BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 18

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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SHELLFISH MANAGEMENT AREA 18
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:
__I__ Approved
__N__ Conditionally Approved
__D__ Restricted
__N__ Prohibited

SUMMARY

For this three-year review period, three (3) of the seventeen (17) total shellfish monitoring stations do not meet bacteriological water quality criteria for the Approved classification. Water quality data summarized for the review period indicate Stations 18-08, 18-16 and 18-17 continue to not meet statistical water quality standards criteria for the Approved classification and will remain Restricted. Water quality data for stations 18-09, 18-10 and 18-11 indicate that water quality has improved again this year and met the Approved criteria. These stations are located in Calawassie Creek and will be upgraded from the Restricted classification to Approved for the 2015-2016 Shellfish Harvesting Season.

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, which 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 18 consists of 12,118 acres of shellfish growing area habitat in Beaufort County. It is comprised of the Colleton and Okatie Rivers and their tributaries including Chechessee, Callawassie, and Sawmill Creeks.

The area's northern boundary runs between the intersection of Highway 170 and Highway 278 and the Chechessee River. The eastern boundary runs along the western shore of the Chechessee River to the mouth of Colleton River then to Highway 278. Highway 278 defines the area's southern boundary. The western boundary runs along Highway 170/278.

Before the 2002 increase of rural development, this area was mainly forested and used for agricultural purposes such as timber or farming. Most of the land is now developed and used for housing, golf courses, and commercial purposes. Most of the shellfish resource and harvesting activity continue to occur in the lower portion of the Okatie and in the Colleton River.

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 two shellfish culture permits in Area 18. The general public is allowed to harvest on one state shellfish ground in Area 18, S058, which is located in Chechessee Creek. Recreational harvesting is allowed for clams and oysters in this area, and commercial harvesting by licensed individuals is currently allowed, subject to seasons established by SCDNR. Recreational harvesting only is allowed on the Chechessee Bluff Public Shellfish Ground (R061) in Chechessee Creek.

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-harvesting 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 all shellfish harvested in South Carolina waters are safe for human consumption.

The harvesting classifications of Area 18 prior to this survey were as follows:

Prohibited: None

Restricted/No Depuration: None

Restricted:

1. Chechessee Creek, from Station 18-03, Chechessee Creek and Okatie River, to Stations 18-10 and 18-11, at the Callawassie and Spring Island bridges, Tributary from Spring Island Shrimp Pond. This also includes Stations 18-09.

2. Okatie River and tributaries, from its headwaters to Station 18-07.

Conditionally Approved: None

Approved: The remaining waters of Area 18.

Station Addition/Deactivation/Modification: None.

POLLUTION SOURCE SURVEY

Survey Procedures

Shoreline surveys of Area 18 were conducted by the Lowcountry Beaufort Shellfish Program staff**,** by watercraft, vehicle, and on foot, during the survey period and are ongoing.

Point Source Pollution

A. Municipal and Community Waste Treatment Facilities - Most of the wastewater facilities are located outside of the boundary of Area 18 and therefore are not shown on the map of Potential Pollution Sources. However, treated effluent from these plants is typically disposed of on golf courses in Area 18. The Beaufort Jasper Water & Sewer Authority (BJWSA) Okatie Water Reclamation Facility (SC0047279 and ND007404), located in adjacent Shellfish Management Area 19, is permitted to dispose of treated effluent at Island West Golf course, Indigo Plantation, Del Webb, and Rose Hill Plantation in Area 18. The plant also has permitted discharges (SC0047279) to the Great Swamp wetlands to the New River, as well as Dell Webb's Sun City Hilton Head wetlands to the New River. Callawassie Island WWTP disposes of its treated effluent on its golf course. Spring Island WWTP by utilizing spray irrigation to dispose of treated effluent onto 150 acres at the Old Tabby Golf Course. Treated effluent is piped from the Bluffton Regional WWTP to a holding tank at Colleton River Plantation, where it will be applied onto the golf courses. BJWSA Rose Hill WWTP is being used as a lift station to pump wastewater into the Okatie Water Reclamation plant and reclaimed water is returned to be spray irrigated at its Equestrian Paddocks area, Rose Hill Golf Course, Western Nine Fairways, Block "X", Block "B-6", Belfair Plantation golf course, and Old Carolina Golf Links. BJWSA Bluffton WWTP has discontinued disposal of treated effluent at the Hilton Head National golf course and Colleton River Plantation golf course. This plant now will be used to store reclaimed water.

