Total Maximum Daily Load Document for Shellfish Monitoring Station 17-16A in Habersham Creek Within HUC 030502080605 Fecal coliform Bacteria

Prepared for
SCDHEC Bureau of Water
Technical Document Number 009-2021

dhec

by
Banu Varlik
July 22, 2021

Abstract

§303(d) of the Clean Water Act and EPA's *Water Quality Planning and Management* Regulations (40 CFR Part 130 2006 ed.) requires states to develop total maximum daily loads (TMDLs) for water bodies that are included on the §303(d) list of impaired waters. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting water quality standards (WQS) for the pollutant of concern. All TMDLs include a waste load allocation (WLA) for any National Pollutant Discharge Elimination System (NPDES)-permitted dischargers, a load allocation (LA) for all nonpoint sources, and an explicit and/or implicit margin of safety (MOS). This technical report describes the development of fecal coliform TMDL for impaired shellfish monitoring station 17-16A in Habersham Creek watershed located in Beaufort County, South Carolina. Stations 17-16 and 17-16A have been included inthe EPA-approved final 2018 303(d) list for exceeding fecal coliform WQS for shellfish harvesting use and have been prioritized for restoration or protection. From headwaters and including station 17-16, this area is classified as "restricted" and closed for shellfish harvesting.

Currently, there are two NPDES permitted MS4 entities in this watershed: Beaufort County and the South Carolina Department of Transportation (SCDOT). Both of these MS4s have beenallocated a wasteload allocation (WLA).

For SCDOT, existing and future NPDES MS4 permittees, compliance with terms and conditions of their NPDES permit is an effective implementation of the WLA to the Maximum Extent Practicable (MEP) and demonstrates consistency with the assumptions and requirements of the TMDL. For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of their permit is an effective implementation of the WLA. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and are eligible for the *Clean Water Act* (CWA) §319 grants.

The South Carolina Department of Health and Environmental Control (SCDHEC) recognizes that adaptive management/implementation of these TMDLs might be needed to achieve the water quality standard and we are committed to targeting the load reductions to improve water quality in Habersham Creek. As additional data and/or information become available, it may become necessary to revise and/or modify these TMDL targets accordingly.

Table Ab1. TMDLs for Habersham Creek watershed. Loads are expressed as the most probable number (mpn) per 100 ml and allocations are expressed as % reductions.

Station	90th %tile of Existing Load (mpn/ 100ml)	TMDL [1, 2] (mpn/ 100ml)	WQ Target (mpn/ 100ml)	Margin of Safety (mpn/100ml)	WLA			LA
					Continuous Sources[3] (mpn/100ml)	Non-Continuous [4, 7] Sources (% Reduction)	Non-Continuous SCDOT [7] (% Reduction)	% Reduction to Meet LA [7]
17-16A	140.2	43	40.85	2.15	See Note Below	70.85	70.85[5]	70.85
17-16	35.8	43	40.85	2.15	See Note Below	0	0[6]	0

Table Notes:

1. TMDL is expressed as a concentration. If daily average tidal exchange estimates were available, this number could be converted to load in mpn/day by multiplying flow by concentration and a conversion factor.
2. TMDL Target = SFH water WQS for single sample maximum not to exceed 43 mpn/100 ml.
3. WLA is expressed as a daily maximum of 43 mpn/100 ml. There are no continuous dischargers at this time. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings are developed based upon the permitted flow and an allowable permitted maximum concentration of 43 mpn/100ml.
4. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4s, 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 the pollutant of concern in accordance with their NPDES Permit.
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 these TMDLs and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
6. As long as the conditions within the SCDOT MS4 area remain the same the Department deems the current contributions from SCDOT negligible and no reduction of FC bacteria is necessary. SCDOT must continue to comply with the provisions of its approved NPDES stormwater permit.
7. Percent reduction applies to the existing concentration.

Contents

Figures

Tables

1.0 Introduction

1.1 Background

The federal *Clean Water Act (CWA)* directs each state to review the quality of its waters every two years to determine whether water quality standards (WQS) are being met. If it is determined that the WQS is not being met, the states are to list the impaired water body under §303(d) of the CWA. These impairments are then addressed by a Total Maximum Daily Load (40 CFR 130.31(a)).

A Total Maximum Daily Load (TMDL) is a written plan and analysis to determine the maximum pollutant load a waterbody can receive and still meet applicable water quality standards. The TMDL process includes estimating pollutant contributions from all sources, linking pollutant sources to their impacts on water quality, allocation of pollutant contributions to each source, and establishment of control mechanisms to achieve water quality standards. All TMDLs include a wasteload allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES) permitted discharges, a load allocation (LA) for all unregulated nonpoint sources, and an explicit and/or implicit margin of safety (MOS).

In South Carolina, oysters and clams are the two species of bivalve molluscan shellfish that are harvested commercially, recreationally, and utilized for aquaculture. These two species are Eastern or American oyster, *Crassostrea virginica*, and hard clam or Northern quahog, *Mercenaria mercenaria*. Both species are native to the North American Atlantic and Gulf coasts and have economic importance. Hard clams can and are harvested as wild but as a fishery, their importance comes from being used in mariculture.

Oysters in South Carolina cluster together to form oyster beds and oyster reefs. These formations stabilize shorelines from erosion, provide nursery grounds as well as protection for other marine species. In South Carolina, 95% of oyster reefs are intertidal, meaning they are exposed during low tide and submerged during high tide.

Both oysters and clams are filter feeders, meaning they filter water for algae as a nutrient source. In brackish and saltwaters, there are naturally occurring bacteria and viruses. Also, there are other sources for bacteria and viruses to enter these waters as a result of human activities, some examples are agricultural runoff, malfunctioning septic systems, pet waste, sanitary sewer overflows, and stormwater runoff.

An adult oyster can filter approximately 50 gallons of water a day, while an adult clam can filter approximately 24 gallons a day. These filter feeders can concentrate naturally occurring bacteria, such as pathogenic bacteria *Vibrio vulnificus* (*V.v.)* and *Vibrio* *parahaemolyticus* (*V.p.*), and viruses that are in the water as well as those resulting from human-related activities.

The National Shellfish Sanitation Program (NSSP) is the federal and state cooperative program recognized by both the United States Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC). States have agreed, through participation in NSSP and membership in the ISSC, to enforce the Model Ordinance. The Model Ordinance supplies states with standards as well as administrative practices required for the sanitary control of shellfish produced and sold for human consumption.

The fecal coliform group of bacteria is usually not pathogenic and they are used as indicatororganisms. As an indicator, they may indicate the presence of other pathogenic bacteria. Inthe NSSP Model Ordinance, the water quality standard for shellfish harvesting waters is "… samples shall not exceed 14/100 ml and not more than 10% of the samples shall exceed anMPN of 43 MPN/100 ml for a five-tube decimal dilution test" which is the standard adoptedby the State of South Carolina (SC DHEC 2014).

This TMDL document details the development of fecal coliform bacteria TMDL for two shellfish monitoring stations, 17-16 and 17-16A, located in Habersham Creek, within shellfish management area (SFMA) 17 in Beaufort County, South Carolina (Figure 1). South Carolina Department of Health and Environmental Control (SCDHEC) currently has 2 active shellfish monitoring stations within the Habersham Creek watershed. For station location descriptions, please refer to Table 1.

Shellfish monitoring stations 17-16A and 17-16 have been included on the final 2018 303(d) list of impaired waters approved by the United States Environmental Protection Agency (the EPA) and subsequently prioritized for protection.

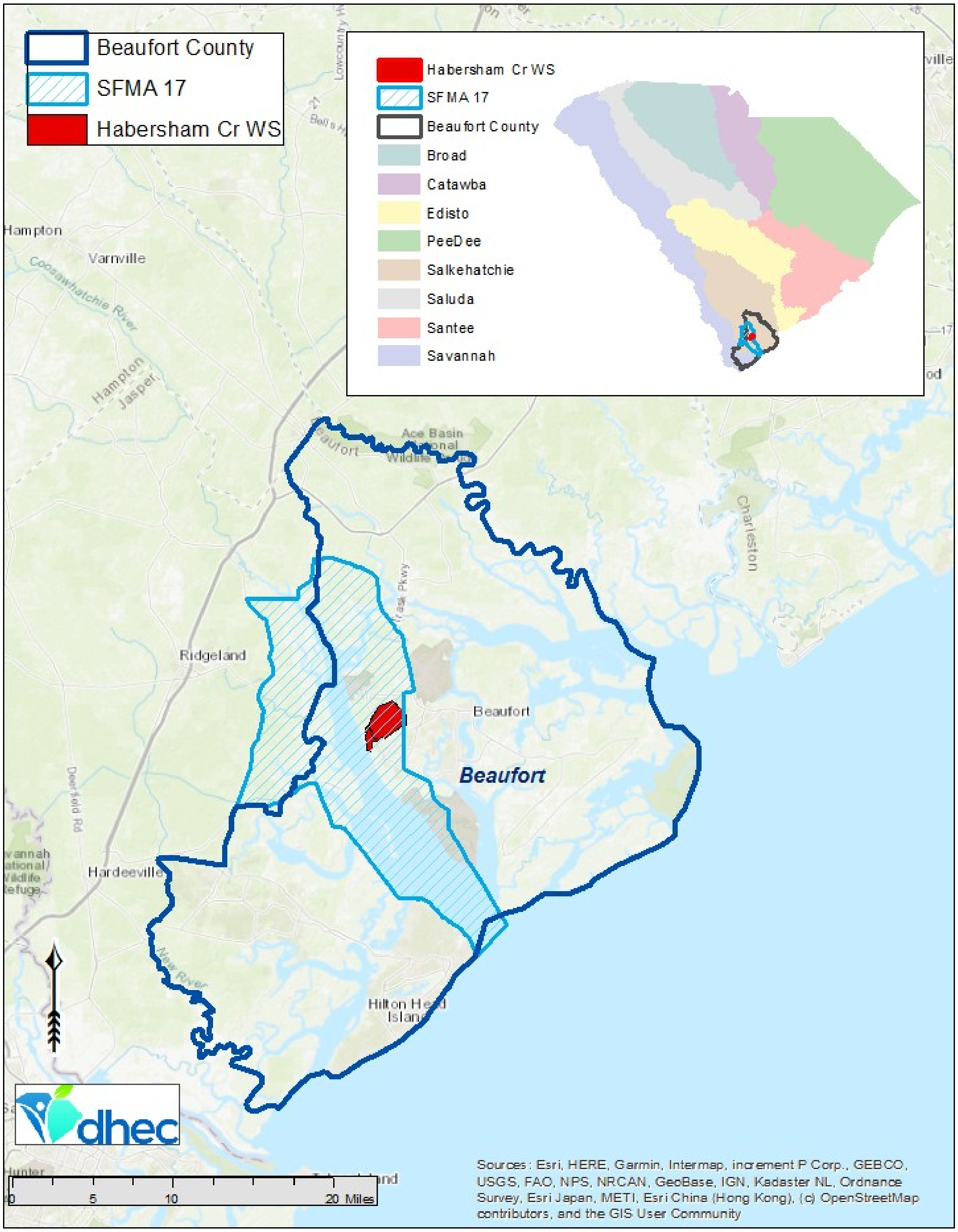


Figure 1. Locations of shellfish management area 17, Habersham Creek watershed, Beaufort County, SC.

