfalls will be surveyed for dry weather flow. Figure C-1 illustrates the process that will be used for conducting field screening activities and follow-up of any findings of dry weather flow.

A standard Field Screening Report Form has been developed to log all pertinent information. The form includes the following information:

<b>Field Screening Report Form</b>		
<b>General Information</b>	<b>Visual Observations</b>	<b>Sampling Analysis*</b>
Outfall ID number	Photographs	Temperature
Date & Time	Odor	pH
Date/Quantity of last rain event	Color	Bacteria
Location of Outfall	Clarity	Chlorine
Sub-watershed Basin	Floatables	Copper
Type of Outfall	Vegetation Condition	Dissolved Oxygen
	Structural Condition	Nitrates
		Iron
		Phosphates

Figure C-1



\*Checking for intermittent flow includes re-checking outfall at a later date as well as visual observations for evidence of intermittent flow.

NOTE: Analytical monitoring is required only if an obvious source of dry weather flow cannot be determined through an investigation of the upstream stormwater collection system.

Each outfall will be observed twice within a 24-hr period following a minimum of 72 hours of dry weather. Dry-weather flow will be analyzed in the field using a LaMotte Urban Water Test Kit.

Additional analytical monitoring is required only if an obvious source of dry weather flow cannot be determined through an investigation of the upstream stormwater collection system. In those cases, samples will be analyzed by a North Carolina certified laboratory.

When necessary, other field methods may be used to further identify illegal discharges. These approaches include additional flow monitoring, dye-testing, smoke-testing or television inspection.

#### **D. Training**

NC State Stormwater Management will offer annual training to the campus population that will include:

- Stormwater Awareness and Education
- Procedures for reporting suspected illicit discharges and illegal dumping
- University contract information
- Allowable and Non-Allowable Discharges

Additionally, Stormwater Management staff members and other appropriate departments will be trained on the procedures for routine inspections and maintenance of outfalls, contact information, reporting and recordkeeping and best management practices.

## Sediment and Erosion Control Program

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NC State Stormwater Management has been implementing a Sediment and Erosion Control Program since 2004. Components of the program include:

1. Written guidelines detailing the proper design, installation and maintenance of BMPs
2. Identification of approved/accepted structural BMPs
3. Inspection and Maintenance requirements of temporary BMPs
4. Public Involvement
5. Training
6. Recordkeeping

A representative of Stormwater Management evaluates each site by means of a monthly inspection. A written report is generated to document the findings. The report is sent via e-mail to the University Project Manager, the Director of Construction Management and NC DENR Land Quality Section. The University Project Manager is responsible for ensuring that all necessary corrective actions have been taken.

The University has not received a Notice of Violation for any construction activity since the effective date of the Permit.

## Pre- and Post-Construction Stormwater Management Program

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NC State Stormwater Management has developed and implemented a Pre- and Post-Construction Stormwater Management Program in accordance with the Neuse River Basin Nutrient Sensitive Waters Management Strategy: Basinwide Stormwater Requirements (15A NCAC 2B .0235).

All projects are required to develop a plan based on the Stormwater Management Plan Guidelines. Guidelines are available at the following website:  
<http://www.ncsu.edu/ehs/environ/Stormwater.htm>

New development projects are required to meet the 30% nitrogen reduction goal by implementing planning considerations and best management practices. Additionally, all new construction shall meet the nitrogen-loading limit of 3.6 pounds per acre per year (lb/ac/yr).

Each project is required to incorporate permanent BMPs into the design. If the project can demonstrate that it is simply not feasible to do so, written justification is required. The project will then have the option of partially offsetting projected nitrogen loads by paying an offset fee. However, the total nitrogen-loading rate cannot exceed 6.0 lbs./acre/year for residential development or 10 lbs./acre/year for non-residential development.

Diffuse flow of runoff must be maintained in the riparian buffer by dispersing concentrated flow and reestablishing vegetation. Concentrated runoff from ditches or manmade conveyances are to be converted to diffuse flow before the runoff enters Zone 2 of the riparian buffer. If diffuse flow cannot be achieved, the stormwater must pass through an approved Best Management Practices (BMPs) for a total nitrogen reduction of 30% or greater.

All permanent structural BMPs will be inspected and maintained in accordance with the University's BMP Inspection and Maintenance Program.

## Pollution Prevention and Good Housekeeping

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NC State Stormwater Management and various affected departments will continue to implement the non-structural best management practices, preventative measures and innovative programs currently in place.

