BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 19

2015 ANNUAL UPDATE

Shellfish Sanitation Section
Water Monitoring, Assessment and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, SC 29201

October 2015

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South Carolina Department of Health and Environmental Control

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SHELLFISH MANAGEMENT AREA 19
2015 ANNUAL UPDATE

[Data Through December 2014]

Prepared By:

Randy Moody, Shellfish Program Lead
Low Country EQC Beaufort Office
104 Parker Drive
Burton, South Carolina 29906

Reviewer/Editor:

D.M. Pearson, Statewide Shellfish Program Manager
Monitoring, Assessment, and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

Charles M. Gorman, Division Director
Water Monitoring, Assessment, and Protection Division
Environmental Quality Control - Bureau of Water

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Data Inclusive Dates:
01/01/12 thru 12/31/14

Classification Change:
_X_ Yes ___ No

Shoreline Survey Completed: _Yes_

Prior Report & Date: Annual - 2014

(I)ncreased/(D)ecreased/(N)one:
_D_ Approved
_N_ Conditionally Approved
_I_ Restricted
_N_ Prohibited

SUMMARY

Water quality in Shellfish Management Area 19 exhibits nearly the same conditions as reported in the 2014 Area 19 Annual Update, with the exception of four stations located in May River. All remaining stations within the management area meet fecal coliform indicator organism standards for an Approved shellfish harvest classification.

There is one classification change necessary in this management area for the 2015-2016 Shellfish Harvesting Season. A portion of the May River will be downgraded from Approved to Restricted. Stations 19-19B and 19-19C failed to meet the criteria for the Approved classification. Therefore, the section of the May River extending from Station 19-19B to Station 19-24 will be Restricted for shellfish harvesting in the 2015-2016 Season.

Bacteriological water quality and shoreline survey data indicate that Area 19 is properly classified.

INTRODUCTION

Purpose and Scope

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47 that provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State. This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish

is used by the United States Food and Drug Administration (USFDA) to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved Area - Growing areas shall be classified approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations that would render shellfish unsafe for human consumption. Approved classifications shall be determined upon a sanitary survey that includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, nor shall more than ten percent of the samples exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform MPN shall not exceed fourteen per one hundred milliliters, nor shall the estimated ninetieth percentile exceed an MPN of forty three per one hundred milliliters (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be determined using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Conditionally Approved Area - Growing areas may be classified conditionally approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in non-point source pollution from rainfall runoff or discharge of a major river, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as conditionally approved. Where appropriate, the management plan for each conditionally approved area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems), evaluation of each source of pollution, and means of rapidly closing and subsequently reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish shall not be directly marketed from a conditionally approved area until conditions for an approved classification have been met for a period of time likely to ensure the shellfish are safe for consumption. Shellstock from conditionally approved areas that have been subjected to temporary conditions of actual or potential pollution may be relayed to approved areas for purification or depurated through controlled purification operations only by special permit issued by the Department.

Restricted Area - Growing areas shall be classified restricted when sanitary survey data show a moderate degree of pollution or the presence of deleterious or poisonous substances to a degree that may cause the water quality to fluctuate unpredictably or at such a frequency that a conditionally approved classification is not feasible. Shellfish may be harvested from areas classified as restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. The suitability of restricted areas for harvesting of shellstock for relay or depuration purposes may be determined through the use of comparison studies of background tissue samples with post-process tissue samples, as well as other process verification techniques deemed appropriate by the Department. For restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Conditionally Restricted Area - Growing areas may be classified conditionally restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as conditionally restricted. Where appropriate, the management plan for each conditionally restricted area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems and an evaluation of each source of pollution, and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as conditionally restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For conditionally restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of conditionally restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty per one hundred milliliters (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Prohibited Area - Growing areas shall be classified prohibited if there is no current sanitary survey report or if the sanitary survey report or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area

or otherwise indicate that such substances could potentially reach quantities that could render shellfish unfit or unsafe for human consumption.

Background Information

Shellfish Management Area 19 consists of approximately 28,609 acres of shellfish growing area habitat in Beaufort and Jasper Counties. Nearly 480 acres are classified as prohibited. It is comprised of the May, Cooper, New and Wright Rivers and their tributaries including Bull Creek and Ramshorn Creek.

The area's northern boundary begins at Highway 170 near the intersection of Highway 46 and Highway 170. It continues along Highway 278 to the western shore of Mackay Creek. The eastern boundary is defined by the shoreline of Calibogue Sound to the confluence of the Savannah River. The Savannah River defines the southern boundary. The western boundary begins in the vicinity of Station 19-20 in the Wright River and Station 19-21 in the New River and ends at the intersection of Highways 46 and 170.

The Atlantic Intracoastal Waterway (AIWW) runs through Area 19 between the Cooper River and Savannah River. Residential development in Area 19 is centered around Highway 278 and the Bluffton area and on Daufuskie Island, which is accessible only by boat. The majority of the shellfish resources and harvesting activity is located around the May River area.

The shellfish industry in South Carolina is based mainly on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams (*Mercenaria sp.*). Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State Shellfish Grounds, Culture Permits, and Kings Grant areas.

There are four (4) shellfish culture permit areas in Area 19. The general public is allowed to harvest on three state shellfish grounds in Area 19. State Shellfish Ground S003 is located on Turtle Island, S005 is located on Haig Point, and S007 is in Bull Creek. Recreational harvesting is allowed for clams and oysters in all approved areas, and commercial harvesting by licensed individuals is allowed, subject to seasons established by SCDNR. Recreational harvesting only is allowed on the Bull Creek/May River on Public Shellfish Ground (R008). The Bluffton Oyster Company operates an oyster shucking plant adjacent to the May River.

The shellfish-harvesting season in South Carolina typically extends from October 1 through May 30, although actual dates may vary. SCDNR has the authority to alter the shellfish harvest season for management purposes. The South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that shellfish harvested in South Carolina waters are safe for human consumption.

In 2009, Station 19-19, *May River at First Dock in Headwaters past Bluff* located in the headwaters of the May River, appeared to be in a state of decline. Beginning in CY2010, new monitoring stations were established to better assess water quality along portion of the May River extending from the upper most headwaters seaward through Station 19-19 and continuing to Station 19-24, *May River at Southern end of Crane Island.*

The harvesting classification of Area 19 prior to this survey was as follows:

Prohibited: (Administrative closure)

1. Freeport Marina (Cooper River), closure zone of 1,000 feet around marina.
2. Melrose Landing (Cooper River), closure zone of 1,000 feet around marina.
3. Savannah River, all waters in South Carolina portion.
4. Field's Cut, from its confluence with the Savannah River to its confluence with the Wright River at Station 19-22.

