Total Maximum Daily Load
The Okatie River
Shellfish Fecal Coliform
Total Maximum Daily Load for Stations
18-07, 18-08, 18-16, 18-17
Shellfish Management Area 18
Hydrologic Unit Code 030502080606

Prepared for
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D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Abstract

The Okatie River is located in Shellfish Management Area 18 in Beaufort and Jasper Counties and is 25.5 mi^2 in area. There are six shellfish monitoring sites located in this drainage area. Four of these shellfish monitoring stations are included on the 2008-303(d) List of Impaired Waters for exceeding shellfish fecal coliform water quality standards. This area is also restricted for shellfish harvesting.

Existing conditions and percent reductions for the hydrodynamically complex system of the Okatie River were calculated using cumulative probability distributions. Depending on the station, the percent reduction required to meet the fecal coliform water quality standard ranges from 21% to 51%. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the wasteload allocation (WLA) and demonstrate consistency with the assumptions and requirements of the TMDL. For SCDOT, existing and future NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of WLA to the Maximum Extent Practicable (MEP). For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of its permit is effective implementation of the WLA. Required load reductions in the load allocation (LA) portion of this TMDL can be implemented through voluntary measures.

The South Carolina Department of Health and Environmental Control (SCDHEC) recognizes that **adaptive management/implementation** of this TMDL might be needed to achieve the water quality standard and we are committed towards targeting the load reduction to improve water quality in the watershed used in the development of this TMDL document. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL target accordingly.

Table Ab-1. Total Maximum Daily Loads for the Okatie River watershed. Loads are expresses as colony forming units (cfu) per 100 ml

Station	90th %tile of Existing Load (cfu/100ml)	TMDL [1, 2] (cfu/ 100ml)	WQ Target (cfu/ 100ml)	Margin Of Safety (cfu/ 100ml)	WLA			LA
					Continuous Sources[3] (cfu/ 100ml)	Non-Continuous [4, 7] Sources (% Reduction)	Non-Continuous SCDOT [7] (% Reduction)	% Reduction to Meet LA[7]
18-07	33	43	40.9	2.1	N/A	N/A	N/A	N/A
18-08	84	43	40.9	2.1	N/A	51%	51% [6]	51%
18-16	67	43	40.9	2.1	N/A	39%	0% [5]	39%
18-17	58	43	40.9	2.1	N/A	21%	0% [5]	21%

Table Notes:

1. TMDL is expressed as a concentration. If daily average tidal exchange estimates were available, this number could be converted to load in cfu/day by multiplying flow by concentration and a conversion factor.

2. Shellfish WQS = No more than 10% of the samples shall exceed 43cfu/100 ml
3. WLA is expressed as a daily maximum; N/A = not applicable, no point sources. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings are developed based upon permitted flow and an allowable permitted maximum concentration of 43/100ml.
4. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.
5. As long as the conditions within the SCDOT MS4 area remain the same the Department deems the current contributions from SCDOT negligible and no reduction of FC bacteria is necessary. SCDOT must continue to comply with the provisions of its approved NPDES stormwater permit.
6. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform, the SCDOT will comply with this TMDL and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 Permit.
7. Percent reduction applies to existing concentration.

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ACRONYMS AND ABBREVIATIONS

BCSWMP	Beaufort County Storm Water Management Plan
BMP	Best management practice
CFR	Code of Federal Regulations
cfu	Colony forming units
CWA	Clean Water Act
EMC	Event Mean Concentration
EQIP	Environmental Quality Incentives Program
FC	Fecal coliform
FR	Federal Register
GIS	Geographic Information System
GUI	Graphic User Interface
HUC	Hydrologic unit code
HW	Headwater
LA	Load allocation
LC	Load Capacity
SF	Shellfish
MEP	Maximum Extent Practicable
MOS	Margin of Safety
MPN	Most probable number
MS4	Municipal Separate Storm Sewer Systems
MSD	Marine Sanitation Device
NLCD	National Land Cover Data
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NSSP	National Shellfish Sanitation Program
OCRM	Ocean and Coastal Resource Management
ORW	Outstanding Resource Waters
RC	Reach
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCDOT	South Carolina Department of Transportation
SFH	Shellfish harvesting waters
SRS	Systematic Random Sampling
SSA	State Shellfish Authority
SSO	Sanitary Sewer Overflow
SWMP	Stormwater Management Plan
TMDL	Total Maximum Daily Load
USEPA	U. S. Environmental Protection Agency
USFDA	U.S. Food and Drug Administration
USGS	U. S. Geological Survey
WLA	Wasteload allocation
WQM	Water quality monitoring
WQS	Water quality standard

1.0 INTRODUCTION

The Federal Clean Water Act (CWA) directs each state to review the quality of its waters every two years to determine if water quality standards are being met. If it is determined that the water quality is not being met, the states are to list the impaired water bodies under Section 303(d) of the CWA. Okatie River shellfish fecal coliform impaired stations are located within Shellfish Management Area 18. The stations 18-08, 18-16, and 18-17 are impaired for fecal coliform (FC) bacteria. The Okatie River is restricted for shellfish use from headwaters to station 18-07 in accordance with Food and Drug Administration (FDA) guidance.

A Total Maximum Daily Load (TMDL) is a written plan and analysis to determine the maximum pollutant load a waterbody can receive and still meet applicable water quality standards. The TMDL process includes estimating pollutant loadings from all sources, linking pollutant sources to their impacts on water quality, allocation of pollutant loads to each source and establishment of control mechanisms to achieve water quality standards (US EPA, 1999). All TMDLs include a wasteload allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES) permitted discharges, a load allocation (LA) for all unregulated nonpoint sources, and an explicit and/or implicit margin of safety (MOS). TMDLs are required to be developed for each waterbody and pollutant combination on the States' 303(d) lists by 40 CFR 130.31(a) (US EPA, 1999).

Public participation has been encouraged since commencement (June 1, 2008) of the Okatie River Shellfish Fecal Coliform TMDL development. A public information and stakeholder meeting was held in Hardeeville, SC on August 12, 2008. The purpose of this meeting was to announce commencement of the TMDL development and ask the public for input. Also, organizations, citizen groups and local communities have been given the opportunity to contribute to the process of this TMDL. The Department has received various data and input through out the process from local stakeholders. For detailed information on all stakeholder involvement activities conducted for this TMDL, please see Appendix C.

1.1 Background

The Okatie River is located in the Middle Atlantic Coastal ecoregion of South Carolina within Jasper and Beaufort Counties (Figures 1 and 4). This area of the State is characterized by low slopes, wide intertidal salt marshes with interconnected tidal creeks. The Okatie River is a riverine tidal estuary with extensive intertidal salt marshes, sinuous channeling, barriers (Figures 2 and 3), and features asymmetrical tidal flow patterns (Huang et al., 2008). There are a number of previous studies and reports that focus on the Okatie River. These studies were used to characterize this watershed and gain an understanding of the scope of interest in the Okatie River.

During the last 10 years, some of the coastal counties in South Carolina, including Beaufort and Jasper Counties have experienced rapid growth and population increases.

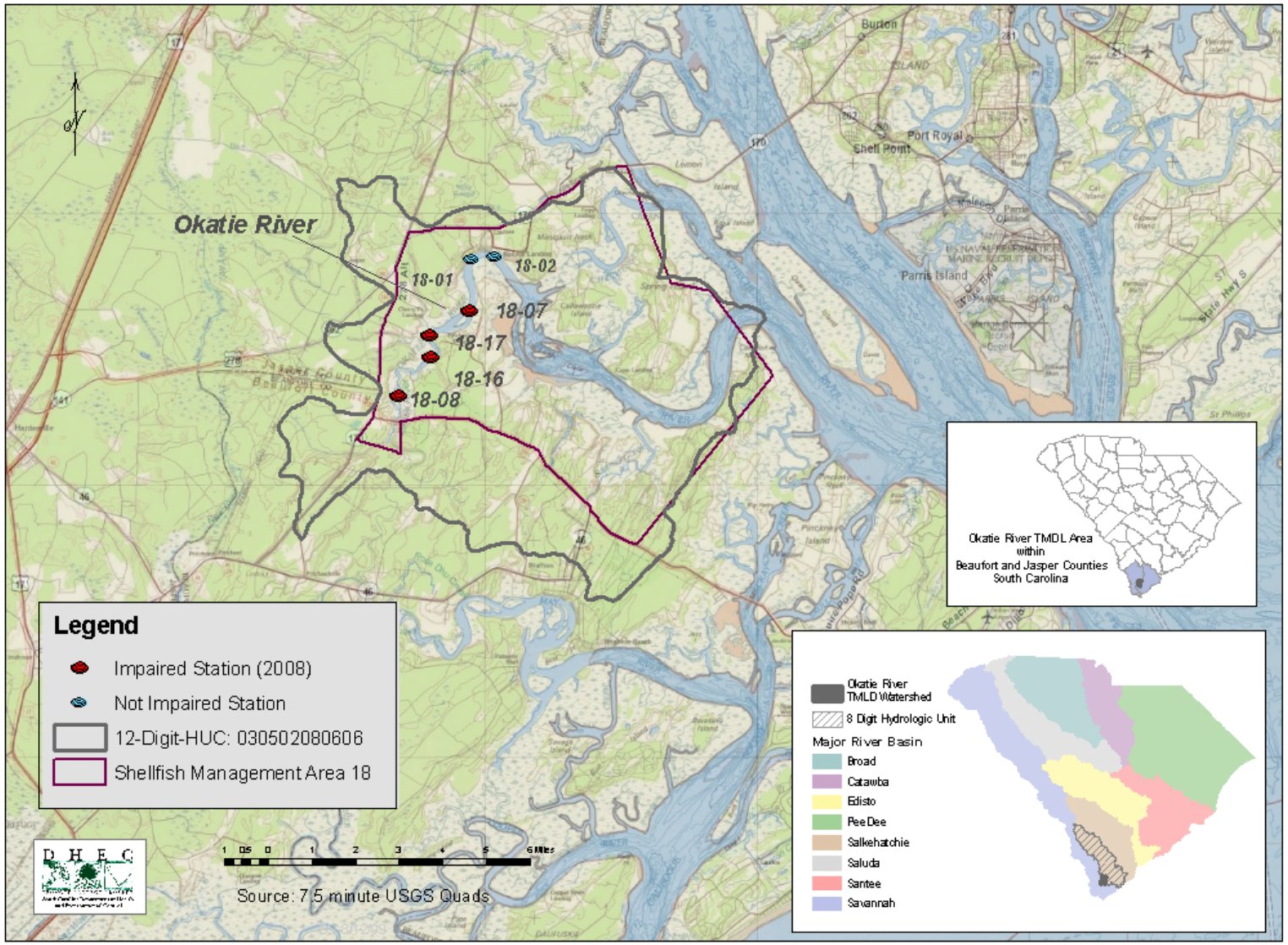


Figure 1. The Okatie River is contained within HUC 030502080606 and Shellfish Management Area 18.

The April 1, 2000 US Population Census estimated population of Beaufort County to be 120,937. A July 1, 2007 estimate was 147,316 people, which is a 21.8% increase in the population of the county in a little over 7 years. On the other hand, the population for Jasper County has increased by only 6.2 % within the same time period. Compared to the population increase in SC within the same period, which was 11.7%, the percent increase seen in Beaufort County is almost twice that of SC (US Census Bureau). This population growth trend in coastal regions is expected to increase, not just in South Carolina, but also in Georgia and North Carolina as well. The population increase along with development is already impacting coastal resources and watersheds. Impacts of rapid and often loosely managed growth can drastically alter the quality of life of people living in the Southeast (DeVoe and Kleppel, 2006). Fletcher et al. (1998) indicated that one of the most tangible signs of urbanization is the closure of shellfish beds due to contamination which are areas where human activities have degraded the environmental quality.

Landuse along South Carolina's coast is being converted from conifer trees to golf courses and residential communities (Siewicki et al. 2005). Increased urbanization and population growth have led to increased nonpoint source pollution of coastal waters (Mallin et al. 2000). Fecal coliform sources in urban and suburban areas include feces from birds, wildlife, horses, and cats and dogs (Mallin et al 2000b). It has been shown that dog feces have 10^6 fecal coliforms per gram and large portions of are deposited on the landscape and adjacent to impervious surfaces such as sidewalks, roads and parking lots. Other sources of fecal coliform in urban and suburban areas are Sanitary Sewer Overflows (SSOs), stormwater runoff, failing septic tanks, etc. Another component of urban and suburban development is, by increasing human population, wildlife activity moves to the edges of marshes near shellfish harvesting areas (Siewicki et al. 2005).

Studies have shown that proximity of certain land-use practices, such as parking lots, shopping malls, golf course communities, bridges and roads, especially near the estuarine salt marshes adversely affect these systems (Bejarano et al. 2004). Major sources of stormwater runoff in coastal and estuarine areas come from impervious surfaces. Another study, conducted by Mallin et al. (2000b) in southeastern North Carolina correlated the landuse activities with fecal coliform exceedances in nearby estuaries. They concluded that when fecal coliform bacteria are deposited on or near impervious surfaces, bacteria and other pollutants are concentrated and rapidly removed to downstream receiving waters. Several studies have shown that with increased urbanization in coastal areas impervious surfaces also increase resulting in degraded water quality (Mallin et al. 2000b, Siewicki et al, 2005, Schill and Jensen, 2000).

Sources of fecal coliform bacteria are commonly diffuse or nonpoint in nature and may originate from stormwater runoff, failing septic systems, agricultural runoff, leaking sewers, wildlife, pets, birds, etc. Occasionally, the source of the pollutant is a point source, such as wastewater treatment plants, MS4, etc. Section 303(d) of the Clean Water Act (CWA) and Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop TMDLs for water bodies not meeting applicable water quality standards. The TMDL process

establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream water quality conditions so that states can establish water quality-based controls to reduce pollution and restore and maintain the quality of water resources (USEPA, 1991).

The State of South Carolina has placed 4 shellfish monitoring stations in the Okatie River on South Carolina's 2008 Section 303(d) list for impairment due to exceedances of fecal coliform bacteria. These stations are identified on Table 1 and shown on Figures 1 and 4. Because the sites are impaired, a TMDL must be developed for the pollutant of concern. The goal of this project will be to determine what and where the sources for fecal coliform potentially are, and calculate TMDLs that will meet the applicable water quality standard.

Table 1. Fecal coliform impaired stations on the Okatie River

Shellfish Monitoring Stations	Station Description
18-07	Okatie River at Indigo Plantation
18-08	Okatie River at Dock without house
18-16	Okatie River at converge of Pinckney Colony tributary
18-17	Okatie River at converge of Cherry Point tributary

1.2 Watershed Description

Okatie River watershed is located in Beaufort and Jasper counties in southern part of South Carolina. This area is encompassed within 8-digit hydrologic unit code (HUC) 03050208 which is the Broad River portion of the Salkehatchie basin, and the 10-digit HUC 0305020806 which includes Port Royal Sound. Okatie River is in 12-digit HUC 030502080606, Colleton River portion of the basin. Majority of the Okatie River is located in Beaufort County.

Various tributaries converge and form the Okatie River. The Okatie River has two main headwater streams, where both stream converges to the south of US 278 Bridge. Flow is in a northerly direction from US 278 Bridge to past Barrel Landing. To the north of Cherry Point Landing, Malind Creek converges with the Okatie River. The River takes a northeasterly direction past Pinckney Colony. A major bend of the River occurs near Camp St. Mary's, Okatie Bluff and to the north of Garrets Point. Please see Figures 4 and 5 for a detailed map of the TMDL area. To the north northwest of Callawassie Island, the Chechessee Creek converges with the Okatie River and becomes the Colleton River. To the east of the Spring Island and to the west of Daws Island, the Colleton River converges with the Chechessee River. East of Hilton Head Island, the Chechessee River converges with the Broad River and flows to the Port Royal Sound and ultimately to the Atlantic Ocean.

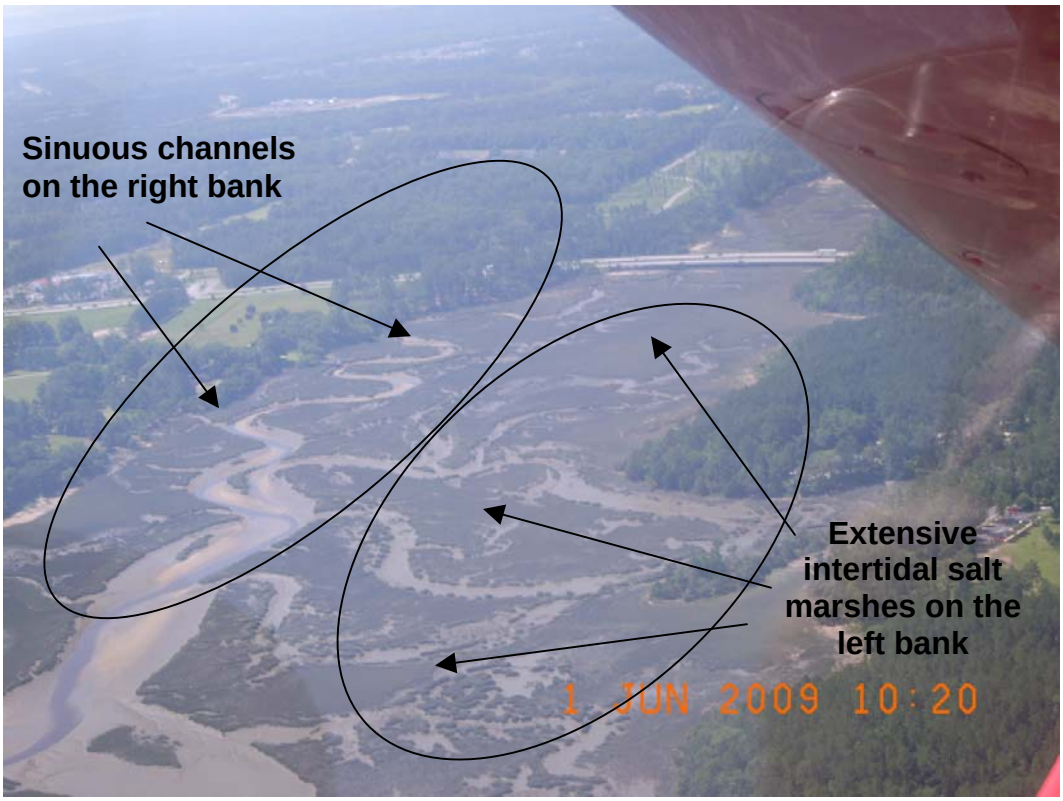


Figure 2. Sinuous channel closer to the right bank of the Okatie River and large intertidal areas on the left bank can be seen in the picture below. Photograph was taken during out going tide.

SCDHEC and USEPA Region 4 have established seven priority watersheds across South Carolina, and one of these include the Okatie River (HUC 030502080606) (Figure 1). Priority watersheds are areas where USEPA Region 4 and SCDHEC have agreed to target mutual resources for watershed restoration.

Shellfish Management Area 18 is comprised of the Colleton and the Okatie Rivers and their tributaries. The area's northern boundary runs between the intersection of Highway 170 and US 278 and the Chechessee River. The eastern boundary runs along the western shore of the Chechessee River to the mouth of the Colleton River and then to US 278. US 278 define the area's southern boundary. The western boundary runs along Highway 170 and US 278 (SCDHEC, 2007) (Figure 4).

1.2.1 Tides and Streamflows

The Okatie River is a tidally-influenced, shallow estuary with narrow channels and extensive intertidal salt marshes/mud flats, small islands, tidal creeks, and barriers that influence the water flow (Figures 2, 3 and 6). Spring tide range is over 9.8 feet. Headwaters and tidal creek depth range from 6.6 feet to 13, and approximately 50 feet near the river mouth (Huang et al.2008).

Figure 3. Aerial view of a portion of the Okatie River emphasizing the intertidal salt marches and barriers.

Blanton and Moore (2005) studied the flushing rates in the upper Okatie River and the Malind Creek for the LU-CES. By comparing the ratio of two Radium isotopes, ^{224}Ra versus ^{228}Ra, they have calculated the age of the water upstream from the Bailey's Landing to be approximately 3.4 days. They have concluded that 84% of the water flushed from the upstream reaches of the Okatie River return with the flood tide.

As part of the LU-CES, Chen and Huang (2005) applied the findings and data collected from the part described to a model (FVCOM) and created a management-oriented, multi scale model for the marsh dominant Okatie and Colleton Rivers. Validation results show that the model could be useful for characterizing flows; however there is not a Graphical User Interface (GUI) to make it easy for application of management scenarios. The model results also showed residual clockwise and counterclockwise eddy like currents, further emphasizing the very complex nature of the hydrodynamics in the Okatie River.

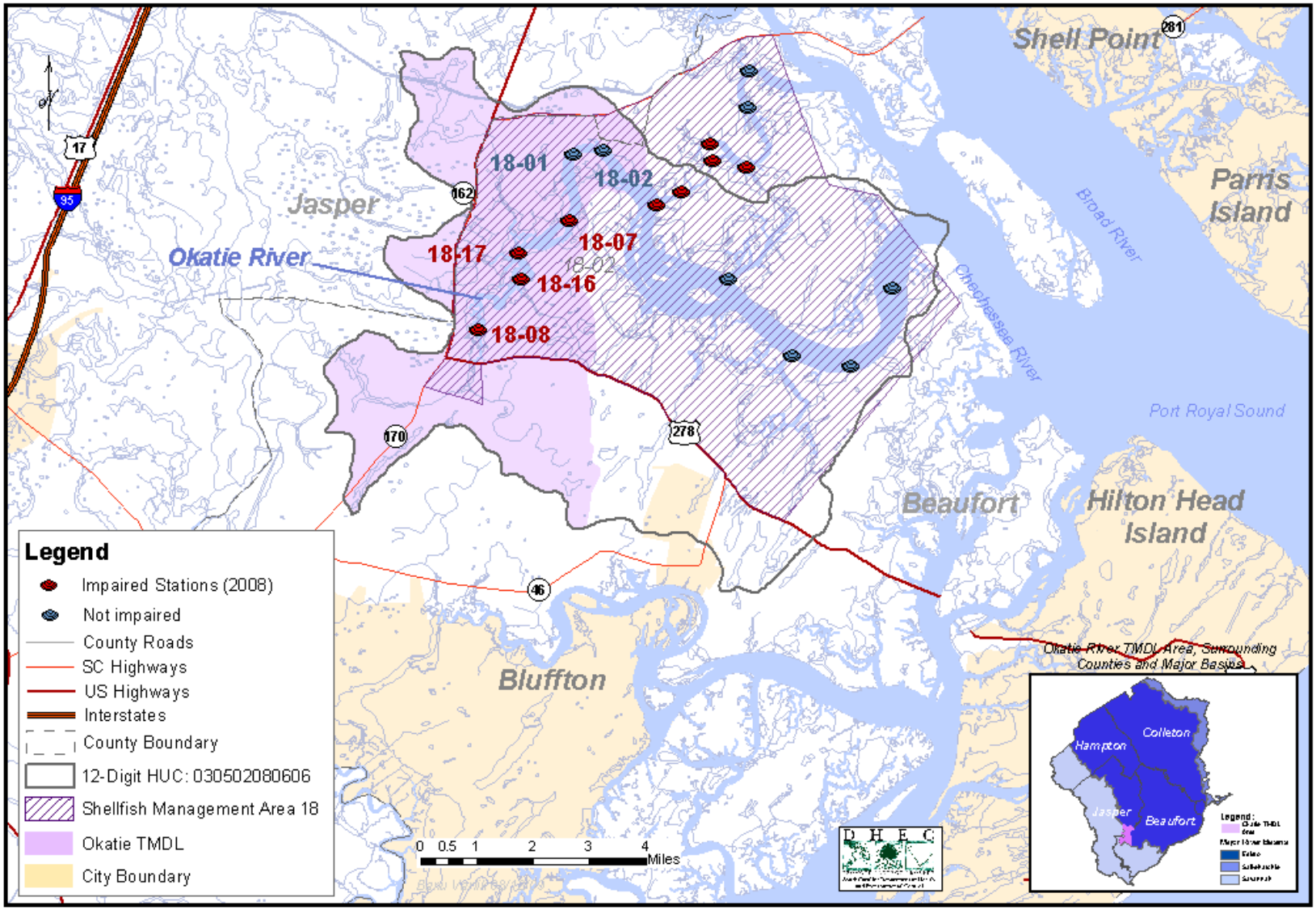


Figure 4. General overview of Okatie River watershed within Shellfish Management Area 18 and shellfish monitoring stations.

