Total Maximum Daily Load
James Island Creek Enterococcus Daily Loads for Stations RT-052098, JIC1 and JIC2 in Hydrologic Unit Codes 030502020202 and 030502010605

Prepared for
SCDHEC Bureau of Water

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November 2019

SCDHEC Technical Document Number: 002-2020

Abstract

James Island Creek is located within City of Charleston and Town of James Island in Charleston County, South Carolina (SC). Total land area draining to James Island Creek is approximately 6.8 mi2. Historically, there was one SC Department of Health and Environmental Control (DHEC) water quality monitoring station, RT-052098, which was monitored in 2005 for fecal coliform. Currently, there are two water quality monitoring stations, JIC1 and JIC2, monitored for enterococcus bacteria by the Charleston Waterkeeper.

For recreational use, if greater than 10% of the monthly geometric mean of available data collected during an assessment period exceeds the criterion, the station is included on South Carolina's 303(d) list. If there are not an adequate number of monthly samples to calculate a geometric mean, then the available sample results are only compared against the single sample maximum (SSM) criterion. If greater than 10% of these samples exceed this criterion then the station is included on South Carolina's 303(d) list due to recreational use. All three stations have been included in the EPA approved 2016 303(d) List and draft 2018 303(d) List of Impaired Waters for exceeding the water quality standard for enterococcus bacteria.

Existing conditions and percent reductions for James Island Creek were calculated using cumulative probability distributions. For stations JIC1 and JIC2, the percent reductions required to meet the SSM enterococcus water quality standard are 74% and 95%, the percent reductions to meet the geometric mean is 82% and 96%, respectively. For SCDOT, existing and future NPDES MS4 permittees, compliance with terms and conditions of their NPDES permit is effective implementation of Wasteload Allocation (WLA) to the Maximum Extent Practicable (MEP) and demonstrates consistency with the assumptions and requirements of the Total Maximum Daily Load (TMDL). For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of its permit is effective implementation of the WLA. Required load reductions in the Load Allocation (LA) portion of this TMDL can be implemented through voluntary measures and are eligible for Clean Water Act (CWA) §319 grants.

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

Table Ab-1. TMDLs for James Island Creek watershed. Loads are expressed as most probable number (MPN) per 100 ml.

Station	90th %tile of Existing Load (MPN/100 ml)	TMDL [1, 2] (MPN/100 ml)	WQ Target (MPN/100 ml)	Margin of Safety (MPN/100 ml)	WLA			LA
					Continuous Sources[3] (MPN/100ml)	Non-Continuous [4, 6] Sources (% Reduction)	Non-Continuous SCDOT [5, 6] (% Reduction)	% Reduction to Meet LA [6]
JIC1	385	104	98.8	4.2	See Note Below	74%	74%	74%
JIC1	**178**	**35**	**33.25**	**1.52**	**See Note Below**	**81%**	**81%**	**81%**
JIC2	2090	104	98.8	4.2	See Note Below	95%	95%	95%
JIC2	**769**	**35**	**33.25**	**1.52**	**See Note Below**	**96%**	**96%**	**96%**

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. SA water WQS = Not to exceed a geometric mean of 35/100 ml over a 30-day period; nor shall a single sample maximum exceed 104 MPN/100 ml
3. WLA is expressed as a daily maximum of 104 MPN/100 ml and a 30-day geometric mean of 35 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 permitted flow and an allowable permitted maximum concentration of 104 MPN/100ml or 30-day geometric mean of 35 MPN/100 ml.
4. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.

5. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address Enterococcus, the SCDOT will comply with these TMDLs and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
6. Percent reduction applies to existing concentration.

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1.0 Introduction

The Federal Clean Water Act (CWA) directs each state to review the quality of its waters every two years to determine if water quality standards are being met. If it is determined that the water quality is not being met, the states are to list the impaired water bodies under §303(d) of the CWA. The area of interest defined in this document includes James Island Creek in Charleston County, South Carolina (Figure 1). South Carolina Department of Health and Environmental Control (SCDHEC) station RT-052098 and two stations monitored by Charleston Waterkeeper (CWK), JIC1 and JIC2, are considered impaired for recreational uses due to elevated *Enterococci* bacteria levels.

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 concentrations 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). TMDLs are required to be developed for each waterbody and pollutant combination on the States' §303(d) lists by 40 CFR 130.7. 2001.

1.1 Background

James Island Creek is in the Sea Islands/Coastal Marsh ecoregion of South Carolina within Charleston County. Generally, Sea Islands/Coastal Marsh ecoregions have the lowest elevations in South Carolina. Environment is highly dynamic and is affected by wind, ocean wave, 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).

Between 2000 and 2010, some of the coastal counties in South Carolina, including Charleston County, has experienced rapid growth and population increases. From 2000 US Population Census to 2010 Census, Charleston County's population increased by 13% to 350,209 and total population for South Carolina increased by 15.3% to 4,625,384 (U.S. Census Bureau 2012).This population growth trend in coastal regions is expected to increase, not just in South Carolina, but also in Georgia and North Carolina as well. The population increase along with development is already impacting coastal resources and

watersheds. Impacts of rapid and often loosely managed growth can drastically alter the quality of life of people living in the Southeast (DeVoe and Kleppel 2006).

Genus *Enterococci* are Gram-positive cocci common in the feces of warm-blooded animals which includes humans. Starting in 1986, US Environmental Protection Agency (EPA) has recommended using *Enterococci* as the indicator organism for fecal contamination and health risk in marine waters (US EPA 1986).

Sources of bacteria are commonly diffuse or nonpoint in nature and may originate from stormwater runoff, failing septic systems, agricultural runoff, leaking sewers, wildlife, pets, birds, etc. Occasionally, the source of the pollutant is a point source, such as wastewater treatment plants, MS4s, etc.

Section §303(d) of the Federal Clean Water Act (CWA) and *Water Quality Planning and Management* Regulations (40 CFR 130.7. 2001) 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 contribution 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 (US EPA 1991).

Table 1. SCDHEC and Charleston Waterkeeper monitoring stations and their location descriptions.

Water Quality Monitoring Stations	Station Descriptions
RT-052098	James Island Creek North of White Hall Plantation
JIC1	James Island Creek 1 – South Side, Center of Harbor View Rd. Bridge
JIC2	James Island Creek 2 – End of Oak Point Drive Dock (Private Access)

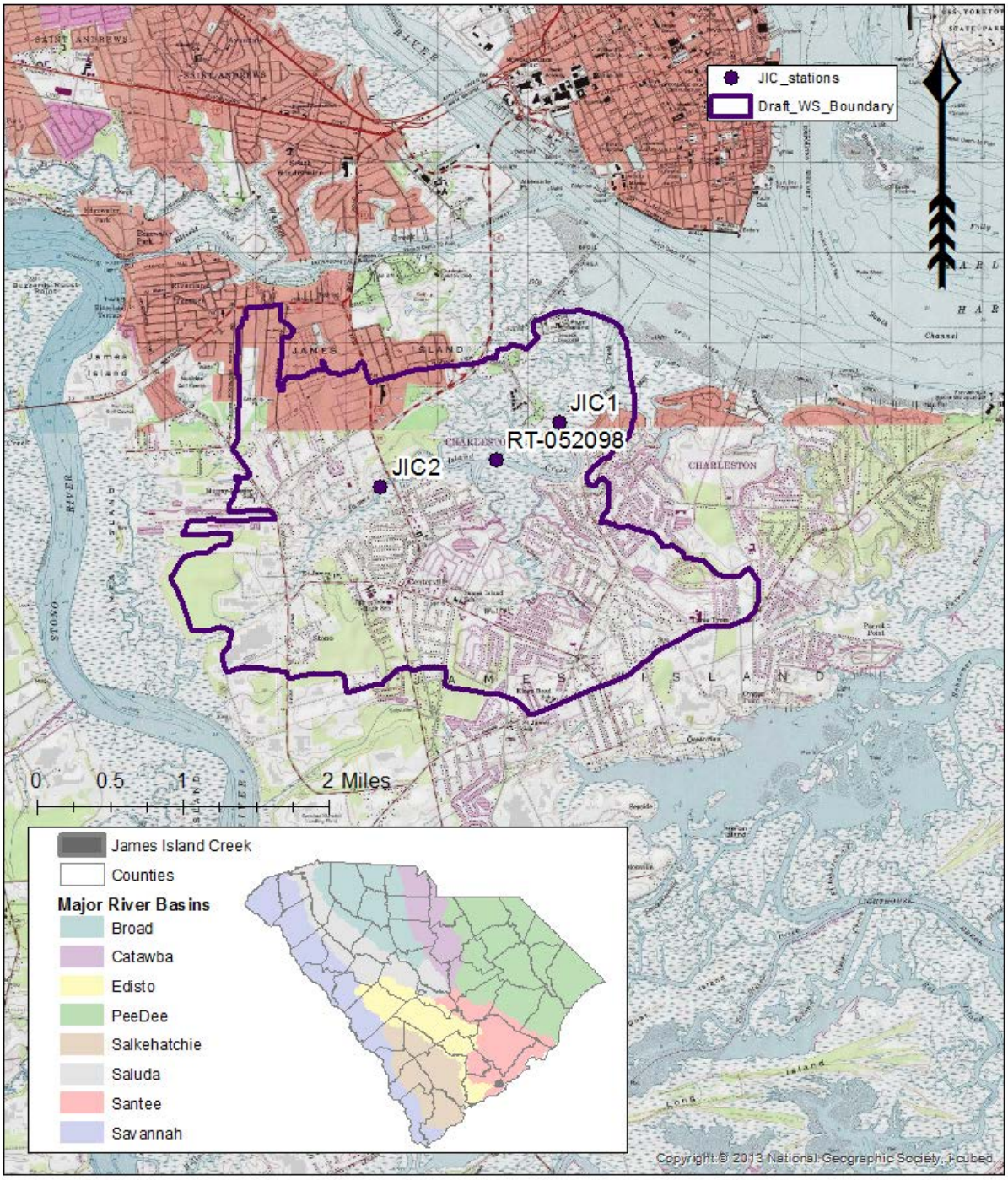


Figure 1. James Island Creek water quality monitoring stations and watershed boundary.

The State of South Carolina has included three monitoring stations in James Island Creek on South Carolina's EPA approved 2016 §303(d) List and draft 2018 303(d) List of Impaired Waters (SC DHEC, 2016) for recreational uses due to exceedances of *Enterococci* bacteria. Because the sites are impaired, a TMDL must be developed for the pollutant of concern.

The goal of this project will be to determine what and where the sources for *Enterococci* potentially are and calculate reductions that will meet the applicable water quality standard.

All three stations covered in this TMDL document are identified and shown on Figure 1 and Table 1.

1.2 Watershed Description

James Island Creek TMDL watershed is in Town of James Island and City of Charleston in Charleston County, South Carolina. The TMDL watershed is encompassed within two 12-digit hydrologic unit codes (HUC) 030502010605 which is the Lower Ashley River portion of the larger Santee River basin, and 030502020202 which is the Stono River-Atlantic Intracoastal Waterway.

James Island Creek watershed was delineated in collaboration with City of Charleston, Town of James Island, Charleston County, and with input from Charleston Waterkeeper. A draft watershed boundary was identified by the department based on topography, digital elevation models (DEM), satellite imagery, various GIS layers provided by the MS4s, such as outfall locations, in the watershed. Areas with questionable flow patterns were ground truthed during site visits, and the City of Charleston stormwater manager and the City's GIS group helped refine the final watershed boundary based on local data. Concurrence on the final watershed boundary was sought and received from all MS4s and the waterkeeper. Finalized watershed boundary has a drainage area of 6.8 mi2 and is shown on Figure 1.

James Island Creek is an urban tidal stream situated to the southwest of Charleston Harbor, SC. Creek is approximately 600 feet wide at its entrance from Charleston Harbor and tapers to less than 1 foot near James Island County Park, with an average tidal range of approximately 5 feet.

Currently, there are two active stations in James Island Creek that are being monitored by Charleston Waterkeeper. Station JIC1 is sampled from south side of Harbor View Road, where the creek is approximately 400 feet wide and approximately 0.9 miles upstream from the confluence with Charleston Harbor (Figure 2). From June 2013 to October 2018, there were 143 samples collected and analyzed from this station, where 57% of the samples exceeded SSM WQS of 104 MPN/100 ml, while 96% of the samples exceeded the calculated geometric mean WQS of 35 MPN/100 ml. Sample range is 10 – 2489 MPN/100 ml.

Figure 2. North side of Harbor View Road, vicinity of station JIC1, where is creek is named as James Island Creek.

Station JIC2 is sampled from a private dock upstream from Folly Road. At this location, depending on tidal stage, the creek is approximately 80 feet wide and is 2.9 miles upstream from confluence with Charleston Harbor (Figure 3). During the same sampling period, 2013-2018, 142 samples were collected and analyzed from this station. Of the 142 samples collected and analyzed from JIC2, 88% of the samples exceed the WQS of 104 MPN/100 ml, while calculated geometric mean was exceeded 100% of the time. Samples range was 10 – 24196 MPN/100 ml.

Figure 3. Downstream of Folly Road, vicinity of station JIC2, where the creek is named as Ellis Creek.

United States Geological Survey topographic maps labels the creek as "James Island Creek" in its entirety but the creek is also known as Ellis and Newtown Cut creeks by the residents. Over Harbor View Road it is "James Island Creek" (Figure 2) and over Folly Road "Ellis Creek" (Figure 3). Portion of the creek to the southwest of Riverland Drive towards Stono River is named as Newtown Cut Creek (Bostick 2018). This TMDL document will refer to this waterbody as "James Island Creek".

Based on historical accounts by Douglas Bostick (Personal communication, 2018), during colonial times James Island Creek was a connector creek between Stono River and Charleston Harbor. Per Mr. Bostick, the creek was navigable and used for ferrying farm goods from Johns Island to Charleston.

To determine current connectivity status of the creek between the Stono River and Charleston Harbor, two drone missions were flown on January 25, 2018. Both flights were flown off of James Island Parkway before entrance to James Island County Park. In this

vicinity, the creek is known as Newtown Cut. First flight was flown in the morning during slack low tide conditions. The purpose of the low tide flight was to determine if there is a clear, visible channel indicating James Island Creek is connecting Charleston Harbor and the Stono River.

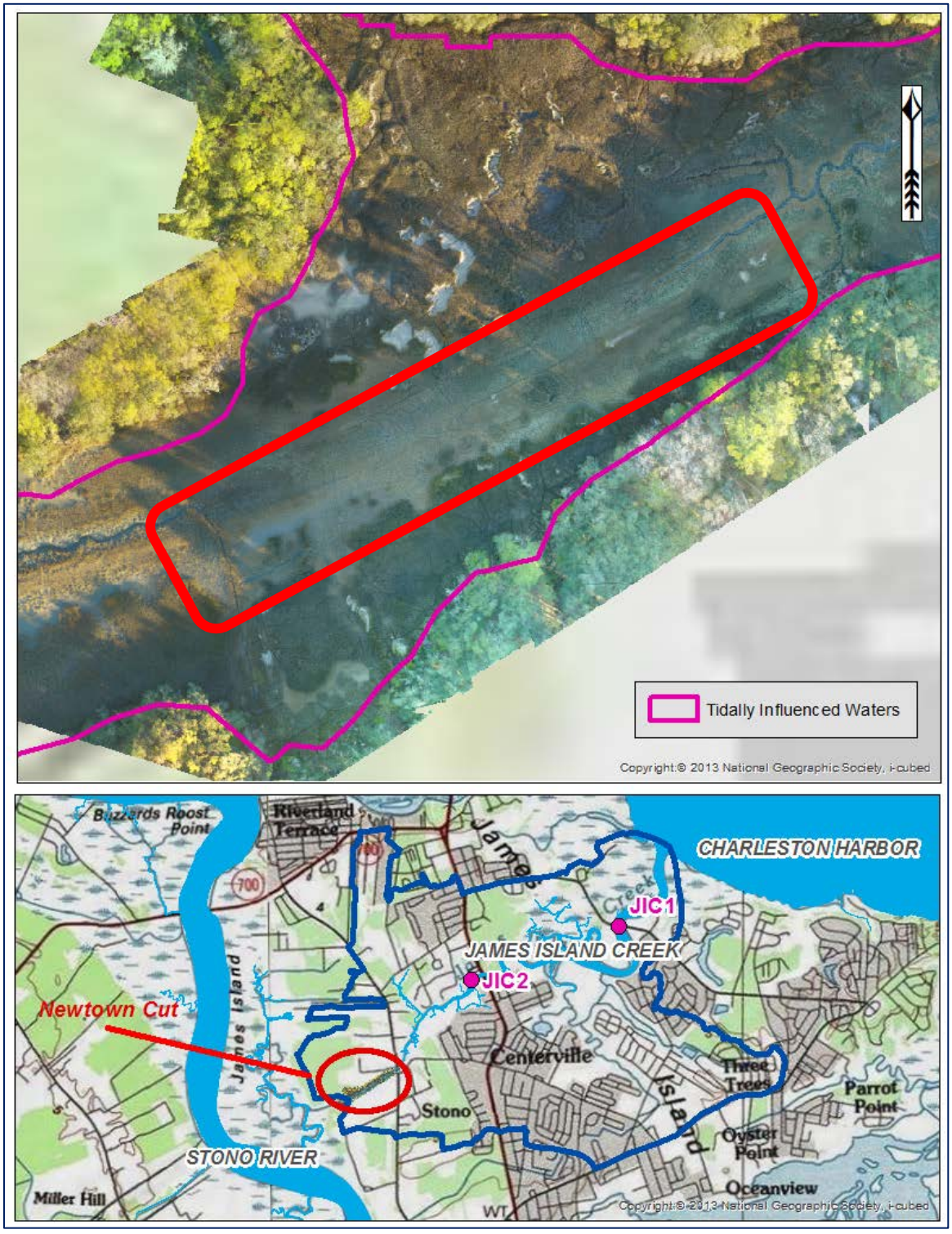


Figure 4. Map on the bottom shows the James Island Creek and its watershed boundary. Orthomosaic image at the top shows Newtown Cut portion of James Island Creek, to the southeast of the James Island County Park.

