

GOOSE CREEK WATERSHED

MANAGEMENT PLAN

SEPTEMBER 2026 | FINAL

PREPARED FOR

Berkeley County

212 Oakley Plantation Drive
Moncks Corner, SC 29461



PREPARED BY

KCI TECHNOLOGIES, INC.

2456 REMOUNT ROAD, STE 308
NORTH CHARLESTON SC, 29406



McCORMICK TAYLOR

1441 MAIN STREET, STE 875
COLUMBIA, SC 29201



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2 Introduction

This Watershed Management Plan for a portion of the Goose Creek watershed is developed to address key issues impacting natural resources in the watershed. The watershed faces many of the problems typically associated with increased urbanization, and the associated stormwater impacts, including stream and shoreline erosion, water quality degradation, and loss of natural resources. Stormwater runoff also washes pollutants from both urban and rural landscapes into our streams and rivers. If these pollutants – which can include sediment, nitrogen, phosphorus, oils, bacteria, and metals among others – are delivered to the stream system in high enough concentrations the results can be harmful to the fish, amphibians, and aquatic insects, and to humans, who rely on the Goose Creek Reservoir as a source of recreation and water supply. This plan encompasses the portion of the watershed draining to Goose Creek Reservoir that is within Berkeley County and the watershed draining to Goose Creek below the Reservoir down to the railroad crossing below North Rhett Avenue. This is the Focus Area for the recommendations in this watershed management plan and is shown in Figure 1:

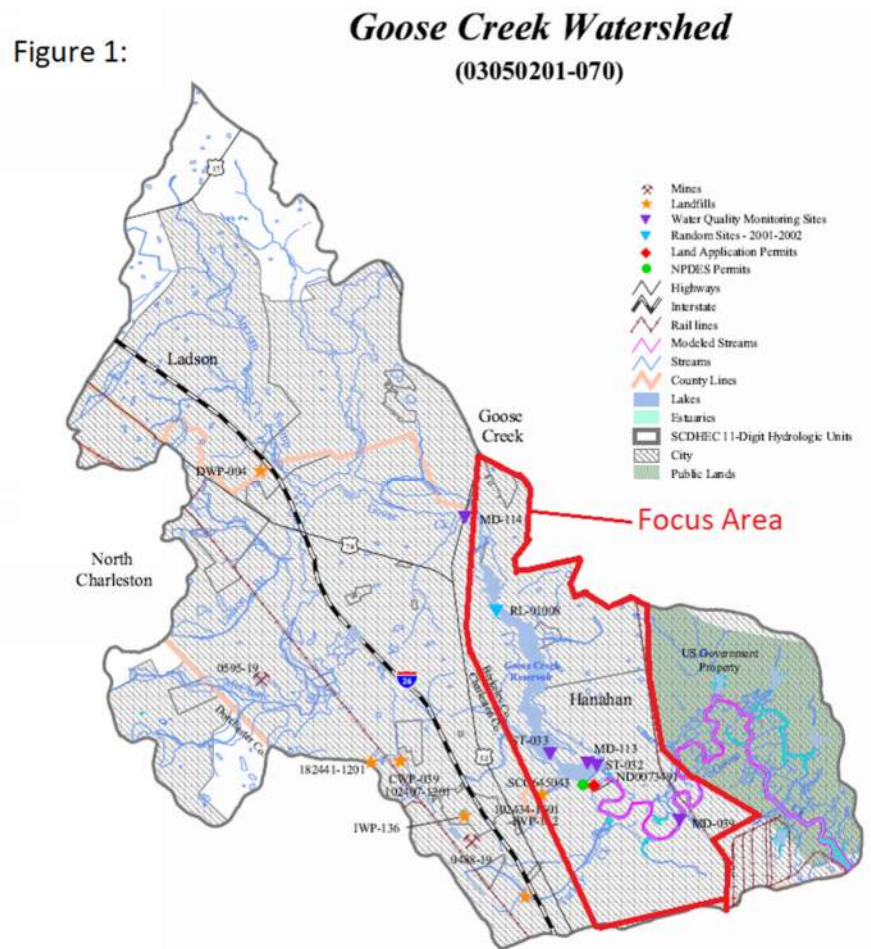


Figure 1 – Focus Area within Goose Creek Watershed

Multiple monitoring stations in Goose Creek and the Goose Creek Reservoir are currently listed on SCDES's 2016 303(d) list for water quality impairments, although no Total Maximum Daily Loads (TMDL) have been established. Impairments in the stream and reservoir sections of Goose Creek include Bacteria (E. coli and Enterococcus) pH impairments. Other issues documented in the watershed include periodic flooding, excessive stream bank erosion, degraded stream habitat, and a lack of riparian or stream-side vegetation.

2.1 Goals and Objectives

It is the goal of Berkeley County to develop a Watershed Management Plan for Goose Creek, the reservoir, and associated tributaries, and to develop a Monitoring and Mitigation Plan for 303(d) impaired waters. In addition to these local goals, implementation of the recommendations in these plans will assist Berkeley County in meeting the pollutant load reduction goals for nitrogen, phosphorus, and bacteria loadings into Goose Creek and the Goose Creek Reservoir.

The **Watershed Management Plan** builds from the results of comprehensive watershed assessments and sets forth management strategies and restoration project recommendations to address the identified issues. The plan includes planning level cost estimates and a prioritized list of recommendations with a description of their benefits related to water quality and overall stream health. Following completion of the plan, the focus will shift to **Implementation** of the recommended strategies and restoration projects.

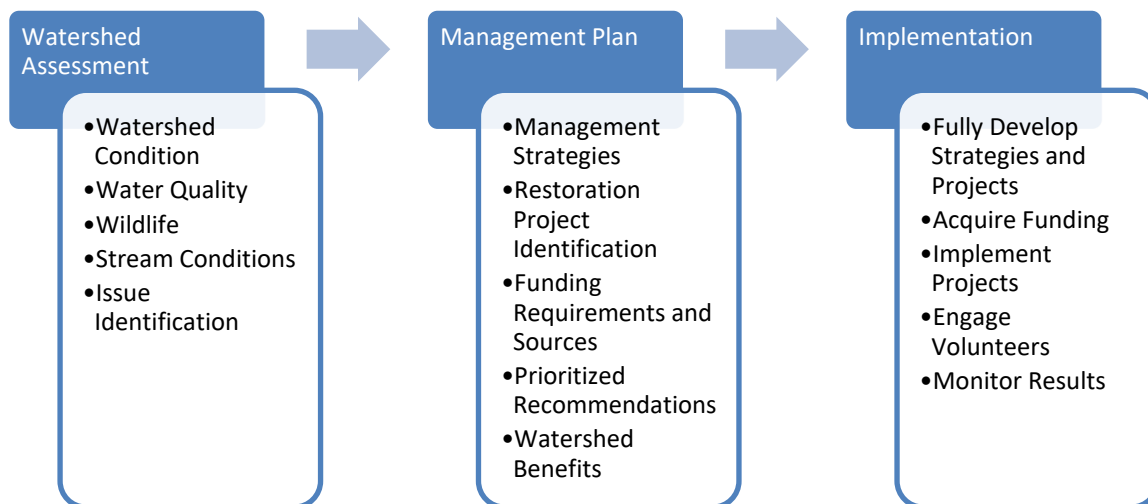


Figure 2 – Watershed Planning and Restoration Process

2.2 Reader's Guide to the Plan

The following is intended to provide a brief description of the plan components and identify the linkage between the various assessments and plan sections.

2.2.1 Plan Components

Section 1. Introduction – Introduces the Watershed Management Plan, Goals and Objectives and the overall planning context.

Section 2. Watershed Characteristics - provides a detailed description of the watershed landscape, land use, living resources and regulatory environment. This section is largely based on research from existing data and reports.

Section 3. Current Condition Assessment – provides a summary of the field investigations and new data developed as part of the Watershed Assessment. The full Watershed Assessment Report is included in Appendix A. This section also introduces the calculation of existing conditions pollutant loading, and assists in identifying the sources of various pollutants.

Section 4. Implementation Plan – includes descriptions of the recommended management strategies and restoration projects, estimates of the water quality benefits that would be realized from plan implementation, and a schedule of future activities. This section includes cost estimates for strategy implementation, identifies potential funding sources, and describes schedules and monitoring programs to document plan implementation and changes in the watershed condition over time.

2.2.2 EPA Watershed Plan Elements

The U. S. Environmental Protection Agency has established a series of nine essential watershed elements (A – I criteria) that must be addressed in the watershed plan for subsequent projects to be eligible for restoration funds under section 319 of the federal Clean Water Act. The plan was designed to satisfy these requirements. The elements are listed here with the plan sections that address each.

- A. Identification of pollutant causes and sources to achieve load reductions addressed in watershed management plan:
 - Chapter 2 Watershed Characteristics
 - Section 3.1 Watershed Assessment
 - Section 3.2 Pollutant Loads
- B. Estimate of load reductions anticipated to be achieved through specified management measures:
 - Section 3.2 Pollutant Loads
 - Section 4.2.1 Pollutant Load Reductions.
- C. Description of non-point source management measures necessary to achieve load reductions:
 - Section 4.1 Management Strategies
- D. Estimate of technical and financial assistance, cost, and authorities necessary to implement the watershed management plan:
 - Section 4.3 Funding Requirements and Sources

- E. Information or education component to enhance public understanding of watershed management:
 - Section 4.4 Community Engagement
- F. Schedule for implementing the non-point source management measures specified in plan:
 - Section 4.5 Implementation Schedule.
- G. Interim, measurable milestones to determine implementation of non-point source management measures:
 - Section 4.5 Implementation Schedule
- H. Criteria to determine if load reductions are being achieved:
 - Section 4.5 Monitoring Program.
- I. Monitoring component to evaluate effectiveness of implementation efforts:
 - Section 4.6 Monitoring Program

3 Watershed Characteristics

3.1 Watershed Delineation and Hydrology

Our target area is within the watershed designated by the DHEC watershed ID number 03050201-070, the 11-digit USGS hydrologic unit (HU) encompassing the project which is located in Berkeley, Charleston, and Dorchester Counties and consists primarily of Goose Creek and its tributaries. The entire HU watershed occupies 38,766 acres of the Lower Coastal Plain region of South Carolina. The area of the watershed that this Watershed Management Plan covers is written for is approximately 7,547 acres (11.8 mi²) in area and includes approximately 10 miles of stream channel. This will be referred to as the Focus Area for the purposes of this plan, as previously shown in Figure 1.

3.2 Landscape

3.2.1 Climate

Climate influences soil formation and erosion processes, stream flow patterns, vegetation coverage and a significant part of the geomorphology of a watershed. Precipitation not only provides water to streams and vegetation, but the intensity, frequency and amount of rainfall can greatly influence watershed characteristics. Berkeley County is located in the southeastern climatic region of the U.S. and has a temperate climate with a mean annual temperature of 64.2°F and a mean annual rainfall of 49.6 inches.

3.2.2 Physiography

The Focus Area of the Goose Creek watershed is situated in Berkeley County and consists primarily of the Goose Creek Reservoir, Goose Creek below the reservoir and associated tributaries. The watershed Focus Area occupies 7,547 acres of the Lower Coastal Plain region of South Carolina. Below the focus area Goose Creek flows to the Cooper River and then on the Charleston Harbor. Above the Focus Area, Ancrum Swamp and Huckhole Swamp flow into Bluehouse Swamp (Ladson Branch, McChune Branch) to form the headwaters of Goose Creek, which is dammed to form the Goose Creek Reservoir. The Goose Creek Reservoir is used for recreation and water supply.

The Focus Area is contained within the Berkeley County MS4 Area, although there are headwaters of tributaries draining into Goose Creek that originate in the urbanized areas of the Charleston County MS4 area. We acknowledge the hydrologic connection but have limited the scope of this report to be bound by the Berkeley County MS4 area. The Focus Area boundary and watershed characteristics are shown in Figures 3-5. Figure 3 shows the location of the Goose Creek Reservoir, the spillway into Goose Creek, and Goose Creek itself. The Goose Creek Reservoir is a 600-acre impoundment that extends from Goose Creek Road south to the spillway that empties into tidal Goose Creek. Figure 4 shows the 18 sub-watersheds that were delineated based on watershed topography. These sub-watersheds and their topography can be seen in Figure 5. These 18 sub-watersheds will be used to focus in on specific areas in need of management strategies based on the physical characteristics of each sub-watershed.