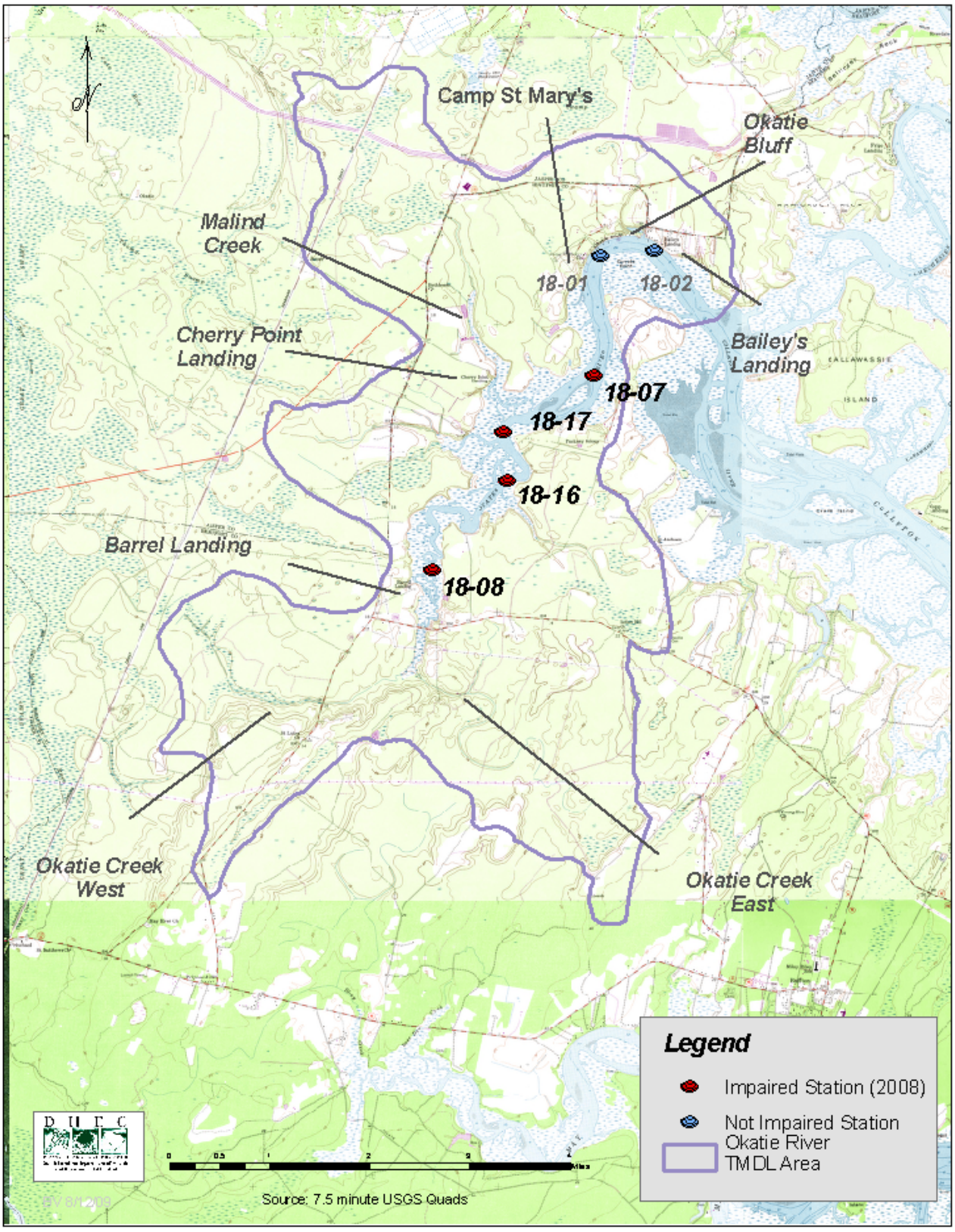


Figure 5. The Okatie River TMDL area with geographical references

Figure 6. Extensive intertidal areas, narrow channels and many tributaries dominate the Okatie River. Station 18-08 is shown on the photograph during out going tide conditions.

As part of the LU-CES, Conrads and Blanton analyzed the hydraulics and hydrology at upper reaches of the Okatie River and the Malind Creek. Acoustic velocity meters were deployed in upper reaches of the Okatie River and the Malind Creek. Data such as continuous tidal streamflows as well as water level and precipitation were collected. Based on their analysis, authors theorized that the increase of volume in the Okatie River may be due to a larger urbanized area thus less infiltration of precipitation.

1.2.2 Precipitation

Based on annual reports for Shellfish Management Area 18, mean annual rainfall for the area is 49.78 inches, with August being the wettest month. However, 2008 Shellfish Management Area 18 annual update indicates that the yearly average rainfall amount for 2007 was 46.24 inches. This is slightly below the 30-year mean rainfall totals for this area (NOAA Climatological Data Center). Approximately 40% of the annual rainfall occurs within a three-month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and thundershower activity of short duration. In addition, these three months also have the highest numbers of days with rainfalls greater than 1.00". The months of December through March historically have the greatest number of days with rainfall exceeding 0.10" and 0.50". Rainfall events during these months are typically of a longer duration (SCDHEC, 2008). Appendix B shows shellfish monitoring data 2000 through 2006 along with antecedent precipitation data on sampling dates that were observed at BJW&SA Chelsea Plant.

1.2.3 Winds

Prevailing wind direction during January through February is generally from the west to northwest with an average speed of 8-12 MPH. During the months of March through August, wind direction is typically a southerly component at an average speed of 7-10 MPH and September through December normally maintains a north-north easterly wind direction with an average speed of 6-8 (NOAA) (SCDHEC, 2008).

1.2.4 Landuse and Soils

The National Land Cover Data project (NLCD) 1992 was the first land cover mapping with a national scope. In 2001, the second NLCD was done and was improved by adding impervious surface and canopy density to the land cover to NLCD 1992. A pixel to pixel comparison of the current (2001) and the prior (1992) NLCD is not recommended by EPA due to substantial differences in methodology, accuracy and resolution between the two coverages. Therefore, this document will not address the probable landuse changes in the Okatie River watershed from 1992 to 2001. At the time of the writing of this document, 2006 NLCD was not available for comparison between 2001 and 2006 coverages (EPA, 2007).

Landuse within the TMDL area of the Okatie River was calculated using 2001 National Land Cover Data (NLCD). The results based on landuse characteristics are summarized in Table 2 below. Primary landuse within the TMDL area is forested lands with 35.39% followed by wetlands and open water with 31.1%. Developed landuse within the overall Okatie River TMDL drainage area is approximately 15.9% (NLCD, 2001).

The delineated drainage area for the Okatie River TDML has been further divided into sub watersheds labeled as headwaters, and reaches 1 through 6. These reaches were delineated using shellfish monitoring stations as starting points, and by using the USGS 7.5 minute topographical maps (Figure 7).

Headwaters of the Okatie River watershed on the left bank[1] have concentrated areas of development, woody wetlands, and evergreen forests. On the right bank[1] of the headwaters are dominated by woody wetlands, evergreen forests, hay pasture and developed areas (Figure 8) (Table 2a).

[1] River or stream banks are defined as “right” or “left” as an observer is facing the direction of flow from headwaters to downstream.

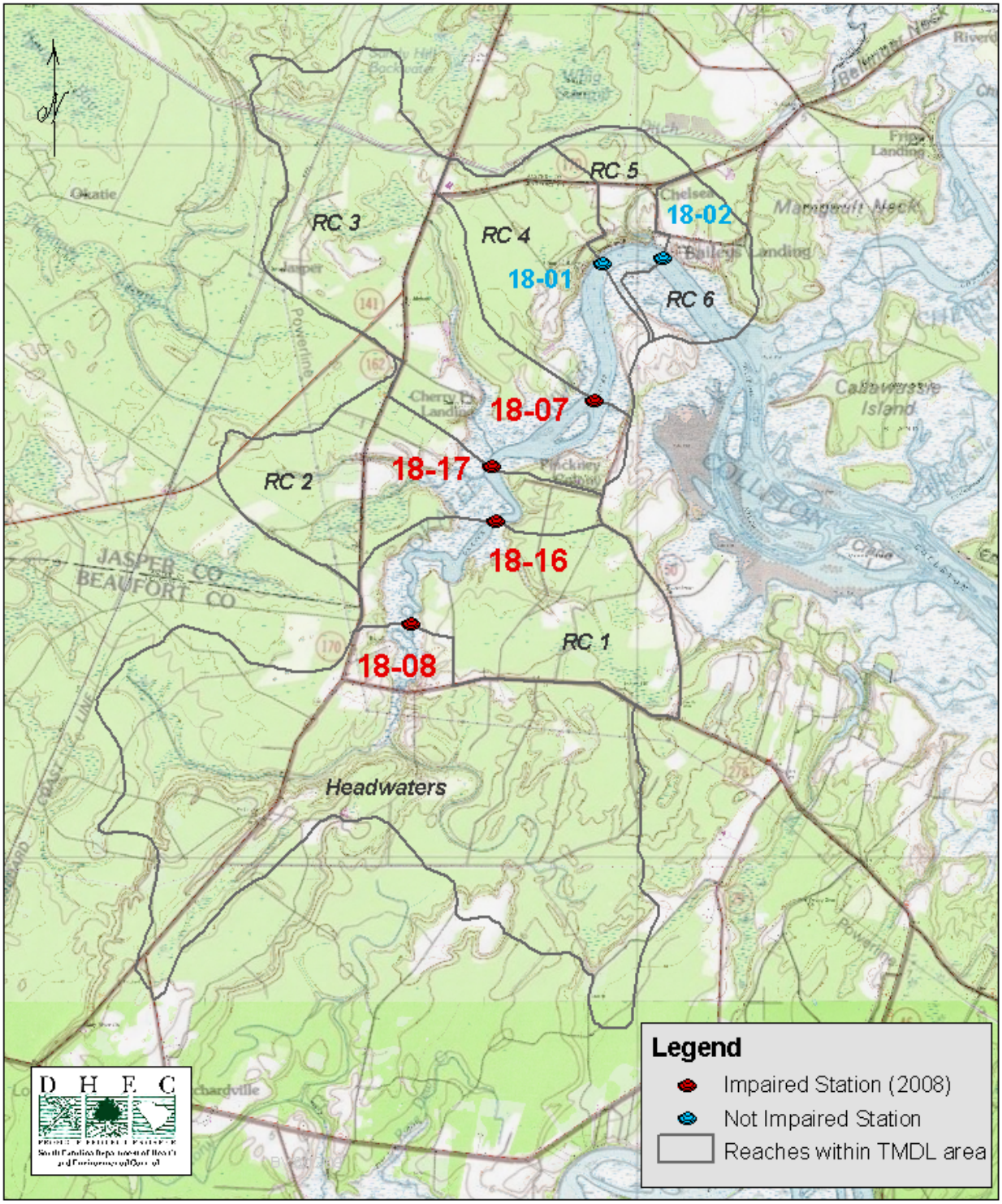


Figure 7. The Okatie River TMDL area with its delineated sub watersheds (reaches) and shellfish monitoring stations.

Table 2a. The Okatie River Landuse based on 2001 NLCD.

Landuse	Area (mi2)	Area (%)
Open Water	1.25	4.91
Woody Wetlands	4.63	18.16
Emergent Herbaceous Wetland	2.05	8.03
Total Wetlands/Open Water	**7.93 mi2**	**31.1%**
Developed Open Space	2.38	9.32
Developed, Low Intensity	1.16	4.55
Developed, Medium Intensity	0.50	1.95
Developed, High Intensity	0.01	0.05
Total Developed	**4.05 mi2**	**15.87%**
Deciduous Forest	0.96	3.77
Evergreen Forest	7.37	28.91
Mixed Forest	0.69	2.71
Total Forested	**9.02 mi2**	**35.39%**
Pasture/Hay	0.70	2.75
Cultivated Crops	1.22	4.77
Total Agricultural	**1.92 mi2**	**7.52%**
Scrub/Shrub	0.80	3.14
Grassland/Herbaceous	1.79	7.00
Total Other	**2.59 mi2**	**10.14 %**
Total Area	**25.5 mi2**	**100%**

Table 2b. Developed landuse summary by shellfish monitoring stations within the Okatie River TMDL Area (NLCD 2001).

Station	Total Drainage Area of the Station (mi2)	Total Developed Area (mi2)	Percent of Developed Area (%)
18-17 to 18-07	5.33	0.64	2.51
HW to 18-08	9.81	1.78	6.98
18-08 to 18-16	3.24	0.94	3.68
18-16 to 18-17	2.77	0.41	1.6
Total *	**21.15 mi2 ***	**3.77 mi2 ***	**14.77 % ***

* Areas represent the portion of the Okatie River watershed from headwaters to station 18-07.

Landuse within reach 1 (RC 1) of the watershed consists predominantly of developed open spaces, open water and wetlands, forested areas, and hay/pasture. Reach 2 (RC 2) of the watershed is mainly forested areas, with some developed areas especially along the north/south bound HW 170 corridor, and open water and wetlands. Reach 3 (RC 3) consists mostly of woody wetlands and forested areas. There developed areas along the major roads and the peninsula extending between Cherry Point Landing and Camp St. Mary's. Reach 4 (RC 4) is more mixed in terms of landuse with predominant

landuse being forests, wetlands, and developed open spaces. Secondarily pasture/hay, cultivated crops and to a smaller extent grasslands. Reach 5 (RC 5) is mainly mixed forests, open water and wetlands, and cultivated crops, and to a lesser extent open spaces, and pasture/hay. Main landuse in reach 6 (RC 6) is open water and wetlands, followed by mixed forests. In the vicinity of the Bailey's Landing, landuse is compromised predominantly of cultivated crops, pasture/hay, grassland and developed open spaces (Figure 5).

Predominant soils in the Okatie River watershed are Bladen, Santee, Bertie, Coosaw, Seabrook, Cape Fear, and Wahee, which account for approximately for 81% of the area. Bladen soils are fine sandy loam, and are poorly drained with slow permeability. Santee association soils have very poor drainage, slow permeability, high water table and are susceptible to flooding. Bertie type soils are loamy fine sand soils which are moderately well drained, have high water table and moderately permeability. These soils are very acidic. Coosaw soils are loamy fine sand which are some what poorly drained and have moderate permeability. Cape Fear types of soils are loams with slow permeability, and very poor drainage. Wahee soils are fine sandy loams that have poor drainage and slow permeability. In areas with where these types of soils are dominant, such as in the Okatie River TMDL area, there may be high runoff potential due to the slow permeability and relatively high water table. See Appendix G for soil survey map of the Okatie River TMDL area.

Majority of soils surrounding the Okatie River TMDL area are either partially hydric or all hydric, with smaller areas of not hydric soils. Partially hydric and hydric soils have low infiltration rates, high water table, and high runoff potential (Figure 9). Soils that are not hydric have moderate to high infiltration rates and low runoff potential.

1.2.5 Biological Resources

Benthic macroinvertebrate communities are important components of estuarine and marine food web which includes organisms as diverse as worms, crustaceans, mollusks and other taxa that live in tubes or burrows in the sediment. Benthos is consumed by predatory species including most fish and larger crustaceans such as crab and shrimp. These benthic communities are relatively sessile and are excellent indicators of habitat condition.

A study was conducted by Van Dolah, et al. (2000) to determine a baseline assessment of the conditions in the Broad Creek and Okatie River in Beaufort County. A goal of the study was to document the both environmental and biological conditions in these two systems. Benthic macrofauna collected from subtidal areas and intertidal mud flats of the TMDL area along the Okatie River consisted mainly of Polychaetes, Amphipods, Oligochaetes, and various other Crustaceans and mollusks. The study results indicate that benthic communities from station near the US 278 (headwaters) shows signs of stress and variation in salinity (26.4 ppt) may support biological degradation may be occurring (Van Dolah, et al. 2000).

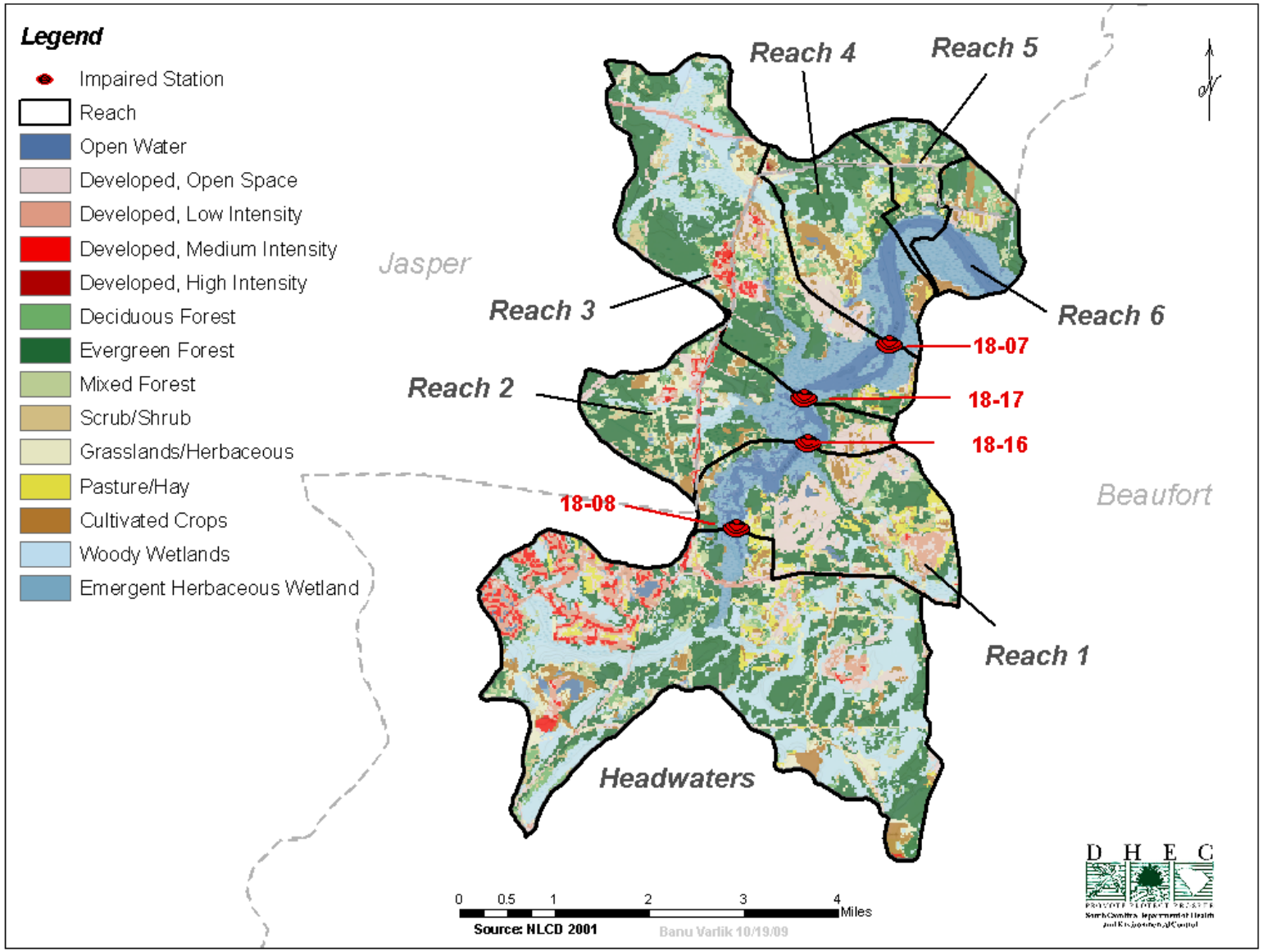


Figure 8. Landuse within the TMDL area of the Okatie River watershed (NLCD 2001)

1.3 Water Quality Standard

The Okatie River is classified as outstanding water resources (ORW), which is defined in SC Regulation 61-68 (2008) as:

> "Outstanding Resource Waters (ORW) are freshwaters or saltwaters which constitute an outstanding recreational or ecological resource or those freshwaters suitable as a source for drinking water supply purposes with treatment levels specified by the Department."

The Okatie River is also shellfish harvesting waters and the fecal coliform standard for the shellfish harvesting waters are guided by the minimum requirements of the National Shellfish Sanitation Program Model Ordinance (US FDA, 2007), which are:

> "Not to exceed an MPN fecal coliform geometric mean of 14/100 ml; nor shall more than 10% of the samples exceed an MPN of 43/100 ml".

The National Shellfish Sanitation Program (NSSP) is a tripartite cooperative program involving the Federal government, states and the industry that relies on regulatory controls by the State Shellfish Authority (SSA) to ensure the safety of the molluscan shellfish. This program is recognized by the U. S. Food and Drug Administration (FDA) for safe and sanitary control of growing, processing, and shipping of molluscan shellfish for human consumption. By participating in the National Shellfish Sanitation Program and through membership in the Interstate Shellfish Sanitation Conference, states have agreed to enforce the Model Ordinance which sets the minimally necessary requirements for sanitary control of molluscan shellfish (US FDA, 2007).

1.4 Shellfish Classification of the Okatie River TMDL Area

The Okatie River and tributaries from the headwaters to station 18-07 at Indigo Plantation is classified as "Restricted" (Figures 6, 11 and 12). From station 18-07 including stations 18-01 and 18-02, the Okatie River is classified as "Approved" in the 2008 Shellfish Sanitary Survey (SCDHEC, 2008) (Figure 10). Based on sanitary surveys, "Restricted" is an indication of a moderate degree of pollution or the presence of deleterious or poisonous substances to a degree that may cause the water quality to fluctuate unpredictably or at such a frequency that a "Conditionally Approved" classification is not feasible. Shellfish harvesting in the restricted areas are only allowed for the purpose of relaying or depuration and is allowed only with a permit issued by the Department and under supervision. The suitability of restricted areas for harvesting as described above may be determined through the use of comparison studies of background tissue samples with post-process tissue samples, as well as other process verification techniques deemed appropriate by the Department. Computation of the estimated threshold shall be obtained using the National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology (SCDHEC, 2008).