B. Industrial Discharges -There are no permitted industrial discharges in Area 18.

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 no marinas currently established in Area 18.

D. Radionuclides -Sources of radionuclides have not been identified within Area 18, and radionuclide monitoring has not been conducted. No other sources of poisonous or deleterious substances have been identified within the area.

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.

In Area 18, stormwater canals drain large areas of land south of Highway 278 to the Colleton River, and areas west of Highway 170/278 into the Okatie River. Stormwater runoff following rainfall may be contributing to high fecal coliform concentrations at station 18-08 in the headwaters of the Okatie. Some impact is also apparent at two stations on the Okatie River, 18-16 and 18-17, which are located near tributaries that receive stormwater. Stormwater coming from a drainage ditch that extends north of Highway 170 may also be impacting water quality in Chechessee Creek. Stormwater runoff impacts 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 that is typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments, which drain into tidal creeks.

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 development 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 recommended monitoring on a rotating basis wet detention ponds in 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 1,000 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 – Numerous cattle and horses are located near the headwaters of the Okatie River. A waste management plan has been developed to control runoff to the river. Manure from horses are collected and mixed with sawdust to be applied to the land on Spring Island. The SCDNR Waddell Mariculture Center is a mariculture research facility located adjacent to the Colleton River, which pumps water out and discharges it back into the Colleton River.

C. Individual Sewage Treatment and Disposal System (ISTDS) - The majority of homes in Area 18 utilize sewer for wastewater disposal. Older homes adjacent to the Okatie River and Chechessee Creek areas utilize ISTDS.

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.

E. Boat Traffic -The Colleton River and Chechessee Creek provide access to Broad River and Port Royal Sound and the Atlantic Ocean for commercial and recreational vessels.

F. Hydrographic and Habitat Modification - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. No modifications were approved for Area 18 for this annual review period. Hydrographic and Habitat Modification - Hydrographic and habitat modification in estuarine areas require both State and Federal approval. No modifications were approved for Area 17 for this annual review period.

Naturally Occurring Pathogens

A. Marine Biotoxins - Bivalve shellfish contamination from marine biotoxins has not been shown to be a human health concern within Area 14. 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 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 18 is part of the Broad River estuary, which is a drowned river valley system and the largest of Sea Island Coastal Region estuaries (219 square kilometers). This estuary, which includes Broad River, Beaufort River, Port Royal Sound, and several tidal tributaries, includes an extensive system of marshes, tidal creeks, and sea islands. The average depth of the estuary is approximately 7 meters at mid tide level. Broad and deep natural channels exist throughout Port Royal Sound, Beaufort River, and major tidal tributaries. Large shoal areas occur primarily in the Beaufort River and Port Royal Sound (NOAA, 1994).

Tides in Area 18 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range is 5.9 feet during normal tides and 6.9 feet 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.

Mean annual rainfall is normally 49.78 inches, with August being the wettest month. For the reporting period of CY2012-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.

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.

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).

There are no freshwater rivers that discharge directly into Area 18. The salinity structure of the Broad River estuary is primarily determined by the seasonal freshwater discharge from the Coosawhatchie and Pocotaligo Rivers and mean salinities vary with less than 5 ppt between typical during high and low salinity periods.

WATER QUALITY STUDIES

Description of Sampling Methods and Historical Information

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 18 in lieu of sampling 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 the review period.

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

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

During the period January 1, 2012 through December 31, 2014, Five hundred sixty-one (561) surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses and classification purposes at 17 active water quality sampling stations in Area 18. 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, Tides and Currents Predictions website located at http://tidesandcurrents.noaa.gov/tide_predictions.shtml?gid=155

A report, *A Baseline Assessment of Environmental and Biological Conditions in Broad Creek and the Okatie River, Beaufort County, South Carolina* was published in the spring of 2000. The study, conducted by SCDHEC, SCDNR, and the NOAA National Ocean Service, involved a comprehensive assessment of overall water quality, sediment quality, and biological conditions of the two study areas. The report states that system wide, fecal coliform bacteria concentrations were higher in Broad Creek than in the Okatie River. Biotyping of the fecal coliform samples that had *E. coli* indicated that Broad Creek had both a higher incidence of *E. coli* in the samples and a higher percentage of antibiotic resistant strains that were indicative of human sources than the Okatie River. There was also a clear association of areas with high *E.coli* counts related to human sources and obvious pollution sources (land application of treated wastewater and septic tanks) in Broad Creek. However, the majority of stations in both Broad Creek (53.3%) and the Okatie River (80%) were negative for the antibiotic resistance tests used for typing probable sources. This suggests that animal wastes are a major contributor of the fecal coliform levels observed in both systems (SCDHEC, 2000).

