Total Maximum Daily Load
Toogoodoo Creek
(Hydrologic Unit Code 030502060401)
Impaired Stations 12B-34, 12B-35, 12B-45
Fecal Coliform Bacteria

September 2010

SCDHEC Technical Document Number: 012D-21
Prepared for:
Bureau of Water

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

Prepared by:
Ann-Marie Altman

Abstract

The delineated watershed surrounding impaired stations 12B-35, 12B-34, and 12B-45 (Toogoodoo Creek and Lower Toogoodoo Creek) located within Shellfish Management Area 12B in Charleston County, South Carolina consists of approximately 23.08 square miles of shellfish growing area habitat. Water quality monitoring stations 12B-34, 12B-35, and 12B-45 are listed on the 2008 303(d) list as impaired for shellfish use support due to exceeding the fecal coliform standard. All of these stations have previously been listed in 2006 while 12B-35 was also listed in 2004. Stations are listed as impaired on the basis of at least 30 monthly samples taken over a period of 3 years as required by the National Shellfish Sanitation Program. Meeting the percentage reduction or the water quality standard (WQS) at each station will effectively protect the shellfish harvesting beds in the referenced watershed for human consumption. Station 12B-45 requires a reduction of 66 % while station 12B-35 requires a reduction of 32 % and 12B-34 requires a reduction of 30% (Table Ab-1). This TMDL document is based on 77-157 data points per each monitored station from 1994-2007 to ensure greater temporal variability. The primary land use of the watershed is forested area (35.45%) followed by wetlands/open water (34.73%). Probable sources of fecal coliform (FC) bacteria are large populations of water birds and wildlife, agricultural runoff and failing septic systems.

Existing conditions and percent reductions were calculated using cumulative probability distributions. 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 the WLS to the Maximum Extent Practicable. For existing and future NPDES construction and Industrial stormwater permitees, 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 and are eligible for CWA 319 grants.

The Department recognizes that **adaptive management/implementation (i.e. WLA and LA)** 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 watershed used in the development of this TMDL document. As additional data and/or information becomes available, it may become necessary to revise and/or modify the TMDL target accordingly.

Table Ab-1. Total Maximum Daily Load for the Toogoodoo Creek TMDL Watershed. Loads are expressed as colony forming units (cfu) per day.

Station ID	90th %tile of Existing Load (cfu/100ml)	TMDL[1,2] (cfu/100ml)	WQ Target (cfu/100ml)	Margin of Safety (MOS) (cfu/100ml)	WLA			LA
					Continuous Sources[3] (cfu/100ml)	Non-Continuous Sources[4,7] (% Reduction)	Non-Continuous SCDOT[7] (% Reduction)	% Reduction to Meet Load Allocation[7]
12B-34	58.3	43	40.9	2.1	See Note Below	30%	0%[5]	30%
12B-35	60.3	43	40.9	2.1	See Note Below	32%	32%[6]	32%
12B-45	122	43	40.9	2.1	See Note Below	66%	0%[5]	66%

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.
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 OF CONTENTS

TABLES AND FIGURES

1.0 INTRODUCTION

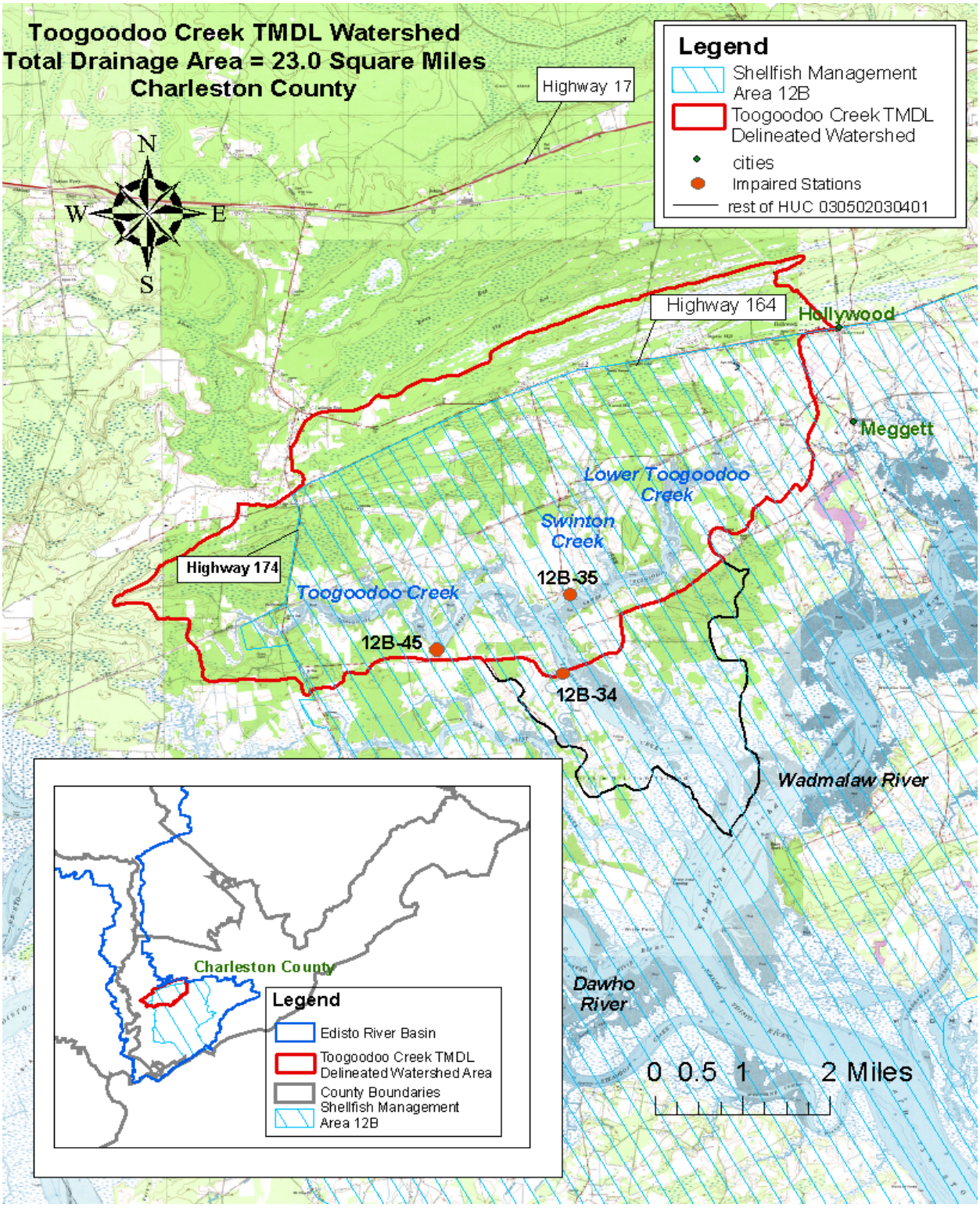
1.1 Background

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 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 State 303(d) list by 40 CFR 130.31(a) (US EPA, 1999).

1.2 Watershed Description

This watershed is located in Charleston County, South Carolina within Shellfish Area 12B, Hydrologic Unit Code 030502060401 and the Edisto River basin (see Figure 1). The drainage area of the delineated watershed is 23.08 square miles. Highway 17 is located to the north of the watershed. The towns of Meggett and Hollywood are located just outside the eastern portion of the watershed. There are two branches of the creek: Toogoodoo Creek and Lower Toogoodoo Creek. Swinton Creek flows into Lower Toogoodoo Creek. Both Lower Toogoodoo Creek and Toogoodoo Creek branches eventually flow into one Toogoodoo Creek branch that flows into the Wadmalaw River. There are 3 impaired sites within this watershed and each will be addressed as it's own reach throughout this document. Reach 1 (RC-1) is comprised of the western watershed to impaired station 12B-45. Reach 2 (RC-2) is comprised of the eastern watershed to impaired station 12B-35, and Reach 3 (RC-3) is comprised of the area between impaired station 12B-45 and 12B-35 (see Table 1b and Figure 2b).

Figure 1. Location of Toogoodoo Creek TMDL Delineated Watershed SCDHEC Impaired Monitoring Stations 12B-34, 12B-35, 12B-45 Located within HUC 030502060401, Charleston County



1.2.1 Tides

Tides in the Toogoodoo Creek watershed are semidiurnal, consisting of two low and two high tides occurring each lunar day. Wind direction and intensity, as well as atmospheric pressure, typically cause variations in predicted tidal ranges. The prevailing currents in the Atlantic Ocean as well as the tidal cycles contribute to the complex nature of the system.

1.2.2 Precipitation

Precipitation in the watershed is heaviest during late summer and early autumn. Tropical storms and hurricanes occasionally produce extremely large amounts of rainfall. During winter months heavy rainfall events are uncommon, yet occasional intense thunderstorms associated with rapidly moving low-pressure systems generate heavy rains. Precipitation rarely occurs in the form of snow or ice. Spring weather patterns may be dynamic with associated thunderstorms and severe weather conditions.

The yearly rainfall average for a sixty-five year period (1945-2005) in Charleston, recorded at the Charleston Airport, was 51.5 inches. The data from this meteorological station may not be representative of daily precipitation in the Toogoodoo Creek watershed due to the distance of Toogoodoo Creek from Charleston.

1.2.3 Winds

Prevailing winds along the central portion of the South Carolina coast are from the south and west during spring and summer and from the north during autumn and winter. Wind speeds are generally less than 15 miles per hour (mph); however, strong weather systems may generate winds in excess of 25 mph. Tropical storms and hurricanes occur occasionally.

1.2.4 River Discharges

Freshwater influence is primarily due to rainfall in the Toogoodoo Creek watershed. The nearest river freshwater inflow is through the Dawho River, which is south of the Toogoodoo Creek watershed.