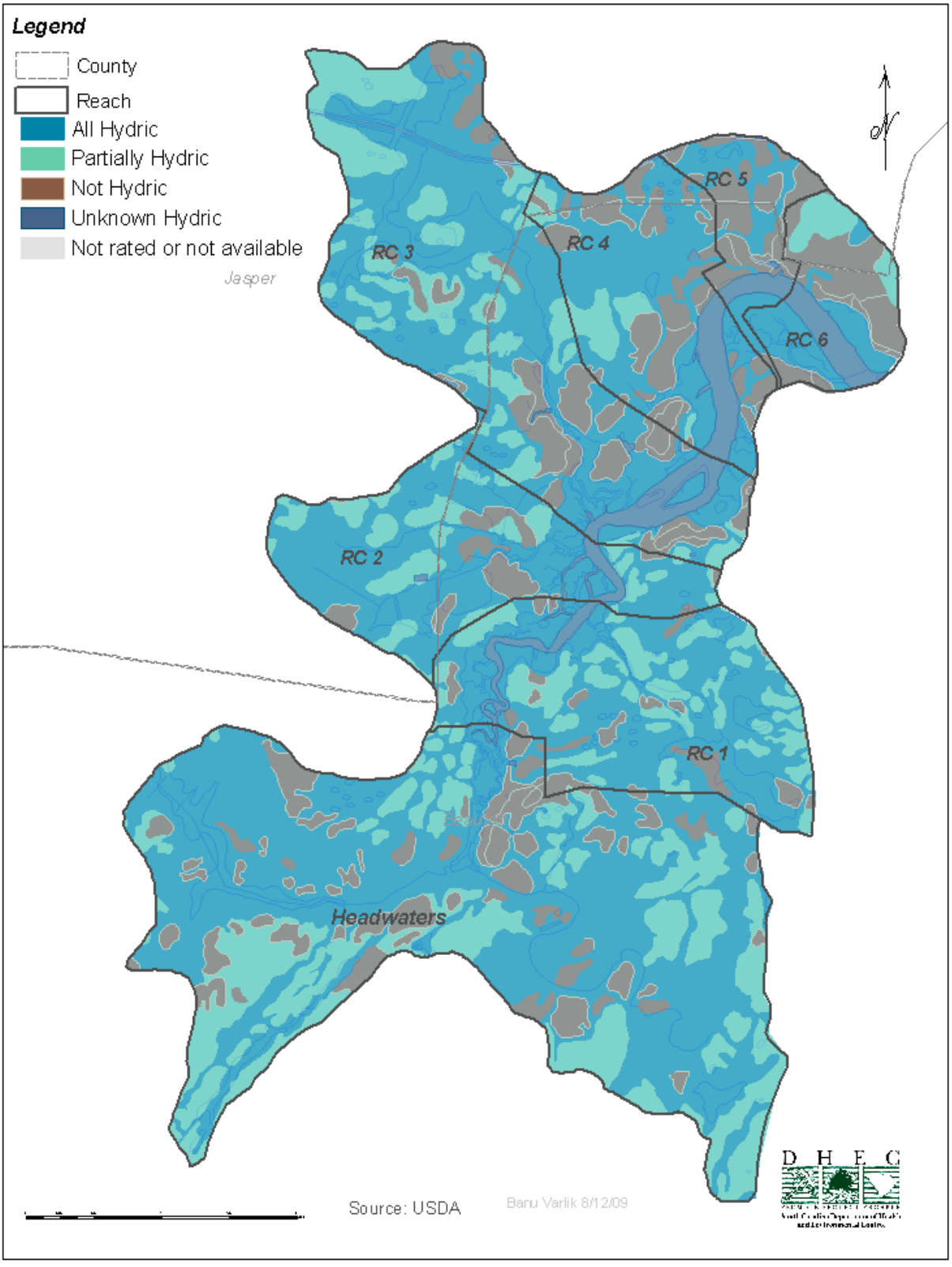


Figure 9. Hydric soil groups within the Okatie River TMDL area.

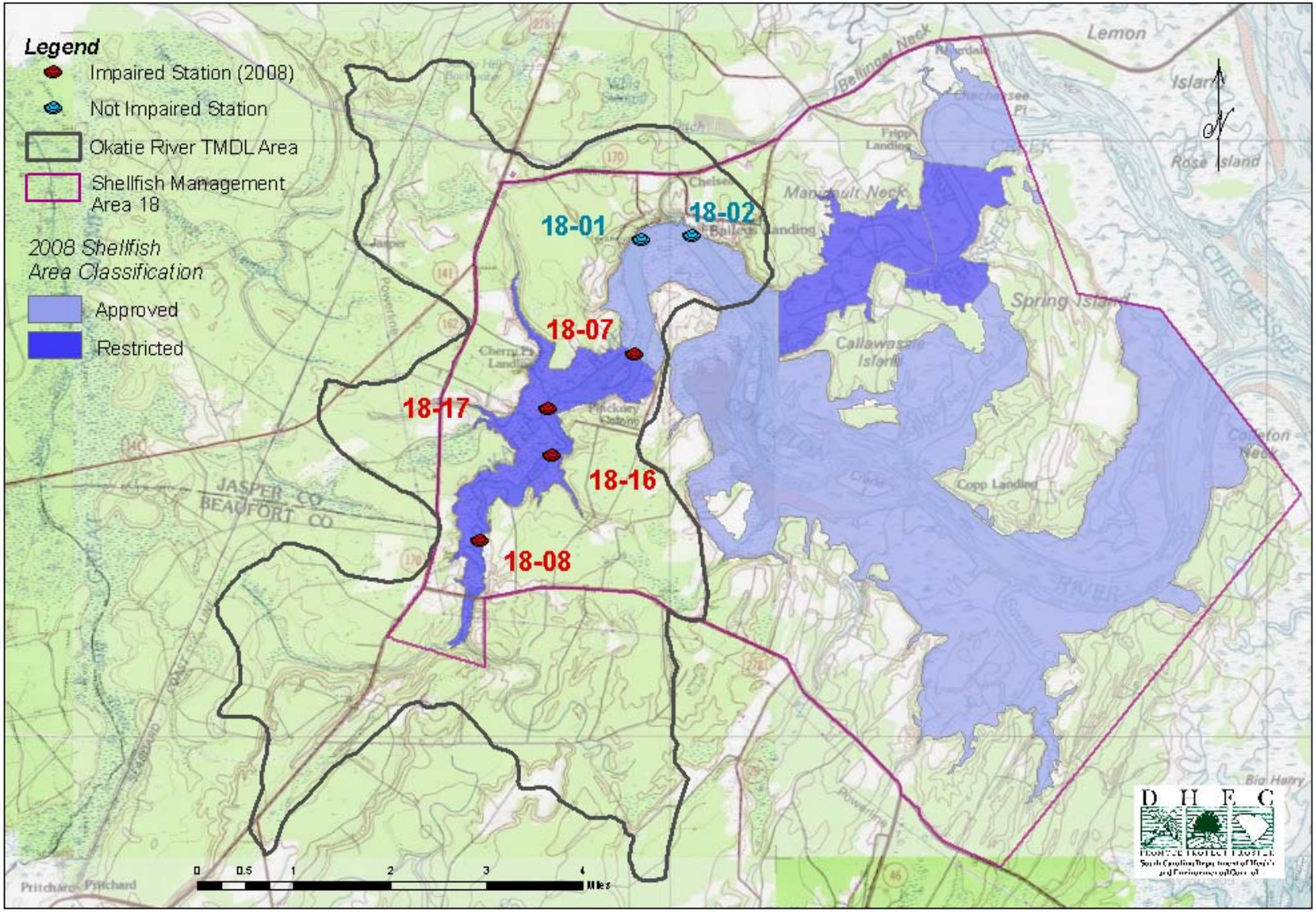


Figure 10. Shellfish Management Area 18 classifications and shellfish monitoring stations within the Okatie River TMDL area.

2.0 WATER QUALITY ASSESSMENT

The National Shellfish Sanitation Program (NSSP) allows shellfish growing areas to be classified using either total or fecal coliform, and application of either standard to different water bodies within the state. There are also two sampling strategies for the application of the standards:

a) Adverse pollution control
b) Systematic random sampling (US FDA, 2007).

The SCDHEC Shellfish Program currently utilizes the systematic random sampling (SRS) strategy within Area 18 instead of sampling under adverse pollution control conditions. To insure random sampling, sampling dates are computer generated prior to the beginning of the each quarterly period. Due to shipping requirements and manpower constraints, samples are collected on Mondays, Tuesdays or Wednesdays (SCDHEC, 2008).

In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period, which is three years. During July 1998, data analysis procedure was updated and formalized. For classification purposes, samples are collected in accordance with SRS for a 36-month period between January 1st and December 31st. This allows for a maximum of 36 samples per station for a three year period yet provides a six-sample "cushion" (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

All samples collected after September 1, 1986, have been analyzed using the five-tube/three dilution modified A-1 method described by Nuefeld (1985) (SCDHEC, 2008).

In addition to bacteriological samples, surface water temperatures are measured using a hand-held, laboratory-quality calibrated thermometer. Salinities are measured in the laboratory using automatic temperature compensated refractometer. Additional field data collected during samplings are ambient air temperature, wind direction, tidal stage, date and time of sampling. Tidal stages are determined by Nautical Software's *Tides and Currents*, Version 2 (1996) (SCDHEC, 2008)

3.0 SOURCE ASSESSMENT

As mentioned previously, these TMDLs are based on a delineated portion of a 12-digit HUC 030502080606 that encompasses the Okatie River. Based on the six shellfish monitoring stations located in the Okatie River, the TDML watershed was delineated into 7 sub watersheds although four of the six stations are on the 2008-303(d) list. In this document, these smaller sub watershed delineations were utilized for documenting probable sources of pollution and determining where the percent reductions are applied (Figure 7). These sub watersheds are labeled as headwater, and reaches (RC) 1 through reach 6. Each reach was delineated using the shellfish monitoring stations as the downstream end, and USGS 7.5 minute topography maps. Please see figure 7 for a map of the delineated sub watersheds.

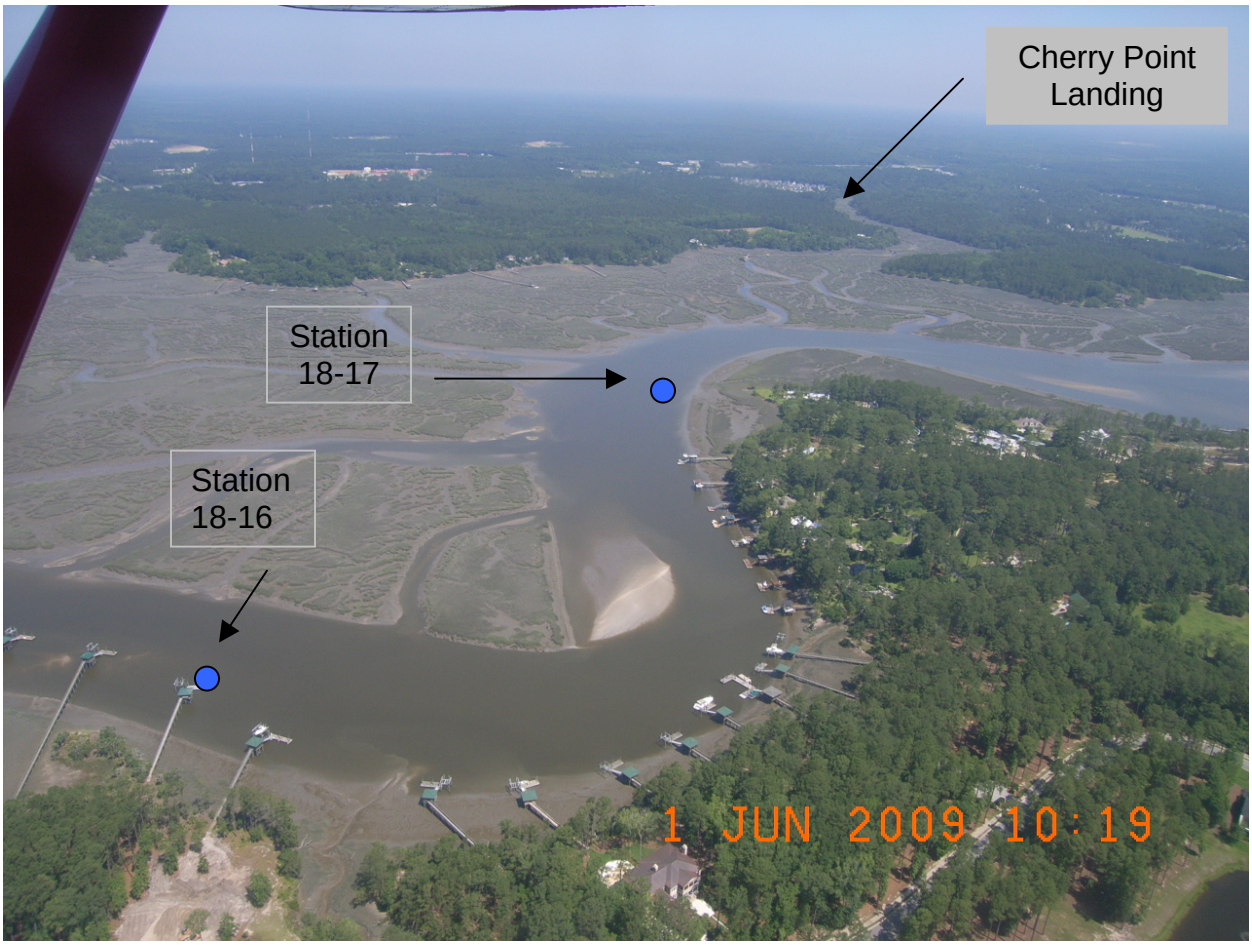


Figure 11. Locations of stations 18-16 and 18-17 in the Okatie River during out going tide.

There are many sources of pathogen pollution in surface waters. These sources may be classified as point and nonpoint sources. Point sources are generally defined as pollutant loads discharged at a specific location from pipes, outfalls, ditches and conveyance channels from either municipal wastewater treatment plants, industrial waste treatment facilities or MS4s. Nonpoint source pollution originates from multiple sources that are unregulated over a relatively large area. Nonpoint sources can be divided in source activities related either to land or water use and include failing septic tanks, improper animal keeping practices, forestry practices, as well as urban and rural runoff. With the implementation of technology-based controls, pollution from continuous point sources, such as factories and wastewater treatment facilities, has been greatly reduced. These point sources are required by the CWA to obtain a NPDES permit. In South Carolina NPDES permits require that dischargers of sanitary wastewater must meet the state standard for fecal coliform at the point of discharge.

The potential sources within each sub watershed (reach) are summarized at the end of this section (Figure 20).

Figure 12. Station 18-07 in the Okatie River during out going tide.

3.1 Point Sources

3.1.1 Continuous Point Sources

Municipal and private sanitary wastewater treatment facilities may be sources of pathogen or FC bacteria pollution when not meeting limits for FC bacteria. However, if these facilities are discharging wastewater that meets their permit limits, they are not causing or contributing to impairment provided that a daily maximum limit is being met as specified in the TMDL. If any of these facilities are not meeting their permit limits, enforcement actions/mechanisms are in place.

Currently, there are no continuous NPDES-permitted discharges to the Okatie River. Future NPDES dischargers in the referenced watershed are required to comply with the load reduction prescribed in the WLA and demonstrate consistency with the assumption and requirements of the TMDL.

3.1.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under

permits numbered SCS and SCR and regulated under SC Water Pollution Control Permits Regulation 61-9 122.26(b)(14) & (15) (2008). All regulated MS4 entities have the potential to contribute FC pollutant loading in the delineated drainage area used in the development of this TMDL.

Industrial facilities that have the potential to cause or contribute to a violation of a water quality standard are covered by the NPDES Storm Water Industrial General Permit (SCR000000). Construction activities may be covered by the NPDES Storm Water Construction General Permit from DHEC (SCR100000). Where permitted construction activities have the potential to affect water quality of a water body with a TMDL, the Storm Water Pollution Prevention Plan (SWPPP) for the site must address any pollutants of concern and adhere to any WLAs in the TMDL. Construction activities are on going within the Okatie River TMDL area. Note that there may be other stormwater discharges not covered under permits numbered SCS and SCR that occur in the referenced watershed. These activities are not subject to the WLA portion of the TMDL.

Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, 235, P.68837) or other unregulated MS4 communities located in the Okatie River watershed and surrounding watersheds may have the potential to contribute FC bacteria in stormwater runoff. These unregulated entities are subject to the LA for the purposes of this TMDL.

The SCDOT is currently the only designated MS4 within the watershed. The SCDOT operates under NPDES MS4 SCS040001 and owns and operates roads in the watershed. However, the Department recognizes that SCDOT is not a traditional MS4 in that is does not possess statutory taxing or has enforcement powers. SCDOT does not regulate landuse or zoning, issue building or development permits.

Current developed land use for the entire TMDL watershed is 15.9 %. Based on current Geographic Information System (GIS) information (available at time of TMDL development) there are currently no SCDOT rest areas or other facilities located in the referenced watershed area.

If future MS4 permits are applicable to this TMDL watershed, then those discharges will be subject to the assumptions and requirements of the wasteload allocation (WLA) portion of this TMDL.

During a recent site visit to the Okatie River watershed on June 8, 2009, there were several scattered thunderstorms and heavy rains in the TMDL area that were observed. The stormwater runoff from roads and road side ditches were filled with stormwater runoff (Figure 13). In particular, stormwater runoff was observed from US 278 Bridge over the Okatie River (Figure 14). Rain events such as these may act as a conveyor by washing off fecal matter directly to the receiving waters with shellfish beds. An extensive network of SCDOT roads exists in the Okatie River watershed at the present time (Figure 15).

3.2 Nonpoint Sources

Nonpoint source pollution is likely a major contributing factor impacting water quality in the watershed. Stormwater runoff may negatively impacts water quality by transporting FC bacteria from land to the receiving waters. Additionally, the Department recognizes that there is likely wildlife, agricultural activities, grazing animals, failing septic tanks and/or other nonpoint source contributors located within this watershed. Nonpoint sources located in this watershed are subject to the LA and not the WLA component of the TMDL.

Figure 13. Stormwater ditch along US 278 within the Okatie River watershed. The photograph was taken following one of the localized scattered thunderstorm events on June 8, 2009.

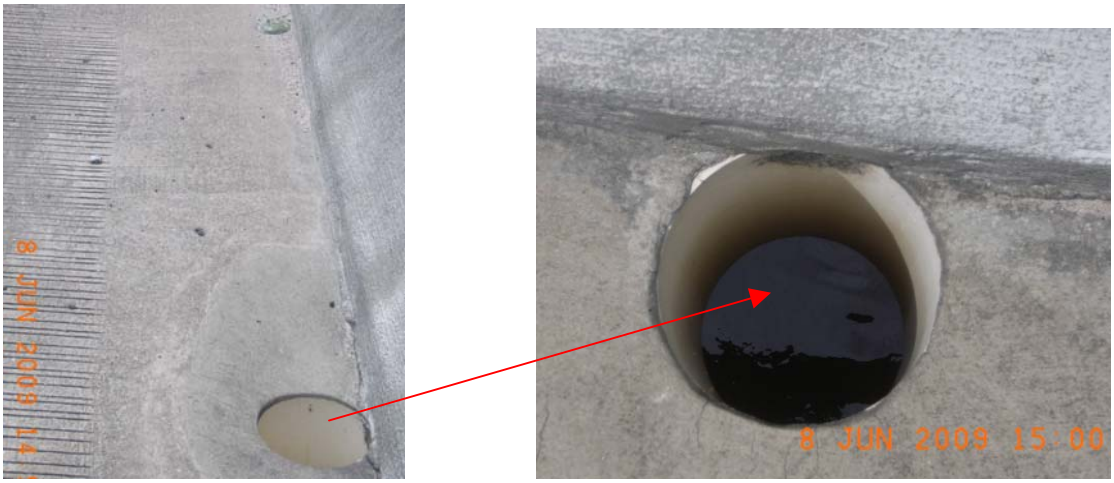


Figure 14. Stormwater drainage hole on US 278 Bridge spanning across the Okatie River.

3.2.1 Urban and Suburban Stormwater Runoff

The Town of Bluffton and its surrounding area are experiencing substantial growth. A retirement community development near Bluffton has added residential and commercial growth to the area. There are numerous golf and/or residential developments within the TMDL watershed. Increased development may increase NPS runoff into the waterbody. The Okatie River watershed is a rapidly developing area, especially around the US 278 corridor towards Bluffton where there are many new residential communities, commercial lots and light industrial areas. The traffic on both Hwy 170, and especially on US 278 on both directions are heavy and continuous. During rain and extreme weather events, runoff from surrounding impervious areas and roads can be significant, increasing the stormwater runoff to the Okatie River (Figure 15).

Dogs, cats and other domesticated pets are one of many sources of fecal coliform deposited on the urban landscape. There are also “urban” wildlife, such as squirrels, raccoons, pigeons and other birds, all of which contribute to the fecal coliform load.

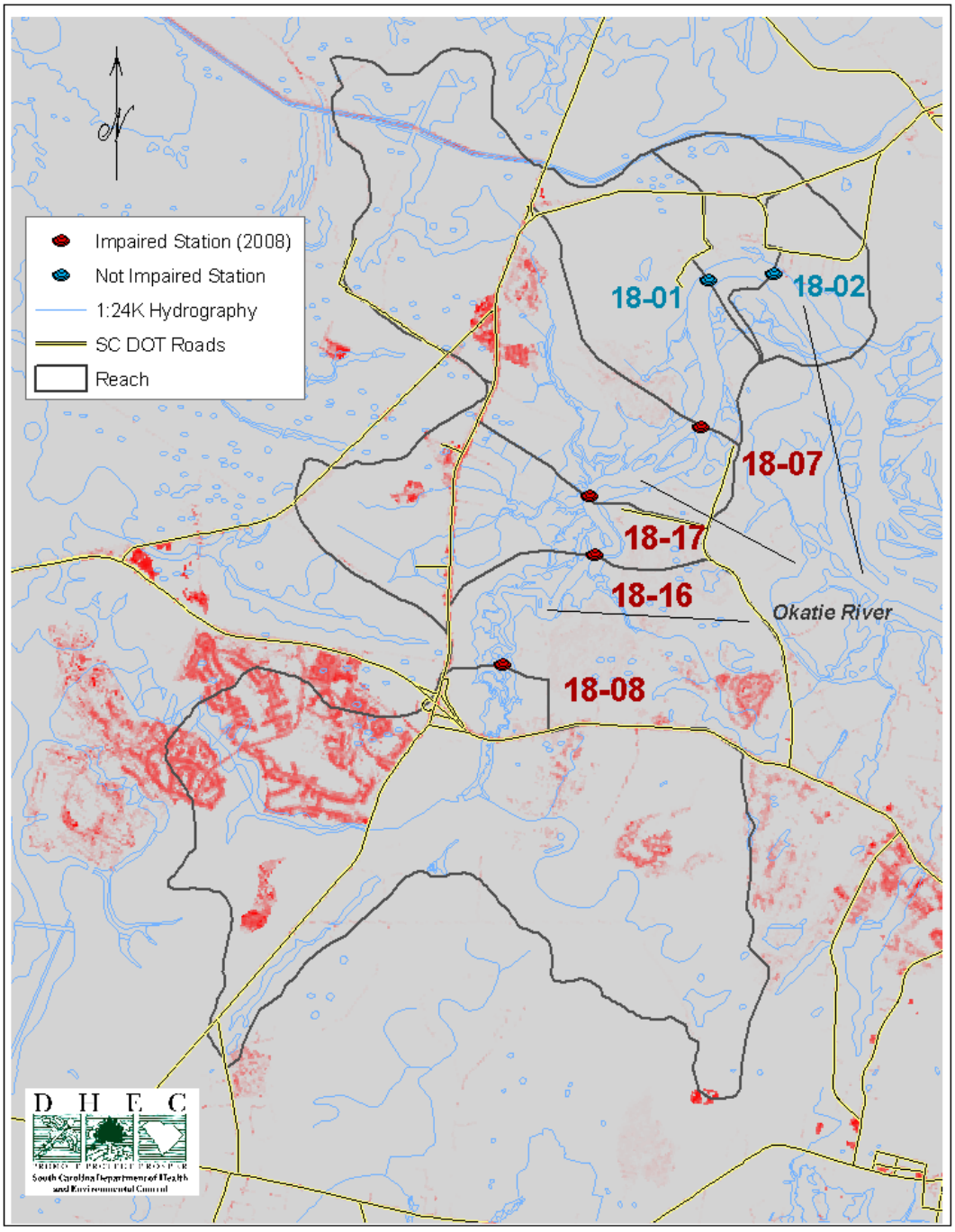


Figure 15. SC DOT roads, pervious and impervious areas within the Okatie River TMDL area. Gray represents pervious areas and shades of red represent impervious areas.

3.2.2 Agricultural Runoff

Owners/operators of most commercial animal growing operations are required by R. 61-43, Standards for the Permitting of Agricultural Animal Facilities, to obtain permits for the handling, storage, treatment (if necessary) and disposal of the manure, litter and dead animals generated at their facilities (SC DHEC 2002). The requirements of R. 61-43 are designed to protect water quality and there is a reasonable assurance that

facilities operating in compliance with this regulation should not contribute to downstream water quality impairments. In addition to the state permit, animal operations that are considered Concentrated Animal Feeding Operations (CAFOs) are also required to have an NPDES Permit if they have a discharge to surface waters. There are currently no permitted CAFOs in South Carolina.

There are several unregulated agricultural operations within the TMDL watershed especially on the right bank of the Okatie River (Figure 16). During the site visits several horses, cows, and other hobby farm animals were observed on farms along the right bank of the Okatie River. Also, there are some residential communities with horses within the Okatie River watershed (Figure 17).