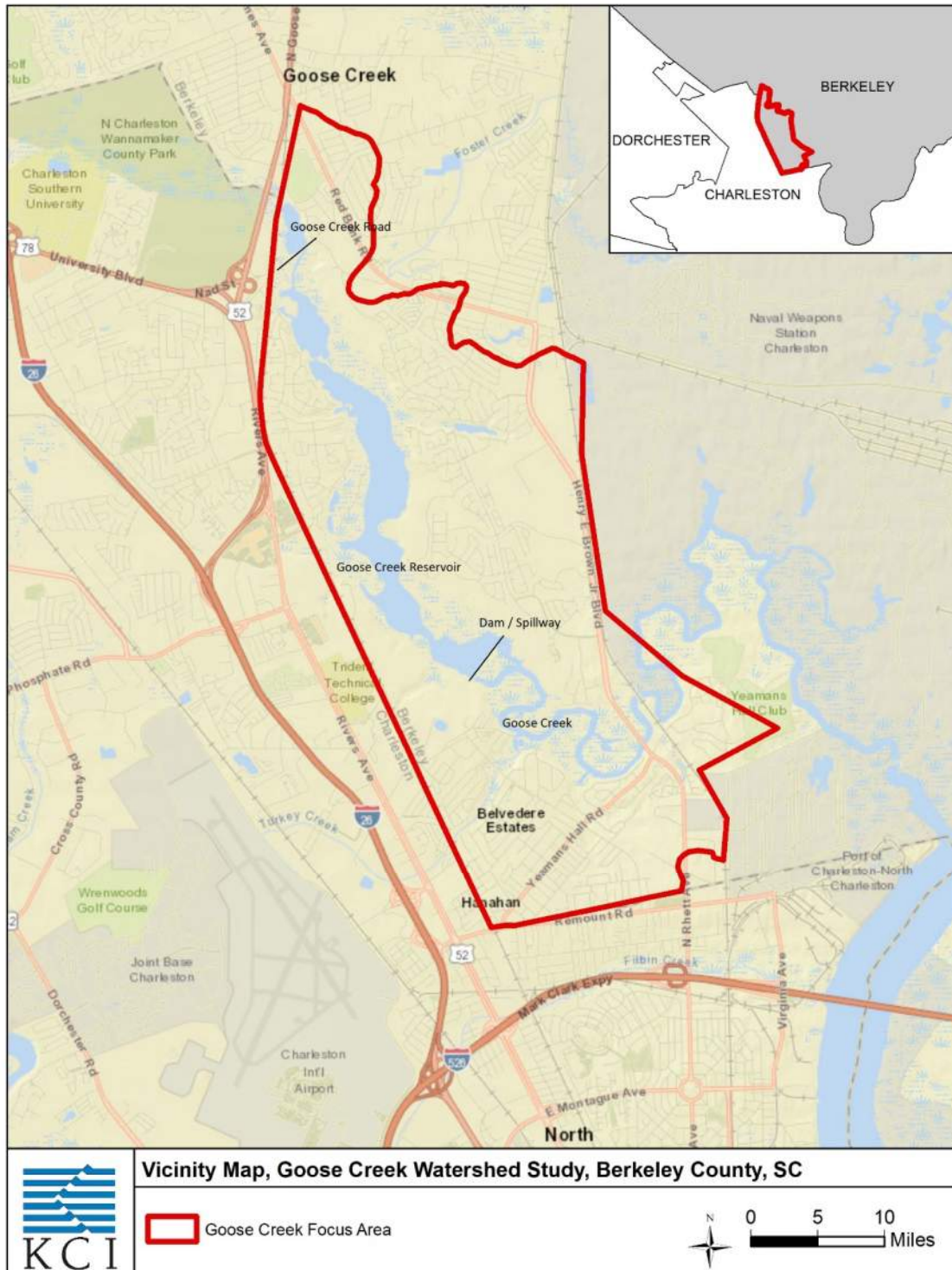


Figure 3 – Watershed Focus Area Vicinity

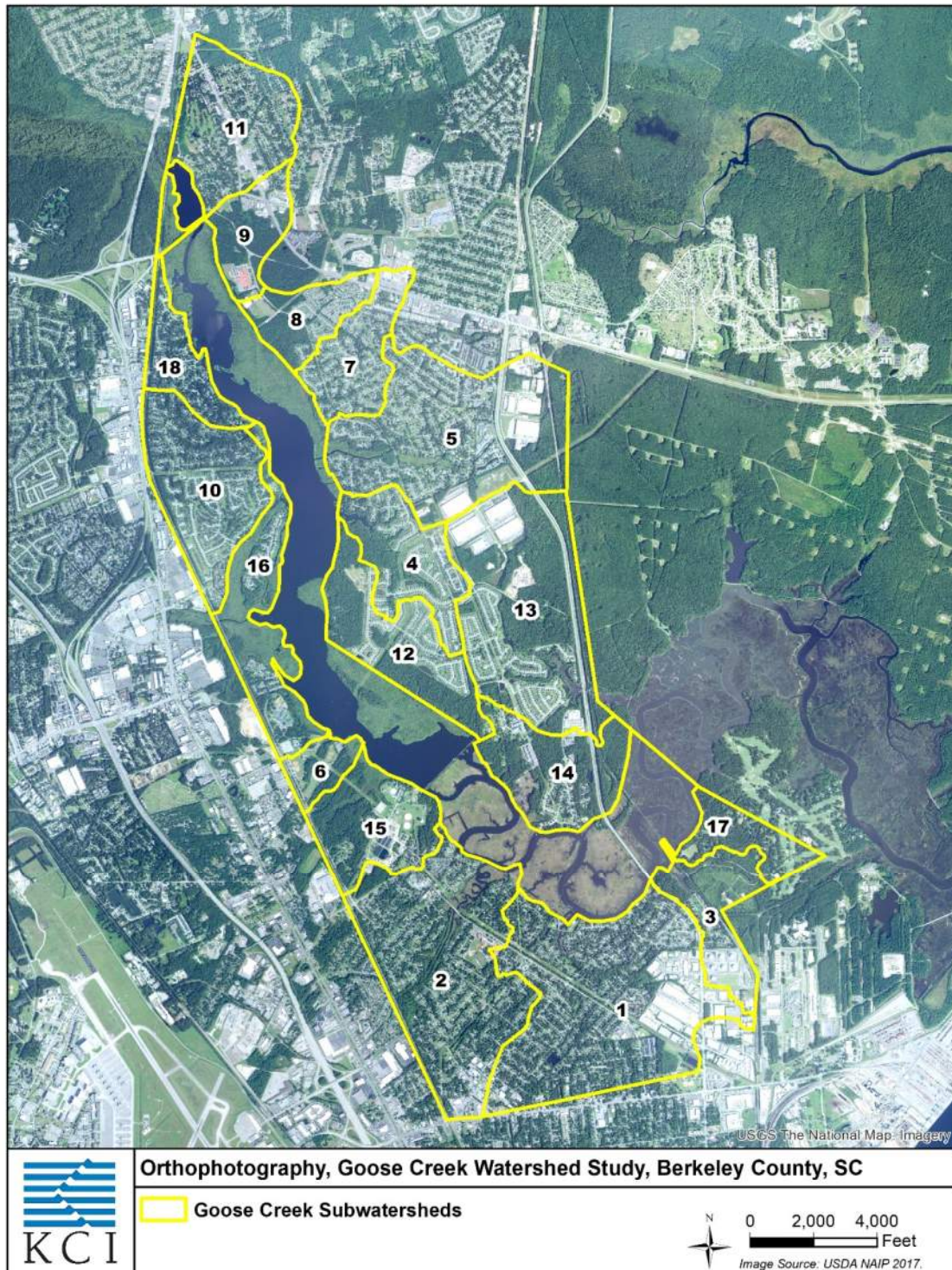


Figure 4 - Orthophotography

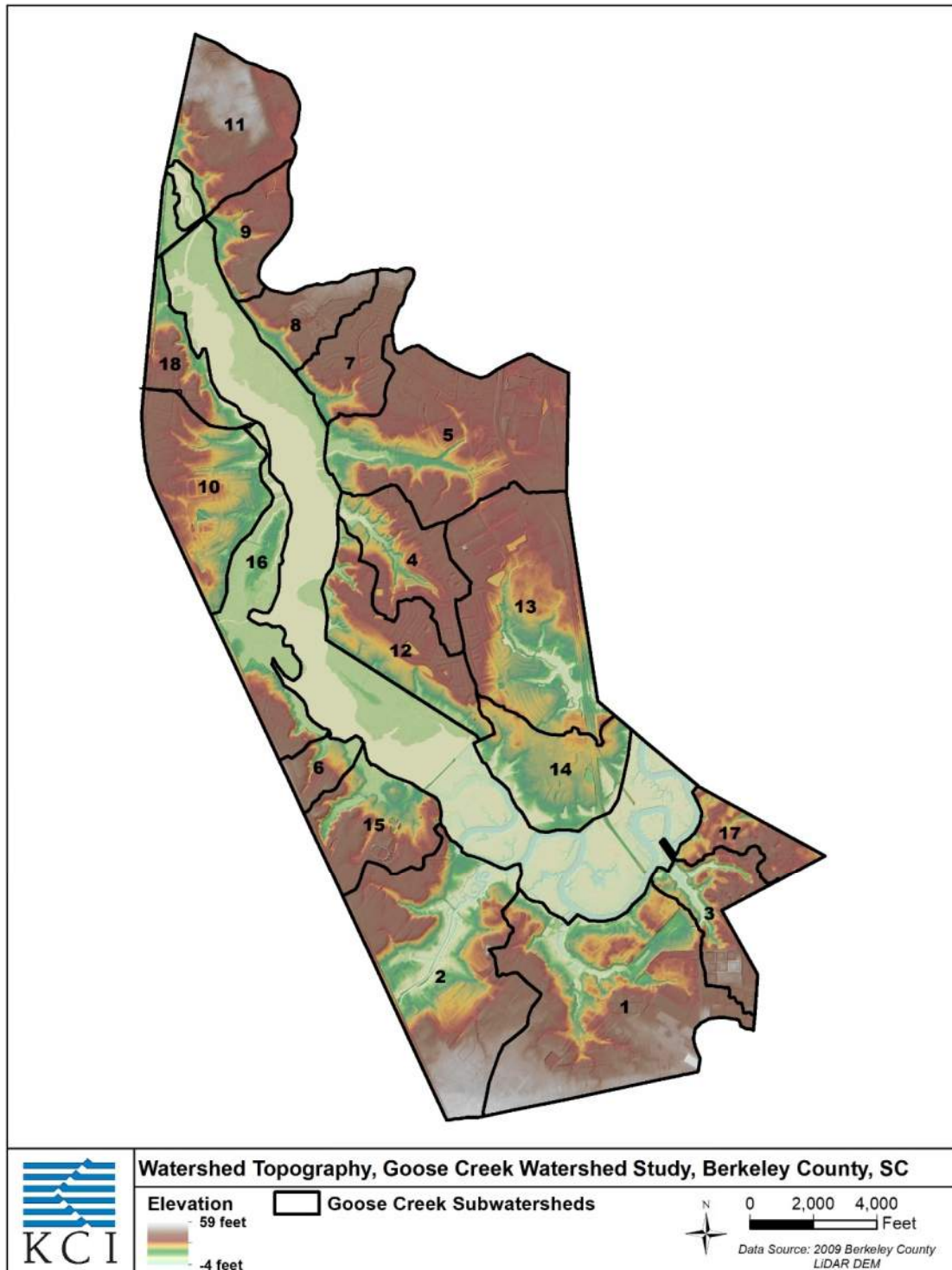


Figure 5 – Watershed Topography

3.2.3 Geology

The geologic formations underlying a watershed have a significant effect on the water resources. Geology is a major determinant of the type of topography and surface features. The chemical composition and minerals of the parent rock or unconsolidated sediments determines in large part the soil characteristics, including erodibility and infiltration rates.

The Focus Area is located in the Southern Coastal Plain ecoregion (Level 3 Key), specifically the Sea Islands/Coastal Marsh (Level 4 Key). The physiography of this region includes barrier islands, dunes, beaches, lagoons, estuaries, and tidal marshes. The Sea Island/Coastal Marsh geology is composed of Holocene saline marsh deposits of silt, sand, peat and clay with common soil series including Bohicket and Capers in tidal marshes (Griffith et al., 2002).

3.2.4 Soils

Soil types and characteristics are an important factor to consider when evaluating current water quantity and quality in streams and rivers, as well as when targeting projects aimed at improving water quality or habitat. Soil type, moisture, and slope conditions affect how land may be used and its potential for vegetative cover. These in turn greatly impact the amount and quality of runoff.

Throughout the entire watershed, the predominant soil types consist of an association of the Bohicket-Bladen-Wahee-Yonges series. The erodibility of the soil (K) averages 0.15 and the slope of the terrain averages 1%, with a range of 0-2%. This is characteristic of a flat, low lying watershed with potential for erodible soils in specific areas.

In the Focus Area, as shown in Figure 6, the majority of soils (53%) are classified as hydrologic soil group C/D. These soils have relatively high runoff potential, meaning that water transmission, or infiltration, is somewhat restricted. Hydrologic soil group B also accounts for a large portion of the soils in the watershed (18.1 percent). Soils in group B have moderately low runoff potential with unimpeded water transmission through the soil. An estimated 8.6% of soils are of the soil group D, which have a high runoff potential with restricted or very restricted water movement through the soil. These can be seen in the areas where there is saltwater tidal influence.

Table 1 – Soil Types in Focus Area of Goose Creek Watershed

Soil Type	Acres	%
A	14.4	0.2%
A/D	64.6	1.0%
B	1136.3	18.1%
B/D	117.2	1.9%
C	1075.5	17.1%
C/D	3322.8	53.0%
D	542.5	8.6%
Water	1258.5	
Total Acres	7531.7	

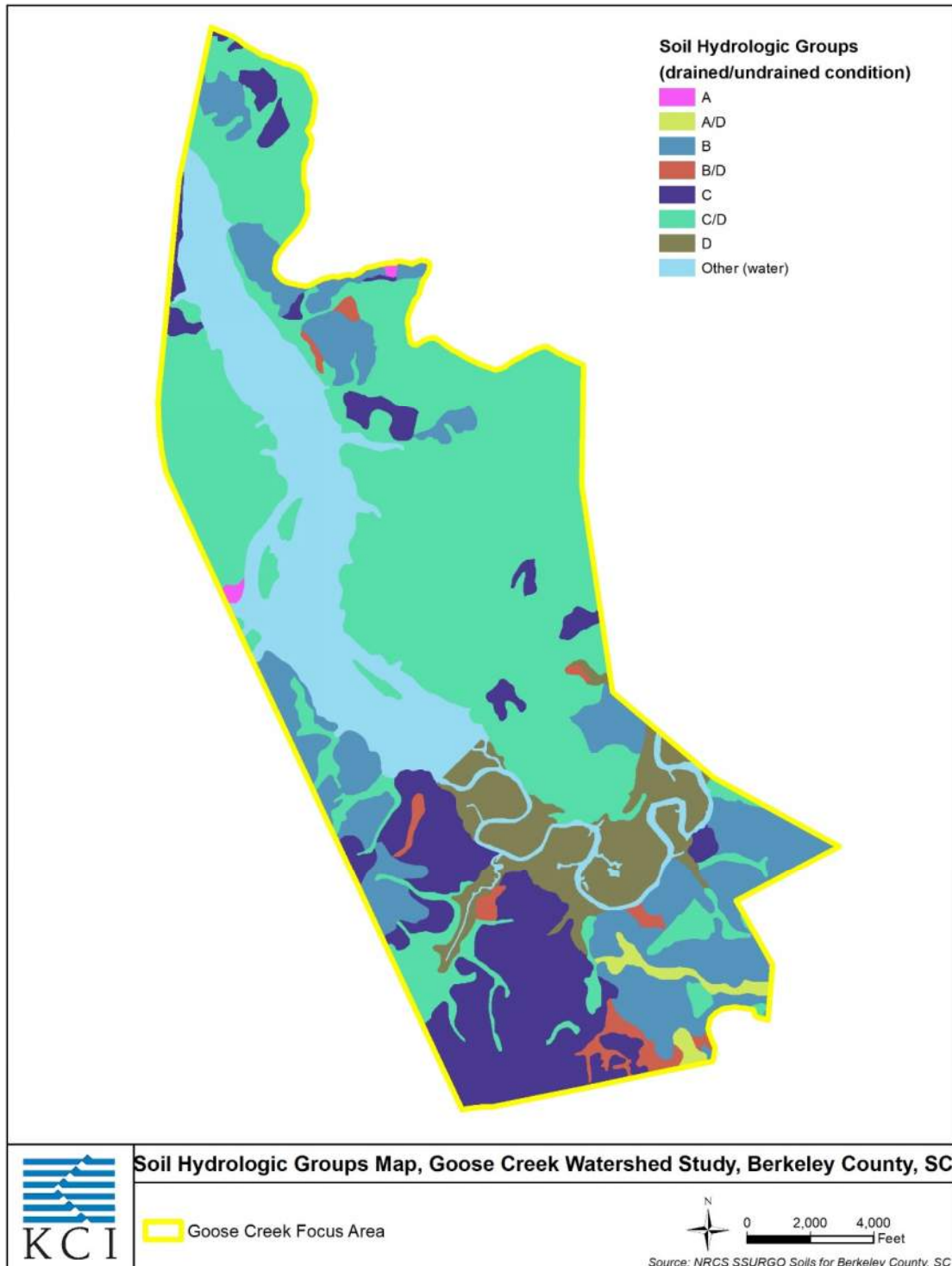


Figure 6 – Hydrologic Soil Groups

3.2.5 Soil Erodibility

Soil erodibility is a measure of the soil's susceptibility to erosion. The Universal Soil Loss Equation (USLE) developed by the United States Department of Agriculture (USDA) Agricultural Research Service is a model used to describe soil erosion processes. In the USLE, erodibility is described quantitatively using the K factor, which represents both the susceptibility of soil to erosion and its contribution to the rate of runoff. For example, clay soils have low K values because they are resistant to detachment. Coarse soils such as sand can also have low K values because even though they are easily detached, they are less susceptible to runoff. Silts have the highest K values because they detach easily and produce high rates of runoff (Institute of Water Research, 2002).