Restricted:

1. Portions of the May River, from the headwaters to Station 19-19B. This also includes Rose Dhu and Stoney Creeks.

Conditionally Approved: None

Approved: The remaining waters of Area 19

Station Addition/Deactivation/Modification: None

POLLUTION SOURCE SURVEY

Survey Procedures

Shoreline surveys of Area 19 were conducted by the Lowcountry Beaufort Shellfish Program staff, by watercraft, vehicle, and on foot, during the survey period, and are ongoing.
Extensive visual examination of lands adjacent to the waters of Area 19 was conducted to determine potential sources of pollution entering shellfish growing waters.

Point Source Pollution (See Table 1 and Figure 1)

A. Municipal and Community Waste Treatment Facility - There are no direct discharges of wastewater into the waters of Area 19. Treated effluent from the area's wastewater treatment plants is typically used for spray irrigation on golf courses. The Beaufort Jasper Water & Sewer Authority/Palmetto Bluff WWTP is a 0.20 mgd facility consisting of a Hycor fine screen, aerated pond, chlorination, and effluent holding pond. The Palmetto Bluff WWTP discharges treated effluent to a dedicated 86-acre golf course and a 167-acre all weather disposal site as a backup site. Because the disposal sites are adjacent to shellfish waters, the permit's fecal coliform bacteria limits are a monthly average of 14/100 ml and a daily maximum of 43/100 ml.

The Haig Point WWTP is a 0.64 mgd facility consisting of four aerated lagoons, chlorination, and effluent holding pond. Effluent is applied to the Haig Point and Melrose Golf Courses. The Daufuskie Island Club WWTP is a 0.08 mgd facility

consisting of an aeration pond, chlorination, and effluent holding pond. Effluent is applied to an 18 hole golf course.

The Beaufort Jasper Water & Sewer Authority/Cherry Point Plant provides service to all other sewered areas within Area 19, although the physical location of the plant is not within the Area 19 boundaries. Effluent treated by this facility is also applied to five golf courses within the Area 19 borders.

B. Industrial Discharges - There are no permitted industrial discharges in Area 19.

C. Marinas - In 2007, prompted by the Department's Office of Coastal Resource Management (OCRM) marina definition change, the Shellfish Sanitation Section incorporated the following marina definition. S.C. Regulation 61-47, Shellfish defines Marina as any of the following: (1) locked harbor facility; (2) any facility which provides fueling, pump-out, maintenance or repair services (regardless of length); (3) any facility which has effective docking space of greater than 250 linear feet or provides moorage for more than 10 boats; (4) any water area with a structure which is used for docking or otherwise mooring vessels and constructed to provide temporary or permanent docking space for more than ten boats, such as a mooring field; or (5) a dry stack facility.

There are two active marinas located in Area 19. Freeport Marina and Melrose Landing, located on the Cooper River at Daufuskie Island, have an approximate 1,100 meter by 470 meter administratively Prohibited closure zone encompassing both facilities. Freeport Marina and Melrose Landing have sewage pump-out facilities.

D. Radionuclides - Due to concerns related to the Department of Energy - Savannah River site (DOE-SR), the Savannah River is routinely monitored for radionuclide impacts. Radiological monitoring of surface water is conducted on and adjacent to the Savannah River Site. Routine samples from surface water locations are collected weekly for tritium analysis. Samples are also collected weekly from each location to produce a monthly composite. The monthly composites from each location are analyzed for gross alpha, gross beta and beta-gamma-emitting radionuclides. An annual report is generated and can be reviewed at:

http://www.scdhec.gov/HomeAndEnvironment/Pollution/DHECPollutionMonitoringServices/

This report has summarized that very low doses of radionuclides are present in the Savannah River that are located near the southern portion of Area 19 that can affect waters located on Fields Cut leading from the Savannah River to the confluence of the Wright River. All portions of the Savannah River within South Carolina, as well as Fields Cut (Savannah River to the Wright River near Station 19-22) are administratively Prohibited to shellfish harvest. No radiological adversities that exist affecting water quality for shellfish harvesting. In 2010, the ESOP was tasked to conduct mercury monitoring that may affect South Carolina waters located in or near Area 19. Current Fish Advisory postings can be located at:

http://www.scdhec.gov/environment/water/fish/.

Non-Point Source Pollution

A. Urban and Suburban Stormwater Runoff - Stormwater runoff may impact water quality by transporting fecal coliform bacteria (and other pollutants) from land to the shellfish growing area. Stormwater from roads, residences, and agricultural land is directed to the lowest point of elevation - typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments that drain into tidal creeks.

There is a significant amount of residential and business development in progress along Highway 278 and in the Bluffton area. Land disturbance activities associated with these developments are subject to current stormwater regulations and, with few exceptions, all are on public sewer.

Beaufort County enacted a stormwater management utility in 2001. The stormwater utility assesses a stormwater fee to residential and non-residential property owners, and the fees collected are dedicated to stormwater-related activities. These may include operation and maintenance of stormwater systems, implementation of improvements to reduce stormwater-related problems such as flooding and stormwater runoff pollution, and related studies.

The Stormwater Master Plan report was funded through the fees collected by the stormwater utility. The study was designed to identify problem areas related to stormwater, and to recommend a plan to solve problems and better control the impacts on receiving waters in Beaufort County.

In June 2007 the Beaufort Stormwater Utility initiated a Monitoring Program to implement recommendations in the Beaufort County Stormwater Management Plan. This plan called for monitoring to:

1. Track water quality trends in areas of the county expecting large increases in impervious surfaces (development). This long-term effort (10 years or longer) will be to determine if the current Best Management Practices (BMP) are protecting our water resources.

2. Establish Baseline Water Quality – Most of the current water quality impairments are due to Stormwater from developments that occurred before the County and Municipalities required BMPs on new development. The Plan identified a number of potential sites to construct regional water quality control facilities. Sites were identified to monitor water quality to prioritize sites and establish a baseline to compare with monitoring to be done after construction of water quality control facilities. This data will be collected for 2 to 3 years to establish a baseline.

3. Develop Data to Support Water Quality Modeling – The Stormwater Management Plan used a number of models to predict pollutant loading from existing and future

development. It identified monitoring recommendations to validate the planning level modeling. This data will also be collected for approximately 3 years.

4. Determine Effectiveness of BMPs - Current County requirements specify the BMP and sizes needed to mitigate new development. These requirements assume a certain level of effectiveness for these BMPs. One of the most widely used BMPs is a wet detention pond. The plan recommends monitoring wet detention basins on a rotating basis within the county. It is expected this type of monitoring would be for 1 to 2 years and then moved to another pond.

