

Chapter 10

Stormwater and Wastewater Management for Improved Water Quality

10.1 Introduction to Stormwater Runoff

Stormwater runoff is rainfall or snowmelt that runs off the ground or impervious surfaces (e.g., buildings, roads, parking lots, etc.). In some cases, it drains directly into streams, rivers, lakes, and oceans. In other cases, particularly in urbanized areas, stormwater drains into streets and manmade drainage systems consisting of inlets and underground pipes, commonly referred to as a storm sewer system. Storm sewer systems are designed simply to capture the stormwater and convey it to the nearest surface water without treatment. These sewers should not be confused with sanitary sewers, which transport human and industrial wastewaters to a treatment plant before discharging into surface waters.

Common stormwater pollutants include sediment, nutrients, organic matter, bacteria, oil and grease, and toxic substances (e.g., metals, pesticides, herbicides, hydrocarbons). Stormwater can also impact the temperature of a surface waterbody, which can affect the water's ability to support certain fish and aquatic communities.

Uncontrolled stormwater runoff has many impacts on both humans and the environment. Cumulative effects include flooding, undercut and eroding streambanks, widened stream channels, threats to public health and safety, impaired recreational use, and increased costs for drinking and wastewater treatment. For more information on stormwater runoff, visit the DWQ Stormwater Permitting Unit at <http://h2o.enr.state.nc.us/su/stormwater.html> or Chapter 5 of the *Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans* <http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>.

10.2 Stormwater Programs

The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include National Pollutant Discharge Elimination System (NPDES) Phase I and II regulations, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Currently, there are 25 individual stormwater permits listed for the Pasquotank River basin and Phase I regulations are not applicable. However, there are a few local governments and/or counties that are affected by other water quality protection programs.

DWQ's Stormwater Permitting Unit webpage: <http://h2o.enr.state.nc.us/su/index.htm> provides links to the stormwater BMP manual, a map tool to identify where file a permit and guidance on North Carolina's evolving stormwater programs. A description of Federal and State stormwater regulations and programs are also described in detail in Chapter 5 of the *Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans* <http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>.

Stormwater Regulation Challenges

One challenge in meeting the goal of enhancing and protecting water quality is the state's inaccurate or lack of location data to identify permitted stormwater discharges. This permit data is important to DWQ for both tracking and renewing permits, assessing the program, and determining potential cumulative impacts. Discharge outfall locations are also important to compliment protection and restoration efforts by other organizations. In particular, the Division of Environmental Health needs to include the data in their extensive surveys of pollution sources for shellfish growing areas.

To correct this problem, updating discharge locations began in 2005 to include GPS coordinates of outfalls and digital photographs. A temporary administrative staff position has been requested to begin updating or correcting coastal stormwater permit data in DWQ's Basinwide Information Management System (BIMS) database. DWQ is working with regional offices to ensure data entry is consistent and a protocol exists for collecting GPS coordinates in a consistent manner at permitted sites.

As a result of the 2005-2006 municipal outfalls updates the number of untreated stormwater outfalls detected are listed in Table 22 below:

Table 22 Stormwater Outfalls (2005-06)

Municipality	Number of Outfalls Identified
Columbia	9
Creswell	5
Elizabeth City	10
Hertford	11
Kill Devil Hills	2
Manteo	5
Southern Shores	3

2007 Recommendations

DWQ recommends that local government and county officials in the basin develop stormwater management programs for new development and to retrofit existing development. In particular, Elizabeth City and Dare County would improve water quality in their jurisdiction if they were to voluntarily begin developing stormwater programs meeting Phase II standards. DWQ and other NCDENR agencies will continue to provide information on funding sources and technical assistance to support local government and county stormwater program development.

10.3 Wastewater Management Programs

10.3.1 NPDES Wastewater Discharge Permit Summary

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities and stormwater discharges associated with certain industrial activities. Point

source dischargers in North Carolina must apply for and obtain a NPDES permit. Discharge permits are issued under the NPDES program, which is delegated to DWQ by the Environmental Protection Agency (EPA).

Currently, there are 33 permitted wastewater dischargers in the Pasquotank River basin. Table 23 provides summary information (by type and subbasin) about the discharges. The types of dischargers listed in the table are described in the inset box. Facilities are mapped in each subbasin chapter, and a complete listing of permitted facilities is included in Appendix III.

Table 23 Summary of NPDES Dischargers and Permitted Flows for the Pasquotank River Basin (August 2006).

