Total Maximum Daily Load Document

E-013 and E-113
South Fork Edisto River

12 Digit HUCs 030502030101, 030502030102, 030502030104, 030502030103, 030502030106, 030502030105, 030502030201, 030502030204, 030502030202, 030502030206, 030502030208, 030502030210, 030502030205, 030502030207, 030502030303, 030502030302, 030502030301, 030502030305, 030502030306, 030502030308, 030502030203, 030502030209, 030502030304', 030502040106', '030502040101', '030502040107', '030502040103', '030502040102', '030502040109', '030502040107', '030502040105', '030502040205', '030502040201', '030502040207', '030502040203', '030502040202', '030502040206', '030502040204', '030502040308', '030502040301', '030502040302', '030502040307', '030502040303', '030502040304', '030502040306', '030502040311', '030502040310', '030502040305', '030502040312', '030502030307', '030502030308', '030502060101', '030502060103', '030502040108', '030502040309', '030502040104'

Fecal Coliform Bacteria,
Indicator for Pathogens

July 2011

Prepared for:
Bureau of Water

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Prepared by:
Ann-Marie Altman

Abstract

§303(d) of the Clean Water Act (CWA) and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for water bodies that are not meeting designated uses under technology-based pollution controls. A TMDL is maximum amount of pollutant a waterbody can assimilate while meeting water quality standards for the pollutant of concern. 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). A fecal coliform TMDL was developed for stations # E-013 and # E-113 within the South Fork Edisto River watershed located in Lexington, Aiken, Calhoun, Edgefield, Barnwell, Bamberg and Orangeburg Counties, South Carolina. The impaired stations are included on the State's 2010 §303(d) list due to excessive fecal coliform numbers documented during the 2004 - 2008 assessment period. Between 1999-2008, 13 percent of the samples collected at impaired monitoring station E-013 exceeded the water quality standards, while 10 percent of the samples at E-113 exceeded water quality standards.

This watershed is predominantly forest and agricultural lands. Probable causes of fecal contamination include agricultural runoff, failing septic systems, leaking sewers, sanitary sewer overflows, and urban runoff. The load-duration curve methodology was used to calculate existing and TMDL loads for each impaired segment. Existing pollutant loadings and proposed TMDL reductions for critical hydrologic conditions are presented in Table Ab-1. Critical hydrologic conditions were defined as either moist, mid-range, or dry depending on which condition demonstrated the highest load reductions necessary to meet water quality standards. In order to achieve the target load (slightly below water quality standards) for this portion of the South Fork Edisto River watershed, reductions in the existing loads of up to 2% will be necessary at station #E-013 and 32% at station #E-113. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. For SCDOT, compliance with terms and conditions of its NPDES MS4 permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP). Required load reductions in the 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** of this TMDL (i.e. WLA and LA) might be needed to achieve the water quality standard and we are committed towards targeting the load reductions to improve water quality in the South Fork Edisto watershed. 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 Loads for the South Fork Edisto River Watershed. Loads are expressed as colony forming units (cfu) per day.

				Wasteload Allocation (WLA)		Load Allocation (LA)	
Station	**Existing Load (cfu/day)**	**TMDL (cfu/day)**	**Margin of Safety (MOS) (cfu/ day)**	**Continuous Sources[1] (cfu/day)**	**Non-continuous Sources[2,3,4] (% Reduction)**	**Load Allocation (cfu/day)**	**% Reduction to Meet LA[3]**
E-013	1.64E+13	1.69E+13	8.46E+11	NA	2%	1.61E+13	2%
E-113	1.38+13	9.94E+12	4.97E+11	NA	32%	9.44E+12	32%

Table Notes:

1. WLAs are expressed as a daily maximum. Existing and future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings were developed based upon permitted flow and an allowable permitted maximum concentration of 400cfu/11ml.
2. 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.
3. Percent reduction applies to existing instream load; Where Percentage Reduction = (Existing Load-Load Allocation) / Existing Load.
4. 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

CONTENTS

LISTOF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 Introduction

1.1 Background

Fecal coliform bacteria are widely used as an indicator of pathogens in surface waters and wastewater. The presence of FCs in surface waters may signify a presence of pathogens, which in turn leads to a greater risk of health for individuals participating in recreational activities within the water body (USEPA, 2001). Acute gastrointestinal illnesses caused by pathogens affect millions of people in the United States and cause billions of dollars of costs each year (Gaffield et al. 2003). Of these illnesses many are caused by contaminated drinking water. Untreated stormwater runoff has been associated with a number of disease outbreaks, most notably an outbreak in Milwaukee that caused many deaths in 1993.

Though occurring at low levels from natural sources, the concentration of fecal coliform bacteria can be elevated in water bodies as the result of pollution. Sources of fecal coliform bacteria are usually diffuse or nonpoint in nature and originate from stormwater runoff, failing septic systems, agricultural runoff, leaking sewers among other sources. Occasionally, the source of the pollutant is a point source. Section 303(d) of the CWA and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop TMDLs for water bodies that are not meeting designated uses under technology-based pollution controls. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in stream water quality conditions so that states can establish water quality-based controls to reduce pollution and restore and maintain the quality of water resources (USEPA 1991).

The State of South Carolina has placed two monitoring stations in the South Fork Edisto River watershed on South Carolina's 2010 §303(d) list for impairment due to fecal coliform bacteria. These stations are identified in Table 1 and Figure 1a.

Table 1. South Fork Edisto River Watershed Fecal Coliform Impaired Waters.

Waterbody	***Station Number***	***Description***
South Fork Edisto River	E-113	South Fork Edisto River at S-02-152
Edisto River	E-013	Edisto River at Zig Zag Landing

1.2 Watershed Description

The South Fork Edisto River is within the Edisto River Basin. The headwaters are located near the town of Batesburg in Lexington County. It flows in a southeasterly direction eventually meeting with the North Fork Edisto River to form the Edisto River near the city of Branchville in Orangeburg County. There are 2 impaired sites within this watershed and each will be addressed as it's own reach in the document. Reach 1 addresses the location from the headwaters to impaired station E-013 and Reach 2 addresses the location from E-013 to E-113. There are four areas that fall within the total TMDL watershed drainage area that have already been addressed in separate TMDL documents. They are shown with their respective technical document numbers in Figure 1b. These areas are included in the total delineated drainage area for impaired stations addressed in this

TMDL, however they are not included in assessments for each impaired station's reach. The total South Fork Edisto River watershed (HUCs 030502030101, 030502030102, 030502030104, 030502030103, 030502030106, 030502030105, 030502030201, 030502030204, 030502030202, 030502030206, 030502030208, 030502030210, 030502030205, 030502030207, 030502030303, 030502030302, 030502030301, 030502030305, 030502030306, 030502030308, 030502030203, 030502030209, 030502030304', 030502040106', '030502040101', '030502040107', '030502040103', '030502040102', '030502040109', '030502040107', '030502040105', '030502040205', '030502040201', '030502040207', '030502040203', '030502040202', '030502040206', '030502040204', '030502040308', '030502040301', '030502040302', '030502040307', '030502040303', '030502040304', '030502040306', '030502040311', '030502040310', '030502040305', '030502040312', '030502030307', '030502030308', '030502060101', '030502060103', '030502040108', '030502040309', '030502040104') drains approximately 1027.23 square miles. For the purposes of this TMDL the total drainage area used in the land use summary (reach to reach, excluding the previous TMDLs' drainage areas) is 837 square miles.

Figure 1a. Location of Impaired SCDHEC Monitoring Stations E-113 and E-013

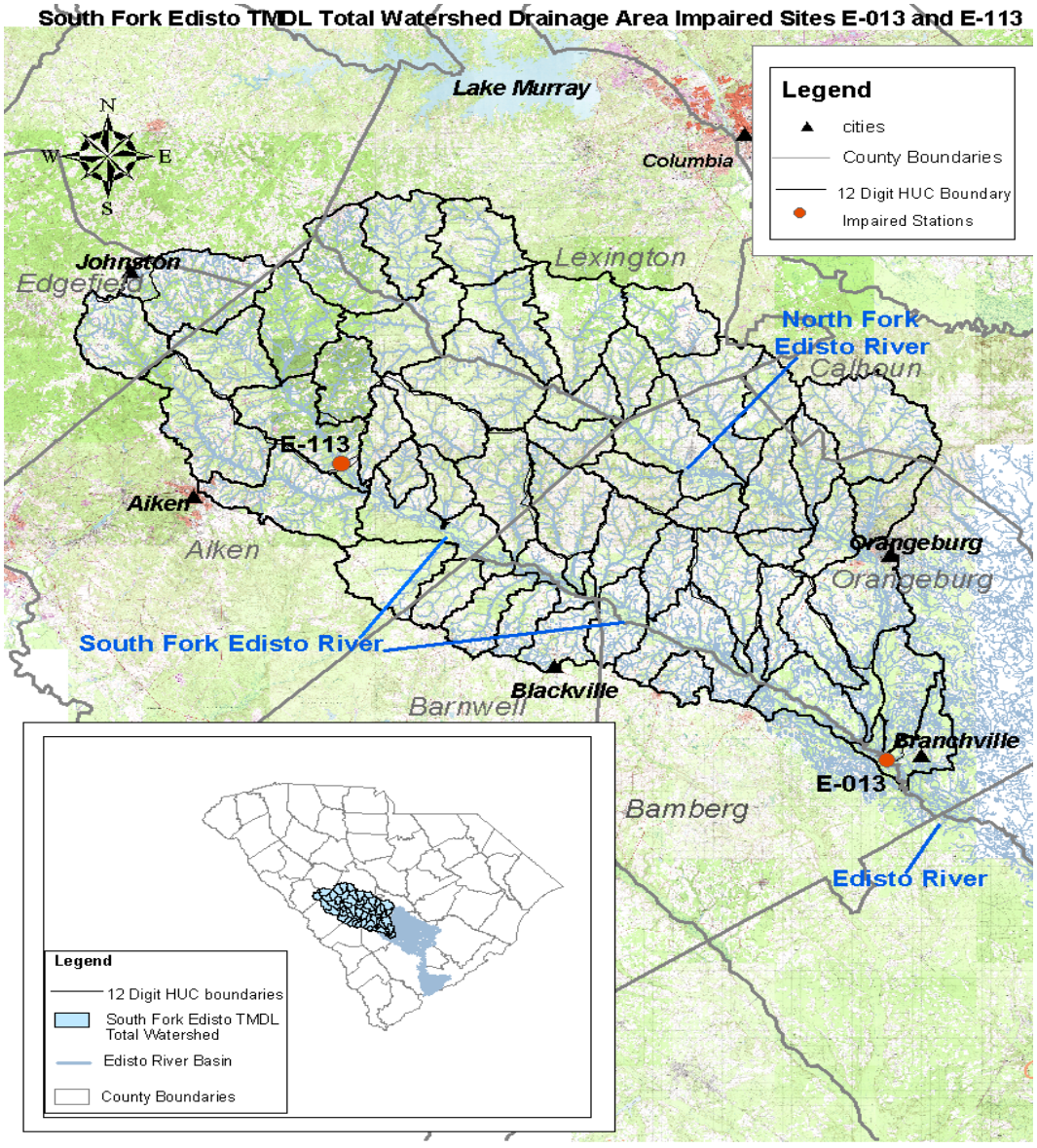
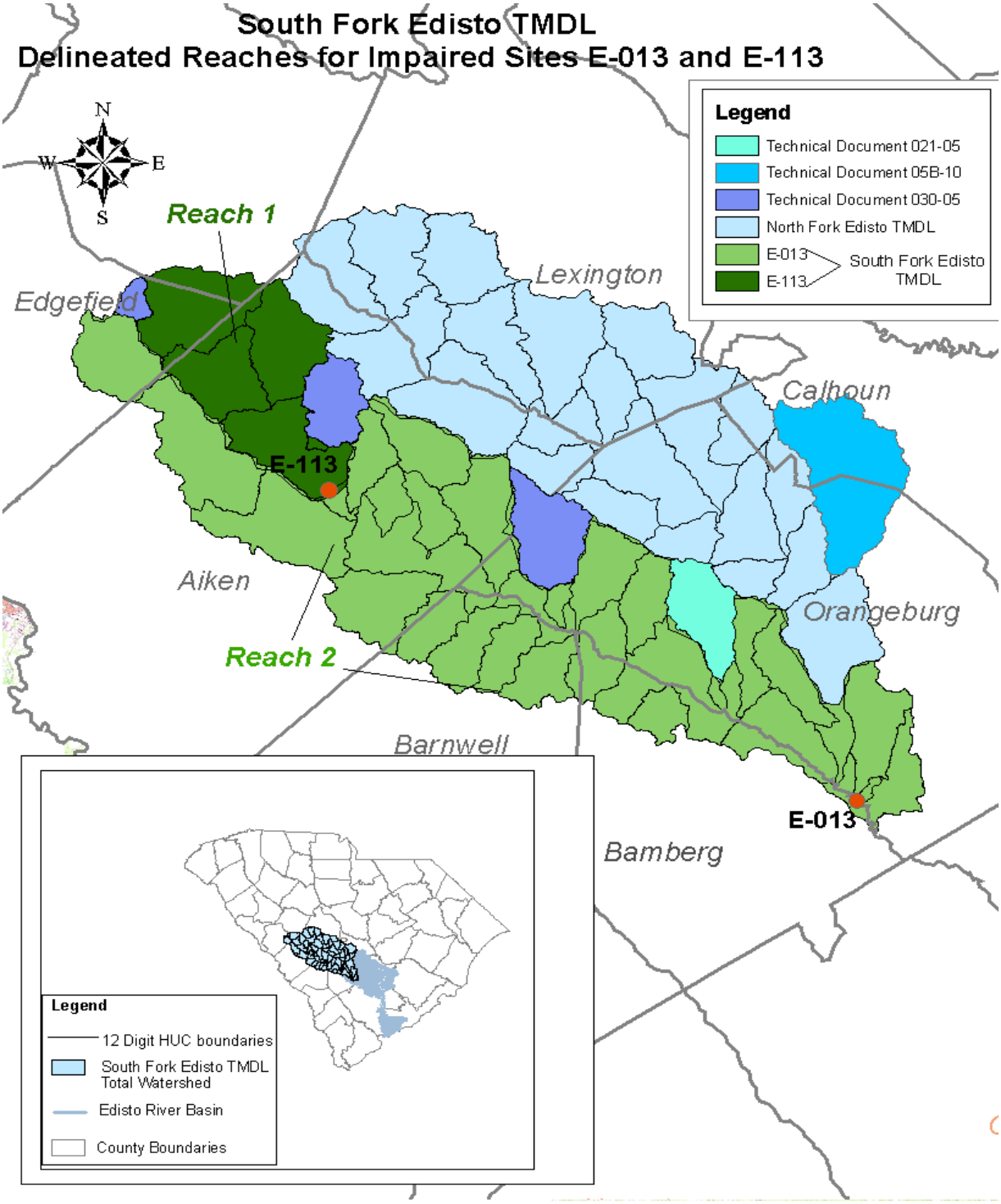


Figure1b. Location of Station Reaches (Reach 1 and Reach 2 Comprise the South Fork Edisto TMDL



Land use within the watershed is predominately forest (36.8%) and agricultural lands (23.5%) (NLCD 2001). Developed lands (residential, commercial, industrial or open urban space) comprise approximately 5.6% of the watershed (Table 2a; Figure 2a).