Annual educational seminars and training will be made available to promote practices conducive to the reduction of pollution and improve awareness about the impacts polluted storm water runoff discharges can have on water quality. As individuals become more informed about the effects their activities have on the quality of the natural environment around them, they are more likely to support and comply with policies to protect the environment.

# Permanent Best Management Practices Inspection and Maintenance

NC State Stormwater Management will work in cooperation with Facilities Operations to inspect and maintain all permanent structural BMPs. The following guidelines have been developed to meet the requirements of the Permit.

The management of stormwater runoff can be achieved through proper design, installation, inspection and maintenance of various types of Best Management Practices (BMPs). BMPs are defined as activities or structures that help reduce the quantity and improve the quality of stormwater runoff. It is common to categorize BMPs as either structural or non-structural, depending on whether there is a physical control or a management approach to reducing pollution. This document will discuss the inspection and maintenance of structural BMPs only.

The following is a list of devices accepted by the University as structural BMPs for new construction and/or retrofits within the existing landscape:

- Wet Detention Basins
- Constructed Wetlands
- Open Channel Practices
- Riparian Buffers
- Vegetative Filter Strips w/ Level Spreaders
- Bioretention Areas (Rain Gardens)
- Sand Filters
- Proprietary BMP devices
- Green Tree Reservoirs

All designs must be based on the latest edition of the North Carolina Department of Environment and Natural Resources (NC DENR) Design Manual. Any deviation from the Design Manual will require written documentation from the designer proving the design will sufficiently meet all University requirements.

## **Current Inventory of Permanent BMPs**

A current inventory of permanent BMPs is contained in Appendix B. The College of Agriculture and Biological Engineering has performed an extensive study to identify, categorize and prioritize existing BMPs on the campuses of NC State. Facilities Division will utilize this information to develop and implement an inspection and maintenance program to ensure all BMPs continue to function properly. The study will further aid the University in prioritizing those BMPs that require updating or retrofitting.

## **Types of Stormwater Management Ponds**

Stormwater Management Ponds include wet detention basins, dry detention basins, and constructed wetlands.

A wet detention basin is a very desirable method to satisfy both stormwater detention and stormwater quality requirements. It is applicable to most locations

for which the contributing drainage area can support a permanent pool of water. The wet detention basin is effective in removing suspended solids and nutrients.

A dry detention basin is intended to be dry between storm events, but may not necessarily have a chance to drain completely prior to the next storm event. The primary objective is to reduce peak flow discharge and slow the stormwater runoff.

A wetland is defined as an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions, such as a swamp, marsh, bog or vernal spring.

There are two basic wetland designs: extended detention wetlands and pocket wetlands. The intent of a wetland system is to create a shallow matrix of sediment, plants, water and detritus that collectively removes multiple pollutants through a series of complementary physical, chemical and biological pathways.

### **Maintenance of Stormwater Management Ponds**

Maintenance items:

1. Mow vegetative cover to maintain maximum height of six inches.
2. Inspect system for erosion and repair bare or denuded areas immediately.
3. Re-seed as necessary to maintain good vegetative cover.
4. Remove floating debris &/or trash in/around basin or wetland system.
5. Inspect piping, swales, risers, rip rap, etc for damage and repair deficiencies.
6. Remove oil sheen, scum, etc from wet detention basin water surface. Dispose of absorbent materials properly.
7. Remove any obstructions from riser, spillway, and/or inlet/outlet structures.
8. Remove dead or diseased plants and replace during the appropriate planting season.
9. Invasive Plant Removal

#### **For Wet Detention Basin:**

Remove cattails and other native wetland plants when they cover 50% of the **basin** surface. These wetland plants should be encouraged to grow along the vegetative shelf or forebay berm only.

#### **For Stormwater Wetlands:**

Remove cattails, other invasive plants and non-native species as needed to ensure survival of indigenous wetland plants.

10. Sediment Removal:

#### **For Wet Detention Basins:**

Remove accumulated sediment from the wet detention basin system semi-annually or as indicated by the permanent pool marker. A marker shall be placed in the appropriate place to indicate the need for sediment removal. If no marker is present, please contact Environmental Affairs at 515-6850. Removed

sediment shall be disposed of in an appropriate manner and shall be handled in a manner that will not adversely impact water quality.

**For Stormwater Wetlands:**

If the elevation of the marsh areas exceeds the permanent pool elevation, the sediment should be removed to design levels. This shall be performed by removing the upper 6 inches of soil and stockpiling the topsoil. The marsh area shall be excavated 6 inches below design elevations. Afterwards, the stockpiled soil shall be spread over the marsh area. The soil shall not be stockpiled for more than 2 weeks.