1.2 Watershed Description

Habersham Creek is located west of the city of Beaufort, in Beaufort County, South Carolina. The Creek is encompassed within Shellfish Management Area (SFMA) 17 and 12-digit hydrologic unit code (HUC) 030502080605. Habersham Creek TMDL area has an approximate drainage area of 4.28 mi2 (Figure 1).

Habersham Creek is located within the Sea Islands/Coastal Marsh ecoregion of South Carolina in Beaufort County. Generally, Sea Islands/Coastal Marsh ecoregions have the lowest elevations in South Carolina. The environment is highly dynamic and is affected by wind, ocean waves, and river flows. In these types of ecoregions slash pine, cabbage palmetto, red cedar, and live oaks forests are common. In the marshes saltgrass, rushes, and various cordgrasses are the dominant flora. Marshes are nursery grounds for shrimp, fish, crabs, and other species (Griffith, et al. 2002).

South Carolina Department of Health and Environmental Control (SCDHEC) currently has two active shellfish monitoring stations within this area. For station location descriptions, please refer to Table 1. Of the two currently active stations and based on recent data, station 17-16A is not meeting the fecal coliform WQS for shellfish harvesting. Station 17-16 is meeting the WQS however, per United States Food and Drug Administration (FDA) rules regulations, from headwaters to station 17-16 this area is classified as restricted and closed for shellfish harvesting (Figure 3).

Table 1. Habersham Creek shellfish monitoring stations and their location descriptions.

Station	Description
17-16A	First Split in Habersham Creek above Station 17-16
17-16	Broad River at Corn Island - Mouth of Creek

1.1 Landuse

Landuses of stations 17-16A and 17-16 in Habersham Creek were calculated using the National Land Cover Database (NLCD) 2016. Landuse characteristics are summarized in Table 2. Based on data analysis using NLCD 2016, primary landuse within both stations' drainage are is woody and emergent wetlands (Figure 2).

Table 2. Shellfish monitoring stations 17-16A and 17-16 landuses based on NLCD 2016.

Landuse – Station 17-16A	Area (acres)	Percent of Area (%)
Open Water	54.93	2.31
Developed	507.06	21.35
Deciduous/Evergreen/Mixed Forest, Scrub/Shrub	727.67	30.64
Barren Land	3.11	0.13
Cultivated Crops, Pasture/Hay, Grassland/Herbaceous	121.43	5.11
Woody Wetland, Emergent Herbaceous Wetlands	960.74	40.45
Total	2,374.94	100%

Landuse – Station 17-16	Area (acres)	Percent of Area (%)
Open Water	105.41	28.81
Developed	14.23	3.89
Evergreen/Mixed Forest, Scrub/Shrub	30.91	8.45
Woody Wetland, Emergent Herbaceous Wetlands	251.28	58.84
Total	365.84	100%

1.2 Water Quality Standard

Habersham Creek is classified as shellfish harvesting waters (SFH). SFH waters are defined in SC Regulation 61-68 (SC DHEC 2014) as:

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

Fecal coliform WQS for SFH waters is (SC DHEC 2014):

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

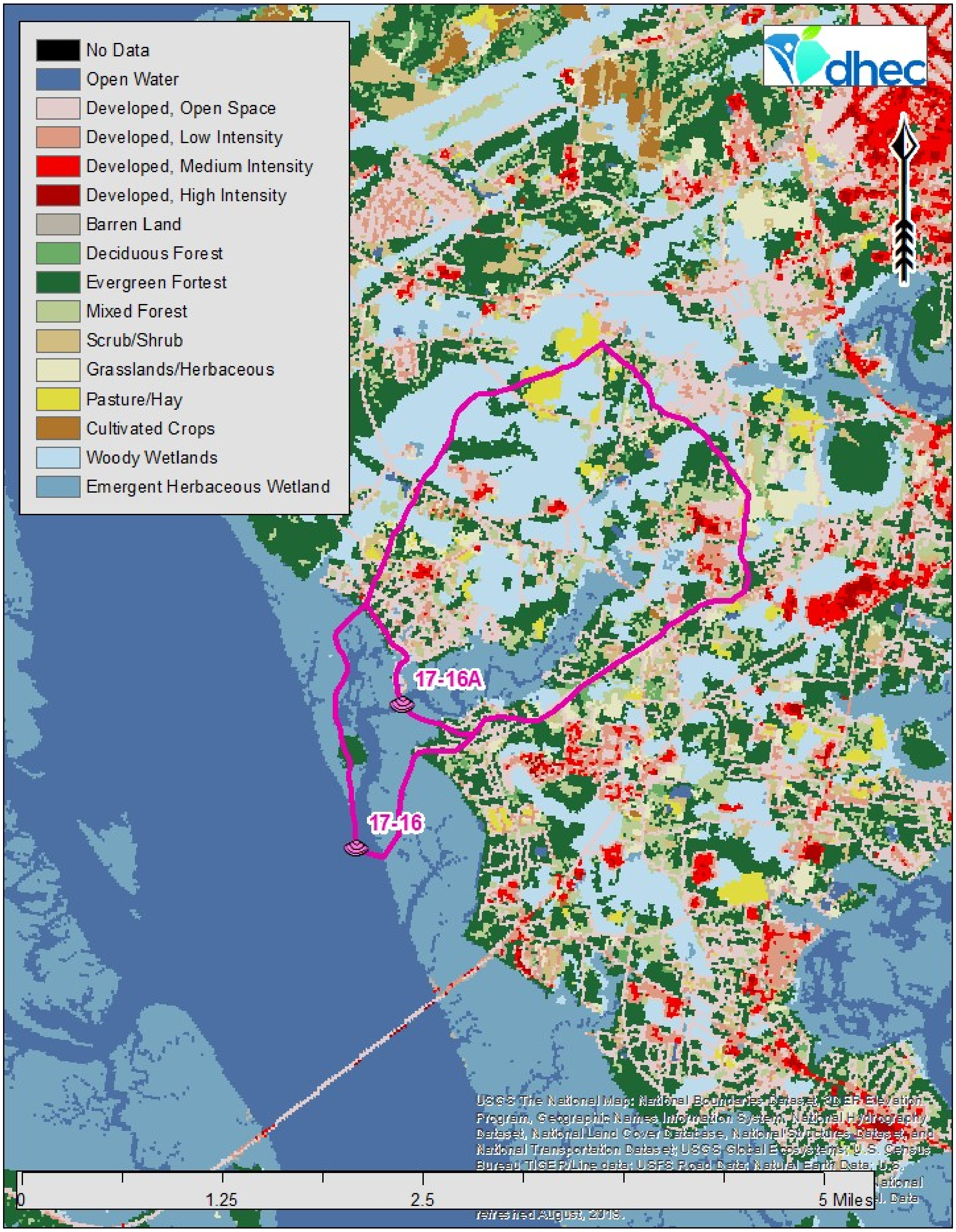


Figure 2. Landuses based on NLCD 2016 for stations 17-16A and 17-16 in Habersham Creek.

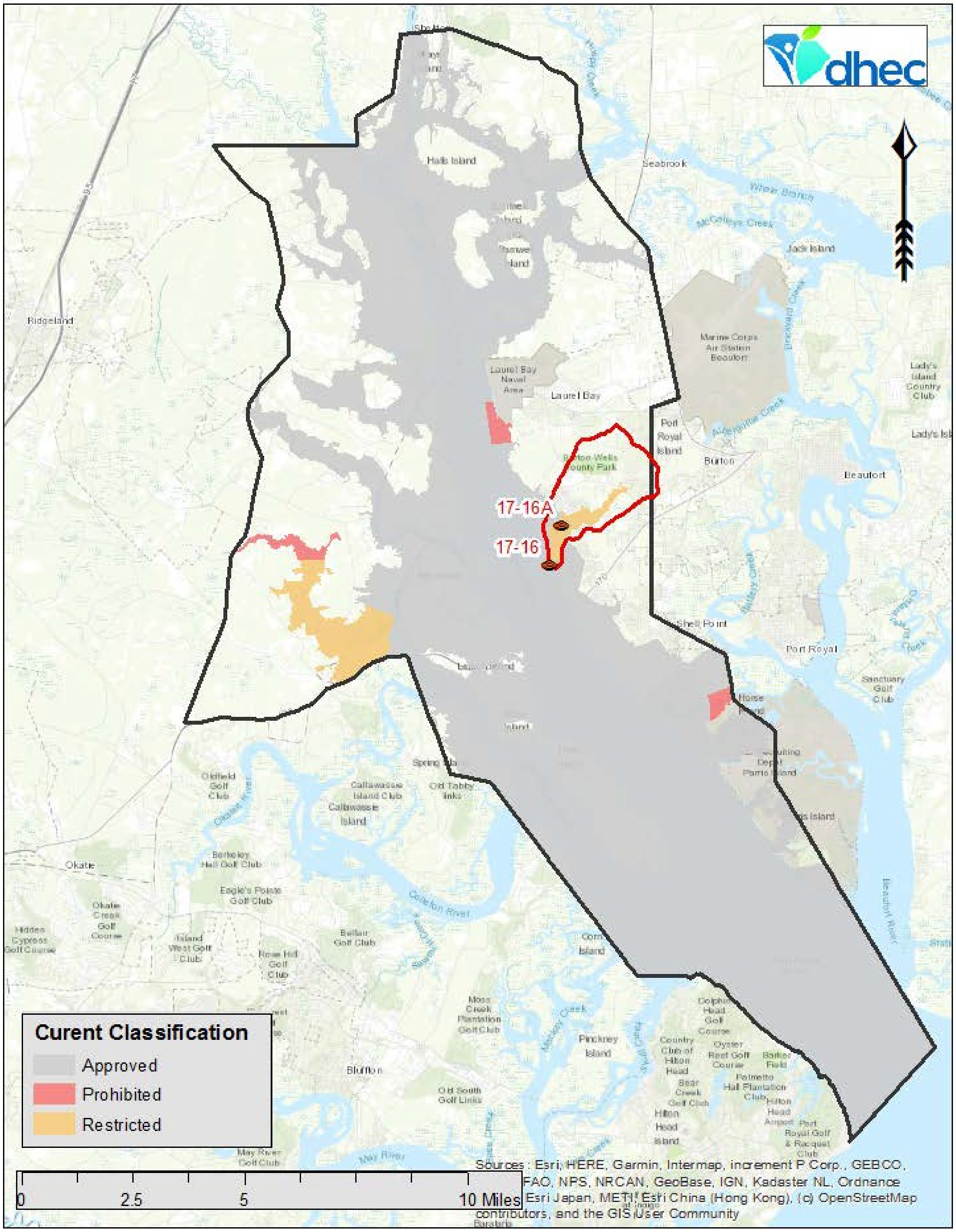


Figure 3. Shellfish management area 17 and Habersham Creek shellfish monitoring stations, and their shellfish harvesting classifications for the 2020-2021 season.

2.0 Water Quality Assessment

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

a) Adverse pollution control,
b) Systematic random sampling (US FDA, 2011 Revision).