Table 2a. South Fork Edisto Watershed Land Use (derived from NLCD 2001).

Land Use (NLCD 2001)	**Area (mi^2)**	**Percent**
Woody Wetlands	175.4	16.1%
Open Water	5.5	0.6%
Emergent Herbaceous Wetlands	2.1	0.2%
Total Wetlands/Open Water	***183.0***	***16.9%***
Evergreen Forest	248.3	23.6%
Deciduous Forest	102.3	10.5%
Mixed Forest	25.9	2.7%
Total Forested	***376.5***	***36.8%***
Cultivated Crops	159.4	14.3%
Pasture/Hay	88.9	9.2%
Total Agricultural	***248.3***	***23.5%***
Developed, Open Space	38.2	3.9%
Developed, Low Intensity	12.8	1.3%
Developed, Medium Intensity	3.1	0.3%
Developed, High Intensity	0.98	0.1%
Total Developed	***55.08***	***5.6%***
Scrub/Shrub	7.32	0.7%
Grassland/Herbaceous	157.03	16.1%
Total Other	***164.35***	***16.8%***
Total Area	**1027.23**	**100%**

Figure 2a. Land Use Within the South Fork Edisto TMDL
Total Delineated Watershed Drainage Area

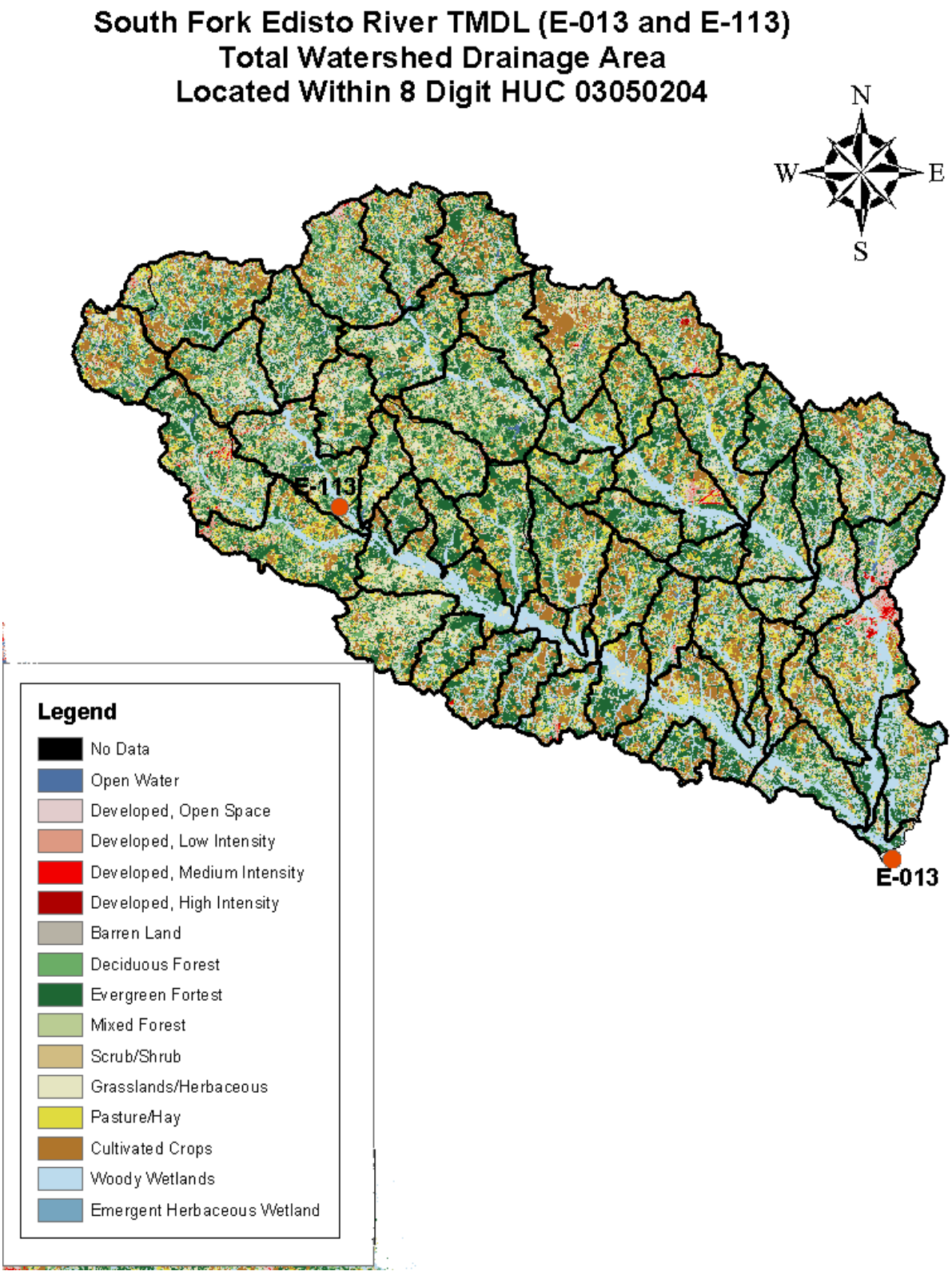


Table 2b. Developed Area From Reach to Reach

Station Reach	*Total Drainage Area of Station Reach (sq. miles)*	*Total Developed Area (sq. miles)*	*Percent Developed Area (%)*
1.From Top of Watershed to E-113	161.14	8.53	5.3
2. Drainage to E-013	676.50	33.57	4.97
Total	837.64	42.1	5.03

Figure 2b. Land Use for Reach 1

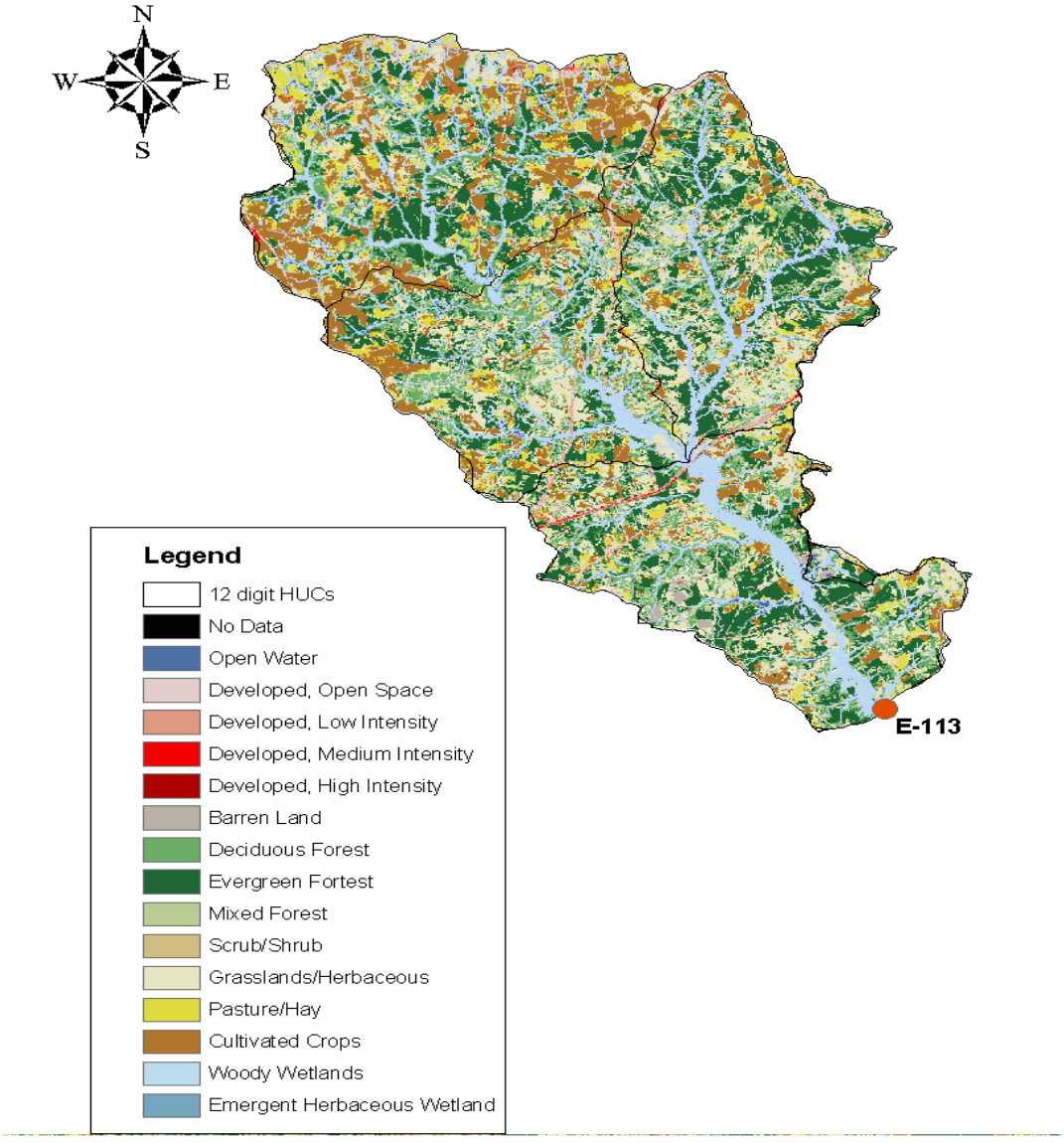
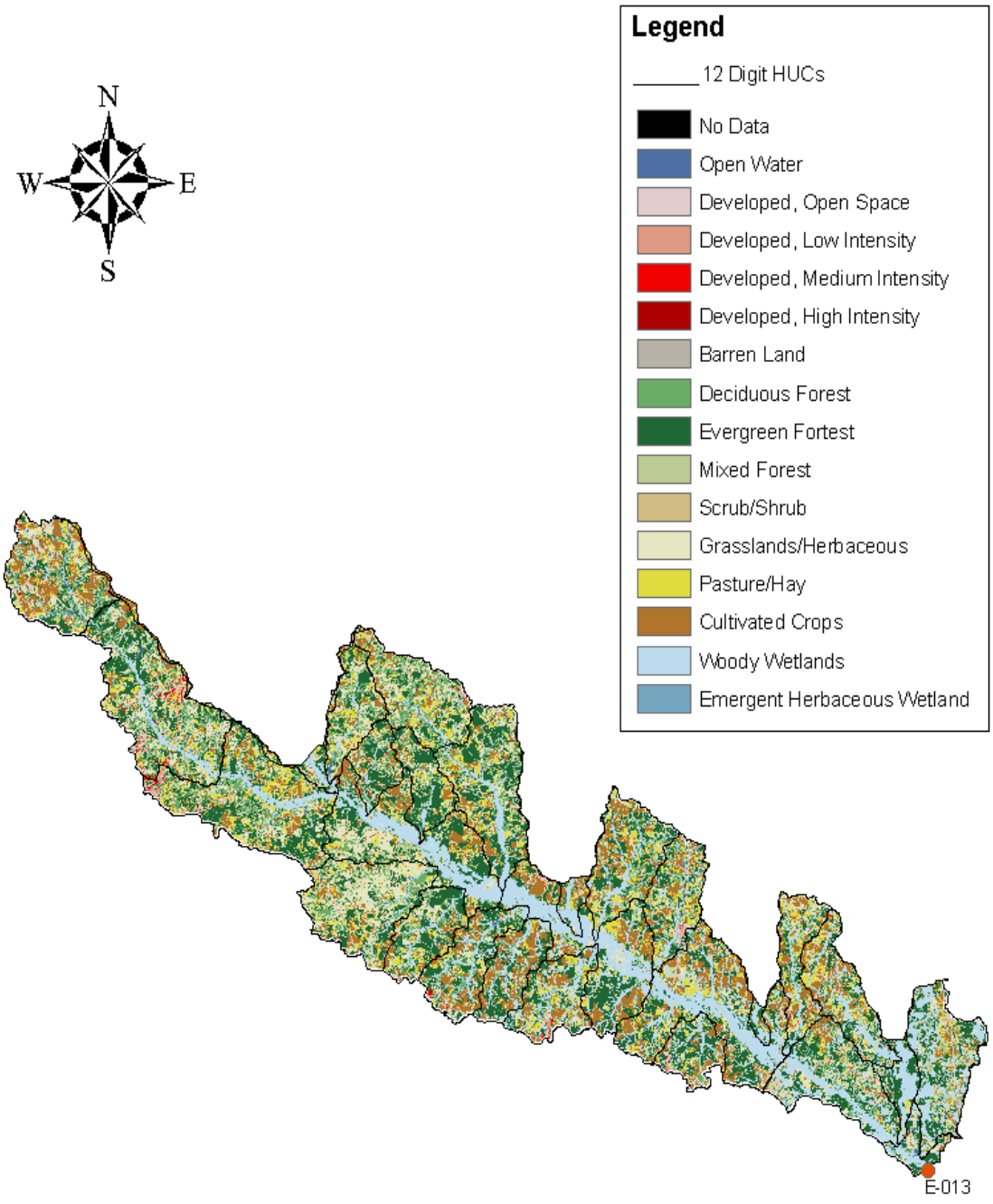


Figure 2c. Land Use for Reach 2



1.3 Water Quality Standard

The impaired stream segment of the South Fork Edisto River basin is designated as Class Freshwater. Waters of this class are described as:

> "Freshwaters (FW) are freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses." (R.61-68)

South Carolina's Water Quality Standard (WQS) for fecal coliform in freshwater is:

> "Not to exceed a geometric mean of 200/100 mL, based on five consecutive samples during any 30 day period; nor shall more than 10% of the total samples during any 30 day period exceed 400/100 mL." (R.61-68).