1.2.5 Land Use and Soils

The primary land use within the Toogoodoo Creek watershed is forested area (35.76%), followed by wetlands/open water (33.8%). Agricultural lands make up 13.1% of the watershed area (Table 1a). This area consists of various soil textures defined by the United States Department of Agriculture (USDA), Soil Conservation Service (1971) utilizing general classifications and descriptions. Most of the area is generally comprised of Yonges-Hockley-Edisto soils, and occur on a low, broad plain and contain randomly spaced drainage ways that lead to tidal streams. Figure 2a shows the land use for the entire Toogoodoo Creek watershed and Figure 2b shows land use from reach to reach.

Table 1a. Land Use Within the Toogoodoo Creek TMDL Watershed (derived from NLCD 2001)

Land Use (NLCD 2001)	Area (mi^2)	Percent
Woody Wetlands	5.0	21.69%
Open Water	0.76	3.3%
Emergent Herbaceous Wetlands	2.03	8.81%
Total Wetlands/Open Water	***7.79***	***33.8%***
Evergreen Forest	5.12	22.2%
Deciduous Forest	2.15	9.32%
Mixed Forest	1.0	4.24%
Total Forested	***8.27***	***35.76%***
Cultivated Crops	0.9	3.86%
Pasture/Hay	2.13	9.24%
Total Agricultural	***3.03***	***13.1%***
Developed, Open Space	0.78	3.37%
Developed, Low Intensity	0.12	0.54%
Developed, Medium Intensity	0.02	0.08%
Developed, High Intensity	0.00	0.00%
Total Developed	***0.92***	***4.0%***
Scrub/Shrub	1.1	4.79%
Grassland/Herbaceous	1.97	8.55%
Total Other	***3.07***	***13.3%***
Total Area	**23.08**	**100.0%**

Figure 2a. Toogoodoo Creek TMDL Watershed Land Use

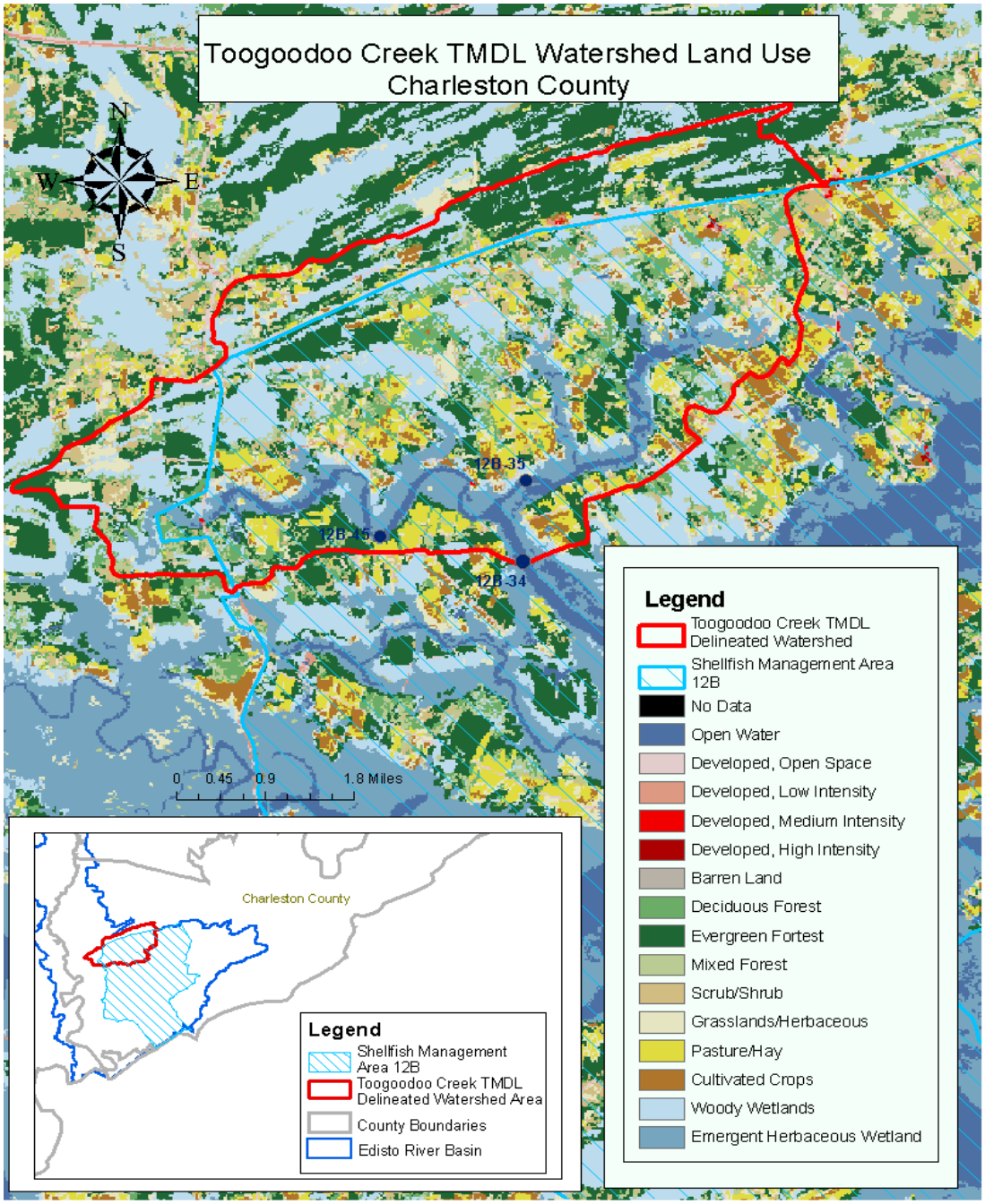
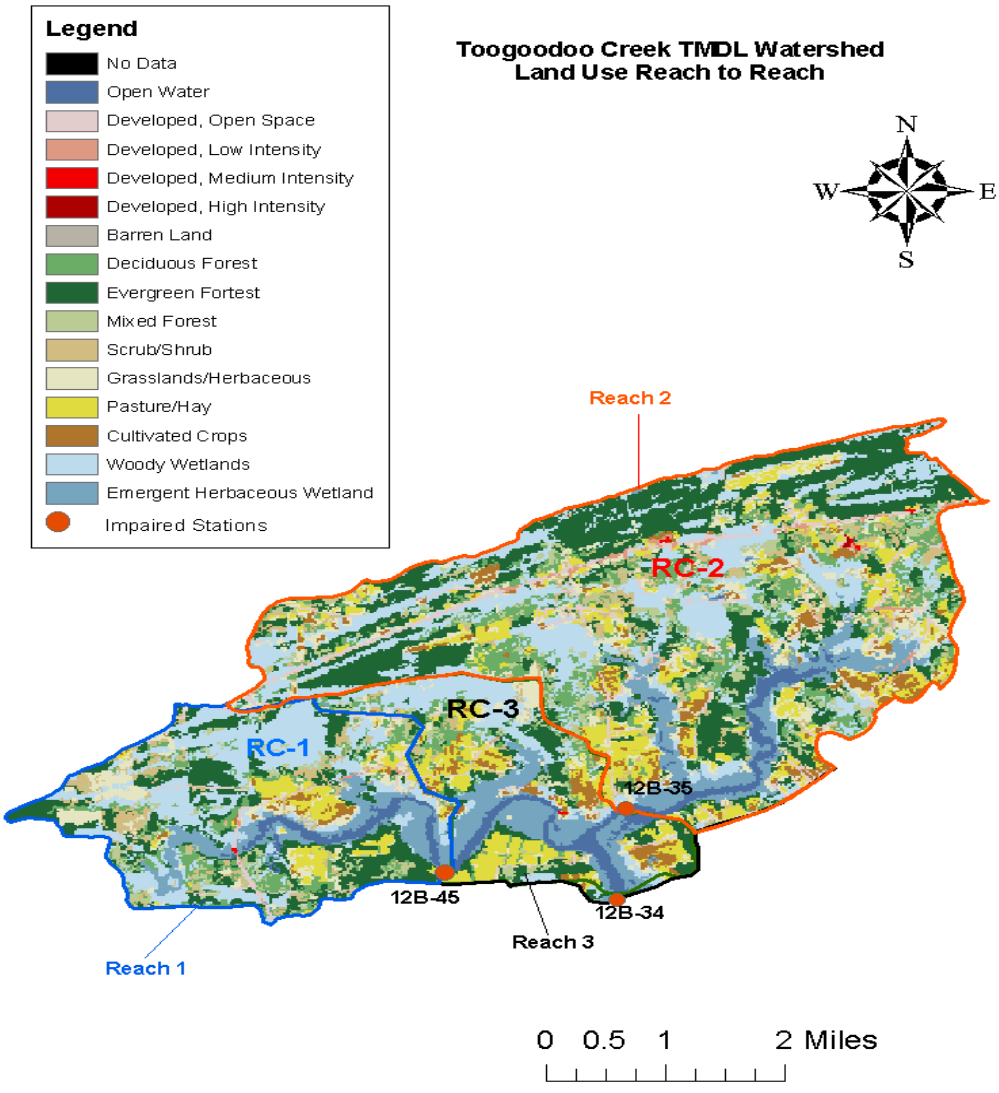


Table 1b. Developed Land Use by Station Reach Within the Toogoodoo Creek TMDL Watershed (derived from NLCD 2001)

Station Reach	*Total Drainage Area of Station Reach (sq. miles)*	*Total Developed Area (sq. miles)*	*Percent Developed Area (%)*
1.Western watershed to 12B-45	5.63	0.16	2.84
2. Eastern watershed to 12B-35	13.8	0.70	5.08
3. Between 12B-45 and 12B-35	3.54	0.07	1.98
Total	**23.0**	**0.931**	**4.08**

Figure 2b. Land Use From Reach to Reach



1.3 Water Quality Standard

Water quality standards (WQS) are based on the classification of the waterbody and are designed to protect the designated uses of that classification. Lower Toogoodoo Creek is designated as Shellfish Harvesting Waters (SFH) by R.61-69, Classified Waters (SC DHEC, 2004a). SFH waters are defined as:

> "tidal saltwaters protected for shellfish harvesting and uses listed in Class SA and Class SB. Suitable for primary and secondary contact recreation, crabbing, and fishing. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora" (SC DHEC, 2004b p.26).