The SCDHEC Shellfish Program currently utilizes the SRS strategy within SFMA 17 instead of sampling under adverse pollution control conditions. To ensure random sampling, sampling dates are computer-generated before the beginning of each quarterly period. Due to shipping requirements and manpower constraints, samples are collected on Mondays, Tuesdays, or Wednesdays (SCDHEC November 2019).

To comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period, which is three years.

For classification purposes, samples are collected according to the SRS strategy for 12 months between January 1st and December 31st, for three years. This allows for a maximum of 36 samples per station for three years yet provides a six-sample "cushion" (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria (SCDHEC November 2019).

In addition to bacteriological samples, surface water temperatures are measured using a hand-held, laboratory-quality calibrated thermometer. Salinities are measured in the laboratory using an automatic temperature compensated refractometer. Additional field data collected during samplings are ambient air temperature, wind direction, tidal stage, date, and time of sampling (SCDHEC November 2019).

3.0 Source Assessment

Pathogens, which are usually difficult to detect, cause disease, and make full-body contact recreation in lakes, streams, beaches a risk to public health. Indicators such as fecal coliform, total coliform, enterococcus, or E. coli bacteria are easy 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 illness.

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

Non-continuous point sources that are required to obtain NPDES permits include stormwater discharges from MS4s, industrial activities, and construction sites. Each may be a source of pathogens. These sources are expected to meet the percentage reductions as prescribed in this TMDL or the existing instream standard for the pollutant(s) of concern, to the maximum extent practicable (MEP), through compliance with the terms and conditions of their NPDES permit.

3.1 Point Sources

3.1.1 Continuous Point Sources

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

Currently, there are no continuous point sources within Habersham Creek. Future NPDES dischargers to Habersham Creek are required to comply with the load reduction prescribed in the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

3.1.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS and SCR and regulated under *SC Water Pollution Control Permits*: R.61-9, §122.26(b)(4),(7),(14) - (21) (SC DHEC 2011). All regulated MS4 entities have the potential to contribute to fecal coliform bacteria loading, other bacteria, and pathogens in the delineated drainage area used in the development of this TMDL and may be subject to the WLA portion of the TMDL.

The South Carolina Department of Transportation (SCDOT) is one of the designated MS4s within the Habersham Creek TMDL watershed. The SCDOT operates under NPDES MS4 Permit SCS040001 and owns and operates roads within the watershed. 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 landuse or zoning, issue building, or development permits (Figure 4). Based on the information available at the time of TMDL development there are no SCDOT facilities located in the Habersham Creek watershed.

The other designated MS4 in the watershed is Beaufort County and operates under NPDES MS4 Permit SCR031301. Beaufort County has elected to run its MS4 program for the unincorporated areas of the county in which another MS4 is not operating. Municipalities excluded from countywide coverage are the cities of Beaufort, Bluffton, Hilton Head Island, and Port Royal (Figure 5). For Beaufort County's stormwater outfall locations and stormwater drainage network within the Habersham Creek watershed, please see Figure 6.

Beaufort County is subject to the wasteload allocation prescribed in this TMDL document and will be responsible for submitting a TMDL monitoring plan within one year from the approval date of this document by the US EPA.

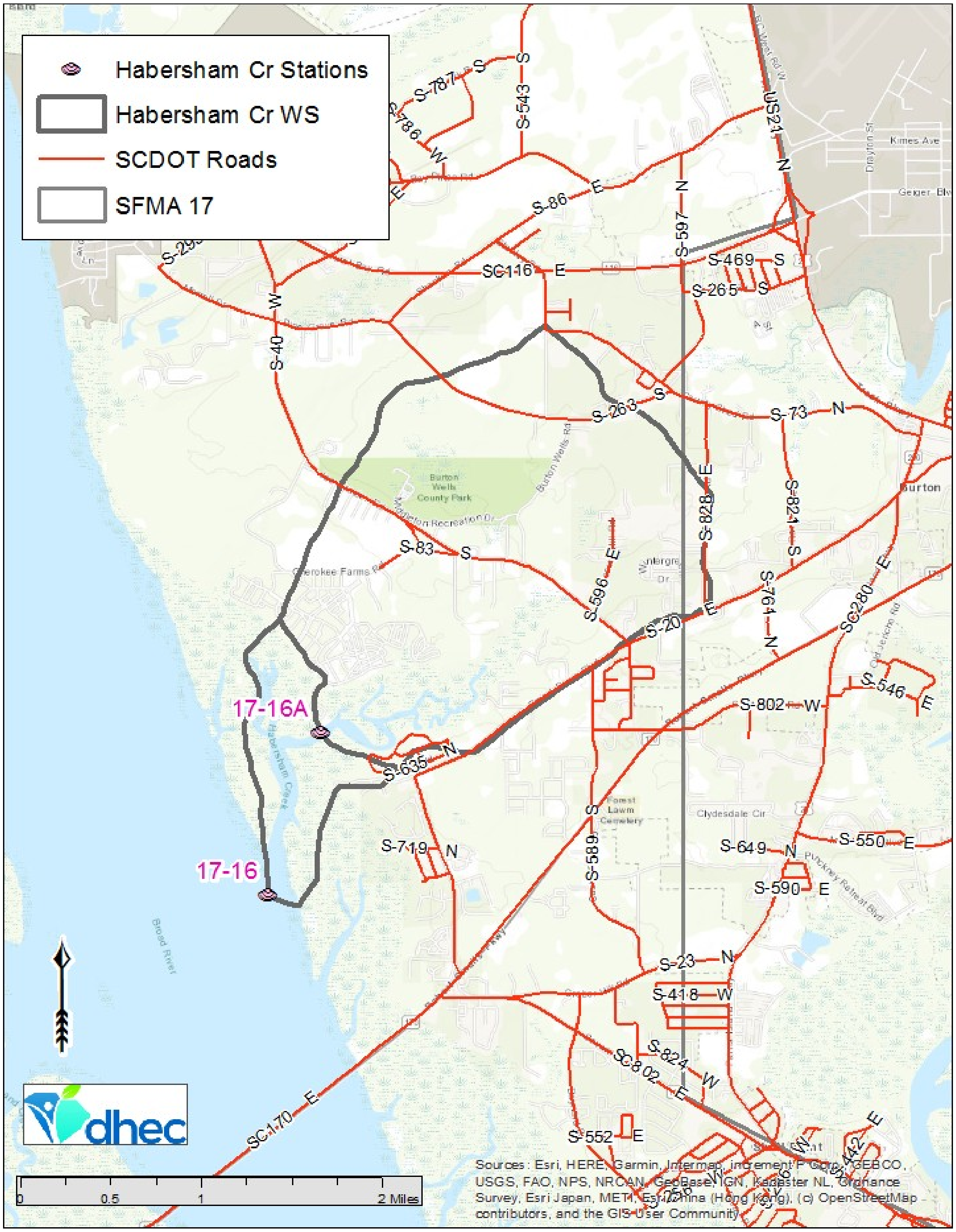


Figure 4. SCDOT owned and operated roads within the Habersham Creek TMDL watershed.

Future permitted sanitary sewer or stormwater systems in the Habersham Creek watershed are required to comply with the load reductions prescribed in the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

Industrial facilities that have the potential to cause or contribute to a violation of a water quality standard due to stormwater discharges are covered by the NPDES Stormwater Industrial General Permit (SCR000000). Construction activities are usually covered by the NPDES Stormwater Construction General Permit from SCDHEC (SCR100000). Where the construction has the potential to affect the water quality of a water body with a TMDL, the Stormwater Pollution Prevention Plan (SWPPP) for the site must address any pollutants of concern and adhere to any waste load 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.

Like regulated MS4s, potentially designated MS4 entities (as listed in 64 FR, 235, P.68837) or other unregulated MS4 communities located in the Habersham Creek watershed have the potential to contribute fecal coliform and other pollutants in stormwater runoff. The unregulated entities within this watershed will be subject to the LA portion for these TMDLs.

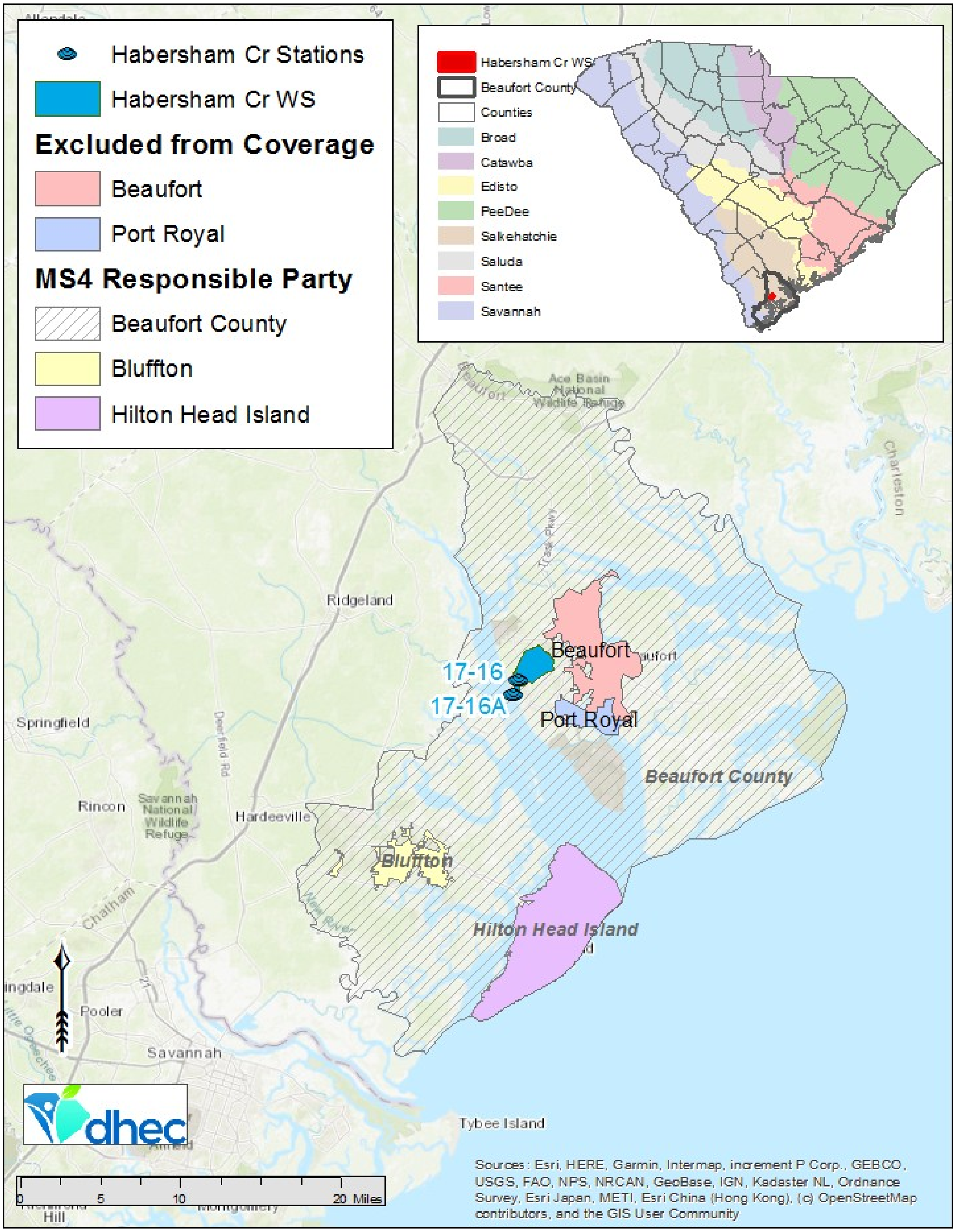


Figure 5. Beaufort County's MS4 permit coverage area is shown on the map above. It should be noted that Beaufort County does not administer the MS4 programs of the cities of Beaufort, Bluffton, Hilton Head Island, and Port Royal. These exceptions are shown and labeled on the map.