Primary contact recreation is not limited to large streams and lakes. Even streams that are too small to swim in will allow small children the opportunity to play and immerse their hands and faces. The current water quality standard protects all surface water for primary use recreation.

2.0 WATER QUALITY ASSESSMENT

The South Carolina Department of Health and Environmental Control (SCDHEC) conducts monitoring at two locations within the South Fork Edisto watershed (SCDHEC 2004). Monitoring is conducted at stations E-013 and E-113.

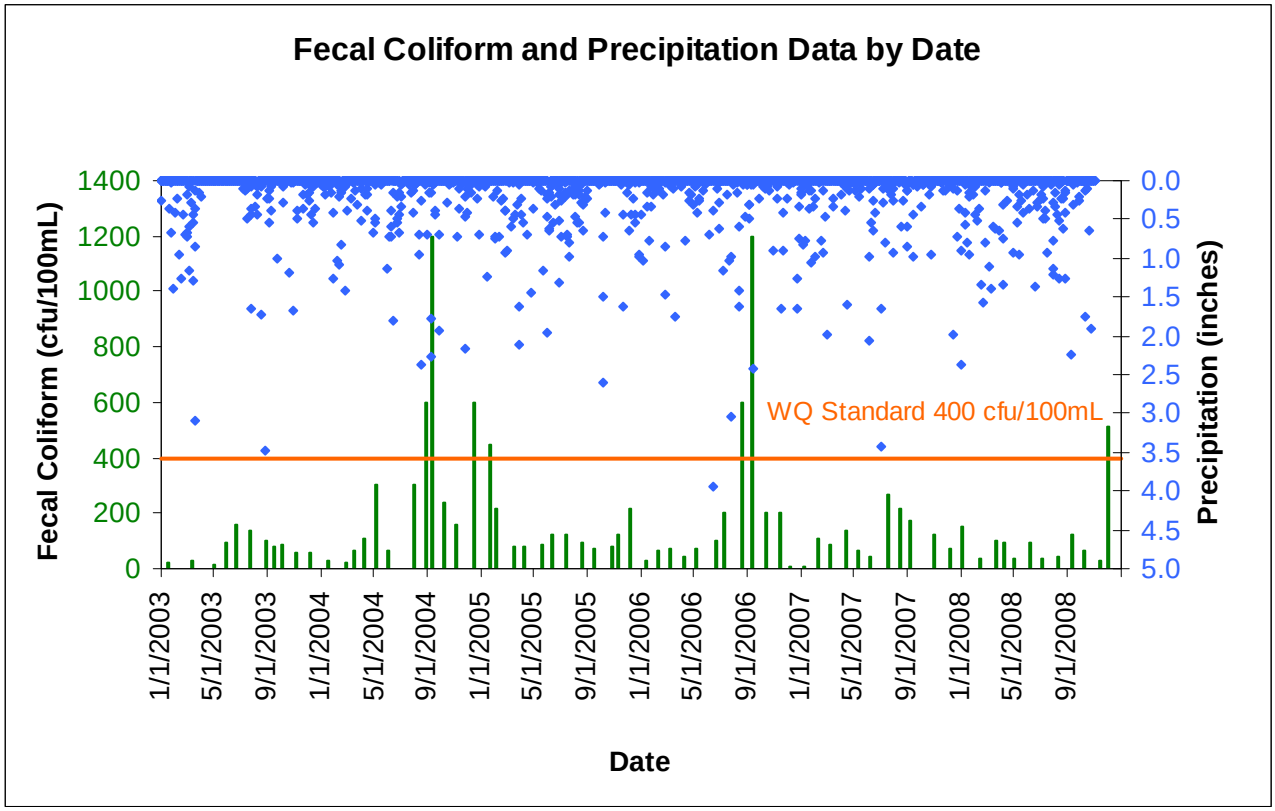
Waters in which no more than 10% of the samples collected over a five year period are greater than 400 fecal coliform counts or cfu/100 ml are considered to comply with the South Carolina WQS for fecal coliform bacteria. Waters with more than 10% of samples greater than 400 cfu/100 ml are considered impaired for fecal coliform bacteria and placed on South Carolina's §303(d) list[1]. The South Fork Edisto (E-013 and E-113) is considered impaired due to fecal coliform WQS exceedences. Table 3 provides a summary of number of samples collected, number of exceedences and exceedence percentage. A detailed list of all samples by date with their respective water quality data is presented in Appendix C at the end of this document. Figure 3 illustrates precipitation and fecal coliform by date for E-113. Additional rain charts by station are presented in Appendix A. For E-013 a weak negative correlation was observed between FC and rain ($r = -0.03$) and also between FC and flow ($r = -0.05$). E-113 has a negative correlation between FC and flow ($r = -0.06$) and a weak positive correlation between FC and rain ($r = 0.03$).

[1] The frequency of sampling was fewer than five samples within a 30 day period, therefore the water quality assessment was based on the 10% standard (400/100 mL).

Table 3. Fecal Coliform WQS Exceedence Summary for Impaired Stations E-013, E-113 (1999-2006; time-frame not consistent with that of 2010 303(d) listing cycle).

Station	Waterbody	Number of Samples	Number Samples >400/100mL	% Samples Exceed WQS
E-013	Edisto River	46	6	13 %
E-113	South Fork Edisto River	70	7	10 %

Figure 3. Precipitation and Fecal Coliform Data by Date for E-113



3.0 SOURCE ASSESSMENT AND LOAD ALLOCATION

Fecal coliform 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 fecal coliform 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 continuous point sources are required by the CWA to obtain a NPDES permit to discharge treated process or sanitary effluent. 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 fecal coliform bacteria pollution. However, if these facilities are discharging wastewater that meets their permit limits, they are not causing impairment. If any of these facilities is not meeting its permit limits, enforcement actions/mechanisms are required.

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 construction or industrial sites. The operator of an MS4 will require an NPDES permit for storm water discharges from industrial and construction activities under the NPDES Stormwater regulations if that operator engages in industrial and construction activities under the regulations. These sources are also required to comply with 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.

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

Currently there are twenty-one NPDES dischargers within the South Fork Edisto watershed (impaired stations E-013 and E-113), however only the domestic sanitary dischargers are permitted to discharge fecal coliform. There is one domestic sanitary waste discharger in the North Fork Edisto area of this watershed, however this should be meeting standard per the North Fork Edisto TMDL that already exists (Table 4). Future NPDES discharges in the referenced watershed are required to implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

Table 4. NPDES Treated Sanitary Waste Dischargers.

Impaired Station	Facility Name	Permit #	Type
E-008	Edisto High School	SC0040185	Minor domestic

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 South Carolina 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 possess taxing or has enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits.

Current developed land use for the South Fork Edisto Watershed is 5.6 %. Based on current Geographic Information System (GIS) information (available at time of TMDL development) there are currently 4 SCDOT owned buildings located in the referenced watershed area.

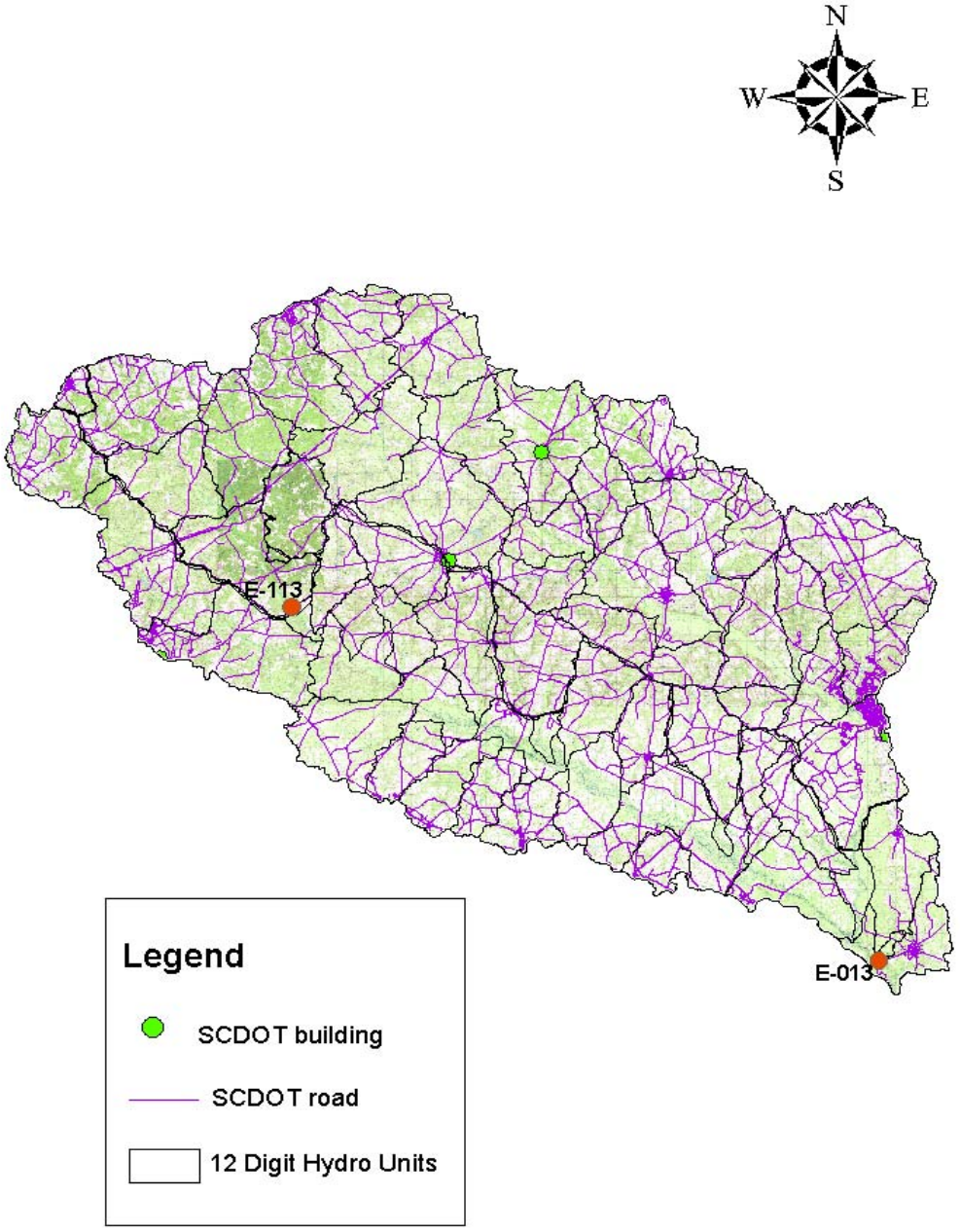
The City of Orangeburg is currently a potentially designated Municipal Separate Storm Sewer Systems (MS4) community under NPDES Phase II Stormwater rules. The city of Aiken and Aiken County are small MS4s. Similar to regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, P. 688837) or other unregulated MS4 communities located in the South Fork Edisto watershed may have the potential to contribute FC bacteria in stormwater runoff. If future MS4 permits are applicable to this watershed, then those discharges will be subject to the assumptions and requirements of the If future MS4 permits are applicable to this watershed, then those discharges will also become 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 are usually covered by the NPDES Storm Water Construction General Permit from DHEC (SCR100000). Where 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 wasteload allocations 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.

Sanitary sewer overflows (SSOs) to surface waters have the potential to severely impact water quality. These untreated sanitary discharges result in violations of the WQS. It is the responsibility of the NPDES wastewater discharger, or collection system operator for non-permitted ‘collection only’ systems, to ensure that releases do not occur. Unfortunately releases to surface waters from SSOs are not always preventable or reported. There were 11 reported releases in Aiken County, 9 reported releases in Lexington County and 7 reported releases in Orangeburg County between 1998 and 2008. It is not known what percentage of these releases occurred specifically in the South Fork Edisto watershed.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iteration. Progress towards 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.

Figure 4. SCDOT Owned and Maintained Roads and Buildings



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 this watershed. The Department recognizes that there may be wildlife, agricultural activities, grazing animals, septic tanks and/or other nonpoint source contributors located within unregulated areas (outside the permitted area) of the South Fork Edisto watershed. Nonpoint sources located in unregulated areas are subject to the LA and not the WLA component of the TMDL.

3.2.1 Wildlife

Wildlife (mammals and birds) can be a significant contributor of fecal coliform bacteria. Wildlife in this area typically includes deer, squirrels, raccoons, and other mammals as well as a variety of birds. A windshield survey demonstrated that there are several different kinds of wildlife in the South Fork Edisto River. According to a study conducted by SCDNR in 2008, there are an estimated 30-45 deer per square mile within Orangeburg County and Calhoun County and less than 15 deer per square mile in Aiken County and Lexington County (SCDNR 2008). Wildlife wastes are carried into nearby streams by runoff following rainfall or deposited directly in streams.

3.2.2 Agricultural Activities

Agricultural activities that involve livestock or animal wastes are potential sources of fecal coliform contamination of surface waters. Fecal matter can enter the waterway via runoff from the land or by direct deposition into the stream. Agricultural activities may represent a significant source in the South Fork Edisto watershed.

3.2.2.1 Agricultural Animal Facilities

Owners/operators of most commercial animal growing operations are required by South Carolina Regulation 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 (SCDHEC 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. South Carolina currently does not have any confined animal feeding operations (CAFOs) under NPDES coverage; however, the State does have permitted animal feeding operations (AFOs) covered under R. 61-43. These permitted operations are not allowed to discharge to the South Fork Edisto and its tributaries and are covered under ‘no discharge’ (ND) permits. Discharges from these operations to the South Fork Edisto watershed are illegal and are subject to enforcement actions by SCDHEC.

There are currently 254 permitted active animal feeding operations (AFOs) in the South Fork Edisto watershed (Table 5) along with 119 associated spray fields. These facilities are routinely inspected for compliance. Permitted agricultural facilities that operate in compliance with their permit are not considered to be sources of impairment. Along with the AFOs there are numerous spray fields,

however during site visits it was observed that these are not directly contributing to the fecal coliform load of the watershed.