The County was contracted to these recommendations of the Plan in June 2007 and has been modified to meet plan requirements for a second year contract. The first year report has been received by the county and is now posted for viewing at:

http://www.bcgov.net/Stormwater/index.php

Most land disturbing activities in South Carolina must comply with the Stormwater Management and Sediment Reduction Act of 1991. The final regulations, effective on June 26, 1992, establish the procedures and minimum standards for a statewide stormwater management program. For activities in the eight coastal counties, additional water quality requirements are imposed. For all projects, regardless of size, which are located within one-half mile of a receiving water body in the coastal zone, the criteria for permanent water quality ponds having a permanent pool is that they are designed to store the first inch of runoff from the entire site over a 24-hour period or storage of the first one inch of runoff from the built-upon portion of the property, whichever is greater. Storage may be accomplished through retention, detention, or infiltration systems, as appropriate for the specific site. In addition, for those projects that are located within 1000 feet of shellfish beds, the first one and one half inches of runoff from the built-upon portion of the property must be retained on site. Since 1992, these regulations have been applied to the development of residential subdivisions, golf courses, and business areas.

B. Agricultural Waste – There is a number horse stables observed and documented in Area 19 with an unknown approximation for the number of horses at each stable. These numbers vary from season to season. Joint cooperation between the Town of Bluffton, the Beaufort County Stormwater Utility, South Carolina Department of Health and Environmental Control Environmental Quality Control and each owner of the horse stables have an established waste management plan implemented for the proper disposal of horse manure. It appears there are no adverse impacts to water quality existing between the locations of these stables and nearby water bodies throughout the shellfish management area. No cattle have been observed in Area 19 during the survey update period.

C. Individual Sewage Treatment and Disposal System (ISTDS) - The majority of homes in Area 19 utilize central sewage collection systems for wastewater disposal. Older homes adjacent to the May River typically utilize ISTDS. In 2008, the Town of Bluffton contracted for a thermal image study (reference Water Quality Study section of this

report for further details) to observe any indications of failing septic tanks near the headwaters of the May River. No evidence of major violations of failed septic systems was noted upon the completion of this study.

D. Wildlife and Domestic Animals - This area supports populations of white-tailed deer, raccoons, wading birds, migratory waterfowl, and other wildlife, which may contribute to fecal coliform levels in some areas. Domestic animals present in the area include dogs, cats, horses, and goats. SCDNR is currently in the planning stages of conducting an update to wildlife habitat in specific designated areas throughout Beaufort County.

E. Boat Traffic - Calibogue Sound provides access to the Atlantic Ocean for commercial and recreational vessels. The Atlantic Intracoastal Waterway (AIWW) runs between the Cooper River and the Savannah River. Tugs and barges, commercial and recreational vessels utilize this North/South route. The Town of Bluffton has identified impacts concerning water quality on the May River and is currently addressing the need to control watercraft and its recreational usages. These can be reviewed in the May River Waterbody Management Plan located on the Town of Bluffton's website referenced in the Water Quality Studies section of this report.

F. Hydrographic and Habitat Modification - Hydrographic and habitat modification in estuarine areas require both State and Federal approval.

Naturally Occurring Pathogens

A. Marine Biotoxins - Bivalve shellfish contamination from marine biotoxins has not been shown to be a human health concern within Area 19. During the winter and spring of 1988, South Carolina experienced an occurrence of "Red Tide", specifically Ptychodiscus brevis (K. brevis), which affected water quality in Area 01. There has been no documented reoccurrences of this organism at levels requiring emergency response in South Carolina waters subsequent to the 1988 event. Due to the vast media coverage of events related to Pfiesteria pisicida, the Department participates in a State Task Group on Toxic Algae and operates a toxic algae emergency response team.

B. *Vibrio parahaemoliticus* – Because State water temperatures exceed 81 degrees Fahrenheit (F) during June through September, *Vibrio parahaemoliticus* (Vp) management controls must be implemented during these months. Management controls for permitted Aquaculture facilities are specifically addressed in R.61-47. The season for wild-stock harvest is currently closed from May 30 through September 30. The Department is currently not opposed to the issuance of special harvest permits to Certified Shippers during the closed season, provided permit conditions include current NSSP requirements for temperature control. Special permit conditions must also include current NSSP temperature control requirements to be included in the Certified Shipper's HACCP plan.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

Physiography

Area 19 is part of the Savannah River estuary, a coastal plain system that includes the New, Wright, and Savannah Rivers and several distributaries of Savannah River (e.g. Front, Back, and Middle Rivers and the South Channel). It is separated from the Broad River estuary by a tidal node in Calibogue Sound, just northeast of May River. The average depth of the estuary is approximately 5 meters at mid tide level. Navigational channels downstream from Highway 17 in the lower Savannah and Front Rivers range from 9m to 12m in depth and facilitate the intrusion of saltwater into the estuary. The conversion of thousands of acres of saltwater wetlands into diked disposal areas on the South Carolina side could also have altered flow patterns and salinity regimes.

Most tidal exchange occurs through the entrance to Savannah River, primarily through the North Channel; however, limited exchange occurs with the Broad River estuary through Calibogue Sound. The salinity structure is primarily determined by controlled releases of freshwater from impoundments on Savannah River and its tributaries. (NOAA, 1994).

Tides in Area 19 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range is 7.0 feet during normal tides and 8.9 feet above mean low water during spring tides. The greatest tidal ranges of the year typically occur around full moon during the months of September through December. There is considerable variation in the normal tide range due to the prevailing strength and direction of winds.

Rainfall data used in this survey is collected at a weather station located at the Broad Creek Public Service District, Hilton Head, S.C. The rainfall gauge is typically read at approximately 7:00 AM and the rainfall amount is recorded for that date. As most shellfish samples are collected after 7:00 AM, the rainfall for the sample date + 24 hours has been added to the rainfall summary table. Rainfall for the sample date + 24 hours may correlate better and help to explain elevated fecal coliform concentrations in sample results, particularly if there was zero rainfall on the date of or prior to sampling.

Mean annual rainfall is normally 49.78 inches, with August being the wettest month. For the reporting period of CY2014 and this annual update, the yearly average rainfall amount was 44.93 inches. This is slightly below the 30-year mean rainfall totals for this area (NOAA Climatological Data Center). Typically 40% of the annual rainfall falls in the three-month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and thundershower activity of short duration. In addition, these three months also have the highest numbers of days with rainfall greater than 1.00". The months of December through March historically have the greatest number of days with rainfall exceeding 0.10" and 0.50". Rainfall events during these months are typically of a longer duration.