Facility Categories	03-01-50	03-01-51	03-01-52	03-01-53	03-01-54	03-01-55	03-01-56	TOTAL
Total Facilities	6	6	4	11	2	3	1	34
Total Permitted Flow (MGD)	4,984,000	1,490,000	700,000	753,000	600,000	2,143,200	1,420,000	12,090,200
Facilities Grouped by Size								
Major Discharges	1	1	0	0	0	0	0	2
Permitted Flow (MGD)	4,500,000	1,000,000	0	0	0	0	0	5,500,000
Minor Discharges	5	5	4	11	2	3	1	32
Permitted Flow (MGD)	484,000	490,000	700,000	753,000	600,000	2,143,200	1,420,000	6,590,200
Facilities Grouped by Type								
100% Domestic Waste	1	0	0	1	0	0	0	2
Permitted Flow (MGD)	7,000	0	0	6,000	0	0	0	13,000
Municipal Facilities	1	1	1	3	0	0	0	6
Permitted Flow (MGD)	4,500,000	1,000,000	700,000	449,000	0	0	0	6,649,000
Nonmunicipal Facilities	5	5	3	8	2	3	1	28
Permitted Flow (MGD)	484,000	490,000	---	304,000	600,000	2,143,200	1,420,000	5,441,200

10.3.2 NPDES Wastewater Non-Discharge Permit Summary

The Land Application Unit (LAU) in the Aquifer Protection Section of DWQ oversees non-discharge wastewater treatment and recycle systems including land application of wastewater and residuals. The program has operational and monitoring requirements similar to those of the NPDES wastewater program; however, the primary difference is that the treated effluent is not discharged to surface waters. Instead, it is usually discharged to a spray irrigation system for land application. Some other options for the land application of effluent include rapid infiltration basins and drip irrigation systems.

Systems that are reviewed and permitted by LAU include spray irrigation systems, animal waste management systems, rapid infiltration basins, drip irrigation systems, land application of residuals, wastewater collection systems, and beneficial reuse of wastewater systems. The non-discharge program and all associated permits, is regulated by North Carolina General Statutes 143.215.1 and Administrative Code Section 15A NCAC 2T .0100 - Waste Not Discharged to Surface Waters. These sections not only give DWQ the authority to issue permits, but they also provide details on the permitting process and information that must be submitted with a permit application.

Every wastewater treatment facility in the State of North Carolina, including large NPDES facilities, pretreatment systems and non-discharge systems, produce some form and amount of wastewater residuals. DWQ requires a permit for the land application of these residuals. The program was developed around the EPA rules 40 CFR Part 257 and 40 CFR Part 503.

Within the Pasquotank basin, it is important to note that there is a direct connection between groundwater and surface water in many places. Drainage ditches and canals are widespread in northeastern NC and function as a direct pathway for groundwater that may be impacted from nutrients and coliform bacteria, especially in rural areas where agriculture is widespread, to enter into the surface water system. In other cases, surface water bodies, themselves, directly border areas where groundwater quality may be impaired. In many areas, the time it takes for groundwater to move into the surface water system is brief. Although groundwater quality at non-discharge facilities may be compliant with 2L groundwater quality standards, groundwater flux moving into the surface water system has the ability to transport contaminants into surface water bodies and add to total mass loadings. It is recommended that research be conducted to better establish and understand the relationship between groundwater and surface water in eastern North Carolina. Such understanding would provide for more accurate assessment of surface water impairments resulting from groundwater discharges and enable the state to make sound permitting judgments and recommendations to better protect water quality in general.

Many non-discharge systems are constructed by the developer and turned over to a homeowners association (HOA) after completion. If there is a major problem, the HOA is responsible for the repair bill and funding the repair can be an issue. For systems that will be or are owned by a HOA, the statutes and rules require special accounts be set up by the HOA for the operation of the treatment system. In addition, the HOA must set up a reserve fund for major repairs.

Non-discharge systems create some challenges for the DWQ regional offices in terms of inspections and assuring permit and compliance conditions are met. DWQ may seek additional staffing resources to meet these challenges. One of DWQs goals is to better review covenants and bylaws upon permit review to make sure that HOAs are adhering to the financial assuredness requirements under the permit.

In the Pasquotank River basin, 20 non-discharge permits have been issued (See Table 24). More information about non-discharge permits can be found on the DWQ LAU Web site (<http://h2o.enr.state.nc.us/lau/main.html>) and in the *Supplemental Guide to North Carolina's Basinwide Planning* document (<http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>).

Table 24 Summary of NPDES Non-Discharge Permits for the Pasquotank River Basin (August 2006).