Based on orthomosaiced imagery, Figure 4, Newtown Cut and James Island/Ellis Creek channels are visible during low tide. However, there is not a clear, incised channel connecting Newtown Cut and James Island/Ellis Creek (Please see the area within the red rectangle on Figure 4. Therefore, it can be concluded that, under current conditions, Stono River and Charleston Harbor are not connected. The second mission was flown in the afternoon, during slack high tide conditions to determine whether water was flowing through the creek and connecting the Harbor and the Stono River. However, due to gusting winds, reduced flight altitude of the drone, and due to flight activity at the nearby Charleston Executive Airport, the mission was aborted, and results were inconclusive.

1.2 Landuse

Landuse within James Island Creek TMDL area was calculated using National Land Cover Database (NLCD) 2011 (Homer, et al. 2015). The results based on landuse characteristics are summarized on Table 2. Figure 6 shows the NLCD 2011 landuse within James Island Creek watershed. Based on NLCD 2011, primary landuse within the TMDL area is urban (3.3 mi2) followed by forested and non-forested wetlands (1.8 mi2). Based on NLCD 2011, the James Island Creek watershed is 47.7% developed and 12.2% impervious.

Table 2. James Island Creek landuse based on NLCD 2011

Landuse	Area (mi2)	Percent of Area (%)
Open Water	0.1	2.1
Urban	3.3	47.7
Barren	0.01	0.1
Forest	1.6	22.9
Pasture/Hay	0.1	1.5
Forested and non-forested Wetlands	1.8	25.7
Total	6.8 mi2	100%

1.4 Water Quality Standard

James Island Creek is classified as Class SA waters in SC Regulation 61-69 (SC DHEC 2014). Class SA waters are defined in SC Regulation 61-68 (SC DHEC 2014) as:
"Class SA are tidal saltwaters suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes

or human consumption and uses listed in Class SB. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora."

Enterococci standard for Class SA waters (SC DHEC 2014):
"Not to exceed a geometric mean of 35/100 ml based on at least four samples collected from a given sampling site over a 30-day period; nor shall a single sample maximum exceed 104/100 ml. Additionally, for beach monitoring and notification activities for CWA Section 406 only, samples shall not exceed a single sample maximum of 104/100 ml."

2.0 Water Quality Assessment

In 1986, the USEPA documented that *E. coli* and *Enterococci* bacteria are better indicators than FC bacteria group in predicting the presence of human gastroenteritis (upset stomach, nausea, diarrhea, vomiting) causing pathogenic bacteria in fresh and marine recreational waters. The USEPA study was based on data collected when swimmers were directly exposed in freshwater lakes with established public swimming areas. In almost all cases of water-borne illnesses, pathogens come from inadequately treated waste of humans or other warm-blooded animals. Also, *Enterococci* and *E. coli* are more specific to sewage and fecal sources than the FC bacteria group. In light of this information, USEPA has recommended the use of *E. coli* for fresh waters and *Enterococci* for marine water as the pathogen indicators.

In order to determine which pathogen indicator bacteria is better suited in South Carolina as the recreational use water quality standard in fresh and salt waters, the SCDHEC designed, and conducted a Pathogen Indicator Study (PIS) during 2009. Weekly water samples were collected from 73 stations statewide and analyzed for *E. coli, Enterococci* and for FC bacteria group. PIS results showed *Enterococci* is a better indicator for predicting the presence of pathogens and assessing recreational uses in South Carolina salt waters.

During 2012 and following the public participation, public comment period and legislative processes, the SDHEC submitted a proposed amendment to EPA to change the pathogen indicator from FC bacteria to *Enterococci* in R. 61-68. The proposed amendment was approved by the USEPA on February 28, 2013 and *Enterococci* has been promulgated in R. 61-68. *Enterococci* is the applicable water quality standard indicator for recreational use in salt waters.

Charleston Waterkeeper (CWK), based in Charleston, South Carolina is an organization whose mission is "to protect, promote, and restore the quality of Charleston's waterways…" (http://charlestonwaterkeeper.org/). The organization has a DHEC approved Quality

Assurance Project Plan (QAPP) and has been collecting water samples since 2013. Weekly water samples are collected May through October, from approximately 15 stations from recreational marine waters around Charleston. Samples are collected from each station in pre-sterilized 120 ml bottles (Figure 5). Samples are analyzed for Enterococci according to Enterolert assay (Figure 7).

Locations sampled by the CWK include waters with heavy recreational uses such as swimming, kayaking, stand-up paddling, canoeing, etc. James Island Creek is one of the tidal streams monitored by the Waterkeeper. The Waterkeeper collects samples from two stations within James Island Creek which are identified in Table 1. Data collected by the Waterkeeper is available through their website, available at: http://charlestonwaterkeeper.org/what-we-do/programs/water-quality-monitoring/

Image, courtesy of Cheryl Carmack, Charleston Waterkeeper.

Figure 5. August 30, 2017 sample collected by Cheryl Carmack from station JIC2.

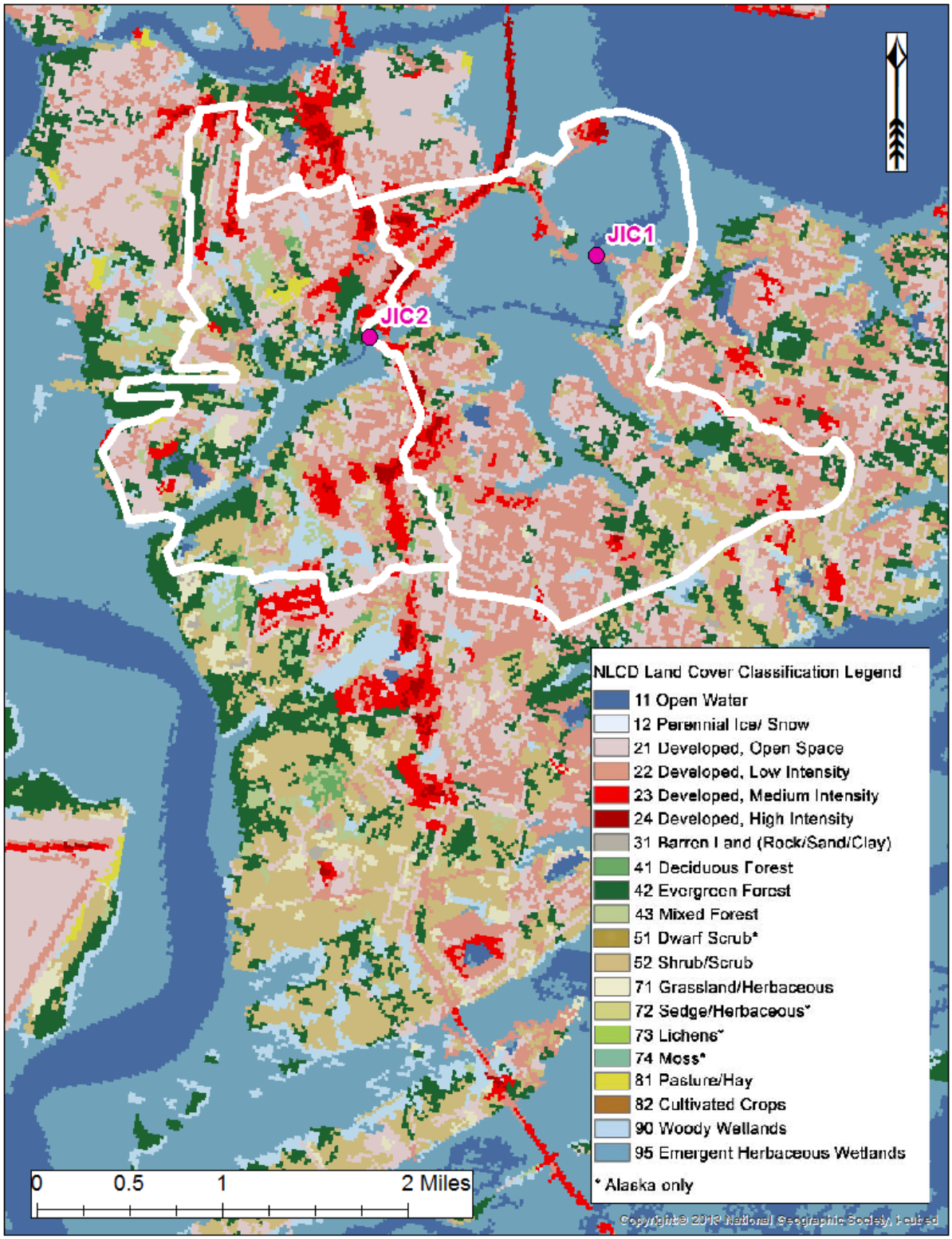
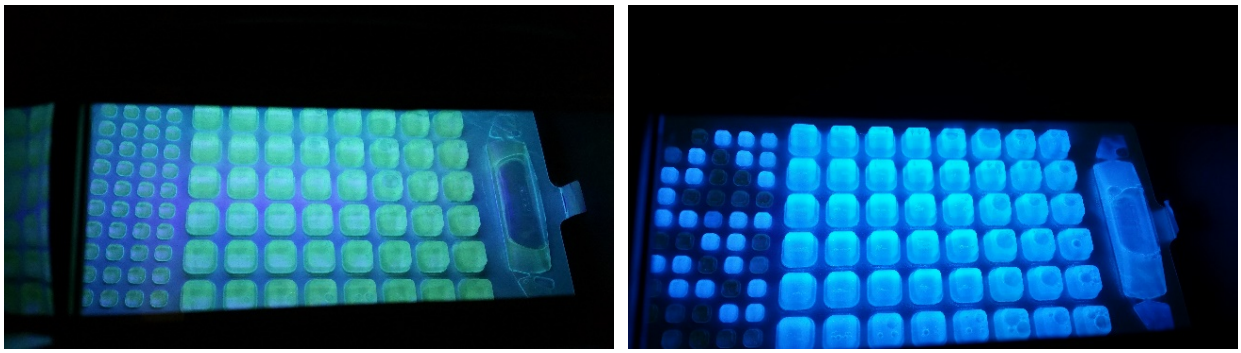


Figure 6. Landuse characteristics of James Island Creek watershed and the surrounding area.

3.0 Source Assessment

Pathogens, which are usually difficult to detect, cause disease and make full body contact recreation in lakes, streams a risk to public health. Indicators such as FC bacteria, *Enterococci*, 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.



Image, courtesy of Cheryl Carmack, Charleston Waterkeeper.

Figure 7. Results of sample collected from JIC2 on August 30, 2017 (Figure 5) is shown on the right. The analysis results indicated there were 7270 MPN/100 ml Enterococcus in the sample. On the left is the "blank control" tray with 0 MPN/100 ml.

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

Non-continuous point sources required to obtain NPDES permits include stormwater discharges from municipal separate storm sewer systems (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 through compliance with the terms and conditions of their permit.

3.1 Point Sources

3.1.1 Continuous Point Sources

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

Currently, there are no continuous NPDES-permitted discharges to James Island Creek with an *Enterococci* effluent limit on their NPDES permit. Future NPDES dischargers of enterococcus in James Island 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.

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/or regulated under *South Carolina 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 *Enterococci* pollutant loading in the delineated drainage area used in the development of this TMDL.

The South Carolina Department of Transportation (SCDOT) is a designated MS4 within James Island Creek 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.

Individual landuses for the two CWK stations included in this TMDL document were calculated utilizing NLCD 2011 and a Geographic Information System (GIS) tool and are summarized in by each landuse category. Total developed landuse for JIC1 and JIC2 is 46.3% and 49.9% of their total drainage area, respectively. Based on current GIS information

available at the time of TMDL development, there are no SCDOT facilities located within these referenced watersheds.

Other than SCDOT, there are three additional permitted stormwater systems in this watershed: Charleston County (SCR0319020), City of Charleston (SCR031901) and Town of James Island (SCR031910). Future permitted sanitary sewer or stormwater systems in the referenced watershed are required to comply with the load reductions prescribed in the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

Table 3, below, shows the total contributing areas (acres) of each MS4 within the James Island Creek watershed, which is 3795.2 acres, or 5.9 mi^2. Within James Island Creek TMDL watershed, there are areas without a designated MS4. Total area of James Island Creek TMDL watershed is 6.8 mi^2, compared to 5.9 mi^2 of designated MS4 areas (Figure 12).

Table 3. MS4s within James Island Creek TMDL watershed and their total contributing areas (ac) by station.

	Charleston County acres	City of Charleston acres	Town of James Island acres	SC DOT acre
JIC1	54.9	1335.2	921.2	101.5
JIC2	240.5	754.9	285.8	101.2
Total	3795.2 ac (5.9 mi^2)			

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 SCDHEC (SCR100000). Where the construction has 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 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.

Similar to regulated MS4s, potentially designated MS4 entities or other unregulated MS4 communities located in these watersheds may have the potential to contribute *Enterococci* bacteria in stormwater runoff. These unregulated entities are subject to the LA for the purposes of these TMDLs.

Sanitary sewer overflows to surface waters have the potential to impact water quality. These untreated sanitary discharges may 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. Based on the Department's record, there have not been any reported SSOs in James Island Creek watershed since December 29, 2011. SSOs in James Island Creek may be underreported.

On James Island, water and sewer utilities are not included under the same organization and customers are billed separately. In some cases, this situation can lead to disconnection of sewer service for nonpayment while water service continues as long as the water bill is current. When this happens, untreated sewage may be discharged directly to the land surface. This is a human health concern as well as an environmental issue and is a potential source of pollution to nearby waters.

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 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.

Nonpoint source pollution is a likely contributing factor to negatively impact water quality in these watersheds. 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 James Island 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 no permitted CAFOs in South Carolina. Currently, there are no regulated agricultural operations within the TMDL 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 James Island Creek 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 Enterococcus 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 James Island Creek. 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 James Island Creek watershed.

3.2.3 Urban and Suburban Stormwater Runoff

There are 'urban' wildlife such as resident waterfowl, squirrels, rodents, raccoons, geese and other birds, all of which can contribute to the bacteria load. Urban runoff is considered to be significant within James Island Creek TMDL watershed.

Other contributors to the *Enterococci* loading to streams, estuaries, and lakes are the household cats and dogs as well as other domesticated animals such as horses, chickens,

pigs and others. One study found cat feces can contain between $3.3x10^4$ to $4.1x10^7$ MPN/g (wet), and dog feces between $8.4x10^6$ to $1.2x10^8$ MPN/g (wet) of fecal indicator bacteria (Cox, et al., 2005). U.S. Pet Ownership Statistics show 28% of households' own dogs and 23% own cats (American Veterinary Medical Association, 2014). Based on the 2010 US Population Census, there are approximately 7961 households with a population of 15962 within James Island Creek watershed. Based on these statistics, there are approximately 3585 dogs and 3917 cats within James Island Creek TMDL watersheds. American Veterinary Medical Association Pet Ownership Calculator is available at: https://www.avma.org/KB/Resources/Statistics/Pages/US-pet-ownership-calculator.aspx

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 James Island Creek watershed may have the potential to contribute bacteria in stormwater runoff.

3.2.4 Failing Septic Systems

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

A preliminary analysis was done, using older GIS data, to calculate the potential number of septic tanks within the James Island Creek watershed. Analysis results showed that close to 40% of the households were using septic tanks. Because this number seemed to be high, the MS4s and CWK has have requested from DHEC to calculate and determine the numbers as well as locations of septic tanks within the watershed.

An internal DHEC database of permitted septic tanks and addresses were obtained. The database consists of two separate date intervals:

- Legacy data between 1969 and to the beginning of April 2006
- Newer data starting with second week of April 2006 to February 1st, 2018

Three GIS layers were created using the DHEC database as well as the Charleston County parcel layers. Utilizing the septic database and county database, three shapefiles were created:

1. New Septics: 2013 to 2017. New permits have been issued from 2006 to 2012, however these new permitted septics are not within the JIC watershed.
2. Legacy Septics: 1969 to 2006

3. Pre- 1969

The pre-1969 layer was created using aerial imagery and street views from Google Earth and Bing Maps, main sewer lines, parcel data, and real estate websites such as Realtor.com and Zillow.com. Aerial imagery (Google Maps, Bing Maps) and their street views were used to look for visible signs of septic failure, such as visible drain lines, out of season lush green ground cover, etc. The real estate websites were also used to determine the approximate age of homes in older neighborhoods and whether there is information on septic or sewer service. In the case of lots for sale, same information was used to determine the availability of sewer service.

Results of this analysis is summarized on
Table 4, and locations are shown in Figure 10, below. Note that overall number of septic tanks within James Island Creek is approximately 860. However, when these approximate number of septic tanks are categorized by the responsible MS4s, the total number is greater than 860. This is due to some parcels straddling more than one MS4, therefore are being counted more than once. Based on the 2010 US Census results, there are approximately 7961 housing units with a population of 15,962. Of these housing units, approximately 10.8% are using septic tanks. Results of this analysis has been shared with the MS4s during the drafting phase of this document.

Table 4. Approximate number of septic tank currently in use, and their distribution by designated MS4, and overall James Island Creek watershed.

MS4	Area of MS4 mi^2 (%)	Pre- 1969 # of Septic Tanks	1969-2007 # of Septic Tanks	2013-2017 # of Septic Tanks	Total # of Septic Tanks
Charleston County	0.5 (8.5)	186	7	2	195
City of Charleston	3.4 (57.6)	436	25	5	466
Town of James Island	2.0 (33.9)	377	47	8	432
James Island Creek Watershed		792	60	8	860

SCDOT is not a conventional MS4, therefor is not included in the table above.

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 significant source of Enterococcus in James Island Creek watershed. SCDNR's 2013 deer density study indicate there are approximately 15 to 30 deer per square mile in the vicinity of James Island Creek TMDL area (SC DNR 2013). The study estimated deer density based on suitable habitat 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 James Island Creek watershed however there are numerous private docks along the 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 (United States Code 2012). Properly-maintained MSDs should not be causing or contributing to bacteria exceedances in James Island Creek. It is prohibited under Federal law to discharge untreated sewer from vessels within navigable waters as stated in Clean Vessel Act.