Prevailing wind direction during January through February is generally from the west to northwest with an average speed of 8-12 MPH. During the months of March through August,

wind direction is typically a southerly component at an average speed of 7-10 MPH and September through December normally maintains a north-north easterly wind direction with an average speed of 6-8 (NOAA).

The May River receives no freshwater from river discharges, but some from freshwater wetlands. The New River receives freshwater input from the Great Swamp. The Wright River receives most of its freshwater input from the Savannah River. Fields Cut connects the AIWW and Wright River to the Savannah River. Highest river discharge usually occurs in late winter and early spring due to heavy precipitation in the Blue Ridge and piedmont areas, with the lowest discharge occurring late summer and fall. The salinity structure of the Savannah River estuary is primarily determined by controlled releases of freshwater from impoundments on Savannah River and its tributaries. Field's Cut, from the Savannah River to near its confluence with the Wright River is administratively Prohibited.

WATER QUALITY STUDIES

Description of Sampling Methods and Historical Information

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 19 in lieu of monitoring under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during this annual review period. Monitoring dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather.

Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station and provides a six-sample "cushion" that is above the NSSP required 30 sample minimum. This also allows each annual report to meet the NSSP Triennial Review monitoring criteria.

During the period of January 1, 2012 through December 31, 2014 Eight hundred eighty-four (884) surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses and classification purposes at twenty-six (26) active water quality monitoring stations in Area 19. The samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported to South Carolina Department of Health and Environmental Control Lowcountry Environmental Quality Control laboratory located in Burton, South Carolina. Each bacteriological sample run included a 120 ml water temperature control sample maintained at less than or equal to 10 degrees Celsius. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding period or contained a temperature control greater than 10 degrees Celsius were discarded.

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

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined using the National Oceanic and Atmospheric Administration, 2014 Tides and Currents Predictions website located at http://tidesandcurrents.noaa.gov/tide_predictions.shtml?gid=155.

The final report on "*A Baseline Assessment of Environmental and Biological Conditions in the May River, Beaufort County, South Carolina*" was released in April 2004. The report's conclusions state that: "A triad assessment of water quality, sediment quality, and biotic condition was used in this study to evaluate overall condition in each habitat (i.e., headwater creeks, large tidal creeks, and open water sites) using a weight of evidence. Based on current State criteria and regional guidelines, the results indicated that most of the May River estuarine habitats are in good condition, although several headwater creeks showed some signs of stress.

Based on an evaluation of land use patterns, the stressful conditions observed in these creeks were probably not related to anthropogenic inputs, and are likely natural phenomena of this system.

Fecal coliform bacteria concentrations, while relatively high in all headwater tidal creeks were generally not indicative of human sources (relatively 'high' concentrations of fecal coliform have been observed in headwater creeks during previous studies.) These elevated bacterial counts in the unpopulated Palmetto Bluff Creek and the sparsely populated Stony and Rose Dhu Creek watersheds indicate a natural source of fecal coliform bacteria that is probably attributable to wildlife.

In June 2008, the May River Waterbody Management Plan was established through a collaborative planning effort between the Town of Bluffton and the South Carolina Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management (DHEC OCRM). This plan was to recognize the significance of the May River and its importance both to local residents and to the region. Beginning in the late 1990s, the sleepy coastal area began to expand as new development resulted in a larger year-round population. Bluffton also grew from roughly one square mile to almost 55 square miles through the annexation of nearby areas. Recognizing the potential impacts of this sudden change, the Town Council was instrumental in identifying and engaging collaborators to document, study, and analyze the May River. A major theme of the project was identifying and advancing realistic options that would, first and foremost, preserve the River and its uses into the future. The project team, comprised of staff from the Town of Bluffton's Department of Environmental Protection and DHEC OCRM, began work in May 2007. Considerable information and data had been collected on and about the environment, ecology, habitats, and physical parameters of the May River and its watershed. However, this information had not been previously consolidated and summarized in one document specific to the manner and extent in which people utilize the River. The Waterbody Management Plan for the May River provided an opportunity for the compilation and review of existing information from a variety of sources, and analysis based on goals and objectives established for the project. This analysis resulted in the identification of

potential issues and conflicts between users, user groups, and the environmental conditions that were identified for protection. Ultimately the Waterbody Management Plan identified specific tasks and recommendations that should be implemented over the next five years that would be the most likely to achieve the various Project Goals and Objectives. The development of the Waterbody Management Plan involved a three-step process beginning in June 2007. First, an Inventory of Existing Conditions within the Study Area was prepared, incorporating information on the ecology, water quality, flora and fauna, boat use, drainages, public access, fishing and bathing, economy, and a range of uses of the May River and its upland watershed. The Second phase involved the project team performing an analysis of the information gathered against the Project Goals and Objectives established for the protection of the River. This analysis identified recurring issues, conflicts that currently or is predicted to occur between the uses and the project goals and objectives, and possible options to avoid or minimize the problems identified. The final phase involved the identification of implementation priorities and development of a strategy to advance the goals and objectives of the Waterbody Management Plan. Further details concerning this documentation can be reviewed at the Town of Bluffton Office of Planning & Environmental Sustainability located at:

http://www.townofbluffton.sc.gov/departments/growthmanagement/Pages/planningandenvironmentalsustainability.aspx

In 2008, the Town of Bluffton contracted for a thermal image study to observe any indications of failing septic tanks near the headwaters of the May River. No evidence of major violations of failed septic systems was noted upon the completion of this study. The Town of Bluffton is continuously observing and addressing all septic systems to review and implement best management practices.

Special Sampling Studies

The SCDHEC Office of Ocean and Coastal Resource Management completed a Waterbody Management Plan that provided the Town of Bluffton an assessment tool to better understand the delicate balance between the natural environment and the Town's continued growth in development. The on-going efforts and diligent work from the town's committed environmental staff, along with this watershed management plan, the Town of Bluffton has received several EPA grant awards distributed through the SCDHEC Section 319 program. Further updates and information concerning the progresses of these grant projects can be found through the Town of Bluffton's Growth Management Department located at:

http://www.townofbluffton.sc.gov/government/departments/growthmanagement/Pages/planning.aspx

The Town of Bluffton, along with the Beaufort County Stormwater Utility is continually conducting water quality monitoring throughout all sensitive areas of the watershed. Specific areas of interest are along the May River and the New River sub-watersheds. The Town of Bluffton also continues collaborative efforts with several other private and government agencies and is constantly analyzing consolidated data for trends in water quality in the May River and other bodies of water in the Beaufort County district.

Monitoring Results

All stations in Shellfish Management Area 19 exhibit excellent water quality, with the exception of Stations 19-19, 19-19A, 19-19B and 19-19C.