The subwatersheds with the largest percentage of highly erodible soils offer the greatest potential for addressing soil conservation with best management practices (BMPs) aimed at maintaining topsoil, such as riparian buffer forestation. Combining this indicator with other information, such as land use, slope steepness and distance to streams would help to determine how to protect highly erodible land, as a management strategy. Additionally, a high K value helps to identify areas where urban development near streams, such as road construction or utility placement may have particularly adverse watershed impacts.

Soil erodibility is divided into four categories:

- Water
- Low Erodibility (K factor <0.24)
- Medium Erodibility (K factor 0.24-0.32)
- High Erodibility (K factor >0.32)

Figure 7 presents the soil erodibility categories based on K factor for the watershed Focus Area. The majority of the watershed consists of soils with medium erodibility or low erodibility, as shown in Table 2.

Table 2 – Soil Erodibility

Category	Acres	Percent
Water	1,258.5	16.7%
Low Erodibility (K factor <0.24)	4,033.6	53.6%
Medium Erodibility (K factor 0.24-0.32)	1,697.1	22.5%
High Erodibility (K factor >0.32)	542.5	7.2%

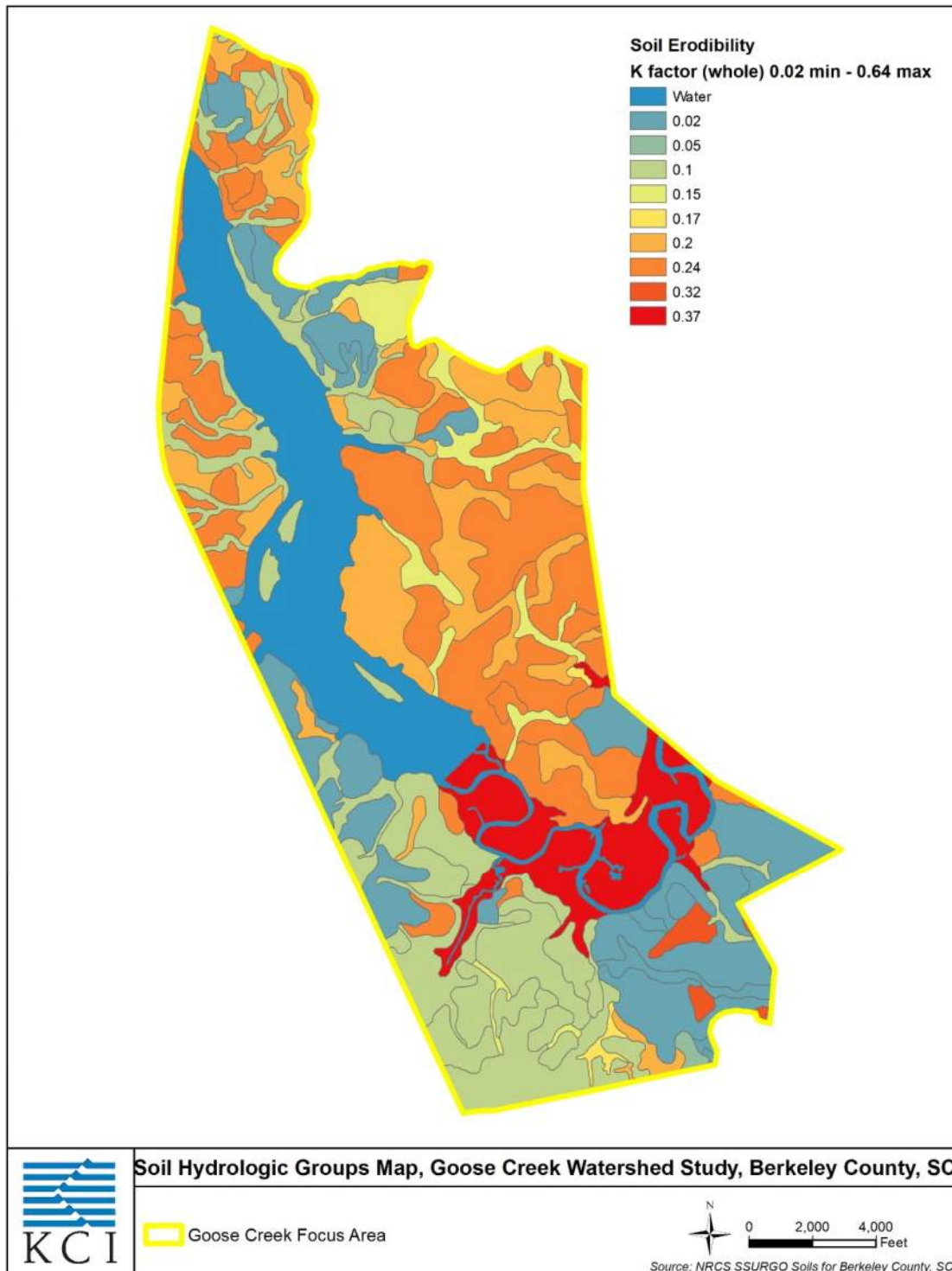


Figure 7 – Soil Erodibility

3.2.6 Wetlands

Section 404 of the Clean Water Act (USEPA, 1972) defines wetlands as the following:

Wetlands are “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Wetlands generally include swamps, marshes, bogs, and similar areas.”

Wetlands are environmentally sensitive habitats that play an integral part in supporting the water quality and water storage of a watershed. These reservoirs help to control flooding by retaining surface runoff and releasing steady flows of water downstream. Wetlands also support biological diversity, erosion control, and sediment retention.

Based on the National Wetland Inventory, there are 1,947.6 acres of wetland habitat throughout the watershed (USFWS, 2010) the majority of which are freshwater forested/shrub wetlands (747.4 acres).

Table 3 – Wetland Categories and Areas

WETLAND CATEGORY	Acres	Percent
Estuarine and Marine Deepwater	180.1	9.2%
Freshwater Emergent Wetland	399.2	20.5%
Freshwater Forested/Shrub Wetland	747.4	38.4%
Freshwater Pond	69.5	3.6%
Lake	453.0	23.3%
Riverine	98.3	5.0%
TOTAL:	1947.6	100%

Figure 8, below, shows wetland types from the NWI in the Focus Area.

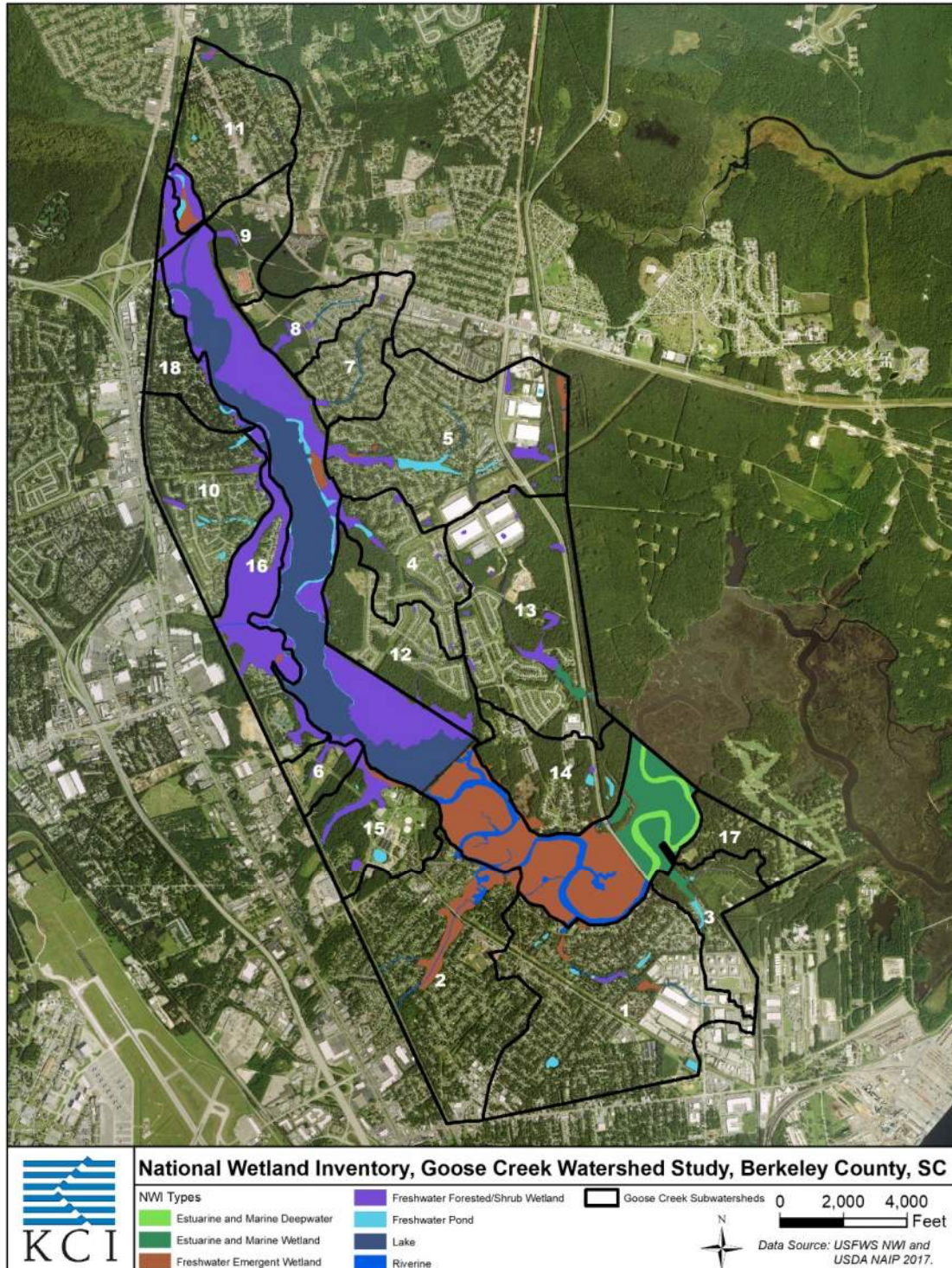


Figure 8 – National Wetland Inventory

3.3 Water Quality

3.3.1 Use Designations and Classifications

SCDES has established water quality classifications of surface waters and groundwater throughout the state which are promulgated in S.C. Regulations 61-68, Water Classifications and Standards. Use designations of Goose Creek and the Goose Creek Reservoir include Aquatic Life Use (AL) and Recreational Use (REC). Goose Creek itself is listed as Saltwater Class B (SB), and the Goose Creek Reservoir is listed as Freshwater (FW). These standards are shown below in Table 4.

Table 4 – Water Quality Standards applicable to the Goose Creek Reservoir and Goose Creek

ITEMS	STANDARDS	
	FRESHWATER	SALTWATER CLASS B
a. Garbage, cinders, ashes, oils, sludge, or other refuse.	None allowed.	None allowed.
b. Treated wastes, toxic wastes, deleterious substances, colored or other wastes except those given in a. above.	None alone or in combination with other substances or wastes in sufficient amounts to make the waters unsafe or unsuitable for primary contact recreation or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.	None alone or in combination with other substances or wastes in sufficient amounts to make the waters unsafe or unsuitable for primary contact recreation or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.
c. Toxic pollutants listed in the appendix.	As prescribed in Section E of this regulation.	As prescribed in Section E of this regulation.
d. Stormwater, and other nonpoint source runoff, including that from agricultural uses, or permitted discharge from aquatic farms, and concentrated aquatic animal production facilities.	Allowed if water quality necessary for existing and classified uses shall be maintained and protected consistent with antidegradation rules.	Allowed if water quality necessary for existing and classified uses shall be maintained and protected consistent with antidegradation rules.
e. Dissolved oxygen.	Daily average not less than 5.0 mg/l with a low of 4.0 mg/1.	Not less than 4.0 mg/1.