3.2.7 Summary of Potential Sources of Bacteria in James Island Creek Watershed

There are many sources of bacteria and numerous paths of entry into the waterways. Some of these sources and pathways are:

1. Malfunctioning septic tanks
2. Homeless camp located near the intersection of Folly and Oak Point roads
3. Pet Waste
4. Sanitary sewer overflows
5. Utility disconnecting sewer lines
6. Stormwater runoff
7. Illicit discharges

Enterococci SSM (104/100 ml) results from stations JIC1 and JIC2 were compared to cumulative 24, 48, 72, 96-hour precipitation to determine under which conditions WQS was meeting or exceeding. CWK collects samples on Wednesdays, May through October.

Interpolated precipitation data for each station was obtained from PRISM Climate Group (http://prism.oregonstate.edu/), and cumulative totals were calculated for both stations.

Cumulative 24-hour precipitation represents total amount of rain that fell over the area draining to a station from 8 am Tuesday morning to 8 am Wednesday morning which is the sampling day. Similarly, 48-hour total precipitation would be from 8 am Monday morning to 8 am Wednesday morning.

Majority of the samples collected from JIC1 are meeting the WQS when there has not been any precipitation for 24, 48, and 72-hours (dry conditions), while exceeding the WQS after 96-hours of cumulative precipitation. As mentioned above, in the vicinity of station JIC1, width of the creek is approximately 400 ft, 0.9 miles upstream from Charleston Harbor, and has large expanse of marsh area to the south, west, and north of the station (Figure 8). These conditions are suitable to provide tidal exchange due to the width of creek and proximity to Charleston Harbor, as well as pollutant filtering by the surrounding marshes.

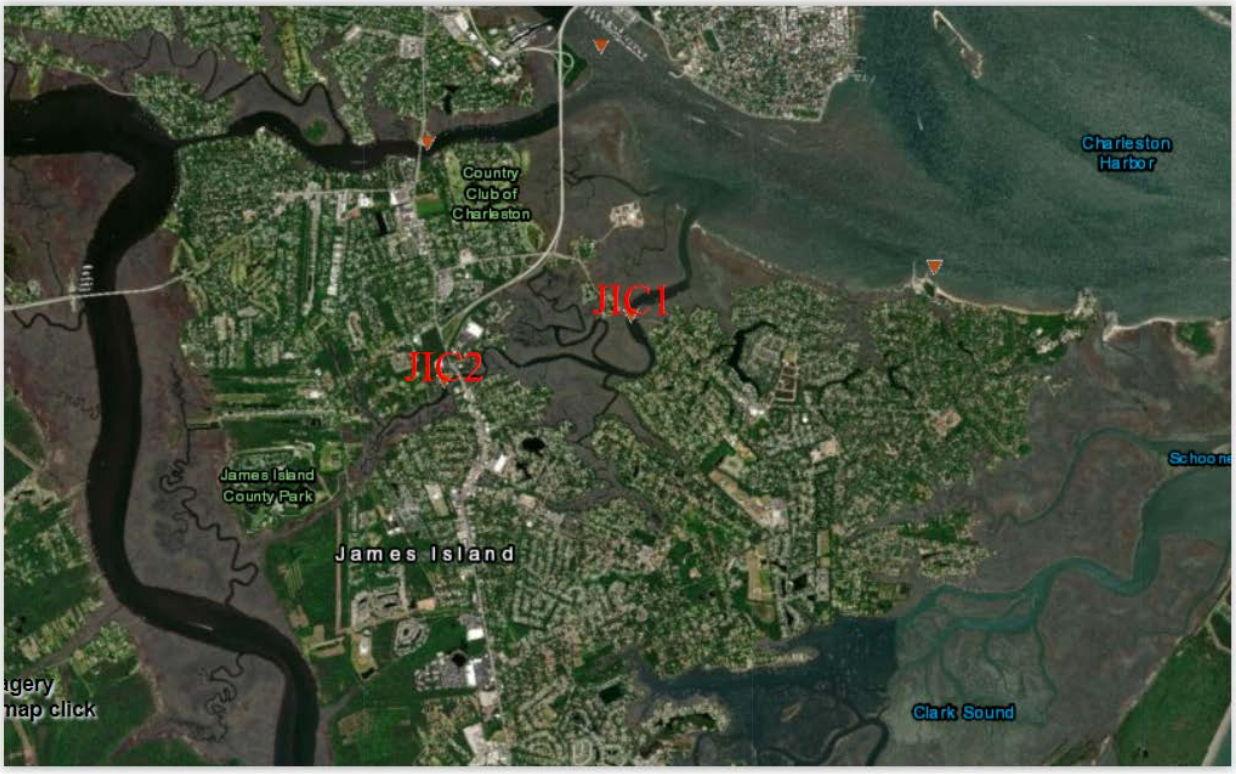


Figure 8. Locations of stations JIC1 and JIC2.

Enterococcus sample results collected from JIC2 were analyzed using the same cumulative precipitation intervals, 24, 48, 72, and 96-hours. Analysis results show station JIC2 is not meeting the WQS when there has been no precipitation for up to 72-hours, dry conditions. As previously mentioned, creek is narrower and approximately 2.9 miles upstream from

Charleston Harbor. This may be an indication of constant sources of bacteria entering this portion of James Island Creek during dry conditions, limited tidal exchange, and developed landuse. Analysis results for both stations are summarized on

Table 5.

Table 5. Comparison of total precipitation with bacteria sampling results from stations JIC1 and JIC2 (2013-2018).

JIC1 n=142	Zero precipitation: # of samples (%) **meeting** WQ	Zero precipitation: # of samples (%) **not** meeting WQ	0.11 to 10.8 inches of precipitation: # of samples (%) **meeting** WQ	0.11 to 10.8 inches of precipitation: # of samples (%) **not** meeting WQ
24 hours	**71 (50%)**	41 (28.9%)	10 (7%)	20 (14.1%)
48 hours	**60 (42.3%)**	28 (19.7%)	21 (14.8%)	33 (23.2%)
72 hours	**52 (36.6%)**	25 (17.6%)	29 (20.4%)	36 (25.4%)
96 hours	39 (27.5%)	15 (10.6%)	42 (29.6%)	**46 (32.4%)**

JIC2 n=142	Zero precipitation: # of samples (%) **meeting** WQ	Zero precipitation: # of samples (%) **not** meeting WQ	0.11 to 10.8 inches of precipitation: # of samples (%) **meeting** WQ	0.11 to 10.8 inches of precipitation: # of samples (%) **not** meeting WQ
24 hours	17 (12%)	**95 (66.9%)**	0 (0%)	30 (21.1%)
48 hours	16 (11.3%)	**72 (50.7%)**	1 (0.7%)	53 (37.3%)
72 hours	14 (9.8%)	**63 (44.4%)**	3 (2.1%)	62 (43.7%)
96 hours	12 (8.5%)	43 (30.3%)	5 (3.5%)	**82 (57.7%)**

4.0 Cumulative Probability Method

Cumulative probability distributions were used to calculate existing conditions and percent reductions necessary to meet recreational saltwater water quality standards for enterococcus in James Island Creek TMDL watershed. For the calculations of the cumulative probability distributions, data collected by Charleston Waterkeeper from 2013 through 2017 were used. DHEC station RS-052098, a statistical survey or random sampling site, was sampled for fecal coliform for one year during 2005. Because enterococcus is the applicable recreational use water quality indicator and more recent data have been collected at JIC1 and JIC2 in the watershed, the Department believes that the historical fecal coliform data collected at RT-052098 are less representative of current condition in the watershed. The calculated reductions for JIC1 and JIC2 are expected to address the current recreational use water quality standard at RT-052098.

For the calculations of the cumulative probability distributions, data collected by Charleston Waterkeeper from 2013 through 2018 were used. Enterococcus results for stations JIC1and JIC2 were separated into Excel spreadsheets, and were sorted by date, older to newer, from 2013 to 2018. Geometric mean of first 30-days of Enterococcus data from 2013 was calculated. Then, geometric mean of the next 30-days of data were calculated, and continued calculations for 2013. Same procedure was repeated for each station and year. An example calculation is shown on Figure 9.

After the calculations, cumulative probabilities for each station was plotted using Cumulative Probability Plot 3.0 (Tuttle, Oliver and McGinnis 2003). Log transformed geometric means are copied into the program. The program sorts the log transformed data in ascending order to determine rank and then assigns 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 Enterococci 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 Class SA waters in South Carolina, the TMDL target equates to a geometric mean of 35 MPN/100 ml minus a 5% margin of safety (33.25 MPN/100ml), and SSM of 104 MPN/100ml minus a 5% margin of safety (98.8 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 geometric means and SSMs. If the line crosses below the standard reference the site does meet the water quality standard. If the data does not meet the geometric mean or 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:

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

Station	2013 Date	Result	Geomean
JIC2	7/10	1014	Data on the left column was used to calculate geometric mean shown below
JIC2	7/17	538	
JIC2	7/24	171	
JIC2	7/31	616	
JIC2	8/7	94	
	1st 30-day period (above)		**351.97**
JIC2	8/14	370	Data on the left column was used to calculate geometric mean shown below
JIC2	8/21	168	
JIC2	8/28	440	
JIC2	9/4	500	
JIC2	9/11	540	
	2nd 30-day period (above)		**374.68**
JIC2	9/18	160	Data on the left column was used to calculate geometric mean shown below
JIC2	9/25	909	
JIC2	10/2	299	
JIC2	10/9	633	
JIC2	10/16	317	
	3rd 30-day period (above)		**387.40**
JIC2	10/23	573	Data not used
JIC2	10/30	990	Data not used

Figure 9. Example of data used for calculating the Enterococcus geometric means for 2013. **Bold** indicates geometric mean is exceeding the water quality standard.

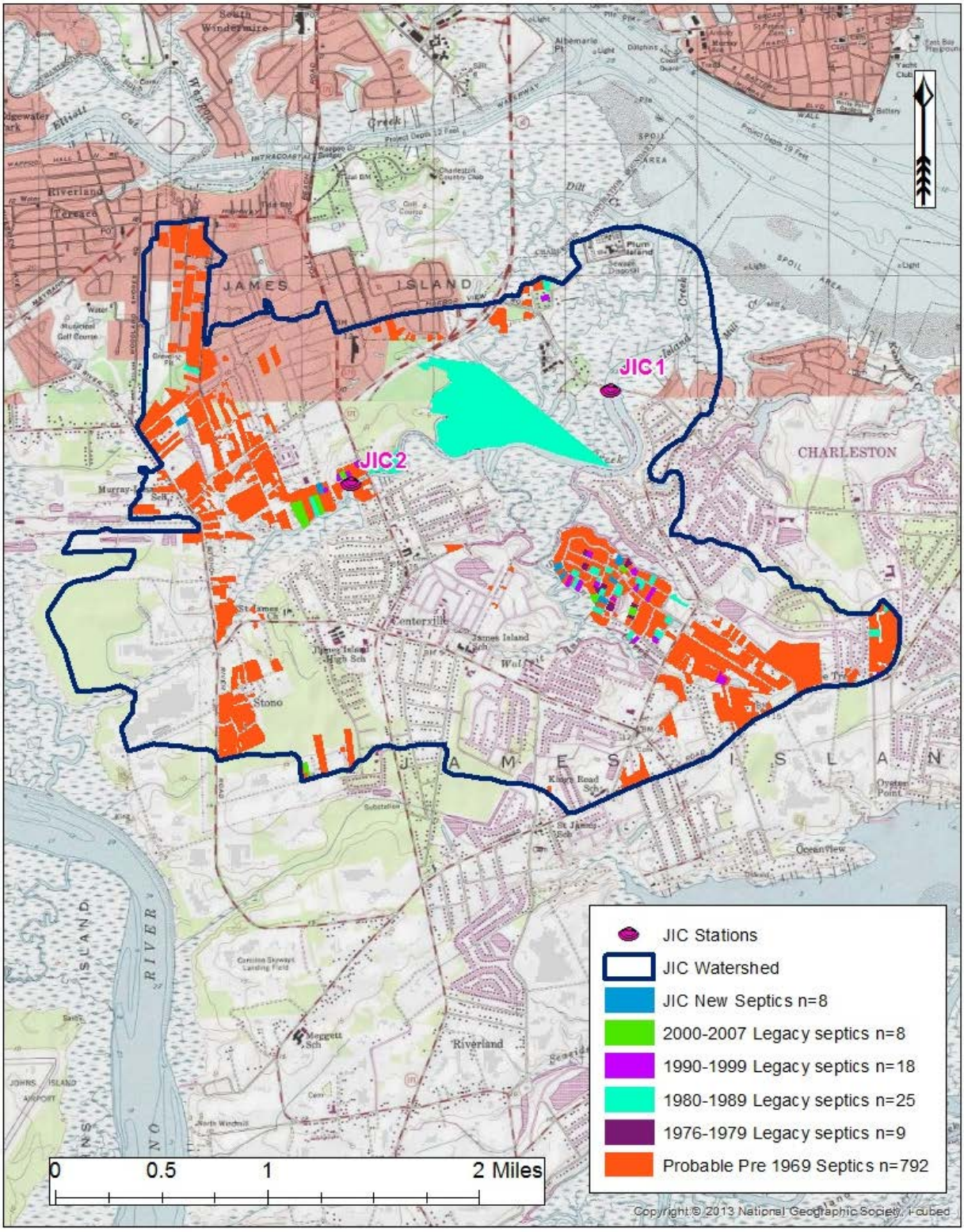
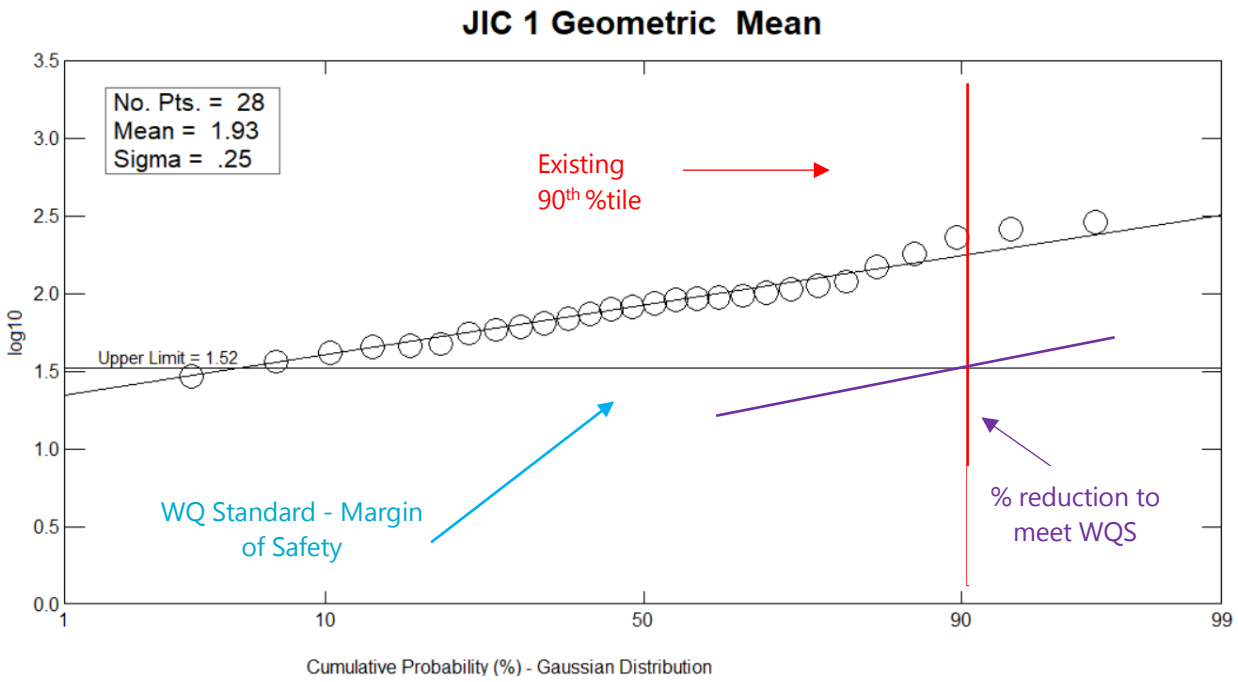


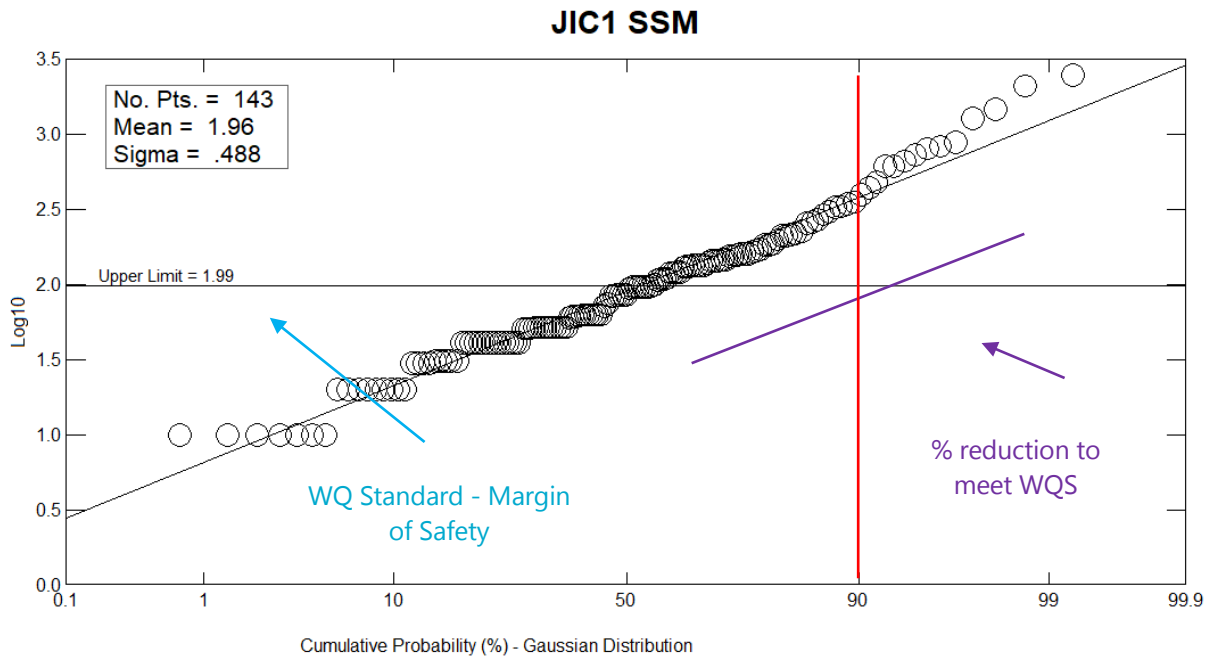
Figure 10. Locations of potential septic tanks within James Island Creek watershed, sub divided by installation date.