11. Level spreaders or other structures that provide diffuse flow shall be maintained semi-annually. All accumulated sediment and debris shall be removed from the structure, and a level elevation shall be maintained across the entire flow spreading structure. Any down gradient erosion must be repaired and/or replanted as necessary.
12. If the basin must be drained for an emergency or to perform maintenance, the flushing of sediment through the emergency drain shall be minimized to the greatest extent possible.
13. All components of the wet detention basin system shall be maintained in good working order.

**Open Channel Practices**

Open Channel Practices include drainage ditches, grass channels, grassed swales, rip rap channels and concrete lined channels.

Grassed swales convey stormwater and provide some stormwater management for small storms by retarding peak flow rates, lowering velocities of runoff and by infiltrating runoff water into the soil. Enhanced grass swales are ordinary swales with small check dams and wide basins along their course. The check dams and wide areas create small pools of water, which slow the water's flow, encourage the water to infiltrate into the soil and enhance pollutant removal.

**Maintenance of Open Channel Practices**

Maintenance items:

1. Mow vegetative cover to maintain maximum height of six inches.
2. Inspect system for erosion and repair bare or denuded areas immediately.
3. Re-seed as necessary to maintain good vegetative cover.
4. Remove debris &/or trash in/around area.
5. Remove any obstructions from spillway, and/or inlet/outlet structures.

**Riparian Buffers**

A Riparian Buffer consists of grass, shrubs and/or trees along the banks of rivers and streams. The protected buffer shall have two zones with a combined width of 50 feet on all sides of the surface water. The zones are described below:

- Zone 1 shall consist of a vegetative area that is undisturbed, beginning at the most landward limit of the top of bank or the rooted herbaceous vegetation and extend landward a distance of 30 feet on all sides of the surface water, measured horizontally on a line perpendicular to the surface water.
- Zone 2 shall consist of a stable, vegetated area that is undisturbed, beginning from the outer edge of Zone 1 and extending landward 20 feet as measured horizontally on a line perpendicular to the surface water.

### **Maintenance of Riparian Buffers**

Maintenance items:

- Debris and litter control checks
- Approved vegetative management practices
- Repair rills and gullies and reseed & replant to maintain dense growth

### **Vegetated Filter Strips w/ Level Spreader**

A vegetated filter strip is a relatively flat band of vegetation located between a pollutant source and surface water. A vegetated filter strip is not intended to receive concentrated flow. Therefore, in most cases it is used in combination with other BMP devices such as a level spreader.

The purpose of a level spreader is to turn concentrated stormwater runoff into sheet flow. This increases infiltration and reduces the volume of runoff. Concentrated flow enters the level spreader then flows through the vegetated filter strip as sheet flow.

### **Maintenance of Vegetated Filter Strips w/ Level Spreader**

Maintenance items:

- Debris and litter control checks
- Vegetative management practices (mowing, trimming, replanting)
- Removal of accumulated sediment
- Repair rills and gullies
- Maintain level spreader
- Reseed & regrade to maintain dense growth

### **Bioretention Areas (Rain Gardens)**

Bioretention areas are landscaping features modeled after forested ecosystems often used as off-line systems to treat the first flush of runoff from impervious surfaces. Specific plant species are selected based on their ability to cycle and assimilate nutrients, pollutants and metals. Bioretention areas are commonly located in parking lot islands or within small pockets of landscaped areas.

Surface runoff is directed into shallow, landscaped depressions where it is allowed to infiltrate through the surface organic layer of mulch and/or ground cover. Over a period of days, the runoff is discharged to the in-situ material underlying the bioretention area or through an underdrain.

### **Maintenance of Bioretention Areas (Rain Gardens)**

Maintenance items:

- Debris and litter control checks for obstructions
- Vegetative management practices (mowing, pruning, fertilizing, weed control)
- Mulch denuded or void areas
- Erosion control
- Remove/replace all dead vegetation
- Treat or replace diseased vegetation

Due to precipitation and the influences of stormwater runoff, the bioretention area may become very acidic. For that reason, it may be necessary to apply an alkaline substance to the area. Testing of the pH of the organic layer and soil should precede the application to determine the proper amount required.

When necessary, replace support stakes by hand in the spring of each year.

### **Sand Filters**

Sand filters are devices that filter stormwater runoff through a sand layer into an underdrain system then convey the treated runoff to a detention facility or to the ultimate point of discharge. The sand filtration system consists of an inlet structure, sedimentation chamber, and underdrain piping. Sand filters rely on physical straining, pollutant settling and pollutant adsorption to remove pollutants from stormwater runoff.