Sanitary sewer overflows (SSOs) are considered non-continuous point sources. SSOs to surface waters have the potential to severely impact water quality. 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. BJW&SA has sewer lines in the Habersham Creek watershed and therefore the potential of SSOs exists.

The Department acknowledges that progress with the assumptions and requirements of the TMDL by MS4s is expected to take one or more permit iterations. Progress towards achieving the WLA reduction for the TMDL may constitute MS4 compliance with its stormwater management plan (SWMP), provided the Maximum Extent Practicable (MEP) definition is met, even where the numeric percent reduction may not be achieved in the interim.

3.2 Nonpoint Sources

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

Wildlife, agricultural activities, grazing animals, septic tanks, and other nonpoint source contributors located within unregulated areas (outside the permitted area) may contribute to fecal coliform loadings in the Habersham Creek watershed. Nonpoint sources located in unregulated areas are subject to the LA and not the WLA of the TMDL document.

3.2.1 Agricultural Activities

Agricultural activities that involve livestock or animal wastes are potential sources of bacterial contamination of surface waters. Fecal matter can enter the waterway via runoff from the land or by direct deposition into the stream. Owners/operators of most commercial animal growing operations are required by R. 61-43, Standards for the Permitting of Agricultural Animal Facilities, to obtain permits for the handling, storage, treatment (if necessary), and disposal of the manure, litter, and dead animals generated at their facilities (SC DHEC 2002). The requirements of R. 61-43 are designed to protect water quality and there is a reasonable assurance that facilities operating in compliance with this regulation should not contribute to downstream water quality impairments. In addition to the state permit, animal operations that are considered Concentrated Animal Feeding Operations (CAFOs) are also required to have an NPDES Permit if they have a discharge to surface waters. There are currently no permitted CAFOs in South Carolina. Currently, there are no regulated agricultural operations within the Habersham Creek watershed.

3.2.2 Land Application of Industrial, Domestic Sludge, or Treated Wastewater

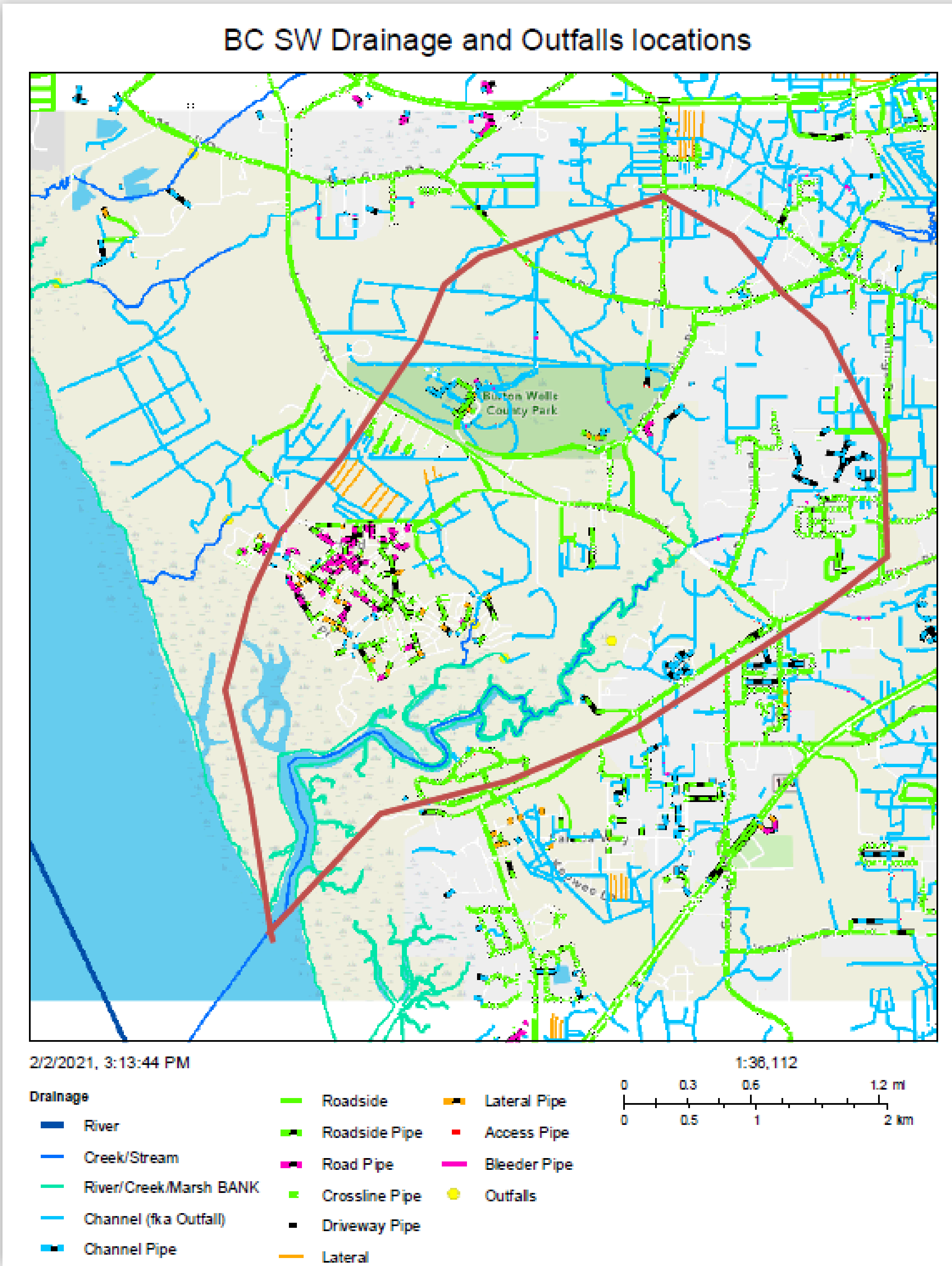
NPDES-permitted industrial and domestic wastewater treatment processes may generate solid waste bi-products, also known as sludge. In some cases, facilities may be permitted to land apply sludge at designated locations and under specific conditions. There are also some NPDES-permitted facilities authorized to land apply treated effluent at designated locations and under specific conditions. Land application permits for industrial and domestic wastewater facilities may be covered under SC Regulation 61-9 (SC DHEC 2011), Sections 503, 504, or 505.

It is recognized that there may be operating, regulated land application sites located in this watershed. If properly managed, waste is applied at a rate that ensures pollutants will be incorporated into the soil or plants and pollutants will not enter streams. Land application sites can be a source of fecal coliform bacteria and stream impairment if not properly managed. Similar to AFO land application sites, the permitted land application sites described in this section are not allowed to directly discharge to surface waters in the Habersham Creek watershed. Direct discharges from land application sites to surface waters of the State are illegal and are subject to enforcement actions by the SCDHEC. Currently, there are no NPDES permitted facilities with a land application permit of treated wastewater within the Habersham Creek watershed.

3.2.3 Urban and Suburban Stormwater Runoff

Dogs, cats, and other domesticated pets are the primary source of fecal coliform as well as other bacteria and viruses deposited on the urban and suburban landscape. Other wildlife such as resident waterfowl, squirrels, rodents, raccoons, geese, pigeons and other birds, can contribute to the bacteria load.

Similar to regulated MS4s, potentially designated MS4 entities as listed in FR 4, Appendix 7 (Federal Register 1999), or other unregulated MS4 communities located in Habersham Creek watershed may have the potential to contribute to bacteria loadings in stormwater runoff.



Note that the map above was created using Beaufort County's web-based GIS platform, and the size and boundary of the watershed are approximate. Accessed on February 2, 2021: https://gis.beaufortcountysc.gov/PublicWorks/

Figure 6. Beaufort County stormwater outfall locations and drainage network.

3.2.4 Failing Septic Systems

Improperly maintained and failing septic tanks can contribute to bacterial contamination of downstream water bodies. Untreated sewage from failing septic systems may have the potential to enter surface waters in this watershed. Although loading to streams from failing septic systems is likely to be a continual source, wet weather events can increase the rate of transport of effluent from failing septic systems.

Beaufort Jasper Water and Sewer (BJW&SA) authority has shared their sewer and water-related GIS files with the Department. Based on this information, the majority of the homes in the Habersham Creek watershed are not connected to the sewer system. Based on the 2010 U.S. Census, there are approximately 1956 housing units with a population of 4430 people (Figure 7).