Toogoodoo Creek and Swinton Creek are designated as Outstanding Resource Waters (ORW). Standards for class ORW waters are those applicable to the classification of the waterbody immediately prior to reclassification to Class ORW. In this case, waters would be required to meet SFH standards. ORW waters are described as:

> "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." (SC DHEC, 2004b p.22).

Guided by the minimum requirements of the National Shellfish Sanitation Program Model Ordinace (US FDA, 2005), the State of South Carolina has implemented a Water Quality Standard (WQS) for fecal coliform in Shellfish Harvesting Waters as:

> "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." (SC DHEC, 2004b).

The National Shellfish Sanitation Program (NSSP) is the federal/state cooperative program recognized by the U. S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold for human consumption. The purpose of the NSSP is to promote and improve the sanitation of shellfish (oysters, clams, mussels and scallops) moving in interstate commerce through federal/state cooperation and uniformity of State shellfish programs. Participants in the NSSP include agencies from shellfish producing and non-producing States, FDA, EPA, NOAA, and the shellfish industry. Under international agreements with FDA, foreign governments also participate in the NSSP. Other components of the NSSP include program guidelines, State growing area classification and dealer certification programs, and FDA evaluation of State program elements (US FDA, 2005).

2.0 WATER QUALITY ASSESSMENT

The Department currently utilizes a systematic random sampling (SRS) strategy within the watershed in lieu of sampling under adverse pollution conditions. In order to comply with National Shellfish Sanitation Program (NSSP) guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling

dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July 1998, an updated shellfish water quality data scheduling and collection procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station, yet provides a six-sample 'cushion' (above the NSSP required 30 minimum) for broken sample bottles, lab error, breakdowns, etc. This also allows each annual report's water quality data to meet the requirements for the NSSP Triennial Review sampling criteria.

Water quality sample data was used for this document during the period of 01/01/04 through 12/31/06. Samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported to the South Carolina Department of Health and Environmental Control's Region 7 Environmental Quality Control laboratory at North Charleston, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. At the laboratory, sample sets exceeding a 30-hour holding time or containing a temperature control in excess of 10 degrees Celsius were discarded (APHA, 1970).

Surface water temperatures are measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using an automatic temperature compensated refractometer. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages are determined by using Nautical Software's *Tides & Currents*, Version 2 (1996).

There are 3 monitoring stations within the delineated watershed (Appendix A). As referenced from DHEC's Shellfish Management Area 12B 2008 Annual Update, station 12B-45 exceeded the fecal coliform geometric mean MPN value of 14cfu/100 mL. All 3 stations exceeded the fecal coliform MPN estimated 90th percentile value of 43cfu/100 mL(Table 2). Data used in this document can be found on EPA's Storet website (http://www.epa.gov/storet/).

Table 2. Fecal Coliform Data Summary (01/01/04- 12/31/06)

Station	# Samples	Geometric Mean	90th Percentile	2008 303(d) List	Shellfish Classification
12B-34	35	11.7	**58.3**	Yes	Restricted
12B-35	35	12.8	**60.3**	Yes	Restricted
12B-45	35	**19.3**	**122**	Yes	Restricted

90th percentile calculated per US FDA Model Ordinance (2005).
Numbers in bold and yellow exceed standard.

3.0 SOURCE ASSESSMENT AND LOAD ALLOCATION

FC bacteria are used by the State of South Carolina as the indicator for pathogens in surface waters. Pathogens, which are usually difficult to detect, cause disease and make full body contact recreation in lakes and streams a risk to public health. Indicators such as FC bacteria, enteroccoci, or *E. coli* are easier to measure, have similar sources as pathogens, and persist in surface waters for a similar or longer length of time. These bacteria are not in themselves disease causing, but indicate the potential presence of organisms that may result in sickness.

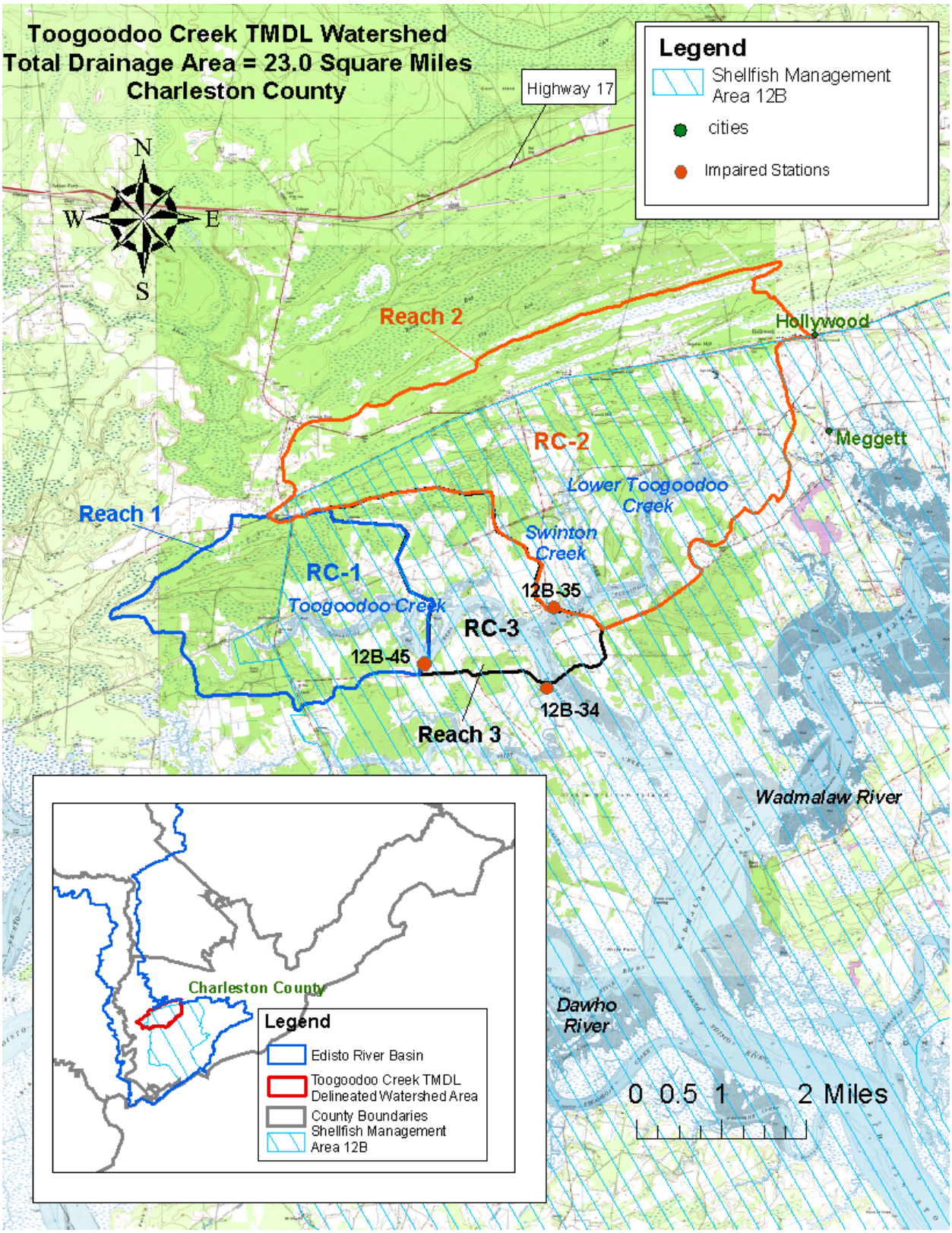
There are many sources of pathogen pollution in surface waters. In general these sources may be classified as point and nonpoint sources. With the implementation of technology-based controls, pollution from continuous point sources, such as factories and wastewater treatment facilities, has been greatly reduced. These point sources are required by the Clean Water Act (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.

Municipal and private sanitary wastewater treatment facilities may occasionally be sources of pathogen or FC bacteria pollution. However, if these facilities are discharging wastewater that meets their permit limits, they are not causing impairment provided that a daily maximum limit is being met as specified in the Total Maximum Daily Load. If any of these facilities is not meeting its permit limits, enforcement actions/mechanisms are required.

Other non-continuous point sources required to obtain NPDES permits that may be a source of pathogens include Municipal Separate Storm Sewer Systems (MS4s) and stormwater discharges from industrial or construction sites. MS4s may require NPDES discharge permits under the NPDES Stormwater regulations. These sources are also required to comply with the state standard for the pollutant(s) of concern. If discharges from regulated MS4 entities and from construction and industrial sites meet the percentage reduction or the water quality standard as prescribed in Section 5 of this TMDL document and required in their permit(s), they should not be causing or contributing to an instream FC bacteria impairment.

This TMDL is based on a delineated portion of the 12-digit HUC that encompasses Toogoodoo Creek (3 impaired stations). In order to address potential sources affecting each specific impaired station (and therefore each specific percent reduction), the overall delineated watershed has been broken down into 3 delineated subwatershed reaches(RC-1, RC-2, RC-3) and each will be discussed in the appropriate sections below (see map, Figure 3). Each subwatershed reach was delineated using the impaired station as the downstream end. Reach 1 (RC-1) focuses on potential sources impacting the area around 12B-45, Reach 2 (RC-2) focuses on potential sources impacting the area around 12B-35, and Reach 3 (RC-3) focuses on an area of potential sources impacting 12B-34.