Table 5. Permitted Active Animal Feeding Operations within the South Fork Edisto Watershed

NPDES	FACILITY	OPERATION	# ANIMALS
ND0005126	A&A FARMS	POULTRY (BROILERS)	112000
ND0083062	ADKINSON POULTRY FARM	POULTRY (BROILERS)	114679
ND0082198	BACKMAN LAND APPLICATION	LAND APPLIER	NO ANIMALS
ND0069779	BARR WAYNE/BROILER FACILITY	POULTRY (BROILERS)	40000
ND0072648	BARTL POULTRY	POULTRY (BROILERS)	23000
ND0066311	BERRY SWINE FACILITY	SWINE	450
ND0069841	BOATWRIGHT BROILER FARM	POULTRY (BROILERS)	100000
ND0062944	BOATWRIGHT JONES/BROILER FACILITY	POULTRY (BROILERS)	44000
ND0086631	BOLEN POULTRY FARM	POULTRY (BREEDERS)	75000
ND0082724	BREAST & THIGHS LLC	POULTRY (BROILERS)	90000
ND0073610	BRICKLE POULTRY	POULTRY (BROILERS)	45000
ND0077046	BROWN POULTRY	POULTRY (BROILERS)	84000
ND0063606	BROWN POULTRY FARM	POULTRY (BROILERS)	120000
ND0078697	BRYANT MALCOLM/BROILER FACILITY	POULTRY (BROILERS)	28000
ND0083402	BUFFALO CREEK BROILER FARM	POULTRY (BROILERS)	88400
ND0081736	C&A BROILER FARMS	POULTRY (BROILERS)	47000
ND0078760	C&C POULTRY FARM	POULTRY (BROILERS)	140000
ND0082198	C.W. Backman	LAND APPLIER	NO ANIMALS
ND0082953	CAREY BROILER FARM	POULTRY (BROILERS)	54000
ND0083445	CAROL CLAMP POULTRY FARM #2	POULTRY (BROILERS)	55555
ND0079863	CASSIDY BROILER FACILITY	POULTRY (BROILERS)	108000
ND0073440	CHARLES ANDERSON POULTRY	POULTRY (BROILERS)	36000
ND0080560	CHILDERS BROTHERS BREEDER FARM	POULTRY (BROILERS)	36669
ND0084247	CHRISTOPHER CRISP BROILERS	POULTRY (BROILERS)	109600
ND0064912	CLAMP BROILER FACILITY	POULTRY (BROILERS)	78000
ND0063274	CLAMP BROILER FACILITY	POULTRY (BROILERS)	333000
ND0060631	CLAMP POULTRY FARM	POULTRY (BROILERS)	44000
ND0060798	CLAMP POULTRY FARM	POULTRY (BROILERS)	54000
ND0071536	CLEARVIEW FARMS	POULTRY (BROILERS)	30000
ND0076155	COKER BRANCH FARM	POULTRY (BROILERS)	114400
ND0077054	COLLUM POULTRY FACILITY	POULTRY (BROILERS)	100000
ND0082643	COLLUM POULTRY FACILITY	POULTRY (BROILERS)	98000
ND0060895	COLUMBIA FARMS LEESVILLE	POULTRY (BROILERS)	87000
ND0060895	COLUMBIA FARMS LEESVILLE	POULTRY (BROILERS)	87000
ND0072508	COOK POULTRY FARM	POULTRY (BROILERS)	40000
ND0070661	CORDER BROILER FACILITY	POULTRY (BROILERS)	72000
ND0083755	CORN HOUSE FARM	POULTRY (BREEDERS)	31000
ND0083755	CORN HOUSE FARM	POULTRY (BREEDERS)	31000
ND0084735	CRAIG POULTRY FARM	POULTRY (BROILERS)	224000
ND0071609	CREEKSIDE FARM	POULTRY (BREEDERS)	30000

ND0081710	CUMBEE BROILER FARMS	POULTRY (BROILERS)	102000
ND0074039	D & J POULTRY FARM	POULTRY (BROILERS)	159000
ND0082287	DANNELLY POULTRY FARMS LLC	POULTRY (BROILERS)	180000
ND0076180	DAVIS BROILER FACILITY	POULTRY (BROILERS)	165000
ND0073059	DAY'S POULTRY	POULTRY (BROILERS)	20000
ND0086134	DELANO KNEECE & SON, INC.	LAND APPLIER	NO ANIMALS
ND0086177	DERRICK FARMS	POULTRY (BROILERS)	119600
ND0066192	DIEM DAIRY	DAIRY	250
ND0086789	DONALD ARENDER BROILER FARM	POULTRY (BROILERS)	59200
ND0085774	DONALD R. KYZER	LAND APPLIER	NO ANIMALS
ND0005819	DONAVIC BROILER FACILITY	POULTRY (BROILERS)	48000
ND0065757	DOUGLAS POULTRY FARM	POULTRY (BROILERS)	150000
ND0070840	DRAFTS BROILER FACILITY	POULTRY (BROILERS)	135000
ND0068543	EARGLE FARMS	POULTRY (BROILERS)	461000
ND0076317	EARGLE POULTRY	POULTRY (BROILERS)	30000
ND0072940	EARGLE POULTRY	POULTRY (BROILERS)	150000
ND0082686	EARLY MICHAEL & E BROILER	POULTRY (BROILERS)	216000
ND0085138	ED WATSON FARM, LLC	POULTRY (BROILERS)	112000
ND0084379	FARVIEW POULTRY FARM	POULTRY (BROILERS)	110000
ND0086681	FIELDS POULTRY FARMS	POULTRY (BROILERS)	272000
ND0063649	FINK POULTRY FARM	POULTRY (BROILERS)	92000
ND0074292	FLYING H FARM INC	POULTRY (BROILERS)	166000
ND0077372	FOUNTAIN POULTRY FACILITY	POULTRY (BROILERS)	143000
ND0076988	FOX POULTRY	POULTRY (BROILERS)	144000
ND0085120	FRICK (CAREY) BREEDER FARM	POULTRY (BREEDERS)	72000
ND0070131	FRICK DARRELL BROILER FACILITY	POULTRY (BROILERS)	88000
ND0069116	FRICK RICKY BROILER FACILITY	POULTRY (BROILERS)	112000
ND0076384	FULMER POULTRY	POULTRY (BROILERS)	73000
ND0011941	FUNCHESS SWINE FACILITY	SWINE	2303
ND0082457	FURTICK BROILER FACILITY	POULTRY (BROILERS)	135000
ND0082368	FURTICK BROILER FACILITY	POULTRY (BROILERS)	245000
ND0082457	FURTICK BROILER FACILITY	POULTRY (BROILERS)	135000
ND0085197	FURTICK POULTRY FARM	POULTRY (BROILERS)	192000
ND0082082	GARRICK DAN BROILER FACILITY	POULTRY (BROILERS)	139500
ND0083577	GOLDEN POULTRY FARMS	POULTRY (BROILERS)	125000
ND0087246	GOODING FARM	POULTRY (PULLETTS)	50000
ND0068845	GRAY POULTRY	POULTRY (BROILERS)	100500
ND0086347	GREGG COVINGTON FARMS PARTNERSHIP	LAND APPLIER	NO ANIMALS
ND0068012	GUNTER JODY BROILER FACILITY	POULTRY (BROILERS)	160000
ND0066419	GUNTER ROY BROILER FACILITY	POULTRY (BROILERS)	104000
ND0005321	GUNTER SWINE	SWINE	580
ND0010049	HAIR SWINE	SWINE	100
ND0074691	HALL BROILER FACILITY - MURIEL	POULTRY (BROILERS)	48000
ND0073946	HALL BROILER FACILITY - STARRETT JR	POULTRY (BROILERS)	100000
ND0075639	HALL POULTRY FACILITY	POULTRY (BROILERS)	80000
ND0073172	HALL POULTRY FARM #5	POULTRY (BROILERS)	11500
ND0065072	HALL RALPH BROILER FACILITY	POULTRY (BROILERS)	44000

ND0073822	HALL STARRETT BROILER FACILITY	POULTRY (BROILERS)	100000
ND0074454	HALLMAN BROILER FACILITY - MICHAEL	POULTRY (BROILERS)	53000
ND0076171	HALLMAN BROILER FACILITY - TRACY	POULTRY (BROILERS)	92000
ND0068926	HALLMAN POULTRY FACILITY - ROD	POULTRY (BROILERS)	46500
ND0080420	HALLMAN POULTRY FACILITY - ROD	POULTRY (BROILERS)	94000
ND0068926	HALLMAN POULTRY FACILITY - ROD	POULTRY (BROILERS)	46500
ND0079723	HAMMETT FARMS	POULTRY (BROILERS)	97000
ND0073989	HARTLEY POULTRY	POULTRY (BROILERS)	98000
ND0080641	HARTLEY POULTRY FARM	POULTRY (BROILERS)	60400
ND0069485	HARTLEY POULTRY FARM	POULTRY (BROILERS)	120000
ND0072541	HARTLEY POULTRY FARMS	POULTRY (BROILERS)	55000
ND0082295	HENRY HEN HOUSE	POULTRY (BROILERS)	90000
ND0087564	HIBERNIA BREEDER FARM	POULTRY (BREEDERS)	73800
ND0082376	HICKORY RIDGE FARM	POULTRY (PULLETS)	54000
ND0009369	HICKORY RIDGE FARM	SWINE	3264
ND0070238	HIGHPOINT FARMS	POULTRY (BROILERS)	310000
ND0071501	HOFFMAN BROILER FACILITY - MICHAEL	POULTRY (BROILERS)	57000
ND0078212	HOLLOW CREEK FARM	POULTRY (BROILERS)	48000
ND0072931	HOLLOW CREEK FARM	POULTRY (BROILERS)	92000
ND0078212	HOLLOW CREEK FARM	POULTRY (BROILERS)	48000
ND0060810	HOLMES & SONS PEACH FACILITY	PEACHES	NO ANIMALS
ND0073083	HOWARD POULTRY	POULTRY (BROILERS)	104800
ND0086100	HUTTO POULTRY FARM	POULTRY (BROILERS)	70000
ND0080624	HYDRICK POULTRY FARM	POULTRY (BROILERS)	118000
ND0071102	J & A Poultry-formerly KEISLER POULTRY (LEASED) - SOX	POULTRY (BREEDERS)	36300
ND0069671	J&B POULTRY FARM	POULTRY (BROILERS)	88000
ND0081302	J&J FARMS	POULTRY (BROILERS)	114400
ND0014664	J&M ENTERPRISES	POULTRY (LAYERS)	24800
ND0086894	Jackson Brothers Farm	LAND APPLIER	NO ANIMALS
ND0072354	JACKSON POULTRY	POULTRY (BROILERS)	85000
ND0069205	JAMESON POULTRY FACILITY	POULTRY (BROILERS)	250500
ND0084417	JEFFREY & TAMMY SWARTZ POULTRY FARM	POULTRY (BREEDERS)	20200
ND0080110	JIMMIE SMITH FARM	POULTRY (BROILERS)	53600
ND0084778	JODEE COLLUM POULTRY	POULTRY (BROILERS)	150000
ND0071803	JOHNSON BROILER FACILITY - TIMOTHY	POULTRY (BROILERS)	64500
ND0078883	JOHNSON BROILER FARMS	POULTRY (BROILERS)	102000
ND0068900	JONES POULTRY FACILITY	POULTRY (BROILERS)	23000
ND0070441	JRM POULTRY FARM	POULTRY (BROILERS)	20000
ND0075167	JUDY'S POULTRY INC #1 & #2	POULTRY (BROILERS)	110000
ND0068365	JUDY'S POULTRY INC #3 & #4	POULTRY (BROILERS)	91000
ND0071170	JULIAN BAIR FARM	POULTRY (BROILERS)	159000
ND0082350	K & K FARMS	POULTRY (BROILERS)	90000
ND0081906	KAMINER BROILER FACILITY	POULTRY (BROILERS)	60000
ND0082996	KC BROILER FARMS	POULTRY (BROILERS)	111200
ND0014401	KEISLER POULTRY FACILITY	POULTRY (BROILERS)	18500
ND0087262	KELLY FARMS	POULTRY (PULLETTS)	328000

ND0070751	KIRKLAND POULTRY FACILITY	POULTRY (BROILERS)	136000
ND0084166	KNEECE FARM	POULTRY (BROILERS)	83500
ND0084212	KNIGHT BREEDER FARM	POULTRY (BREEDERS)	20200
ND0069256	KYZER JIMMY/POULTRY FACILITY	POULTRY (BROILERS)	62000
ND0083593	LAIRD POULTRY FARM	POULTRY (BROILERS)	108000
ND0070688	LARRY D MCCARTHA FARMS	POULTRY (BROILERS)	130000
ND0066931	LEAPHART EDDIE/BROILER FACILI	POULTRY (BROILERS)	128000
ND0086606	LINN JENNINGS LAND APPLIER	LAND APPLIER	NO ANIMALS
ND0085243	LISA SHUMPERT FARMS	POULTRY (BROILERS)	117600
ND0085243	LISA SHUMPERT FARMS	POULTRY (BROILERS)	117600
ND0087106	LITTLE CREEK FARMS, LLC	POULTRY (BROILERS)	120000
ND0085057	LUCAS POULTRY FARM	POULTRY (BROILERS)	120000
ND0085804	Luther E. Kneece Farm	LAND APPLIER	NO ANIMALS
ND0078000	M&M POULTRY	POULTRY (BROILERS)	204000
ND0070084	MARVIN GANTT POULTRY	POULTRY (BROILERS)	82000
ND0085693	MAYDO FARMS	POULTRY (BROILERS)	120000
ND0069302	MCALISTER POULTRY FARM	POULTRY (BROILERS)	108000
ND0085553	MCCARSON FARMS	POULTRY (BROILERS)	124000
ND0072346	MCCARTHA H POULTRY FACILITY	POULTRY (BROILERS)	82500
ND0072591	MCCARTHA POULTRY	POULTRY (BROILERS)	108000
ND0073024	MCPHERSON BREEDER FACILITY	POULTRY (LAYERS)	15000
ND0002828	MILLWOOD FARMS	PIGEONS	22500
ND0085111	Millwood Farms, Inc.	LAND APPLIER	NO ANIMALS
ND0081809	MSW WILES FARMS INC	POULTRY (BREEDERS)	26000
ND0087157	NEW LIFE TURF	COMPOSTER	NO ANIMALS
ND0082899	NORRIS FARMS (BREEDERS)	POULTRY (BREEDERS)	114500
ND0068641	NORRIS POULTRY FARM	POULTRY (BROILERS)	67500
ND0084671	NORTHCUTT FARMS	POULTRY (BROILERS)	120000
ND0085901	O'CAIN POULTRY FARM	POULTRY (BROILERS)	124000
ND0078531	OLIVER WEST POULTRY FARMS	POULTRY (BROILERS)	143000
ND0060496	OSWALD FARM	POULTRY (BROILERS)	242000
ND0069884	OSWALT WM & P/BROILER FACILIT	POULTRY (BROILERS)	127500
ND0080021	PADGETT #2 BROILER FACILITY	POULTRY (BROILERS)	53000
ND0082929	PADGETT FARMS	POULTRY (BROILERS)	55800
ND0067741	PADGETT POULTRY FARM	POULTRY (BROILERS)	172000
ND0063878	PADGETT POULTRY FARM	POULTRY (BREEDERS & PULLETS)	68900
ND0066427	PADGETT RANDY/POULTRY	POULTRY (BROILERS)	132000
ND0083411	PAGE FARMS POULTRY	POULTRY (BROILERS)	180000
ND0064041	PARADICE POULTRY FARM	POULTRY (BROILERS)	165000
ND0063207	PARADICE POULTRY FARM	POULTRY (BROILERS)	117500
ND0067911	PARKER POULTRY FARM	POULTRY (BROILERS)	100000
ND0082325	PEBBLE CREEK ENTERPRISES	POULTRY (BROILERS)	90000
ND0082791	PINEY RIDGE FARM	POULTRY (BROILERS)	92000
ND0084999	PLATO KNEECE	POULTRY (BROILERS)	33700
ND0076163	POOLE POULTRY	POULTRY (BROILERS)	110000
ND0068667	POOLE POULTRY	POULTRY (BROILERS)	110000
ND0076163	POOLE POULTRY	POULTRY (BROILERS)	110000