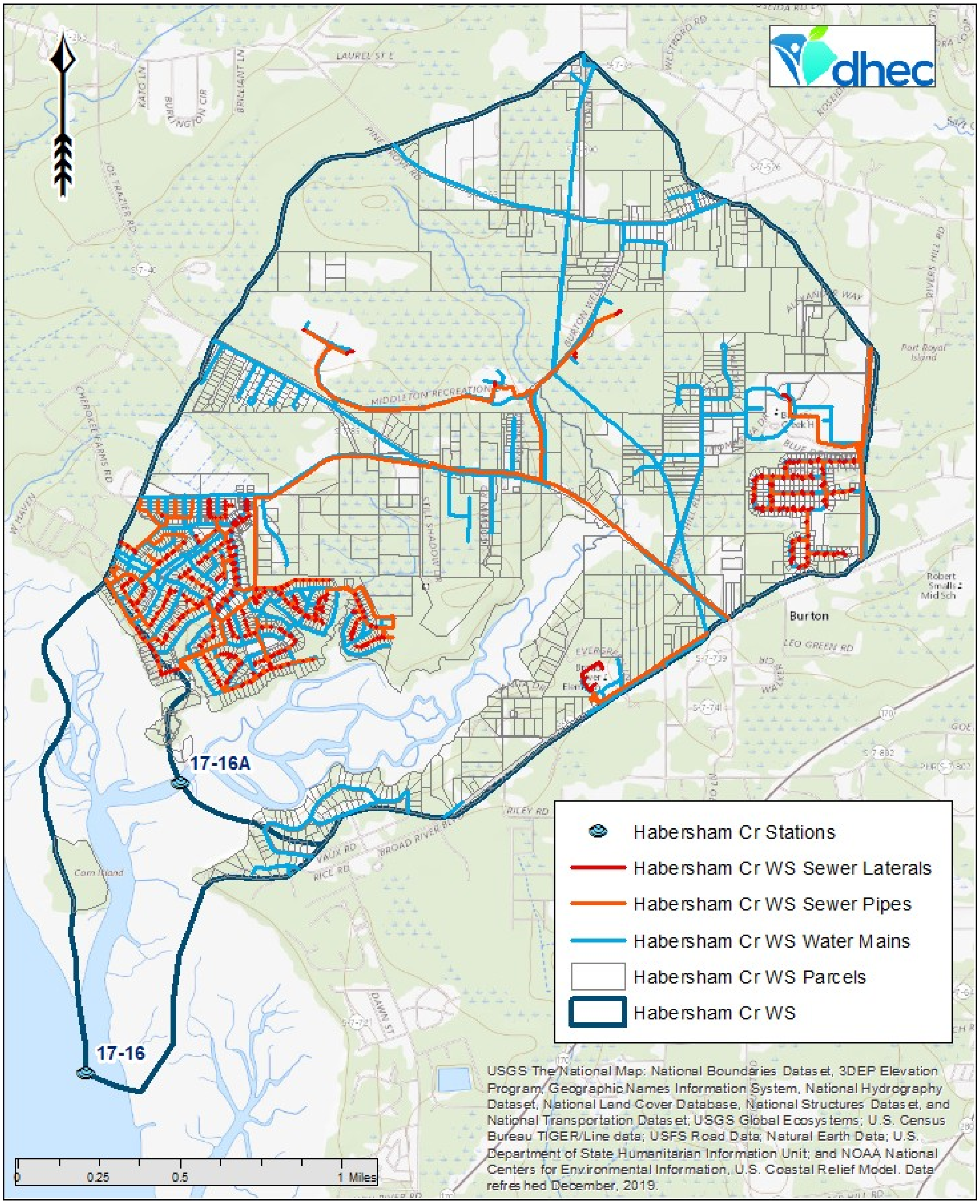
3.2.5 Wildlife

Resident, migrant and seasonal wildlife wastes that are carried into nearby streams by runoff following rainfall or deposited directly in or adjacent to streams may be a source of fecal coliform. According to the study conducted by the South Carolina Department of Natural Resources (SCDNR) in 2013, deer density there are approximately 15 to 45 deer per square mile in this watershed (SC DNR 2013). The study estimated deer density based on suitable habitats such as forests, croplands, and pastures. Data compiled by Yagow show the fecal indicator bacteria production can be 347 x 10^6 mpn/deer/day, 113 x 10^6 mpn/raccoon/day, and 4,853 x 10^6 mpn/duck/day (Yagow 2001).

3.2.6 Marinas, Boating Activities, and Structures

Currently, there are no marinas within the Habersham Creek watershed however, there are private docks along Habersham Creek.

There are 3 main types of marine sanitation devices (MSD) that are suitable for different kinds of marine vessels and have varying effluent treatment levels. Every vessel with an MSD installed as of January 30, 1980, must be equipped with one of the three types of MSDs (The United States Code 2012). Properly maintained MSDs should not be causing or contributing to bacteria exceedances in impaired waters. It is prohibited under Federal law to discharge untreated sewage from vessels within navigable waters as stated in the Clean Vessel Act.



Source: Data courtesy of BJW&SA.

Figure 7. BJW&SA sewer lines, sewer laterals, and water lines within Habersham Creek watershed.

4.0 Cumulative Probability Method

Cumulative probability distributions were used to calculate existing conditions and percent reductions necessary to meet shellfish harvesting waters standards for fecal coliform in Habersham Creek.

For the calculation of the cumulative probability distributions, data collected by DHECfrom 2014 through 2019 were used.

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

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

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

In this case, the log base 10 of fecal coliform is used. If the data follows a log-normal distribution, the data points on the plot will approximate a straight line (the normal distribution). This straight line is then compared to the water quality standard at the appropriate percentile. For shellfish waters in South Carolina, the TMDL target equates to 43 mpn/100ml minus a 5% margin of safety (MOS) (40.9 mpn/100ml) at the 90th percentile. If the fit line crosses the 90th percentile reference line above the standard, the site is considered to not meet the standard for single sample maximums. If the line crosses below the standard reference the site does meet the water quality standard. The evaluation is consistent with the NSSP approach under a systematic random sampling scheme (which is used in place of adverse condition sampling). If the data do not meet the single sample standard, a line is drawn parallel to the original normal distribution line that intersects the standard at the 90th percentile point. Drawing the line parallel to the original distribution assumes that the coefficient of variation remains the same for the original data and the desired water quality data (Novotny, 2004). The necessary percent reduction is calculated as the difference between the distributions at the 90th percentile point:

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

Based on an evaluation of 2014-2019 fecal coliform data, station 17-16A exceeds the single standard sample maximum (SSM) criterion. The SSM criterion will be targeted for the calculation of a TMDL for station 17-16A.

If sufficient approximations of tidal exchange and flow patterns were available, this method could be extended to calculate the total maximum daily fecal coliform loading in mpn/day for locations within the watershed. The average daily tidal exchange would be multiplied by the water quality standard of 43 mpn/100ml and a conversion factor. This number would represent the maximum daily load for all waters within the delineated watershed, whether impaired or not. There are not sufficient data to calculate the loadings for each station which is a limitation of this method. For probability plots of stations 17-16A and 17-16, please see Figure 8 and Figure 9, respectively.

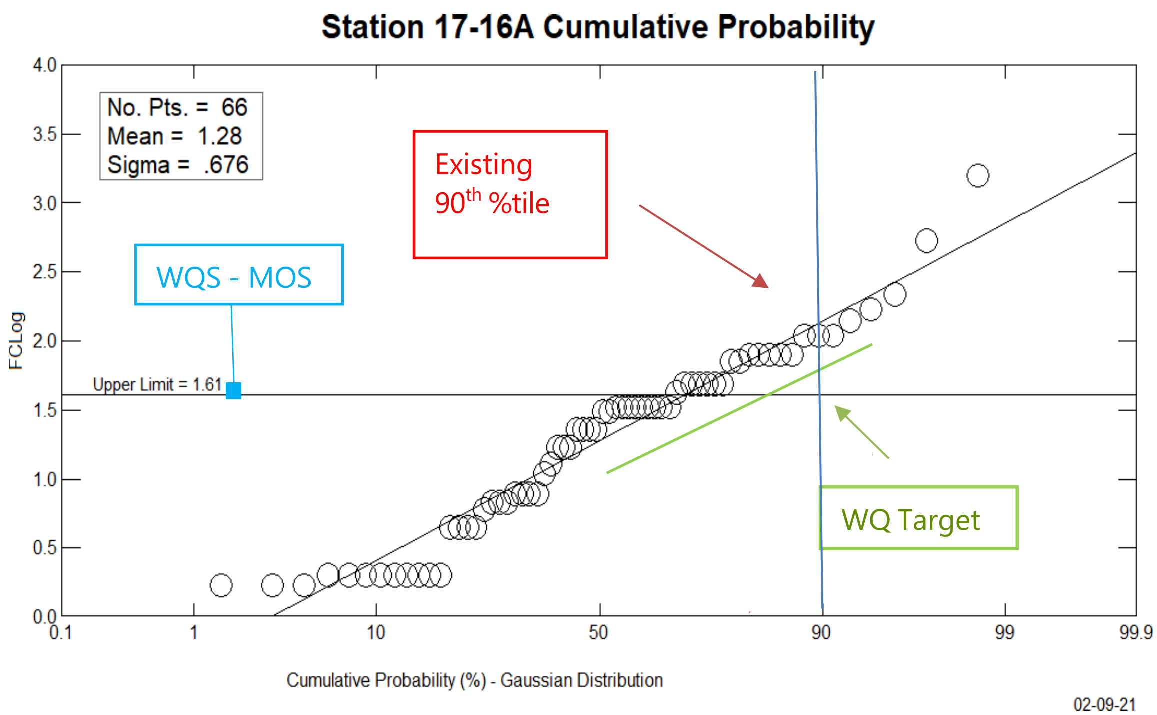


Figure 8. Cumulative probability plot for station 17-16A.

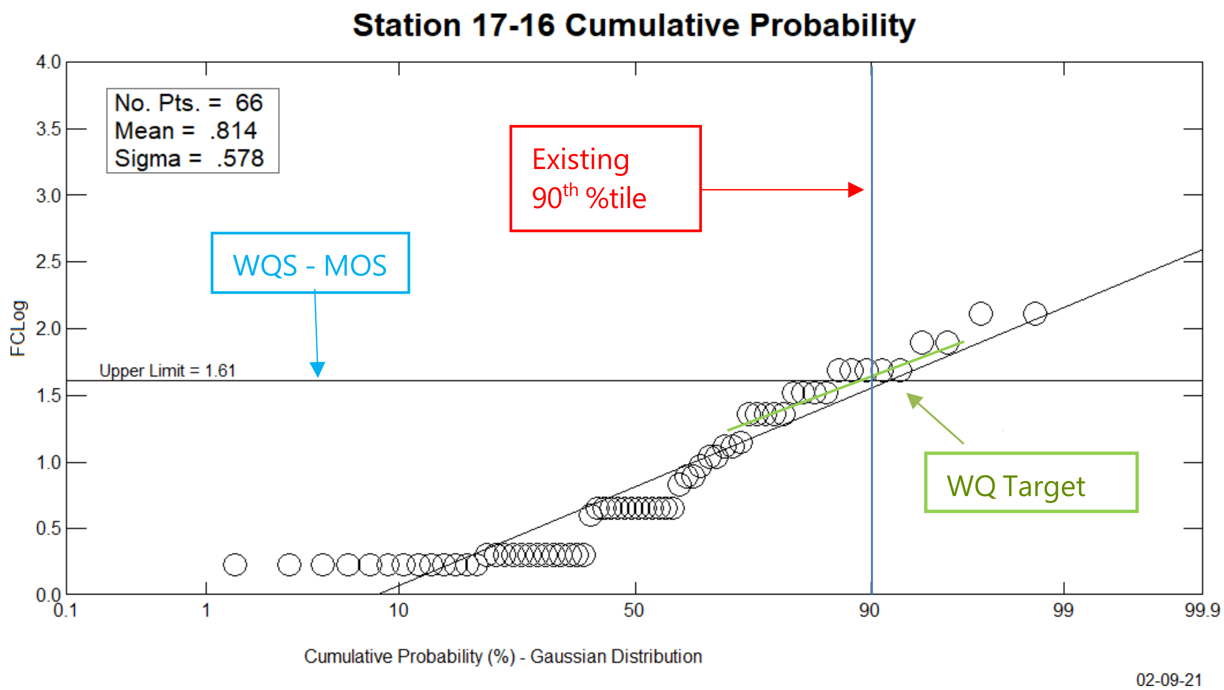


Figure 9. Cumulative probability plot for station 17-16.

5.0 Development of the TMDL

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. Also, 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 a 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), mpn (most probable number), or percent (%) reductions per 40 CFR 130.2(l). Refer to Table 3 for TMDL allocations for Habersham Creek.

5.1 Critical Conditions

Critical conditions are the "worst-case" environmental conditions for exceedance of water quality standards and which occur at an acceptable frequency (US EPA 1999). Due to the tidal and complex hydrologic nature of this system, it is unclear what a critical flow would be. By including all data in the calculations, the inclusion of the critical condition is implicit.