Table 4 – continued

ITEMS	STANDARDS	
	FRESHWATER	SALTWATER CLASS B
f. Enterococci.	Not to exceed a geometric mean of 126/100 ml based on at least four samples collected from a given sampling site over a 30 day period, nor shall a single sample maximum exceed 349/100 ml.	Not to exceed a geometric mean of 35/100 ml based on at least four samples collected from a given sampling site over a 30 day period; nor shall a single sample maximum exceed 501/100 ml. Additionally, for beach monitoring and notification activities for CWA Section 406 only, samples shall not exceed a single sample maximum of 501/100 ml.
g. pH.	Between 6.0 and 8.5.	Shall not vary more than one-half of a pH unit above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.5 or above 8.5
h. Temperature.	As prescribed in E.12. of this regulation.	As prescribed in E.12. of this regulation.
i. Turbidity.	Not to exceed 25 NTUs provided existing uses are maintained	Not to exceed 25 NTUs provided existing uses are maintained

3.3.2 303(d) Impairments

Under the Federal Clean Water Act, the state of South Carolina is required to assess and report on the quality of waters throughout the state. Where designated uses are not fully supported, Section 303(d) requires states to list these water bodies as impaired waters. States are then required to develop a Total Maximum Daily Load (TMDL) for each of the listed impaired waters. The impairments in the Goose Creek Reservoir from the 2016 303(d) list are Chlorophyll *a*, Dissolved Oxygen, Total Phosphorous, pH and bacteria (*Escherichia coli* for freshwater and *Enterococcus* for saltwater). Table 5, below lists the impairments in the Goose Creek Watershed from the 2016 303(d) list.

Table 5 – Impaired Stations in Goose Creek Watershed

DESCRIPTION	STATION	CAUSE(S)
GOOSE CK AT S-08-136 BRIDGE	MD-039	ENTERO
GOOSE CK RES 2.3 M S OF GOOSE CREEK TOWN CENTER	RL-01008	DO
GOOSE CREEK RESERVOIR 1.0 MI NW OF SPILLWAY NEAR W SHORELINE	RL-03340	CHLA, DO, TP
GOOSE CREEK RESERVOIR 2.8 MI NW OF SPILLWAY NEAR OTRANTO	RL-04390	CHLA, DO, TP
GOOSE CREEK RESERVOIR 0.55 MI W OF DAM	RL-05412	TP
GOOSE CREEK RESERVOIR 2 MI N OF SPILLWAY	RL-06434	DO
GOOSE CK RESERVOIR 0.6 MI NW OF 2ND POWERLINES US OF BOAT RAMP, NEAR W SHORE BTWN 2 WESTERN EMBAYMENTS	RL-07017	DO
GOOSE CK RESERVOIR MIDLAKE IN LINE WITH NORTHBROOK BLVD	RL-08065	DO, TP
GOOSE CREEK RESERVOIR 0.1 MILE NORTHEAST OF THE JOHN R. BETTIS BOAT LANDING AND 0.1 MILES SOUTHEAST OF ST-033 NEAR THE NORTHEAST BANK.	RL-09081	CHLA, TP
LAKE, GOOSE CK RESERVOIR 1.95MI WEST OF POPPENHEIM CROSSING	RL-10104	CHLA, DO, TP
LAKE, GOOSE CK RESERVOIR 1.95MI WEST OF POPPENHEIM CROSSING	RL-10104	ECOLI
LAKE, GOOSE CK RESERVOIR 2.5MI SW OF POPPENHEIM CROSSING	RL-10108	CHLA, DO, TP
GOOSE CREEK RESERVOIR APPROXIMATELY 1.3 MILES UPSTREAM FROM THE DAM. SITE IS LOCATED 100 YARDS SOUTH OF THE MAJOR POINT ON THE EAST BANK IN THE MIDDLE OF THE RESERVOIR.	RL-11118	CHLA, PH, TP
GOOSE CK RESERVOIR APPROX 250 YDS NW OF END OF HANAHAN RD	RL-13132	PH, TP
GOOSE CREEK RESERVOIR 100 M US OF DAM	ST-032	TP
GOOSE CK RESERVOIR AT 2ND POWERLINES US OF BOAT RAMP	ST-033	TP

3.4 Flooding

Figure 9 depicts the 100-year Federal Emergency Management Agency (FEMA) floodplain extent in the Focus Area. All of Goose Creek Reservoir and the low-lying areas of Goose Creek are within the 100-year floodplain. The process by which streams swell during storms and spill out on to their floodplain is natural. Anthropocentric concerns with flooding problems often stem from land development occurring in flood prone areas and/or structures being built in floodplains. Such flooding concerns are exacerbated when development throughout the watershed, and the associated impervious surfaces, result in increased volumes of runoff and expansion of those flood prone areas over time. These concerns are also provoked by the gradually increasing storm frequencies and intensities we are experiencing as a result of climate change. Developed areas on the west side of the Goose Creek Reservoir, along Turkey Creek, and the unnamed tributary downstream are most vulnerable to flooding.

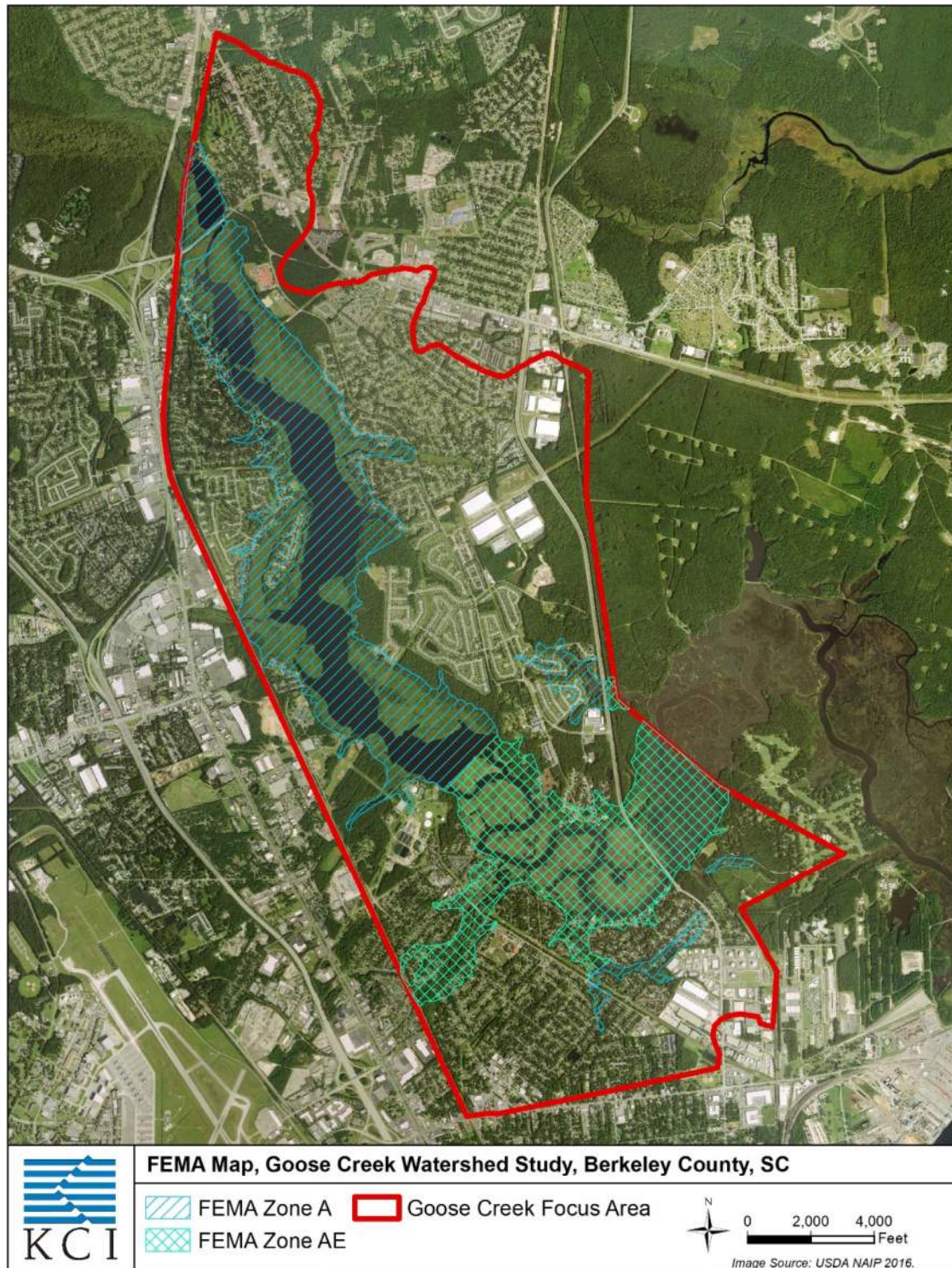


Figure 9 – FEMA 100 Year Floodplain

3.5 Land Use

The types and densities of various land uses can have dramatic effects on water quality and stream habitat. Forested floodplains help to slow stormwater flow and allow water to gradually infiltrate into soils which eventually help to contribute to stream baseflows. Developed areas, with a higher percentage of impervious surfaces (buildings, paved roads, parking lots, etc.), facilitate quick runoff of overland stormwater flow and increase the amount of pollutants directly entering waterbodies. Increased stormflow can also negatively affect stream habitat by increasing bank erosion and bed degradation and impairing decreasing instream and riparian habitat conditions.

3.5.1 Existing Land Use and Land Cover

Land use and cover in the entire 38,766 acre Goose Creek Watershed (03050201-070) includes: 41.7% urban land, 45.0% forested land, 4.5% non-forested wetland, 2.6% scrub/shrub land, 2.6% agricultural land, 2.1% forested wetland, 1.4% water, and 0.1% barren land (SCDES). In the 7,547 acre drainage area of the Focus Area for this watershed management plan, over half of is developed (50.5%), of which the majority consists of residential development. Close to one-third of the watershed is forested land (29.7%). Open space, water and marsh accounts for 19.8% of the watershed. Table 6, below, lists the specific acreage and percentages of land use cover in the Focus Area.

Table 6 - 2015 Land Cover for Goose Creek Watershed Focus Area

Land Cover	Land Use	Acres	Percent
Residential	Developed	2,327.6	30.8%
Forest	Forested	1,849.3	24.5%
Roads	Developed	837.4	11.1%
Water	Open Space	824.0	10.9%
Institutional/Industrial/Commercial	Developed	651.0	8.6%
Marsh	Marsh	464.8	6.2%
Forested Wetlands	Forested	213.1	2.8%
Vacant	Forested	181.3	2.4%
Public Facilities	Open Space	149.2	2.0%
Grass	Lawn	49.6	0.7%
Total Land Area	-	7,547.3	100%

Source: USDA NAIP 2017

Subwatersheds 1, 2 and 3 contain the most impervious surface, and are some of the oldest developed portions of the watershed. They also contain the areas where development is most prone to flooding, along Turkey Creek and the downstream unnamed tributary. These land use areas are shown below in Figure 10.

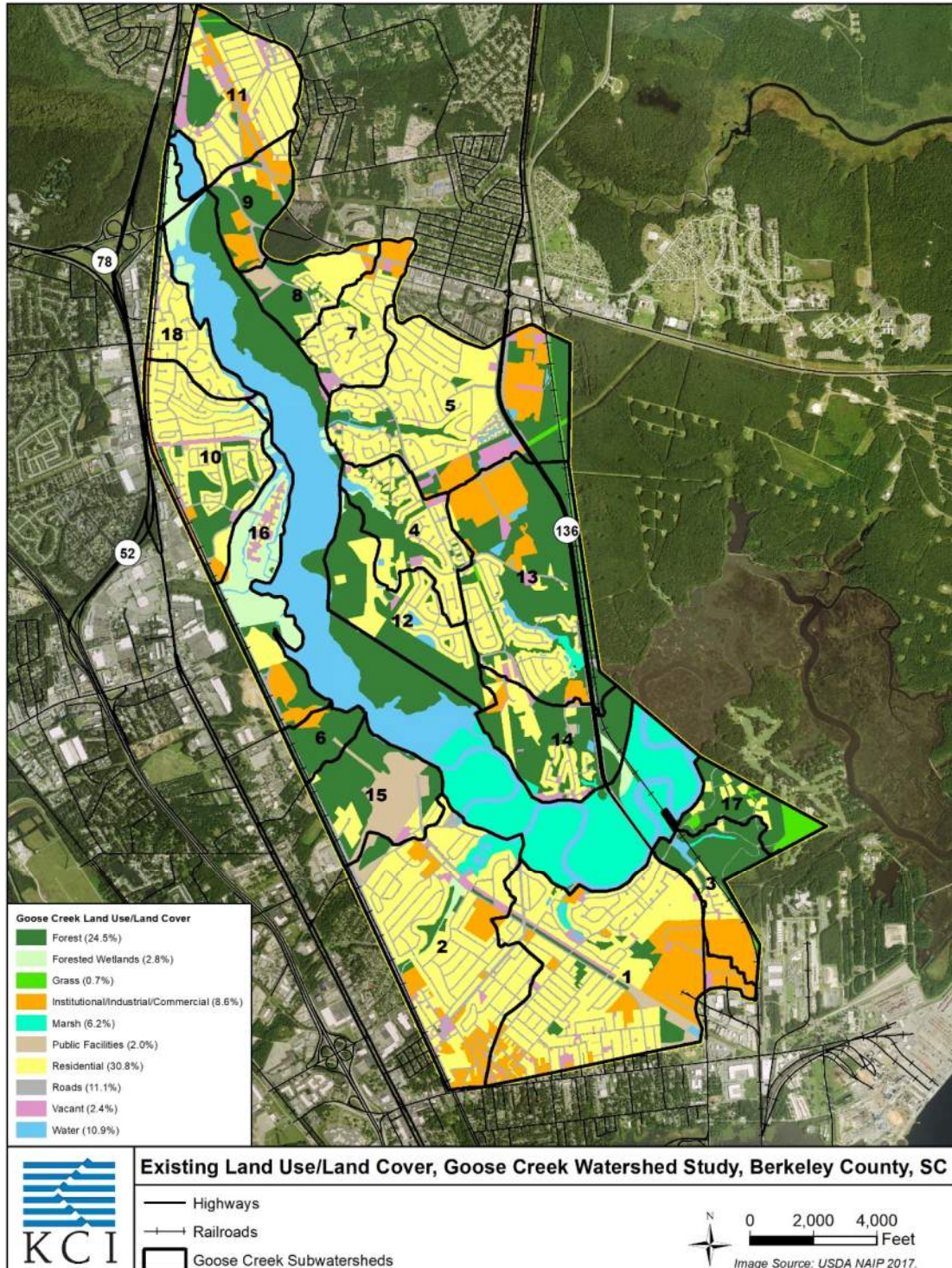


Figure 10 - Existing Land Use / Land Cover

3.5.2 Imperviousness

Impervious surfaces are hard surfaces that do not allow water to infiltrate slowly into the ground as it would in pervious landscapes, such as a forest, meadow, or open field. Examples of impervious surfaces include roadways, parking lots, driveways, sidewalks, and rooftops. These surfaces generate higher volumes of stormwater runoff, which is typically concentrated into drainage infrastructure (such as gutters, pipes, and ditches), which in turn accelerate flow rates and direct stormwater to a receiving waterbody. This accelerated, concentrated runoff often causes stream erosion and habitat degradation. Runoff from impervious surfaces picks up and washes off pollutants (oil, metals, sediment etc.) and is highly polluted relative to the minimal amounts of runoff generated from pervious areas. In general, undeveloped watersheds with small amounts of impervious cover are more likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover. Impervious cover is a primary factor when determining pollutant characteristics and loadings in stormwater runoff.