ND0072290	POPLAR BRANCH FARMS	POULTRY (BROILERS)	102000
ND0063509	POPLAR SPRINGS POULTRY FARM	POULTRY (BROILERS)	60000
ND0084581	PRICKETT POULTRY FARM	POULTRY (BREEDERS)	75000
ND0079359	PROVEAUX POULTRY FARM	POULTRY (BROILERS)	141000
ND0068691	RICARD POULTRY FARM	POULTRY (BROILERS)	91000
ND0016977	RIDDLE DAIRY FARM	DAIRY	600
ND0006271	RIKARD POULTRY FARM	POULTRY (BROILERS)	87500
ND0084743	RISH FARMS	POULTRY (BROILERS)	120000
ND0063185	ROBINSON (DAVID) HOG FARM	SWINE	1260
ND0083542	ROCKY GROVE BROILER FARM	POULTRY (BROILERS)	90000
ND0070921	ROLLIN MEADOWS FARM	POULTRY (LAYERS)	140000
ND0004766	ROY J FRICK & SONS INC	POULTRY (BROILERS)	400000
ND0081779	RUCKER POULTRY FARM	POULTRY (BROILERS)	199000
ND0085456	RUSHTON POULTRY FARM	POULTRY (BROILERS)	248000
ND0084751	RUTLAND FARMS, LLC	POULTRY (BROILERS)	240000
ND0069876	S.L. SMITH BREEDER FARM	POULTRY (BREEDERS)	10000
ND0085405	SAMPLES POULTRY FARM	POULTRY (BROILERS)	248000
ND0083704	SAND HILL FARMS	POULTRY (BROILERS)	83500
ND0085448	SAND RIDGE FARMS, LLC	POULTRY (BROILERS)	116000
ND0081264	SANDERS BREEDER FARM	POULTRY (BREEDERS)	40600
ND0081566	SANDLAND FARM BROILER HOUSES	POULTRY (BROILERS)	141600
ND0073911	SCHUMPERT POULTRY	POULTRY (BROILERS)	41600
ND0083186	SCOTT CUMBEE BROILER FARMS	POULTRY (BROILERS)	102000
ND0068985	SENN POULTRY FACILITY	POULTRY (BROILERS)	40000
ND0082627	SEVEN OAKS FARM NO 1	POULTRY (BROILERS)	96300
ND0069299	SHADY OAK FARM	POULTRY (BROILERS)	66000
ND0082571	SHARPE FARMS INC	POULTRY (BROILERS)	204000
ND0002852	SHEALY POULTRY FARM	POULTRY (BROILERS)	69900
ND0068063	SHULL POULTRY FARM	POULTRY (BROILERS)	52000
ND0083534	SHUMPERT (DERWIN) POULTRY FARM	POULTRY (BROILERS)	114500
ND0080764	SHUMPERT DAIRY	DAIRY	160
ND0082511	SHUMPERT POULTRY INC	POULTRY (BROILERS)	114500
ND0079022	SMITH POULTRY	POULTRY (BROILERS)	52000
ND0069876	SMITHS POULTRY FARM	POULTRY (BROILERS)	10000
ND0084875	SMOAK POULTRY FARM	POULTRY (BREEDERS)	48000
ND0086991	SOUTH EDISTO POULTRY FARM	POULTRY (BROILERS)	192000
ND0083500	SOUTH FORK BREEDER FARM	POULTRY (BREEDERS)	31000
ND0084255	SPURS & FEATHERS POULTRY	POULTRY (BROILERS)	109600
ND0077941	STARNES BREEDER FARM	POULTRY (BROILERS)	46100
ND0082538	STARNES POULTRY FARM	POULTRY (BROILERS)	92000
ND0072231	STEVEN RAUCH POULTRY FARM	POULTRY (BROILERS)	127500
ND0084239	STILLINGER POULTRY	POULTRY (BROILERS)	164400
ND0084603	SUGAR HILL FARM	POULTRY (BROILERS)	240000
ND0010057	SUNNYVIEW FARM	POULTRY (BROILERS)	104000
ND0082279	SWARTZ BREEDER FACILITY	POULTRY (BREEDERS)	20500
ND0073881	SWARTZ POULTRY FACILITY	POULTRY (BROILERS)	20000
ND0074250	SWARTZ POULTRY FACILITY	POULTRY (BROILERS)	40000
ND0083453	TAILFEATHERS FARM LLC	POULTRY (BROILERS)	176800

ND0082554	TAMPA CREEK FARMS	POULTRY (BROILERS)	143200
ND0061204	TITAN PEACH PACKING SHED	PEACHES	NO ANIMALS
ND0084590	TRACY HALLMAN POULTRY FACILITY #2	POULTRY (BROILERS)	52500
ND0083569	TRINITY POULTRY FARM	POULTRY (BROILERS)	109600
ND0085171	TRIPLE P FARMS	POULTRY (BROILERS)	112000
ND0067768	TROTTER'S FARM	POULTRY (BROILERS)	34500
ND0068683	TROY & ALLYSON SHELDON POULTRY FARM	POULTRY (PULLETS)	56000
ND0078727	TURNER BROILER FACILITY	POULTRY (BROILERS)	64000
ND0078701	ULMER POULTRY FARM (CHRIS)	POULTRY (BROILERS)	150000
ND0086509	VAQSSER POULTRY FARM	POULTRY (BREEDERS)	48000
ND0077925	VERNON WILLIAMS FARMS	POULTRY (BROILERS)	56000
ND0082121	WALKER NIX CHICKENFARM	POULTRY (BREEDERS)	26000
ND0080501	WALL MARK POULTRY FARM	POULTRY (BROILERS)	106000
ND0085006	WALLING POULTRY FARM	POULTRY (BROILERS)	120000
ND0066249	WALLY GANTT POULTRY	POULTRY (BROILERS)	14222
ND0017523	WALLY GANTT POULTRY	POULTRY (BROILERS)	45250
ND0084760	WANG POULTRY	POULTRY (BROILERS)	180000
ND0072907	WATKINS JUDY/BROILER FACILITY	POULTRY (BROILERS)	43000
ND0007340	WHISENHUNT & SONS INC NO 2	SWINE	3290
ND0082104	WHISENHUNT J W & SONS INC	POULTRY (BROILERS)	200000
ND0069124	WHITTLE POULTRY FACILITY	POULTRY (LAYERS)	23000
ND0086754	WILLIAMSON POULTRY FARM	POULTRY (BROILERS)	132000
ND0081299	WINDY HILL CREEK FARM	POULTRY (BREEDERS)	52000
ND0002062	WOOD BRUCE BROILER FACILITY	POULTRY (BROILERS)	129000
ND0071773	WOODS POULTRY FARM	POULTRY (BROILERS)	124500
ND0062880	YONCE & SONS PEACH FARM	PEACHES	NO ANIMALS

3.2.2.2 Grazing Animals

Livestock, especially cattle, are frequently major contributors of fecal coliform bacteria to streams. Cattle on average produce some 1 E+11 cfu/day per animal of fecal coliform bacteria (ASAE 1998). Grazing cattle and other livestock may contaminate streams with fecal coliform bacteria indirectly by runoff from pastures or directly by defecating into streams and ponds. The grazing of unconfined livestock (in pastures) is not regulated by SC DHEC. The United States Department of Agriculture's National Agricultural Statistics Service reported 12,737 cattle in Aiken County, 2,442 cattle in Calhoun County, 9,356 cattle in Lexington County, 7,486 cattle in Bamberg County, 4,587 cattle in Barnwell County, 8,501 cattle in Edgefield County and 16,735 cattle in Orangeburg County in 2007 (USDA 2009). Direct loading by cattle or other livestock to surface waters within the watershed is likely to be a significant source of fecal coliform. Pasture and crop land use within the South Fork Edisto total watershed is estimated to be 248.3 square miles (158,911 acres), which was derived from NLCD 2001. Pasture and crop land use within Aiken, Calhoun, Edgefield, Lexington, Bamberg, Barnwell and Orangeburg Counties is estimated to be 298,247 acres, or 466.0 square miles. By taking the ratio of the above land use, the South Fork Edisto watershed is proportional to 53.3 % of Aiken, Calhoun, Edgefield, Lexington, Bamberg, Barnwell and Orangeburg Counties' pasture/crop land use, assuming an even distribution across the counties.

3.2.3 Leaking Sanitary Sewers and Illicit Discharges

Leaking sewer pipes and illicit sewer connections represent a direct threat to public health since they result in discharge of partially treated or untreated human wastes to the surrounding environment. Quantifying these sources is extremely speculative without direct monitoring of the source because the magnitude is directly proportional to the volume and its proximity to the surface water. Typical values of fecal coliform in untreated domestic wastewater range from 10^4 to 10^6 MPN/100mL (Metcalf and Eddy 1991).

Illicit sewer connections into storm drains result in direct discharges of sewage via the storm drainage system outfalls. Monitoring of storm drain outfalls during dry weather is needed to document the presence or absence of sewage in the drainage systems. Besides SCDOT there are currently no entities subject to any NPDES MS4 permit in the watershed.

3.2.4 Failing Septic Systems

Studies demonstrate that wastewater located four feet below properly functioning septic systems contain on average less than one fecal coliform bacteria organism per 100 mL (Ayres Associates 1993). Failed or non-conforming septic systems, however, can be a major contributor of fecal coliform to the South Fork Edisto and tributaries. Wastes from failing septic systems enter surface waters either as direct overland flow or via groundwater. Although loading to streams from failing septic systems is likely to be a continual source, wet weather events can increase the rate of transport of pollutants from failing septic systems because of the wash-off effect from runoff and the increased rate of groundwater recharge.

Within the South Fork Edisto watershed it is estimated that there are 97,124 people living in 42,099 households (16,121 people living in 6,915 households in the Aiken County portion of the watershed, 29,031 people living in 11,887 households in the Lexington County portion of the watershed, 47,376 people living in 20,077 households in the Orangeburg County portion of the watershed, 20 people living in 11 households in the Edgefield portion of the watershed, 3,201 people living in 1,388 houses in the Barnwell County portion, 1,085 people living in 446 households in the Bamberg County portion and 290 people living in 1,375 households in the Calhoun County portion of the watershed). This is based off of the 2000 U.S. Census. Of these a small part of the watershed near the cities of Leesville and Swansea in Lexington County, city of Aiken in Aiken County, and the city of Orangeburg in Orangeburg County is serviced by a community sewer system. This is comprised of 2,248 people living in 993 households (298 people in 144 households near Aiken, 4,262 people in 1907 households near Leesville and Swansea, and 12,188 people in 5,591 households near Orangeburg). Given that information and assuming one septic tank per household, it is estimated that there are 22,838 septic tanks within the entire South Fork Edisto watershed.

3.2.5 Urban Runoff

The City of Orangeburg is currently a potentially designated MS4 located in this watershed. The city of Aiken and Aiken County are small MS4s in the watershed. Similar to regulated MS4s, potentially designated MS4 entities (as listed in FR 64, 235, P. 688837) or other unregulated MS4 communities located in the South Fork Edisto Watershed may have the potential to contribute fecal coliform bacteria in 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, squirrels, raccoons, pigeons, and other birds, all of which contribute to the fecal coliform load. A

windshield survey demonstrated that many households have dogs and/or cats, many of which are free roaming.

Roads, facilities and/or properties owned and/or operated by the South Carolina Department of Transportation (SCDOT) is/are currently covered under NPDES MS4 SCS040001, hence covered under the WLA (waste load allocation) portion of this TMDL. There may be other non-regulated roads (county roads) within the watershed that could contribute to FC loading within the South Fork Edisto watershed. Runoff from properties including but not limited to ditches, culverts and right of ways may have the potential to contribute or convey fecal coliform loading.

4.0 LOAD-DURATION CURVE METHOD

The load-duration curve method was developed as a means of incorporating natural variability, uncertainty, and risk assessment into TMDL development (Bonta and Cleland 2003). The analysis is based on the range of hydrologic conditions for which there are appropriate water quality data. The load-duration curve method uses the cumulative frequency distribution of stream flow and pollutant concentration data to estimate existing and TMDL loads for a water body. Development of the load-duration curve is described in this chapter.

The load-duration curve method depends on an adequate period of record for flow data. Gauge 02173501, South Fork Edisto River near Bamberg, was used. This gauge began recording daily flows in 1970 and provides the flow data required to establish flow duration curves at each of the impaired stations.

Flow data for a ten-year period (1996-2006) were used to establish flow duration curves. The records for this period were complete (i.e., no missing dates) for the South Fork Edisto River gauge. The flow records were used to estimate flow at the impaired monitoring stations.