There are no stations that currently exceed the geometric mean criteria that do not also exceed the single standard sample. Figure 11. Geometric mean and SSM cumulative propability graphs for stations JIC1 and JIC2.

 shows the geometric mean and SSM cumulative probability graph for stations JIC1 and JIC2.

If sufficient approximations of tidal exchange and flow patterns were available, this method could be extended to calculate the total maximum daily *Enterococci* loading in MPN/day for locations within the watershed. Average daily tidal exchange would be multiplied by the water quality standard of 104 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 is not sufficient data to calculate the loadings for each station which is a limitation of this method.


JIC 1 Geometric Mean
No. Pts. = 28
Mean = 1.93
Sigma = .25
Existing
90th %tile
Upper Limit = 1.52
log10
WQ Standard - Margin of Safety
% reduction to meet WQS
Cumulative Probability (%) - Gaussian Distribution


JIC1 SSM
No. Pts. = 143
Mean = 1.96
Sigma = .488
Upper Limit = 1.99
Log10
WQ Standard - Margin of Safety
% reduction to meet WQS
Cumulative Probability (%) - Gaussian Distribution

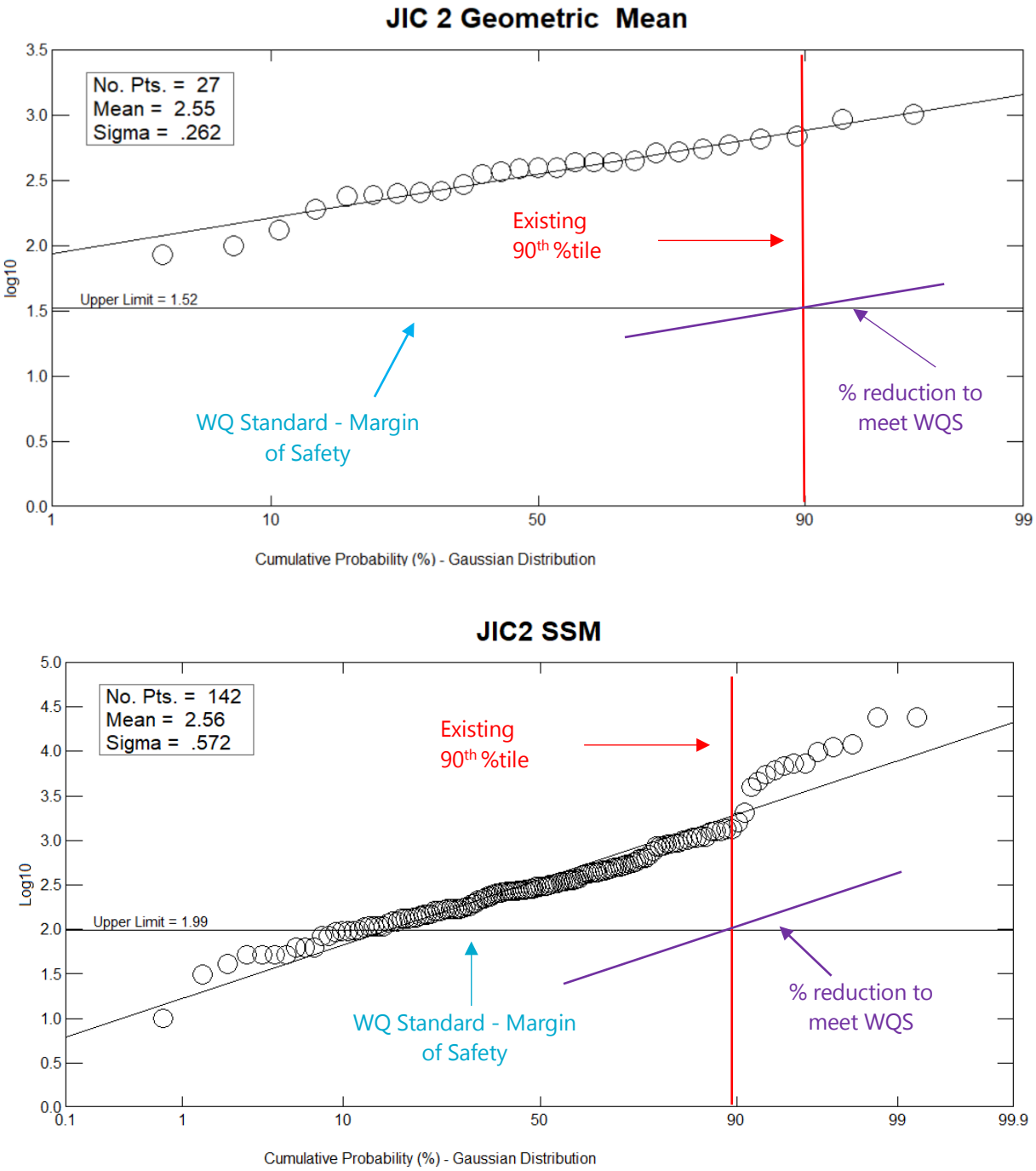


Figure 11. Geometric mean and SSM cumulative propability graphs for stations JIC1 and JIC2.

5.0 Development of the TMDLs

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

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

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

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

5.1 Applicable Water Quality Standards

James Island Creek is classified as Class SA tidal waters. In Regulation 61-68, enterococci water quality standard for SA waters is as follows: "Not to exceed a geometric mean of 35/100 ml based on at least four samples collected from a given sampling site over a 30 day period; nor shall a single sample maximum exceed 104/100 ml. Additionally, for beach monitoring and notification activities for CWA Section 406 only, samples shall not exceed a single sample maximum of 104/100 ml".

Percent reductions applicable to stations JIC1 and JIC2 are summarized in Table 6 below. For station JIC1, there is an 8% difference between SSM and geometric mean criteria. Geometric mean and SSM percent reductions are essentially same for station JIC2.

As previously mentioned, the Charleston Waterkeeper has been collecting weekly samples during the months May through October since summer of 2013. In most cases, the Department does not have sufficient data to calculate geometric means and determine if a station is meeting the geometric mean criterion. Instead, TMDLs normally only target the SSM criterion.
In the case of James Island Creek, there are sufficient weekly samples collected to allow for geometric mean calculations. Table 7 in Section 5 includes TMDLs that address both the

SSM and geometric mean criteria. The percent reductions required to meet geometric mean TMDLs are higher than the percent reductions to meet the SSM TMDLs; therefore, the target percent reductions for James Island Creek stations are based on meeting the geometric mean TMDLs.

James Island Creek must meet both enterococci criteria in order to attain water quality standards. It is expected that achieving the larger of the two percent reductions, and/or meeting the recreational use criteria at the point of entering James Island Creek will result in meeting the recreational use standard.

Table 6. SSM and geometric mean percent reductions for stations JIC1 and JIC2 in James Island Creek.

	SSM % reduction	Geomean % reduction
JIC1	74	81
JIC2	95	96

5.2 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 James Island Creek, it is unclear what a critical flow would be. By including all data in the calculations, inclusion of the critical condition is implicit.

5.3 Existing Conditions

Due to the tidal nature of the system, it is difficult to calculate an existing load for this system. For this reason, existing conditions are given as a concentration. Existing concentration is calculated as the concentration of Enterococcus at the 90th percentile point based on the normal line fit to the monitoring data. Existing 30-day geometric mean concentrations range from 178/100 ml to 769MPN/100 ml for stations JIC1 and JIC2, respectively. SSMs are 385 MPN/100ml and 1965 MPN/100ml for stations JIC1 and JIC2, respectively.

5.4 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.

5.4.1 Continuous Point Sources

James Island Creek is classified as SA 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 an *Enterococci* 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 daily maximum concentration of 104 MPN/100mL and monthly geomean concentration of 35 MPN/100mL.

5.4.2 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.

Table 7. TMDLs for James Island Creek watershed. Loads are expressed as most probable number (MPN) per 100 ml.

Station	90th %tile of Existing Load (MPN/100 ml)	TMDL [1, 2] (MPN/ 100ml)	WQ Target (MPN/10 0ml)	Margin of Safety (MPN/100ml)	WLA			LA
					Continuous Sources[3] (MPN/100ml)	Non-Continuous [4, 6] Sources (% Reduction)	Non-Continuous SCDOT [5, 6] (% Reduction)	% Reduction to Meet LA [6]
JIC1	385	104	98.8	4.2	See Note Below	74%	74%	74%
JIC1	**178**	**35**	**33.25**	**1.52**	**See Note Below**	**81%**	**81%**	**81%**
JIC2	2090	104	98.8	4.2	See Note Below	95%	95%	95%
JIC2	**769**	**35**	**33.25**	**1.52**	**See Note Below**	**96%**	**96%**	**96%**

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. SA water WQS = Not to exceed a geometric mean of 35/100 ml over a 30-day period; nor shall a SSM exceed 104 MPN/100 ml
3. WLA is expressed as a daily maximum of 104 MPN/100 ml and a 30-day geometric mean of 35 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 permitted flow and an allowable permitted maximum concentration of 104 MPN/100ml or 30-day geometric mean of 35 MPN/100 ml.
4. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.

5. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 Permit to address Enterococcus, the SCDOT will comply with these TMDLs and its applicable WLA to the maximum extent practicable (MEP) as required by its MS4 permit.
6. Percent reduction applies to existing concentration.

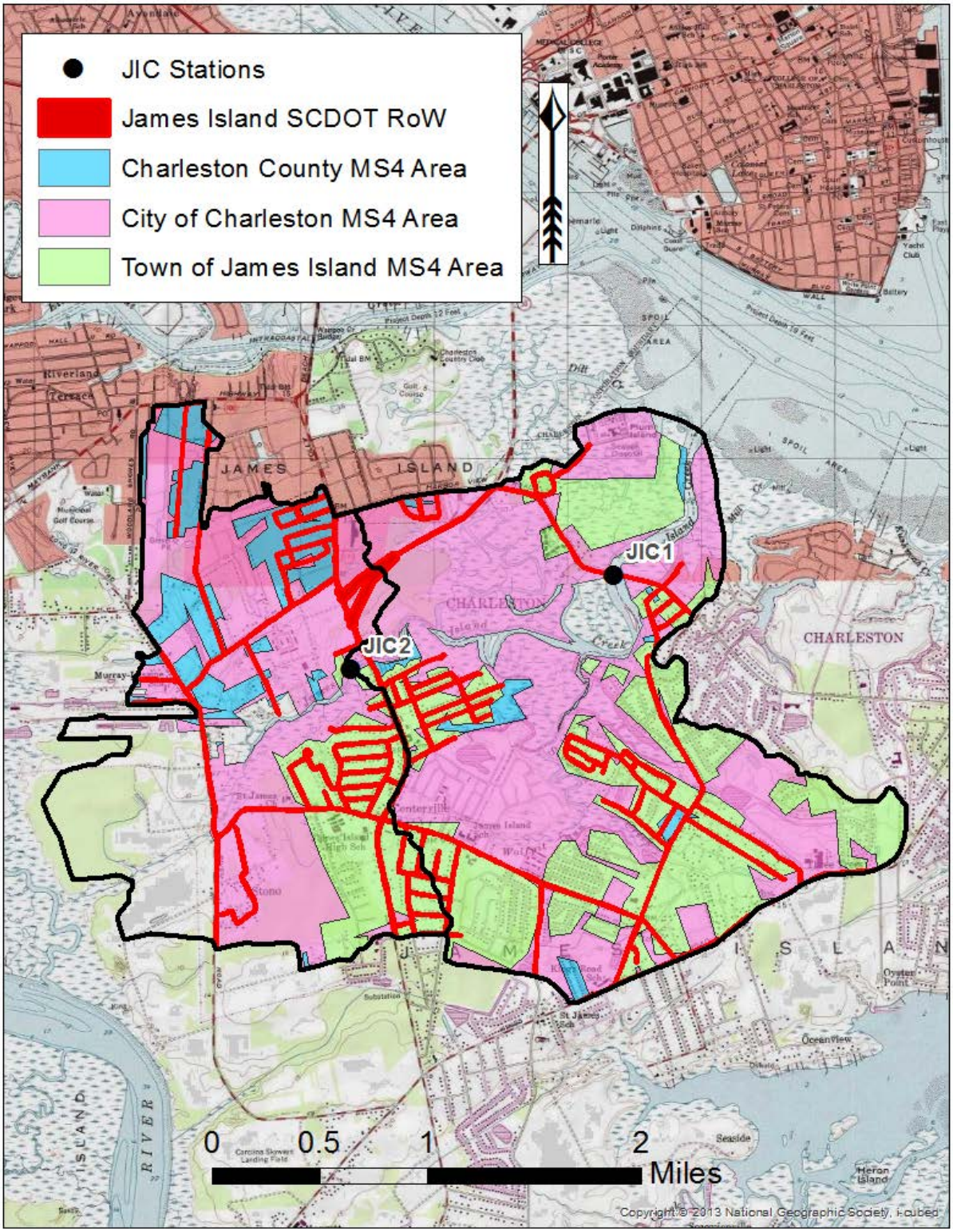


Figure 12. MS4s located within James Island Creek TMDL watershed.

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. Based on the 2010 US Census, at the time of the TMDL development, a portion of James Island Creek watershed was classified as urbanized area.

Charleston County, City of Charleston, SCDOT, and Town of James Island are the designated MS4s located in the TMDL areas (Figure 12). 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 7 presents the reductions needed for the impaired segments. The percent reductions in this TMDL also apply to the *Enterococci* 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 shape files.
- 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.
- 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 of zoning, issue building or development permits.

5.5 Load Allocation

The Load Allocation (LA) applies to the nonpoint sources of *Enterococci* bacteria which includes 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 each of the impaired stations in James Island Creek is expressed in tables as percent reduction. The Department believes that meeting the highest percent reduction or the WQS, whichever is less restrictive, will effectively protect the recreational uses of James Island Creek. Besides SCDOT, there are three other regulated NPDES permitted MS4s located in the drainage area, City of Charleston, Town of James Island, and Charleston County. There may be other unregulated stormwater discharges located in the watershed that are subject to LA component 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).

5.6 Seasonal Variability

Federal regulations require that TMDLs take into account the seasonal variability in watershed loading. The variability in these TMDLs is accounted for by using multiple years of data collected during hydrological and water quality sampling data sets. In addition, an evaluation of historic fecal coliform data collected at RT-052098 from November through April demonstrated that the instream recreational use standard will be protected by TMDLs developed using enterococci data collected at JIC1 and JIC2 May through October.

5.7 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% margin of safety. All water quality data is compared to of 104 MPN/100ml which is the SSM water quality standard minus five percent margin of safety (MOS), and to 35 MPN/100ml with is the geometric mean water quality standard minus 5% 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).

5.8 Calculation of the TMDL

A TMDL represents the loading capacity (LC) of a waterbody, which is the maximum loading a waterbody can receive without exceeding water quality standards (US EPA, 1999). The TMDL is the sum of the WLA for point sources, the 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 reductions of Enterococci concentrations ranging from 74% to 95% to meet the SSM and 81% to 96% in order to meet the geometric mean water quality standards for *Enterococci*. Calculated TMDL reductions applicable to each station, as well as target concentration of 33.25/100 ml, are shown on Table 7.

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

5.9. Reasonable Assurance

NPDES permits are issued for regulated dischargers, including continuous and non-continuous sources of pathogenic bacteria. In salt waters, the applicable recreation use water quality standard indicator is *Enterococcus* bacteria. Continuous discharges are required to target the *Enterococcus* water quality standard at the point of discharge. For regulated non-continuous discharges, the *Enterococcus* standard should be targeted to the

maximum extent practicable. There may be other regulated activities present that could contribute to *Enterococcus* 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 *Enterococcus* loadings in the watershed may include wildlife, urban and suburban runoff. These sources may be reduced through means such as best management practices, local ordinances, outreach education efforts as well as 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 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.

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 *Enterococci* loading to James Island Creek in order to achieve water quality standards. Using existing authorities and mechanisms, an implementation plan providing information on how point and non-point sources of pollution are being abated or may be abated in order to meet water quality standards is provided. Sections 6.1 and 6.2 and their subsections presented below correspond with sections 3.1 and 3.2 and their subsections of the source assessment presented in the TMDL document. As the implementation strategy progresses, DHEC may continue to monitor the effectiveness of implementation measures and evaluate water quality where deemed appropriate.

Point sources are discernible, confined, and discrete conveyances of pollutants to a water body including but not limited to pipes, outfalls, channels, tunnels, conduits, man-made ditches, etc. The Clean Water Act's primary point source control program is the 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 WWTF. 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 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 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 Enterococcus loadings to James Island Creek. 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 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 towards targeting the load reductions to improve water quality in James Island Creek watershed. 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

The strategies presented in this document for implementation of the referenced TMDL are not inclusive and are to be used only as guidance. The strategies are informational

suggestions which may lead to the required load reductions being met for the referenced 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. Currently, there are no direct discharges to James Island Creek.

6.1.2 Non-Continuous Point Sources

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

The level of monitoring necessary, deployment of structural and non-structural BMPs, evaluation of BMP performance, and optimization or revisions to the existing pollutant reduction goals of the SWMP or any other plan is TMDL and watershed specific. Hence, it is expected that NPDES permit holders evaluate their existing SWMP or other plans in a manner that would effectively address implementation of this TMDL with an acceptable schedule and activities for their permit compliance.

The Department staff (permit writers, TMDL project managers, and compliance staff) is willing to assist in developing or updating the referenced plan as deemed necessary. Please see Appendix C – 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 MEP. For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and condition of its permit is effective implementation of the WLA. 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 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 (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 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 websites and bumper stickers.

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 (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 high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies (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 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 (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 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 (US EPA, 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 (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 waterbody of concern online at:
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 pertaining to the National Menu of BMPs, Urban BMP Performance Tool, Outreach Documents, etc.