Figure 3. Source Assessment Reaches In Relation to Impaired Stations



3.1 Point Sources

Point sources are defined as pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants, industrial waste treatment facilities, or regulated stormwater discharges. Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river. Point sources can be further broken down into continuous and non-continuous.

3.1.1 Continuous Point Sources

Domestic Wastewater

There are currently no domestic/municipal wastewater treatment facilities permitted to discharge treated effluent within the delineated watershed or within the 12 digit HUC. Future NPDES discharges in the referenced watershed are required to comply with the load reductions prescribed in the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

Industrial Wastewater

There are two permitted industrial wastewater facilities in the area of Reach 2 (Rentz Land Clearing- SCG730114 and L Dean Weaver- SCG730436; Table 3). These permits, however, have been issued for dewatering concerns associated with land clearing and borrow pit excavations. Groundwater and solids are permitted for discharge under a general mining permit. (SC DHEC Shellfish Management Area 12B 2008 Annual Update). There are no hazardous bacteriological or chemical components expected to be discharged from the treated effluent, therefore for the purposes of developing this TMDL document these facilities will not be provided a WLA.

Table 3. NPDES Dischargers in the Toogoodoo Creek TMDL watershed

Permit Number	Name	Type
SCG730114	Rentz Land Clearing/ Rentz Mine	Industrial- Discharge- Mine Dewatering
SCG730436	L Dean Weaver/ Vanness Mine	Industrial- Discharge- Mine Dewatering

Marinas

S.C. Regulation 61-47, South Carolina Shellfish (2007) defines *Marina* as "any of the following: (1) locked harbor facility; (2) any facility which provides fueling, pump-out, maintenance or repair services (regardless of length); (3) any facility which has effective docking space of greater than 250 linear feet or provides moorage for more than 10 boats; (4) any water area with a structure which is used for docking or otherwise mooring vessels and constructed to provide temporary or permanent docking space for more than ten boats, such as a mooring field; or (5) a dry stack facility."

There are currently no marinas or commercial boat docking facilities located within the watershed.

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 122.26(b)(14)&(15). All regulated MS4 entities have the potential to contribute FC pollutant loadings in the delineated drainage area used in the development of this TMDL.

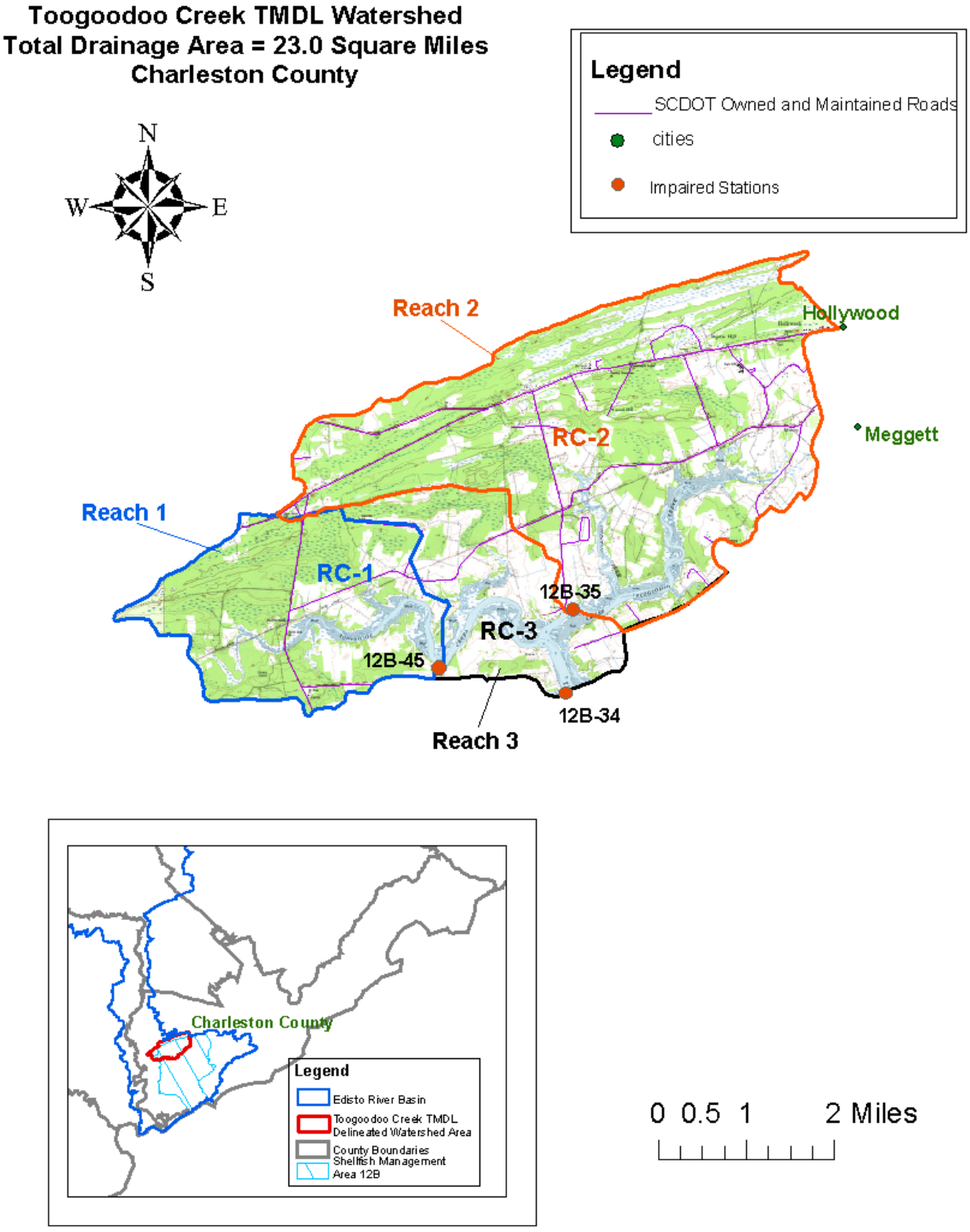
The South Carolina Department of Transportation (SCDOT) is currently the only designated Municipal Separate Storm Sewer System (MS4) within the watershed. The SCDOT operates under NPDES MS4 SCS040001 and owns and operates roads in the watershed (Figure 4). However, the Department recognizes that SCDOT is not a traditional MS4 in that it does not possess statutory taxing or has enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits.

Current developed land use for station 12B-34 is 2.06%, 5.05% for station 12B-35 and 2.68% for station 12B-45. 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 watershed, then those discharges will be subject to the assumptions and requirements of the WLA portion of this TMDL. However, there may be industrial or construction activities going on at any time that could produce stormwater runoff.

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. 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.

Figure 4. SCDOT Owned and Maintained Roads in the Toogoodoo Creek TMDL Watershed



3.2 Nonpoint Sources

Nonpoint source pollution is defined as pollution that is not released through pipes but rather originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related either to land or water use including failing septic tanks, improper animal-keeping practices, agriculture, forestry practices, wildlife and urban and rural runoff.

Nonpoint source pollution is likely the major contributing factor to negatively impact water quality in the watershed. Stormwater runoff impacts water quality by transporting FC bacteria from land to the shellfish growing area. The Department recognizes that there is likely wildlife, agricultural activities, grazing animals, septic tanks and/or other nonpoint source contributors located within unregulated areas, such as the referenced Watershed (at time of TMDL development). Nonpoint sources located in unregulated areas are subject to the LA and not the WLA component of the TMDL.

3.2.1 Urban and Suburban Stormwater Runoff

Dogs, cats and other domesticated pets are the primary source 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. There is little urban development within the delineated watershed, therefore, urban non-point sources are considered to be negligible. The Army Corps of Engineers has not conducted any dredging projects recently in the watershed used in the development of this document.

A few single-family homes continue to be built in the entire watershed. Land clearing associated with this new construction can accelerate shoreline erosion. Stormwater runoff impacts water quality by transporting fecal coliform bacteria from land to the shellfish growing area (DHEC Shellfish Management Area 12B 2008 Annual Update).

As previously stated, SCDOT is currently the only permitted MS4 in the referenced watershed and is subject to the WLA component of the TMDL. Similar to regulated MS4 entities, potentially designated MS4 entities (as listed in 64 FR, P.68837) or other unregulated MS4 communities located in 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.

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; therefore, we have 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 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.

South Carolina does have an AFO (animal feeding operation) permit program in place. There are currently no permitted agricultural facilities (AFOs) located in the watershed, however shoreline surveys have identified several animal farms adjacent to Toogoodoo Creek (see pictures, Appendix D). In addition, there are extensive agricultural crop farms in the area.
There are two cow farms located within Reach 1, one of which has a large pasture of cows with fencing right near the shoreline, (noted during source assessment, see pictures, Appendix D) as well as one horse farm. There are also two cow farms and one horse farm in Reach 2.

3.2.3 Failing Septic Systems

Failed septic tanks can contribute to bacterial contamination of downstream waterbodies (US EPA, 2001). Nearly all homes in the area are served by individual septic systems. Each system requires inspection by Region 7 DHEC Health and approval before final installation. The homes along the northern border of the area, near the town of Hollywood, are served by Charleston County Public Works, which does not discharge within this area. Studies demonstrate that wastewater located four feet below properly functioning septic systems contain on average less than one FC bacteria organism per 100 mL (Ayres Associates 1993).

3.2.4 Wildlife and Domestic Animals

The watershed supports a large population of domestic animals and a moderate amount of wildlife (primarily various types of water birds and terrestrial and semi-terrestrial mammals). The area has an extensive network of small tidal creeks. This creek system provides a possible conduit for animal fecal coliform bacteria to be transported to the adjacent growing waters.