5.2 Wasteload Allocation

The WLA is the portion of the TMDL allocated to NPDES-permitted point sources (US EPA 1991). The wasteload summation is determined by subtracting the margin of safety and the sum of the load allocation from the total maximum daily load. Note that all illicit dischargers, including SSOs, are illegal and not covered under the WLA of this TMDL.

5.2.1 Continuous Point Sources

Habersham Creek is classified as SFH waters and dischargers to these waters are allowable if the Department deems appropriate. Currently, there are no continuous NPDES-permitted discharges to the affected TMDL watersheds with a fecal coliform effluent limit on their NPDES permit. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern based on permitted flow and assuming an allowable permitted single sample maximum of 43/100 ml.

5.2.2 Non-Continuous Point Sources

Non-continuous point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial discharges covered under permits numbered SCS and SCR and/or regulated under South Carolina Water Pollution Control Permits: R61-9, §122.26(b)(4),(7),(14)-(21) (SC DHEC 2014). Illicit discharges, including SSOs, are not covered under any NPDES permit and are subject to compliance and enforcement mechanisms.

All areas defined as "Urbanized Area" by the US Census are required under the NPDES Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater. Other non-urbanized areas may be required under the NPDES Phase II Stormwater Regulations to obtain a permit for the discharge of stormwater.

Regulated MS4s are subject to the WLA component of this TMDL; however, there may be other unregulated MS4s located in the watershed that are subject to the LA component of this TMDL. At such time that the referenced entities or other future unregulated entities become regulated NPDES MS4 entities and subject to applicable provisions of SC Regulation 61-68, they will be required to meet load reductions prescribed in the WLA component of the TMDL. This also applies to future discharges associated with industrial and construction activities that will be subject to R61-9, §122.26(b)(4),(7),(14)-(21) (SC DHEC 2011).

Waste load allocations for stormwater discharges are expressed as a percentage reduction instead of a numeric concentration due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet the percentage reduction or the existing instream standard for the pollutant of concern. The percent reduction is based on the maximum percent reduction (critical condition) necessary to achieve target conditions. Table 3 presents the reductions needed for the impaired segment. The percent reductions identified for the impaired station in this document also apply to the fecal coliform waste load attributable to those areas of the watershed which are covered or will be covered under NPDES MS4 permits.

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

- An inventory of service boundaries of the MS4 area covered in the MS4 permit provided as ArcGIS compatible shapefiles.
- An inventory of all existing and planned stormwater discharge points, conveyances, and drainage areas for the discharge points, provided as ArcGIS compatible shapefiles. If drainage areas are not known, any information that would help estimate the drainage areas should be provided. The percentage of impervious surfaces within the MS4 area should also be provided.
- 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) will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. However, the Department recognizes that the SCDOT is not a traditional MS4 in that it does not possess statutory taxing or enforcement powers. The SCDOT does not regulate land use or zoning, issue building, or development permits.

5.3 Load Allocation

The Load Allocation (LA) applies to the nonpoint sources of fecal coliform bacteria which include unregulated processes/entities and is expressed both as a load and as a percent reduction. The LA is calculated as the difference between the target concentration under the critical condition and the point source WLA. The LA for stations 17-16A and 17-16 in Habersham Creek are expressed in tables as percent reduction. The Department believes that meeting the percent reduction or the WQS, whichever is less restrictive, will effectively protect the shellfish harvesting uses within the Habersham Creek watershed. Currently, SCDOT and Beaufort County are the only regulated MS4s located in the drainage area; these entities are subject to the WLA component of the TMDL.

There may be other unregulated stormwater discharges located in the watershed that are subject to LA components of this TMDL which currently are not NPDES permitted. 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 61-68D, they will be required to meet load reduction prescribed in the WLA component of the TMDL. This also applies to future discharges associated with industrial and construction activities will be subject to R. R61-9 §122.26(b)(4),(7),(14) - (21) (SC DHEC 2011).

5.4 Existing Load

Due to the tidal nature of the system, it is difficult to calculate an existing load for this system. For this reason, existing conditions are given as a concentration. The existing concentration is calculated as the concentration of fecal coliform bacteria at the 90th percentile point based on the normal line fit to the monitoring data. The existing load for station 17-16A was calculated to be 140.2 mpn/100 ml (Table 3).

5.5 Margin of Safety

A margin of safety (MOS) allows for an accounting of the uncertainty in the relationship between pollutant loads and receiving water quality (US EPA, 1999). Incorporation of a MOS can be done either explicitly within the TMDL calculation or implicitly by using conservative assumptions (US EPA 1991). This TMDL has an explicit 5% MOS. All water quality data is compared to 40.9/100ml which is the single sample maximum water quality standard minus five percent MOS. There is also an unspecified implicit margin of safety in the percent reduction calculations derived from the cumulative probability graphs due to the assumption of independence of the data points (Novotny, 2004).

5.6 Calculation of the TMDL

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

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

The equation above results in a 70.9% reduction of fecal coliform loading to consistently meet the instantaneous SSM water quality standard for fecal coliform at station 17-16A and 0% at station 17-16. Using the same 2014-2019 data set, a geometric mean was also calculated. The overall geomean is 19.1 mpn/100 ml which is an exceedance of the geomean WQS of 14 mpn/100.The calculated 70.9% reduction for station 17-16A was applied to each 2014-2019 data points and an overall geomean was recalculated. The recalculated geomean is 5.7 mpn/100ml. Achieving the 70.9% reduction of fecal coliform loading is expected to result in meeting both SSM and geomean WQS. Calculated TMDL reductions applicable to the impaired station are presented in Table 3.

Based on the information available at this time, the portions of the watersheds that drain directly to a regulated MS4 and that which drain through the non-regulated MS4 have not been clearly defined. Loading from both types of sources (regulated and non-regulated) typically occurs in response to rainfall events, and discharge volumes, as well as recurrence intervals, are largely unknown. Therefore, where applicable, the regulated MS4 is assigned the same percent reduction as the non-regulated sources in the watershed. Compliance with the MS4 permit regarding this TMDL document is determined at the point of discharge to the waters of the state. The regulated MS4 entity is only responsible for implementing the TMDL WLA by following their MS4 permit requirements and is not responsible for reducing loads prescribed as LA in this TMDL document.

5.7. Reasonable Assurance

NPDES permits are issued for regulated dischargers, including continuous and non-continuous sources of pathogenic bacteria. In shellfish harvesting waters, the applicable water quality standard indicator is fecal coliform bacteria. Continuous discharges are required to target the fecal coliform water quality standard at the point of discharge. For regulated non-continuous discharges, the fecal coliform standard should be targeted to the maximum extent practicable. There may be other regulated activities present that could contribute to fecal coliform loadings in the watershed. New septic tanks, animal feeding operations (AFOs), land application of treated sludge or wastewater also require permits that reduce the potential for runoff of bacteria into waters of the State.

Other unregulated sources of fecal coliform loadings in the watershed may include wildlife, improper agricultural or silvicultural activities, urban and suburban runoff. These sources may be reduced through means such as best management practices, local ordinances, outreach education efforts as well as section 319 grant opportunities. SCDHEC has fostered effective partnerships between other federal, state, and local entities to help reduce the potential for runoff of bacteria into the waters of the State. Collectively, and once implemented, these reduction mechanisms will provide reasonable assurance that the recreation use water quality standard will be attained in this watershed.

Table 3. TMDLs for Habersham Creek watershed. Loads are expressed as the most probable number (mpn) per 100 ml and allocations are expressed as % reductions.

Station	90th %tile of Existing Load (mpn/ 100ml)	TMDL [1, 2] (mpn/ 100ml)	WQ Target (mpn/ 100ml)	Margin of Safety (mpn/100ml)	WLA			LA
					Continuous Sources[3] (mpn/100ml)	Non-Continuous [4, 7] Sources (% Reduction)	Non-Continuous SCDOT [7] (% Reduction)	% Reduction to Meet LA [7]
17-16A	140.2	43	40.85	2.15	See Note Below	70.85	70.85[5]	70.85
17-16	35.8	43	40.85	2.15	See Note Below	0	0[6]	0

Table Notes:

1. TMDL is expressed as a concentration. If daily average tidal exchange estimates were available, this number could be converted to load in mpn/day by multiplying flow by concentration and a conversion factor.
2. TMDL Target = SFH water WQS for single sample maximum not to exceed 43 mpn/100 ml.
3. WLA is expressed as a daily maximum of 43 mpn/100 ml. There are no continuous dischargers at this time. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Loadings are developed based upon the permitted flow and an allowable permitted maximum concentration of 43 mpn/100ml.
4. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction, and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for the pollutant of concern in accordance with their NPDES Permit.
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 these TMDLs and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
6. As long as the conditions within the SCDOT MS4 area remain the same the Department deems the current contributions from SCDOT negligible and no reduction of FC bacteria is necessary. SCDOT must continue to comply with the provisions of its approved NPDES stormwater permit.
7. Percent reduction applies to the existing concentration.

6.0 Implementation

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

Point sources are discernible, confined, and discrete conveyances of pollutants to a water body including but not limited to pipes, outfalls, channels, tunnels, conduits, man-made ditches, etc. The Clean Water Act's primary point source control program is the NPDES. Point sources can be broken down into continuous and non-continuous point sources. Some examples of a continuous point source are domestic and industrial WWTP. Non-continuous point sources are related to stormwater and include MS4s and construction activities, etc. Current and future NPDES discharges in the referenced watersheds are required to comply with the load reductions prescribed in the WLA.

Nonpoint source pollution originates from multiple sources over a relatively large area. It is diffuse 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, urban and suburban runoff. Nonpoint sources located in unregulated portions of the watershed are subject to the LA and not the WLA of the TMDL document.

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

Interested parties (local stakeholder groups, universities, local governments, etc.) may be eligible to apply for CWA §319 grants to install BMPs that will implement the LA portion of these TMDLs and reduce nonpoint source fecal coliform loadings to impaired areas. Congress amended the CWA in 1987 to establish the §319 Nonpoint Source Management Program. Under §319, States receive grant money to support a wide variety of activities including the restoration of impaired waters. TMDL implementation projects are given the highest priority for §319 funding. CWA §319 grants are not available for implementation of the WLA component of this TMDL but may be available for the LA component within permitted MS4 jurisdictional boundaries. Additional resources are provided in Section 7.0 of this TMDL document.

SCDHEC will work with the agencies in the area to provide nonpoint source education in this watershed and the surrounding watersheds. Local sources for nonpoint source education include Charleston Counties Soil and Water Conservation Districts, local Natural Resources Conservation Service, Clemson Extension Service, South Carolina Department of Natural Resources, S.C. Sea Grant Extension Program.

The Department recognizes that adaptive management/implementation of these TMDLs might be needed to achieve the water quality standard and we are committed to targeting the load reductions to improve water quality in Habersham Creek. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL targets accordingly.

6.1 Implementation Strategies

Implementation of both, point (WLA) and nonpoint source (LA) components of the TMDL are necessary to reduce fecal coliform loading and achieve WQS in Habersham Creek watershed.

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

6.1.1 Continuous Point Sources

Continuous point source WLA reductions are implemented through NPDES permits. Existing and future continuous dischargers are required to meet the prescribed WLA for the pollutant of concern and demonstrate consistency with the assumptions and requirements of the TDML. Currently, there are no direct discharges to the Habersham Creek Watershed.