Drainage areas of each sampling station were delineated using USGS topographic maps and ArcMap software. The cumulative area drained was calculated and used to estimate flow based on the ratio of the monitoring station drainage area to the downstream USGS gauge. For example, the USGS South Fork Edisto gauge records flow from 683 square miles (sq mi). The cumulative drainage area at monitoring stations E-013 and E-113 is approximately 837 square miles, or 123% of the area drained at the South Fork Edisto River gauge. Mean daily flow for the monitoring locations was assumed to be 123 % of the daily flow at the South Fork Edisto gauge.

Flow duration curves were developed by ranking flows from highest to lowest and calculating the probability of occurrence (presented as a percentage or duration interval), where zero corresponds to the highest flow. The duration interval can be used to determine the percentage of time a given flow is achieved or exceeded, based on the period of record. Flow duration curves were divided into five hydrologic condition categories (High Flows, Moist Conditions, Mid-Range, Dry Conditions and Low Flows). Categorizing flow conditions can assist in determining which hydrologic conditions result in the greatest number of exceedences. A high number of exceedences under dry conditions might indicate a point source or illicit connection issue, whereas moist conditions may indicate nonpoint sources. Data within the High Flow and Low Flow categories are generally not used in the development of a TMDL due to their infrequency.

A target load-duration curve was created by calculating the allowable load using daily flow, the fecal coliform WQS concentration and a unit conversion factor. The water quality target was set at 380 cfu/100ml for the instantaneous criterion, which is five percent lower than the water quality criteria of 400 cfu/100ml. A five percent explicit Margin of Safety (MOS) was reserved from the water quality criteria in developing target load-duration curves. The load-duration curve for station E-113 is presented in Figure 5.

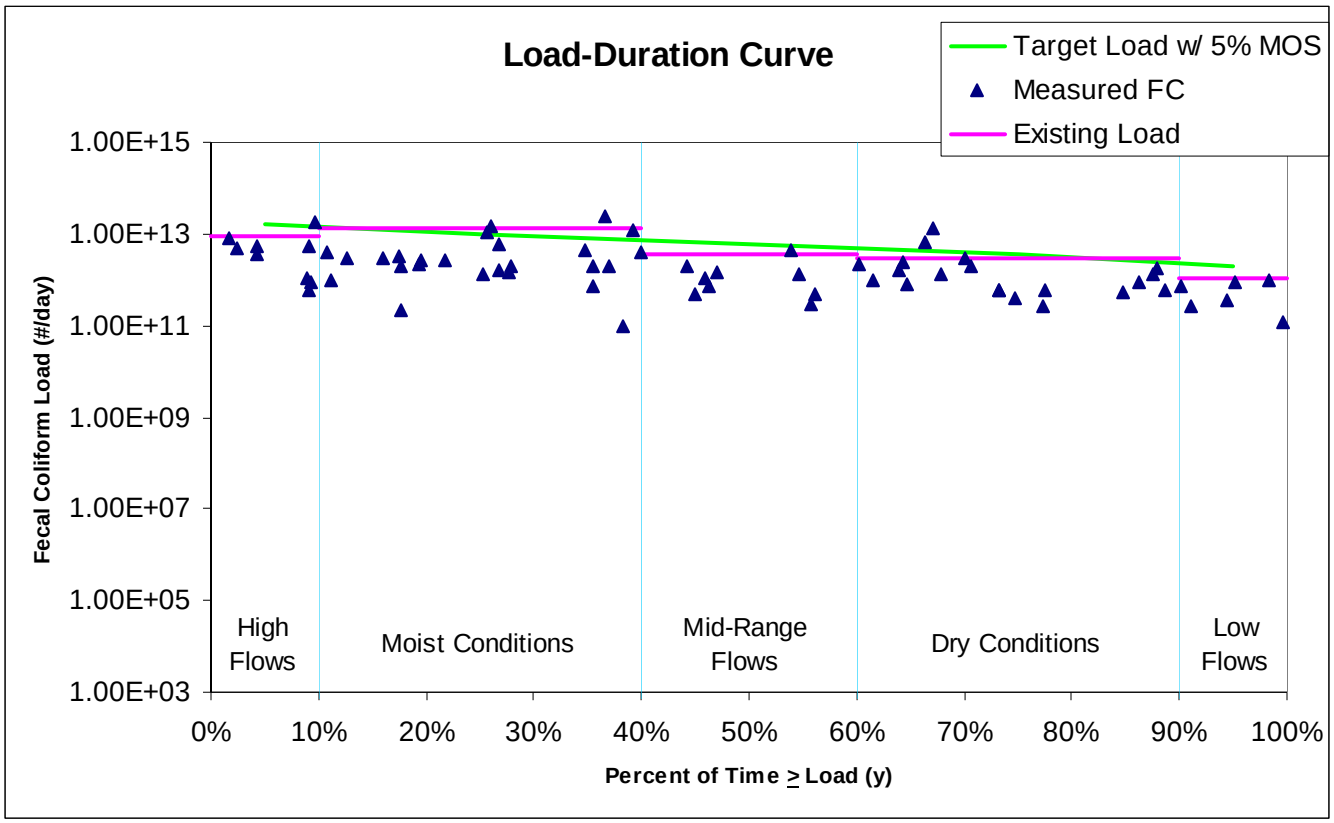
For the load duration curve, the independent variable (X-Axis) represents the percentage of estimated flows greater than value x. The dependent variable (Y-Axis) represent the fecal coliform loading at each estimated flow expressed in terms of colony forming units per day (cfu/day). In each defined flow interval, existing and target loadings were calculated by the following equations:

Existing Load = Mid-Point Flow in Each Hydrologic Category *x* 90th Percentile Fecal Coliform Concentration *x* 10000

Target Load = Mid-Point Flow in Each Hydrologic Category *x* 380 (WQ criterion minus a 5% MOS) x 10000

Percent Reduction = (Existing Load - Target Load) / Existing Load

Figure 5. Load Duration Curve for South Fork Edisto Station E-113



Instantaneous loads for each of the impaired stations were calculated. Measured fecal coliform concentrations from 2001- 2008 were multiplied by measured (or estimated flow based on drainage area) flow on the day of sampling and a unit conversion factor. These data were plotted on the load-duration graph based on the flow duration interval for the day of sampling. Samples above the target line are violations of the WQS while samples below the line are in compliance (Figure 5). Only the instantaneous water quality criterion was targeted because there is insufficient data to evaluate against the 30-day geometric mean.

An existing load was determined for each hydrologic category for the TMDL calculations. The 90th percentile of measured fecal coliform concentration within each hydrologic category was multiplied by the flow at each category midpoint (i.e., flow at the 25% duration interval for the Moist Conditions, 50% interval for Mid-Range, and 75% for Dry Condition). Existing loads are plotted on the load-duration curves presented in Figure 4. These values were compared to the target load (which includes an explicit 5% MOS) at each hydrologic category midpoint to determine the percent load reduction necessary to achieve compliance with the WQS. This TMDL assumes that if the highest percent reduction is achieved than the WQS will be attained under all flow conditions.

5.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

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

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

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

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

5.1 Critical Conditions

This TMDL is based on the flow recurrence interval between 10% and 90% and excludes extreme high and low flow conditions; flows that are characterized as ‘Low’ or ‘High’ were not included in the analysis. The critical condition for each monitoring station is identified as the flow condition requiring the largest percent reduction, within the 10-90% duration intervals. Critical conditions for the South Fork Edisto watershed pathogen impaired segments are listed in Table 6. These data indicate that for stations E-113 and E-013 moist weather conditions results in larger bacteria loads and is therefore the critical condition.

5.2 Existing Load

An existing load was determined for each hydrologic category for the TMDL calculations as described in Section 4.0 of this TMDL. The existing load under the critical condition, described in Section 5.1 above was used in the TMDL calculations. Loadings from all sources are included in this value: wildlife, cattle-in-streams, urban run-off as well as failing septic systems. The existing load for stations E-013 and E-113 in the South Fork Edisto River watershed is provided in Appendix C.

Table 6. Percent Reduction Necessary to Achieve Target Load by Hydrologic Category.

Station	Waterbody	Moist Conditions	Mid-Range Flow	Dry Conditions
E-013	Edisto River	2%	NRN	NRN
E-113	South Fork Edisto	32%	NRN	NRN

Highlighted cells indicate critical condition.
NRN = no reduction needed. Existing load below target load.

5.3 Wasteload Allocation

The wasteload allocation (WLA) is the portion of the TMDL allocated to NPDES-permitted point sources (USEPA 1991). Note that all illicit dischargers, including SSOs, are illegal and not covered under the WLA of this TMDL.

5.3.1 Continuous Point Source

There is currently one active NPDES-permitted domestic discharger of FC bacteria in the South Fork Edisto watershed, however it should be meeting standard per the North Fork Edisto TMDL. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern based on permitted flow and an allowable permitted maximum concentration of 400cfu/100mL. To determine the waste load allocation (WLA) for a permitted sanitary discharger, the average monthly permitted flow for the facility is multiplied by the instantaneous WQS (400 cfu/100 mL) and a unit conversion factor.

5.3.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial stormwater discharges covered under permits numbered SCS & SCR and regulated under South Carolina Water Pollution Control Permits Regulation 122.26(b)(14) & 15 (SCDHEC 2003). 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.

Waste load allocations for stormwater discharges are expressed as a percentage reduction instead of a numeric loading 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 8 presents the reduction needed for the impaired segment. The reduction percentages in this TMDL also apply to the fecal coliform waste load attributable to those areas of the watershed which are covered or will be covered under NPDES MS4 permits. Compliance by an entity with responsibility for the MS4, with the terms of its individual MS4 permit may fulfill any obligations it has towards implementing this TMDL.

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.

Table 7. Percent Reduction Necessary to Achieve Target Load.

Station	Waterbody	% Reduction
E-013	Edisto River	2 %
E-113	South Fork Edisto	32 %

5.4 Load Allocation

The Load Allocation applies to the nonpoint sources of fecal coliform bacteria and is expressed both as a load and as a percent reduction. The load allocation is calculated as the difference between the target load under the critical condition and the point source WLA. The load allocation for each station is listed in Table Ab-1 and Table 9. The City of Orangeburg is a potentially designated MS4 and the City of Aiken and Aiken County are small MS4s located in this watershed. They are currently subject to the LA component of this TMDL. There may also be other unregulated MS4s located in the watershed that are subject to the LA component of this TMDL. At such time that the

referenced entities, or other future unregulated entities become regulated NPDES MS4 entities and subject to applicable provisions of SC Regulation 61-68 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) (SCDHEC 2003).

5.5 Seasonal Variability

Federal regulations require that TMDLs take into account the seasonal variability in watershed loading. The variability in this TMDL is accounted for by using a 10-year hydrological data set and 1-year water quality sampling data set, which includes data collected from all seasons.

5.6 Margin of Safety

The margin of safety (MOS) may be explicit and/or implicit. The explicit margin of safety is 5% of the TMDL or 20 counts/100mL of the instantaneous criterion of 400 cfu/100 mL (380 cfu/100mL). Target loads are therefore 95% of the assimilative capacity (TMDL) of the waterbody. The MOS is expressed as the value calculated from the critical condition defined in Section 5.1 and is the difference between the TMDL and the sum of the WLA and LA. The calculated values of the MOS for each station are given in Table 8.

5.7 TMDL

For most pollutants, TMDLs are expressed as a mass load (e.g., kilograms per day). For bacteria, however, TMDLs are expressed in terms of cfu or organism counts (or resulting concentration), in accordance with 40 CFR 130.2(l). Only the instantaneous water quality criterion was targeted because there is insufficient data to evaluate against the 30-day geometric mean. The target load is defined as the load (from point and nonpoint sources) minus the MOS that a stream segment can receive while meeting the WQS. The TMDL value is the median target load within the critical condition (i.e., the middle value within the hydrologic category that requires the greatest load reduction) plus WLA and MOS. Values for each component of the TMDL for the impaired segments of the South Fork Edisto watershed are provided in Table 8.

While TMDL development was primarily based on instantaneous water quality criterion, terms and conditions of NPDES permits for continuous discharges require facilities to demonstrate compliance with both geometric mean and instantaneous water quality criteria for fecal coliform bacteria in treated effluent. NPDES permits for continuous dischargers require data collection sufficient to monitor for compliance of both criteria at the point of outfall.

Table 8 indicates the percentage reduction or water quality standard for each impaired station of the South Fork Edisto TMDL. Note that all future NPDES-permitted stormwater discharges will also be required to meet the prescribed percentage reductions, or the water quality standard. It should be noted that in order to meet the WQS for FC bacteria, prescribed load reductions must be targeted from all sources, including NPDES permitted and nonpoint sources.