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

6.2 Nonpoint Sources

6.2.1 Urban and Suburban Stormwater Runoff

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

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 rain water collection system, such as a cistern, for later use in landscape watering or other none potable uses. Another

option would be, when appropriate, constructing rain gardens or wetlands to slow surface water runoff rates from impervious surfaces and to allow for percolation of runoff to recharge ground water. Also, using porous pavements/materials allows runoff due to precipitation percolate hence reducing the runoff rate.

6.2.2 Agricultural Runoff

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

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, Enterococcus, needs to be identified.

Fencing livestock is an effective way for confining the livestock in a certain area where BMPs are deployed; however, in certain cases it may not be sufficient for prevention of overland runoff. 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 or rural homeowners reduce sources of NPS pollution from their property. This document guides homeowners through a self-assessment, including information on proper maintenance practices for septic tanks. SCDHEC also employs a nonpoint source educator who can assist with distribution of these tools as well as provide additional BMP information.

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

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

Do's:

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

Don'ts's:

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

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

6.2.5 Marinas, Boating Activities and Structures

Boating related activities have potential to contribute to Enterococcus contamination through potential discharges from 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 attention of boating public to available pumpout facilities near James Island Creek. A map of available pumpout facilities can be found at http://www.dnr.sc.gov/marine/vessel/pdf/coastalmaps2013.pdf

Also, Charleston Waterkeeper provides boaters free pumpouts. For details, contact the organization: http://charlestonwaterkeeper.org/what-we-do/programs/mobile-pumpout/

Another important factor is outreach and education for boat and dock owners regarding the proper use and maintenance of MSDs, and impact of improper vessel discharges in Class SA waters. There are pumpout facilities located in Cooper and Ashley Rivers and within the Charleston Harbor (SC DNR, 2012).

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.

7.0 Resources

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

7.1 General Information for Non-Continuous Point Sources

Center for Watershed Protection. Available at: http://www.cwp.org/
Interlocking Concrete Pavement Institute. Available at: http://www.icpi.org/
Rain pillows: Rainwater Harvesting from Rooftop Catchments. Available at:
http://www.oas.org/usde/publications/Unit/oea59e/ch10.htm
DC Greenworks Green Roofs. Available at: http://www.dcgreenworks.org/
Roofscapes, Inc. Taking Green Roofs to the Next Level. Available at:
http://www.roofmeadows.com/
Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows. Natural Resources Defense Council. Available at:
http://www.nrdc.org/water/pollution/rooftops/contents.asp
Low Impact Development Center, Inc. Sustainable Design and Water Quality Research. Available at: http://www.lowimpactdevelopment.org/
SCDHEC Stormwater Outreach – Resources for Phase II Stormwater. Available at:
http://www.scdhec.gov/environment/water/ms4/html/other_programs.htm

7.2 General Information for Nonpoint Sources

7.2.1 Pet Waste

EPA Nonpoint Source Outreach Toolbox. Pet Care. Available at:
http://cfpub.epa.gov/npstbx/FeaturedProductsDetail.cfm?TopicID=70

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

7.2.2 Wildlife

Bird Deterrents:
http://www.boatliftanddock.com/c-190-dock-bird-deterrent.aspx
https://www.hotfoot.com/
http://www.birdbusters.com/bird_control_products.html

7.2.3 Septic Systems

Septic System Care. Available through Nonpoint Source Outreach Toolbox at:
http://cfpub.epa.gov/npstbx/FeaturedProductsDetail.cfm?TopicID=70
Clemson Extension Home*A*Syst. Available at:
http://www.clemson.edu/psapublishing/Pages/Water/WQL21.pdf

7.4 Outreach and Education

Nonpoint Source Runoff Pollution SCDHEC
http://www.scdhec.gov/HomeAndEnvironment/Water/Stormwater/PreventingStormwaterPollution/

7.5 Stormwater

Stormwater Ponds in Coastal South Carolina, Denise M. Sanger. S.C. Sea Grant Consortium (n.d.). Accessed on February 26, 2014. Available at:
http://www.dnr.sc.gov/marine/NERR/present/stormwater/SangerStormwaterPondsSC.pdf

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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.

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.

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.

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.

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.

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.

Appendix A – NLCD 2011 Individual Landuses for TMDL Stations in James Island Creek

Landuse	JIC1 mi^2 (%)	JIC2 mi^2 (%)
Open Water	0.12 (3.02)	0.02 (0.75)
Urban	1.9 (46.3)	1.4 (49.9)
Forest	0.7 (16.41	0.9 (32.0)
Pasture/Hay	0.04 (1.0)	0.1 (2.4)
Woody and Emergent Herbaceous Wetlands	1.33 (33.3)	0.4 (14.9)
Total	4 mi^2	2.83 mi^2

Appendix B – Water Quality Data

Date JIC1	JIC1 Enterococcus	Date JIC2	JIC2 Enterococcus
7/10/2013	52	7/10/2013	1014
7/17/2013	121	7/17/2013	538
7/24/2013	52	7/24/2013	171
7/31/2013	166	7/31/2013	616
8/7/2013	10	8/7/2013	94
8/14/2013	140	8/14/2013	370
8/21/2013	31	8/21/2013	168
8/28/2013	120	8/28/2013	440
9/4/2013	60	9/4/2013	500
9/11/2013	100	9/11/2013	540
9/18/2013	30	9/18/2013	160
9/25/2013	132	9/25/2013	909
10/2/2013	30	10/2/2013	299
10/9/2013	262	10/9/2013	633
10/16/2013	161	10/16/2013	317
10/23/2013	144	10/23/2013	573
10/30/2013	613	10/30/2013	990
5/7/2014	63	5/7/2014	275
5/14/2014	20	5/14/2014	96
5/21/2014	256	5/21/2014	275
5/28/2014	31	5/28/2014	63
6/4/2014	20	6/4/2014	85
6/11/2014	20	6/11/2014	10
6/18/2014	52	6/18/2014	269
6/25/2014	52	6/25/2014	41
7/2/2014	41	7/2/2014	171
7/9/2014	10	7/9/2014	233
7/16/2014	134	7/16/2014	464
7/23/2014	20	7/23/2014	331
7/30/2014	31	7/30/2014	98
8/6/2014	63	8/6/2014	862
8/13/2014	41	8/13/2014	171
8/20/2014	31	8/20/2014	195
8/27/2014	20	8/27/2014	52
9/3/2014	63	9/3/2014	1333

9/10/2014	41	9/10/2014	122
9/17/2014	441	9/17/2014	6131
9/24/2014	1467	9/24/2014	305
10/1/2014	345	10/1/2014	1076
10/8/2014	52	10/8/2014	122
10/15/2014	833	10/15/2014	24196
10/22/2014	96	10/22/2014	160
10/29/2014	85	10/29/2014	414
5/6/2015	10	5/6/2015	145
5/13/2015	121	5/13/2015	181
5/20/2015	51	5/20/2015	135
5/27/2015	41	5/27/2015	246
6/4/2015	97	6/4/2015	1259
6/10/2015	480	6/10/2015	11199
6/17/2015	158	6/17/2015	131
6/24/2015	30	6/24/2015	96
7/1/2015	52	7/1/2015	223
7/8/2015	75	7/8/2015	520
7/15/2015	10	7/15/2015	31
7/22/2015	51	7/22/2015	350
7/29/2015	62	7/29/2015	63
8/5/2015	211	8/5/2015	282
8/12/2015	10	8/12/2015	52
8/19/2015	2098	8/19/2015	12033
8/26/2015	134	8/26/2015	171
9/2/2015	63	9/2/2015	213
9/9/2015	331	9/9/2015	5475
9/16/2015	110	9/16/2015	279
9/23/2015	131	9/23/2015	682
9/30/2015	41	9/30/2015	148
10/7/2015	355	10/7/2015	305
10/14/2015	187	10/14/2015	435
10/21/2015	211	10/21/2015	759
10/28/2015	1281	10/28/2015	556
05/04/2016	155	05/04/2016	221
05/11/2016	31	05/11/2016	269
05/18/2016	160	05/18/2016	1106

05/25/2016	10	05/25/2016	52
06/01/2016	146	06/01/2016	307
06/08/2016	41	06/08/2016	262
06/15/2016	135	06/15/2016	160
06/22/2016	20	06/22/2016	109
06/29/2016	663	06/29/2016	9804
07/06/2016	52	07/06/2016	909
07/13/2016	72	07/13/2016	428
07/20/2016	109	07/20/2016	441
07/27/2016	20	07/27/2016	256
08/10/2016	146	08/03/2016	285
08/17/2016	216	08/10/2016	1106
08/24/2016	41	08/17/2016	171
08/31/2016	86	08/24/2016	106
09/07/2016	41	08/31/2016	512
09/21/2016	63	09/07/2016	85
09/28/2016	85	09/14/2016	1081
10/12/2016	399	09/21/2016	1281
10/19/2016	98	09/28/2016	269
10/26/2016	120	10/12/2016	355
5/3/2017	41	10/19/2016	320
5/10/2017	10	10/26/2016	259
5/17/2017	161	5/3/2017	359
5/24/2017	884	5/10/2017	52
5/31/2017	135	5/17/2017	109
6/7/2017	292	5/24/2017	24196
6/14/2017	41	5/31/2017	328
6/21/2017	305	6/7/2017	7270
6/28/2017	97	6/14/2017	108
7/5/2017	41	6/21/2017	3968
7/12/2017	132	6/28/2017	359
7/19/2017	107	7/5/2017	109
7/26/2017	63	7/12/2017	181
8/2/2017	84	7/19/2017	345
8/9/2017	145	7/26/2017	4611
8/16/2017	156	8/2/2017	253
8/23/2017	51	8/9/2017	496

8/30/2017	2489	8/16/2017	867
9/6/2017	218	8/23/2017	284
9/14/2017	272	8/30/2017	7270
9/20/2017	84	9/6/2017	480
9/27/2017	226	9/14/2017	1334
10/4/2017	52	9/20/2017	235
10/11/2017	171	9/27/2017	426
10/18/2017	41	10/4/2017	63
10/25/2017	616	10/11/2017	860
5/2/2018	20	10/18/2017	142
5/9/2018	52	10/25/2017	2064
5/16/2018	30	5/2/2018	131
5/23/2018	97	5/9/2018	131
6/6/2018	86	5/16/2018	118
6/13/2018	63	5/23/2018	457
6/20/2018	41	5/30/2018	272
6/27/2018	41	6/6/2018	341
7/2/2018	96	6/13/2018	301
7/11/2018	144	6/20/2018	197
7/18/2018	199	6/27/2018	135
7/25/2018	94	7/2/2018	459
8/1/2018	733	8/8/2018	627
8/8/2018	97	8/15/2018	6867
8/15/2018	183	8/22/2018	269
8/22/2018	41	8/29/2018	405
8/29/2018	52	9/5/2018	145
9/5/2018	185	9/19/2018	1585
9/19/2018	109	9/26/2018	97
9/26/2018	20	10/3/2018	373
10/3/2018	169	10/12/2018	934
10/12/2018	805	10/17/2018	933
10/17/2018	61	10/24/2018	175
10/24/2018	61	10/31/2018	1281
10/31/2018	327		

Appendix C – Evaluating the Progress of MS4 Programs

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

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

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

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

5. Links:
   - Evaluating the Effectiveness of Municipal Stormwater Programs. September 2007. EPA 833-F-07-010
   - The BMP database - http://www.bmpdatabase.org/BMPPerformance.htm (this link is specifically to the BMP performance page, and lot more)
   - EPA's STORET data warehouse - http://www.epa.gov/storet/dw_home.html
   - EPA Region 5: STEPL – Spreadsheet tool for estimating pollutant loads http://it.tetratech-ffx.com/stepl/
   - Measurable goals guidance for Phase II Small MS4 - http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm
   - Environmental indicators for stormwater program- http://cfpub.epa.gov/npdes/stormwater/measurablegoals/part5.cfm
   - National menu of stormwater best management practices (BMPs) - http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm
   - SCDHEC – BOW: 319 grant program has attempted to calculate the load reductions for the following BMPs:

     - Septic tank repair or replacement
     - Removing livestock from streams (cattle, horses, mules)
     - Livestock fencing
     - Waste Storage Facilities (a.k.a. stacking sheds)
     - Strip cropping
     - Prescribed grazing
     - Critical Area Planting
     - Runoff Management System
     - Waste Management System

- Solids Separation Basin
- Riparian Buffers

James Island Creek Enterococcus Bacteria TMDLs Responsiveness Summary

Comments were received from the following:

Charleston County

And the following individuals:

Gabriella Andrews
Melissa Archer
Mary Arnold
Suzanne Auld
Tony Beall
Jennifer Biondi
Baker Bishop
Kattie Boggeman
Abigail Boyer
Richard Brendel
Walker Brock
Erica Browne
Maggie Carragher
Jocelyn Chateauvert
Brandon Clark
Michael Claypoole
Carl Cole
Austin Dandridge
Sharon & Roland Day
Laureen Deibert
Joe Dennig
Richard Dom
Kyle Draganov
Walt Dunlap
Nicole Fagala
Louise Farrell
Caroline Forgason
Mary Edna Fraser (2)
Matthew Gamble
Rob Glasser
Darcie Goodwin
Vicky Grant
Richards Gregory
Kathy Greider
Tyler Grespin
Carol Gross
Kaitlyn Hackathorn
Lisa Hakamiun
Lynday Hall
Tyrone Hanlan
Gerald Haram
Meagan Harper
Kevin Hayes
Melissa Hayes
Karen Henderson
Franny Henty
TL Herbert
Kimberly Imbus
Carol Jackson (2)
Liz Jannetta
Chris Jude
Katie Koval
Judith Kramer
Hannah Kuhl
Nathan Leach
Luke Levanchy
Bryan Luce
Patricia Luck
Bobbie Lyon
Deanna Maguire
Jennifer Mathis
Kathryn Matrangola
Mike McCarthy
Jerilyn McCombs
Sarah McKenna
Savannah McLain

Sean McQuilken	Sarah Romano	Benjamin Toy
Alicia Mendicino	Irene Rowe	Phil Turner
Christine Mooberry	Jay Rucker	Christine von Kolnitz
Kathryn Mundy	Maureen Ryan	Theodosia Wade
Melissa Myers	Lisa Scharin	Kris Wetzel
Elizabeth Nemeth	Gustavo Serrano	Ian Wheeler
Jill Norton	Parker Singleton	Brian Wildstein
Dusty Parker	Rob Spawar	Richard Williams
Blake Pearce	Jeanne Sprott	Glenn Williman
Jessica Peragine	Christina Stanton	Carrie Wilson
Kate Pfile	Cris Sumpter	Mary Wofford
Stephanie Ragsdale	Nancy Swan	Elizabeth Zsolnay
Emily Randisi	Susan Thompson	
Christine Magnarella Ray	Mike Tinkey	
Harriet Reavis	Chris Toler	

Amendments:

The following additional amendments were made by the Department to the draft James Island Creek Enterococcus Bacteria TMDLs and associated appendices during the 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, Page ii, abstract:

Fecal coliform bacteria was added to the following sentence in paragraph one: "Historically, there was one SC Department of Health and Environmental Control (DHEC) water quality monitoring station, RT-052098, which was monitored in 2005 for fecal coliform bacteria."

Amendment 2, Page 21, Section 4.0 Cumulative Probability Method:

A sentence was added to first paragraph: Because enterococcus is the applicable recreational use water quality indicator and more recent enterococcus data have been collected at JIC 1 and JIC2 in the watershed, the Department believes that the historic fecal coliform data collected at RT-052098 are less representative of current conditions in the watershed. The calculated reductions for JIC1 and JIC2 are expected to address the current recreational use water quality standard at RT-052098.

Amendment 3, Page 37, Section 5.6 Seasonal Variability:

After submitting the James Island Creek Enterococcus TMDL document to the USEPA Region 4 for final approval on September 19, 2019, the Department received a comment from USEPA staff. Specifically, the comment was that the TMDL document did not sufficiently address the seasonal variability.

In order to address their comment, the Department reviewed historical recreational use fecal coliform data collected monthly during 2005 from station RT-052098. These data were separated into two sets, May through October and November through April. This grouping allowed for an evaluation of James Island Creek data that includes the astronomical winter as well as the six month period where samples are not collected by the Charleston Waterkeeper (CWK) at sites JIC1 and JIC2.

From November through April 2005, there was one exceedance (500 cfu/100ml) of the fecal coliform 400 cfu/100 ml SSM of WQS out of 6 samples (n=6), a 17% exceedance rate. During May through October 2005, there was one exceedance (above 1600 cfu/100 ml) of the fecal coliform 400 cfu/100 ml SSM of WQS out of 7 samples (n=7), a 14% exceedance rate.

The specific method that was used for analyzing samples for fecal coliform during 2005 had an upper detection limit of 1600 cfu/100 ml. The sample result between November-April was 500 cfu/100 ml, and May-October result was above 1600 cfu/100 ml. This analysis of the 2005 fecal coliform data collected at RT-052098 is also summarized in the table below. Note that all data from 1999-current may be downloaded at the following link: https://www.waterqualitydata.us/portal/

James Island Creek	May-Oct	Nov-April
n	7	6
Number of Samples Exceeding WQS of 400 cfu/100 ml	1	1

Exceedance Rate	14%	17%
Average Exceedance	>1600 (n=1)	500 (n=1)

While frequency of exceedances were similar during these two time periods, the magnitude of the exceedances was different. The magnitude is normally determined as the arithmetic average of the sample results above the WQS of 400 cfu/100 ml. Here, with just one exceedance in each period, it is simply the exceedance value. While there are limited data available at this location, the magnitude of the exceedance is greater May-October suggesting that time frame is the critical period for bacterial levels in James Island Creek.

Since CWK samples for Enterococcus are collected on weekly basis, we were able to calculate monthly geometric means (35 mpn/100 ml WQS) for the two stations on James Island Creek. Using the monthly geometric means of Enterococcus data collected by CWK, percent reductions were calculated and are presented in tables Ab-1 and 5, as well as the WQ target (33.25 mpn/100 ml). Since the indicator bacteria for recreational waters was changed from fecal coliform to Enterococcus in 2013, comparison of magnitudes of fecal coliform to Enterococcus is not possible.