Figure 16. Horses adjacent to the Okatie River on an unregulated agricultural facility with minimal vegetative buffers of other BMPs.

3.2.3 Failing Septic Systems

On September 9, 2008 Beaufort Jasper Sewer and Water Authority (BJW&SA) provided SCDHEC with GIS coverages for the TMDL area. The GIS coverages included information regarding the number of households in the Okatie River watershed based on the information BJW&SA provided as of 2008. Based on this information, there are approximately 8635 households with a population of approximately 16,925 people within the Okatie River watershed. Of these 8635 households within the TMDL area, an estimated 919 households with an approximate population of 1,553 people are not served by sewer. Assuming one septic tank per household, there are an estimated 919 septic tanks within the Okatie River TMDL area.

Construction activities may be ongoing within the watershed. Future commercial and residential developments are expected to be connected to the central sewer system. Newer homes and communities are generally connected to the centralized sewer system.

Figure 17. An example of a residential community with horses.

Some of the older, existing homes utilize septic tanks. Improperly maintained and failing septic tanks can contribute to bacterial contamination of downstream waterbodies (US EPA, 2001). Untreated sewage from failing septic systems may have a potential to enter surface waters in this watershed. Although loading to streams from failing septic systems is likely to be a continual source, wet weather events can increase the rate of transport of effluent from failing septic systems. Figure 18 shows areas within the TMDL area that may not be connected to central sewer system.

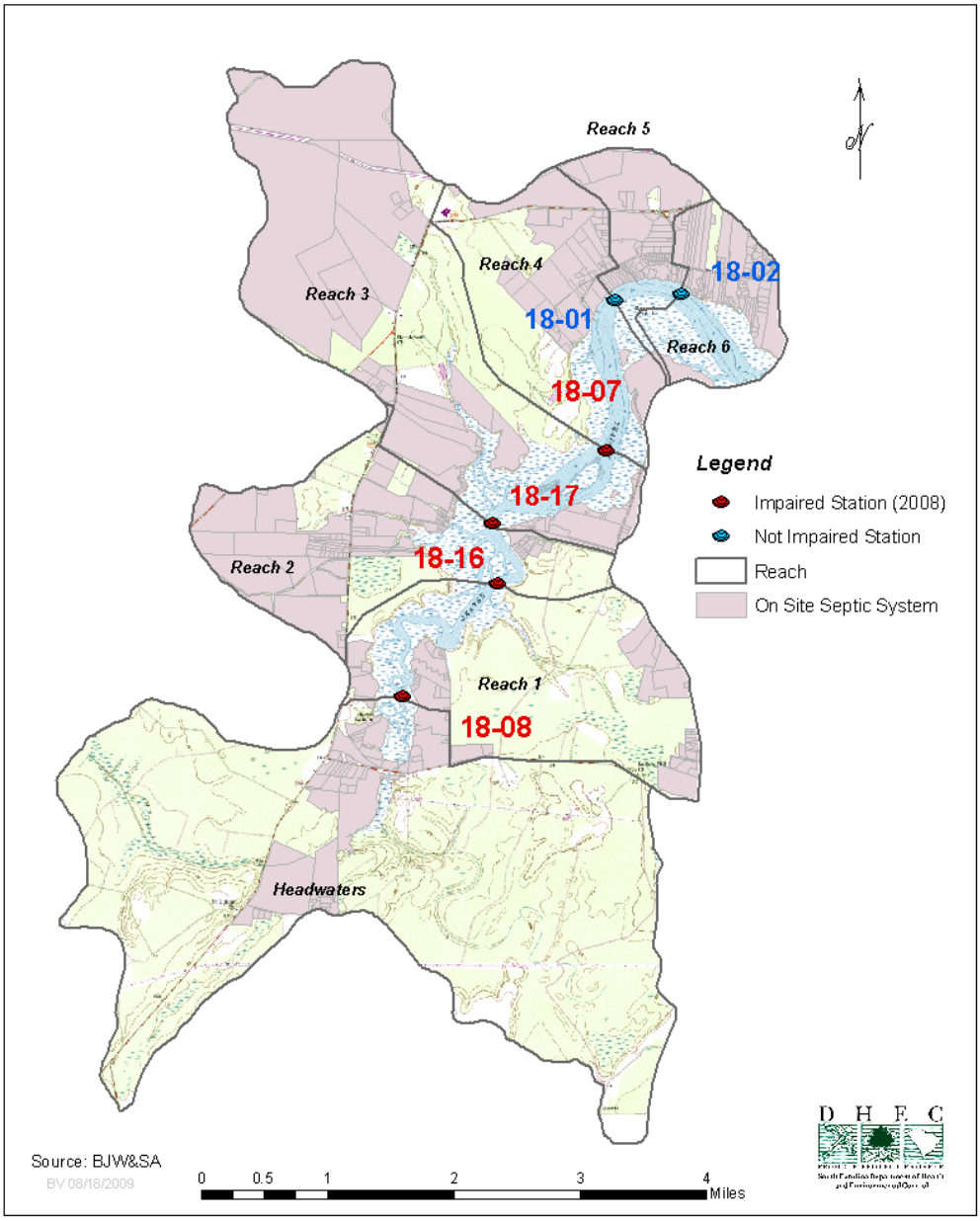


Figure 18. Areas with possible on site septic systems in the Okatie River TMDL area.

3.2.4 Wildlife and Domestic Animals

There is at least one known rookery (nesting or breeding places for animals) in vicinity of the Okatie River. This is located on the east side of Spring Island. Also, the two most abundant forms of wildlife are raccoons and deer. Population densities for deer are estimated to be approximately one per acre for hardwood/pine mixed forest and one deer per 20 acres for young pine forest. Raccoon densities are estimated to be approximately one per 1000 feet of linear shoreline (Dr. Chris Marsh, personal communication, May 22, 2009). As the population of wildlife increase, the water quality

in the Okatie River may also be negatively impacted by the increase of fecal matter deposited in adjacent areas and washed off during tidal cycles or by precipitation.

Within the TMDL watershed, there are at least 3 rural critical lands which were acquired by Beaufort County Council for conservation, parks, buffers, scenic vistas and for preservation of valuable economic and natural resources. Although these areas are protected, the existing urban wildlife may be a contributor of sources for fecal coliform in these areas.

Based on the SC DNR's 2008 deer density, there are 30 to 45 deer per square mile in the Okatie River TMDL area (SC DNR, 2008). These estimates by SC DNR are based on the suitability of the habitat. Yarow (1999) has shown the fecal coliform production by deer can be 3.47 x 10^3 cfu/deer a day. During numerous site visits, deer and raccoon tracks, water fowl and other birds were observed (See Appendix D for pictures taken during site visits).

3.2.5 Marinas, Boating Activities and Structures

There are currently no marinas within the TMDL watershed. Marinas are not allowed in shellfish harvesting waters unless the area is prohibited for the purposes of shellfish harvesting.

Data from SCDHEC Ocean & Coastal Resource Management (OCRM) show there are approximately 88 private recreational boat docks of various capacities, designs and lengths along the Okatie River (Figure 19).

There are 3 main types of marine sanitation devices (MSD) that are suitable for different kinds of marine vessels and have varying effluent treatment levels (Table 3). Every vessel with an MSD installed as of January, 30 1980 must be equipped with one of the three types of MSDs (33 USC 1322, 2008). Properly-maintained MSDs should not be causing or contributing to fecal coliform exceedances in the Okatie River.

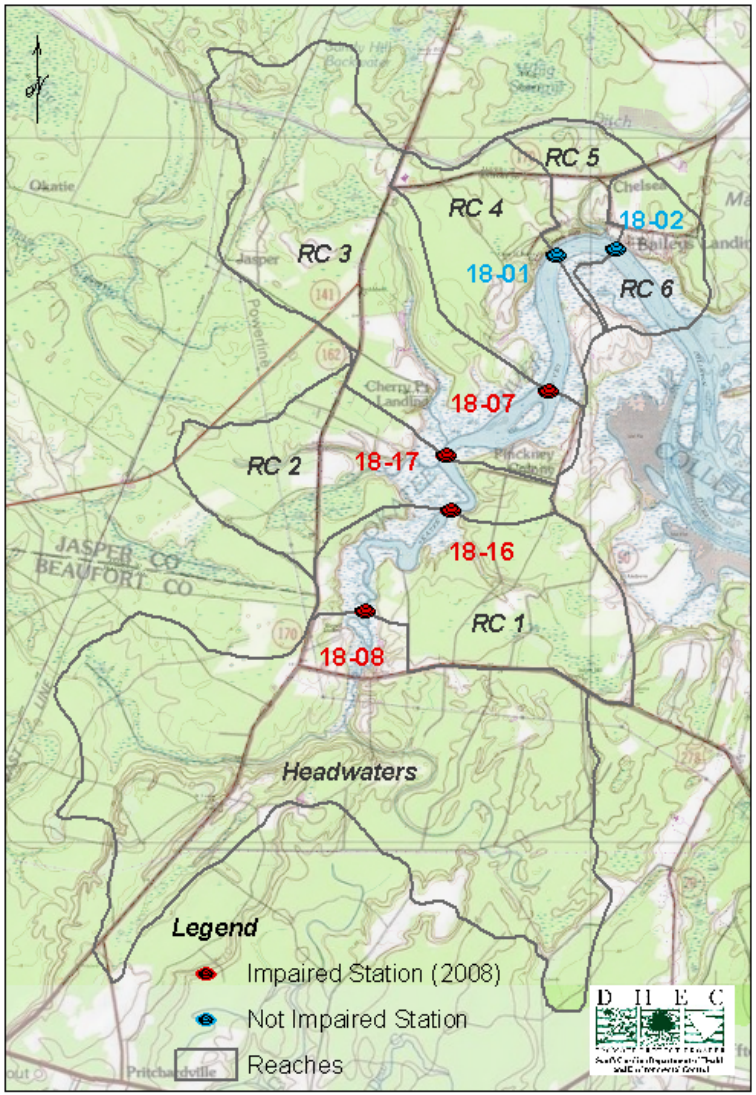
Table 3. Types of Marine Sanitation Devices

Sewage Treatment Device	Vessel Length	Effluent Standard
Type I MSD – flow through with maceration and disinfection	Equal to or less than 65 ft in length	FC count no greater than 1000/100ml and no visible floating solids
Type II MSD- flow through with advanced maceration and disinfection	Greater than 65 ft in length	FC count no greater than 200/100ml and suspended solids no greater than 150 mg/l
Type III MSD – holding tank	Any length	This type of MSD prevents overboard discharge of treated or untreated sewage

It is prohibited under Federal law to discharge untreated sewer from vessels within navigable waters as stated in Clean Vessel Act. Due to inadequate treatment by Type III MSDs, sewage discharge by recreational vessels is a substantial contributor to localized degradation of water quality in the United States (Clean Vessel Act, 1992). Although there are numerous boats and docks along the Okatie River, there are no pumpout facilities in the nearby vicinity.

In 2003, National Oceanic and Atmospheric Association's (NOAA) National Centers for Coastal Ocean Science organized a workshop to clarify factual information about the environmental impacts of docks. Documents resulting from this workshop highlight one of the following: The surface areas created especially by longer walkways and dock structures create hard, impervious surfaces for bird fecal mater to concentrate and possibly enter receiving waters through precipitation runoff. During numerous site visits by the Department staff, many birds were observed on docks, railings and other dock related structures. This was especially true during the colder months when the boat docks and dock structures are not being used.

Figure 19. Private docks at the end of walkways of various lengths along the Okatie River. Photograph was taken during outgoing tide.



Reach/Station	Potential Source of Fecal Coliform
Headwaters Station 18-08	SCDOT Maintained roads Non-regulated agricultural facilities Stormwater runoff Wildlife and pet waste Stormwater pond releases Failing septic tanks
Reach 1 Station 18-16	SCDOT Maintained roads Non-regulated agricultural facilities Stormwater runoff Wildlife and pet waste Stormwater pond releases Failing septic tanks Boating and boating related activities
Reach 2 Station 18-17	SCDOT Maintained roads Wildlife and pet waste Failing septic tanks Boating and boating related activities
Reach 3 Station 18-07	SCDOT Maintained roads Wildlife and pet waste Stormwater pond releases Failing septic tanks Boating and boating related activities
Reach 4 18-01 Reach 5 18-01 Reach 6 Not impaired	SCDOT maintained roads Wildlife and pet waste Failing Septic tanks Boating and boating related activities Unregulated agricultural activities

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Figure 20. Potential sources of fecal coliform within each reach as they relate to the Okatie River fecal coliform TMDL area.

4.0 CUMULATIVE PROBABILITY METHOD

The Okatie River is hydrodynamically complex system with large intertidal salt marshes, many creeks, sinuous channeling and ebb dominated flow. As mentioned previously, a model has been developed by Chen et al. however the model does not have an user interface to make it available to be used as a decision making tool.

Developing a functional and user friendly hydrodynamic and water quality model of the Okatie River system is resource intensive in many ways. However, through statistical and graphical methods a general understanding of the system can be obtained and necessary percent reductions in fecal coliform loading can be calculated. This approach has been supported by EPA Region 4 as well.

Cumulative probability distributions were used to calculate existing conditions and percent reductions necessary to meet shellfish waters standards for fecal coliform. For the calculations of the cumulative probability distributions, data from 2002 through 2006 were used for each station. Station 18-07 is included on the 303(d) due to human health concerns and FDA rules rather than for water quality sampling data excursions. Therefore a reduction is not applicable for this station. Prior to 2002, shellfish monitoring stations were included on the 303(d) List based on extent of the shellfish closure areas. The methodology changed with development of the 2002-303(d) list where the Department began listing individual stations. Table 4 illustrates the site history by 303(d) listing cycle.

Table 4. 303(d) listing history of impaired stations on the Okatie River.

Station	2008-303(d)	2006-303(d)	2004-303(d)
18-07	Yes	No	No
18-08	Yes	Yes	No
18-16	Yes	Yes	No
18-17	Yes	No	No

To create a cumulative probability graph, water quality measurements are first sorted in ascending order to determine rank and then assigned a probability plotting position using the following function:

$$p(\%) = \frac{100M}{N+1}$$

where, M = rank and N = number of samples (Novotny, 2004).

In this case, the log base 10 of fecal coliform is used. If the data follows a log-normal distribution, the data points on the plot will approximate a straight line (the normal distribution). This straight line is then compared to the water quality standard at the appropriate percentile. For SC shellfish waters this equates to 43 cfu/100ml minus a 5% margin of safety (40.9 cfu/100ml) at the 90th percentile. If the fit line crosses the 90th percentile reference line above the standard, the site is considered to not meet the standard for single sample maximums. If the line crosses below the standard reference

the site does meet the water quality standard. The evaluation is consistent with the NSSP approach under systematic random sampling scheme (which we use in place of adverse sampling). If the data does not meet the single sample standard, a line is drawn parallel to the original normal distribution line that intersects the standard at the 90th percentile point (Appendix D). Drawing the line parallel to the original distribution makes the assumption that the coefficient of variation remains the same for the original data and the desired water quality data (Novotny, 2003). The necessary percent reduction is calculated as the difference between the distributions at the 90th percentile point:

$$\frac{\text{Existing Load} - (\text{Standard} - \text{MOS})}{\text{Existing Load}} * 100$$

There are no stations that currently exceed the geometric mean criteria that do not also exceed the single standard sample. Figure 21 shows the cumulative probability graph for station 18-08. The graphs for the remaining stations can be found in Appendix A.

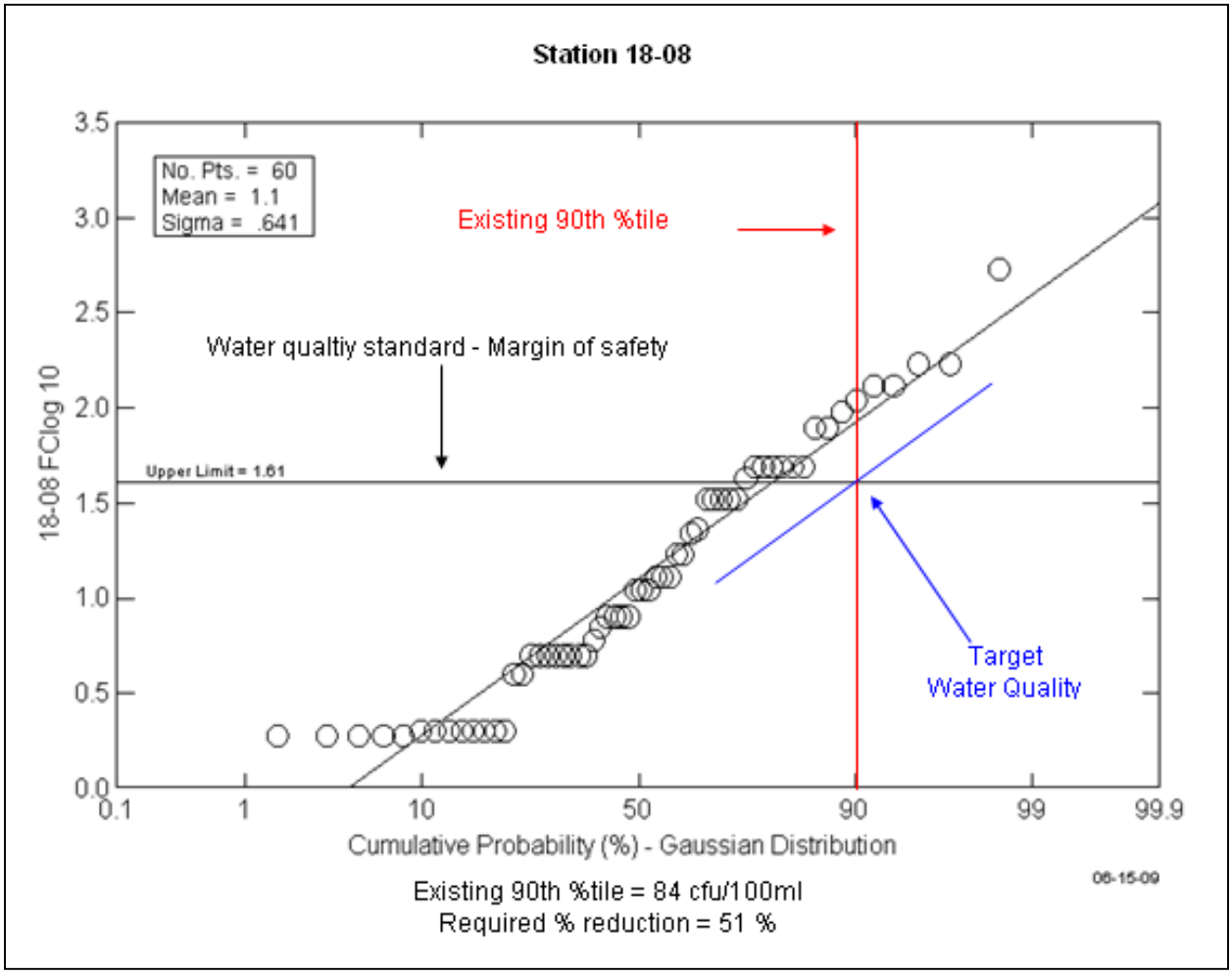

Figure 21. Cumulative probability graph for station 18-08

If sufficient approximations of tidal exchange and flow patterns were available, this method could be extended to calculate the total maximum daily fecal coliform loading in cfu/day for locations within the watershed. Average daily tidal exchange would be multiplied by the water quality standard of 43 cfu/100ml and a conversion factor. This number would represent the maximum daily load for all waters within the delineated watershed, whether impaired or not. There is not sufficient data to calculate the loadings for each station which is a limitation of this method.

5.0 DEVELOPMENT of the TMDLs

A total maximum daily load (TMDL) for a given pollutant and water body is comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body. Conceptually, this definition is represented by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while still achieving compliance with WQS. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established and thereby provide the basis to establish water quality-based controls.

For most pollutants, TMDLs are expressed as a mass load (e.g., kilograms per day). For bacteria, however, TMDLs are expressed in terms of number (#), colony forming units (cfu), organism counts (or resulting concentration), or MPN (Most Probable Number), in accordance with 40 CFR 130.2(l).

5.1 Critical Conditions

Critical conditions are the “worst-case” environmental conditions for exceedance of water quality standards and which occur at an acceptable frequency (US EPA, 1999). Due to the tidal and very complex hydrologic nature of the Okatie River, it is unclear what a critical flow would be. By including all data in the calculations, inclusion of the critical condition is implicit. Seasonal variation is also taken into account by including all monitoring data.

5.2 Wasteload Allocation

The WLA is the portion of the TMDL allocated to NPDES-permitted point sources (US EPA, 1999). The wasteload summation is determined by subtracting the margin of safety and the sum of the load allocation from the total maximum daily load. Note that all illicit dischargers, including Sanitary Sewer Overflows (SSOs), are illegal and not covered under the WLA of this TMDL.

SCDOT is currently the only designated MS4 located in the drainage area. Regulated MS4s are subject to the WLA component of this TMDL; however, there may be other unregulated MS4s located in the watershed that are subject to the LA component of this TMDL. At such time that the referenced entities or other future unregulated entities become regulated NPDES MS4 entities and subject to applicable provisions of SC Regulation 61-68, they will be required to meet load reductions prescribed in the WLA component of the TMDL. This also applies to future discharges associated with industrial and construction activities that will be subject to SC R. 61-9 122.26(b)(14) & (15) (2008).

5.2.1 Continuous Point Sources

The Okatie River is classified as ORW waters and direct dischargers to these waters are not allowable; however facilities with land application permits are allowable, but such operations are not allowed to discharge to waters of the State. Currently there are no direct discharges to the Okatie River. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern based on permitted flow and assuming an allowable permitted maximum concentration of 43cfu/100mL.

5.2.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS & SCR and regulated under SC Water Pollution Control Permits Regulation 122.26(b)(14) & (15). Illicit discharges, including SSOs, are not covered under any NPDES permit and are subject to compliance and enforcement mechanisms. All areas defined as “Urbanized Area” by the US Census are required under the NPDES Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater. Other non-urbanized areas may be required under the NPDES Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater.

Waste load allocations for stormwater discharges are expressed as a percentage reduction instead of a numeric concentration due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet the percentage reduction or the existing instream standard for the pollutant of concern. The percent reduction is based on the maximum percent reduction (critical condition) within any hydrologic category necessary to achieve target conditions. Table 5 presents the reduction needed for the impaired segments.

The percent reductions in this TMDL also apply to the fecal coliform waste load attributable to those areas of the watershed which are covered or will be covered under NPDES MS4 permits.

As appropriate information is made available to further define the pollutant contributions for the permitted MS4, an effort can be made to revise these TMDLs. This effort will be initiated as resources permit and if deemed appropriate by the Department. For the Department to revise these TMDLs the following information should be provided, but not limited to:

1) An inventory of service boundaries of the MS4 area covered in the MS4 permit provided as ARCGIS compatible shape files.

2) An inventory of all existing and planned stormwater discharge points, conveyances, and drainage areas for the discharge points, provided as ARCGIS compatible shape files. If drainage areas are not known, any information that would help estimate the drainage areas should be provided. The percentage of impervious surface within the MS4 area should also be provided.

3) Appropriate and relevant data should be provided to calculate individual pollutant contributions for the MS4 permitted entities. At a minimum, this information should include precipitation, water quality, and flow data for stormwater discharge points.

Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the wasteload allocation (WLA) and demonstrate consistency with the assumptions and requirements of the TMDL. However, the Department recognizes that SCDOT is not a traditional MS4 in that is does not possess statutory taxing or enforcement powers. SCDOT does not regulate landuse or zoning, issue building or development permits.