Inspections and maintenance shall be performed as needed, or as indicated on the BMP01 Form and within 24 hours after a rain event producing greater than 0.50 inches of rain per 24 hours.

### **Maintenance of Sand Filters**

Maintenance items:

- Debris and litter control checks for obstructions
- Vegetative management practices (mowing, pruning, fertilizing, weed control)

At least once a year, each filter must be inspected after a storm event to determine if the filter bed is passing the runoff as expected. Maintenance is required if the system is not passing at least one inch of runoff within 24 hours.

Remove the first 2 or 3 inches of discolored sand and replace with new sand. Contaminated sand should be dewatered (if necessary) then land filled. Additionally, the sediment chamber should be pumped and cleaned. This material can also be dewatered then land filled.

### **Proprietary BMP Devices**

Proprietary devices shall be installed and maintained in accordance with manufacture's recommendations.

## Monitoring

NC State Stormwater Management has contracted with Piedmont Geologic to conduct stormwater discharge and water quality monitoring. Twelve (12) locations throughout the campuses of NC State will be sampled. The table below details each location.

<b>Table 5: Sampling Locations</b>				
<b>Sample No.</b>	<b>NCSU Sample Location Name</b>	<b>Campus Location</b>	<b>Outfall or In-stream</b>	<b>Location Information</b>
1	RBS69	Main Campus – Rocky Branch	Outfall	Corner of Sullivan & Gorman
2	RBS40	Main Campus – Rocky Branch	Outfall	Corner of Dan Allen & Sullivan
3	RBS14	Main Campus – Rocky Branch	Outfall	Outfall at Morrill Dr culvert
4	RBN10	Main Campus – Rocky Branch	Outfall	Outfall directly to Rocky Branch
5	RBN00	Main Campus – Rocky Branch	In-stream	Before Pullen Rd culvert
6	NB100	Centennial Campus – North Creek	Outfall	Beginning of North Creek
7	SWP02	Centennial Campus – North Creek	Outfall	Stormwater Mgmt Pond #2
8	NA105	Centennial Campus – North Creek	Outfall	Outfall at constructed wetland
9	SWP03	Centennial Campus – North Creek	In-stream	Under pedestrian crossing
10	HCV01	Centennial Biomedical Campus	Outfall	Outfall of constructed wetland
11	HVC02	Centennial Biomedical Campus	In-stream	In-stream grab sample
12	HVC03	Centennial Biomedical Campus	In-stream	In-stream grab sample

Stormwater Discharges and Water Quality Sampling results can be found in Appendix C.

The Stormwater Management Advisory Committee evaluates potential locations suitable for a stormwater retrofit or BMP update. The campus population is encouraged to submit proposals and ideas for consideration. Funds will be made available for qualifying projects through the Offset Payment Fund. Current proposals being investigated at this time include:

1. DH Hill Library: modifications to the existing landscape and stormwater inlets to reduce flooding.
2. Flex Laboratory Building: improvements to the wet detention pond to stabilize outfall and establish appropriate vegetation.
3. Tucker-Owen Beach Renovation: improvements to existing storm sewer system to eliminate flooding and improve pedestrian access.

## Environmental Management System

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The Environmental Health and Safety Center at North Carolina State University has initiated a computer based environmental compliance information management system to store, maintain, automate and report environmental compliance data related to its environmental programs. The purpose of the electronic database is to develop a user-friendly system that will be used by the environmental managers and his staff to track the status of regulatory compliance at three NC State campuses and to ensure NC State's ability to maintain compliance.

The electronic Compliance Information Management System (CIMS) incorporates the following major features:

- Ability to generate reports of applicable environmental requirements;
- Query tools to easily sort data (i.e. provide all requirements due next month or provide all requirements associated with a specific staff member, etc.);
- Integrated, automatic e-mail notification of upcoming regulatory deadlines;
- Data entry, editing and exporting routines; and
- Ability to mark tasks as complete.

The data management system provides a tool for NC State managers to track and maintain regulatory compliance and ultimately gives the managers decision-making tools to manage complex programs and access important environmental data quickly and easily, saving time and maximizing existing resources.

## Certification

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"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Printed

Name: Mr. Charles D. Leffler

Title: Vice Chancellor for Finance and Business

**APPENDIX A**

**ILLICIT DISCHARGE TRACKING FORMS**

**APPENDIX B**

**PERMANENT BMP INVENTORY**

**APPENDIX C**

**STORMWATER DISCHARGES  
AND WATER QUALITY SAMPLING RESULTS**