Stations 19-19, 19-19A, 19-19B and 19-19C, along the upper portions of the May River, have exceeded the minimum fecal coliform bacteriological criteria with a geometric mean greater than 14 and a 90th percentile of greater than 43 MPN.

Table #5 includes the 90^{th} percentile values for all water quality monitoring stations in Shellfish Management Area 19 for the past ten years.

CONCLUSIONS

During this review period, the fecal coliform bacteriological data in combination with the pollution source survey indicates that Area 19 is affected by four sources of actual or potential pollution; Non-Point Source Runoff, Individual Sewage Treatment and Disposal Systems (ISTDS) and Freshwater Inflow.

Point Source Pollution

Numerous point sources such as waste water treatment facilities and marinas are located within Area 19. Administratively Prohibited closures are established around these pollution sources.

Non-Point Source Runoff

Stormwater runoff appears to be the primary source of fecal coliform bacteria concentrations in Area 19. Possible sources of fecal coliform bacteria contamination include pets, wildlife, domestic animals such as horses and cows, failing septic systems, and drainage from roads and freshwater wetlands. Particular areas of concern are located near the headwaters of the May River.

Freshwater Inflow

Freshwater inflows from the furthest reaches of the New River influence the water quality in the lower portions of shellfish management Area 19. Other fresh water influences come from surrounding swamp and wetlands that discharge into these sub-watersheds. Wildlife, shallow ground water flow and soil bacteria can also cause elevated fecal coliform concentrations throughout the management area.

Individual Sewage Treatment and Disposal Systems (ISTDS)

Most homes adjacent to shellfish waters in Area 19 are served by ISTDS. Soils in most areas are considered to be suitable for ISTDS and should operate properly if maintained. However, many

older homes with “grandfathered” systems may not meet current standards.

RECOMMENDATIONS

There is only one change that involves two monitoring stations necessary for the 2015-2016 Shellfish Harvesting Season. Water quality in Shellfish Management Area 19 exhibits nearly the same excellent conditions as reported in the 2014 Area 19 Annual Update, with the exception of Stations 19-19, 19-19A, 19-19B and 19-19C which will cause the current restricted zone to extend further downstream to sample 19-24. All remaining stations within the management area meet fecal coliform indicator organism standards for an Approved shellfish harvest classification.

Based upon this annual report, the following shellfish growing area classification is recommended:

Prohibited: (Administrative closure)

1. Freeport Marina (Cooper River), closure zone of 1,000 feet around marina.
2. Melrose Landing (Cooper River), closure zone of 1,000 feet around marina.
3. Savannah River, all waters in South Carolina portion.
4. Field’s Cut, from its confluence with the Savannah River to its confluence with the Wright River at Station 19-22.

Restricted:

1. May River, from the headwaters including Rose Dhu and Stoney Creeks and associated tributaries and marshlands to Station 19-24.

Conditionally Approved: None

Approved: The remaining waters of Area 19

Station Addition/Deactivation/Modification: None

Analysis of sampling data for Area 19 demonstrates the probability of a significant impact if rainfall exceeds 4.00" during a 24-hour period. A precautionary closure of Area 19 prohibiting the harvesting of all shellfish will be implemented following all rainfall events of greater than 4.00" within a 24-hour period, as measured at the Broad Creek Public Service District, Hilton Head, SC. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP) estimates for the coastal United States published in a series of hydro-meteorological reports (HMR) by the National Weather Service (*National Weather Service*). PMP estimates for South Carolina’s growing areas are derived from HMR 51, 52, and 53 (*National Research Council, 1985*).

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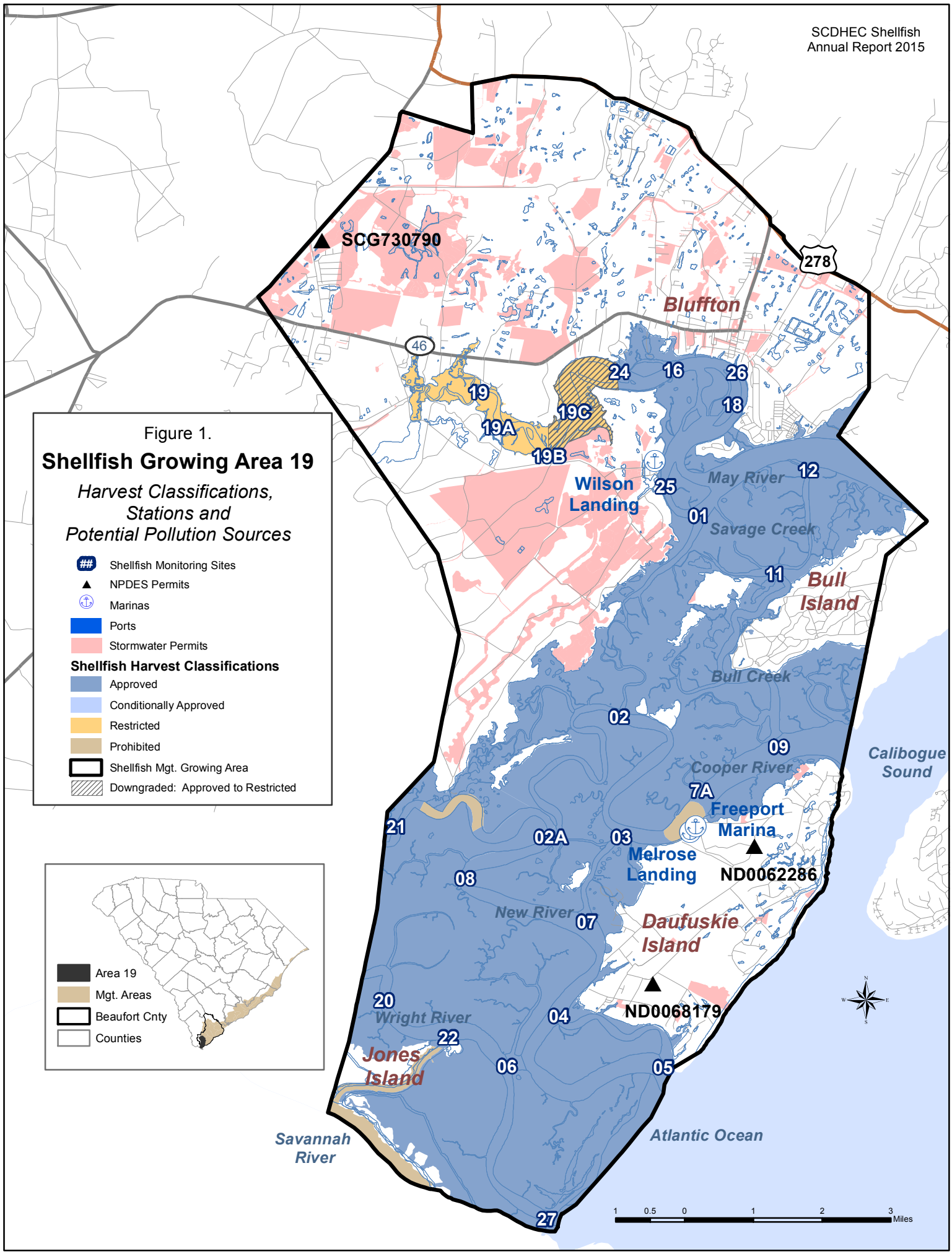
Figure 1.
Shellfish Growing Area 19
Harvest Classifications, Stations and Potential Pollution Sources
Shellfish Monitoring Sites
NPDES Permits
Marinas
Ports
Stormwater Permits
Shellfish Harvest Classifications
Approved
Conditionally Approved
Restricted
Prohibited
Shellfish Mgt. Growing Area
Downgraded: Approved to Restricted
Area 19
Mgt. Areas
Beaufort Cnty
Counties
SCG730790
ND0062286
ND0068179
Bluffton
Wilson Landing
Freeport Marina
Melrose Landing
Daufuskie Island
Jones Island
May River
Savage Creek
Bull Island
Bull Creek
Cooper River
New River
Wright River
Calibogue Sound
Atlantic Ocean
Savannah River
278
46
24
16
26
18
19
19C
19A
19B
12
25
01
11
09
7A
02
21
02A
03
08
07
20
04
22
06
05
27
1 0.5 0 1 2 3 Miles