Monitoring Results

Stations 18-08, 18-16 and 18-17 exceed both the geometric mean and 90th percentile criteria for an Approved classification. However, Stations 18-09, 18-10 and 18-11 meet the criteria for the Approved classification again this year, as well as all remaining stations in the shellfish management area for this review period.

Table #5 includes the 90th percentile values for all water quality monitoring stations in Shellfish Management Area 18 for the past ten years.

Special Sampling Studies

EPA approval for DHEC to conduct a special study for a shellfish Total Maximum Daily Load (TMDL) reduction model that began in 2008. The purpose for this study and model was to review and analyze water quality data to better understand influences and environmental stressors to the Okatie River in the Salkehatchie Watershed Basin and to provide predictive numerical reductions of pollutants that may be influencing the degradation of this water body. This study has been completed by DHEC and has been given final approval from EPA. An EPA 319 section federal grant was issued by SCDHEC that will be used by local interest groups to implement Best Management Practices concerning stormwater run-off and other non-point source pollutants affecting the headwaters of the Okatie River.

CONCLUSIONS

During this review period, the fecal coliform bacteriological data in combination with the pollution source survey indicates that Area 18 is minimally affected by three sources of actual or potential pollution; Non-Point Source Runoff, Individual Sewage Treatment and Disposal Systems (ISTDS) and Freshwater Inflow.

Point Source Pollution

There are no permitted point source discharges or marinas located within Area 18.

Non-Point Source Runoff

Stormwater runoff appears to be the major source of fecal coliform bacteria contamination in Area 18. The area is experiencing continued development. Large tracts of forest and farmland adjacent to the Colleton and Okatie Rivers are in the process of being developed. Increases in impervious surface result in an increase in the volume of stormwater runoff that transports fecal coliform bacteria and other pollutants to shellfish waters. Station 18-09 continues to show elevated levels of fecal coliform bacteria in correlation to rainfall amounts in excess of 1.0 inch.

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.

Freshwater Inflow

The surrounding swamp and wetlands are the only fresh water inflow influences affecting this shellfish management area that that discharge into the Okatie sub-watershed. Wildlife, shallow ground water flow and soil bacteria can also cause elevated fecal coliform concentrations throughout the management area.

Individual Sewage Treatment and Disposal System (ISTDS)

Most homes adjacent to shellfish waters in Area 18 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

Water quality data summarized for the review period indicate Stations 18-08, 18-16 and 18-17 continue to not meet statistical water quality standards criteria for the Approved classification and will continue to be classified as Restricted. Stations 18-09, 18-10 and 18-11 meet Approved criteria again this year and will therefore be upgraded from Restricted to Approved for the 2015-2016 Shellfish Harvesting Season.

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

Prohibited: None

Restricted/No Depuration:

1. Okatie River from its headwaters to Station 18-16.

Restricted:

1. Okatie River and tributaries, from Station 18-16 to Station 18-07.

Conditionally Approved: None

Approved: The remaining waters of Area 18.

Station Addition/Deactivation/Modification: None.