The degree of imperviousness in a watershed also affects aquatic life. There is a strong relationship between watershed impervious cover and the decline of a suite of stream indicators. As imperviousness increases the potential stream quality decreases as referenced in research indicating that stream quality begins to decline at or around 10% imperviousness (Schueler, 1994; CWP, 2003). However, there is considerable variability in the response of stream indicators to impervious cover observed from 5 to 20% imperviousness due to historical effects, watershed management, riparian width and vegetative protection, co-occurrence of stressors, and natural biological variation. Due to this variability, one cannot conclude that streams draining low impervious cover will automatically have good habitat conditions and a high quality aquatic life.

The Focus Area of the Goose Creek Watershed contains impervious cover in the residential, institutional, industrial and commercial areas. Approximately 51% of the watershed (3,816 acres) consists of land uses associated with impervious surfaces – 30.8% of which is Residential land use, 8.6% is Institutional/Industrial/Commercial land use, and 11.1% are Roads. Even in these developed areas impervious surfaces do not cover every square foot of land area. The amount of actual impervious surface cover is less than the total area, and not every land use category includes the same proportions of actual impervious cover. For example, as a percentage, low density residential use includes less impervious cover than commercial or institutional development.

3.6 Stormwater

As rainfall runs off of the landscape it is often directed to a stormwater drainage system that conveys the concentrated flow to a receiving water such as a pond, lake, or stream, or to a stormwater management facility. Historically a stormwater system's primary focus was to move water from the landscape to receiving waters to avoid standing water and localized flooding, but in the last 20 or so years the focus has also been holding and treating the water in a stormwater management facility such as a stormwater pond. Captured stormwater is detained for a period of time for reduction and treatment of pollutants, and is discharged from the pond at a slower rate to a downstream receiving water. Modern stormwater management facilities treat both the stormwater quality and manage the stormwater quantity to reduce the intensity of the runoff reaching the receiving water.

Detailed stormwater infrastructure (inlets, pipes, outlets, management facilities) mapping is not currently available for use in the Goose Creek watershed, and the development of that geospatial data is outside of the scope of this project; therefore this section describes the current stormwater system in the watershed based on general field observations and aerial mapping.

3.6.1 Storm Drains

In the Focus Area the stormwater system is varied and dependent on the era of development, runoff patterns, and the density of development. Typically, stormwater infrastructure will be more extensive in more recent developments and in those areas with denser development and impervious surface.

Within the more forested areas in the Focus Area, there is little stormwater infrastructure. In some areas the stormwater simply sheet flows off of roadways to swales and grassy areas. The roadway slope and side grades are generally flat. Roadside ditches and open swales are used in some areas to direct flow along the road to a low point, which is usually a small tributary. This type of system is termed a 'disconnected' system.

In most areas along the Goose Creek and the Goose Creek Reservoir, where the density of development and the percentage of impervious surfaces are higher, the stormwater must be managed more intensely and is termed a 'connected' system. The streets are lined with inlets, swales or curbs that elevate the sidewalks. Stormwater flowing into the inlets then flows through stormwater pipes downgrade to stormwater outfalls into tributaries leading to the Goose Creek or the Goose Creek Reservoir (See Figures 11 and 12 below for examples). In both of these rural and more urban scenarios, most of the stormwater enters surface waterbodies with little to no treatment.

During the Stream Corridor Assessment, approximately 20 pipe stormwater outfalls were identified. All of the stormwater outfalls were in generally good physical condition; however, the lack of stormwater treatment at each of these inputs creates long term issues in terms of the volume and quality of stormwater entering the system.



Figure 11 – Example of untreated stormwater entering Goose Creek tributary along Murray Avenue



Figure 12 – Example of a concrete lined channel in a residential neighborhood that outfalls into Turkey Creek

3.6.2 Stormwater Management

In 1991 South Carolina Legislation passed the Stormwater Management and Sediment Reduction Act (72-300), which was crafted in close consultation with EPA regulators to ensure that the state's stormwater regulations contained standards that either met or surpassed the requirements mandated in Phase 1 of the NPDES Stormwater Program. This piece of legislation allowed South Carolina to obtain permitting authority over the NPDES Stormwater Program within the State's jurisdiction.

The Stormwater Management and Sediment Reduction Act's Standards were revised on June 28, 2002 to address Phase II requirements mandated by the EPA. Under this revision certain local municipalities have taken on the role of state and federal permitting authorities through the MS4 Program. In 2014, R. 61-68, Water Classifications and Standards, established appropriate classified water uses to be achieved and protected, general rules and specific water quality criteria to protect classified and existing water uses, anti-degradation rules, standards to protect the public health and welfare, and to maintain and enhance water quality.

According to data available through Berkeley County GIS records for stormwater pond mapping, there are 43 wet ponds and 8 dry ponds known to exist in the Focus Area of the watershed. By utilizing desktop GIS analysis and verification in the field, an additional 20 wet ponds and 1 dry pond were also identified in the Focus Area, primarily located in newer development on either side of the Goose Creek Reservoir. The drainage area to the total 63 wet ponds and 9 dry ponds is approximately 1,779 acres or approximately 23.6% of the watershed. The ponds capture runoff from approximately 648 acres of impervious surface or approximately 33.4% of the land based impervious surface in the watershed.

3.6.3 Stream Crossings / Culverts

Stream crossings are critical components of local infrastructure both in terms of transportation connectivity and their potential impact on the stream system. Impacts can include presenting a barrier to aquatic organism passage, particularly fish, and crossings can also be locations where stream bank and stream bed erosion can occur due to the placement of bridge footers and culvert bottoms. Stream flooding at road crossings and the need to keep transportation corridors open during emergency events is a particularly important challenge in most watersheds.

Major culvert crossings within the Focus Area are found under Railroad Avenue by Bettis Boat Landing Road, under Murray Avenue near Yeamans Hall Road and under North Rhett Avenue below the Spring Valley Mobile Home Park. The Murray Drive culvert is showing signs of erosion at the outlet and on the upstream side of the culvert is an old stormwater facility within the Park. Restoration of this facility could reduce the scour that is occurring downstream, and subsequent sediment loading into the tributary. The inlet control structure is shown in Figure 13. There are also several smaller culvert crossings in the neighborhoods on either side of Turkey Creek. Tributaries to Turkey Creek cross under residential roads at these crossings.



Figure 13 – Culvert Crossing under Murray Drive

2.7 Point & Non-Point Discharges

There are no permitted industrial point source discharges in the Goose Creek Watershed. Point source discharges into the Goose Creek Watershed are systems which are typically associated with residential and urbanized development, as seen above in figures 11-13. These systems collect and convey treated and untreated stormwater and non-point sources of water pollution. The Goose Creek Reservoir is surrounded by The City of Hanahan and The City of Goose Creek. Both cities have MS4 designation and Berkeley County manages both MS4 programs. Berkeley County maintains an inventory of stormwater assets which is used to help monitor this area. Discharge points and outfalls are seen below.

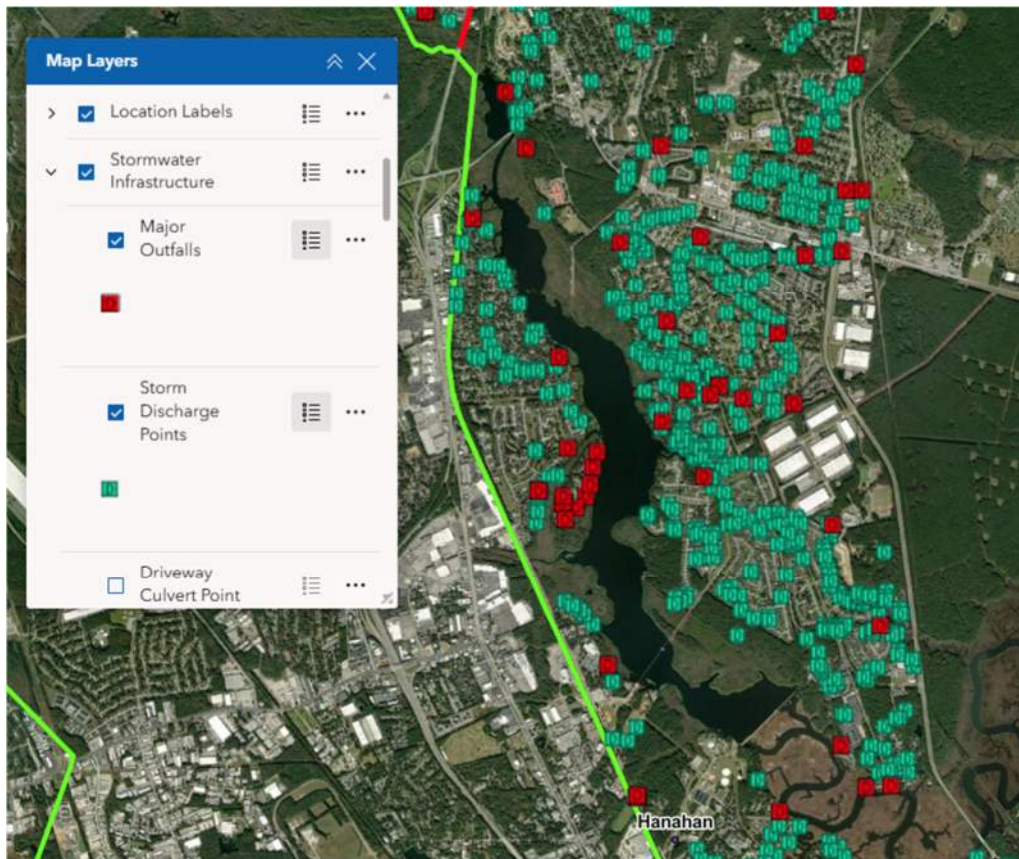


Figure 14 – Outfalls & Storm Discharge Points

These point source discharge points may include natural and/or manmade watercourses and detention ponds incorporated into the development as seen below.

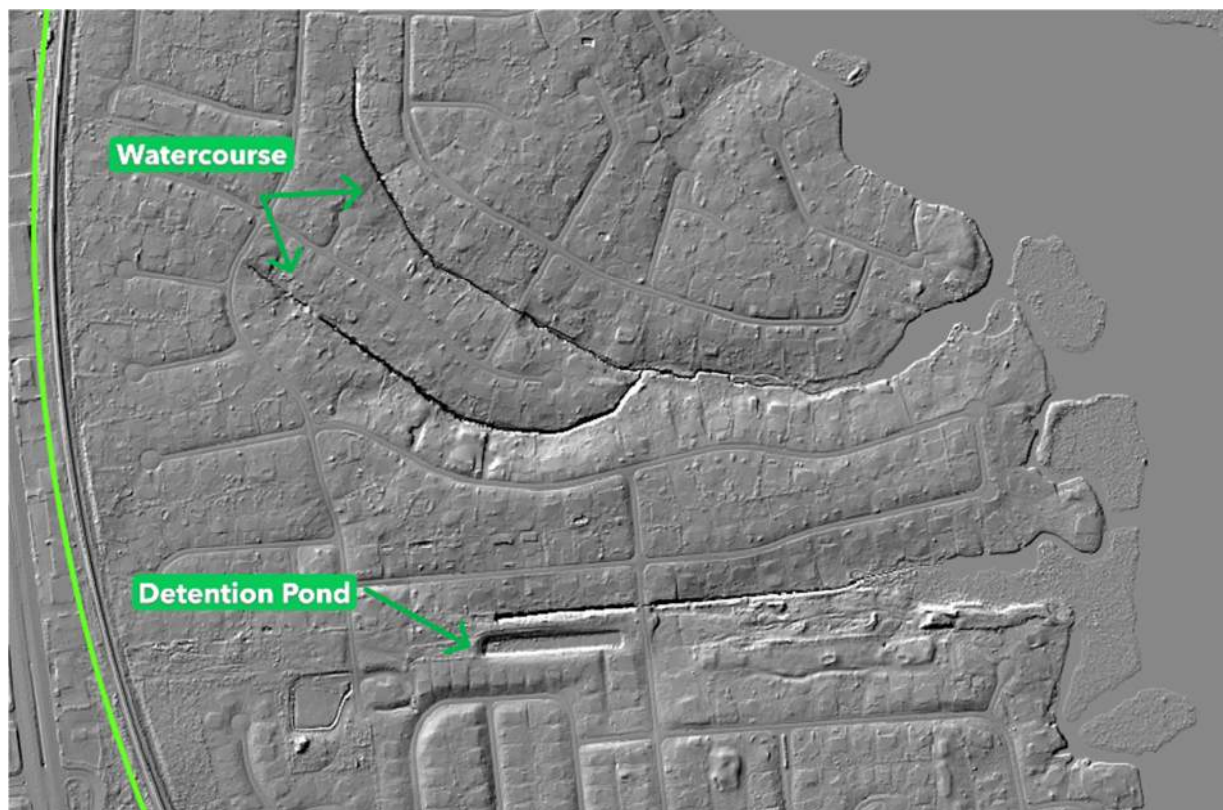


Figure 15 – Watercourses and Detention Pond in the Otranto neighborhood, Hanahan.

Berkeley County Stormwater Management Program oversees active construction Stormwater Pollution Prevention and Sediment and Erosion Control which significantly mitigates point-source water pollution associated with construction sites.

Non-point sources of water pollution in the Goose Creek Watershed include runoff across residential lots, streets, forest, parks, and commercial development. Non-point source discharges in the Goose Creek Watershed have the ability to increase nutrient loading from fertilizer and lawn chemicals, bacteria from animal waste, sediment from streambank erosion, and pollutants from vehicles, fuels, waste, and cigarettes, among many other common pollutants.