6.1.2 Non-Continuous Point Sources

An iterative BMP approach as defined in the general stormwater NPDES MS4 permit is expected to provide a significant implementation of the WLA. Discovery and removal of illicit storm drain cross-connections is one important element of the stormwater NPDES MS4 permit. Public nonpoint source pollution education is another. Other permit requirements for implementing WLAs in approved TMDL documents will vary across water bodies, discharges, and pollutant(s) of concern. The allocation within a TMDL area can take many different forms – narrative, numeric, specified BMPs – and may be complemented 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 Stormwater Management Plan (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 the implementation of this TMDL with an acceptable schedule and activities for their permit compliance.

The Department (permit writers, TMDL project managers, and compliance staff) is willing to assist in developing or updating the referenced plan as deemed necessary. Please see Evaluating the Progress of MS4 Programs 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, existing and future NPDES MS4 permittees, compliance with terms and conditions of its NPDES permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP). For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of its permit is effective implementation of the WLA. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and are eligible for CWA §319 grants.

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 an 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 criteria 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 an SWMP.

An informed and knowledgeable community is crucial to the success of a stormwater management plan (US EPA, 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 water bodies 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 websites and bumper stickers.

The public can provide valuable input and assistance to an 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 (US EPA, 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 to high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving water bodies (US EPA, 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 that 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 (US EPA, 2005). For information on specific BMPs please refer to the SCDHEC Stormwater Management BMP Handbook online at: http://www.scdhec.gov/Environment/WaterQuality/Stormwater/BMPHandbook/

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 water bodies. 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 (US EPA, 2005). Strategies might be developed to include a combination of structural and/or nonstructural 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 (US EPA, 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 water body of concern online at https://scdhec.gov/environment/your-water-coast/watersheds-s-program-
http://www.scdhec.gov/HomeAndEnvironment/Water/Watersheds/Contacts/

For additional information on stormwater discharges associated with MS4 entities please see the US EPA NPDES website online at https://www.epa.gov/npdes/stormwater-discharges-municipal-sources for information about the National Menu of BMPs, Urban BMP Performance Tool, Outreach Documents, etc.

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

6.2 Nonpoint Sources

6.2.1 Urban and Suburban Stormwater Runoff

In estuaries, runoff is considered the leading cause of impairment. Runoff from urban and suburban areas is the result of imperviousness, population, and traffic density, and all activities connected with urban living (Novotny, 2003). Also, estuaries are saline environments and urban runoff, due to precipitation is freshwater. This freshwater runoff into the estuarine environments causes salinity variances, adversely affecting organisms that are adapted to high salinity. Several studies have shown that salinity fluctuations cause a decrease in biomass of organisms, change in species dominance, reduced growth, and survival, and other physiological stress. These studies recommend gaining control of salinity fluctuations may help improve estuarine habitats through the management of freshwater runoff from urban and suburban environments (Montague & Ley 1993, Mallin et al. 2008).

Potential BMPs for residential, industrial and commercial lots with impervious surfaces for consideration but not limited to are, capturing rain by either using rain barrels or rain pillow (for single-family residential units or other small buildings), or a rainwater collection system, such as a cistern, for later use in landscape watering or other non-potable uses. Another option would be, when appropriate, constructing rain gardens or wetlands to slow surface water runoff rates from impervious surfaces and to allow for percolation of runoff to recharge groundwater. Also, using porous pavements/materials allows runoff due to precipitation to percolate hence reducing the runoff rate.

6.2.2 Agricultural Runoff

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

Agricultural BMPs can be vegetative, structural, or management-oriented. When selecting BMPs, it is prudent to keep in mind that nonpoint source related pollution occurs when a pollutant becomes available, is detached, and then transported to nearby receiving waters.

Therefore, for BMPs to be effective, the transport mechanism of the pollutant, fecal coliform, needs to be identified.

Fencing livestock is an effective way of confining the livestock in a certain area where BMPs are deployed; however, in certain cases, it may not be sufficient for the prevention of overland runoff. It may help to deploy additional BMPs such as a vegetative buffer with different growth rates behind the fence of where livestock are kept.

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

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

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

6.2.3 Failing Septic Systems

Age, lack of maintenance, and improper use can cause septic systems to malfunction. Homeowner education about proper maintenance and repairing of their septic systems may help reduce runoff from these treatment systems. Also, encouraging homeowners to have their septic systems inspected and pumped on regular basis is another potential intervention for reducing bacterial runoff/contamination from these systems.

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

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

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

Dos:

- 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 downspouts and other surface water away from your drain field. 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 drain field or compact the soil in any way.
- Don't dig in your drain field 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 drain field except grass. Roots from nearby trees and 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/environment/envhealth/Septic/

6.2.4 Wildlife and Domestic Animals

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

Planting and maintaining a vegetative buffer around the residential areas will help filter pet waste that may accumulate in gardens and public walkways. Without any buffers or other BMPs, during rain events, the fecal matter may be washed off to the roadside stormwater ditches. Installation of pet waste collection stations in residential neighborhoods along with dispensers of pet waste bags and bag holders for dog owners is recommended.

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

6.2.5 Marinas, Boating Activities and Structures

Boating related activities have the potential to contribute to fecal coliform contamination through potential discharges from the installed toilet (MSD) and gray water, and these discharges can contain bacteria. Improperly maintained or malfunctioning MSDs have the potential to leak or discharge untreated sewage (US EPA, January 2010). Therefore, it is important to bring the attention of the boating public to available pump-out facilities nearby. Another important factor is outreach and education for boat and dock owners regarding the proper use and maintenance of MSDs, and the impact of improper vessel discharges in Class SA waters. Local pump-out facilities can be found at http://www.dnr.sc.gov/marine/vessel/pdf/coastalArea1.pdf

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

8.0

Bibliography

33 CFR . 2014. *Part 159 - Marine Sanitation Devices.* https://www.gpo.gov/fdsys/pkg/CFR-2014-title33-vol2/pdf/CFR-2014-title33-vol2-part159.pdf.

2006 ed. "40 CFR Part 130." *Water Quality Planning and Management.*

American Veterinary Medical Association. 2016. *https://www.avma.org/KB/Resources/Statistics/Pages/US-pet-ownership-calculator.aspx.*

American Veterinary Medical Association. n.d. *Pet Ownership Calculator.* Accessed June 16, 2016. https://www.avma.org/KB/Resources/Statistics/Pages/US-pet-ownership-calculator.aspx.

Bejarano, A. C. , K. A. Maruya, and G. T. Chandler. 2004. "Toxicity Assessment of Sediments Associated with Various Land-Uses in Coastal South Carolina, USA, Using Meiobenthic Copepod Bioassay." *Marine Pollution Bulletin* 39 (1-2): 23-32.

Bonta, J V, and B Cleland. 2003. "Incorporating natural variability, uncertainty, and risk into water quality evaluations using duration curves." *Journal of the American Water Resources Association* 39 (6): 1481-1496.

Bostick, Douglas (Personal Communication). 2018. "Executive Director, South Carolina Battleground Preservation Trust." Town of James Island, SC, April 16.

Cox, P, M Griffith, M Angles, D Deere, and C Ferguson. 2005. "Concentrations of pathogens and indicator in animal feces in the Sydney watershed." *Applied Environmental Microbiology* 71 (10): 5929-5934.

DeVoe, M., and G. Kleppel. 2006. "Introduction - The Effects of changing landuse patterns on marine resources: Setting a research agenda to facolitate management." In *Changing Land Use Patterns in the Coastal Zone*, edited by G. S. Kleppel, M. R. DeVoe and M. V. Rawson, 305. New York: Springer-Verlag.

Federal Register. 1999. "Storm Water Phase II Final Rule." *Federal Register*. Vol. 64. no. 235. Accessed April 19, 2013. http://www.gpo.gov/fdsys/pkg/FR-1999-12-08/pdf/99-29181.pdf.

Fletcher, M., P. G. Verity, M. E. Frischer, K. A. Maruya, and G. I. Scott. 1998. *Microbial indicators and phytoplankton and bacterial indicators as evidence of contamination caused by changing land use patterns*. Land Use-Coastal Ecosystem Study State of Knowledge Report, Charleston, SC: South Carolina Sea Grant Consortium.

Griffith, G. E., J. M. Omernik, J. A. Comstock, M. P. Schafale, W. H. McNab, D. R. Lenat, T. F. MacPherson, J. B. Glover, and V. B. Shelburne. 2002. "Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs)." Reston , Virginia: U.S. Geological Survey (map scale 1:1,500,00).

Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulson, N. D. Herold, J. D. Wickham, and K. Megown. 2015. "Completion of the 2011 National Land Cover Database for the conterminous United States- Representing a decade of land cover change." *Photmetric Engineering and Remote Sensing* 81 (5): 345-354.

Mallin, A. A., J. M. Burkholder, and L. B. Cahoon. 2000a. "North and South Carolina Coasts." *Marine Pollution Bulletin* (Pergamon) 41 (1-6): 56-75. http://uncw.edu/cms/aelab/Reports%20and%20Publications/2000/2000,Mar%20Poll%20Bull,North%20and%20South%20Carolina%20Coasts.pdf.

Mallin, M. A., K. E. Williams, E. C. Esham, and R. P. Lowe. 2000b. "Effect of Human Development on Bacteriological Water Quality in Coastal Watersheds." *Ecological Applications* 10 (4): 1047-1056.

Novotny, V. 2003. *Water Quality: Diffuse Pollution and Watershed Management*. John Wiles and Sons.

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

SC DHEC. 2014. "Classified Waters (R. 61-69)." Columbia, SC: Bureau of Water, Includes all amendments through June 22, 2012.

SC DHEC. 1998. "Implementation Plan for Achieving Total Maximum Daily Load Reduction from Nonpoint Sources for the State of South Carolina." http://www.scdhec.gov/HomeAndEnvironment/Water/Stormwater/SCPlanReduceRunoff/.

SC DHEC. 2002. *R. 61-43 Standards for the Permitting of Agricultural Animal Facilities*. Effective June 28, 2002. Columbia, SC. Accessed March 19, 2018. http://www.scdhec.gov/Agency/docs/water-regs/r61-43.pdf.

SC DHEC. 2016. "State of South Carolina Section 303(d) List of Impaired Waters." (SCDHEC Bureau of Water).

—. 2014. "Water Classifications and Standards, R.61-68." Columbia, SC. 65pp.

SC DHEC. 2011. *Water Pollution Control Permits: R61-9*. February. http://www.scdhec.gov/Agency/docs/water-regs/r61-9.pdf.

SC DNR. 2013. Accessed March 23, 2016. http://www.dnr.sc.gov/wildlife/deer/pdf/2013deerdensitymap.pdf.

—. 2013. *Coastal South Carolina Pumpout Stations*. Accessed June 21, 2016. http://www.dnr.sc.gov/marine/vessel/pdf/coastalmaps2013.pdf.

SC DNR. 2013. *South Carolina Deer Density - 2013*. http://www.dnr.sc.gov/wildlife/deer/deermap.html.