5.3 Load Allocation

The Load Allocation applies to the nonpoint sources of FC bacteria and includes unregulated processes/entities. It is expressed both as a concentration and as a percent. The load allocation is calculated as the difference between the target concentration under the critical condition and the point source WLA. The load allocation for each of the impaired stations in the Okatie River is expressed in tables as percent reduction (Table 5). The Department believes that meeting the highest percent reduction or the WQS, whichever is less restrictive, will effectively protect the shellfish harvesting beds in the referenced watershed for human consumption. There are no designated or potentially designated MS4s located in the drainage area. There may be other stormwater discharges located in the watershed that are subject to the LA component of this TMDL. At such time that the referenced entities, or other future unregulated entities become regulated NPDES MS4 entities and subject to applicable provisions of SC Regulation 61-68 D, they will be required to meet load reduction prescribed in the WLA component of the TMDL. This also applies to future discharges associated with industrial and construction activities that will be subject to SCR 122.26(b)(14) & (15).

5.4 Existing Load

Due to the tidal nature of the system, it is difficult to calculate an existing load for this system. For this reason, existing conditions are given as a concentration. Existing concentration is calculated as the concentration of fecal coliform at the 90th percentile

point based on the normal line fit to the monitoring data. Existing loads range from 52 cfu/100ml to 84 cfu/100ml (Table 5).

5.5. Margin of Safety

A margin of safety (MOS) allows for an accounting of the uncertainty in the relationship between pollutant loads and receiving water quality (US EPA, 1999). Incorporation of a MOS can be done either explicitly within the TMDL calculation or implicitly by using conservative assumptions (US EPA, 1999). This TMDL has an explicit 5% margin of safety, all water quality data is compared to 40.9 cfu/100ml which is the water quality single sample standard of 43 cfu/100ml minus five percent. There is also an unspecified implicit margin of safety in the percent reduction calculations derived from the cumulative probability graphs due to the assumption of independence of the data points (Novotny, 2004).

5.6 Calculation of the TMDL

A TMDL represents the loading capacity (LC) of a waterbody, which is the maximum loading a waterbody can receive without exceeding water quality standards (US EPA, 1999). The TMDL is the sum of the WLA for point sources, the load allocation (LA) for non-point sources and natural background, and a margin of safety (MOS). The TMDL can be represented by the equation (US EPA, 2001):

$$TMDL = LC = WLA + LA + MOS$$

The equation above results in reduction of fecal coliform concentrations ranging from 21% to 51% in order to consistently meet the instantaneous water quality standard for fecal coliform (Table 5) (Figure 22). From headwaters to station 18-08, required reductions are 51%. For station 18-16, reach 1 of the watershed, calculated reductions are 39%. Required reductions for station 18-17 are 21%. There are no required reductions for station 18-07 because existing water quality data demonstrate water quality standard is being attained. Station 18-07 has been listed as restricted by the shellfish program. Station 18-07 meets the approved water quality criteria but is classified as restricted to provide a buffer per Shellfish Sanitation Program protocol. The classification and 303(d) listing for station 18-07 is not based on documented water quality impairment; therefore, a percentage reduction is not needed at this time (hence, N/A). Applying the required percent reduction to each data point in the 2002-2006 dataset also results in the geometric mean criteria being met for all stations (Table 6).

Based on the information available at this time, the portion of the watershed that drains directly to a regulated MS4 and that which drains through the non-regulated MS4 has not been clearly defined. Loading from both types of sources (regulated and non-regulated) typically occur in response to rainfall events, and discharge volumes as well as recurrence intervals are largely unknown. Therefore, the regulated MS4 is assigned the same percent reduction as the non-regulated sources in the watershed. Compliance with the MS4 permit in regards to this TMDL document is determined at the point of discharge to waters of the state. The regulated MS4 entity is only responsible

for implementing the TMDL WLA in accordance with their MS4 permit requirements and is not responsible for reducing loads prescribed as LA in this TMDL document.

Table 5. Components of the Okatie River shellfish fecal coliform TMDL

Station	90th %tile of Existing Load (cfu/100ml)	TMDL [1, 2] (cfu/ 100ml)	WQ Target (cfu/ 100ml)	Margin Of Safety (cfu/ 100ml)	WLA			LA
					Continuous Sources[3] (cfu/ 100ml)	Non-Continuous [4, 7] Sources (% Reduction)	Non-Continuous SCDOT (% Reduction)	% Reduction to Meet LA[7]
18-07	33	43	40.9	2.1	N/A	N/A	N/A	N/A
18-08	84	43	40.9	2.1	N/A	51%	51% [6]	51%
18-16	67	43	40.9	2.1	N/A	39%	0% [5]	39%
18-17	58	43	40.9	2.1	N/A	21%	0% [5]	21%

Table Notes:

1. TMDL is expressed as a concentration. If daily average tidal exchange estimates were available, this number could be converted to load in cfu/day by multiplying flow by concentration and a conversion factor.
2. Shellfish WQS = No more than 10% of the samples shall exceed 43cfu/100 ml
3. WLA is expressed as a daily maximum; N/A = not applicable, no point sources. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings are developed based upon permitted flow and an allowable permitted maximum concentration of 43/100ml.
4. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.
5. As long as the conditions within the SCDOT MS4 area remain the same the Department deems the current contributions from SCDOT negligible and no reduction of FC bacteria is necessary. SCDOT must continue to comply with the provisions of its approved NPDES stormwater permit.
6. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address fecal coliform, the SCDOT will comply with this TMDL and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 Permit.
7. Percent reduction applies to existing concentration.

Table 6. Geometric means of actual data from 2004 through 2006

Station	Geometric Mean Actual Data (2002-2006)	TMDL % Reduction	Geometric Mean with % Reduction Applied
18-07	9.14	0 %	9.14
18-08	16.22	51%	7.95
18-16	14.68	39 %	8.96
18-17	11.48	21 %	9.07

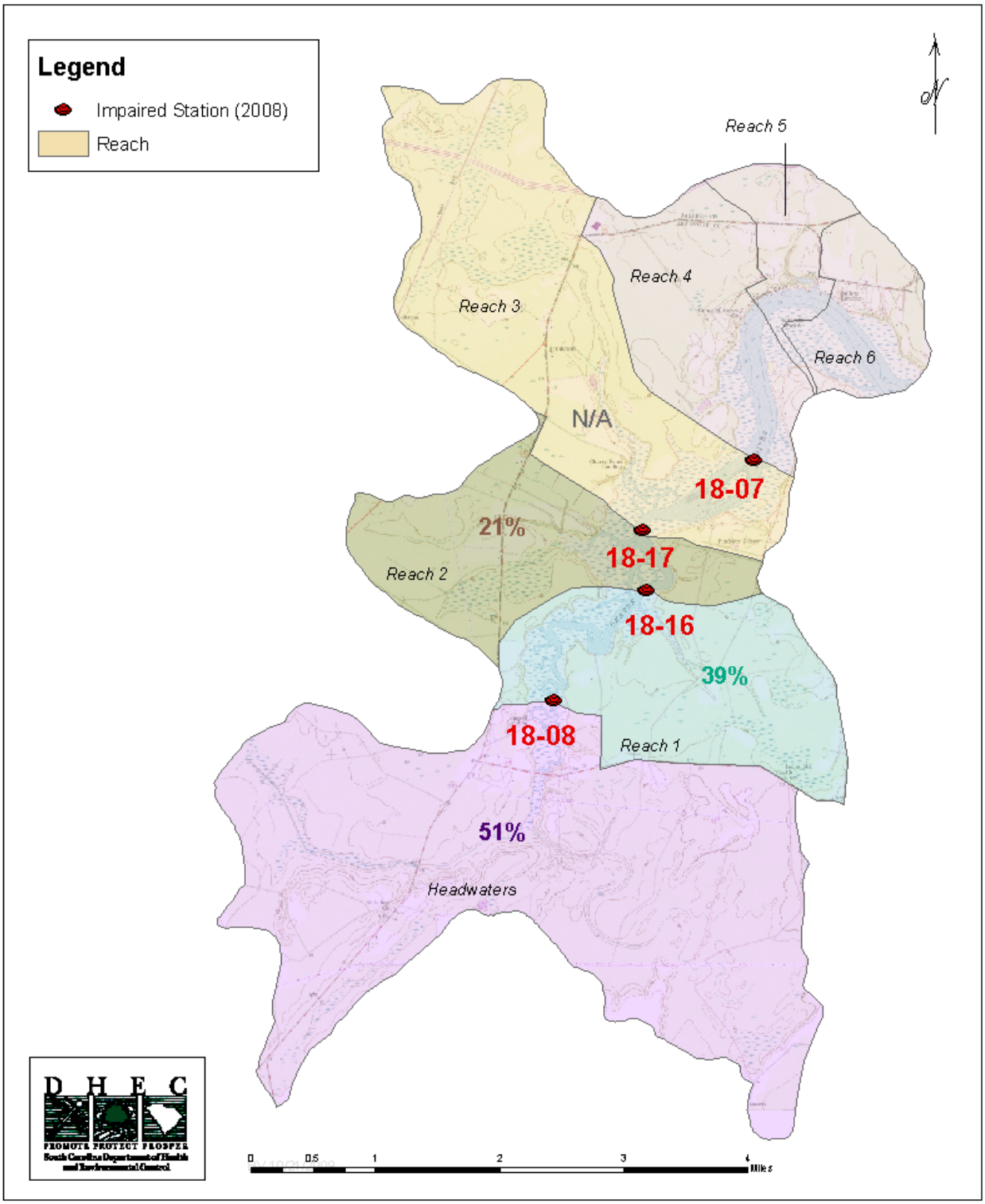

Figure 22. Percent reductions those are applicable to each reach within the Okatie River TMDL area is shown on the color coded map above.

6.0 IMPLEMENTATION

The implementation of both point (WLA) and non-point (LA) source components of the TMDL are necessary to bring about the required reductions in FC bacteria loading to the Okatie River in order to achieve water quality standards. Using existing authorities and mechanisms, an implementation plan providing information on how point and non point sources of pollution are being abated or may be abated in order to meet water quality standards is provided. Sections 6.1 and 6.2 and their subsections presented below correspond with sections 3.1 and 3.2 and their subsections of the source assessment presented in the TMDL document. As the implementation strategy progresses, DHEC may continue to monitor the effectiveness of implementation measures and evaluate water quality where deemed appropriate.

Point sources are discernible, confined, and discrete conveyances of pollutants to a water body including but not limited to pipes, outfalls, channels, tunnels, conduits, man-made ditches, etc. The Clean Water Act's primary point source control program is the National Pollutant Discharge Elimination System (NPDES). Point sources can be broken down into continuous and non-continuous point sources. Some examples of a continuous point source are wastewater treatment facilities (WWTF) and industrial facilities. Non-continuous point sources are related to stormwater and include municipal separate storm sewer systems (MS4), construction activities, etc. Current and future NPDES discharges in the referenced watershed are required to comply with the load reductions prescribed in the wasteload allocation (WLA).

Nonpoint source pollution originates from multiple sources over a relatively large area. It is diffuse in nature and indistinct from other sources of pollution. It is generally caused by the pickup and transport of pollutants from rainfall moving over and through the ground. Nonpoint sources of pollution may include, but are not limited to: wildlife, agricultural activities, illicit discharges, failing septic systems, and urban runoff. Nonpoint sources located in unregulated portions of the watershed are subject to the load allocation (LA) and not the WLA of the TMDL document.

South Carolina has several tools available for implementing the non-point source component of this TMDL. The *Implementation Plan for Achieving Total Maximum Daily Load Reductions from Nonpoint Sources for the State of South Carolina* (SCDHEC 1998) document is one example. Another key component for interested parties to control pollution and prevent water quality degradation in the watershed would be the establishment and administration of a program of Best Management Practices (BMPs). Best management practices may be defined as a practice or a combination of practices that have been determined to be the most effective, practical means used in the prevention and/or reduction of pollution.

Interested parties (local stakeholder groups, universities, local governments, etc.) may be eligible to apply for CWA §319 grants to install BMPs that will implement the LA portion of this TMDL and reduce nonpoint source FC loading to the Okatie River. Congress amended the Clean Water Act (CWA) in 1987 to establish the Section 319 Nonpoint Source Management Program. Under Section 319, States receive grant money to support a wide variety of activities including the restoration of impaired waters.

TMDL implementation projects are given highest priority for 319 funding. CWA §319 grants are not available for implementation of the WLA component of this TMDL nor within the MS4 jurisdictional boundary. Additional resources are provided in Section 7.0 of this TMDL document.

SC DHEC will work with the agencies in the area to provide nonpoint source education in this watershed and the surrounding watersheds. Local sources for nonpoint source education include Beaufort County Soil and Water Conservation District, Jasper County (serves Beaufort County) Natural Resources Conservation Service, Clemson Extension Service, South Carolina Department of Natural Resources, S.C. Sea Grant Extension Program.

The Department recognizes that **adaptive management/implementation** of this TMDL might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the Okatie River Watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL target accordingly.

6.1 Implementation Strategies

The strategies presented in this document for implementation of the referenced TMDL are not inclusive and are to be used only as guidance. The strategies are informational suggestions which may lead to the required load reductions being met for the referenced watershed while demonstrating consistency with the assumptions and requirements of the TMDL. Application of certain strategies provided within may be voluntary and are not a substitute for actual NPDES permit conditions.

6.1.1 Continuous Point Sources

Continuous point source WLA reductions are implemented through NPDES permits. The Okatie River is classified as ORW and direct discharges are not permitted. Currently, there are no direct discharges to the Okatie River.

6.1.2 Non-Continuous Point Sources

An iterative BMP approach as defined in the general storm water NPDES MS4 permit is expected to provide significant implementation of the WLA. Discovery and removal of illicit storm drain cross connections is one important element of the storm water NPDES permit. Public nonpoint source pollution education is another. Other permit requirements for implementing WLAs in approved TMDLs will vary across waterbodies, discharges, and pollutant(s) of concern. The allocation within a TMDL can take many different forms – narrative, numeric, specified BMPs – and may be complimented by other special requirements such as monitoring.

The level of monitoring necessary, deployment of structural and non-structural BMPs, evaluation of BMP performance, and optimization or revisions to the existing pollutant reduction goals of the SWMP or any other plan is TMDL and watershed specific. Hence, it is expected that NPDES permit holders evaluate their existing SWMP or other plans in

a manner that would effectively address implementation of this TMDL with an acceptable schedule and activities for their permit compliance. The Department staff (permit writers, TMDL project managers, and compliance staff) is willing to assist in developing or updating the referenced plan as deemed necessary. Please see Appendix E which provides additional information as it relates to evaluating the effectiveness of an MS4 Permit as it related to compliance with approved TMDLs. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. For SCDOT, exiting and future NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of the WLA to the MEP. For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and condition of its permit is effective implementation of the WLA.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Achieving the WLA reduction for the TMDL may constitute MS4 compliance with its SWMP provided the MEP definition is met; even where, the numeric percent reduction may not be achieved in the interim.

Regulated MS4 entities are required to develop a SWMP that includes the following: public education, public involvement, illicit discharge detection & elimination, construction site runoff control, post construction runoff control, and pollution prevention/good housekeeping. These measures are not exhaustive and may include additional criterion depending on the type of NPDES MS4 permit that applies. These examples are recognized as acceptable stormwater practices and may be applied to unregulated MS4 entities or other interested parties in the development of a stormwater management plan.

An informed and knowledgeable community is crucial to the success of a stormwater management plan (USEPA, 2005). MS4 entities may implement a public education program to distribute educational materials to the community, or conduct equivalent outreach activities about the impacts of stormwater discharges on local waterbodies and the steps that can be taken to reduce stormwater pollution. Some appropriate BMPs may be brochures, educational programs, storm drain stenciling, stormwater hotlines, tributary signage, and alternative information sources such as web sites and bumper stickers (USEPA, 2005).

The public can provide valuable input and assistance to a MS4 program and they may have the potential to play an active role in both development and implementation of the stormwater program where deemed appropriate. There are a variety of practices that can involve public participation such as public meetings/citizens panels, volunteer water quality monitoring, volunteer educators, community clean-ups, citizen watch groups, and “Adopt a Storm Drain” programs which encourage individuals or groups to keep storm drains free of debris and monitor what is entering local waterways through storm drains (USEPA, 2005).

During a recent site visit on June 8, 2009, a heavy rain event was observed within the Okatie River watershed and runoff from impervious surfaces. Due to the very complex hydrologic nature of the Okatie River, it's classification as ORW, its use as shellfish harvesting waters, it is recommended that measures be taken to minimize the stormwater runoff surrounding the Okatie River. Being a saline estuary and input of freshwater as runoff due to precipitation can change the chemistry of the Okatie River by causing salinity variances may potentially impact aquatic life. One option is to develop a stormwater collection and reclamation system along major roads with drainage to the receiving waters can be used for none potable purposes. Other options are building wetlands and/or rain gardens for reducing such stormwater runoff. Also, planting vegetative buffers have been shown to be highly effective for prevention of stormwater runoff. http://www.scdhec.gov/environment/ocrm/pubs/docs/backyard.pdf

Illicit discharge detection and elimination efforts are also necessary. Discharges from MS4s often include wastes and wastewater from non-stormwater sources. These discharges enter the system through either direct connections or indirect connections. The result is untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies (USEPA, 2005). Pollutant levels from these illicit discharges have been shown in EPA studies to be high enough to significantly degrade receiving water quality and threaten aquatic, wildlife, and human health. MS4 entities may have a storm sewer system map which shows the location of all outfalls and to which waters of the US they discharge to. If not already in place, an ordinance prohibiting non-stormwater discharges into MS4 with appropriate enforcement procedures may also be developed. Entities may also have a plan for detecting and addressing non-stormwater discharges. The plan may include locating problem areas through infrared photography, finding the sources through dye testing, removal/correction of illicit connections, and documenting the actions taken to illustrate that progress is being made to eliminate illicit connections and discharges.

A program might also be developed to reduce pollutants in stormwater runoff to their MS4 from construction activities. An ordinance or other regulatory mechanism may exist requiring the implementation of proper erosion and sediment controls on applicable construction sites. Site plans should be reviewed for projects that consider potential water quality impacts. It is recommended that site inspections should be conducted and control measures enforced where applicable. A procedure might also exist for considering information submitted by the public (USEPA, 2005). For information on specific BMPs please refer to the SCDHEC Stormwater Management BMP Handbook online at: http://www.scdhec.com/environment/ocrm/pubs/docs/SW/BMP_Handbook

Post-construction stormwater management in areas undergoing new development or redevelopment is recommended because runoff from these areas has been shown to significantly affect receiving waterbodies. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management (USEPA, 2005). Strategies might be developed to include a combination of structural and/or non-structural BMPs. An ordinance or other regulatory mechanism may also exist requiring the implementation of post-construction runoff controls and ensuring their long term-

operation and maintenance. Examples of non-structural BMPs are planning procedures and site-based BMPs (minimization of imperviousness and maximization of open space). Structural BMPs may include but are not limited to stormwater retention/detention BMPs, infiltration BMPs (dry wells, porous pavement, etc.), and vegetative BMPs (grassy swales, filter strips, rain gardens, artificial wetlands, etc.)

Pollution prevention/good housekeeping is also a key element of stormwater management programs. Generally this requires the MS4 entity to examine and alter their actions to ensure reductions in pollution are occurring. This could also result in a reduction of costs for the MS4 entity. It is recommended that a plan be developed to prevent or reduce pollutant runoff from municipal operations into the storm sewer system and it is encouraged to include employee training on how to incorporate pollution prevention/good housekeeping techniques. To minimize duplication of effort and conserve resources, the MS4 operator can use training materials that are available from EPA or relevant organizations (USEPA, 2005).

MS4 communities are encouraged to utilize partnerships when developing and implementing a stormwater management program. Watershed associations, educational entities, and state, county, and city governments are all examples of possible partners with resources that can be shared. For additional information on partnerships contact the SCDHEC Watershed Manager for the waterbody of concern online at: http://www.scdhec.gov/environment/water/shed/contact.htm. For additional information on stormwater discharges associated with MS4 entities please see the USEPA NPDES website online at http://cfpub.epa.gov/npdes/home.cfm?program_id=6 for information pertaining to the National Menu of BMPs, Urban BMP Performance Tool, Outreach Documents, etc.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Achieving the WLA reduction for the TMDL may constitute MS4 compliance with its SWMP, provided the MEP definition is met, even where the numeric percent reduction may not be achieved in the interim.

6.2 Nonpoint Sources

6.2.1 Urban and Suburban Stormwater Runoff

In estuaries, urban runoff is considered the leading cause of impairment. Runoff from urban areas is the results of imperviousness, population and traffic density and all activities connected with urban living (Novotny, 2003). Also, estuaries are saline environments and urban runoff, due to precipitation is fresh water. This fresh water runoff into the estuarine environments causes salinity variances, adversely effecting organisms that are adapted to high salinity. Several studies have shown that salinity fluctuations cause a decrease in biomass of organisms, change in species dominance, reduced growth and survival and other physiological stress. These studies recommend gaining control of salinity fluctuations may help improve estuarine habitats through management of freshwater runoff from urban and suburban environments (Montague & Ley 1993, Mallin et al. 2008). Although there are no required reductions for

downstream of station 18-07, it is recommended that measures be taken to reduce nonpoint source runoff in the form of stormwater runoff input to reaches 3, 4, 5 and 6.

Figure 23: Aerial view of US 278 flying from west to east. Portion of the proposed widening of the US 278 is indicated on the picture Photograph was taken during low tide conditions.

Beaufort County has taken steps to reduce the effects of stormwater runoff and these are summarized in Beaufort County Stormwater Management Plan (2008). Based on County's stormwater ordinance, ponds with a positive outfall should be designed so that the post development peak flow rate is less than or equal to peak flow rate for 25-year/24-hour design storms. For ponds with no outfalls (retention and detention ponds), they should be designed to retain 100-year/24-hour design storms. Minimizing surface water runoff directly to the receiving streams may help to improve the water quality in the Okatie River.

The Beaufort County Stormwater Management Plan (BCSWMP) further requires vegetative strips between wetlands and urban development. In January of 2008, Beaufort County adopted Town of Bluffton's BMPs into the County BMP Manual and with this inclusion; the following are required of developers in the County to reduce the amount of post development stormwater runoff:

- Directing of drainage from roofs to adjacent pervious surfaces
- Installing grass swales on lots with appropriate soil types
- Parking lot islands to be sunken rather then raised with curbs
- Commercial parking lots must have at least 50% pervious pavements
- Install disconnected drainage where possible.

The Stormwater Management Plan also has an overview of structural BMPs that are appropriate for Beaufort County as well as FC removal efficiencies of certain types of

BMPs. For further details, please refer to Beaufort County Stormwater Management Plan (2008).

Potential BMPs for residential, industrial and commercial lots with impervious surfaces for consideration but not limited to are, capturing rain by either using rain barrels (for single family residential units or other small buildings) or a rain water collection system for later use in landscape watering or other none potable uses. Another option would be, when appropriate, constructing rain gardens or wetlands to slow surface water runoff rates from impervious surfaces and to allow for percolation of runoff to recharge ground water. Also, using porous pavements/materials allows runoff due to precipitation percolate hence reducing the runoff rate.

6.2.2 Agricultural Runoff

Agriculture is a complex and large industry with great potential to adversely affect the environment by nonpoint source runoff (Novotny 2003).

Sources of fecal coliform bacteria of nonpoint source origins to the nearby water bodies from agricultural and silvicultural activities are livestock with uncontrolled access to riparian areas, improper manure application, and concentrated or pastured animal operations, etc. Pastureland without proper erosion control measures is over grazed, or when grazing livestock are allowed to approach receiving waters are contributing to nonpoint source pollution. If these are controlled, and with additional BMPs, pollution from these lands can be minimized (Novotny 2003).

There are several agricultural facilities as well as horse barns around the Okatie River. During the last site visit on June 8th, horses, cows and a number of dogs were seen on farms on right bank of the Okatie River, downstream from US 278 Bridge. Also, during the aerial flight on June 1, 2009, numerous farm animals were seen near the Okatie River. Potential sets of BMPs to reduce fecal mater runoff for such facilities may include reviewing the manure application/management systems at these facilities for a better understanding of potential sources for runoff. Installing vegetative buffers may be helpful for reducing runoff especially in areas that are dominated by hydric soils.

Also, many of the residential communities have horses on their properties. Although these residential areas are not agricultural facilities, they are mentioned in this section. It may be beneficial to review the manure application/management plans of these communities. The runoff from horse fields may be entering the stormwater ponds of these communities and thus concentrated fecal coliform may be unintentionally being released to the Okatie River.