TABLE 1
Point Source Pollution

MARINAS				
NAME/GPS LOCATION	**# Slips/Dock Length/Ac**	**# Live Aboards**	**Pump Out (Y/N)**	**Fuel (Y/N)**
Freeport +32.13178 -80.87322	/1040' 2.50 acres	0	No	No
Melrose Landing +32.13345 -80.87100	/488' 0.90 acres	0	Yes	No

Land Application (ND) Permitted Facilities						
Facility Name	**Permit #**	**Type of Discharge**	**Discharge Location**	**Facility Permitted Allowable Flow (MGD)**	**~Avg Outfall Flow (MGD)**	**Facility Violations**
BJW&SA/ Cherry Point WWTP +32.339010 -80.948466	ND0074004 (002, 007, 008, 011, 013)	Municipal	Island West, Rose Hill, Old Carolina, Hilton Head National, and Hampton Hall Golf Courses	7.50	3.50	None
BJW&SA/ Palmetto Bluff WWTP +32.191028 -80.914599	ND0082147 (001 – 003)	Domestic	Palmetto Bluff Golf Course & All Weather Disposal Site	0.2	0.08	None
Haig Point / Melrose WWTP +32.128136 -80.856910	ND0062286	Domestic	Haig Point & Melrose Golf Courses	0.640	0.423	Sampling records and O&M. BOD.
Daufuskie Island Club WWTP +32.099442 -80.882160	ND0068179	Domestic	Spray Irrigation onto one 18 Hole Golf Courses near Mungen Creek.	0.080	0.077	Sampling records.

National Pollutant Discharge Elimination System (NPDES) Permitted Facilities						
Facility Name	**Permit #**	**Type of Discharge**	**Discharge Location (Outfall #)**	**Permitted Allowable Flow (MGD)**	**~Avg Outfall Flow (MGD)**	**Facility Violations**
None						

Sanitary Sewer Overflow (SSO) Violations
Between Jan 01, 2014 and Dec 31, 2014

No SSO's that adversely affected shellfish grounds were reported during CY2014.

TABLE 2
Shellfish Water Quality Monitoring Stations Description

Station	Description	Latitude	Longitude
19-01	May River South of Palmetto Bluff, Marker #8	32.1986	-80.8704
19-02	Unnamed Creek at Jack Crow Island in Cooper River	32.1562	-80.8903
19-02A	Cooper River at New River	32.1308	-80.9073
19-03	Ramshorn Creek at Cooper River	32.1307	-80.8897
19-04	Cooper River at Marker #41 - Daufuskie Island	32.0929	-80.9053
19-05	Bloody Point at Mungen Creek	32.0821	-80.8795
19-06	Wight River, Marker #43	32.0823	-80.9182
19-07	Ramshorn Creek at New River	32.1129	-80.8984
19-08	First Creek on Left up New River at Pollution Line	32.1220	-80.9285
19-09	Bull Creek at Cooper River	32.1498	-80.8507
19-11	Bull Creek at Savage Creek	32.1862	-80.8516
19-12	Bull Creek at May River	32.2082	-80.8433
19-16	May River Behind Bluffton Oyster Co-op	32.2294	-80.8769
19-17A	Cooper River Marina at Edge of CSZ	32.1405	-80.8687
19-18	May River below Drainage Canals at Marker #11	32.2220	-80.8621
19-19	May River at First Dock in Headwaters past Bluff	32.2248	-80.9252
19-19A	Unnamed Tributary near SW corner of Gasciogne Bluff	32.2173	-80.9203
19-19B	Bend in May River nearest the high bluff of Palmetto Bluff	32.2112	-80.9077
19-19C	First Unnamed Tributary leading from Gascoigne Bluff	32.2205	-80.9015
19-20	1.5 Miles up Wright River from Fields Cut	32.0962	-80.9487
19-21	2.5 Miles up New River from Station 19-02A	32.1330	-80.9457
19-22	Wright River at Fields Cut	32.0885	-80.9328
19-24	May River at Southern end of Crane Island	32.2290	-80.8901
19-25	May River at Green Marker #25	32.2048	-80.8787
19-26	May River, Southeast of Heyward Cove	32.2288	-80.8609
19-27	Wright River at confluence with Atlantic Ocean	32.0500	-80.9083

(Total Active: 26)

TABLE 3
Fecal Coliform Bacteriological Data Summary
Shellfish Water Quality Sampling Stations between
January 1, 2012 and December 31, 2014

Station # ►	1	2	2A	3	4	5	6	7	8	9	11
SAMPLES	34	34	34	34	34	34	34	34	34	34	34
GEOMEAN	2.9	4.8	3.9	3.2	3	2.8	3.7	3.3	2.7	2.6	2.8
EST 90TH%ILE	7	16	13	8	7	6	12	9	6	6	6
WATER QLTY	A	A	A	A	A	A	A	A	A	A	A
CLASSIFICATION	A	A	A	A	A	A	A	A	A	A	A

Station # ►	12	16	17A	18	19	19A	19B	19C	20	21	22
SAMPLES	34	34	34	34	34	34	34	34	34	34	34
GEOMEAN	2.8	4.7	2.7	4.8	37.2	21.3	11.4	11.1	4.6	5.5	6.2
EST 90TH%ILE	7	13	6	20	204	95	52	56	16	20	25
WATER QLTY	A	A	A	A	R	R	R	R	A	A	A
CLASSIFICATION	A	A	A	A	R	R	R	R	A	A	A

Station # ►	24	25	26	27
SAMPLES	34	34	34	34
GEOMEAN	7.3	3.4	4.6	3.4
EST 90TH%ILE	29	9	16	9
WATER QLTY	A	A	A	A
CLASSIFICATION	R	A	A	A

A - Approved **CA** - Conditionally Approved **R** - Restricted **RND** - Restricted/No Depuration **P** – Prohibited

OBTAINING WATER QUALITY SAMPLING STATION DATA

Detailed data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports can be obtained through South Carolina's Department of Health and Environmental Control – Freedom of Information office at the address below.