SCDHEC. November 2019. "Shellfish Management Area 15 - 2019 Annual Update." Annual Update, Shellfish Sanitation Section, Columbia.

Schill, S. R., and J. R. Jensen. 2000. "Predicting the Impact of Coastal Development on Water Quality Using Remote Sensing and GIS-Assisted Hydrologic Modeling Techniques." *Geocarta International* 15 (4): 7-16.

Siewicki, T. C., W. P. Pullaro, P. S. McDaniel, and G. J. Stewart. 2005. "Models of Total and Presumed Wildlife Sources of Fecal Coliform in Coastal Ponds." *Journal of Environmental Management* 82 (1): 120-132.

The United States Code. 2012. "33 U.S.C. 1322 - Marine Sanitation Devices." *United States Code, 2006 Edition, Supplement 5, Title 33 -Navigation and Navigable Waters*. January 3.

Tuttle, R J, B Oliver, and R McGinnis. 2003. "ProbPlot 3.0." http://www.radprocalculator.com/Probability.aspx.

U.S. Census Bureau. 2012. *2010 Census of Population and Housing. Population and Housing Unit Counts, CPH-2-42, South Carolina*. Washington, DC: U.S. Government Printing Office. Accessed May 15, 2017. https://www.census.gov/prod/cen2010/cph-2-42.pdf.

US Census, Quick Facts. n.d. Accessed 12 27, 2018. https://www.census.gov/quickfacts/fact/table/beaufortcountysouthcarolina,jaspercountysouthcarolina,colletoncountysouthcarolina,sc/INC110217.

US EPA. 1986. *Ambient Water Quality Criteria for Bacteria - 1986*. Vols. EPA440/5-84-002. Prod. Office of Water Regulations and Standards Criteria and Standards Division.

Washington, DC, January. Accessed May 2017. https://www.regulations.gov/document?D=EPA-HQ-OW-2007-0808-0001.

—. 1999. "Draft Guidance for Water Quality-based Decisions: The TMDL Process." Vols. EPA 841-D-99-001. Washington DC: Office of Water, August.

US EPA. 2010. *Evaluation of Improved Type I Marine Sanitation Devices*. Performance Evaluation Report, Office of Research and Development, National Risk Management Research Laboratory - Water Supply and Water Resources Division. http://nepis.epa.gov/Exe/ZyNET.exe/P1007JT5.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&.

US EPA. 1991. *Guidance for Water Quality Based Decisions: The TMDL Process*. Prod. US EPA Office of Water. Washington, DC.

Yagow, G. 2001. "Fecal Coliform TMDL Mountain Run Watershed Culpeper County, Virginia." April.

Yang, L, S Jin, P Danielson, C Homer, L Gass, A Case, C Costello, et al. 2018. "A New Generation of the United States National Land Cover Database: Requirements, Research Priorities, Design, and Implementation Strategies." 108-123.

Yang, L, S Jin, P Danielson, C Homer, L Gass, S Bender, A Case, et al. 2018. "A new generation of the United States National Land Cover Database: Requirements, research priorities, design, and implementation strategies." *ISPRS Journal of Photogrammetry and Remote Sensing*, December: 108-123.

Appendix A – Evaluating the Progress of MS4 Programs

Meeting the Goals of TMDLs and Attaining Water Quality Standards
Bureau of Water
August 2008

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

1. Calculate pollutant load reduction for each best management practice (BMP) deployed:
   - Retrofitting stormwater outlets
   - Creation of green space
   - LID activities (e.g., creation of porous pavements)
   - Creations of riparian buffers
   - Streambank 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 of 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 the stream and/or lake clean-up events or activities
   - Number of environmental action pledges
4. Water quality monitoring: A direct and effective way to evaluate the effectiveness of stormwater management plan activities.

- ➢ Use of data collected from existing monitoring activities (e.g., SCDHEC data for ambient monitoring program available through STORET; water supply intake testing; voluntary watershed group's monitoring, etc)
- ➢ Establish a monitoring program for permitted outfalls and/or waterbodies within MS4 areas as deemed necessary– use a certified lab
- ➢ Monitoring should focus on water quality parameters and locations that would both link pollutant sources and BMPs being implemented

5. Links:

- ➢ Evaluating the Effectiveness of Municipal Stormwater Programs. September 2007. EPA 833-F-07-010
- ➢ The BMP database - http://www.bmpdatabase.org/BMPPerformance.htm (this link is specifically to the BMP performance page, and lot more)
- ➢ EPA's STORET data warehouse - http://www.epa.gov/storet/dw_home.html
- ➢ EPA Region 5: STEPL – Spreadsheet tool for estimating pollutant loads http://it.tetratech-ffx.com/stepl/
- ➢ Measurable goals guidance for Phase II Small MS4 - http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm
- ➢ Environmental indicators for the stormwater program- http://cfpub.epa.gov/npdes/stormwater/measurablegoals/part5.cfm
- ➢ National menu of stormwater best management practices (BMPs) - http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm
- ➢ SCDHEC – BOW: 319 grant program has attempted to calculate the load reductions for the following BMPs:
  - Septic tank repair or replacement
  - Removing livestock from streams (cattle, horses, mules)
  - Livestock fencing
  - Waste Storage Facilities (a.k.a. stacking sheds)
  - Strip cropping
  - Prescribed grazing
  - Critical Area Planting
  - Runoff Management System
  - Waste Management System

- Solids Separation Basin
- Riparian Buffers

Appendix B – Shellfish Data Used for Calculation of the TMDL

Station	SF_Date	FCMPN
17-16A	2/25/2014	170
17-16A	3/18/2014	17
17-16A	5/7/2014	79
17-16A	6/17/2014	2
17-16A	7/8/2014	33
17-16A	8/12/2014	11
17-16A	9/3/2014	23
17-16A	10/7/2014	79
17-16A	11/12/2014	8
17-16A	12/3/2014	49
17-16A	1/9/2015	49
17-16A	2/11/2015	2
17-16A	3/17/2015	49
17-16A	4/7/2015	7
17-16A	5/26/2015	33
17-16A	6/10/2015	110
17-16A	7/20/2015	2
17-16A	8/11/2015	43
17-16A	9/8/2015	220
17-16A	10/7/2015	110
17-16A	11/19/2015	7
17-16A	12/8/2015	79
17-16A	1/14/2016	5
17-16A	2/11/2016	8
17-16A	3/16/2016	5
17-16A	4/6/2016	49
17-16A	5/24/2016	8
17-16A	6/14/2016	70
17-16A	7/27/2016	6
17-16A	8/9/2016	31
17-16A	9/7/2016	33
17-16A	11/8/2016	33
17-16A	12/7/2016	1600
17-16A	1/4/2017	17

Station	SF_Date	FCMPN
17-16	2/25/2014	11
17-16	3/18/2014	5
17-16	5/7/2014	5
17-16	6/17/2014	2
17-16	7/8/2014	33
17-16	8/12/2014	13
17-16	9/3/2014	49
17-16	10/7/2014	79
17-16	11/12/2014	2
17-16	12/3/2014	49
17-16	1/9/2015	14
17-16	2/11/2015	2
17-16	3/17/2015	8
17-16	4/7/2015	2
17-16	5/26/2015	2
17-16	6/10/2015	49
17-16	7/20/2015	2
17-16	8/11/2015	5
17-16	9/8/2015	5
17-16	10/7/2015	130
17-16	11/19/2015	33
17-16	12/8/2015	79
17-16	1/14/2016	2
17-16	2/11/2016	5
17-16	3/16/2016	2
17-16	4/6/2016	4
17-16	5/24/2016	2
17-16	6/14/2016	5
17-16	7/27/2016	2
17-16	8/9/2016	5
17-16	9/7/2016	23
17-16	11/8/2016	2
17-16	12/7/2016	49
17-16	1/4/2017	7

17-16A	3/21/2017	79
17-16A	4/5/2017	79
17-16A	6/14/2017	2
17-16A	7/19/2017	140
17-16A	8/9/2017	2
17-16A	9/6/2017	2
17-16A	10/31/2017	33
17-16A	11/8/2017	5
17-16A	12/6/2017	2
17-16A	1/17/2018	2
17-16A	2/14/2018	33
17-16A	3/28/2018	8
17-16A	4/5/2018	23
17-16A	5/16/2018	2
17-16A	6/13/2018	33
17-16A	7/31/2018	2
17-16A	8/14/2018	2
17-16A	9/5/2018	33
17-16A	10/2/2018	33
17-16A	11/7/2018	31
17-16A	12/5/2018	540
17-16A	1/16/2019	49
17-16A	2/13/2019	23
17-16A	3/5/2019	23
17-16A	4/23/2019	49
17-16A	5/14/2019	70
17-16A	6/10/2019	110
17-16A	7/17/2019	2
17-16A	8/14/2019	7
17-16A	9/10/2019	17
17-16A	10/30/2019	13
17-16A	12/11/2019	5

17-16	3/21/2017	5
17-16	4/5/2017	5
17-16	6/14/2017	2
17-16	7/19/2017	49
17-16	8/9/2017	5
17-16	9/6/2017	2
17-16	10/31/2017	2
17-16	11/8/2017	13
17-16	12/6/2017	2
17-16	1/17/2018	2
17-16	2/14/2018	23
17-16	3/28/2018	8
17-16	4/5/2018	2
17-16	5/16/2018	2
17-16	6/13/2018	33
17-16	7/31/2018	2
17-16	8/14/2018	2
17-16	9/5/2018	23
17-16	10/2/2018	5
17-16	11/7/2018	33
17-16	12/5/2018	130
17-16	1/16/2019	9
17-16	2/13/2019	11
17-16	3/5/2019	5
17-16	4/23/2019	2
17-16	5/14/2019	23
17-16	6/10/2019	23
17-16	7/17/2019	2
17-16	8/14/2019	2
17-16	9/10/2019	2
17-16	10/30/2019	2
17-16	12/11/2019	2

Amendments

The following amendments were made by the Department to the Habersham Creek Fecal Coliform Shellfish TMDL document and associated appendices after the original 30-day public comment period. These amendments were not made as a result of written comments received but may have been the result of an error, omission, or the need for clarification.

Amendment 1) The TMDL document that was on public notice incorrectly identified station 17-16 as 'unimpaired' and as 'boundary station' when in fact this station was included in the EPA approved 2018-303(d) list of impaired waters for exceeding the fecal coliform water quality standard for shellfish harvesting use.

The shellfish harvesting use assessment for the 2018 303(d) list used data from 2014 through the end of 2016. Data through 2019 were used to calculate the TMDL for this station. Improvements in water quality at this site show that no reductions in loading are necessary to meet the water quality standard, despite its inclusion on the 2018 303(d) list.

The TMDL document was amended to reflect that station 17-16 was listed as impaired for shellfish harvesting uses on the 2018 303(d) list but no changes were made to the TMDL calculations or tables.

Amendment 2) During the final review by EPA, a typo was found. In the TMDL tables, 90^{th} %tile concentration for station 17-16 was stated as 7.73 mpn/100 ml. The correct calculated 90^{th} %tile concentration is 35.8 mpn/100ml. This was corrected in the TMDL tables. This error did not have affect on the conclusions or the remainder of the document.