Agricultural BMPs can be vegetative, structural or management oriented. When selecting BMPs, it is prudent to keep in mind that nonpoint source related pollution occurs when a pollutant becomes available, is detached and then transported to nearby receiving waters. Therefore, for BMPs to be effective, the transport mechanism of the pollutant, fecal coliform, needs to be identified.
Fencing livestock (Figure 24) is an effective way for confining the livestock in a certain area where BMPs are deployed; however in certain cases it may not be sufficient for

prevention of overland runoff. In the example shown in Figure 25, it may help to deploy additional BMPs such as a vegetative buffer with different growth rates behind the fence of where livestock are kept.

There are several state and federal assistance programs available to agricultural producers, and some of these are described below and electronics links for these programs area available under Section 7 of the TMDL document.

One of the programs that are available through USDA is the Environmental Quality Incentives Program (EQIP). This also is a voluntary conservation program for farmers and ranchers that promote agricultural production and environmental quality as national goals. Eligible participants receive financial and technical help from EQIP to install or implement structural and management related BMPs. Further information is available in Section 7 of this document.

It is recommended that BMPs for all existing agricultural facilities be reviewed for their effectiveness and reduction of runoff.

Figure 24. Fencing is one of the BMPs that can be deployed for confining livestock.

Figure 25. Planting a vegetative buffer consisting of plants with differing growth rates may help in reducing the runoff over fields where livestock are kept.

6.2.3 Failing Septic Systems

Based on the information received from BJW&SA, some of the homes around the Okatie River utilizes on site septic systems. Due to the age, lack of maintenance and improper use can cause septic systems to malfunction. Homeowner education about proper maintenance and repairing of their septic systems may help reduce runoff from these treatment systems. Also, encouraging homeowners to have their septic systems inspected and pumped on regular basis is another potential intervention for reducing bacterial runoff/contamination from these systems.

In addition to the resources cited in Section 7 of this document for the implementation of these TMDLs, Clemson Extension has developed a Home-A-Syst handbook that can help urban or rural homeowners reduce sources of NPS pollution from their property. This document guides homeowners through a self-assessment, including information on proper maintenance practices for septic tanks. SCDHEC also employs a nonpoint source educator who can assist with distribution of these tools as well as provide additional BMP information.

The Office of Coastal Resource Management (OCRM) has created a toolkit for homeowners and local governments which include tips for maintaining their systems. These septic system Do's and Don'ts are as follows:

Septic System Do's and Don'ts from SCDHEC Office of Coastal Resource Management:

Do's:

- Conserve water to reduce the amount of wastewater that must be treated and disposed of by your system. Doing laundry over several days will put less stress on your system.
- Repair any leaking faucets or toilets. To detect toilet leaks, add several drops of food dye to the toilet tank and see if dye ends up in the bowl.
- Divert down spouts and other surface water away from your drainfield. Excessive water keeps the soil from adequately cleansing the wastewater.
- Have your septic tank inspected yearly and pumped regularly by a licensed septic tank contractor.

Don'ts:

- Don't drive over your drainfield or compact the soil in any way.
- Don't dig in your drainfield or build anything over it, and don't cover it with a hard surface such as concrete or asphalt.
- Don't plant anything over or near the drainfield except grass. Roots from nearby trees an shrubs may clog and damage the drain lines.
- Don't use your toilet as a trash can or poison your system and the groundwater by pouring harmful chemicals and cleansers down the drain. Harsh chemicals can kill the bacteria that help purify your wastewater.

For additional information on how septic systems work and how to properly plan a septic system, please visit the DHEC Environmental Health Onsite Wastewater page at the following link: http://www.scdhec.gov/health/envhlth/onsite_wastewater/septic_tank.htm

6.2.4 Wildlife and Domestic Animals

There are several projects around the Okatie River administered by Beaufort County Rural and Critical Land Preservation Program. Some of these properties are zoned for passive recreational purposes. Generally, passive recreation areas are undeveloped spaces and/or environmentally sensitive areas. These areas around the Okatie River watershed are important areas for buffering of environmental impacts related to population growth.

In any public places, feeding of or providing food for wild animals including deer, wild ducks, geese, swans and seagulls should be discouraged. By avoiding the feeding of birds, there will be reduced waste accumulating on impervious areas such as on roadsides, walkways, boats, docks and related structures thus helping to avoid these structures from becoming conveyors of fecal matter into the receiving waters due to run-off from precipitation or tides (EPA, 2001).

Maintaining a vegetative buffer around the residential areas will help filter pet waste that may accumulate in gardens and public walkways. For example, in Figure 26 below, a trench is visible along the fence of a residential unit which flows to a road side ditch. Without any buffers or other BMPs, during rain events, fecal matter may be washed off to the roadside stormwater ditches.

Figure 26. As seen in the photograph a trench that runs off to a road side storm water ditch. For preventing stormwater runoff from areas with pet waste or malfunctioning on site septic systems, planting of vegetative buffers or other BMPs are recommended.

Installation of pet waste collection stations in residential neighborhoods along with dispensing of pet waste bags and bag holders for dog owners are recommended.

There are several other recommendations in Section 7 of this document along with suggestions for public outreach and education.

6.2.5 Marinas, Boating Activities and Structures

Boating related activities have potential to contribute to fecal coliform contamination through potential discharges from installed toilet and gray water, and these discharges can contain bacteria. Improperly maintained or malfunctioning MSDs have the potential to leak or discharge untreated sewage. Therefore, it is important to bring attention of boating public to available pumpout facilities near the Okatie River. A map of available pumpout facilities can be found at Appendix G.

Another important factor is outreach and education for boat and dock owners regarding the proper use and maintenance of MSDs, and impact of improper vessel discharges in shellfish harvesting waters. There are pumpout facilities are located on Skull Creek to the west of Hilton Head Island, and on Beaufort River to the northeast of the Okatie River (SC DNR, 2007). Marinas are prohibited unless the area is prohibited for shellfish

harvesting. Therefore it is prudent to bring awareness to the boating public regarding the locations of available pump out facilities in the nearby vicinity.

Docks can be one of the sources as well as conveyors (as impervious surfaces) for potential fecal coliform contamination. Especially during the boating season, family pets can be also be sources for fecal coliform contamination. Also fishing and shellfishing (such as crabbing) related waste can attract wildlife, especially birds and waste from these types of activities may need to be contained and disposed of properly.

Numerous site visits were conducted during winter months in the Okatie River watershed and many types of birds were observed on dock structures (Figure 27). Outreach and education focusing towards private dock owners and boating public may help mitigate some of the sources of fecal coliform. These outreach and education messages can focus on, but not limited to, awareness about impervious surfaces, pet waste collection, responsible fishing and shellfish activities, not providing food for wildlife, etc.

Figure 27. Shore birds on impervious surfaces, such as docks, may be one of the sources for fecal coliform.

7.0 RESOURCES

This section provides a listing of available resources to aid in the mitigation and control of pollutants. There are examples from across the nation, most of which are easily accessible on the World Wide Web.

7.1 General Information for Non-Continuous Point Sources

Changing Land Use Patterns in the Coastal Zone (2006). Managing Environmental Quality in Rapidly Developing Regions. G.S. Kleppel, M.R. De Voe, M.V. Rawson (Eds). Springer Science+Business Media, LLC.

Cities of the Future – Towards Integrated Sustainable Water and Landscape Management (2007). Proceedings of an International Workshop held July 12-14, 2006 in Racine, WI. V. Novotny and P.R. Brown (Eds). IWA Publishing, London, UK. 427pp.

Center for Watershed Protection. Available at: http://www.cwp.org/

Carolina Clear. Available at http://media.clemson.edu/public/restoration/carolina%20clear/toolbox/publication_raingardenmanual_022709.pdf

Green Highways. Available at: http://www.greenhighways.org/

Interlocking Concrete Pavement Institute. Available at: http://icpi.org/index.cfm

Rain Barrels: Rainwater Harvesting from Rooftop Catchments. Available at: http://www.oas.org/usde/publications/Unit/oea59e/ch10.htm

Puget Sound Partnership. Available at: http://www.psp.wa.gov/

DC Greenworks Green Roofs. Available at: http://www.dcgreenworks.org/

Roofscapes, Inc. Taking Green Roofs to the Next Level. Available at: http://www.roofmeadows.com/

Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows. Natural Resources Defense Council. Available at: http://www.nrdc.org/water/pollution/rooftops/contents.asp

Getting In Step Outreach Guide is a program developed by US EPA and is available through Nonpoint Source Outreach Toolbox at: http://www.epa.gov/owow/nps/toolbox/guide.htm

Low Impact Development Center, Inc. Sustainable Design and Water Quality Research. Available at: http://www.lowimpactdevelopment.org/

Featured Products: General Stormwater and Storm Drain Awareness. Available through Nonpoint Source Outreach Toolbox at: http://www.epa.gov/owow/nps/toolbox/generalstormwater.htm

Clemson Extension Storm Drain Stenciling. Available at: http://www.clemson.edu/waterquality/stencil.htm

7.2 General Information for Nonpoint Sources

7.2.1 Pet Waste

Doggie Dooley In-Ground Waste Digester Systems. Available at: http://www.drsfostersmith.com/product/prod_display.cfm?pcatid=570

Featured Products: Pet Care. Available through Nonpoint Source Outreach Toolbox at: http://www.epa.gov/owow/nps/toolbox/petcare.htm

7.2.2 Wildlife

http://www.epa.gov/nps/mmsp/section4.11.pdf

7.2.3 Septic Systems

Featured Products: Septic System Care. Available through Nonpoint Source Outreach Toolbox at: http://www.epa.gov/owow/nps/toolbox/septic.htm

Clemson Extension Home*A*Syst. Available at: http://www.clemson.edu/waterquality/homasys.htm

7.2.4 Agriculture

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Agricultural Management Assistance. Available at: http://www.nrcs.usda.gov/Programs/AMA/

Environmental Quality Incentives Program. Available at: http://www.nrcs.usda.gov/programs/eqip/

7.3 Restoration

South Carolina Oyster Restoration and Enhancement (SCORE). SCORE is a community based restoration program geared towards oyster habitat restoration and

monitoring program of the SC DNR. Contact Nancy Hadley or Michael Hodges with SC DNR. More information can be found at: http://score.dnr.sc.gov/

A Practitioners Guide to the Design and Monitoring of Shellfish Restoration Projects. Available at: http://www.nmfs.noaa.gov/habitat/restoration/publications/TNCNOAAshellfish_hotlinks_final.pdf

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Shellfish Reefs at Risk: Recommendations for Conservation, Restoration and Management. Available at: http://www.nature.org/initiatives/marine/shellfish/help/

7.4 Outreach and Education

Nonpoint Source Runoff Pollution SCDHEC
http://www.scdhec.gov/environment/water/npspage.htm

Stormwater drain tagging
Scoop the Poop campaign

Buffers: http://www.scdhec.gov/environment/ocrm/pubs/docs/backyard.pdf

Docks: http://www.scdhec.gov/environment/ocrm/pubs/docs/Dock_Building.pdf

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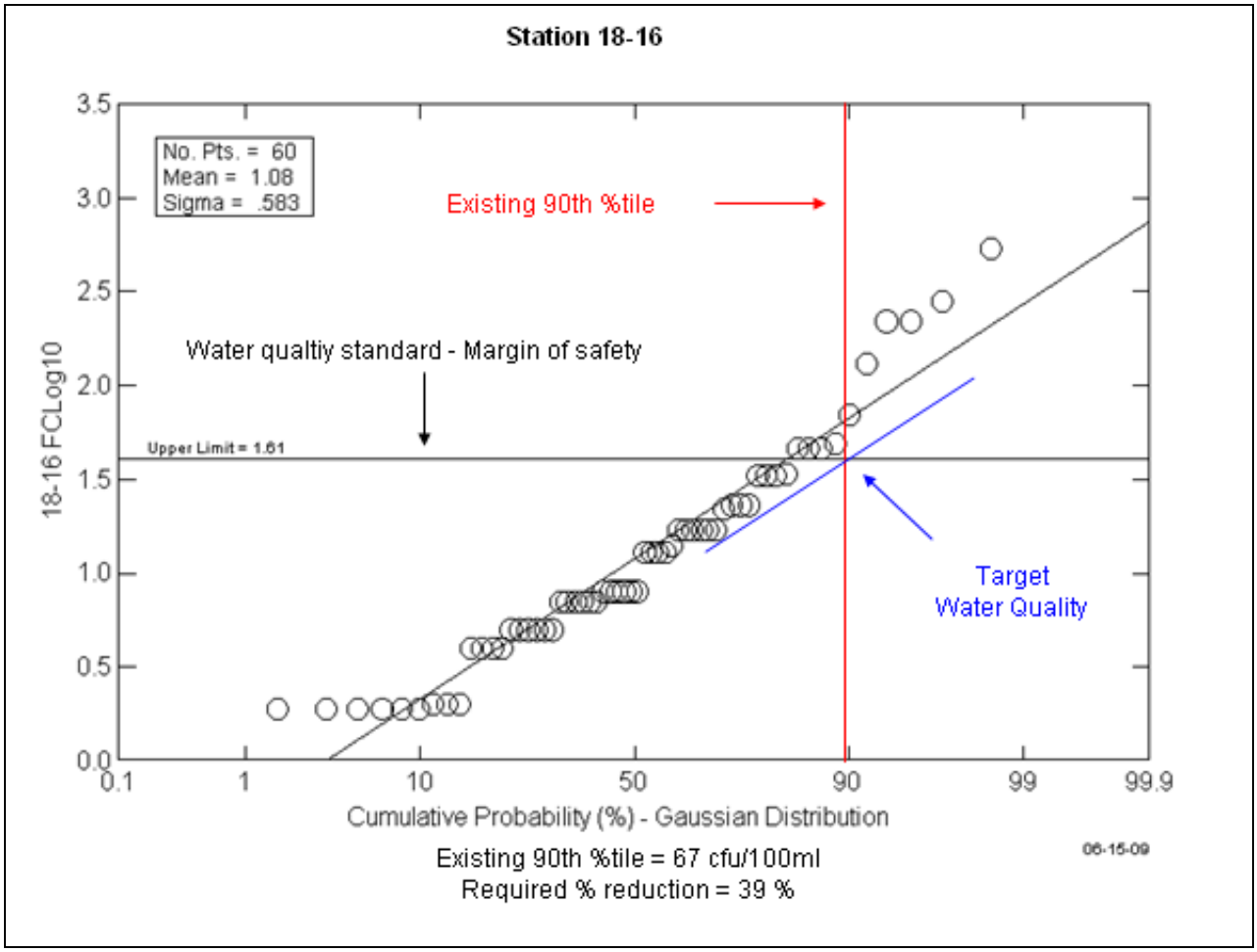
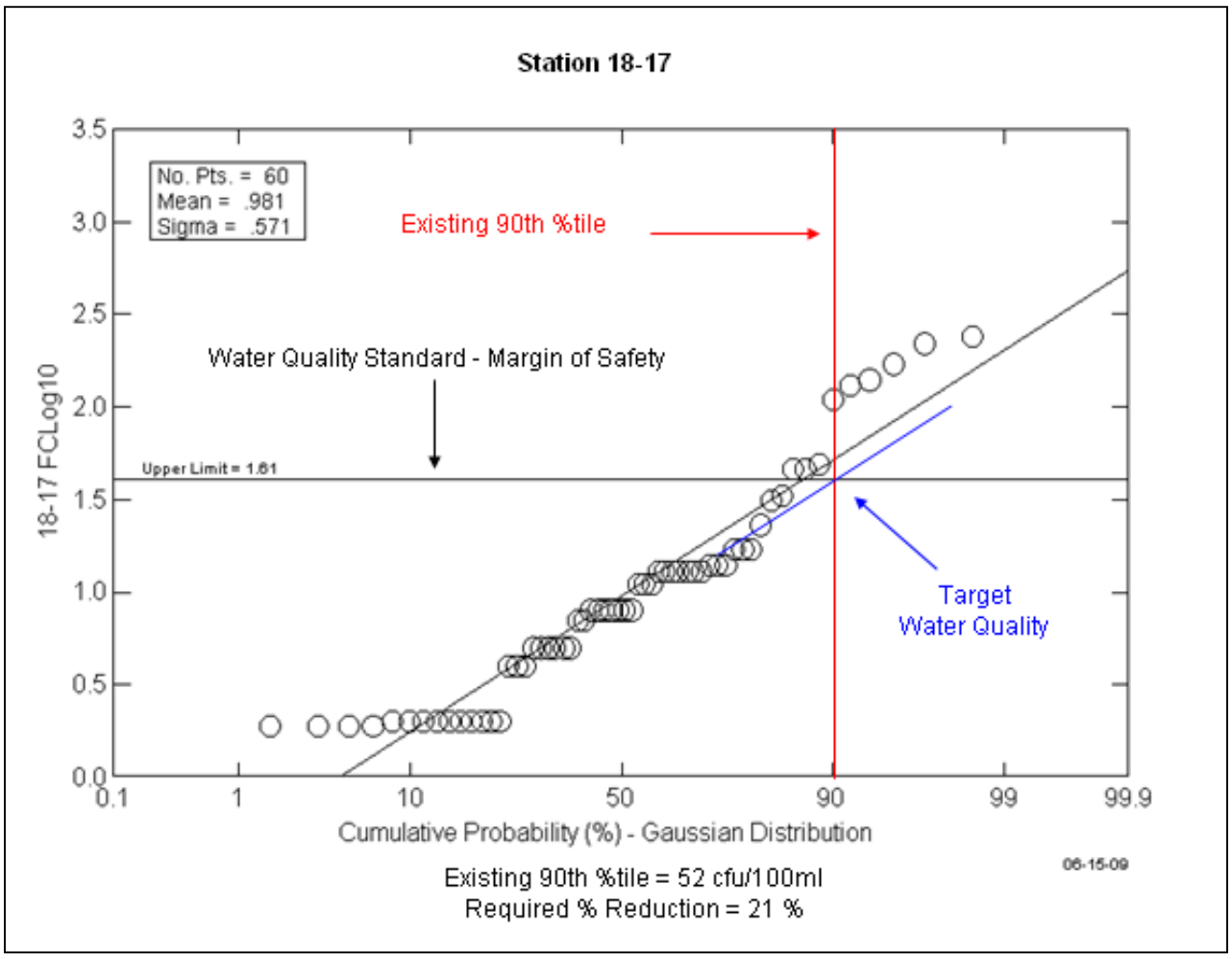
Appendix A

Cumulative Probability Graphs

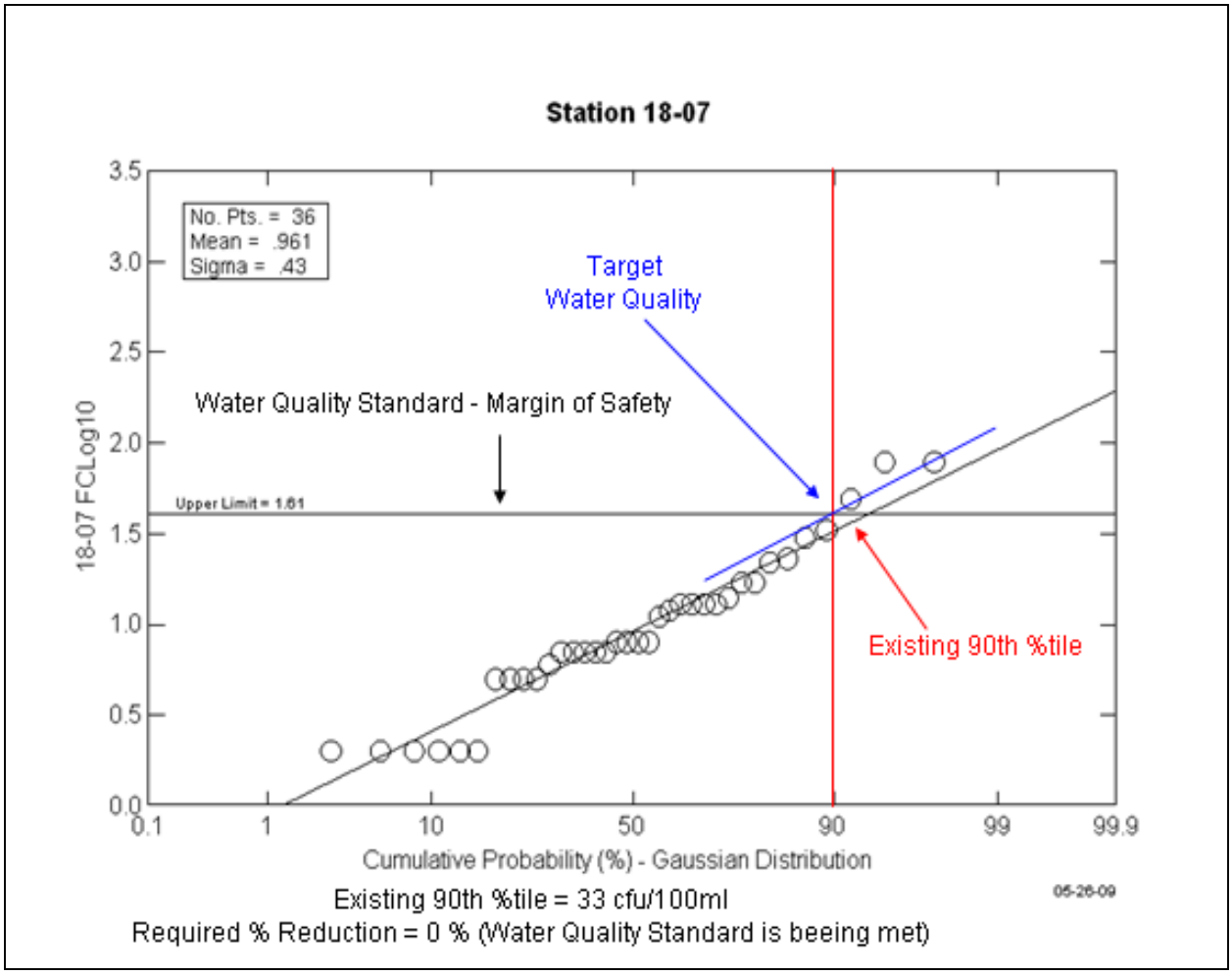
Station 18-16 Cumulative probability graph



Station 18-17 Cumulative probability graph



Station 18-07 Cumulative probability graph



Appendix B

Shellfish Monitoring Data for Stations 18-07, 18-08, 18-16 and 18-17, and Antecedent Observed Precipitation Values from BJW&SA's Chelsea Plant

Station ID	Sample Collection Date	Fecal Coliform Result mpn/100ml	Precipitation Day Of Sample (inches)	Precipitation 1 Day Prior (inches)	Precipitation 2 Days Prior (inches)	Precipitation 3 Days Prior (inches)	Precipitation 4 Days Prior (inches)
18-07	12/14/06	8	0.3	0	0	0	0
18-07	11/28/06	2	0	0	0	0	0
18-07	10/17/06	7	0	0	0	0	0
18-07	09/06/06	30	2	0.01	0.02	1.53	0
18-07	08/15/06	13	0	0.89	0	0.5	0
18-07	07/25/06	11	0.2	0.75	0	0	0
18-07	06/19/06	17	0	0	0	0	0
18-07	05/01/06	8	0	0	0	0	0
18-07	04/18/06	17	0	0	0	0	0
18-07	03/14/06	14	0.07	0	0	0	0
18-07	02/15/06	5	0	0	0	0.01	0.25
18-07	01/23/06	13	0.04	0.02	0.03	0	0
18-07	12/12/05	22	0	0	0	0.24	0.75
18-07	11/08/05	23	0	0.02	0	0	0
18-07	10/19/05	7	0.02	0	0	0	0
18-07	09/21/05	6	0	0	0	1.15	0
18-07	08/10/05	79	3.38	0.45	0.25	0.25	0.25
18-07	07/11/05	2	0	0.22	0.57	0.65	0
18-07	06/15/05	79	0	0	0	0.06	0.03
18-07	05/11/05	2	0	0	0	0	0
18-07	04/06/05	49	0	0	0	0	0.9
18-07	03/14/05	7	0	0	0	0	0
18-07	02/01/05	2	0	0	0.15	0.52	0
18-07	01/11/05	13	0	0	0	0.02	0
18-07	12/15/04	7	0	0	0	0	0
18-07	11/03/04	2	0.02	0	0	0.02	0