Concluding that May-October is the critical period in James Island Creek is based on limited data. In an attempt to reinforce this conclusion, the Department compared bacterial conditions in James Island Creek to nearby Shem Creek, where it so happens that additional November-April data are available that more clearly establish May-October as the critical period for Shem Creek. Similarity of the May-October bacterial responses in the two creeks could be an indication that the November-April responses are likely to be similar as well therefore, May-October is likely the critical period for James Island Creek just as it is for Shem Creek.

The Department also completed a precipitation analysis for James Island Creek and Shem Creek. Both Shem and James Island creeks are headwater tidal creeks located off of lower Charleston Harbor. The impact of 24, 48, 72, and 96 hours of lagged cumulative daily precipitation intervals on instream bacteria levels were analyzed using data collected by the waterkeeper. Cumulative daily precipitation amounts were divided into following intervals: 0, 0.11-0.5, 0.51-2.0, 2.1-4.0, 4.1 up to 10.8 inches. Percent of bacteria samples meeting and exceeding were tabulated by station, for both creeks. When results from lower stations are compared, both creeks have similar exceedances during same precipitation intervals and lag times. When upstream stations from both creeks are

compared, they have very similar exceedances during the same precipitation and lag times.

This analysis showed that most upstream stations had majority of exceedances occur during periods of no precipitation i.e. dry conditions, which may be an indication of that both streams have similar sources of bacteria. Additionally, when percent of exceedances and lag times are compared from both creeks, they are almost identical. Longitudinally moving from upstream to downstream stations, conditions improve and there are less exceedances near the confluence with Charleston Harbor.

The Department also compared the bacteria results shown in the table above to MD-071 results from Shem Creek. To illustrate the similarity between the exceedances and magnitudes, analysis results for MD-071 in Shem Creek and RT-042098 in James Island Creek are shown in the tables below.

Shem Creek	**May-Oct**	**Nov-April**
n	69	68
Number of Samples Exceeding WQS of 400 cfu/100 ml	15	4
Exceedance Rate	22%	6%
Average Exceedance	1047 (n=15)	1250 (n=4)

James Island Creek	**May-Oct**	**Nov-April**
n	7	6
Number of Samples Exceeding WQS of 400 cfu/100 ml	1	1
Exceedance Rate	14%	17%
Average Exceedance	>1600 (n=1)	500 (n=1)

Lastly, simply comparing the calculated TMDL percent reductions based on CWK data shows the percent reductions are almost identical with the same longitudinal trends from headwater to outlet in both creeks, as shown in the table below:

JIC Station	JIC TMDL Percent Reduction (GeoMean)	SC Station	SC TMDL Percent Reduction (GeoMean)
JIC1	81%	SC1	78%
		SC2	88%
JIC2	96%	SC3	96%

To summarize, although there are limited historical data from James Island Creek station RT-042098, comparison to Shem Creek indicates the following:

- ✓ Precipitation analysis indicate similar patterns for both creeks.
- ✓ Both upstream stations may have similar bacteria sources which are impacting the creeks during dry conditions.
- ✓ Conditions, bacteria exceedances starts improving longitudinally, moving upstream to downstream.
- ✓ Current geometric mean standard of 35 cfu/100 is much more restrictive than the former 400 mpn/100 ml.
- ✓ TMDL percent reductions in both creeks for the geometric mean standard are almost identical.

Using both CWK data and DHEC data collected from station MD-071 we can make an inference that these creeks are behaving similarly and likely have similar seasonal patterns; therefore, the calculated percent reductions for James Island Creek will also be protective November-April. Furthermore, because the geometric mean criterion is generally more restrictive than SSM, we are confident that percent reductions presented in the TMDL document, which are applicable year around, will also be protective from November through April.

In order to clarify the point regarding seasonal variability in the TMDL document, the Department has inserted the following language on page 37, Section 5.6: "In addition, an evaluation of historic fecal coliform data collected at RT-052098 from November through April demonstrated that the instream recreational use standard will be protected by TMDLs developed using enterococci data collected at JIC1 and JIC2 May through October."

Charleston County comments were submitted by Michele Richbourg of Thomas and Hutton

Charleston County Comment 1:

"Enterococci Units of Measure: Under Section E of SC R61-68, the Water Quality Standards for enterococci in Class SA saltwaters are given in units of MPN/100 ml. The draft TMDL for James Island Creek uses "cfu/100 ml" or "/100 ml" as units of measure for enterococci. To avoid confusion the TMDL should clearly state the units for enterococci bacteria compliance as MPN/100 ml. The TMDL should clarify when discussing historical data recorded as cfu/100 ml and provide a conversion factor where applicable."

Department's Response 1:

The oversight of using cfu as unit of measurement for enterococci in the draft TMDL document has been corrected and has been replaced by MPN.

Charleston County Comment 2:

"Comparison of total precipitation with bacteria sampling results from stations JIC1 and JIC2: See Table 5 on page 21. The sum of % meeting WQ and % not meeting WQ would be expected to 100%. The table should be revised for clarity."

Department's Response 2:

Table 5 from the from the draft TMDL document is shown below for both JIC1 and JIC 2. Another column shaded in gray has been added to the tables below for your reference. The new column shows the total number of samples used for cumulative precipitation intervals as well as the results of the analysis of data from zero to over 10 inches of precipitation.

The sample sizes for JIC1 and JIC2 are 118 and 120, respectively. Each row of cumulative precipitation such as 24 hours, 48 hours, etc., summarizes the number of samples meeting or exceeding the enterococcus single sample maximum water quality standard of 104 mpn/100 ml, for precipitation amounts ranging from zero to 10.7 inches. Blue arrows were added to the second row (24 hour) of table for JIC1 to show the direction of calculations as an example. As seen on "Table 5" below, percentage of various categories of precipitation and corresponding "meeting" and "not meeting" samples equal to 100% and to the sample size for each station.

Table 1. Comparison of total precipitation with bacteria sampling results from stations JIC1 and JIC2 (2013-2018).

JIC1 n=118	Zero precipitation # of samples (%) meeting WQ	Zero precipitation: # of samples (%) not meeting WQ	0.11 to 10.7 inches of precipitation: # of samples (%) meeting WQ	0.11 to 10.7 inches of precipitation: # of samples (%) not meeting WQ	Total number of samples (% of total)
24 hours	**58 (49.2%)** →	36 (30.5%) →	7 (5.9%) →	17 (14.4%) →	118 (100%)
48 hours	**47 (39.8%)**	25 (21.2%)	17 (14.4%)	29 (24.6%)	118 (100%)
72 hours	**41 (34.7%)**	22 (18.6%)	31 (26.3)	24 (20.3%)	118 (100%)
96 hours	34 (28.8%)	13 (11%)	32 (27.1%)	**39 (33.1%)**	118 (100%)

JIC2 n=120	Zero precipitation: # of samples (%) meeting WQ	Zero precipitation: # of samples (%) not meeting WQ	0.11 to 10.7 inches of precipitation: # of samples (%) meeting WQ	0.11 to 10.7 inches of precipitation: # of samples (%) not meeting WQS	Total number of samples (% of total)
24 hours	16 (13.3%)	**77 (64.2%)**	0 (0%)	27 (22.5%)	120 (100%)
48 hours	15 (12.5%)	**57 (47.5%)**	1 (0.8%)	47 (39.2%)	120 (100%)
72 hours	13 (10.8%)	49 (40%)	3 (2.5%)	**56 (46.7%)**	120 (100%)
96 hours	11 (9.2%)	34 (28.3%)	5 (4.2%)	**70 (58.3%)**	120 (100%)

After the public comment period had ended for the James Island Creek TMDL document, the Department noticed that Table 5 only included data from 2013 through 2017. This was an artifact of an earlier analysis that did not include 2018 data. Table 5 in the TMDL document has been revised to include data from 2013 through 2018 as originally intended. Note that the samples size for JIC1 and JIC2 increased to 142 from the earlier analysis.

Corrected Table 5

JIC1 n=142	Zero precipitation: # of samples (%) meeting WQ	Zero precipitation: # of samples (%) not meeting WQ	0.11 to 10.8 inches of precipitation: # of samples (%) meeting WQ	0.11 to 10.8 inches of precipitation: # of samples (%) not meeting WQ
24 hours	**71 (50%)**	41 (28.9%)	10 (7%)	20 (14.1%)
48 hours	**60 (42.3%)**	28 (19.7%)	21 (14.8%)	33 (23.2%)
72 hours	**52 (36.6%)**	25 (17.6%)	29 (20.4%)	36 (25.4%)
96 hours	39 (27.5%)	15 (10.6%)	42 (29.6%)	**46 (32.4%)**

JIC2 n=142	Zero precipitation: # of samples (%) meeting WQ	Zero precipitation: # of samples (%) not meeting WQ	0.11 to 10.8 inches of precipitation: # of samples (%) meeting WQ	0.11 to 10.8 inches of precipitation: # of samples (%) not meeting WQ
24 hours	17 (12%)	**95 (66.9%)**	0 (0%)	30 (21.1%)
48 hours	16 (11.3%)	**72 (50.7%)**	1 (0.7%)	53 (37.3%)
72 hours	14 (9.8%)	**63 (44.4%)**	3 (2.1%)	62 (43.7%)
96 hours	12 (8.5%)	43 (30.3%)	5 (3.5%)	**82 (57.7%)**

Charleston County comment 3:

"Tables and Figures: References to numbered tables and figures need to be updated."

Department's Response:

References to tables and figures have been updated.

Comments below were submitted by individual stakeholders or other interested parties and deemed similar in content. The Department has grouped together these comments for a single response.

Gabriella Andrews:

"I am writing in support of cleanups for James Island and Shem Creeks. My six-year old lives to swim and shrimp in these creeks every weekend, just as I did as a child, and I find myself hesitant to allow it after learning about the bacteria levels in these areas. Charleston's unique creeks and waterways are what keep us all employed (and sane)- whether we work directly on the water, or whether we benefit from visitors coming to the city to enjoy our incredible natural resources. We owe it to the environment and to future generations to address these issues before it's too late to turn back. Thank you for reading and for all that you do."

Melissa Archer:

"I support clean water in Charleston! I will work to improve water quality through volunteering, voting, and speaking up for environmental issues!"

Suzanne Auld:

"Thank you for all your efforts for making Charleston's waters safe for our families. We are proud to be a born and raised Lowcounty family and it is our joy to teach our sons how to fish, swim, and participate in water sports in our creeks and rivers. It is imperative that our water is safe for these activities. Thank you, and God Bless."

Tony Beall:

"I support efforts to clean up the highly polluted waters mentioned above. Water quality continues to be a problem due to fecal contamination and runoff. Please use DHEC's resources to give us cleaner waterways."

Jennifer Biondi:

"The local waterways are SO important to the beauty & safety of Charleston. Please help protect them by ensuring the cleanliness of the waterways!"

Baker Bishop:

"Dear Ms. Varlik, Thank you for your time. Please clean these Creeks up. Our waterways are too valuable a resource not to have their health and cleanliness a top priority. As an avid fisherman, it pains me to see some of these water quality results."

Kattie Boggeman:

"Please clean up Shem Creek and James Island (Ellis) Creek. We are so lucky to live in such a beautiful place, please restore it so we can enjoy every aspect of it safely. My family and I love to paddle board and it would be wonderful to have more safe places to go."

Abigail Boyer:

"I have grown up here in the low country. I love our creeks and rivers. I am a kayak guide. I take people on the water and share with them the beauty of the creeks. The community needs clean, healthy water ways to enjoy. I am in support of cleaning up our way waters!"

Richard Brendel:

"Water quality is an issue I really don't know that much about. What I do know is that I'm addicted to being in the water and it would be nice to know that it's clean. I understand

that you can't just flip a switch and presto, clean water. I also understand that this is an issue that needs to be addressed from all angles so that we can learn what causes unsafe water, as well as, how to manage it. Thanks for making this a priority!"

Walker Brock:

"Shem Creek and Ellis Creek need your help. Many who recreate on those creeks do not even know how impaired the waterways they enjoy are, and the wildlife certainly does not. As an advocate for clean water in Charleston, I thank you for prioritizing clean water targets for Shem and Ellis creeks."

Erica Browne:

"This is Erica Browne, a student at Georgia State University who partook in an alternative spring break to help clean up trash in creeks and lakes in Charleston this past March. Water standards that are unsafe for swimming pose a detrimental threat to the community and the entire ecosystem. Please take this threat to our safety seriously."

Maggie Carragher:

"It's so important for our rivers and creeks to be clean, especially in these high traffic areas where thousands of people swim and boat daily. Thanks for doing the right thing."

Jocelyn Chateauvert:

"Being a parent in Charleston can be a joy with some many water activities near by. Bacteria in the water is not good for our families and the wildlife that is just trying to keep up. Please do monitor and seek punitive damages to those who pollute our waters."

Brandon Clark:

"My name is Brandon Clark and I am very excited to hear about the efforts you guys will be making for James Island Creek and Shem Creek. I love the idea of safer water for people to swim and fish in. My wife Rachel and I live on Shem Creek at the top near Bowman Rd. on Rosemead Rd. in the house she was born and raised in and we have a true love for the creek and marsh. We have seen a big change in the amount of trash and water quality over the past 30 years (since Hurricane Hugo) and have been concerned about water quality. We pick up trash along the banks regularly and even canoe in the creek to clean out trash and debris. I even have images of my canoe full of trash from the upper section of the creek. This area is the area that is typically reporting high levels of bacteria. We think a lot of that is pet waste and maybe even septic waste that makes it way to the creek as well. I would like to offer my assistance and/or, observations/ideas/opinions, if you think it will help. We know a lot of people that live along the banks of the creek and

would be glad to help advocate clean water in the neighborhood. Let me know if we can help and thank you for your efforts."

Michael Claypoole:

"I urge you to continue supporting healthy ecosystems of the low country by passing bills and providing funding to clean up and protect waterways like Shem & Ellis Creeks."

Carl Cole:

"Healthy tidal creeks are an important part of our Lowcountry natural heritage. Charleston Waterkeeper has worked for several years to document that these creeks, while still largely intact, are no longer healthy. We depend on DHEC to ensure that local governments take effective measures to restore the creeks to health."

Austin Dandridge:

"I have lived in Charleston for over 10 years and on James Island 6 of those years. As a father, Charleston business owner, and avid water enthusiast, I want to see Shem Creek and James Island Creek safe and healthy for swimming. I fish the creeks and want my kids to be able to do the same."

Sharon & Roland Day:

"Thank you and the DHEC for setting cleanup targets for Shem Creek and James Island Ellis Creek. I know we all want to see these areas safe and healthy for swimming and water recreation. My husband and I are extremely pleased and excited that steps are being taken to ensure cleaner and healthier waterways. You have our full support. THANK YOU!"

Laureen Deibert:

"We live here in the Lowcountry because of the nearness to the water. The oceans, the creeks, the marshes all call to our hearts. It absolutely breaks my heart to hear that we do not have clean enough creeks to swim in; that we are polluting our waters to the point that our fish and fowl are also feeling the "pain". I support whatever needs to be done to help keep our waters clean, and I thank you for your testing."

Joe Dennig:

"Good Afternoon. Having lived on James Island for almost 20 years now, it's concerning to see the very high levels of bacteria being reported by Charleston Waterkeeper. Please let's set a cleanup target VERY SOON for James Island Creek as well as Shem Creek in Mt

Pleasant. We love relaxing on the creek in our kayaks and paddleboards and want to see some action. Thank you for your time!"

Richard Dom:

"James Island Creek needs to be cleaned up so that people can swim, water ski and consumefish from this creek. When I moved to Charleston in 1973, James Island Creek was enjoyed by many people because the creek was not polluted."

Kyle Draganov:

"I live on James Island. I'm tired of seeing that our creek water is not safe. Please support cleaning up Ellis Creek on James Island (and Shem Creek, too)."

Walt Dunlap:

"It is imperative to maintain the health of coastal waters such as Shem Creek. The pressure on coastal ecosystems is brutal and we are losing the battle without your help. Please do what you can to aid the Charleston Waterkeeper and their efforts."

Nicole Fagala:

"Please get these creeks clean we go init 3 times a week!"

Louise Farrell:

"[I have lived on James island for 28 years and I'm saddened to see the state of the creek. I hope,you will work to clean it up and restore clean water to future generations of James Islanders. Thank you for your help."

Caroline Forgason:

"Hoping testing and cleanup can make these creeks clean & contributing to the beauty and diversity of The Charleston area."

Matthew Gamble:

"I have been a kayak guide on Shem Creek for the last six years and the information I have learned about the consistently poor water quality in Shem and similar creeks has me more than a little concerned. In order for the creek to continue to provide the wealth of natural and economic benefits we need to make sure the water stays clean and the delicate ecosystem stays healthy. It is up to the lawmakers to listen to good science and feedback from constituents to make the best possible informed decisions. I believe we have an incredible opportunity to do this now, starting with Shem Creek and James Island creek."

Rob Glasser:

"We must take care of our estuaries and creeks"

Darcie Goodwin:

"I regularly paddle on the waters of Charleston, so clean creeks are very important to me. I want to thank you for cleaning up James Island Creek and Shem Creek. Clean, healthy waterways mean that I don't have to worry about falling in or getting water in my face."

Vicky Grant:

"I am in support of the pending clean up mandate for James Island/Ellis Creek that will hopefully be adopted by State and Federal Agencies (DHEC and EPA) that details an intergovernmental water quality improvement program to make our creeks safe for swimming, boating, fishing etc. I have read a draft of the TMDL (total daily maximum load allowed of pollutants) and feel that this offers the best short-term solution for our area."

Richards Gregory:

"I have lived on James Island Creek (Ellis Creek) for over 12 years. I'm an avid boater and I enjoy jumping off my dock and the boat into the water. I have not been able to do this for many years. The fecal bacteria levels are incredibly high. I want DHEC to make James Island Creek and Shem Creek safe for swimming again."

Kathy Greider:

"We need to make and keep all our public waterways clean. Save for our children and our fish."

Tyler Grespin:

"I'm writing in support of the Charleston Waterkeeper's mission to secure cleaner coastal waters in Charleston County. I would like to support their mission to see Shem Creek and James Island Creek safe and healthy swimming venues. As a representative of the East Cooper Land Trust, also a local environmentally conscious non-profit organization, I hope to see SCDHEC take their mission into consideration."