Opportunities for improvement to these types of stormwater systems associated with point and non-point source discharges will be sought. Improvements may include infiltration trenches, bioretention, BMP retrofit projects, and stream restoration. Additionally, education and outreach will be a priority to increase awareness and help mitigate point and non-point sources of water pollution.

4 Current Condition Assessment

4.1 Watershed Assessment

During the spring and summer of 2018, a watershed assessment was conducted to understand historic water quality trends in the reservoir and creek; document the existing stream conditions; and begin identification of restoration opportunities. The assessments were limited to public property and right of ways in the Focus Area.

4.1.1 Historic Sampling Data

SCDES surface water sampling (data retrieved from EPA STORET) from 2001 to 2016 for 16 Water Quality Monitoring Stations (WQMS) in and below the Goose Creek Reservoir were used for an analysis of historic water quality conditions in the watershed, as shown in Appendix A. The following chemical parameters were collected using grab samples and sent to a lab for analysis:

- Bio-Chemical Oxygen Demand (BOD)
- Chlorophyll a, corrected for pheophytin
- Dissolved oxygen (DO)
- *Escherichia coli* (*E. coli*)
- Fecal Coliform (FC)
- Total Kjeldahl nitrogen (TKN)
- Total Nitrogen (TN)
- pH
- Total Phosphorous (TP)
- Temperature
- Turbidity

The sampling locations are located in subwatersheds 1, 2 and 3. These subwatersheds are in the areas discharging to the downstream SCDES WQMS MD-039, where historically high bacteria levels have been observed. Sampling location WS1 is the downstream side of the bridge on Murray Avenue over Turkey Creek, in a saltwater tidally influenced area. Sampling location WS2 is on the downstream side of the small bridge on Yeamans Hall Road over the un-named tributary to Goose Creek. Sampling location WS3 is at the outfall of the pond on Lakeside Drive. According to the SCDES Watershed Atlas, all three of these sampling locations are on streams classified as SB (tidal salt waters). The watersheds contributing to sampling locations WS2 and WS3 are contained almost entirely within Berkeley County. 75% of the Watershed contributing to sampling location WS1 is in Charleston County. The USGS StreamStats reports with this information can be seen in Appendix A.

Historic and current SCDES water quality monitoring data was obtained from the EPA STORET database for the sampling locations shown in the Figure 14 with the red arrows. These stations were selected due to their locations at the top, middle and bottom of the reservoir, and because of they had the most recent data from 2008 to 2016. A seasonal trend analysis for each of the five WQMS shown below was done for DO, TP, E. Coli, FC, and pH and is included in Appendix A.

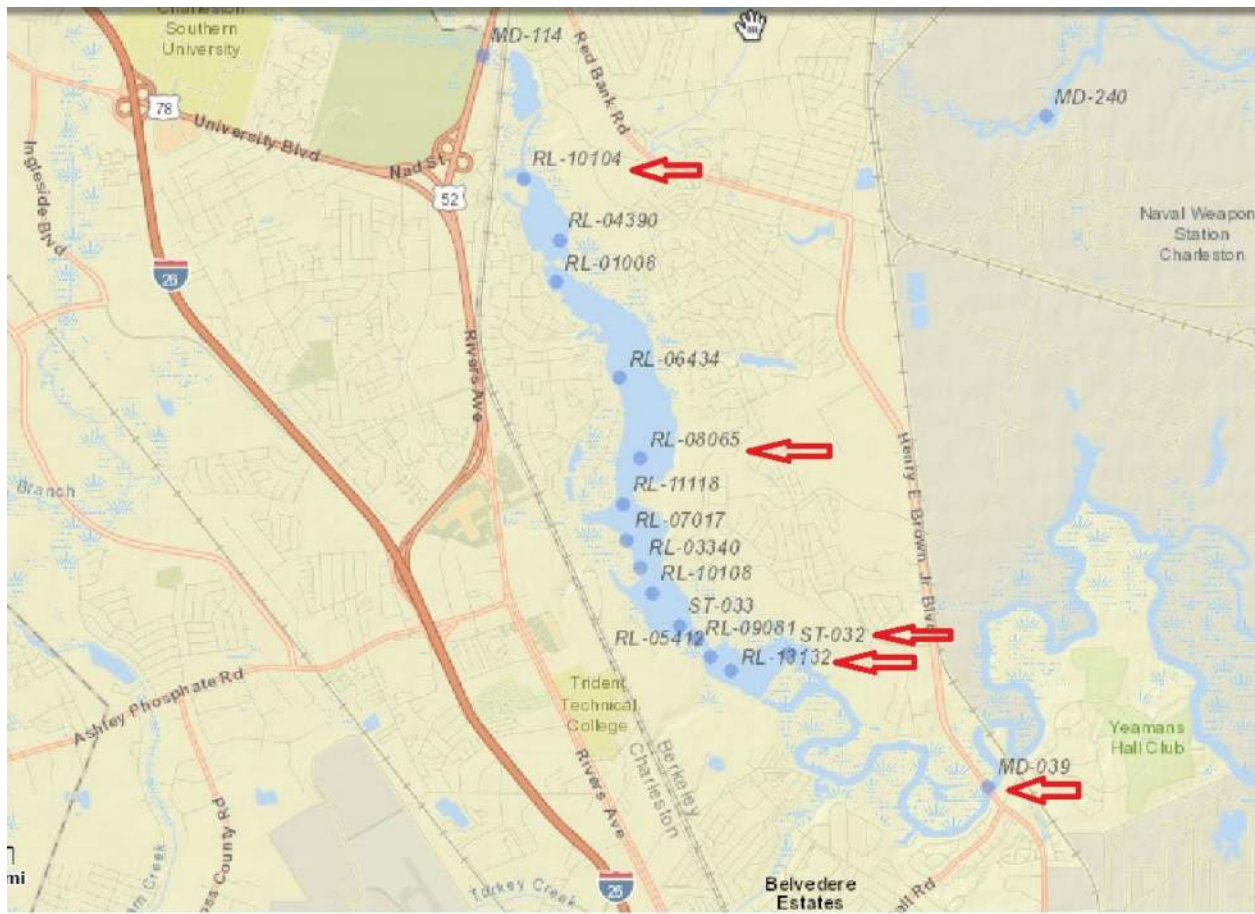


Figure 16 – SCDES Water Quality Monitoring Locations

Bacteria

Elevated levels of bacterial (fecal coliform or *Enterococcus*) were detected at the top of the Goose Creek Reservoir at WQMS RL-10104 and in Goose Creek, below the reservoir at WQMS MD-039. The maximum fecal coliform numbers at these stations was 1600 MPN/100 ml (Most Probable Number/100 ml) on 10/27/2010 and 08/13/2008, respectively. Within the reservoir at WQMS ST-032 fecal coliform was measured at a peak of 100 MPN/100 ml on 07/09/2009. *E. coli* was measured at 83.6 and 162.4 MPN/100 ml at WQMS ST-032 and RL-13132, respectively. These levels were measured on 02/18/2016 and 08/01/2013, respectively. Although bacterial levels are typically higher in the summer months, the two highly elevated sample results at 1600 MPN/100 ml are more typical of a concentrated pollutant source, such as a direct discharge of sewerage into the water body.

Dissolved Oxygen

Eight monitoring stations in the Focus Area are listed as impaired on the 2016 303(d) list. All eight of these stations are located within the reservoir. Dissolved oxygen levels in and below the reservoir behave as expected with seasonal variability according to the historic SCDES surface water monitoring data. In the winter DO is approximately 10 mg/L and in the summer 4 mg/L. There are two samples from WQMS RL-10104 at the top of the reservoir on the dates of 7/28/2010 and 8/26/2010 where DO levels are at 0.1 and 0.18 mg/L respectively. It should be noted that on 7/28/2010 a fecal coliform result

of 910 MPN/100 ml was collected at station WQMS RL-10104 and a correlation between the low DO levels and fecal coliform result has not been determined.

Nutrients and Chlorophyll *a*

In the reservoir, eleven stations are listed as impaired for total phosphorus (TP), and six stations are impaired for chlorophyll *a* (CHLA). Total Nitrogen (TN) is not listed as a cause for impairment in any of the monitored stations in the reservoir. CHLA is a photosynthetic pigment present in all types of green plants; it is used as a measure of algal biomass and is an indicator of nutrient enrichment. TN and TP are used to quantify, monitor, and potentially manage nutrient levels in fresh and saline water systems. Typically, freshwater systems are limited by phosphorus and saltwater bodies are limited by nitrogen. A limiting nutrient has the potential to stimulate phytoplankton growth (blooms) which may be detrimental to water quality, both from depletion of dissolved oxygen and the potential to release toxins from harmful algal blooms (HABs).

Total Phosphorous (TP) levels from the historic SCDES surface water monitoring data (retrieved from the EPA STORET database) in the Goose Creek Reservoir range from being below the detection limit in the winter to 0.35 mg/L in the summer. For WQMS for Stations RL-08065 and ST-032 for 2008, the average annual TP level in the reservoir was approximately 0.12 ppm. State criteria for lakes in the coastal plain, shown in Table 8, indicate recommended TP levels for reservoirs should be at or below 0.09 ppm (mg/L). Below the reservoir, at MD-039 the TP levels are at or below 0.12 ppm all year in 2008; however, this WQMS is in a tidal saltwater area where freshwater nutrient standards do not apply and there are no existing regulatory numeric nutrient criteria for saltwater systems in South Carolina. A possible reason for the difference in TP levels in the creek versus reservoir may be a function of the tidal flushing in the creek.

Table 7 – Numeric Nutrient Criteria for Lakes in Middle Atlantic Coastal Plain

Criteria	Threshold
Total Phosphorus	0.09 mg/L
Chlorophyll <i>a</i>	40 µg/L
Total Nitrogen	1.50 mg/L
<i>Source: (R.61-68, §E11.b(3))</i>	

4.1.2 Stream Corridor Assessment (SCA)

During the spring and summer of 2018, Team members assessed approximately 4.0 miles of the approximate total 10 miles of stream channels. The segments assessed in the field were Turkey Creek and tributaries to Turkey Creek below Rivers Avenue, an un-named tributary running from below Yeamans Hall Road to the Hanahan Public Works Department, the un-named tributary that runs below Railroad Avenue through John R. Bettis Boat Landing Park, the tributary that runs through the park on Murray Avenue, the tributaries on either side of Lombardi Lane, the tributary running through St. James park, and the channel running through St. James III Park.

The Team documented the location, type, and condition of stream corridor infrastructure and impacts to stream health at representative locations. Assessed features include: stream bank erosion, riparian buffer, pipe outfalls, fish movement barriers, trash, channel alteration, active construction, exposed pipes and any unusual conditions. Additionally, the Team members conducted an assessment of potential sites for restoration and construction of new stormwater BMPs using GIS desktop analysis and site visits. Figure 15 below presents the locations of the tributaries that were assessed. The areas with the most severe erosion and buffer impacts are shown in red. These are areas where the overall stream and floodplain condition were considered to be poor. Areas where channel erosion is occurring are shown in orange. The most heavily impacted areas assessed are predominantly in sub-watersheds 1 and 2. Stream restoration is recommended in these areas, as outlined in Section 4. The complete field assessment sheets are in Appendix D.

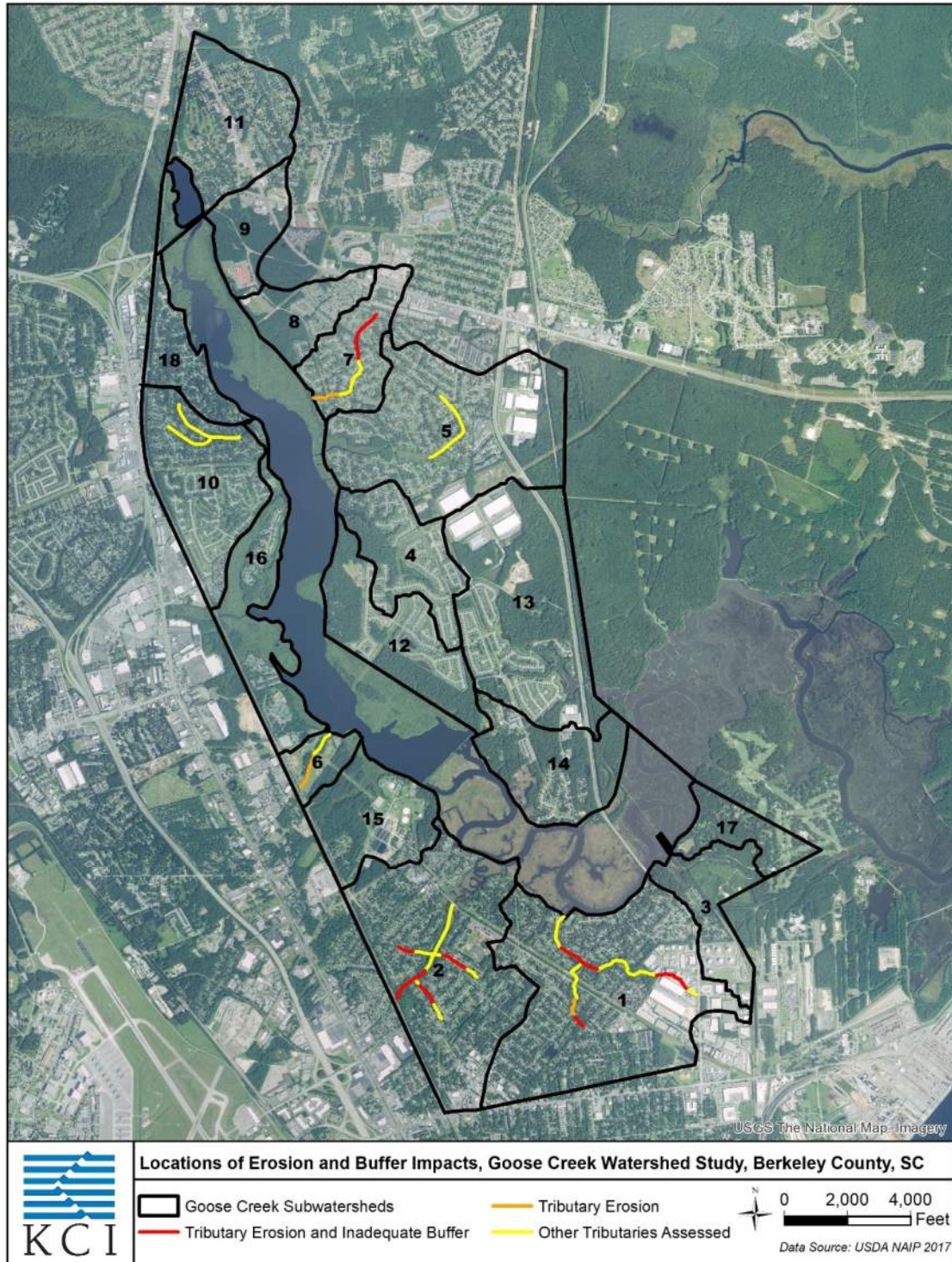


Figure 17 - Locations of erosion and buffer impacts

4.1.3 Additional Bacteria Sampling Methods

Because station MD-039 had not been evaluated since 2009 and no other current SCDES sampling has occurred in this section of Goose Creek, the Team and Berkeley County initiated additional sampling to determine if a bacteria impairment still existed in the tidal creek. There is a large amount of current water quality monitoring data for the Reservoir, and it does not appear that bacteria has been a consistent problem in this section of the watershed. There is one station (RL-10104) that was listed for impairment due to *E. coli* in 2012, but no other stations in the Reservoir have a bacteria impairment. The Team hypothesized that the bacteria impairment may be limited to the tidal creek and decided to examine the tributaries downstream of the reservoir that drain into Goose Creek.