The National Oceanic and Atmospheric Administration (NOAA) conducted a study in 2004 on sites in Toogoodoo Creek. The purpose was to use microbial source tracking to try to provide direct evidence about the origin of pollution by identifying indicator organisms by host (human or animal). The results show consistency with animal-source FC bacteria contamination, particularly cow, raccoon, and deer.

In 2008, SCDNR estimated that there are 30-45 deer per square mile within the delineated watershed within Charleston County (SCDNR 2008). SCDNR estimated deer density based on suitable habitat (forests, croplands, and pastures). The fecal coliform production rate for deer has been shown to be 3.47×10^3 cfu/head-day in a study conducted by Yagow (1999), of which only a portion will enter the watershed.

3.2.5 Boat Traffic

Recreational boat traffic is moderate throughout the area throughout the year. There is a boat ramp that leads into the waters right near 12B-35 (Reach 2).

3.2.6 Hydrographic Modification

Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. There have been little to no modifications done in this area.

4.0 METHODS

Creating a functional hydrodynamic model of this system would be resource intensive. 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.

Cumulative probability distributions were used to calculate existing conditions and percent reduction necessary to meet shellfish waters standards for fecal coliform. All available water quality data were used in calculations to provide a more robust dataset. 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 90^{th} percentile. If the fit line crosses the 90^{th} 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 a 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 90^{th} percentile point (Appendix C). 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 90^{th} percentile point:

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

There are no stations that currently exceed the geometric mean criteria that do not also exceed the single standard sample.

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.

5.0 DEVELOPMENT OF TMDL

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 nature of this system, 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 SSOs, are illegal and not covered under the WLA of this TMDL.

5.2.1 Continuous Point Sources

There are currently no dischargers within the Toogoodoo Creek TMDL area. Future NPDES discharges in the referenced watershed are required to comply with the load reductions prescribed in the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

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 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 4 presents the reduction needed for the impaired segments.

The reduction percentages in this TMDL also applies 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 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 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 it does not possess statutory taxing or enforcement powers. SCDOT does not regulate land use 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 reduction and is initiated through implementation. 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 station is 40.9 cfu/100ml (Table 4). The department believes that meeting the highest percentage reduction or the WQS will effectively protect the shellfish harvesting beds in the referenced watershed for human consumption. SCDOT is currently the only designated MS4 located in the drainage area and is subject to the WLA portion of the TMDL. There may be stormwater discharges located in the watershed that are subject to the LA component of this TMDL. At such time that the referenced entities become regulated NPDES MS4 entities subject to applicable provisions of SC Regulation 61-68 D, 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. 122.26(b)(14) & (15).

5.4 Existing Load

Due to the tidal nature of the system it is extremely 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 90^{th} percentile point based on the normal line fit to the monitoring data (Table 4, Appendix C).

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:

$$TMDL = LC = WLA + LA + MOS \text{ (US EPA, 2001).}$$

This equation results in reductions of concentrations ranging from 25% to 71% to consistently meet the instantaneous water quality standard for fecal coliform. Table 4 indicates the percentage reduction or water quality standard required for each subwatershed. Applying the required percent reduction to each data point in the 2004-2006 dataset also results in the geometric mean criteria being met for all stations (Table 5).

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 4. TMDL Components of the Toogoodoo Creek TMDL Watershed

Station ID	90th %tile of Existing Load (cfu/100ml)	TMDL[1,2] (cfu/100ml)	WQ Target (cfu/100ml)	Margin of Safety (MOS) (cfu/100ml)	WLA			LA
					Continuous Sources[3] (cfu/100ml)	Non-Continuous Sources[4,7] (% Reduction)	Non-Continuous SCDOT[7] (% Reduction)	% Reduction to Meet Load Allocation[7]
12B-34	58.3	43	40.9	2.1	See Note Below	30%	0%[5]	30%
12B-35	60.3	43	40.9	2.1	See Note Below	32%	32%[6]	32%
12B-45	122	43	40.9	2.1	See Note Below	66%	0%[5]	66%

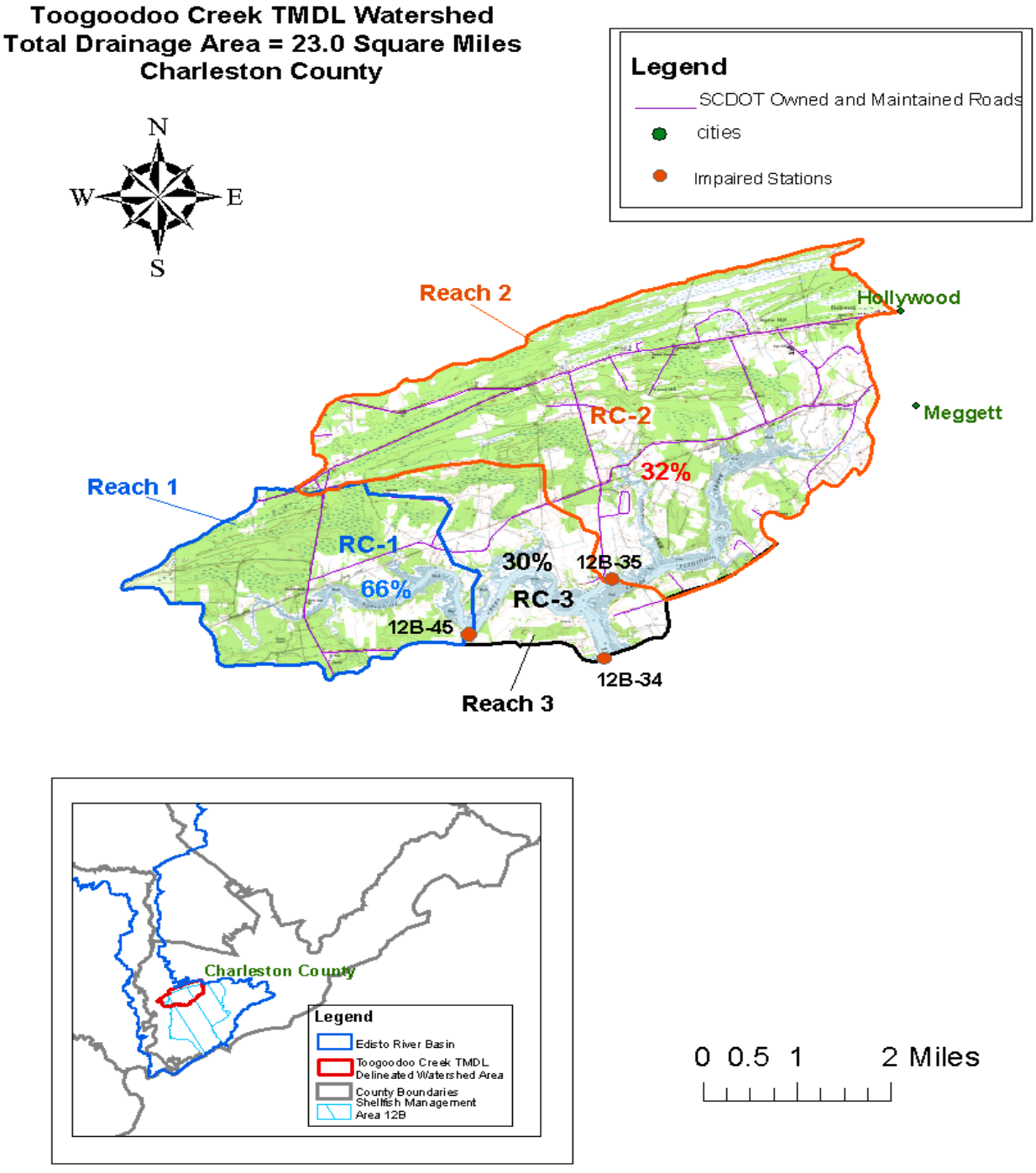
Table Notes:

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 5. Geometric Means

Station ID	Geometric Mean Actual Data (2004-2006)	TMDL % Reduction	Geometric Mean w/ % Reduction Applied
12B-34	11.7	30%	9.2
12B-35	12.8	32%	11.3
12B-45	19.3	66%	9.6

Figure 5. Percent Reductions at Each Impaired Station



6.0 IMPLEMENTATION

The implementation of both point (WLA) and non-point (LA) source components of the TMDL are necessary in order to bring about the required reductions in FC bacteria loading to Toogoodoo Creek and its tributaries in order to meet 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 6.1.1-6.1.7 presented below correspond with sections 3.1.1-3.2.5 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 Toogoodoo Creek and its tributaries. 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 any MS4 jurisdictional boundary. Additional resources are provided in Section 7.0 of this TMDL document.

SCDHEC will also work with the existing agencies in the area to provide nonpoint source education in the Toogoodoo Creek watershed. Local sources of nonpoint source education and assistance include the Natural Resource Conservation Service (NRCS), the Clemson University Cooperative Extension Service, and the South Carolina Department of Natural Resources.

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 Toogoodoo Creek Watershed. As additional data and/or information becomes 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 or may not 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 they are not a substitute for actual NPDES permit conditions.

Point Sources

6.1.1 Continuous Point Sources

Continuous point source WLA reductions will be implemented through NPDES permits. As noted in section 3.1.1, there are two permitted industrial wastewater facilities in the TMDL area however these permits have been issued for dewatering concerns associated with borrow pit excavations and no hazardous biological or chemical components are expected to be discharged from the treated effluent.

Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern and demonstrate consistency with the assumptions and requirements of the TMDL. Loadings are developed based upon permitted flow and an allowable permitted maximum concentration of 400cfu/100ml.