Analysis of sampling data for Area 18 demonstrates the probability of a significant impact if rainfall exceeds 4.0 inches during a 24-hour period. Therefore, a precautionary closure of Area 18, prohibiting the harvesting of all shellfish will be implemented following rainfall events of greater than 4.0 inches of rainfall 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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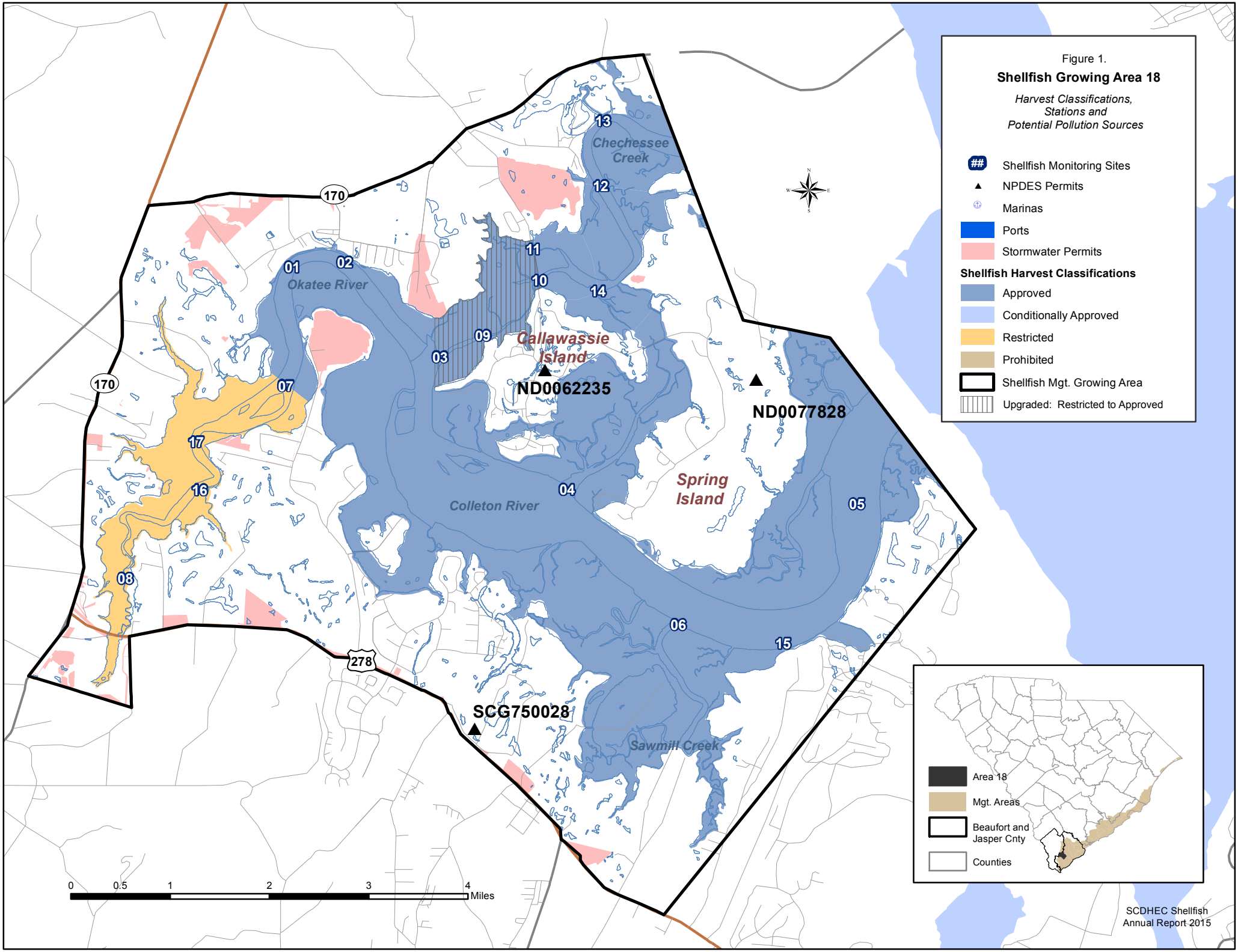
Figure 1.
Shellfish Growing Area 18
Harvest Classifications,
Stations and
Potential Pollution Sources
Shellfish Monitoring Sites
NPDES Permits
Marinas
Ports
Stormwater Permits
Shellfish Harvest Classifications
Approved
Conditionally Approved
Restricted
Prohibited
Shellfish Mgt. Growing Area
Upgraded: Restricted to Approved
Chechessee Creek
Okatee River
Callawassie Island
Colleton River
Spring Island
Sawmill Creek
ND0062235
ND0077828
SCG750028
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17
170
278
0 0.5 1 2 3 4 Miles
Area 18
Mgt. Areas
Beaufort and Jasper Cnty
Counties
SCDHEC Shellfish Annual Report 2015

TABLE 1
Point Source Pollution

MARINAS				
Name/GPS Location	**# Slips/Dock Length/Ac**	**# Live Aboards**	**Pump Out (Y/N)**	**Fuel (Y/N)**
None				