Based on the available information at this time, the portion of the watershed that drains directly to a regulated MS4 and that which drains through the unregulated MS4 has not been clearly defined within the MS4 jurisdictional area. Loading from both types of sources (regulated and unregulated) typically occurs in response to rainfall events, and discharge volumes as well as

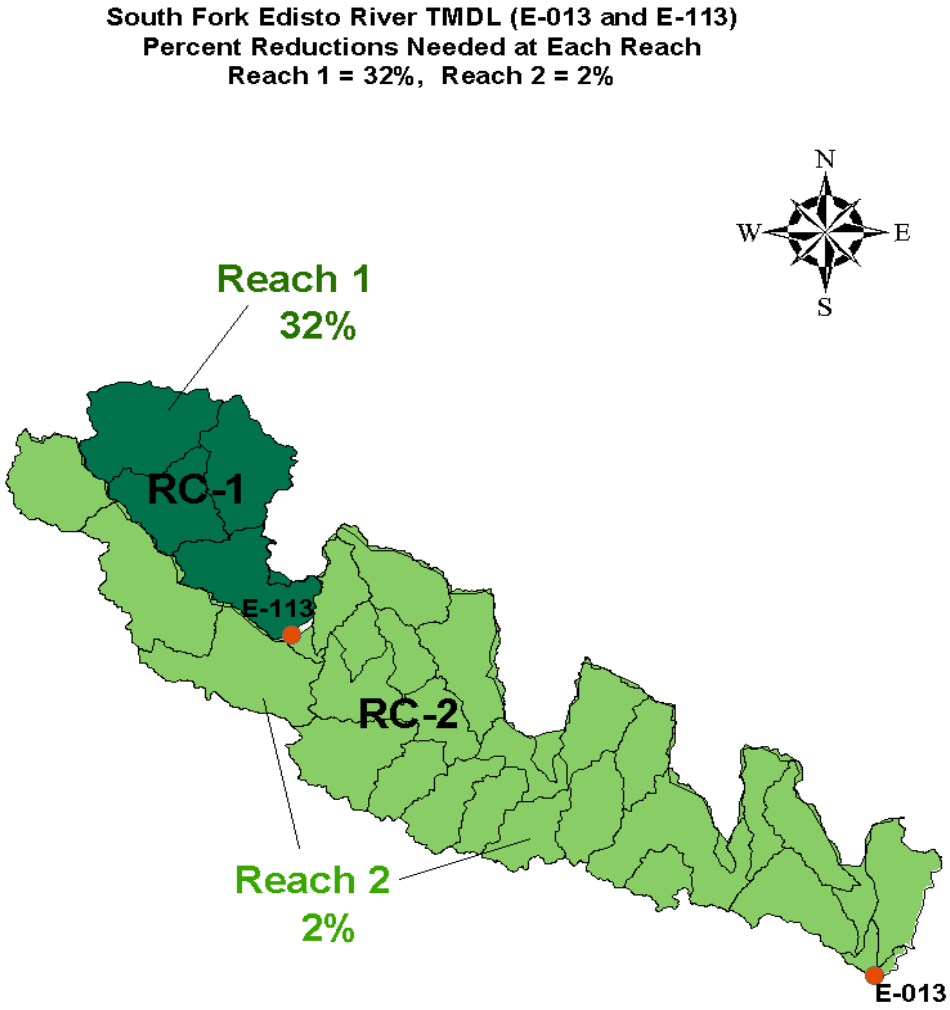
recurrence intervals are largely unknown. Therefore, the regulated MS4 is assigned the same percent reduction as the non-regulated sources in the watershed. Compliance with the MS4 permit in regards to this TMDL document is determined at the point of discharge to waters of the state. The regulated MS4 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 document.

Table 8. TMDL Components for the Fecal Coliform Impaired Segments in the South Fork Edisto Watershed. Loads are expressed as colony forming units (cfu) per day.

				Wasteload Allocation (WLA)		**Load Allocation (LA)**	
Station	**Existing Load (cfu/day)**	**TMDL (cfu/day)**	**MOS (cfu/day)**	**Continuous Sources[1] (cfu/day)**	**Non-continuous Sources[2,3,4] (% Reduction)**	**LA (cfu/day)**	**% Reduction to Meet LA[3]**
E-013	1.64E+13	1.69E+13	8.46E+11	NA	2%	1.61E+13	2%
E-113	1.38+13	9.94E+12	4.97E+11	NA	32%	9.44E+12	32%

1. WLAs are expressed as a daily maximum; NA = not applicable, no point sources. Continuous discharges are required to meet the prescribed loading or the existing instream standard for the pollutant of concern. Loadings were developed based upon permitted flow and an allowable permitted maximum concentration of 400cfu/100ml.
2. 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.
4. Percent reduction applies to existing instream load.
5. 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

Figure 6. Percent Reductions



6.0 Implementation

The implementation of both point (WLA) and non-point (LA) source components of the TMDL are necessary in order to meet water quality standard. Using existing authorities and mechanisms, an implementation strategy 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 will 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. A key component for interested parties to control pollution and prevent water quality degradation in the watershed would be the establishment and administration of a program of Best Management Practices (BMPs). Best management practices may be defined as a practice or a combination of practices that have been determined to be the most effective, practical means used in the prevention and/or reduction of pollution.

Interested parties (local stakeholder groups, universities, local governments, etc.) may be eligible to apply for CWA §319 grants to install BMPs that will implement the LA portion of this TMDL and reduce nonpoint source FC loading to the South Fork Edisto 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 the 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 South Fork Edisto 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 South Fork Edisto 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. 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 F which provides additional information as it relates to evaluating the effectiveness of an MS4 Permit as it related to compliance with approved TMDLs. Compliance with terms and conditions of existing and future NPDES sanitary and stormwater permits (including all construction, industrial and MS4) may effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. For SCDOT, compliance with terms and conditions of its NPDES MS4 permit is effective implementation of the WLA to the MEP.

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 noted that waterfowl were present. Deterrents could be used to keep waterfowl away from lawns in close proximity to surface waters. These include non-toxic sprays, decoys, kites, noisemakers, scarecrows, and plastic owls. 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

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.

There are currently 152 animal feeding operations (AFO) located in the South Fork Edisto watershed. The following are BMP suggestions for these farms.

Installing fencing along the streams within the watershed and providing an alternative water source where livestock are present would eliminate direct contact with the streams. If fencing is not feasible, 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

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 South Fork Edisto 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, and 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 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. Although the South Fork Edisto 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 RESOURCES FOR POLLUTION MANAGEMENT

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

7.1 General for Urban and Suburban Stormwater Mitigation

- National Management Measures to Control Nonpoint Source Pollution from Urban Areas – Draft. 2002. EPA842-B-02-003. Available at: http://www.epa.gov/owow/nps/urbanmm/index.html
- Stormwater Management Volume Two: Stormwater Technical Manual. Massachusetts Department of Environmental Management. 1997. Available at: http://www.mass.gov/dep/brp/stormwtr/stormpub.htm
- Fact Sheets for the six minimum control measures for storm sewers regulated under Phase I or Phase II. Available at: http://cfpub1.epa.gov/npdes/stormwater/swfinal.cfm?program_id=6
- A Current Assessment of Urban Best Management Practices. 1992. Metropolitan Washington Council of Governments. Washington, DC
- Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. 1987. Metropolitan Washington Council of Governments. Washington, DC
- 2004 Stormwater Quality Manual. Connecticut Department of Environmental Protection 2004. Available at: http://dep.state.ct.us/wtr/stormwater/strmwtrman.htm
- Stormwater Treatment BMP New Technology Report. California Department of Transportation. 2004. SW-04-069-.04.02 Available at: http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-04-069.pdf
- Moonlight Beach Urban Runoff Treatment facility: Using Ultraviolet Disinfection to Reduce Bacteria Counts. Rasmus, J. and K. Weldon. 2003. StormWater, May/June 2003. Available at http://www.forester.net/sw_0305_moonlight.html
- Operation, Maintenance, and Management of Stormwater Management Systems. Livingston, Shaver, Skupien, and Horner. August 1997. Watershed Management Institute. Call: (850) 926-5310.
- Model Ordinances to Protect Local Resources – Stormwater Control Operation and Maintenance. USEPA Webpage: http://www.epa.gov/owow/nps/ordinance/stormwater.htm
- Stormwater O & M Fact Sheet Preventive Maintenance. USEPA 1999. 832-F-99-004. Available at: http://www.epa.gov/owm/mtb/prevmain.pdf

- The MassHighway Stormwater Handbook. Massachusetts Highway Department. 2004. Available at: http://166.90.180.162/mhd/downloads/projDev/swbook.pdf
- University of New Hampshire Stormwater Center: Dedicated to the protection of water resources through effective stormwater management. Available at: http://www.unh.edu/erg/cstev/index.htm#
- EPA's Stormwater website: http://www.epa.gov/region1/topics/water/stormwater.html

7.2 Illicit Discharges

- Illicit Discharge Detection and Elimination Manual - A Handbook for Municipalities. 2003. New England Interstate Water Pollution Control Commission. Available at: http://www.neiwpcc.org/PDF_Docs/iddmanual.pdf
- Model Ordinances to Protect Local Resources – Illicit Discharges. USEPA webpage: http://www.epa.gov/owow/nps/ordinance/discharges.htm

7.3 Pet Waste

- National Management Measure to Control Non Point Source Pollution from Urban Areas – Draft. USEPA 2002. EPA 842-B-02-2003. Available from: http://www.epa.gov/owow/nps/urbanmm/index.html
- Septic Systems for Dogs? Nonpoint Source News-Notes 63. Pet Waste: Dealing with a Real Problem in Suburbia. Kemper, J. 2000. New Jersey Department of Environmental Protection. Available from: http://www.state.nj.us/dep/watershedmgt/pet_waste_fredk.htm
- Stormwater Manager's Resource Center. Schueler, T., Center for Watershed Protection, Inc. http://www.stormwatercenter.net
- Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. U.S. EPA, Office of Water 1993. Washington, DC.
- National Menu of Best Management Practices for Stormwater Phase II. USEPA. 2002. Available at: http://www.epa.gov/npdes/menuofbmps/menu.htm
- Welcome to NVRC'S Four Mile Run Program. NVRC 2001. Available at: http://www.novaregion.org/fourmilerun.htm
- Boston's ordinance on dog waste. City of Boston Municipal Codes, Chapter XVI. 16-1.10A Dog Fouling. Available at: http://www.amlegal.com/boston_ma/
- Pet Waste and Water Quality. Hill, J.A., and D. Johnson. 1994. University of Wisconsin Extension Service. http://cecommerce.uwex.edu/pdfs/GWQ006.PDF
- Long Island Sound Study. Pet Waste Poster. EPA. Available at: http://www.longislandsoundstudy.net/pubs/misc/pet.html

- Source Water Protection Practices Bulletin: Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water. USEPA. 2001. EPA 916-F-01-027. Available at: http://www.epa.gov/safewater/protect/pdfs/petwaste.pdf

7.4 Wildlife

- An example of a bylaw prohibiting the feeding of wildlife: Prohibiting Feeding of Wildlife. Town of Bourne Bylaws Section 3.4.3. Available at: http://www.townofbourne.com/Town%20Offices/Bylaws/chapter__3.htm

- Integrated Management of Urban Canadian Geese. M Underhill. 1999. Conference Proceedings, Waterfowl Information Network.

- Urban Canadian Geese in Missouri. Missouri Conservationist Online. Available at: http://www.conservation.state.mo.us/conmag/2004/02/20.htm

7.5 Septic Systems

- National Management Measures to Control Nonpoint Source Pollution from Urban Areas – Draft. Chapter 6. New and Existing Onsite Wastewater Treatment Systems. USEPA 2002. EPA842-B-02-003. Available at: http://www.epa.gov/owow/nps/urbanmm/index.html

- Septic Systems. USEPA Webpage: http://cfpub.epa.gov/owm/septic/home.cfm

7.6 Field Application of Manure

- Conservation Standard Practice-Irrigation Water Management. Number 449. United States Department of Agriculture (USDA) Natural Resources Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

- Conservation Standard Practice-Filter Strip. Number 393. USDA Natural Resources Conservation Service (NRCS). 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

- Buffer Strips: Common Sense Conservation. USDA Natural Resource Conservations Service. No Date. Website. Available at: http://www.nrcs.usda.gov/feature/buffers/

- Conservation Standard Practice-Riparian Forest Buffer. Number 391. USDA Natural Resource Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

7.7 Grazing Management

- Conservation Standard Practice-Stream Crossing. Number 578. USDA Natural Resource Conservation Service. 2003. Available at: http://www.nrcs.usda.gov/technical/Standards/nhcp.html

Guidance Specifying Management Measures for Nonpoint Source Pollution in Coastal Waters. Chapter 2. Management Measures for Agricultural Sources. Grazing Management. USEPA. Available at: http://www.epa.gov/owow/nps/MMGI/Chapter2/ch2-2e.html

7.8 Animal Feeding Operations and Barnyards

- National Management Measures to Control Nonpoint Source Pollution from Agriculture. USEPA 2003. Report: EPA 841-B-03-004. Available at: http://www.epa.gov/owow/nps/agmm/index.html
- Livestock Manure Storage. Software designed to asses the threat to ground and surface water from manure storage facilities. USEPA. Available at: http://www.epa.gov/seahome/manure.html
- National Engineering Handbook Part 651. Agricultural Waste Management Field Handbook. NRCS. Available At: http://www.wcc.nrcs.usda.gov/awm/awmfh.html
- Animal Waste Management. NRCS website: http://www.wcc.nrcs.usda.gov/awm/
- Animal Waste Management Software. A tool for estimating waste production and storage requirements. Available at: http://www.wcc.nrcs.usda.gov/awm/awm.html
- Manure Management Planner. Software for creating manure management plans. Available at: http://www.agry.purdue.edu/mmp/
- Animal Feeding Operations Virtual Information Center. USEPA website: http://cfpub.epa.gov/npdes/afo/virtualcenter.cfm

7.9 Federal Agriculture Resources: Program Overviews, Technical Assistance, and Funding

- USDA-NRCS assists landowners with planning for the conservation of soil, water, and natural resources. Local, state, and federal agencies and policymakers also rely on NRCS expertise. Cost shares and financial incentives are available in some cases. Most work is done with local partners. The NRCS is the largest funding source for agricultural improvements. To find out about potential funding, see: http://www.ma.nrcs.usda.gov/programs/. To pursue obtaining funding, contact a local

NRCS coordinator. Contact information is available at::
http://www.ma.nrcs.usda.gov/contact/employee_directory.html

- NRCS provides a wealth of information and BMP fact sheets tailored to agricultural and conservation practices through the NRCS Electronic Field Office Technical Guide at: http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=SC

The 2002 USDA Farm Bill (http://www.nrcs.usda.gov/programs/farmbill/2002/) provides a variety of programs related to conservation. Information can be found at: http://www.nrcs.usda.gov/programs/farmbill/2002/products.html. The following programs can be linked to from the USDA Farm Bill website:

Conservation Security Program (CSP): http://www.nrcs.usda.gov/programs/csp/
Conservation Reserve Program (CRP): http://www.nrcs.usda.gov/programs/crp/
Wetlands Reserve Program (WRP): http://www.nrcs.usda.gov/programs/wrp/
Environmental Quality Incentives Program (EQIP):
http://www.nrcs.usda.gov/programs/eqip/
Grassland Reserve Program (GRP): http://www.nrcs.usda.gov/programs/GRP/
Conservation of Private Grazing Land Program (CPGL):
http://www.nrcs.usda.gov/programs/cpgl/
Wildlife Habitat Incentives Program (WHIP): http://www.nrcs.usda.gov/programs/whip/
Farm and Ranch Land Protection Program (FRPP):
http://www.nrcs.usda.gov/programs/frpp/
Resource Conservation and Development Program (RC&D):
http://www.nrcs.usda.gov/programs/rcd/

- CORE4 Conservation Practices. The common sense approach to natural resource conservation. USDA-NRCS (1999). This manual is intended to help USDA-NRCS personnel and other conservation and nonpoint source management professionals implement effective programs using four core conservation practices: conservation tillage, nutrient management, pest management, and conservation buffers, available at: http://www.nrcs.usda.gov/technical/ECS/agronomy/core4.pdf

- County soil survey maps are available from NRCS at: http://soils.usda.gov

- Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. U.S. EPA, Office of Water (1993). Developed for use by State Coastal Nonpoint Pollution Control Programs, Chapter 2 of this document covers erosion control, animal feeding operation management, grazing practices, and management of nutrients, pesticides, and irrigation water, available at::
http://www.epa.gov/owow/nps/MMGI/Chapter2/index.html.