Facility Categories	03-01-50	03-01-51	03-01-52	03-01-53	03-01-54	03-01-55	03-01-56	TOTAL
Total Facilities	2	0	3	2	6	1	6	20
Total Permitted Flow (MGD)	260,000	0	487,667	29,000	1,089,000	350,000	584,000	2,799,667
Facilities Grouped by Size								
Major Discharges	1	0	2	1	5	1	4	14
Permitted Flow (MGD)	250,000	0	483,167	25,000	1,085,000	350,000	582,500	2,775,667
Minor Discharges	1	0	1	1	1	0	2	6
Permitted Flow (MGD)	10,000	0	4,500	4,000	4,000	0	1,500	24,000
Facilities Grouped by Type								
Government-Municipal	1	0	0	0	0	0	0	1
Permitted Flow (MGD)	10,000	0	0	0	0	0	0	10,000
Government-County	0	0	0	0	2	0	0	2
Permitted Flow (MGD)	0	0	0	0	540,000	0	0	540,000
Government-State	0	0	0	1	0	0	0	1
Permitted Flow (MGD)	0	0	0	25,000	0	0	0	25,000
Non-Government	1	0	3	1	4	1	6	16
Permitted Flow (MGD)	250,000	0	487,667	4,000	549,000	350,000	584,000	2,224,667

10.3.2.1 Coastal Wastewater Management Strategies

New development activities in coastal areas frequently rely on non-discharge systems for wastewater treatment and disposal. These treatment systems are designed to satisfy at least the minimum permitting requirements for protection of the surface and ground waters that they could potentially impact. Permitted non-discharge facilities can be a good alternative to permitted surface water discharges when appropriately permitted based on site conditions for disposal and treatment. The new rules for waste not discharged to surface waters can be found at: <http://h2o.enr.state.nc.us/admin/rules/documents/2Tbook.pdf> as 15A NCAC 02T. Numerous non-discharge systems and necessary treatment requirements are described at this website. These rules replaced the earlier 15A NCAC 02H .0200 rule version and are used in concert with 15A NCAC 02H .0400 rules (Coastal Waste Treatment Disposal Rules).

Reuse quality treatment may use infiltration ponds, but many systems use a sprayfield area with known soil types and crop designations along with hydraulic limits for disposal. Older, smaller package plants often have rotary distributor disposal systems, although these are becoming outdated and are being replaced by drip irrigation or small spray systems.

Setbacks are required for surface waters, drainage ditches and waterways for all irrigation sites. The land surface provides a final "treatment" phase in the disposal process, allowing for uptake and often vegetative removal of nutrients and/or fecal coliform bacteria that may be present in plant effluent depending on the level of treatment permitted for a given facility. However, the effectiveness of this treatment depends upon the ability of the cover crops to take up the

nutrients. In addition, the coarse grain sands do not always provide adequate adsorption and retention time before it enters groundwater. With the promulgation of the Subchapter 02T rules, high-rate systems must meet more stringent effluent limitations and/or increased setbacks.

If the water table is high in a disposal area, water level meters are installed to prevent irrigation until there is a certain vertical separation between the land surface and the water table. Runoff is a real concern at any irrigation site, but it can be prevented with proper hydraulic loading (water balance), buffering, and storage.

In the Pasquotank River basin there is documentation of some problems associated with these non-discharge systems. These problems are typically traced back to operator and operational system management issues or poor design. The Currituck Club, The Villages at Ocean Hill, Pine Island, The Village at Nags Head, and The Villas in Nags Head are communities with wastewater treated in package plants.

Another issue that can be associated with non-discharge systems is the installation of high rate infiltration systems in very densely developed areas. The high rate systems, combined with low-pressure systems and individual septic tank systems, can overload the upper groundwater aquifer in coastal areas. These conditions make it very difficult to conduct meaningful groundwater compliance monitoring because of the large number of neighboring influences from septic systems. Some solutions include effluent monitoring limits combined with more effective bacteriological treatment, increased denitrification, centralized waste treatment or limiting growth.

Non-discharge systems work well when the site is conducive to infiltration. However, problems can arise when the site is a low-lying area with a high groundwater table (thereby inhibiting infiltration), or with nearby wetlands or ditches that can act as a conduit for runoff. Most non-discharge spray irrigation sites have storage ponds that would allow the wastewater to be held until appropriate to spray.

Many non-discharge systems are constructed by developers and turned over to a homeowners association (HOA) after completion. If there is a major problem, the HOA is responsible for the repair bill and funding the repair can be an issue. For systems that will be or are owned by a HOA, the statutes and rules require special accounts be set up by the HOA for the operation of the treatment system. In addition, the HOA must set up a reserve fund for major repairs.

There are also "space" issues to consider. Although a designated green space area (in essence a repair area) is required for a coastal project, the repair solution can still be difficult to implement due to limited space to work in.

Non-discharge systems create some challenges for the DWQ regional offices in terms of inspections and assuring permit and compliance conditions are met. DWQ may seek additional staffing resources to meet these challenges. One of DWQs goals is to better review covenants and bylaws upon permit review to make sure that HOAs are adhering to the financial assuredness requirements under the permit.