Station ID	Sample Collection Date	Fecal Coliform Result mpn/100ml	Precipitation Day Of Sample (inches)	Precipitation 1 Day Prior (inches)	Precipitation 2 Days Prior (inches)	Precipitation 3 Days Prior (inches)	Precipitation 4 Days Prior(inches)
18-07	10/11/04	8	0.3	0.3	0	0	0
18-07	09/14/04	5	0.32	0.02	0.03	0.32	0.12
18-07	08/17/04	13	0	0	0.4	0	0.9
18-07	07/12/04	2	0.06	0.18	0	0	0
18-07	06/08/04	7	0.01	0.91	0	0	0
18-07	05/12/04	12	0	0	0	0	0
18-07	04/05/04	8	0	0	0	0	0
18-07	03/02/04	5	0	0	0	0	1
18-07	02/23/04	5	0	0	0	0	0
18-07	01/30/04	33	0	0	0	1.1	0.02
18-08	12/14/06	49	0.3	0	0	0	0
18-08	11/28/06	17	0	0	0	0	0
18-08	10/17/06	49	0	0	0	0	0
18-08	09/06/06	79	2	0.01	0.02	1.53	0
18-08	08/15/06	22	0	0.89	0	0.5	0
18-08	07/25/06	4	0.2	0.75	0	0	0
18-08	06/19/06	8	0	0	0	0	0
18-08	05/01/06	33	0	0	0	0	0
18-08	04/18/06	11	0	0	0	0	0
18-08	03/14/06	33	0.07	0	0	0	0
18-08	02/15/06	13	0	0	0	0.01	0.25
18-08	01/23/06	7	0.04	0.02	0.03	0	0
18-08	12/12/05	170	0	0	0	0.24	0.75
18-08	11/08/05	130	0	0.02	0	0	0
18-08	10/19/05	23	0.02	0	0	0	0
18-08	09/21/05	79	0	0	0	1.15	0
18-08	08/10/05	170	3.38	0.45	0.25	0.25	0.25

Station ID	Sample Collection Date	Fecal Coliform Result mpn/100ml	Precipitation Day Of Sample (inches)	Precipitation 1 Day Prior (inches)	Precipitation 2 Days Prior (inches)	Precipitation 3 Days Prior (inches)	Precipitation 4 Days Prior (inches)
18-08	07/11/05	2	0	0.22	0.57	0.65	0
18-08	06/15/05	95	0	0	0	0.06	0.03
18-08	05/11/05	2	0	0	0	0	0
18-08	04/06/05	33	0	0	0	0	0.9
18-08	03/14/05	5	0	0	0	0	0
18-08	02/01/05	6	0	0	0.15	0.52	0
18-08	01/11/05	17	0	0	0	0.02	0
18-08	12/15/04	8	0	0	0	0	0
18-08	11/03/04	2	0.02	0	0	0.02	0
18-08	10/11/04	5	0.3	0.3	0	0	0
18-08	09/14/04	5	0.32	0.02	0.03	0.32	0.12
18-08	08/17/04	43	0	0	0.4	0	0.9
18-08	07/12/04	4	0.06	0.18	0	0	0
18-08	06/08/04	11	0.01	0.91	0	0	0
18-08	05/12/04	33	0	0	0	0	0
18-08	04/05/04	5	0	0	0	0	0
18-08	03/02/04	5	0	0	0	0	1
18-08	02/23/04	49	0	0	0	0	0
18-08	01/30/04	11	0	0	0	1.1	0.02

Station ID	Sample Collection Date	Fecal Coliform Result mpn/100ml	Precipitation Day Of Sample (inches)	Precipitation 1 Day Prior (inches)	Precipitation 2 Days Prior (inches)	Precipitation 3 Days Prior (inches)	Precipitation 4 Days Prior (inches)
18-16	12/14/06	220	0.3	0	0	0	0
18-16	11/28/06	14	0	0	0	0	0
18-16	10/17/06	46	0	0	0	0	0
18-16	09/06/06	280	2	0.01	0.02	1.53	0
18-16	08/15/06	33	0	0.89	0	0.5	0
18-16	07/25/06	8	0.2	0.75	0	0	0
18-16	06/19/06	13	0	0	0	0	0
18-16	05/01/06	17	0	0	0	0	0
18-16	04/18/06	8	0	0	0	0	0
18-16	03/14/06	8	0.07	0	0	0	0
18-16	02/15/06	5	0	0	0	0.01	0.25
18-16	01/23/06	4	0.04	0.02	0.03	0	0
18-16	12/12/05	70	0	0	0	0.24	0.75
18-16	11/08/05	34	0	0.02	0	0	0
18-16	10/19/05	23	0.02	0	0	0	0
18-16	09/21/05	23	0	0	0	1.15	0
18-16	08/10/05	46	3.38	0.45	0.25	0.25	0.25
18-16	07/11/05	2	0	0.22	0.57	0.65	0
18-16	06/15/05	220	0	0	0	0.06	0.03
18-16	05/11/05	2	0	0	0	0	0
18-16	04/06/05	49	0	0	0	0	0.9
18-16	03/14/05	8	0	0	0	0	0
18-16	02/01/05	2	0	0	0.15	0.52	0
18-16	01/11/05	17	0	0	0	0.02	0
18-16	12/15/04	7	0	0	0	0	0
18-16	11/03/04	2	0.02	0	0	0.02	0

Station ID	Sample Collection Date	Fecal Coliform Result mpn/100ml	Precipitation Day Of Sample (inches)	Precipitation 1 Day Prior (inches)	Precipitation 2 Days Prior (inches)	Precipitation 3 Days Prior (inches)	Precipitation 4 Days Prior (inches)
18-16	10/11/04	8	0.3	0.3	0	0	0
18-16	09/14/04	22	0.32	0.02	0.03	0.32	0.12
18-16	08/17/04	13	0	0	0.4	0	0.9
18-16	07/12/04	7	0.06	0.18	0	0	0
18-16	06/08/04	13	0.01	0.91	0	0	0
18-16	05/12/04	33	0	0	0	0	0
18-16	04/05/04	5	0	0	0	0	0
18-16	03/02/04	5	0	0	0	0	1
18-16	02/23/04	17	0	0	0	0	0
18-16	01/30/04	13	0	0	0	1.1	0.02
18-17	12/14/06	46	0.3	0	0	0	0
18-17	11/28/06	8	0	0	0	0	0
18-17	10/17/06	14	0	0	0	0	0
18-17	09/06/06	110	2	0.01	0.02	1.53	0
18-17	08/15/06	13	0	0.89	0	0.5	0
18-17	07/25/06	4	0.2	0.75	0	0	0
18-17	06/19/06	11	0	0	0	0	0
18-17	05/01/06	33	0	0	0	0	0
18-17	04/18/06	2	0	0	0	0	0
18-17	03/14/06	7	0.07	0	0	0	0
18-17	02/15/06	5	0	0	0	0.01	0.25
18-17	01/23/06	11	0.04	0.02	0.03	0	0
18-17	12/12/05	49	0	0	0	0.24	0.75
18-17	11/08/05	31	0	0.02	0	0	0
18-17	10/19/05	23	0.02	0	0	0	0
18-17	09/21/05	5	0	0	0	1.15	0
18-17	08/10/05	170	3.38	0.45	0.25	0.25	0.25

Station ID	Sample Collection Date	Fecal Coliform Result mpn/100ml	Precipitation Day Of Sample (inches)	Precipitation 1 Day Prior (inches)	Precipitation 2 Days Prior (inches)	Precipitation 3 Days Prior (inches)	Precipitation 4 Days Prior (inches)
18-17	07/11/05	4	0	0.22	0.57	0.65	0
18-17	06/15/05	140	0	0	0	0.06	0.03
18-17	05/11/05	2	0	0	0	0	0
18-17	04/06/05	13	0	0	0	0	0.9
18-17	03/14/05	4	0	0	0	0	0
18-17	02/01/05	2	0	0	0.15	0.52	0
18-17	01/11/05	13	0	0	0	0.02	0
18-17	12/15/04	8	0	0	0	0	0
18-17	11/03/04	2	0.02	0	0	0.02	0
18-17	10/11/04	5	0.3	0.3	0	0	0
18-17	09/14/04	17	0.32	0.02	0.03	0.32	0.12
18-17	08/17/04	14	0	0	0.4	0	0.9
18-17	07/12/04	5	0.06	0.18	0	0	0
18-17	06/08/04	11	0.01	0.91	0	0	0
18-17	05/12/04	220	0	0	0	0	0
18-17	04/05/04	13	0	0	0	0	0
18-17	03/02/04	2	0	0	0	0	1
18-17	02/23/04	8	0	0	0	0	0
18-17	01/30/04	8	0	0	0	1.1	0.02

Appendix C

Public Participation Documents

List of Major Meetings Involving Okatie River Stakeholders

June 1, 2008	TMDL Commencement
August 5, 2008	Email sent to Okatie River stakeholders announcing the upcoming informational meeting on August 12, 2008, and the meeting agenda
August 12, 2008	TMDL Commencement/Stakeholder meeting
November 25, 2008	Email sent to Okatie River stakeholders giving a status update on the TMDL
December 5, 2008	Okatie River boat trip organized by the Friends of the Rivers and attended by representatives from SCDHEC, Beaufort County, Low Country Institute, Oldfield Outfitters, SCDNR and Friends of the Rivers.
July 1, 2009	SCDHEC gave a presentation at the Beaufort County Stormwater Utility Board meeting
October 30, 2009	SCDHEC met with representatives from local governments and permitted entities to review the results of the TMDL percent reductions
December 17, 2009	Email sent to Okatie River stakeholders announcing the upcoming public meeting on January 26, 2010
January 26, 2010	Public meeting with stakeholders to announce the results of TMDL calculations, percent reductions, and potential sources for fecal coliform.

D H E C
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South Carolina Department of Health and Environmental Control

Media Advisory

Division of Media Relations
2600 Bull Street
Columbia, S.C. 29201
(803) 898-3886
http://www.scdhec.gov/news

FOR IMMEDIATE RELEASE
Aug. 8, 2008

Okatie River stakeholders meeting announced

The Department of Health and Environmental Control has announced that there will be a meeting of Okatie River stakeholders and other interested parties:

Date: **Aug. 12, 2008**
Time: **2:00 pm to 4:00 pm**
Location: **Palmetto Cooperative Electric**
1 Cooperative Way
Hardeeville, SC 29927

The public is invited to attend this meeting about the Okatie River fecal coliform total maximum daily loads (TMDLs) within DHEC's Shellfish Management Area 18, which is located in Beaufort and Jasper Counties.

The purpose of the meeting is to announce the commencement of the effort that will address four sites impaired for fecal coliform bacteria in shellfish management area 18. Presentations will be followed by a question and answer session.

(Draft) Agenda

2:00 pm	Welcome and introductions
2:10 pm	Overview of TMDL and 303(d) list
2:30 pm	Shellfish Program
2:40 pm	Okatie River Shellfish Fecal coliform TMDL
3:00 pm	Question and Answer Session
4:00 pm	Adjournment

-###-

For more information:
Clair Boatwright – (803) 898-4461
E-mail – boatwrc@dhec.sc.gov
CBNR1406

Information and Stakeholder Meeting for Commencement of the Okatie River Fecal Coliform TMDLs within Shellfish Management Area 18

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

The purpose of this meeting is to announce the commencement of the TMDL development effort to address four sites impaired with fecal coliform in shellfish harvesting area 18 (Okatie River) as shown on the attached map.

All waterbodies with sites that do not meet the water quality standard are placed on the 303 (d) List of Impaired Waters. Clean Water Act mandates that waters identified on the 303 (d) list must have a TMDL developed.

What is a TMDL?

A TMDL is the maximum amount of a pollutant that a waterbody can receive from all sources and still meet water quality standards (WQS). Section 303 of the Clean Water Act established the principle of the total maximum daily load (TMDL) as a means of identifying reductions needed in order to reduce water pollution.

The goal of a TMDL is to identify potential pollution sources, calculate and quantify the reduction of those sources, and provide general implementation guidance needed in order to meet water quality standards and improve water quality.

What is the plan?

- Commencement of the TMDL
- Source assessment and watershed analysis
- Modeling and TMDL calculation
- Developing the TMDL document
- Approximate target date of completion is end of 2009

How can you be involved?

- Provide local knowledge and other relevant information
- Access to existing data
- Ultimately, become potential partners for the implementation of the TMDL

Who can I contact for more information?

- Banu Varlik, TMDL Project Manager varlikb@dhec.sc.gov. 803-898-3701
- Mike Monday, Region 8 Shellfish Manager mondaymw@dhec.sc.gov 843-846-1030
- Andy Miller, Salkehatchie Watershed Manager milleca@dhec.sc.gov 803- 898-4031

A Follow-up email was sent after the informational meeting on August 12, 2008:

Okatie River stakeholders,

Thank you for attending to the August 12, 2008 meeting held at Palmetto Cooperative building in Hardeeville, SC.

The goal of the meeting was to announce the commencement of the Okatie River fecal coliform TMDLs within Shellfish Area 18 and invite stakeholder participation throughout TMDL development.

During the meeting, it was indicated that some of you have data to share. SCDHEC is interested in obtaining relevant water quantity and quality data that may include the following parameters:

Salinity
Conductivity
Fecal coliform
Precipitation
Stream flow
Dye studies
Tidal height
Physical characteristics of the system: width, depth
Landuse
Infrared flyover information
Stormwater outfall locations (GIS coverage)
Septic and sewer information (GIS coverage)
Updated city/town boundaries (GIS coverage)

If you have data for any the above parameters, please forward to:

Banu Varlik
SC DHEC, Bureau of Water
2600 Bull Street
Columbia SC 29201

varlikb@dhec.sc.gov

We are forwarding presentations and a map of the Okatie River watershed and surrounding area. We are also forwarding a copy of the stakeholder sign up sheet.

Thank you again for coming to the August 12, 2008 meeting and we are looking forward to working with you during this TMDL process.

An update email was sent to the stake holders on November 25, 2009 with the subject line of “Update on the Okatie River TMDLs”. A time line was attached to this email (next page)

All,

This is a brief note to give you all a brief update on the Okatie River shellfish TMDLs in shellfish area 18.

As most of you know, we had our first informational meeting on August 12, at Palmetto Cooperative building in Hardeeville, to announce the commencement of these TMDLs. During the meeting, some of you indicated that you may have data to share. After this meeting, a follow up email was sent and based on the input from the meeting, I asked you to share your data with me. I am happy to report, you all have stepped up to the plate and have shared with me the data you have. Currently, I am analyzing the information I have received so far and to see if we can use any of this information and put it to good use while we are calculating these TMDLs.

My next step will be to plan field trips for source identification. If you believe you know of any potential sources for fecal coliform contamination, please send me the specifics regarding these potential sources. I have attached a tentative timeline for the completion of these TMDLs. As you can see from the attached document, I am planning to have another meeting possibly in March or April of 2009 to share with you my findings. A cautionary note, these dates are tentative and subject to change.

Thank you and ff you have any questions, please do not hesitate to contact me. I will do my best to answer your question.

Banu

P. S.: Feel free to forward this email to those that may be interested in these TMDLs. Alternatively, you can send me their e-mail address and I can add them to my list.

Banu Varlik
TMDL Project Manager
TMDL, NPS, and Program Development Section
Phone: 803-898-3701
Fax: 803-898-2893

Time Line for the Okatie River Shellfish TMDL

Action	Initial Date	Description	Status
Start Project Work Plan	February 2008	Write and organize proposed project work plan	Completed
Create map of the project area	February 2008	Review reference material	Completed
Reconnaissance of study area	January-March 2008	On site cursory survey of study area	Completed
Begin TMDL Project	March 2008		On going
Notice of Commencement	June 2008	Post public notice thru local media	Completed
Gather Historical Data	March 2008		On going
Source assessment	March 2008 – July 2009	Locate and Document Non-Point / Point Sources in study area	On going
Initial stake holder meeting	August 12, 2008	Public meeting	Completed
Data analysis	March 2008 – July 2009		On going
Modeling	Present – July 2009	Analyze resource data and review in various model choices	On going
Stakeholder meeting	March – April 2009		
Write TMDL Document	April – August 2009		
Internal Review	September 2009		
Draft TMDL – send to EPA and Public Notice	November 2009		
Publish Final Report	December 2009		

* Tentative dates and timelines: Subject to change.

The following email was sent on December 17, 2009, to Okatie River stakeholders announcing the upcoming public meeting on January 26, 2010

Attention Okatie River Stakeholders and Other Interested Parties:

A Public Information Meeting for the draft Okatie River Fecal Coliform TMDLs within Shellfish Management Area 18 will be held by South Carolina Department of Health and Environmental Control Staff:

Date/Time:

Tuesday, January 26, 2010
6:00 pm to 8:00 pm

Location:

Palmetto Cooperative Electric
1 Cooperative Way
Hardeeville, SC 29927

The purpose of this meeting is to discuss the draft Okatie River Shellfish Fecal Coliform Total Maximum Daily Loads (TMDLs). SCDHEC has been developing a TMDL document to address four sites impaired for fecal coliform bacteria in Shellfish Management Area 18 (Okatie River), which is located in Beaufort and Jasper Counties. A presentation will be given followed by a question and answer session. Stakeholders and other interested parties are invited to attend this meeting.

If you have additional questions before this time, please contact Banu Varlik at (803) 898-3701 or, via e-mail, at Varlikb@dhec.sc.gov.

Appendix D

Site Visit Photographs

POTENTIAL SOURCES FROM AGRICULTURAL ACTIVITIES

An unregulated agricultural facility to the north of US 278 Bridge, on the right bank of Okatie River.

An unregulated agricultural facility on Pinckney Colony Road

An unregulated agricultural facility with horses near the Okatie River with minimal BMPs.

POTENTIAL SOURCES FROM BOATING AND BOATING RELATED ACTIVITIES

Birds on the railings of a private dock

Birds on a public dock

POTENTIAL SOURCES FROM WILDLIFE, DOMESTIC PETS AND DOMESTIC ANIMALS

Irrigating horse pastures without ridding of manure may lead to surface runoff of fecal coliform bacteria.

Wood ducks in a storm water pond

A dog pen near Okatie River

Deer tracks along Pinckney Colony Road

POTENTIAL SOURCES FROM IMPERVIOUS SURFACES AND CHANGES IN THE LANDUSE

One of the residential developments within the Okatie River TMDL area.

Road erosion and debris off of Pinckney Colony Road, flowing towards Okatie River

Horse barn on Logan Road off of Pinckney Colony Road.

Large residential areas (Sun City is partially within the Okatie River watershed).

POTENTIAL SOURCES RELATED TO STORMWATER RUNOFF AND SCDOT

Stormwater ditch along US 278 following a scattered thunderstorm activity on June 8, 2009.

US 278 during a rain event on June 8, 2009

US 278 crossing the Okatie River.

Shellfish beds downstream from US 278 Bridge. The photograph was taken on June 8, 2009 following several scattered thunder storm activity during ebb tide.

Appendix E

Evaluating the Progress of MS4 Programs

Evaluating the Progress of MS4 Programs:

Meeting the Goals of TMDLs and Attaining Water Quality Standards

Bureau of Water

August 2008

Described below are potential approaches that may be used by MS4 permit holders. These are recommendations and examples only, as SCDHEC-BOW recognizes that other approaches may be utilized or employed to meet compliance goals.

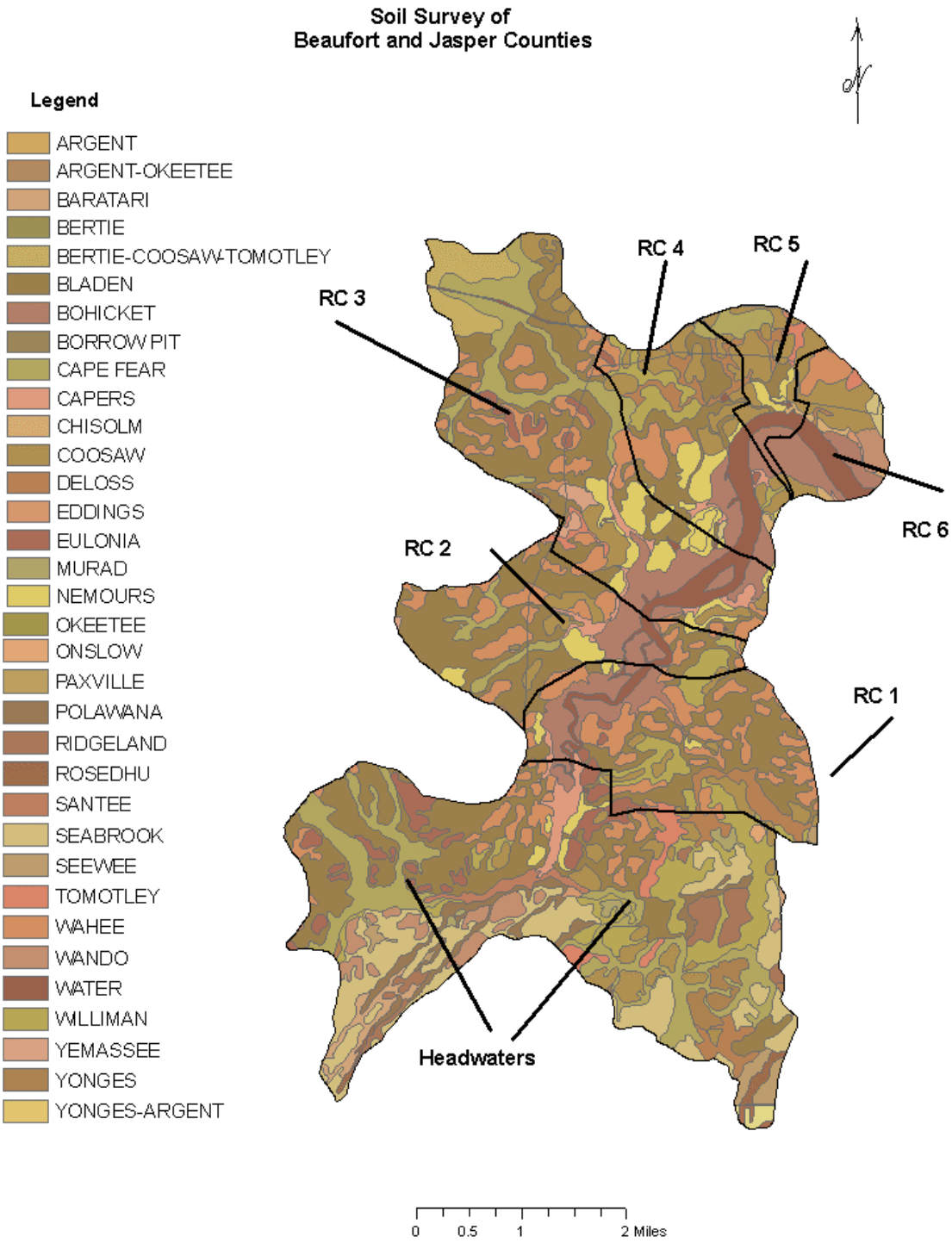
1. Calculate pollutant load reduction for each best management practice (BMP) deployed:
    - Retrofitting stormwater outlets
    - Creation of green space
    - LID activities (e.g., creation of porous pavements)
    - Creations of riparian buffers
    - Stream bank restoration
    - Scoop the poop program (how many pounds of poop were scooped/collected)
    - Street sweeping program (amount of materials collected etc.)
    - Construction & post-construction site runoff controls
2. Description & documentation of programs directed towards reducing pollutant loading
    - Document tangible efforts made to reduce impacts to urban runoff
    - Track type and number of structural BMPs installed
    - Parking lot maintenance program for pollutant load reduction
    - Identification and elimination of illicit discharges
    - Zoning changes and ordinances designed to reduce pollutant loading
    - Modeling of activities & programs for reducing pollutant reductions
3. Description & documentation of social indicators, outreach, and education programs
    - Number/Type of training & education activities conducted and survey results
    - Activities conducted to increase awareness and knowledge – residents, business owners. What changes have been made based on these efforts? Any measured behavior or knowledge changes?
    - Participation in stream and/or lake clean-up events or activities