Carol Gross:

"I want James island and Shem creek safe for. Swimming"

Kaitlyn Hackathorn:

"Shem Creek and James Island Creek are the centerpieces of our community. They represent Charleston for both natives and visitors alike. I grew up swimming, kayaking, and catching seafood in these waters. Please help us to protect them. I truly believe that the history and future of our community lies in the protection of these waterways."

Lisa Hakamiun:

"I would like to see our waterways clean and safe for us and future generations. Thank you so much for what you do to keep everyone safe."

Lyndsay Hall:

"I have been a resident of the Charleston area for over 15 years - within that time Charleston Waterkeeper started testing the sites off Shem Creek and James Island Creek. Both of these sites are consistently unsafe for swimming. Having safe water, especially in South Carolina during summer, is an easy way to cool down and is a great activity for young children to enjoy. Its unfortunate that the bacterial levels continue to be unsafe - its time to act on this. Please clean these sites up!"

Tyrone Hanlan:

"I strongly believe in this push for improvement to water quality in both of these bodies of water."

Gerald Haram:

"Please act to clean up Shem and Ellis creeks. I live on Milton creek on edisto island and know the importance of fishable and swimmable water that is safe for recreation. It is the foundation of our tourist economy."

Meagan Harper:

"My name is Meaghan and I spend lots of time enjoying our beautiful Charleston waterways. It's so peaceful to look out at the water, see dolphins and other wildlife, and enjoy the tranquility it provides."

Kevin Hayes:

"As a local resident and lover of the Low Country I am asking you please help us get our water ways cleaned up and sustainable. I love to crab, fish, shrimp, swim, kayak, and spend my time on our beautiful waters. Without them being clean and safe, I can't enjoy them, nor can our future generations."

Melissa Hayes:

"I've been living in the low country all my life. I love this area and hope to never leave because of one thing alone: our community's relationship with the salt water. I can't imagine leaving these beautiful marshes and beaches. Some of the best moments of my life include them. That being said, I'm writing to support any initiatives to make Shem Creek and James Island Creek safe for swimming so that others can enjoy our waters in the same way that I have. In addition, I think it's crucial that we care for our environment, so it can remain a resource to us for fishing, crabbing, and oystering. Please help our community by working toward cleaner, healthier waters."

Karen Henderson:

"I want to see Shem Creek and James Island Creek safe and healthy for swimming."

Franny Henty:

"Please clean up James Island and Shem Creek asap. Please inspect all septic systems in the vicinity. Furthermore please limit any development until these creeks are safe to swim again. Thank you ever so much."

TL Herbert:

"I live on James Island/Ellis Creek (for 33 years!) and have worked to keep my area clean of trash, tires. But nothing seems to help the bacterial levels - they never seem to go down making the creek a clean place to swim. Friends across the creek go in on high tide and they have lots of ear infections. Please help clean up James Island/Ellis Creek - I'd love to be able to swim in it!"

Carol Jackson:

"Thank you, Ms. Varlik and DHEC team, for creating this Draft TMDL as it will prompt a measurable process to clean up James Island Creek from the pollutants we know from Waterkeeper documented readings are the most prevalent in our local stormwater drainage system and connected waterways. We want and need a much cleaner Creek to facilitate the active use of the James Island/Ellis Creek waterways for human enjoyment. As importantly, we need a cleaner creek to ensure the future of our ecology in and along the Creek and abundant wetlands as a contributor to our area's clean air estuary. We look forward to staying up to date with the process that you are coordinating with DHEC, EPA and regulatory jurisdictions. Please call on me to help with local government involvement and as a resource for citizen engagement."

"I'm sending my second message through Charleston Waterkeeper format to support their citizen education efforts to keep our James Island/Ellis Creek clean for my grandson's

future as resident of our watershed area. My husband and I are active Waterkeeper supporters; helping out with shore clean up activities and adopting our ditch and local street to prevent runoff to the best of our ability as the sea level rises. We look forward to engaging our Bay Front neighborhood neighbors in the long term improvements can help DHEC and local government achieve with citizens support."

Liz Jannetta:

"Thank for your ongoing support and efforts to keep Shem Creek and James Island Creek safe and healthy for swimming."

Chris Jude:

"My wife and I moved to Charleston in 2017 from North Carolina. At first we worried that we wouldn't have as many chances to get out doors here, until we joined a Coastal Expeditions kayaking trip on Shem Creek and into Charleston Bay. Since then we've used the rivers and waterways in the area as our recreation, and it's been great. The problem is, the pollution in these areas concerns us for swimming and what effect it may have on the wildlife that makes the low country so special. Please direct resources towards Shem Creek and James Island Creek water quality, they are vital resources to our community."

Katie Koval:

"I live on Ellis Creek, and it is such a shame that it is so dirty. We don't feel we can swim there with the levels of bacteria. We moved there to have water access but with the safety concerns, aren't able to use it."

Judith Kramer:

"Thank you for the work you do to keep South Carolinians safe and healthy in our beautiful environment. Towards this end, Especially as a kayaker, I wholeheartedly support DHEC 's plan to clean up Shem Creek and James Island Creek (Ellis Creek) which will contribute to the health of all those living on, by, or in these waters."

Hannah Kuhl:

"I have been studying James Island Creek as part of my thesis project to earn my Masters in Environmental Studies at the College of Charleston. I have seen and studied some of the impacts of various forms of pollution in this creek first-hand, and definitely think something needs to be done about it. I have talked to residents in the area who still rely on this waterbody as one of their primary sources of protein, and may not be able to

afford otherwise. This is simply unsafe with the current water quality, and these citizens also need to be educated on this matter. In addition, the high levels of bacteria are making it unsafe for others to enjoy the creek by kayaking, swimming, etc. This has been a part of the James Island/lowcountry culture for a long time, and we cannot allow this to be lost forever."

Nathan Leach:

"I support any effort to make Charleston's waterways safer and cleaner. The creeks around the area are a great way to cool off in the hot summer months, and it'd be a shame if we can't utilize our natural resources around us if the bacteria levels make it unsafe to do so. I've been enjoying those small pleasures for years and wouldn't want to stop now."

Luke Levanchy:

"With the majority of locals unanimously fighting for safer cleaner water availability. I urge you to strongly consider taking proper precautions to protect our waterways and estuaries. Let's show visiters why we live in such a special place."

Bryan Luce:

"Although the aerial map I made of James Island Creek by drone is no longer available online,here is a link to the blog post: https://naturelovesdata.wordpress.com/portfolio/james-islandcreek-ellis-creek/"

Bobbie Lyon:

"Please take the necessary steps to make Shem Creek and Ellis Creek safe for swimming again. As an avid paddleboarder on James Island it is scary to think what I could catch in that creek were I to fall in. And on hot summer days it is a shame to not be safe to get off my board and take a dip in the creek. Our waters are all connected and left unresolved this is likely to become an expanding problem."

Deanna Maguire:

"I am passionate about Charleston waterways, and keeping them clean and safe is a priority. Swimming and fishing are my favorite activities, and just simply put, that is why we need to keep waterways clean."

Jennifer Mathis:

"Thanks for the quick response. I am not sure why it went through without a message but the essence of my email is to advocate for Charleston Waterkeeper and the work they

have been doing to monitor water health. For you all to hear citizen voices supporting waterways that are clean enough to swim and fish in. Thanks for listening."

Kathryn Matrangola:

"Dear Ms. Varlik, I hope for a cleaner waterway to share with the next generations and encourage an active outdoor life! Thank you"

Mike McCarthy:

"Dear Ms. Varlik, Charleston Waterkeeper's testing revealed that Shem Creek and James Island (Ellis) Creek don't meet state water quality standards for safe swimming due to high levels of bacteria. The DHEC clean up efforts are an important step in making both creeks safe for swimming. Thank you for taking action, and making our waterways clean again. Please make an effort to make the public aware of what they can do to clean up and help maintain the cleanliness of the creeks. Thank you"

Jerilyn McCombs:

"Dear Ms. Varlik, These creeks see far too much boat traffic & perhaps runoff from businesses along the waterway. Please regulate our creeks which are home to wildlife."

Sarah McKenna:

"Dear Ms. Varlik, I am a Mt. Pleasant relative and long time creek lover. Along with countless neighbors, friends, and community members, I want to see Shem Creek and James Island Creek safe and healthy for swimming and kayaking. Being outside is critical for my mental health along with many others. Summertime just isn't the same when the water is too toxic to endure. Please help us save our waterways. Thank you."

Savannah McLain:

"Dear Ms. Varlik, We urgently need to protect our water systems. Not only for the people that swim and boat in it, but for the animals that live there and rely on it. We will not get back this ecosystem if we do not protect our water. Please help us get this water clean for future generations. Thank you"

Sean McQuilken:

"As a marine biologist who has literally spent thousands of working hours on waterways from Texas to Cape Cod I have seen firsthand the effects of water pollution. I am urging you to pass protections that would clean up Shem Creek and James Island Creek and make them safe for swimming. I personally kayak and paddleboard on Shem Creek and have friends/ family who use James Island Creek. For far too long there have been water

quality issues with both of these creeks. If we pass and enforce protections for these two (and other bodies of water) they will become healthier for people and animals which will contribute beneficially to our economy as tourism is a major industry in the Charleston area. Thank you"

Alicia Mendicino:

"I am writing to let you know of my concern regarding water quality on both Shem Creek and James Island Creek. As a long time resident of Mt. Pleasant and frequent visitor to James Island, I have always appreciated the beauty of both waterways and the many activities for which they are a haven. I am an avid paddleboarder and am now reluctant to use Shem Creek due to the high level of bacteria in the water. I understand the same is true of James Island Creek. As a South Carolina resident yourself, I am sure you want all of us to be able to enjoy what nature has so abundantly provided us...clean water. I hope you will make cleaning the two waterways a priority! Thank you"

Christine Mooberry:

"Dear Ms. Varlik, I ask that you would prioritize the cleanliness and health of the local waters and environment! We love the beauty of our environment and would appreciate efforts to keep it clean and healthy! Thank you"

Kathryn Mundy:

"Dear Ms. Varlik, Thank you for helping to make James Island Creek and Shem Creek safer for me and my friends to kayak and swim in! I love living in the low country and being able to SAFELY enjoy the tidal creeks and marshes is definitely one of my favorite parts of Mount Pleasant and James Island. Thank you"

Melissa Myers:

"Dear Ms. Varlik, I want to see Shem Creek and James Island Creek safe and healthy for swimming. I'm a frequent paddler on the creeks and want to continue this. Please support clean creeks. Thank you"

Elizabeth Nemeth:

Dear Ms. Varlik, I am writing to voice my support for clean water for Shem Creek and James Island Creek and all of Charleston's tidal creeks. I live on Longbranch Creek in West Ashley and fish, crab, and shrimp the creek; you can find me on the dock wearing my Cajun Reebok's (aka white shrimp boots) most evenings. Our waters are precious- and I wholeheartedly support initiatives to set water quality standards for safe swimming and fishing. Thank you so much for your leadership in preserving the health of our waterways.

Jill Norton:

" Dear DHEC, PLEASE PROCEED IN TIMELY AND EFFECTIVE ACTIONS THAT WILL CLEAN UP THE SHEM CREEK AND ELLIS CREEK FOR THE CHARLESTON COMMUNITY OF WATER ACTIVITIES LOVERS! Thank you"

Dusty Parker:

"Dear Ms. Varlik, I'm sure that you would agree with me that safe, clean oceans and creeks are important. I strongly support DEHC in efforts to clean our local Charleston county area creeks to meet state water quality standards for swimming, especially Shem Creek And Ellis Creek. It's not just important for today, but for future generations to enjoy. Thank you for your time and consideration."

Blake Pearce:

"Dear Ms. Varlik, Please do something about the bad water quality standards in James Island Creek and Shem Creek! Thank you very much. Thank you"

Jessica Peragine:

"Dear Ms. Varlik, As a local and environmentalist, I do my part to help better our lands and waterways and to teach others about the importance of a healthier earth. One of my current concerns is to see Shem Creek and James Island Creek safe and healthy for swimming again and to protect those living in these ecosystems above and below these waters. Many fish, sea birds, and marine mammals are affected too. Yet run-off pollution from roads after storms and waste from boats aid in the reproduction of harmful bacterias which make these waters uninhabitable for animals and unsafe for human aquatic activities. Please help all affected parties be able to safely enjoy these waters again today and for future our generations. Thank you"

Kate Pfile:

"I am a resident of James Island and have the privilege of living on Ellis creek. As a member of CHARLESTON Waterkeepers, I receive a weekly update on the bacteria levels of the local waterways. Week after week the testing site on Ellis Creek is red. This concerns me because this means the water that I moved to be near is not safe when my husband and I go paddle boarding. I am pleased to know DHEC is assessing this situation and urge you to take the necessary steps to making Ellis Creek clean and safe for everyone. Let me know how I can assist you with these efforts."

Stephanie Ragsdale:

"Dear Ms. Varlik, Every body of water should be accessible for safe wading and swimming. We have to stand up before these things are no longer an option. Thank you"

Emily Randisi:

"Dear Ms. Varlik, Please help preserve Shem Creek and James Island Creek and keep them safe and healthy for swimming. As a DHEC employee, it is your professional obligation to keep the public safe from poisons they neither agreed to, nor were warned about. If there is anything people like myself can do to aid in this effort, please do your best to let us know. We support you and we have put our trust and our health in your hands. Thank you"

Christine Magnarella Ray:

"I live on James Island because I love the salt marsh and tidal creeks that thread their way through our neighborhoods. I believe that these creeks, which are valuable nurseries for many ocean animals, should be kept healthy and clean. Our resident dolphins swim and fish in James Island Creek. We James Islanders also swim and fish in the creek. James Island Creek should be safe for us too."

Harriet Reavis:

"Dear Ms. Varlik, I am President of the Marlborough Neighborhood Association on James Island, and we would like to ask for your help in making Shem Creek and Ellis Creek safer. We are counting on you to make sure our waterways are as clean as possible. Thank you"

Sarah Romano:

"Dear Ms. Varlik, I am a mother, an educator, and an avid paddle boarder. I need our local water sources to be safe for all of those reasons. Thank you"

Irene Rowe:

"Dear Ms. Varlik, I am concerned about the water quality of Ellis creek on James Island and Shem Creek In Mount Pleasant. Clean water is imperative. I am hopeful that you are moving to improve the water quality of these two creeks. Thank you"

Maureen Ryan:

"Dear Ms. Varlik, Please Please Please help our creeks. We need to be able to know that we will not get sick because of bacteria levels in our creeks. Please help us have clean water!!! Please! Thank you"

Lisa Scharin:

"Dear Ms. Varlik, The quality and conditions of water in Shem Creek and James Island Creek are a tragedy and an absolute shame, a sin-really!!! These bodies of water are a major attraction for tourists and locals who love paddle boarding, kayaking, canoeing, bird-watching and dolphin watching. Shem Creek is also a focal point for people who want to dine on the water and enjoy the sunset, and watch people enjoy water activities while relaxing at Vickerys', Reds, and the other restaurants along the creek. How horrible that the bacteria in this water is so high-it is a dangerous to swim in and I fear for those who paddle board if they fall into it! YOU should TOO!!! I also have seen enough people fishing and crabbing in this water-they should be warned and aware! This is a health issue and an issue of respect for our environment, wildlife and human rights to be able to enjoy their communities, vacations without fear of getting sick!!!! PLEASE do ALL you can to CLEAN UP these very important bodies of water-as you know-they are connected to other water sources and the ocean too! Thank you"

Michael Shinall:

"Dear Ms. Varlik, Please take the necessary actions to ensure these beautiful waters receive the care they deserve. As I'm sure you are aware, Shem Creek plays a critical role in our local economy and provides family, friends and visitors a place to relax and share memories. Similarly, James Island Creek is home to several Charleston families where it is not unusual to find people fishing, lounging and swimming. Please take all of these aspects into consideration. Thank you for all of your help!"

Parker Singleton:

"Dear Ms. Varlik, I highly applaud and support cleaning up Shem and Ellis creek. I have frequented these beautiful tidal creeks since I was a young boy on vacation with my parents. Now I live here. The constant development troubles me that we are not prioritizing maintaining a pristine environment and that we will soon lose what took millions of years to evolve and develop. Cleanliness allows people to enjoy and appreciate the beauty of these waters and to have more reason to preserve them."

Rob Spawar:

"Dear Ms. Varlik, Thank you for your efforts to clean up our waterways. Especially JI Creek and Shem Creek where we know they need help our and our help. Thank you"

Jeanne Sprott:

"Dear Ms. Varlik, I just wanted you to know that I and my family support DHEC setting targets to clean up Shem Creek and Ellis Creek. They are important recreational resources for our wonderful state. Thank you"

Christina Stanton:

"Dear Ms. Varlik, Please work to keep our water clean. Our ecosystem is a fundamental part of our economy and our society. This is a holistic issue. You need to demonstrate your ability to lead on this front. Thank you"

Cris Sumpter:

"Dear Ms. Varlik, Please help us keep our waters in good health. I have surfed,fished,and kayaked these waters for fifty years. I also am a Creek Watcher with Waterkeepers of Charleston and do a lot of work with DNR in the SCORE program. Obviously the health of our waters is very important to me. Thank you"

Susan Thompson:

"Dear Ms. Varlik, DHEC is setting clean up targets for both creeks. This is an important step in making both creeks, where we live safe for swimming! Please move forward with this effort. Thank you"

Mike Tinkey:

"Dear Ms. Varlik, Please clean up these two popular and iconic creeks We have lived in the Old Village for 36 years and have enjoyed Shem Creek with our children, grandchildren and family. Now with the increases of uses of of the Creek it is important to protect the flora and fauna as well as the water quality for all."