10.4 On-Site Waste Management

North Carolina has enacted laws and adopted rules that mandate significant requirements for inspection and review of On-site Waste System (OSWS) performance. Siting, sizing, inspections, approvals, and permitting are the responsibilities of County Health Departments through their local authorized agents, but engineers and regional soil specialists are called upon for training, authorization, informal appeals, and consultation with environmental health specialists. Enforcement of onsite wastewater rules and laws is the responsibility of the local environmental health specialists. For more information on NC state rules pertaining to site evaluations and soil suitability for septic systems see http://www.deh.enr.state.nc.us/osww_new/images/Rules/1900RulesJune2006.pdf.

Septic Systems and Straight Piping

With increase in development there is an increase in demand for individual wastewater treatment systems requiring higher flows on smaller tracks of land. Wastewater from many households is not treated at wastewater treatment plants associated with NPDES discharge permits. Instead, it is treated on-site through the use of permitted septic systems. Poorly planned and/or maintained systems can fail and contribute to nonpoint source pollution. Wastewater from some of these homes illegally discharges directly to streams through what is known as a "straight pipe". In other cases, wastewater from failing septic systems makes its way to streams or contaminates groundwater. Straight piping and failing septic systems are illegal discharges of wastewater into waters of the State.

With on-site septic systems, the septic tank unit treats some wastes and the drainfield provides further treatment and filtration of the pollutants and pathogens found in wastewater. A septic system that is operating properly does not discharge untreated wastewater to streams and lakes or to the ground's surface where it can run into nearby surface waters. Septic systems are a safe and effective long-term method for treating wastewater if they are sited, sized and maintained properly. If the tank or drainfield are improperly located or constructed, or the systems are not maintained, nearby wells and surface waters may become contaminated, causing potential risks to human health. Septic tanks must be properly installed and maintained to ensure they function properly over the life of the system. Information about the proper installation and maintenance of septic tanks can be obtained by calling the environmental health sections of the local county health departments. See Appendix IV for contact information.

Discharge of untreated or partially treated sewage can be extremely harmful to humans and the aquatic environment. Pollutants from illegally discharged household wastewater contain chemicals, nutrients, disease pathogens and endocrine disrupting chemicals. Although DWQ's ambient monitoring of the waters in the Pasquotank River basin show a relatively small percentage of fecal coliform bacteria samples exceeding state standards for primary recreation, smaller streams may contain a higher concentration of bacteria and other pollutants. The economies of the counties in this basin are highly dependent upon river recreation, especially for tourists and seasonal residents.

2007 Recommendations

In order to protect human health and maintain water quality failing septic systems should be repaired, older systems must be updated, and straight pipes must be eliminated. Additional monitoring of fecal coliform throughout tributary watersheds will aid in identifying where

straight pipes and failing septic systems are problems. Furthermore, precautions should be taken by local septic system permitting authorities to ensure that new systems are sited and constructed properly and an adequate repair area is also available. County, town and city planners need to understand the economic and human health ramifications caused by unsatisfactory septic systems and plan for long-term septic system sustainability. In areas where soils prevent individual septic systems a collective community septic system in appropriate soils may allow for sustainable development where a centralized sewer system is not available. Educational information should also be provided to new septic system owners regarding the maintenance of these systems over time. For more information please see Chapter 9 in the *Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans*. <http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>.

On-going on-site waste management activities in the Pasquotank Basin are led by the Albemarle Regional Health Services (ARHS), a district Board of Health for Bertie, Gates, Pasquotank, Perquimans, Camden, Tyrrell, and Washington counties, which conducts annual inspections on all 3,500 innovative and alternative systems. In addition, Chowan, Currituck, Hertford, and Martin counties contract with ARHS for their services. They follow-up on all on-site waste system repairs and are responsible for conventional systems within the 7-county district.

DENR On-Site Wastewater System Management

DENR has several initiatives related to on-site wastewater education, including current literature and scientific evaluation of potential pollutants from On-site Wastewater Systems. The Division of Environmental Health (DEH) On-Site Wastewater Section has an active grant-seeking program. Current successful grants include those to the Wastewater Discharge Elimination (WaDE) program for eliminating straight pipes and failing systems, nonpoint source coordinator grants for fate and transport of microbes in the shellfish areas, endocrine disrupting chemicals and pharmaceuticals, and an on-site management grant. The DEH Shellfish Sanitation and Recreational Water Quality Section also have significant involvement with on-site wastewater inspections and protection of water quality in the CAMA counties. Sanitary Surveys are conducted for the shellfishing harvesting areas, which include inspecting on-site wastewater discharges. On-site wastewater systems are inspected once every year as a drive-by or shoreline observation, and every three years door-to-door inspections. The Division of Waste Management oversees the septage management firms and septage disposal in NC.