- Number of environmental action pledges

4. Water quality monitoring: A direct and effective way to evaluate the effectiveness of stormwater management plan activities.
    - Use of data collected from existing monitoring activities (e.g., SCDHEC data for ambient monitoring program available through STORET; water supply intake testing; voluntary watershed group's monitoring, etc)
    - Establish a monitoring program for permitted outfalls and/or waterbodies within MS4 areas as deemed necessary– use a certified lab
    - Monitoring should focus on water quality parameters and locations that would both link pollutant sources and BMPs being implemented
5. Links:
    - Evaluating the Effectiveness of Municipal Stormwater Programs. September 2007. EPA 833-F-07-010
    - The BMP database - http://www.bmpdatabase.org/BMPPerformance.htm (this link is specifically to the BMP performance page, and lot more)
    - EPA's STORET data warehouse - http://www.epa.gov/storet/dw_home.html
    - EPA Region 5: STEPL – Spreadsheet tool for estimating pollutant loads http://it.tetratech-ffx.com/stepl/
    - Measurable goals guidance for Phase II Small MS4 - http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm
    - Environmental indicators for stormwater program- http://cfpub.epa.gov/npdes/stormwater/measurablegoals/part5.cfm
    - National menu of stormwater best management practices (BMPs) - http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm
    - SCDHEC – BOW: 319 grant program has attempted to calculate the load reductions for the following BMPs:
        - Septic tank repair or replacement
        - Removing livestock from streams (cattle, horses, mules)
        - Livestock fencing
        - Waste Storage Facilities (aka stacking sheds)
        - Strip cropping
        - Prescribed grazing
        - Critical Area Planting
        - Runoff Management System
        - Waste Management System
        - Solids Separation Basin
        - Riparian Buffers

Appendix F

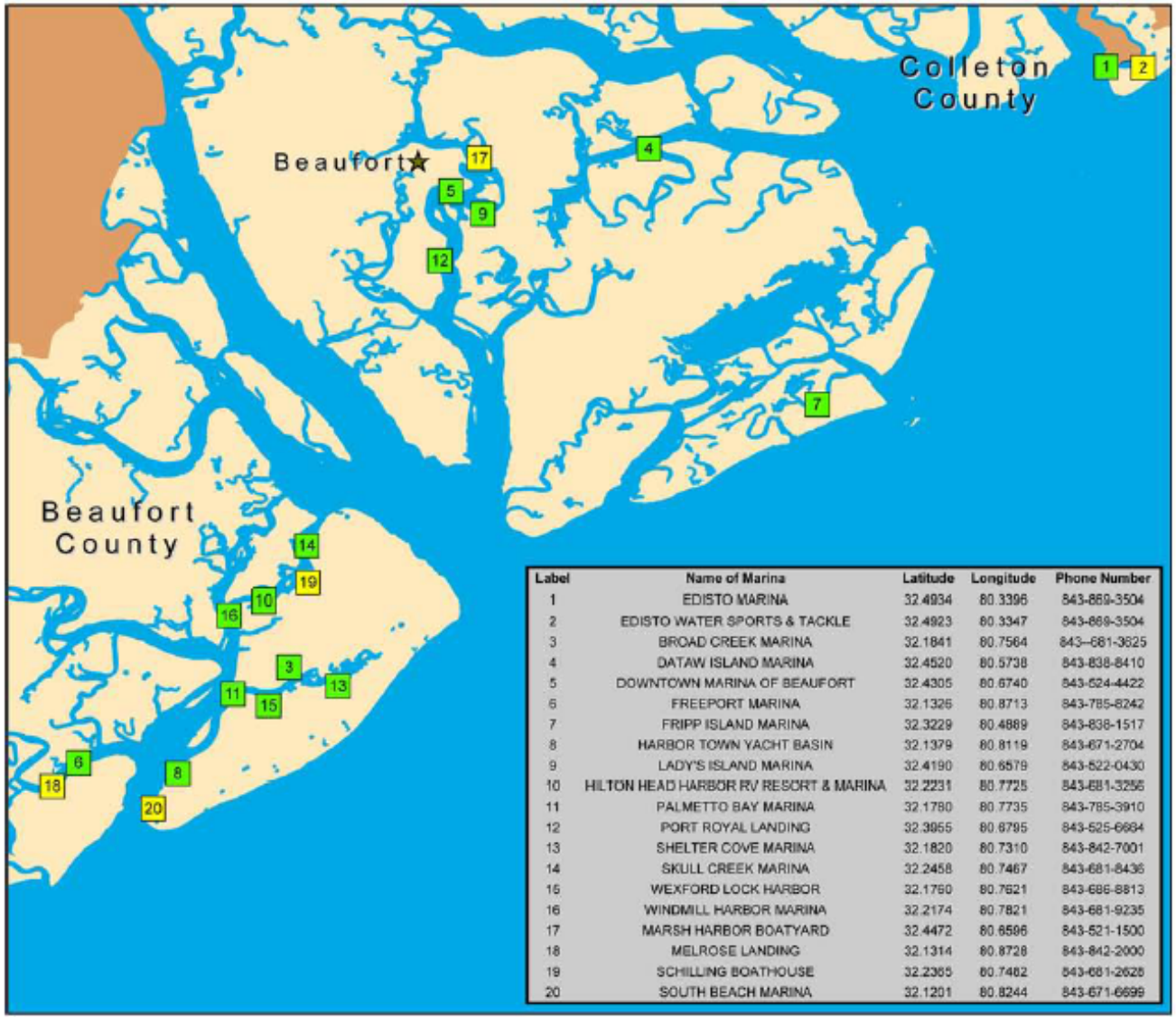
Soil Survey of Beaufort and Jasper Counties


Soil Survey of
Beaufort and Jasper Counties
Legend
ARGENT
ARGENT-OKEETEE
BARATARI
BERTIE
BERTIE-COOSAW-TOMOTLEY
BLADEN
BOHICKET
BORROW PIT
CAPE FEAR
CAPERS
CHISOLM
COOSAW
DELOSS
EDDINGS
EULONIA
MURAD
NEMOURS
OKEETEE
ONSLOW
PAXVILLE
POLAWANA
RIDGELAND
ROSEDHU
SANTEE
SEABROOK
SEEWEE
TOMOTLEY
WAHEE
WANDO
WATER
WILLIMAN
YEMASSEE
YONGES
YONGES-ARGENT
RC 3
RC 4
RC 5
RC 6
RC 2
RC 1
Headwaters
0
0.5
1
2 Miles

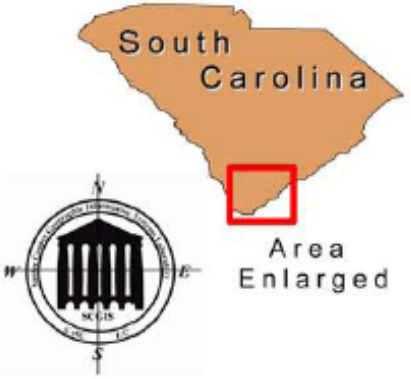
Appendix G

Marina Locations with Pump-out Information for Beaufort and Colleton Counties

Marina Locations with Pump-out Information for Beaufort and Colleton Counties



Label	Name of Marina	Latitude	Longitude	Phone Number
1	EDISTO MARINA	32.4934	80.3396	843-869-3504
2	EDISTO WATER SPORTS & TACKLE	32.4923	80.3347	843-869-3504
3	BROAD CREEK MARINA	32.1841	80.7564	843--681-3625
4	DATAW ISLAND MARINA	32.4520	80.5738	843-838-8410
5	DOWNTOWN MARINA OF BEAUFORT	32.4305	80.6740	843-524-4422
6	FREEPORT MARINA	32.1326	80.8713	843-785-8242
7	FRIPP ISLAND MARINA	32.3229	80.4889	843-838-1517
8	HARBOR TOWN YACHT BASIN	32.1379	80.8119	843-671-2704
9	LADY'S ISLAND MARINA	32.4190	80.6579	843-522-0430
10	HILTON HEAD HARBOR RV RESORT & MARINA	32.2231	80.7725	843-681-3255
11	PALMETTO BAY MARINA	32.1780	80.7735	843-785-3910
12	PORT ROYAL LANDING	32.3955	80.6795	843-525-6984
13	SHELTER COVE MARINA	32.1820	80.7310	843-842-7001
14	SKULL CREEK MARINA	32.2458	80.7467	843-681-8436
15	WEXFORD LOCK HARBOR	32.1760	80.7521	843-686-8813
16	WINDMILL HARBOR MARINA	32.2174	80.7821	843-681-9235
17	MARSH HARBOR BOATYARD	32.4472	80.6596	843-521-1500
18	MELROSE LANDING	32.1314	80.8728	843-842-2000
19	SCHILLING BOATHOUSE	32.2365	80.7462	843-681-2628
20	SOUTH BEACH MARINA	32.1201	80.8244	843-671-6699



★ Major Cities

Marina Locations With Pump-Out Facilities

Marina Locations Without Pump-Out Facilities

This brochure was produced in cooperation with the U. S. Fish and Wildlife Service, Clean Vessel Act Grant Program. Data for marina information was provided by SCDNR and SCDHEC. Dr. Norman Levine of the College of Charleston Geology Department provided map layouts and data. Marina information is current as of January 1, 2007.

Map Author: William Brown
Map Production Date: January 2, 2007

Clean Vessel Act

SPORT FISH RESTORATION

U.S. Fish and Wildlife Service

Source: SC DNR, available at http://www.dnr.sc.gov/marine/vessel/pdf/CVAmaps.pdf

Responsiveness Summary
Okatie River TMDL Document

Comments were received from the following:
Beaufort County Stormwater Utility and Stormwater Utility Board
Coastal Conservation League, South Coast Office
South Carolina Department of Natural Resources

Beaufort County Stormwater Utility and Stormwater Utility Board

Comment 1:

"1. This TMDL did not include flow data in the development of the TMDL. This presents unique issues for implementing voluntary measures to reduce load reductions. Beaufort County has recently enacted controls on stormwater runoff volume due to its role in increasing the amount and concentration of fecal coliform coming out of natural areas. The TMDL does not establish loads reduction goals but percent reduction goals. This will make if difficult to link voluntary and mandatory volume reduction measures to reduction in percentage concentration."

Response 1:

Okatie River is a tidally complex waterbody. Calculation of the net flow out of the system by SC Department of Health and Environmental Control (the Department) would be resource intensive. Therefore, after consulting with US Environmental Protection Agency (EPA) Region 4, percent reductions as an end point for this Total Maximum Daily Load (TMDL) were used instead of load reductions for the calculation of the TMDLs. Furthermore, there are EPA approved TMDLs utilizing percent reductions as end points that have been implemented successfully, such as the "Lynnhaven Bay, Broad Bay and Linkhorn Bay Watersheds TMDL Report for Shellfish Areas Listed Due to Bacteria Contamination", available electronically at: http://www.deq.state.va.us/tmdl/apptmdls/shellfish/lynnfc.pdf. On July 16, 201, EPA Region 4 has also approved Jeremy Inlet and Scott Creek Shellfish Fecal Coliform TMDL. This TMDL document is available electronically at: http://www.scdhec.gov/environment/water/tmdl/docs/tmdl_jeremy.pdf

Reductions for the achievement of the TMDL goals by point source entities are addressed by wasteload allocations (WLA) through the permitting process. Unlike point sources, nonpoint sources are less predictable and difficult to quantify. Implementations of nonpoint source reductions are generally voluntary measures and are addressed by the load allocation (LA) portion of the TDML.

The Department is supportive of collaborative efforts of local entities working towards the achievement of the TMDL target.

Comment 2:

"2. The TMDL does not recognize the recently observed and measured increase in concentration of fecal coliform coming out of natural areas due to discharge of low fecal coliform concentration stormwater from developed areas. As a result of this per the TMDL, an entity not bound to county stormwater volume ordinance (municipality, state department, adjacent county, etc.) will only need to meet the terms of current permit that only includes effective implementation of Waste Load Allocation (WLA) and does not recognize the effect that their additional volume will have on increasing fecal coliform loads from natural receiving waters."

Response 2:

The data used for the development of the TMDL was collected at instream shellfish monitoring stations and not from individual sources or locations. Hence, it encompasses all potential contribution of fecal coliform (FC) within the watershed.

However, if there is specific data available, the Department encourages the use for prioritizing and implementing the Okatie River TMDL.

All existing and future NPDES permitted dischargers, including current and future MS4s, are required to meet the percentage reduction or the existing instream standard for the pollutant of concern in accordance with their permit.

Comment 3:

"3. Since this TMDL is a multicounty document, and only sets percentage reduction requirement, it does not allow for distribution of load reductions by jurisdiction."

Response 3:

TMDLs are not based on administrative, political or jurisdictional boundaries, i.e., towns, cities, counties, etc., but rather are based on the hydrologic drainage area of the watershed. The Okatie River TMDL document addresses the allocation of load reductions by addressing permitted entities under wasteload allocations (WLA) and nonpoint sources under load allocations (LA). The same percent reduction is required from all sources in the relevant watershed in order to meet the TMDLs.

Coastal Conservation League, South Coast Office

Comment 1:

"1. In Sec. 6.0 (Implementation), **land use and community design to reduce impervious cover should be included as a BMP**, as recommended in Policy #52 in EPA document *Protecting Water Resources with Smart Growth,* 2004, Pub No. EPA 231-R-04-002. This document along with EPA's report *Protecting Water Resources with Higher-Density Development,* 2006, Pub. No. 231-R-06-001 should be included in Sec. 7.0 (Resources). These documents describe how new and redevelopment projects can be better designed to reduce amount of impervious surface by community design, a major cause of contamination in a watershed. Since about 77% of the land area (excluding tidal waters and marshes, in the watershed has yet to be developed (from Table 2a), significant opportunity to reduce imperviousness in the watershed exists."

Response 1:

Under the Sections 6 and 7, the information presented is represented as guidance for local governments, permitted entities and citizens, and is not meant to be all inclusive. The Department encourages use of any and all resources available to effectively implement these TMDLs. Also, the Department does not prescribe any one or a combination of implementation strategies but only general guidance.

Comment 2:

> "2. Tables 2a and 2 b (p. 12) provide very useful background information for assessing watershed-wide conditions, however most of the impacts and recommendations in the TMDL document address activities on the land area of the watershed. **To provide information on the land use components, companion tables would be helpful breaking out the "land use" areas in Tables 2a and 2b without the tidal waters and marshes.** That is the total land area of the watershed apparently amounts to 17.57 sq. miles, of which 4.05 sq. miles is developed, or 23% of the land area in the watershed."

Response 2:

Tables 2a and 2b are based on 2001 National Land Cover Data (NLCD 2001), which is a database comprised of land cover, impervious surface, and canopy density. This dataset renders mainly 16 landuse classes based on spatial boundaries. Tidal waters and marshes are part of the landuse practices and should not be arbitrarily removed from analysis. Also, the Okatie River is a dynamic tidal system of saltwater marshes and tidal waters which are a part of its whole environment.

Comment 3:

"3. Section 1.2.5 begins to set "biological criteria", this is important and should be set forth in this TMDL in a very specific manner following the guidance in *Biological Criteria: National Program Guidance for Surface Waters*, April 1990, EPA-440-5-90-004. An assessment of the numbers, diversity and balance of the small bottom dwelling aquatic organisms should be a part of the measurement standards in order to characterize the aquatic communities inhabiting the waters and marshes of the Okatie. This assessment should be included in this TMDL document – with a table that sets forth desired numeric and narrative levels of attainment. **The Federal Clean Water Act mandates that cumulative effects of watershed activities be determined – there is no way to sufficiently measure such impacts without a clear and detailed biological assessment. This should also be an integral component of the monitoring and adaptive management.** The table of biological criteria should include: index of biotic integrity, invertebrate community index, number of each type of benthic macroinvertebrate found and number of types of macroinvertebrates found. This quantification is necessary for evaluating the actual rather than theoretical effectiveness of any watershed restoration plan."

Response 3:

The focus of these TMDLs and the resultant document is to address the observed exceedances of fecal coliform bacteria in the Okatie River that have been included for fecal coliform impairments on the approved 2008 303(d) list of impaired waters.

Comment 4:

"4. Need clearer guidance on monitoring to be able to assess and document progress in the program for restoring the Okatie. **Monitoring should not be limited to SCDHEC ambient monitoring, typically in mid-stream of the river, but include long-term monitoring of volumes and loads at input ditches, culverts, etc. within each of the sub watersheds.** This strategy could be included in Sec. 6.1 (Implementation Strategies) and by expanding on monitoring described in Item 4 of Appendix E.

Response 4:

Currently in South Carolina, shellfish monitoring stations are sampled once a month, 12 times a year. These stations are not ambient water quality monitoring stations but are sampled to ensure that shellfish and the areas from which they are harvested meet the health and environmental quality standards by federal and state regulations. Also, monitoring in shellfish areas are guided by US Food and Drug Administration (FDA). Detailed information on shellfish area monitoring can be found at FDA's website at www.fda.gov.

This TMDL document does not prescribe monitoring and/or limit monitoring activities. However, if any entity would like to conduct their own monitoring and reporting, and consequently would like to submit their data for consideration to the Department has to go through outside data submittal procedures. More information on these procedures can be found in "Outside Data and Quality Assurance Requirements" (SCDHEC, 2010). This document is available electronically at: http://www.scdhec.gov/environment/water/docs/fw_agency.pdf.

Comment 5:

> "5. The TMDL plan indicates that DHEC may apply percentage reductions to all NPDES permits (Abstract) and in Sec. 5.2.2. (p. 34) calls for requirement for percentage reductions for stormwater discharges. Document should outline how this is to be done (perhaps in Sec. 5.3 and 5.4 on pp. 35-36). For example: Will a new development project in the Okatie watershed be required to present a stormwater management plan to DHEC which shows reduction of fecal coliform load by x % from pre-development levels? And, will new projects in the watershed be required to include monitoring of discharged runoff to assure standards are being met, with mitigation to correct discharges exceeding approved standrards?

Response 5:

Stormwater discharges that are referenced in the TMDL document are regulated and non-regulated stormwater discharges. All existing and future NPDES permitted dischargers, including current and future MS4, construction and industrial discharges are required to meet percent reduction or the existing instream standard for pollutant of concern in accordance with their NPDES permit.

Comment 6:

> "6. Beaufort County is expected to be classified as a MS4 community following the 2010 Census. As such according to Sec. 3.1.2 (p.21), Beaufort County will be responsible and subject to Wasteload Allocation portion of the TMDL for discharges into the Okatie. However, some of these discharges will emanate from projects and sources of the Okatie watershed in Jasper County, including the City of Hardeville, which are not likely to become MS4 communities. **The TMDL does not address how Beaufort County can meet its obligations from discharges from Jasper County which must cross Beaufort County before discharging to the Okatie.** Even without MS4 requirements, since the river and its marshes are totally within Beaufort County, Beaufort will still be expected to assure that discharges into the river, regardless of the origin of those discharges, conform to the load reductions specified in Table 5 (p.37).

Response 6:

This TMDL is based on the hydrologic drainage area of the Okatie River. Watershed boundaries are based on the flow of water, geography, and physical attributes among others, and not based on jurisdictional, administrative or political boundaries

Requirements for regulated MS4s are detailed in their NPDES MS4 permit. Further information regarding regulated MS4s and their permit requirements are available electronically through the Department' website at:
http://www.scdhec.gov/environment/water/swnsms4.htm

The Okatie River TMDL document addresses the percent reductions from all point sources under WLAs and all nonpoint sources under LAs. The same percent reductions are required from all sources in order to meet the TMDLs.

Comment 7:

> "7. Majority of discharges into the river are probably from ditches and culverts which carry discharges from inland sites into the river and tidal marshes. Locations and any available information on the volumes and coliform loads of these conveyance systems should be identified and shown by the Reach areas**.**

Response 7:

Data and information received during TMDL development were considered by the Department. However, the data used in the TMDL were collected from SCDHEC shellfish monitoring stations. If said information is available, they can be used for prioritizing and implementation of the Okatie River TMDLs.

Comment 8:

> "8. Table 5 (p. 37) lays out what seems like ambitious goals to return the waters for shellfish harvesting. Some case histories or examples of how and where such goals have been successfully achieved or attempted for salt water estuaries would be helpful as guidance for the Okatie."

Response 8:

Per federal regulations, TMDLs are required to be calculated for impaired waterbodies that are included on the 303(d) list. TMDL WLAs are implemented through permits. LAs are implemented through voluntary measures. One of the successfully implemented TMDLs showing measureable water quality improvements and reopening of shellfish beds is Virginia's Lynnhaven Bay,

Broad Bay and Linkhorn Bay Shellfish Fecal Coliform TMDLs, which is available electronically at:
http://www.vbgov.com/file_source/dept/pw/Boating/Nonpoint_Source_Program_Success_story_070809.pdf

Also, EPA's "TMDLs at Work" website has information regarding other successfully implemented and EPA approved TMDLs, which is available electronically at: http://www.epa.gov/owow/tmdl/tmdlsatwork/

Comment 9:

"9. It would be desirable to provide an overall assessment of the situation of the Okatie, such as:

> Unless the contaminant loads to the river from existing activities can be significantly reduced, impairments should be expected to continue. The cumulative effects from existing practices and additional loading from new projects throughout the watershed must not add to the contaminant load. These loads would be expected to cause even further impairment of the river and lead to impairment to extend further downstream and eventual clean-up of the river an even greater challenge and less likely to be achieved."

Response 9:

The Department believes that an assessment of the overall conditions in the Okatie River has been addressed in the TMDL document. The source assessment and lack of continuous point source discharges (ex: WWTP) in the watershed indicates that the sources of fecal coliform exceedances are non-continuous point and nonpoint in their nature.

TMDL reductions to address all sources, once implemented, have a potential to achieve the shellfish fecal coliform standard.

South Carolina Department of Natural Resources

Comment 1:

"One regulatory strategy that is not discussed in the document is the possibility of designating the Okatie River as a No Discharge Zones (NDZ), which would prohibit any discharge of sewage from MSDs into the Okatie River and its tributaries. The status of the Okatie River as an ORW waterbody that is impaired due to high fecal coliform levels, would seem to merit its designation as a NDZ. This should be discussed as a possible implementation strategy in the TMDL document."

Response 1:

Waterbodies can be designated as NDZs from marine vessels however; establishment of NDZ is beyond the scope of this TMDL. For more information, please refer to S.C. Regulations 61-68 and 61-69 for further information, which are available electronically at:
http://www.scdhec.gov/environment/water/regs/r61-68.pdf

Comment 2:

"Overall, the SCDNR commends DHEC for developing a protective TMDL for fecal coliform in the Okatie River, which is under increasing pressure from rapidly growing residential and commercial development in the area. The SCDNR supports all reasonable efforts to improve and sustain water quality to the greatest extent possible, particularly in SFH and ORW waters such as the Okatie River. Successful implementation of the proposed TMDL should result in a substantial improvement in water quality in this watershed, and effectively protect its shellfish harvesting beds for human consumption. The SCDNR welcomes the opportunity to work with DHEC, as well as other public and private entities, in implementing the proposed TMDL to achieve water quality standards."

Response 2:

The Department appreciates SCDNR's support of the Okatie River TMDLs.

Amendments

The following amendments were made to the Okatie River TMDL document following the public comment period.

Amendment 1 Location: Abstract, paragraph 2.

Amendment:

For SCDOT, **existing and future** NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of WLA to the Maximum Extent Practicable (MEP). **For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of its permit is effective implementation of the WLA.**

Amendment 2 Location: Page 41, paragraph 1

Amendment:

For SCDOT, **exiting and future NPDES MS4 permittees,** compliance with terms and conditions of its NPDES permit is effective implementation of the WLA to the MEP. **For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and condition of its permit is effective implementation of the WLA.**