The Team selected three tributaries to test for *Enterococcus*. According to the SCDES Watershed Atlas, all three of these sampling locations are on streams classified as SB (tidal saltwater). The sampling locations are located in sub-watersheds 1, 2 and 3. These sub-watersheds are in the areas discharging to the downstream WQMS MD-039, where historically high bacteria levels were observed. Sampling location WS1 is the downstream side of the bridge on Murray Avenue over Turkey Creek. Sampling location WS2 is on the downstream side of the small bridge on Yeamans Hall Road over the un-named tributary to Goose Creek. Sampling location WS3 is at the outfall of the pond on Lakeside Drive. Sampling locations are shown in Figure 16, below:

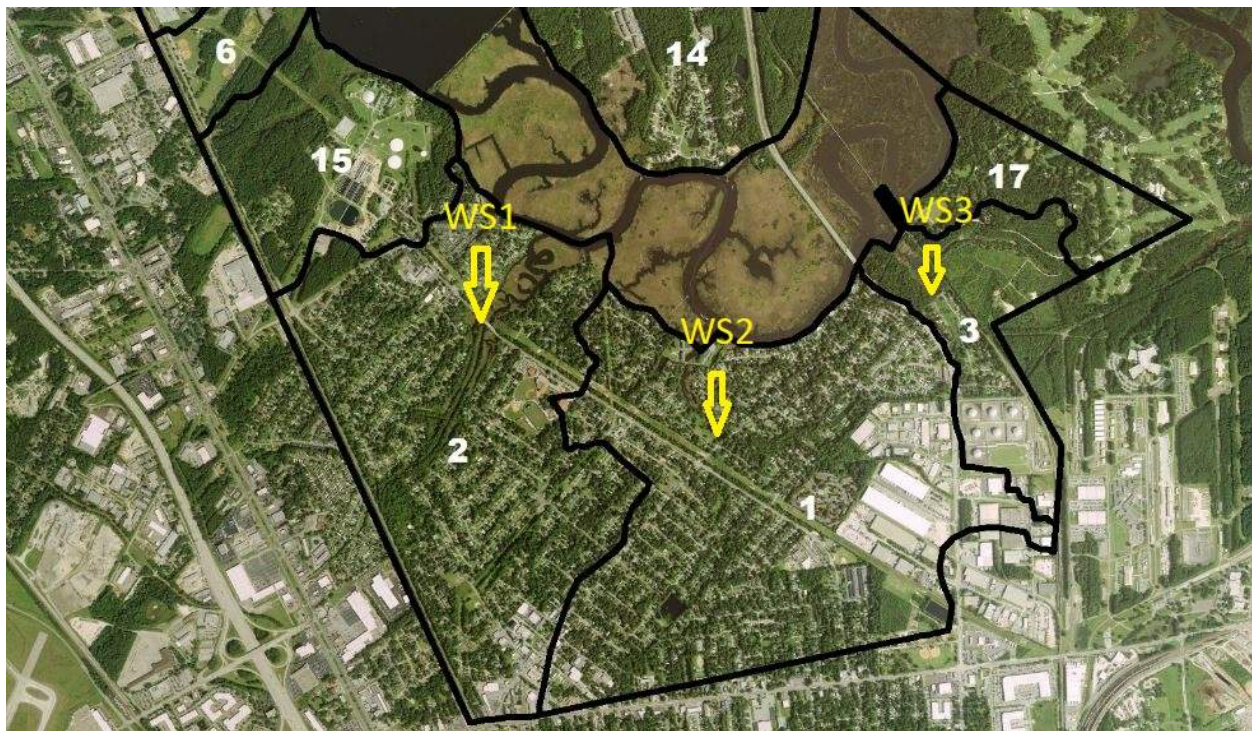


Figure 18 – Sampling Locations

The grab samples for *Enterococcus* were collected by Berkeley County and delivered to Trident Labs. The pH of these samples was measured in the field and the *Enterococci* counts were determined in the laboratory. Table 9 summarizes data collected from April 2018 through August 2018 (lab and field data is included in Appendix A), with the measurements that exceed the single sample maximum (SSM = 501 MPN/mL for Class SB waters) shown in red text. Location 2 (Yeamans Hall Road) had the most exceedances (62.5%), followed by Location 1 (Turkey Creek, 50%). Location 3 only had one exceedance during the study period. The rainfall total from the prior 72 hours is also shown; most of the sampling events occurred when less than 0.1 inch of rainfall had occurred.

Table 8 – Field Grab Sample Concentration Results

Date	72 Hour Rainfall (Inches)	Location WS1		Location WS2		Location WS3	
		Enterococcus MPN/100 ml	pH (Field)	Enterococcus MPN/100 ml	pH (Field)	Enterococcus MPN/100 ml	pH (Field)
4/20/2018	0.00	35	6.79	173	7.57	18	8.72
5/15/2018	0.02	199	6.75	816	7.03	148	6.94
6/22/2018	0.00	1413	7.62	1203	7.9	31	7.45
7/24/2018	0.06	>2420	7.75	1553	7.46	1300	7.32
8/27/2018	0.02	107	7.80	1203	7.85	39	8.17
10/08/2018	0.00	>2420	8.21	1203	8.08	461	8.07
1/23/2019	1.20	250	8.21	144	8.08	150	8.07
3/18/2019	0.26	613	8.0	397	7.86	152	8.5

The *Enterococcus* testing results only indicate bacterial contamination in a waterway. These results can inform the watershed manager of actual presence of contamination, but they do not identify the source of the fecal waste. In order to better understand the factors contributing to the elevated bacteria levels observed in these two tributaries, the Team utilized Clemson University's microbial source tracking (MST) service. The laboratory utilizes quantitative polymerase chain reaction (qPCR) to identify distinct genetic markers for four different species: human, bovine, swine, and canine. Water samples for Location WS1 and WS2 were collected in October 2018, January 2019, and March 2019. Results (also included in Appendix A) detected the presence of human waste in all three samples at both locations.

Figure 17 (below) illustrates the watershed areas upstream of the sampling locations WS1 and WS2. While all of the watershed draining to Location WS2 is located within the Berkeley County MS4 area, note that nearly 75% of the watershed upstream of Location 1 on Turkey Creek is outside of the MS4 area. It may be possible that bacterial contamination is originating outside of Berkeley County, and the Berkeley County Stormwater Management Program/ MS4 operator may need to collaborate with Charleston County on management decisions and practices to address this impairment.

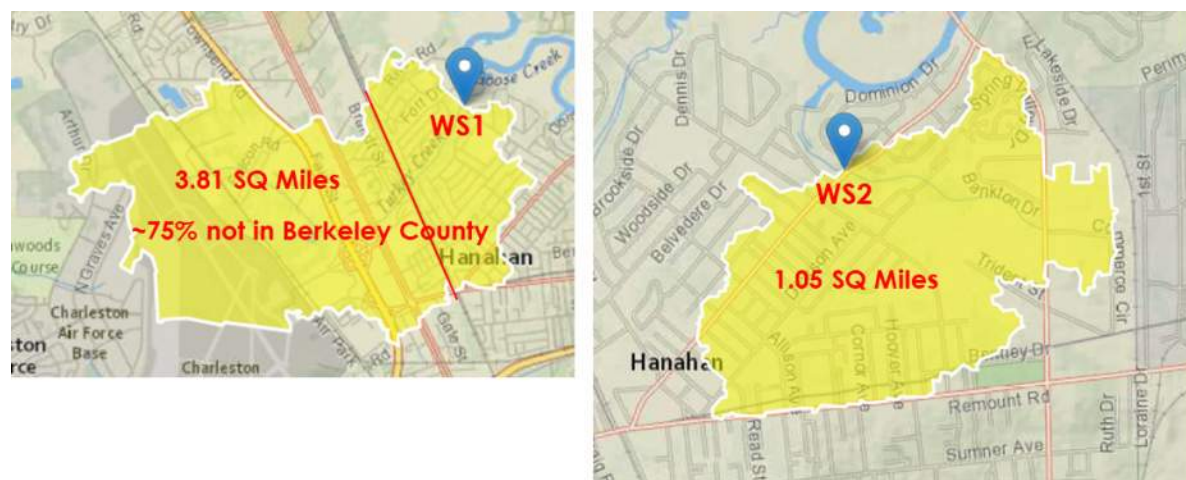


Figure 19 – qPCR Sampling Locations Watersheds

Table 10 summarizes data collected in October 2018, January 2019 and March 2019. The lab data are shown in Appendix A. One sample from station WS1 came back positive for bovine bacteria in October 2018 which appears to be a false positive. There are no cattle known to be present in this area; however, there is a possibility that the bovine bacteria could be derived from water being pumped into the Goose Creek Reservoir from the Edisto River. Human bacteria sources appear to be more of an issue at Sampling Location 1, and do not appear to be linked to runoff or surface loading from storm events. Sanitary sewer leaks or discharge appear to be the most probable source.

Table 9 – qCPR Grab Sample Concentration Results (Human)

Date	72 Hour Rainfall (Inches)	Location 1		Location 2	
		Human Bacteria (CFU/100 ml)	pH (Field)	Human Bacteria (CFU/100 ml)	pH (Field)
10/08/2018	0.00	450	6.79	25	7.57
1/23/2019	1.20	2000	6.75	450	7.03
3/18/2019	0.26	25,000	7.62	3000	7.9

4.2 Pollutant Loads

Calculations of pollutant loads were developed for the Focus Area using the Watershed Treatment Model (WTM) published by the Center for Watershed Protection in 2010. This method was selected because it allows the watershed manager to assess loads from a wide range of wet weather and dry weather land uses found in urban and agricultural watersheds. It provides output on the sources of pollutants and estimates nitrogen, phosphorus, total suspended solids and bacterial loads in the watershed – which are the issues that have the most effect in the watershed based on the water quality analysis described above. The model calculates watershed loadings based on land use, not concentrations in the receiving waterbodies that may result. For this reason, a separate sampling component is also used for the plan.

The method is set up with calculations to report loads for three scenarios: Existing Conditions, as of the date of the watershed assessment; New Development Conditions, which is forecast from zoning, build out, or other land planning data; and Proposed Conditions, which includes proposed changes resulting from in stormwater management, stream restoration projects, or non-structural programs. For this project, only Existing Conditions and Proposed Conditions scenarios were modeled. This section describes existing loads. Loads and load reductions resulting from implementation of management strategies and restoration projects are discussed in later sections.

The loads are calculated using several input worksheets, as follows:

Primary Sources - These elements summarize the loads from sources that can be determined solely by land cover or land use. It requires basic land use information, and calculates surface runoff loads. In addition, it requires basic watershed data, such as annual rainfall, stream length, and soils distribution.

Secondary Sources - Secondary sources are pollutant sources that cannot be calculated based on land use information alone such as septic systems, illicit connections, sanitary sewer overflow (SSO), and channel erosion. Sources, such as SSOs, are at least partially composed of wastewater.

Existing Management Practices - These elements reflects programs currently in place to control loads from urban land. Users need to input information about the effectiveness and level of implementation of various programs and practices.

Together these components calculate the existing loads and allow the user to determine the total annual load of each pollutant and quantify the proportional sources of loads among the various categories, including urban land, channel erosion, rural land, and septic systems. Forest and open water are also included, as forest does supply a small percentage of load and open water captures atmospheric deposition of pollutants that are contributed directly to the water surface. Detailed descriptions of the method are included in Appendix B.

4.2.1 Existing Conditions

Table 11 and Figures 18a to 18d provide the results of the existing conditions pollutant load analysis.

Table 10 – Existing Loads per Source

Source	TN - lbs/year	TP - lbs/year	TSS - lbs/year	Fecal Coliform - billion/year
Urban Runoff	83,360	14,714	1,861,397	1,769,459
Septic Systems	68	11	454	103
SSOs	5	1	32	36,663
Illicit Connections	147	29	1,010	104,367
Active Construction	296	59	201,328	-
Channel Erosion	2,967	2,967	2,966,576	-
Rural	1,209	184	26,274	10,247
Forest	5,535	443	221,406	26,569
Open Water	10,547	412	127,718	-
Total Load	104,133	18,820	5,406,196	1,947,408

The primary source of nitrogen in the watershed Focus Area is runoff from urban land which accounts for 80% of the total nitrogen (see Figure 18 a) and includes sources such as road and parking lot runoff, fertilizers, and pet waste. Sanitary sewer Overflows (SSOs) account for 10% of the load. Phosphorus is linked most directly in the watershed to urban sources which contribute 78% of the total phosphorous (see Figure 18 b). Rural land and water contribute almost 6% of the phosphorus. Sediment, measured in the form of total suspended solids is primarily contributed by channel erosion, which accounts for 55% of the loading. Urban land use accounts for a total of 34% of the sediment. Active construction, which there is not much of in the focus area, accounts for 4%. Results of existing fecal coliform pollutant load modeling using WTM indicate that sources in the Focus Area watershed are dominated by Urban Runoff, which makes up 91% of the loading (see Figure 18 d.). Likely bacteria sources in the urban areas include pet waste and runoff from impervious surfaces. The majority of the remaining inputs are from septic systems, and SSOs, and illicit discharges.