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. Permit requirements for implementing WLAs in approved TMDLs will vary across waterbodies, discharges, and pollutant(s) of concern. The allocations within a TMDL can take many different forms –

narrative, numeric, specific 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. For SCDOT, existing and future NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of the WLA to the Maximum Extent Practicable. For existing and future NPDES construction and Industrial stormwater permittees, compliance with terms and conditions 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).

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/Erosion_prevention.pdf

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.

Nonpoint Sources

6.1.3 Wildlife

Suggested forms of implementation for wildlife will vary widely due to geographic location and species. During a source assessment it was noticed that water birds are present in this watershed area, especially on or near docks. Deterrents could be used to keep water birds away from docks and lawns in close proximity to surface waters. These include non-toxic sprays, decoys, kites, noisemakers, scarecrows, and plastic owls. As mentioned in section 3, a study conducted by NOAA shows the majority of FC bacteria comes from wildlife such as raccoons and deer. Homeowners should be educated on the impacts of feeding wildlife or planting food plots in close proximity to surface waters. Please check local and federal laws before applying deterrents or harassing wildlife. Additional information may be obtained from the "Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water" bulletin provided by USEPA (2001).

6.1.4 Agricultural Activities

The majority of the Toogoodoo Creek watershed is agricultural, therefore focusing on implementation through improving BMPs may be able to reduce pollutant loading significantly. Suggested forms of implementation for agricultural activities will vary based on the activity of concern.

Agricultural BMPs can be vegetative, structural or management oriented. When selecting BMPs, it is important to keep in mind that nonpoint source 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. Numerous livestock farms were present in the watershed at the time a source assessment was conducted. Many of these had fencing, however the fencing was right near the shoreline. Planting vegetative buffers along the fence lines could help reduce the amount of FC bacteria being washed into the creek, especially after a heavy rainfall. Another option would be to have an alternative water source to eliminate direct contact with the streams. It has been shown that installing water troughs within a pasture area reduced the amount of time livestock

spent drinking directly from streams by 92% (ASABE 1997). An indirect result of this was a 77% reduction in stream bank erosion by providing an alternative to accessing the stream directly for water supply. It was also noted during a windshield survey that several cow pastures had numerous amounts of manure. A manure storage facility would not only help water quality by minimizing the amount of FC that could be flushed into the creek after a rain, but it would also allow farmers to purchase little to no fertilizer and save money. The manure could be applied to crops when they will readily use it.

For row crop farms in the referenced watershed, many common practices exist to reduce FC contributions. Unstabilized soil directly adjacent to surface waters can contribute to FC loading during periods of runoff after rain events. Agricultural field borders and filter strips (vegetative buffers) can provide erosion control around the border of planted crop fields. These borders can provide food for wildlife, may possibly be harvested (grass and legume), and also provide an area where farmers can turn around their equipment (SCDNR 1997). A study conducted in 1998 by the American Society of Agricultural and Biological Engineers (ASABE) has shown that a vegetative buffer measuring 6.1 meters in width can reduce fecal runoff concentrations from 2.0E+7 to an immeasurable amount once filtered through the buffer. A buffer of this width was also shown to reduce phosphorous and nitrogen concentrations by 75%.

The agricultural BMPs listed above are a sample of the many accepted practices that are currently available. Many other techniques such as conservation tillage, responsible pest management, and precision agriculture also exist and may contribute to an improvement in overall water quality in the watershed. Education should be provided to local farmers on these methods as well as acceptable manure spreading and holding (stacking sheds) practices.

For additional information on accepted agricultural BMPs you can obtain a copy of the "Farming for Clean Water in South Carolina" handbook by contacting Clemson University Cooperative Extension Service at (864) 656-1550. In addition, Clemson Extension Service offers a 'Farm-A-Syst' package to farmers. Farm-A-Syst allows the farmer to evaluate practices on their property and determine the nonpoint source impact they may be having. It recommends best management practices (BMPs) to correct nonpoint source problems on the farm. You can access Farm-A-Syst by going onto the Clemson Extension Service website: http://www.clemson.edu/waterquality/FARM.HTM or contact the local NRCS district conservationist.

NRCS provides financial and technical assistance to help South Carolina landowners address natural resource concerns, promote environmental quality, and protect wildlife habitat on property they own or control. The cost-share funds are available through the Environmental Quality Incentives Program (EQIP). EQIP helps farmers improve production while protecting environmental quality by addressing such concerns as soil erosion and productivity, grazing management, water quality, animal waste, and forestry concerns. EQIP also assists eligible small-scale farmers who have historically not participated in or ranked high enough to be funded in previous sign ups. Please visit www.sc.nrcs.usda.gov/programs/ for more information, including eligibility requirements.

Also available through NRCS, the Grassland Reserve Program (GRP) is a voluntary program offering landowners the opportunity to protect, restore and enhance grasslands on their property. NRCS and the Farm Service Agency (FSA) coordinate implementation of the GRP, which helps landowners restore and protect grassland, rangeland, pastureland, shrubland and certain other lands and provides assistance for rehabilitating grasslands. The program will conserve vulnerable grasslands from conversion to cropland or other uses and conserve valuable grasslands by helping maintain viable grazing operations. A grazing management plan is required for participants. NRCS has further information on their website for the GRP as well as additional programs such as the Conservation Reserve Program, Conservation Security Program, Farm and Ranch Lands Protection Program, etc. You can visit the NRCS website by going to: www.sc.nrcs.usda.gov/programs/

6.1.5 Leaking Sanitary Sewers and Illicit Discharges

Leaking sanitary sewers and illicit discharges, although illegal and subject to enforcement, may be occurring in the watershed at any time. It should be recognized that these activities may occur in unregulated portions of the watershed. Due to the high concentration of pollutant loading that is generally associated with these discharges, their detection may provide a substantial improvement in overall water quality in the Toogoodoo Creek watershed. Detection methods may include, but are not limited to: dye testing, air pressure testing, static pressure testing, and infrared photography.

SCDHEC recognizes illicit discharge detection and elimination activities are conducted by MS4 entities as pursuant to compliance with existing MS4 permits. Note that these activities are designed to detect and eliminate illicit discharges that may contain FC bacteria. It is the intent of SCDHEC to work with the MS4 entities to recognize FC load reductions as they are achieved. SCDHEC acknowledges that these efforts to reduce illicit discharges and SSOs are ongoing and some reduction may already be accountable (i.e. load reductions occurring during TMDL development process). Thus, the implementation process is an iterative and adaptive process. Regular communication between all implementation stakeholders will result in successful remediation of controllable sources over time. As recreational uses are restored, SCDHEC will recognize efforts of implementers where their efforts can be directly linked to restoration.

6.1.6 Failing Septic Systems

A septic system, also known as an onsite wastewater system, is defined as failing when it is not treating or disposing of sewage in an effective manner. The most common reason for failure is improper maintenance by homeowners. Untreated sewage water contains disease-causing bacteria and viruses, as well as unhealthy amounts of nitrate and other chemicals. Failed septic systems can allow untreated sewage to seep into wells, groundwater, and surface water bodies, where people get their drinking water and recreate. Pumping a septic tank is probably the single most important thing that can be done to protect the system. If the buildup of solids in the tanks becomes too high and solids move to the drainfield, this could clog and strain the system to the point where a new drainfield will be needed.

The Office of Coastal Resource Management (OCRM) has created a toolkit for homeowners and local governments which includes tips for maintaining their systems. These septic system Do's and Don't's 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 and maintain 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

6.1.7 Urban Runoff

Urban runoff is surface runoff of rainwater created by urbanization outside of regulated areas which may pick up and carry pollutants to receiving waters. Pavement, compacted areas, roofs, reduced tree canopy and open space increase runoff volumes that rapidly flow into receiving waters. This increase in volume and velocity of runoff often causes stream bank erosion, channel incision and sediment deposition in stream channels. In addition, runoff from these developed areas can increase stream temperatures that along with the increase in flow rate and pollutant loads negatively affect water quality and aquatic life (USEPA 2005). This runoff can pick up FC bacteria along the way. Many strategies currently exist to reduce FC loading from urban runoff and the USEPA nonpoint source pollution website provides extensive resources on this subject which can be accessed online at: http://www.epa.gov/nps/urban.html.

Some examples of urban nonpoint source bmps are street sweeping, stormwater wetlands, pet waste receptacles (equipped with waste bags), and educational signs which can be installed adjacent to receiving waters in the watershed such as parks, common areas, apartment complexes, trails, etc. Low impact development (LID) may also be effective. LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements (USEPA, 2009).

Some additional urban BMPs that can be adopted in public parks are doggy dooleys and pooch patches. Doggy dooleys are disposal units, which act like septic systems for pet wastes, and are installed in the ground where decomposition can occur (USEPA, 2001). This requires the pet owner to place the waste into the disposal units. During a source assessment, a dog pen was noted directly adjacent to Toogoodoo Creek near impaired site 12B-35. There is also a boat ramp located here with a small park. Installing a doggy dooley here may be one way to reduce FC bacteria loading in the area.

Although the Toogoodoo Creek watershed is rural in nature, many of the urban runoff practices discussed in this section can be applied to individual households in the watershed. Education should be provided to individual homeowners in the referenced watershed on the contributions to FC loading from pet waste. Education to homeowners in the watershed on the fate of substances poured into storm drain inlets should also be provided. For additional information on urban runoff please see the SCDHEC Nonpoint Source Runoff Pollution homepage at http://www.scdhec.gov/environment/water/npspage.htm.

Clemson Extension's Home-A-Syst handbook can also help homeowners reduce sources of NPS pollution on their property. This document guides homeowners through a self-assessment of their property and can be accessed online at: http://www.clemson.edu/waterquality/HOMASYS.HTM.

7.0 REFERENCES

American Public Health Association, Inc. *Procedures for the bacteriologic examination of sea water and shellfish,* 1970. p. 28-47. In *Recommended procedures for the examination of sea water and shellfish*, 4th ed. Library of Congress, Washington, D.C.