Freedom of Information
Dept. of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

TABLE 4 – Rainfall Data
Source: Broad Creek PSD Hilton Head Island, SC
Reporting data for 2012-2014

2012	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
1st	0.00	0.00	0.00	0.01	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.00
2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.48	0.00	0.00
3rd	0.00	0.00	2.08	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00
4th	0.00	0.00	1.36	0.00	0.00	0.02	0.00	0.18	0.01	0.00	0.14	0.01
5th	0.00	0.00	0.00	0.18	0.00	0.44	0.00	0.01	0.00	0.00	0.01	0.01
6th	0.00	0.00	0.00	0.04	0.00	0.66	0.00	0.00	0.00	0.42	0.13	0.00
7th	0.00	0.00	0.00	0.00	0.03	0.04	0.00	0.48	0.00	0.15	0.00	0.00
8th	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.82	0.06	0.52	0.00	0.00
9th	0.00	0.00	0.13	0.00	1.44	0.00	0.00	0.22	0.13	0.00	0.00	0.01
10th	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.78	0.00	0.01	0.01	0.00
11th	0.27	0.00	0.00	0.00	0.00	1.52	0.00	1.02	0.00	0.00	0.00	0.01
12th	0.00	0.00	0.00	0.00	0.00	0.48	0.25	0.00	0.00	0.01	0.06	0.66
13th	0.00	0.00	0.47	0.00	0.00	0.00	0.01	0.00	0.27	0.00	0.00	0.08
14th	0.00	0.13	0.01	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15th	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.13	0.29	0.07
16th	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.01	0.01
17th	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.16	0.00	0.00	0.00	0.39
18th	0.07	0.18	0.00	0.01	0.52	0.00	0.00	0.00	0.25	0.36	0.16	0.01
19th	0.00	1.51	0.01	0.03	0.00	0.00	0.00	0.30	0.00	0.01	0.00	0.00
20th	0.01	0.00	0.00	0.00	0.18	0.00	0.12	0.04	0.00	0.00	0.00	0.28
21st	0.22	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
22nd	0.01	0.00	0.00	0.41	0.01	0.00	0.00	0.58	0.00	0.01	0.00	0.00
23rd	0.00	0.00	0.38	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00
24th	0.01	0.08	0.46	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.02
25th	0.01	0.00	0.07	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.10
26th	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.01	0.48
27th	0.00	0.66	0.00	0.00	0.13	0.00	0.02	0.27	0.00	0.00	0.01	0.00
28th	0.00	0.00	0.00	0.00	0.06	0.00	0.00	4.59	0.00	0.00	0.00	0.00
29th	0.00	0.00	0.00	0.00	0.76	0.00	1.32	0.14	0.15	0.00	0.01	0.60
30th	0.00	--	0.00	0.00	0.34	0.00	0.98	0.38	0.12	0.00	0.00	0.00
31st	0.00	--	0.59	--	0.01	--	0.01	0.01	--	0.00	--	0.00
MAX	0.27	1.51	2.08	0.41	1.44	1.52	1.32	4.59	0.27	0.52	0.29	0.66
AVG	0.019	0.089	0.186	0.023	0.119	0.160	0.121	0.367	0.033	0.071	0.028	0.088
SUM	0.60	2.57	5.77	0.68	3.69	4.81	3.75	11.39	0.99	2.21	0.85	2.74
*Sample Dates are indicated in blue.											Yr Total	40.05

2013	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.01	0.00	0.00	0.03	0.00	0.00	0.14	0.00	0.00	0.00	0.22	0.00
2nd	0.01	0.00	0.00	0.00	0.08	0.00	0.53	0.00	2.76	0.00	1.30	0.00
3rd	0.15	0.00	0.00	0.05	0.16	0.43	0.07	0.00	0.00	0.00	0.00	0.00
4th	0.00	0.00	0.00	0.70	0.70	0.05	0.06	0.78	0.00	0.01	0.00	0.00
5th	0.01	0.00	0.07	0.50	0.71	0.17	0.40	0.30	0.00	0.00	0.00	0.01
6th	0.11	0.00	0.00	0.01	0.00	1.73	0.04	0.00	0.00	0.01	0.04	0.00
7th	0.00	1.00	0.00	0.00	0.05	0.20	0.00	0.00	0.00	0.02	0.00	0.10
8th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00
9th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
10th	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.14
11th	0.01	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12th	0.01	2.19	0.12	0.71	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00
13th	0.02	2.07	0.00	0.00	0.00	0.00	0.10	0.25	0.00	0.00	0.00	0.00
14th	0.01	0.00	0.00	0.50	0.00	0.00	1.68	1.75	0.00	0.00	0.00	1.29
15th	0.00	0.01	0.00	0.11	0.00	0.00	0.09	0.69	0.06	0.00	0.11	0.13
16th	0.01	0.01	0.00	0.00	0.00	0.00	0.00	1.06	0.67	0.00	0.04	0.00
17th	0.04	0.00	0.00	0.01	0.00	0.16	0.00	0.12	0.02	0.00	0.00	0.00
18th	0.00	0.01	0.32	0.00	0.10	0.00	0.00	1.38	0.00	0.00	0.01	0.00
19th	0.00	0.05	0.04	0.51	0.04	1.61	0.00	0.00	0.00	0.23	0.00	0.00
20th	0.00	0.00	0.00	0.56	0.00	0.00	0.46	0.13	0.00	0.00	0.00	0.00
21st	0.00	0.00	0.00	0.07	0.00	0.00	0.37	0.00	0.05	0.00	0.00	0.01
22nd	0.00	0.18	0.01	0.00	0.00	0.10	0.45	1.14	0.00	0.05	0.00	0.00
23rd	0.00	0.90	0.31	0.00	0.01	0.00	0.66	0.00	0.00	0.01	0.00	0.44
24th	0.00	0.01	1.04	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.06
25th	0.00	0.79	0.00	0.00	0.00	0.02	0.07	0.00	0.65	0.00	0.01	0.00
26th	0.00	0.80	0.00	0.00	0.00	0.46	0.01	0.00	0.36	0.00	1.14	0.00
27th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
28th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
29th	0.00	--	0.00	0.11	0.00	1.68	0.16	0.00	0.00	0.01	0.00	0.84
30th	0.27	--	0.00	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00
31st	0.15	--	0.02	--	0.00	--	0.81	0.00	--	0.01	--	0.00
MAX	0.27	2.19	1.04	0.71	0.71	1.73	1.68	1.75	2.76	0.23	1.30	1.29
AVG	0.026	0.309	0.062	0.129	0.060	0.236	0.234	0.245	0.152	0.015	0.096	0.099
SUM	0.81	8.65	1.93	3.88	1.85	7.09	7.26	7.60	4.57	0.48	2.89	3.08
*Sample dates are indicated in blue											Yr Total	50.09