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 (001, 003, 004, 005, 006, 009, 010, 012, 015)	Municipal	Oldfield Sun City - Okatie Creek Sun City – Individual Sites Rose Hill – Polo Field Belfair Sun City - Hidden Cypress Colleton River Plantation Hampton Point Golf Courses	7.50	3.50	None
Callawassie Isl WWTP +32.328842 -80.858245	ND0062235	Domestic	Spray Irrigation	0.238	0.202	None
Spring Isl WWTP +32.326894 -80.818959	ND0077828	Domestic	Spray Irrigation	0.105	0.096	None

National Pollutant Discharge Elimination System (NPDES) Permitted Facilities						
Facility Name	**Permit #**	**Type of Discharge**	**Discharge Location (Outfall #)**	**Facility Permitted Flow (MGD)**	**~Avg Outfall Flow (MGD)**	**Facility Violations[1]**
None						

Sanitary Sewer Overflow (SSO) Violations

Between Jan 01, 2014 and Dec 31, 2014

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

TABLE 2
Shellfish Water Quality Monitoring Stations Description

Station	Description
18-01…	Okatie River at Camp St. Mary's Dock
18-02…	Okatie River Behind Bailey's Oyster Dock
18-03…	Chechessee Creek at Okatie River
18-04…	Callawassie Creek at Colleton River, Mouth of Creek
18-05…	Callawassie Creek at Colleton Creek at Tree Line
18-06…	Sawmill Creek at Colleton Creek
18-07…	Okatie River at Indigo Plantation
18-08…	Okatie River at Dock Without House
18-09…	First Unnamed Tributary in Chechessee Creek from Colleton River
18-10…	Second Bridge to Callawassie Island
18-11…	First Bridge to Callawassie Island
18-12…	Series of Unnamed Tributaries in Chechessee Creek
18-13…	First Unnamed Tributary to Chechessee Point in Chechessee Creek
18-14…	Tributary from Spring Island Shrimp Pond
18-15…	Dock at Waddell Mariculture Center
18-16…	Okatie River at confluence of Pinckney Colony tributary
18-17…	Okatie River at confluence of Cherry Point tributary

(Total 17 Active)

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

Station #►	01	02	03	04	05	06	07	08	09	10	11
SAMPLES	33	33	33	33	33	33	33	33	33	33	33
GEOMEAN	7.1	5.7	5.3	4.5	2.2	5.1	8.8	64.2	8.7	6.9	7
90TH %ILE	26	19	16	14	3	21	38	485	38	25	30
WATERQLTY	A	A	A	A	A	A	A	RND	A	A	A
CLASSIFICATION	A	A	A	A	A	A	R	RND	A	A	A

Station #►	12	13	14	15	16	17
SAMPLES	33	33	33	33	33	33
GEOMEAN	4.2	4	6.7	2.8	23.5	14.5
90TH %ILE	13	12	25	8	146	97
WATERQLTY	A	A	A	A	R	R
CLASSIFICATION	A	A	A	A	R	R

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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00
4th	0.00	0.00	0.00	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	0.00	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	0.00	0.00	0.00	0.00	0.01	0.01	0.00
11th	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
12th	0.00	0.00	0.00	0.00	0.00	0.00	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	0.1
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	0.6
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	0.6	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 18 Stations 90th%ile Values for Annual Updates Related to Rainfall											
Station #	**2014**	**2013**	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004**
18-01	27	31	25	16	11	17	25	29	23	18	15
18-02	28	34	31	17	13	15	20	26	22	19	9
18-03	14	14	15	19	18	27	35	35	27	19	15
18-04	12	12	9	10	11	12	10	12	12	13	9
18-05	4	5	6	5	4	4	5	8	9	8	6
18-06	15	18	18	19	17	16	15	17	14	15	10
18-07	32	30	21	28	28	34	35	32	28	22	17
18-08	315	409	213	264	193	143	123	83	88	58	56
18-09	37	51	53	48	73	80	94	80	84	76	44
18-10	25	23	24	45	47	58	51	51	42	45	51
18-11	32	26	30	35	36	47	52	60	57	47	35
18-12	14	16	15	14	12	13	17	22	22	26	18
18-13	16	16	16	12	11	10	15	25	27	25	15
18-14	29	35	33	26	20	28	36	44	37	32	24
18-15	8	7	7	7	10	14	14	14	10	10	9
18-16	160	176	101	84	79	96	90	74	57	43	35
18-17	82	69	35	42	39	48	56	58	56	41	27
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											