Ayres Associates 1993. Onsite Sewage Disposal Systems Research in Florida. The Capacity of Fine Sandy Soil for Septic Tank Effluent Treatment: A Field Investigation at an In-Situ Lysimeter Facility in Florida.

National Oceanic and Atmospheric Administration (NOAA) National Ocean Service Center for Coastal Environmental Health and Biomolecular Research. 2004. Use of Three Microbial Source Tracking Methods to Analyze Shellfish Harvesting Waters in South Carolina; 93 pp.

Novotny, V. 2003. *Water Quality: Diffuse pollution and watershed management*, Wiley, Hoboken, N.J.

Novotny, V. 2004. "Simplified Databased Total Maximum Daily Loads, or the World is Log-Normal." *Journal of Environmental Engineering*., 130(6), 674-683.

South Carolina Department of Health and Environmental Control (SC DHEC) Bureau of Water. 1998. Implementation Plan for Achieving Total Maximum Daily Load Reductions from Nonpoint Sources for the State of South Carolina.

South Carolina Department of Health and Environmental Control (SC DHEC) Bureau of Water. 2002. Standards for the Permitting of Agricultural Animal Facilities (R.61-43). Effective June 28,2002. [Electronic Version]; 105pp.

South Carolina Department of Health and Environmental Control (SC DHEC) Office of Environmental Quality Control. 2003. Water Pollution Control Permits (R.61-9).

South Carolina Department of Health and Environmental Control (SC DHEC) Bureau of Water. 2004a. Classified Waters (R.61-69). Amended May 28, 2004. Printed April 2005; 36pp.

South Carolina Department of Health and Environmental Control (SC DHEC) Bureau of Water. 2004b. Water Classifications & Standards (R.61-68). Amended June 25, 2004. Printed April 2005; 56pp.

South Carolina Department of Health and Environmental Control (SC DHEC) Bureau of Water. 2008. State of South Carolina Section 303(d) List for 2008. [Electronic Version].

South Carolina Department of Health and Environmental Control (SC DHEC) Bureau of Water. 2007. South Carolina Shellfish (R.61-47). Amended February 23, 2007. [Electronic Version]; 54pp.

Stormwater Program (Phase II); Municipal Sewer Systems and Construction Sites, 64 Federal Register 235 (8 December 1999), pp. 68837.

United States Department of Agriculture, Soil Conservation Service (USDA), 1971. Soil Survey of Charleston County, South Carolina. In cooperation with South Carolina Agricultural Experiment Station and South Carolina Land Resources Conservation Commission, National Cooperative Soil Survey, Washington, D.C. 78pp.

United States Environmental Protection Agency (US EPA). 1999. Draft Guidance for Water Quality-based Decisions: The TMDL Process. Second Edition. Office of Water, EPA 841-D-99-001.

United States Environmental Protection Agency (US EPA). 2001. Protocol for Developing Pathogen TMDLs. First Edition. Office of Water, EPA 841-R-00-002.

United States Food and Drug Administration (US FDA). 2005. Guide for the Control of Molluscan Shellfish, II. Model Ordinance. http://www.cfsan.fda.gov/~ear/nss3-toc.html.

Water Quality Planning and Management, Title 40 Code of Federal Regulations, Pt. 130.2(i). 2006 ed.

Yagow, G. 1999. Unpublished monitoring data. Mountain Run TMDL Study. Submitted to Virginia Department of Environmental Quality. Richmond, Virginia.

Appendix A- Descriptions of Impaired Stations

Station	Description
12B-34	Toogoodoo Creek at last creek before fork
12B-35	Toogoodoo Creek Lower, at public boat ramp
12B-45	Toogoodoo Creek at the second bend past the confluence with Lower Toogoodoo Creek

Appendix B- Water Quality Data for Impaired Stations

12B-34

Date	Result #/100 ml	Date	Result #/ 100 ml
1/26/2004	2	1/4/2006	13
2/18/2004	17	2/21/2006	17
3/10/2004	4	3/21/2006	7
4/19/2004	9	4/17/2006	17
5/19/2004	2	5/16/2006	5
6/2/2004	49	6/27/2006	2
7/7/2004	2	8/21/2006	33
8/11/2004	8	9/19/2006	140
9/21/2004	13	10/25/2006	11
10/19/2004	8	11/15/2006	17
11/2/2004	13	12/19/2006	46
12/20/2004	5		
1/12/2005	33		
2/15/2005	2		
3/2/2005	11		
4/5/2005	5		
5/18/2005	79		
6/20/2005	110		
7/20/2005	17		
8/15/2005	70		
9/27/2005	17		
10/11/2005	33		
11/2/2005	22		
12/7/2005	17		

12B- 35

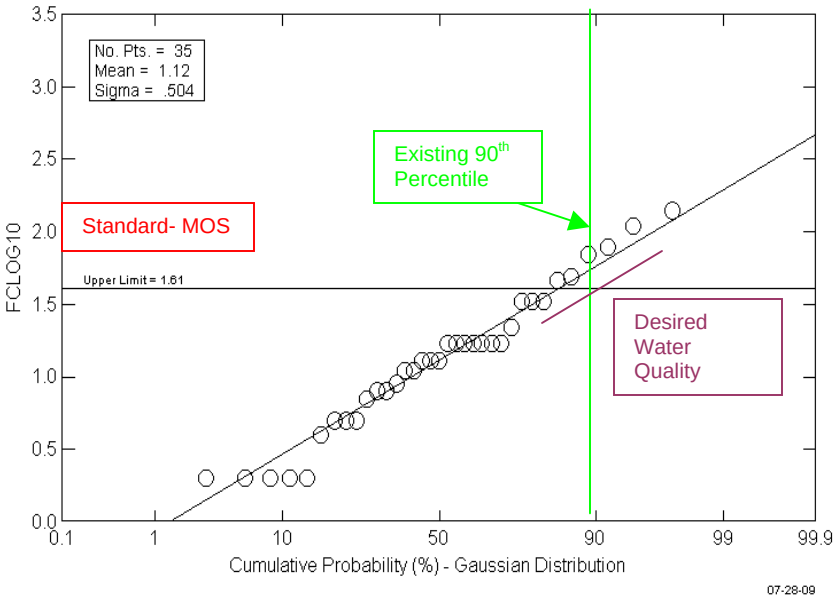
1/26/2004	5	9/19/2006	17
2/18/2004	14	10/25/2006	2
3/10/2004	13	11/15/2006	11
4/19/2004	17	12/19/2006	34
5/19/2004	23		
6/2/2004	49		
7/7/2004	22		
8/11/2004	5		
9/21/2004	13		
10/19/2004	13		
11/2/2004	5		
12/20/2004	5		
1/12/2005	22		
2/15/2005	2		
3/2/2005	11		
4/5/2005	46		
5/18/2005	350		
6/20/2005	70		
7/20/2005	33		
8/15/2005	23		
9/27/2005	46		
10/11/2005	49		
11/2/2005	13		
12/7/2005	13		
1/4/2006	49		
2/21/2006	11		
3/21/2006	17		
4/17/2006	17		
5/16/2006	17		
6/27/2006	17		
8/21/2006	8		

12B-45

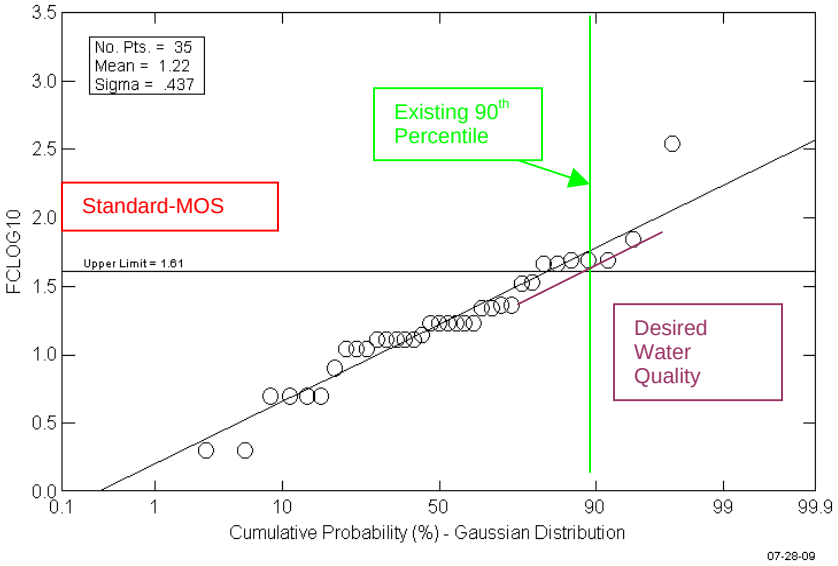
Date	Result #/ 100 ml	Date	Result #/100 ml
1/26/2004	8	1/4/2006	49
2/18/2004	49	2/21/2006	33
3/10/2004	17	3/21/2006	49
4/19/2004	49	4/17/2006	17
5/19/2004	31	5/16/2006	17
6/2/2004	79	6/27/2006	11
7/7/2004	13	8/21/2006	11
8/11/2004	23	9/19/2006	17
9/21/2004	11	10/25/2006	8
10/19/2004	23	11/15/2006	17
11/2/2004	8	12/19/2006	33
12/20/2004	17		
1/12/2005	22		
2/15/2005	1.9		
3/2/2005	46		
4/5/2005	70		
5/18/2005	1600		
6/20/2005	33		
7/20/2005	79		
8/15/2005	14		
9/27/2005	49		
10/11/2005	240		
11/2/2005	70		
12/7/2005	49		