- Farm-A-Syst is a partnership between government agencies and private business that enables landowners to prevent pollution on farms, ranches, and in homes using confidential environmental assessments, available at: http://www.uwex.edu/farmasyst/

- State Environmental Laws Affecting South Carolina Agriculture: A comprehensive assessment of regulatory issues related to South Carolina agriculture has been compiled by the National Association of State Departments, available at: http://www.nasda-hq.org/nasda/nasda/Foundation/state/states.htm
- Waterborne Pathogens in Agricultural Wastewater. Rosen, B.H., 2000. USDA, NRCS, Watershed Science Institute. Available at: ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/Pathogens_in_Agricultural_Watersheds.pdf
- Stormwater Program (Phase II); Municipal Sewer Systems and Construction Sites, 64 Federal Register 235 (8 December 1999), pp. 68837.
- Water Quality Planning and Management, Title 40 Code of Federal Regulations, Pt. 130.2(i). 2006 ed.

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http://www.nass.usda.gov/census/census02/volume1/sc/index2.htm

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United States Environmental Protection Agency (USEPA). 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. Office of Water, EPA 440/4-91-001.

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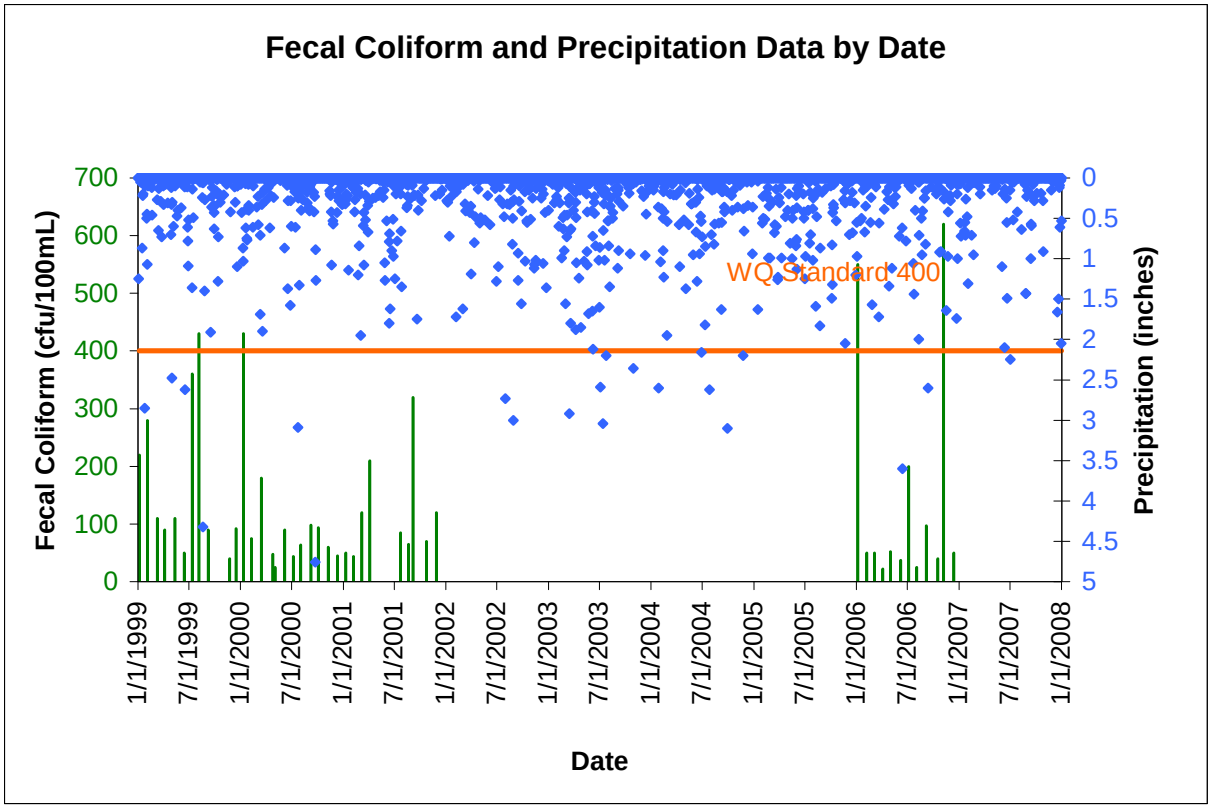
Appendix A

Additional Rain Charts By Station

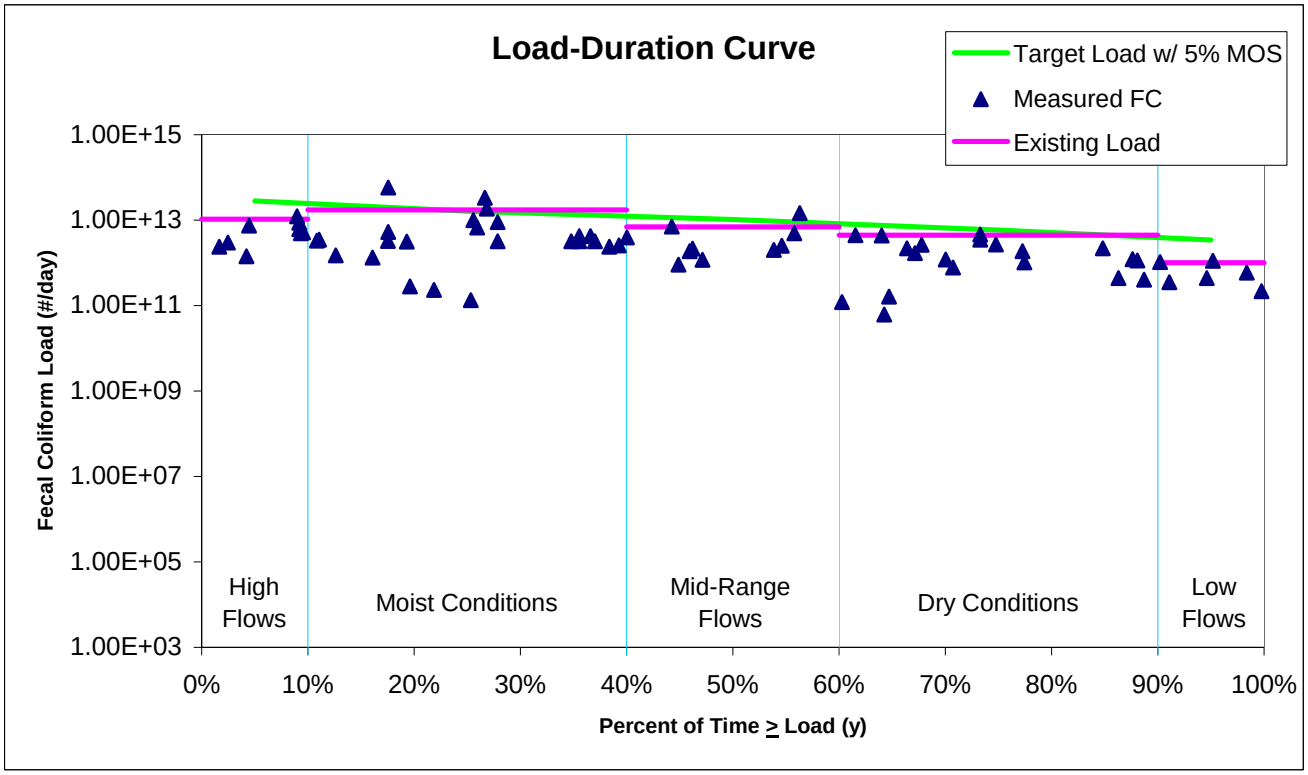
Precipitation and Fecal Coliform Data by Date- Impaired Site E-013



Appendix B

Additional Load Duration Curve Graphs by Station

Load Duration Curve for South Fork Edisto Station E-013



Appendix C- Data Tables

90th Percentile Fecal Coliform Concentrations (#/100 mL)

Hydro Categ Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
E-013	142	387	258	202	315	46

Mid Point Hydrologic Category Flow (cfs)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-013	3044.83	1728.88	1109.49	631.91	367.05

Existing Load (#/day)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-013	1.06E+13	1.64E+13	7.00E+12	3.12E+12	2.83E+12

Target Load (#/day)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-013	2.83E+13	1.61E+13	1.03E+13	5.87E+12	3.41E+12

Load Reduction Necessary (#/day)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-013	N/A	0.03yepE+13	N/A	N/A	N/A

% Load Reduction Necessary					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-013	N/A	2	N/A	N/A	N/A
90th Percentile Fecal Coliform Concentrations (#/100 mL)					

Hydro Categ Range	High Flow 0-10	Moist Cond. 10-40	Mid Range 40-60	Dry Flow 60-90	Low Flow 90-100	Samples
E-113	195	555	228	330	195	70

Mid Point Hydrologic Category Flow (cfs)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-113	1789.19	1015.92	651.95	371.32	215.68

Existing Load (#/day)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-113	8.54E+12	1.38E+13	3.64E+12	3.00E+12	1.03E+12

Target Load (#/day)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-113	1.66E+13	9.44E+12	6.06E+12	3.45E+12	2.01E+12

Load Reduction Necessary (#/day)					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-113	N/A	4.36E+12	N/A	N/A	N/A

% Load Reduction Necessary					
Hydro Categ (Mid-Point)	High Flow (5)	Moist Cond. (25)	Mid Range (50)	Dry (75)	Low Flow (95)
E-113	N/A	32	N/A	N/A	N/A

Appendix D

Fecal Coliform Water Quality Data Summary for Impaired Station E-113 By Date

Activity Start	Result
01/16/03	20
03/12/03	30
04/30/03	16
05/27/03	95
06/19/03	160
07/23/03	140
08/27/03	100
09/15/03	80
10/02/03	85
11/04/03	55
12/03/03	60
01/13/04	26
02/24/04	24
03/15/04	66
04/05/04	110
05/05/04	300
06/01/04	65
07/28/04	300
08/24/04	600
09/08/04	1200
10/04/04	240
11/02/04	160
12/13/04	600
01/19/05	450
02/01/05	220
03/15/05	80
04/06/05	80
05/16/05	90
06/09/05	120
07/11/05	120
08/17/05	93
09/14/05	70
10/24/05	77
11/08/05	120
12/06/05	220
01/10/06	30
02/08/06	62
03/07/06	73
04/05/06	40
05/03/06	70
06/19/06	100
07/05/06	200
08/17/06	600
09/07/06	1200

10/11/06	200
11/14/06	200
12/05/06	5
01/04/07	8
02/06/07	110
03/06/07	88
04/12/07	140
05/08/07	64
06/06/07	44
07/18/07	270
08/14/07	220
09/06/07	170
11/01/07	120
12/06/07	70
01/03/08	150
02/14/08	35
03/20/08	100
04/08/08	97
05/01/08	35
06/03/08	93
07/02/08	33
08/06/08	42
09/11/08	120
10/08/08	67
11/12/08	30
12/02/08	510

Fecal Coliform Water Quality Data Summary for Impaired Station E-013 By Date

Activity Start	Result
1/5/99	220
2/3/99	280
3/10/99	110
4/6/99	90
5/12/99	110
6/14/99	50
7/13/99	360
8/5/99	430
9/7/99	90
10/26/99	430
11/23/99	40
12/15/99	92
1/11/00	430
2/8/00	75
3/14/00	180
4/24/00	48
5/3/00	25

6/6/00	90
7/6/00	44
8/1/00	64
9/7/00	98
10/3/00	94
11/8/00	60
12/11/00	45
1/9/01	50
2/5/01	44
3/7/01	120
4/4/01	210
7/23/01	85
8/20/01	65
9/5/01	320
10/23/01	70
11/28/01	120
12/11/01	410
1/5/06	550
2/6/06	50
3/6/06	50
4/4/06	22
5/1/06	52
6/7/06	37
7/5/06	200
8/3/06	25
9/6/06	97
10/17/06	40
11/7/06	620
12/13/06	50

Appendix E

Watershed Photos

Cows and Goats Present Throughout the Watershed

Various Signs at Zig Zag Landing Boat Ramp

Cotton Fields

Chicken Houses

Zig Zag Landing Boat Ramp

Edisto River from Zig Zag Landing

Upper Watershed

Upper Watershed

Looking from Bridge over Impaired Site E-113

Looking from Other Side of Bridge- Impaired Site E-113

Appendix F. Evaluating the Progress of MS4 Programs:

Meeting the Goals of TMDLs and Attaining Water Quality Standards

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

   - EPARegion 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

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

Amendment Location 1:

Section 1.1 Background, page 7

Amendment:

"Acute gastrointestinal illnesses ***caused by pathogens*** affect millions of people in the United States and cause billions of dollars of costs each year (Gaffield et al. 2003)."

Amendment Location 2:

Section 1.1 Background, page 7

Amendment:

Clean Water Act was replaced with CWA-
"Section 303(d) of the ***CWA*** and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop TMDLs for water bodies that are not meeting designated uses under technology-based pollution controls."

Amendment Location 3:

Section 3.0 Source Assessment, page 16

Amendment:

These ***continuous*** point sources are required by the CWA to obtain a NPDES permit ***to discharge treated process or sanitary effluent***.

Amendment Location 4:

Section 3.0 Source Assessment, page 16

Amendment:

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 construction or industrial sites.

Amendment Location 5:

Section 3.0, page 16

Amendment:

The following statement was added: “The operator of an MS4 will require an NPDES permit for storm water discharges from industrial and construction activities under the NPDES Stormwater regulations if that operator engages in industrial and construction activities under the regulations.”

Amendment Location 6:

Section 3.2.3, page 26

Amendment:

Besides SCDOT there are currently no entities subject to any NPDES MS4 permit in the watershed.

Amendment Location 7:

Throughout document

Amendment:

SC was replaced with South Carolina