Chris Toler:

"Dear Ms. Varlik, I'm writing to you today to voice my support for cleaner, healthier waterways when it comes to Ellis Creek on James Island and Shem Creek in Mt. Pleasant. As an avid waterman that fishes and paddles both of these waterways, cleaning them up is of the upmost importance to me, my family, and my neighbors. Thank you"

Benjamin Toy:

"Dear Ms. Varlik, I want clean up our creeks Thank you"

Phil Turner:

" Dear Ms Varlik, As a Charleston resident and someone who is out on our rivers and creeks several times a week, I strongly support the proposed mandatory testing and standards. This is essential to protecting the health of our citizens. Thank you"

Christine von Kolnitz:

"Dear Ms. Varlik, I live a few blocks from Shem Creek. I do not have pets that would contribute to poor water quality, I do not use fertilizers or pesticides and I capture rainwater from my roof. I know that other neighbors and businesses can do better and can be taught how to help clean up the creek. I am writing today to ask DHEC to get involved in the clean up efforts for Shem Creek and James Island Creek. These creeks contribute food, economic benefits and quality of life benefits for so many. The animals, plants and people that rely on them deserve clean water. Thank you"

Theodosia Wade:

"Dear Ms. Varlik, We are very concerned about the water quality of our creeks and rivers around James Island and the low country. As we experience more rain higher tides flooding issues increase and along with that water quality is affected. Old and or faulty Septic systems also impact our creeks along with runoff."

Kris Wetzel:

"As a resident of Folly Beach and James Island, my family and I spend a lot of time at the beach and James Island Creek. Let's work together to ensure that all of our waterways stay safe and clean for everyone. Thank you so much for your service!"

Ian Wheeler:

"Dear Ms. Varlik, Our waterways are the greatest asset we South Carolinians have. Clean water is, and will increasingly be, a far more important and enticing element in attracting newcomers to S.C., and S.C.'s overall value proposition, than any politician, corporation or business entity. I want to see Shem Creek and James Island Creek safe and healthy for swimming... Not just because it's the right thing to do for our kids, but also because quality-of-life is an increasingly scarce economic resource in the U.S. If we can't do the

right thing simply because it's the right thing to do, perhaps we can at least do it because the economic prosperity of South Carolina and its residents are at stake. Thank you"

Brian Wildstein:

"Dear Ms. Varlik, Please set clean water standards for our creeks. We must protect our waterways. Thank you"

Richard Williams:

"I live on James Island for decades, and spend time in and near the local waters.
I very much care about clean water for swimming and kayak paddling. We need to keep the water safe and clean."

Glenn Williman:

"Dear Ms. Varlik, Please set up thresholds for bacteria in Shem Creek and James Island Creek. As a boater, safe swimming water is not just nice to have, it is necessary for water recreation to prevent disease in people and pets. Thank you"

Carrie Wilson:

"Dear Ms. Varlik, Our family implores you to make every effort possible to help keep our oceans and waterways clean. It is imperative to pass laws to educate people on how to do this. Sadly people do not know unless they are taught or held by our government agencies to do so. Thank you"

Mary Wofford:

"Dear Ms. Varlik, I want to voice my support for DHEC's efforts to clean up James Island Creek and Shem Creek! Thank you"

Elizabeth Zsolnay:

"Dear Ms. Varlik, As waterfront Old Village residents and avid boaters We care about the lowcountry's waterways and the safety of friends and family who also recreate in them. Charleston Waterkeeper's continued testing has revealed that Shem Creek and James Island (Ellis) Creek don't meet state water quality standards for safe swimming due to high levels of bacteria. DHEC setting clean up targets for both creeks is an important step in making both creeks safe for fishing and swimming. Thank you"

Department's Response to Comments Above:

South Carolina Department of Health and Environmental Control (SCDHEC, the Department) appreciates your support, and taking the time to comment on the draft James Island Creek and/or Shem Creek Enterococcus Total Maximum Daily Load (TMDL) documents.

SCDHEC's mission is "To improve the quality of life for all South Carolinians by protecting and promoting the health of the public and the environment". To that end, various tools that are available to us are used, several of which are explained below.

One of these tools is, South Carolina Water Classifications and Standards, Regulation 61-68. These regulations were published in agreement with SC Pollution Control Act, available at: https://www.scdhec.gov/sites/default/files/media/document/R.61-68_0.pdf. These regulations establish a framework for managing and protecting the state's waterways. Classifications and standards relating to waterbodies can be found in this document. For example, James Island Creek is classified as SA recreational salt waters. Based on this classification, the water quality standard for enterococcus specifies that a geometric mean of samples taken within a 30-day period should not exceed 35 mpn/100 ml, nor should any one sample taken on a given day should not exceed 104 mpn/100 ml. Similarly, Shem Creek is classified as SB recreational salt waters. Based on this classification, the water quality standard for enterococcus specifies that a geometric mean of samples taken within a 30-day should not exceed 35 mpn/100 ml, nor should any one sample taken on a given day should not exceed 501 mpn/100 ml.

Another tool available for the Department is the §303(d) List of Impaired Water. The Department evaluates and assesses the quality of SC's waterways every two years. If the water quality standards for a classified waterbody are not met (i.e. impaired), these waters are included in the §303(d) List of Impaired Waters.

Once a waterbody is included on the §303(d) List of Impaired Waters, a total maximum daily load (TMDL) must be calculated for the pollutant of concern and documented in a TMDL document. TMDL documents also provide an inventory of potential sources of pollution, quantify total reductions that are needed to attain water quality standards and provide guidance for remediation.

The Charleston Waterkeeper (CWK) organization has been analyzing weekly bacteriological samples collected from tidally influenced creeks around the Charleston area since 2013. The CWK collects these samples from May through October (the typical recreational season in SC) and determines if the recreational use is being met in these

waters. After two years of sampling by the CWK, data showed that both James Island and Shem Creek are impaired for exceeding recreational use enterococcus water quality standards.

As early as 2014, the Department began to have discussions with stakeholders regarding the potential for developing a TMDL document or an alternative restoration strategy for both creeks.

Following a presentation by Cheryl Carmack of the CWK to some of the residents of James Island Creek, the Department received a petition to develop a TMDL for James Island Creek (November 10, 2014). This petition was coordinated by Ms. Mary Edna Fraser, a resident of James Island Creek.

The CWK organization initially requested that the Department develop an alternative restoration strategy for Shem Creek watershed (October 28, 2014). Ultimately, the CWK and the permitted MS4s within the Shem Creek watershed decided that developing a TMDL document would be the more appropriate path towards restoration of recreational use in Shem Creek.

In order to calculate a scientifically defensible TMDL, additional data were needed. During the time frame from receiving the request/petition and leading to the development of the 2016 §303(d) List of Impaired Waters, the Department assigned a priority rank of "1" for both James Island Creek and Shem Creek, which meant that TMDL development was being targeted for the calendar years 2016-2018. The 2016 §303(d) List of Impaired Waters and statewide priority rankings for all impaired locations were subsequently approved by US Environmental Protection Agency (US EPA) Region 4 on June 22, 2017.

Following the commencement of the James Island Creek and Shem Creek TMDL documents on June 1, 2016, Ms. Fraser provided back ground information about James Island Creek such as its historical use for ferrying goods to and from Charleston peninsula, describing potentially problem areas around the watershed, as well as other relevant information. Other stakeholders provided local knowledge regarding both watersheds during the same time frame. As each TMDL document was drafted, the Department collaborated with the CWK and other regulated MS4s with jurisdiction in each watershed. These were the City of Charleston, Charleston County, SC Department of Transportation, the Town of James Island, and the Town of Mt Pleasant.

Pollutant sources can generally be classified as either point source or nonpoint source:

1) There are two types of point sources, continuous or non-continuous: Discharges from pipes owned and operated by industrial, domestic, and municipal wastewater dischargers are continuous discharges.

   Point sources are permitted by the Department under National Pollutant Discharge Elimination System (NPDES) permits. If these facilities are discharging wastewater that meets their permit limits, they are not causing or contributing to impairment. If any of these facilities are not meeting their permit limits, enforcement actions/mechanisms are in place. Currently, there are no wastewater facilities permitted to discharge treated effluent in either James Island Creek or Shem Creek.

   Stormwater discharges are categorized as non-continuous, because they discharge in response to rain fall or snow melt. Depending on population size, some municipalities also have NPDES permits, called Municipal Separate Storm Sewer System (MS4) permits. Within the James Island Creek TMDL watershed, there four MS4s: The City of Charleston, Charleston County, SC Department of Transportation (state wide permit), and the Town of James Island. Within the Shem Creek TMDL watershed, there three MS4s: Charleston County, SC Department of Transportation (state wide permit), and the Town of Mt Pleasant.

2) Non-point source (NPS) pollution is generally a result of precipitation, deposition from air, seepage, or hydrologic modification. The cause of NPS pollution is precipitation moving over land and picking up and discharging natural or manmade pollutants to nearby waters, such as James Island Creek or Shem Creek. Several examples of NPS of pollutants can include:

   a. Bacteria and viruses from pet poop left on the lawns, streets, or dumped into storm sewers,

   b. Bacteria and viruses from malfunctioning septic systems,

   c. Bacteria and viruses from wildlife poop,

   d. Bacteria and viruses from illegal discharges of sanitary waste from boats.

   e. Bacteria and viruses from poorly maintained marine sanitary devices,

   f. Resuspension of bacteria containing sediment by boats, jet skis, and water skiers not abiding by “no wake zone” speed limits,

   g. Bacteria and viruses from improperly maintained sewer lines,

   h. Eroding stream banks,

i. Excessively applied lawn fertilizers, insecticides, and herbicides from backyards and gardens,

j. Oil, grease, antifreeze, transmission fluid, and other toxic chemicals deposited by vehicles on roads and these pollutants being carried to nearby waters as a result of rain or melting snow.

The Department believes majority of the sources contributing to enterococcus exceedances are caused by pollutants entering both James Island Creek and Shem Creek through NPS as described in #2, above.

We encourage local stakeholders to partner with organizations such as the CWK, local municipalities, sewer districts, and engage in initiatives to reduce the nonpoint sources of bacteria.

Often times, we don't realize the harmful impacts of our actions on water quality. But, the great news is these impacts can be reduced by educating ourselves and implementing these small but impactful actions. Implementing these incremental actions changes will help improve the water quality in both watersheds and help ensure that the recreational use water quality standard is being met. A few examples are given below:

i. As pet owners, picking up after our pets, especially dogs, and removing poop from everywhere including back yards, dog parks, sidewalks, street, etc., and properly discarding the poop in the trash, or installing or building pet waste digesters in our yards.

ii. Regularly having septic tanks inspected and repaired as needed. If feasible, connecting to the local sewer collection system.

iii. Discouraging feeding wildlife,

iv. Using appropriate best management practices (BMP) to discourage roosting of birds on porches, eaves, canopies, docks, dock roofs and railings, and other hard, impervious surfaces, hence reducing the amount of bird poop entering our waters.

v. Having riparian buffer areas in our yards, especially adjacent to creeks. These vegetative areas buffer pollutants from reaching surface waters such as James Island Creek. Planting native vegetative in these buffer area reduces the watering rate, thus reducing runoff that pollute our waters.

vi. Abiding by "no wake zone" speeds while boating, water and/or jet skiing, reduces the resuspension of bacteria containing sediments, and reduces the erosion of stream banks.

vii. Cleaning off of crabbing/shrimping/fishing waste off of docks and disposing of such waste in the trash prevents attracting wildlife which reduces the amount of bacteria from their poop.

viii. Making certain to close the lids of garbage bins and dumpsters to prevent wildlife, such as racoons, from accessing trash.

ix. Properly maintaining our marine sanitation devices and refraining from dumping in our waters. Charleston Waterkeeper has a free and reliable pump out service, where they can set you up with a regular pump out schedule or on as needed basis. To get on Captain Herman Miller's schedule, please call him at 843-608-9287 (http://charlestonwaterkeeper.org/who-we-are/team/)

Responses to other comments

Mary Arnold Comment One:

"As a youth I swan in the James Island Creek. I now live off a tributary of Shem Creek. I paddle board often from my dock on Shem Creek. When paddling in Shem Creek my boards get coated in a brown film. That happens nowhere else that I paddle in the area. I sit on the end of my dock and watch the tides come and go with a top skin layer that appears to the eye to be some sort of pollutant. I have a friend that is a prone paddler that often put in at the Shem creek boat landing She became sick and was ultimately diagnosed with lead poisoning. It was opined that she contracted the disease from paddling in Shem Creek. Thus all assistance cleaning up these creeks would be greatly appreciated."

Mary Arnold Response One:

The James Island Creek Enterococcus TMDL Document evaluates only the existing bacteria levels in James Island Creek. It is important to note that this document does not address other pollutants. Currently, there are no documented exceedances of lead in James Island Creek.

Mary Edna Fraser Comment One:

"Dear Ms. Varlik, I live on James Island Creek and started getting ear infections and sore throat in 2012. Please consider the animals at the Wag Factory and overflow from the Dog Park. We know sewage is going into our creek with high tides it just pours out. We appreciate your efforts to bring back clean water for all. Thank you"

Mary Edna Fraser Response One:

The James Island Creek Enterococcus TMDL Document evaluates existing instream bacteria levels, provides guidance for the improvement of bacteria levels necessary to achieve the recreational use water quality standard. National Pollutant Discharge Elimination System (NPDES) permitted non-continuous point sources, such as small MS4s, construction and industrial activities identified in the draft TMDL document will continue to be addressed through existing and future permits and may be subject to compliance and enforcement mechanisms. Nonpoint sources identified in the TMDL document may be addressed through volunteer efforts. Grant opportunities may be available through the Department as Clean Water Act §319 grants. We encourage local stakeholders to pursue these grants and other initiatives to implement the nonpoint sources of bacteria, such as pet waste in owners yards, malfunctioning septic tanks, discontinuing the feeding of wildlife, using appropriate best management practices to discourage roosting of birds on docks and its railings.

If undocumented sources of bacteria are observed by you or other local stakeholders in the watershed (i.e. sewage), you are encouraged to contact the local SCDHEC regional office located at 1362 McMillian Avenue, Charleston SC at (843) 953-0150. The local office should be able and investigate your concerns.

Mary Edna Fraser Comment Two:

I would like to add that the Wag Factory and County Dog Park also send pet waste into our creek. Every time we have high tides septic is spilled in at Harborview and Centerville Roads and has been reported by concerned citizens for years now. Thank you for doing this study as I live on James Island Creek with my husband John Sperry and the pollution levels are measured on my dock. We appreciate your efforts and applaud the Charleston Waterkeeper and SC Coastal Conservation League and all those who care about our health on James Island Creek.

Mary Edna Fraser Response Two:

SCDHEC appreciates your support. SCDHEC does not regulate development, review zoning decisions or issue local ordinances in these watersheds. For James Island Creek enterococcus TMDL area, local jurisdictions are City of Charleston, Charleston County, and Town of James Island. SCDOT is also a permitted MS4 entity within the watershed.

Local businesses, such as Wag Factory, are not regulated by SCDHEC. Based on the current MS4 boundaries, Wag Factory is within the jurisdictional boundary of Town of

James Island. We suggest you contact Town of James Island directly regarding your concerns.

James Island County Park is located within the unincorporated area of Charleston County. The dog park is surrounded by a retention pond, which does not discharge to storm sewers. For further information please contact Charleston County Parks and Facilities regarding enforcement of pet waste pick up rules, and regarding the sampling efforts from the retention pond and sampling results. County Parks and Facilities are available at: https://ccprc.com/

During the drafting of the James Island Creek TMDL document, the Department worked closely with City of Charleston, Charleston County, Town of James Island, SCDOT, and Charleston Waterkeeper. There were several meetings, site visits, information exchanges, and all parties worked collaboratively to delineate the James Island Creek watershed. During one of the meetings, issues regarding septic tanks such as their locations, age, and maintenance was discussed. Jurisdictions shared available data with the Department for analysis. The analysis results, along with a map (Figure 10), can be found in section "3.2.4 Failing Septic Systems" of the TMDL document.

Depending on the jurisdictional area, the Centerville area and along Harborview Road are served by either James Island Public Service District or Charleston Water System. Based on information available at time of TMDL development, there are currently no onsite septic systems in the Centerville area and along Harborview Road. However, to the west of Folly Road, to the north and north-northwest of James Island Creek and to the north-northwest of Dills Bluff Road, there are numerous onsite septic systems currently in use. The Department does not inspect septic tanks after they are installed unless complaints are brought to the attention of the local SCDHEC Office. It is the responsibility of property owner to have their septic system and drainfield inspected annually, maintain it properly, and have regular pump outs. Functionality and maintenance status of onsite septic systems currently in use with in the James Island Creek TMDL watershed area is unknown.

If undocumented sources of bacteria are observed by you or other local stakeholders in the watershed (i.e. failing septic tanks), you are encouraged to contact the local SCDHEC regional office located at 1362 McMillian Avenue, Charleston SC at (843) 953-0150. The local office should be able and investigate your concerns.

Jay Rucker Comment One:

"I live on the upper portion of Ellis Creek. My children routinely swim in the water and so we are thrilled to hear DHEC is taking steps to improve the creek's water quality. I am

familiar with what I think is an undocumented septic tank bordering Ellis creek. Who can I contact to have this looked into?"

Jay Rucker Response One:
SCDHEC issues permits for the installation of septic tanks in the State. For additional information see: https://www.scdhec.gov/environment/your-home/septic-tanks. In Charleston County, the regional office located at 1362 McMillian Avenue can be contacted directly at (843) 953-0150. The local office should be able and assist you with regards to undocumented septic tanks.

Incomplete Comment Submittals:

Kimberly Imbus Comment One:

"Dear Ms. Varlik, [your message here] Thank you, [your name here]."

Kimberly Imbus Response One:

SCDHEC attempted to reach the commenter for further clarification after receiving the initial message on 06/12/2019. The Department did not receive an additional response.

Patricia Luck Comment One:

"Dear Ms. Varlik, [your message here] Thank you, [your name here]."

Patricia Luck Response One:

SCDHEC attempted to reach the commenter for further clarification after receiving the initial message on 06/12/2019. The Department did not receive an additional response.

Gustavo Serrano Comment One:

"Dear Ms. Varlik, [your message here] Thank you, [your name here] Gustavo Serrano"

Gustavo Serrano Response One:

"DHEC: Mr. Serrano, I believe you meant to send me comments, however I have not received it (see below). If you would like to send your comments, I would encourage you to do that by 5 pm, June 14th.

Gustavo Serrano Comment Two:

"Realized that after I sent it, sorry about that..."

Gustavo Serrano Response Two:

SCDHEC attempted to reach the commenter for further clarification after receiving the initial message on 06/12/2019. The Department did not receive an additional response.