Appendix C- Cumulative Probability Plots

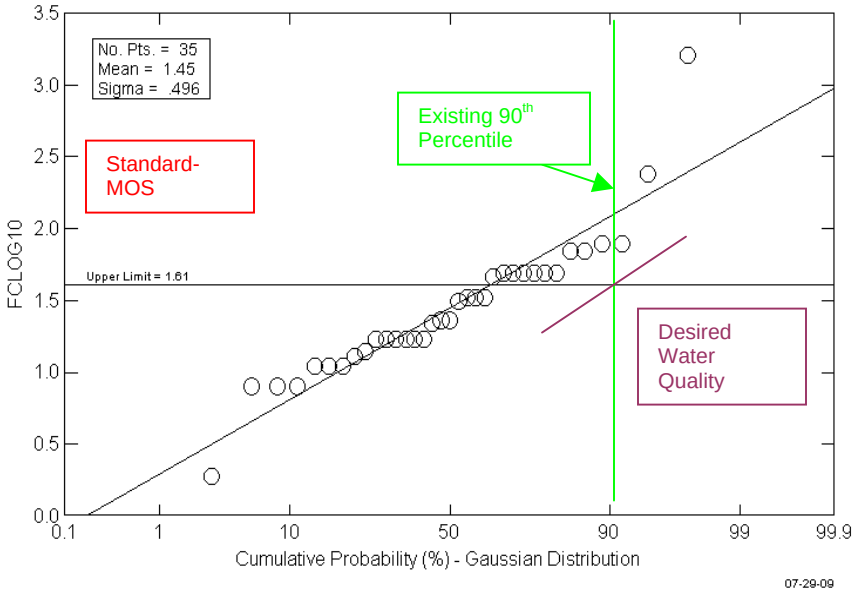
12B-34
Existing 90th Percentile = 58.3
Percent reduction = 30%



12B-35
Existing 90th Percentile = 60.3
Percent reduction = 32%



12B-45
Existing 90th Percentile = 122
Percent Reduction = 66%



Appendix D- Watershed Photos

Near SCDHEC Impaired Monitoring Station 12B-34 off Ethel PO Road; fencing for cows right near water and obvious evidence of cows

Cows in pasture near SCDHEC Impaired Monitoring Station 12B-34

SCDHEC Impaired Monitoring Station 12B-35
This picture was taken by boat, the public boat ramp is just to the right of the dock (ramp not in picture). Note also dog kennels right near water

SCDHEC Impaired Monitoring Station 12B-45 (picture taken by boat)
Fencing for cattle right near shoreline and oysters lie in mud lower left (low tide)

Near SCDHEC Impaired Monitoring Station 12B-45 (picture taken by road)
Creek with fencing is beyond trees; again obvious that cows are in area

Oysters

Farm along Toogoodoo Creek

Appendix E

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 sotrmwater 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

Responsiveness Summary
Toogoodoo Creek TMDL Document

Comments were received from the following:

Charleston County Public Works Department and South Carolina Department of Natural Resources

Comments from Charleston County Public Works Department

Comment 1:

"The boundaries of the delineated watershed are unclear. Specific delineation is needed by road names, channels, canals, Latitude/Longitude, and/or SCDHEC supplied map that is in either AutoCAD or GIS format."

Response 1:

The map in the TMDL document of the delineated watershed was developed using GIS and major roads and waterbodies are labeled on the map. The watershed boundary is based on a 12 digit HUC. Figure 1 in the document shows the location in relation to the surrounding area.

Comment 2:

"In Table 1b, the percent of developed area is not a cumulative function. The correct value is 0.931/23.0 acres = 4.08% total developed land for all three reaches. "

Response 2:

Table 1b of the document will be changed to reflect 0.931 acres/23 acres = 4.08% total developed land.

Comment 3:

"Why was data from 2004 to 2006 used for reporting while data is available from 2003 to 2007? Is sampling still occurring at the three (3) Toogoodoo Creek TMDL waterstations?"

Response 3:

The TMDL was developed for sites included in the 2008 303d list. Data were used based on the 2009 Shellfish Sanitation Report.

Comment 4:

"Where can the laboratory certification of whom ever reported fecal coliform samples to SCDHEC be viewed in accordance with SC Regulation 61-81?

South Carolina Regulation 61-81 gives the Office of Environmental Laboratory Certification authority to issue certification to laboratories analyzing regulatory compliance samples for reporting to the S.C Department of Health and Environmental Control (S.C. DHEC).

Regulation 61-81 applies to any laboratory performing analyses to determine the quality of air, drinking water, hazardous waste, solid waste, or wastewater; performing bioassays; or performing any other analyses related to environmental quality evaluations required by the Department or which will be officially submitted to the Department."

Response 4:

DHEC data were used. For information regarding lab certification please contact Carol Smith at DHEC's Office of Environmental Laboratory Certification or see their web site: http://www.scdhec.gov/environment/envserv/lccontactus.htm

Comment 5:

"Why were four (4) additional data points (1/22/07, 2/7/07, 3/6/07, and 4/3/07) used for Station 12B-45 and not for Stations 12B-34 and 12B-35. Data was available on Storet (http://www.epa.gov/storet/dw_home.html) for all three (3) Stations with identical sampling dates? Those four additional points should be removed from the statistical analysis of Station 12B-45."

Response 5:

The referenced data points in Appendix B for site 12B-45 were included by mistake and will be removed from the final document. The cumulative probability plot was re-calculated and confirmed to have used data from 2004 to 2006.

Comment 6:

"In Appendix B, the data in Table 12B-35 is duplicated for 10/25/2006 and 11/15/2006. This does not appear correct."

Response 6:

These dates were indeed duplicated and have been removed from Appendix B for station 12B-35.

Comment 7:

"Your analysis does not address baseline or natural background data. If the natural background level is not provided, how can pollutants be reduced by some percent? In essence, a water body's baseline or natural background may be the measured values

supplied in Appendix B. Therefore, how can MS4 entities be expected to decrease the FCU if they were not responsible for its increase. Provide facts to suggest otherwise."

Response 7:

Regardless of natural background, water quality standards must be met from all sources (point sources and nonpoint sources), including regulated MS4 to the MEP and in accordance with their MS4 permit.

Regulated MS4s are only responsible for reducing pollutant loads that pass through their conveyance and are not responsible for reducing other pollutant loads.

Comment 8:

"Document does not provide means for demonstration of compliance for new construction or industrial activities to regulated MS4 entities."

Response 8:

A TMDL is not required to recommend or evaluate compliance plans for MS4, however TMDL staff is assisting MS4 and compliance staff to demonstrate compliance.

Comment 9:

"Provide technical data/sampling report to support that commercial animal growing operations are not contributing to downstream water quality impairments with emphasis on fecal coliform. "

Response 9:

These data do not exist. South Carolina does have permitted feeding operations (AFOs) covered under R. 61-43. These permitted operations are not allowed to discharge to waters of the state and are covered under 'no discharge' (ND) permits. There are currently no permitted AFOs in the Toogoodoo Creek TMDL watershed.

Comments from South Carolina Department of Natural Resources

Comment 1:

"As noted in the report, shoreline surveys have identified several unpermitted animal farms (cow and horse pastures) immediately adjacent to Toogoodoo Creek. In addition to large populations of domestic farm animals, the report cites *"a moderate amount of wildlife (primarily various types of waterfowl and marine mammals)"* as a significant source of fecal coliform bacteria. The SCDNR believes that terrestrial and semi-terrestrial mammals probably contribute more fecal coliform bacteria to the system than "marine mammals". As noted in the TMDL report, the results of microbial source tracking studies are consistent with animal-source fecal coliform bacteria contamination, *"particularly cow, raccoon, and deer"*. Therefore, the SCDNR believes it would be more accurate to substitute the term "terrestrial and semi-terrestrial mammals" for the term "marine mammals"."

Response 1:

The word "marine mammals" has been replaced with "terrestrial and semi-terrestrial mammals".

Comment 2:

"We also believe that a variety of birds, including marsh birds, wading birds, seabirds, and shorebirds, probably contribute as much as or more fecal coliform bacteria to the Toogoodoo Creek watershed than "waterfowl" *per se* (e.g., ducks and geese). Therefore, the SCDNR recommends that the term "waterfowl" be changed to "water birds"."

Response 2:

The word "waterfowl" has been replaced with "water birds".

Comment 3:

"Overall, the SCDNR commends DHEC for developing a protective TMDL for fecal coliform in the Toogoodoo Creek watershed. 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 those encompassed by the Toogoodoo Creek watershed."

Response 3:

The Department (SCDHEC) appreciates DNR's support of the TMDL effort.

The following amendments were made to the document after the public comment period:

Amendment Location 1:

Abstract

Amendment:

Existing conditions and percent reductions were calculated using cumulative probability distributions. 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 the WLA to the Maximum Extent Practicable. For existing and future NPDES construction and Industrial stormwater permittess, compliance with terms and conditions of its permit is effective implementation of the WLA.**

Amendment Location 2:

Section 6.1.2, Page 30

Amendment:

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

Amendment Location 3:

Table Ab-1 and Table 4

Amendment:

The wasteload allocation column for continuous sources has been revised as follows:

Station ID	90th %tile of Existing Load (cfu/100ml)	TMDL[1,2] (cfu/100ml)	WQ Target (cfu/100ml)	Margin of Safety (MOS) (cfu/100ml)	WLA			LA
					Continuous Sources[3] (cfu/100ml)	Non-Continuous Sources[4,7] (% Reduction)	Non-Continuous SCDOT[7] (% Reduction)	% Reduction to Meet Load Allocation[7]
12B-34	58.3	43	40.9	2.1	**See Note Below**	30%	0%[5]	30%
12B-35	60.3	43	40.9	2.1	**See Note Below**	32%	32%[6]	32%
12B-45	122	43	40.9	2.1	**See Note Below**	66%	0%[5]	66%