2014	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.45	0.16	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
2nd	0.67	0.00	0.01	0.00	0.00	0.00	0.00	0.58	0.05	0.01	0.00	0.02
3rd	0.00	0.00	0.02	0.00	0.00	0.00	0.48	0.43	0.01	0.32	0.00	0.00
4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.21	0.00	0.00	0.01
5th	0.00	0.22	0.22	0.00	0.00	0.84	0.83	0.00	0.14	0.00	0.00	0.00
6th	0.00	0.10	0.61	0.33	0.00	1.07	0.46	0.00	0.31	0.00	0.00	0.00
7th	0.00	0.00	0.03	0.71	0.00	0.03	0.00	0.00	0.14	0.00	0.00	0.00
8th	0.00	0.04	0.00	0.65	0.00	0.11	0.00	1.23	0.16	0.00	0.00	0.00
9th	0.03	0.00	0.00	0.00	0.01	0.00	0.00	1.52	0.00	0.00	0.07	0.00
10th	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00
11th	0.44	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
12th	0.00	0.45	0.32	0.00	0.00	0.00	0.51	0.18	0.00	0.00	0.00	0.00
13th	0.00	0.02	0.00	0.01	0.00	0.07	0.18	0.00	0.00	0.00	0.00	0.00
14th	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.60	0.00	0.00
15th	0.01	0.02	0.00	0.83	1.41	0.00	0.13	0.03	1.08	0.00	0.00	0.00
16th	0.00	0.00	0.11	0.00	0.00	0.00	0.22	0.00	1.45	0.00	0.09	0.00
17th	0.07	0.00	0.45	0.00	0.00	0.00	0.95	0.00	0.04	0.00	0.18	0.00
18th	0.00	0.00	0.29	3.18	0.00	0.00	0.00	0.00	1.89	0.00	0.00	0.00
19th	0.00	0.00	0.00	0.34	0.02	0.00	0.06	0.12	0.63	0.00	0.00	0.00
20th	0.00	0.00	0.01	0.03	0.00	0.00	0.01	0.00	0.15	0.00	0.00	0.03
21st	0.00	0.44	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.04	0.00	0.34
22nd	0.00	0.00	0.06	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
23rd	0.00	0.00	0.01	0.01	0.00	0.57	0.00	0.00	0.05	0.00	0.86	0.22
24th	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.12	0.03	0.00	0.75	0.36
25th	0.00	0.00	0.64	0.00	0.00	0.15	2.69	0.00	0.00	0.00	0.65	0.00
26th	0.00	0.49	0.00	0.00	0.02	0.00	0.13	0.00	0.01	0.00	0.05	0.00
27th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
28th	0.35	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
29th	0.29	--	0.60	0.00	0.00	0.00	0.00	0.00	0.13	0.01	0.00	0.21
30th	0.01	--	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
31st	0.00	--	0.00	--	0.34	--	0.00	0.00	--	0.00	--	0.00
MAX	0.67	0.49	0.64	3.18	1.41	1.07	2.69	1.52	1.89	0.60	0.86	0.96
AVG	0.096	0.069	0.1096	0.214	0.058	0.107	0.245	0.168	0.216	0.032	0.088	0.07
SUM	2.98	1.94	3.40	6.43	1.80	3.23	7.62	5.21	6.49	1.00	2.66	2.17
*Sample dates are indicated in blue											Yr Total	44.93

TABLE 5 – Fecal Coliform Historical Trend

Area 19 Stations 90th%ile Values for Annual Updates Related to Rainfall											
Station #	**2014**	**2013**	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**
19-01	6	7	7	9	11	14	11	10	6	7	5
19-02	15	17	13	14	12	17	16	17	19	17	15
19-02A	7	11	14	22	17	15	11	17	17	14	11
19-03	8	8	9	14	15	21	14	14	6	5	4
19-04	6	8	13	13	13	9	10	10	8	7	6
19-05	6	5	8	11	11	11	9	10	8	8	7
19-06	9	8	11	15	15	16	14	13	9	7	6
19-07	9	9	9	10	10	8	12	12	10	6	5
19-08	6	7	12	14	13	7	9	10	10	7	6
19-09	6	6	8	9	10	11	11	13	8	7	6
19-11	5	6	8	11	10	15	14	14	8	6	6
19-12	5	6	7	8	8	10	10	13	8	7	4
19-16	14	18	18	17	14	18	20	23	14	12	8
19-17A	7	7	10	14	14	13	7	8	5	4	5
19-18	8	13	11	14	11	19	16	19	13	13	9
19-19	206	148	153	144	132	81	42	22	17	15	10
19-19A	82	80	78	95	70	ND	ND	ND	ND	ND	ND
19-19B	40	46	50	60	48	ND	ND	ND	ND	ND	ND
19-19C	29	35	33	37	31	ND	ND	ND	ND	ND	ND
19-20	12	8	10	12	14	14	15	14	11	9	7
19-21	15	30	28	48	42	36	26	22	21	13	11
19-22	17	16	24	25	28	17	18	13	11	10	9
19-23	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	6
19-24	21	26	24	26	22	29	28	30	19	14	9
19-25	5	7	6	7	8	9	10	9	9	10	8
19-26	12	16	14	19	14	20	17	26	24	27	ND
19-27	7	7	8	9	10	11	11	12	13	ND	ND
Annual Rainfall (inches)	42.70	35.54	37.18	46.33	52.21	50.23	49.66	48.63	53.79	49.55	45.84
3yr Annual Rainfall Average for Data Inclusive Years of Respective Annual Updates ND = No Data Red = Impaired Water Quality											