Per acre loading rates from the WTM Model are shown in Table 12 for Rural and Urban Land Use:

Table 11 – Loading Rates from WTM Model

Land Use	TN - lbs/acre/year	TP - lbs/acre/year	TSS - lbs/acre/year	Fecal Coliform - billion/acre/year
Rural	5.2	0.3	113.7	11.2
Urban	20.9	4.3	1,213.3	460.8

5 Implementation Plan

The Implementation Plan includes description of the recommended management strategies and restoration projects, and provides an estimation of the water quality benefits that would be realized from plan implementation. This section includes cost estimates for strategy implementation, identifies potential funding sources and partners, and describes monitoring programs to document plan implementation and changes in the watershed condition over time.

5.1 Management Strategies

To address the watershed impacts described in Section 2, a series of watershed management strategies have been reviewed for applicability in the Focus Area. The results are presented here and generally fall into three categories.

Restoration Projects are defined as those projects with a specific setting, typically located on one property, which may require the design and construction of a particular treatment method such as the installation of a stormwater management facility. Four types of restoration projects are listed below.

- Pond Restoration (PR) involves the restoration and/or retrofit of an existing stormwater treatment structure. There are two industrial sites with ponds listed (Ind).
- Retrofit Projects (RF) are mostly the addition of stormwater BMPs such as Bioretention cells on properties which may or may not have other stormwater BMPs. There is one enhanced drainage swale Project (SW1) included with the other Retrofit Projects.
- Stream Restoration Projects (SR) are primarily located on Blue Line streams that have been converted for use as drainage ditches.

Community-wide programs include education and outreach activities and implementation of dispersed programs that involve many community members such as a rain-barrel workshop to distribute rain-barrels and inform homeowners of their use and impact on watershed health. Berkeley County, City of Goose Creek and the City of Hanahan currently have a contract with Carolina Clear, a program of the Clemson University Cooperative Extension that fulfills Minimum Control Measures 1 and 2 (Public Education & Outreach, and Public Involvement & Participation) of their MS4 permit. *Municipal programs* are programs that are typically implemented by a local municipality, such as street sweeping and illicit discharge detection; however, some may be implemented by citizen groups and volunteers.

5.1.1 Restoration Projects

Restoration projects for the Focus Area were identified primarily through the SCA completed in summer of 2018. The types of projects recommended are listed in Table 13. Full descriptions of the current conditions, restoration approach, project benefits, and potential project constraints for each project are included in Appendix C along with a preliminary cost estimate. Currently 30 projects have been identified and included in the plan. More projects could certainly be identified, particularly on private property; however this list provides Berkeley County with a good starting point.

In some cases the recommended projects overlap in location and provide managers with options for the level of effort and type of project chosen for a site. Project IDs that are highlighted with the green background are on publicly owned property. Participation from property owners in restoration projects identified on private property is completely voluntary.

Table 12 – Retrofit Project Details

Project ID	Project Type	Details
PR1 - Goose Creek Primary	Wet Stormwater Detention Basin	Vegetation and Sediment removal for 2 wet ponds treating 5.1 impervious acres
PR2 – Berkeley County Business Center Pond	Wet Stormwater Detention Basin	Vegetation and Sediment removal for 1 wet pond treating 97 impervious acres
PR3 – Hanahah Middle School	Dry Stormwater Detention Basin	Vegetation and Sediment removal for dry pond treating 3.06 impervious acres
PR4 – Hanahan Rec Center	Wet Stormwater Detention Basin	Vegetation and Sediment removal for wet pond treating 2.72 impervious acres
PR5 - Murray Ave Park	Wet Stormwater Detention Basin	Outfall modification and sediment removal for wet pond treating 78.4 impervious acres
PR6 – St James Lake	Wet Stormwater Detention Basin	Outfall modification, vegetation and sediment removal for wet pond treating 152.5 impervious acres
PR7 – Redeemer Drive	Wet Stormwater Detention Basin	Outfall modification, sediment removal and plantings for wet pond treating 24 impervious acres
PR8 – Gold Cup Lake	Wet Stormwater Detention Basin	Sediment removal, forebay addition, wetland plantings and outfall repair for wet pond treating 34 impervious acres
PR9 – Hanahan Elementary	Dry Stormwater Retention Basin	Vegetation and Sediment removal for dry pond treating 5.1 impervious acres
Ind1 - North Pointe Industrial	Wet Stormwater Detention Basins	Vegetation and Sediment removal for 2 wet ponds treating 78 impervious acres
Ind2 - North Rhett Industrial P	Wet Stormwater Detention Basin	Vegetation and Sediment removal for 2 wet ponds treating 47 impervious acres
RF1 - Goose Creek Primary	Bioretention Areas (Multi Purpose)	Creation of 4 Bioretention Areas treating 3.35 impervious acres
RF2 - Hanahan High School	Bioretention Areas (Multi Purpose)	Creation of 4 Bioretention Areas treating 3.35 impervious acres
RF3 - Hanahan Middle School	Bioretention Areas (Multi Purpose)	Creation of up to 5 Bioretention Areas treating 3.0 impervious acres
RF4 - Hanahan Rec Center	Bioretention Areas (Multi Purpose)	Creation of a Bioretention Area treating 1.36 impervious acres
RF5 – Goose Creek High	Bioretention Areas (Multi Purpose)	Creation of 4 new Bioretention Areas treating 3.35 impervious acres
RF6 – Goose Creek High	Dry Detention Basin	Retrofit of 2 Dry Ponds into Bioretention Areas treating 3.35 impervious acres
RF7 - Aims Elementary	Bioretention Areas (Multi Purpose)	Creation of 2 new Bioretention Areas treating 3.0 impervious acres
RF8 – Kapstone ROW	Bioretention Areas (Multi Purpose)	Creation of 2 new Bioretention Areas treating 5.68 impervious acres
SW1 – BL Parcel	Enhanced WQ Swale	Enhancement of approximately 1000 feet of existing drainage ditch into a water quality swale receiving water from 52.1 impervious acres

Table 13 – Stream Restoration Project Details

Project ID	Project Type	Details
SR1 - Bettis Park	Stream Restoration	1200 Linear Feet
SR2 - Hanahan Park	Stream Restoration	500 Linear Feet
SR3 - St James Park	Stream Restoration	300 Linear Feet
SR4 - St James III	Stream Restoration	700 Linear Feet
SR5 - Kapstone	Stream Restoration	415 Linear Feet
SR6 - City of Hanahan	Stream Restoration	550 Linear Feet
SR7 - OL Thompson	Stream Restoration	550 Linear Feet
SR8 - Kensington HOA	Stream Restoration	500 Linear Feet
SR9 - Rest Church	Stream Restoration	730 Linear Feet
SR10 - Mellard Dr.	Stream Restoration	200 Linear Feet
TOTAL:		5,145 Linear Feet

The following describes each practice in more detail:

Pond Restoration - Eleven pond restoration projects have been identified as a part of this project. These are projects where existing stormwater treatment ponds need repairs or retrofits to their outfall structures, removal of sediment, buffer plantings or other work. Ponds identified for restoration are typically those that are in need of maintenance. Restoration of these ponds will capture runoff from a total area of 1,437 acres with treatment of runoff from approximately 527 acres of impervious surface. Due to site constraints, pond restoration projects PR5 and PR7 are not capable of the full WQV of ½" of runoff from the entire area draining to a pond having a permanent pool. These two ponds will only be able to treat the first 0.1" and 0.075" of runoff, respectively. Calculations and cost estimates for the pond restoration sites are in Appendix C.

Stormwater Retrofit – Stormwater retrofits include many types of projects that capture and treat stormwater runoff from impervious surfaces in existing development. The types of projects recommended in this plan include bioretention and infiltration trenches. The nine projects are proposed to capture a total area of 179.5 acres with treatment of runoff from approximately 80 acres of impervious surface.

Bioretention — These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtration through soil media and the biological and biochemical reactions within the soil matrix and the plant root zones. The bioretention areas are designed to capture and temporarily store stormwater runoff in the engineered soil media, where it is subjected to the hydrologic processes of evaporation and transpiration, before being conveyed back into the storm drain system through an underdrain or allowed to infiltrate into the surrounding soils. The engineered soil media is comprised of sand, soil, and organic matter. For more information see Section 4.2 *Bioretention in Low Impact in Coastal South Carolina: A Planning and Design Guide*.

Bioretention projects are proposed for seven sites in the watershed Focus Area. The majority of these sites are schools, and one bioretention area is located on public property.

Enhanced Water Quality Swale — Enhanced dry swales are conveyance channels engineered to capture, treat, and release the storm water quality runoff volume from a particular drainage area. Enhanced swales are different from normal drainage swales in that they have a designed structure implemented in them to enhance detention and storm water pollutant removal. Enhanced dry swale systems are designed primarily for storm water quality and have only a limited ability to provide storm water runoff volume control and downstream channel protection. Enhanced dry swales are vegetated channels designed to include a filter bed of prepared soil that overlays an underdrain system. Dry swales are sized to allow the entire water quality storage volume to be filtered or infiltrated through the swale bottom. Because these swales are predominantly dry, they are preferred in residential settings. Yearly inspections to determine if the basin or trench is still infiltrating runoff will be needed. For more information see Sections 4.4 Stormwater Infiltration and/or 4.8 Open Channel Systems in Low Impact in Coastal South Carolina: A Planning and Design Guide.

Infiltration Trench - Infiltration trenches are excavations typically filled with stone to create an underground reservoir for storm water runoff. The runoff volume gradually exfiltrates through the bottom and sides of the trench into the subsoil over a maximum period of 72 hours (three days), and eventually reaches the water table. By diverting storm water runoff into the soil, an infiltration trench not only treats the water quality volume, but it also preserves the natural water balance by recharging groundwater and preserving channel baseflow. Using natural filtering properties, infiltration trenches remove a wide variety of pollutants from the runoff through adsorption, precipitation, filtering, and bacterial and chemical degradation.

Infiltration trenches are limited to areas with highly porous soils where the water table and or bedrock are located well below the trench bottom. They are only applicable for Hydrologic Soil Group A soils, or soils that have a minimum infiltration rate of 0.3-inches per hour. Infiltration trenches are not intended to trap sediment and are designed with a sediment forebay or other

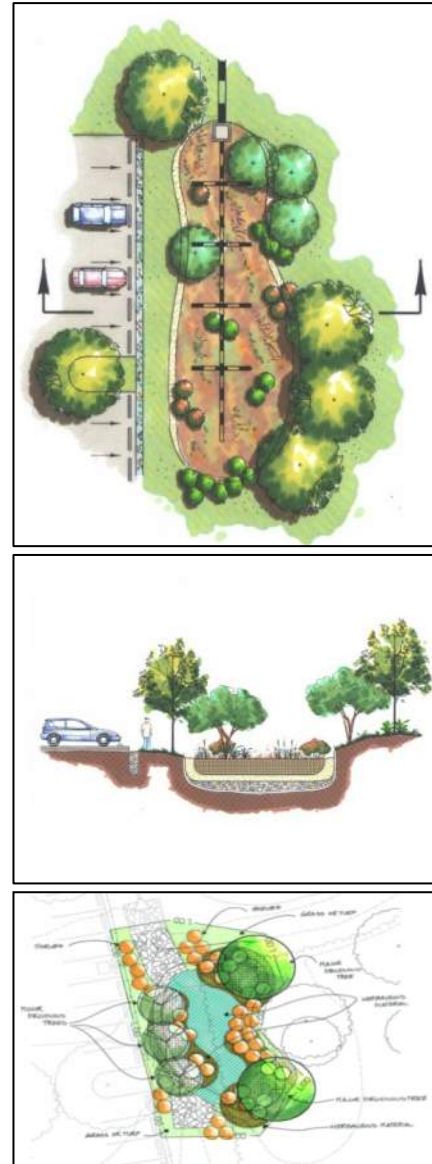


Figure 20 – Example bioretention projects shown in planview (top), cross-section, with landscaping plan, and following one growing season (bottom)

pre-treatment measure to prevent clogging in the gravel. Infiltration trenches are used for medium- to high- density residential, commercial, and institutional developments. They are most applicable for impervious areas where there are low levels of fine particulates in the runoff and the site is completely stabilized and the potential for possible sediment loads is very low. Do not use Infiltration trenches for manufacturing and industrial sites where there is potential for high concentrations of soluble pollutants and heavy metals. Infiltration trenches are designed to capture sheet flow from a drainage area or function as an off-line device. Due to the relatively narrow shape, infiltration trenches are adapted to many different types of sites and are utilized in retrofit situations. Unlike some water quality BMPs, infiltration trenches can easily fit into margin, perimeter or other unused areas of development sites.

Table 14- Infiltration Trench: Average Pollutant Removal Capability

Total Suspended Solids: 80%-90%	Zinc: 80%-90%
Metals: 70%-85%	Total Phosphorus: 50%-60%
Copper: 50%-60%	Total Nitrogen: 35%-55%
Lead: 80%-90%	Pathogens/Bacteria: 90%-98%
Hydrocarbons: 85%	

Source: *SCDES BMP Field Manual*

A swale providing water quality treatment is proposed in the ditch that runs under the power lines along Belvedere Avenue from Loftis Road to Sedgfield Drive. Runoff currently enters Turkey Creek untreated. The swale will be able to infiltrate only about 10% of the water quality storage volume due to limited available land area to provide water quality treatment for approximately 122 acres draining to this site. Additionally, the swale will provide an area where sediment can accumulate and be removed during annual maintenance.

Stream Restoration – Stream restoration is used to improve both agricultural and urban stream ecosystems by reconstructing the natural landscape and channel form. Restoration also helps improve instream and habitat and water quality conditions in degraded streams by reducing erosion and sedimentation. Recent science from the Chesapeake Bay Program has also indicated that stream restoration projects can significantly reduce nutrient loads within a watershed. Stream restoration in all cases is accompanied by restoration of a riparian buffer with plantings of native trees and shrubs. The 10 recommended projects include



Figure 21 – Example stream restoration project one year following restoration

5,645 linear feet of restoration. Riparian forest buffers are linear wooded areas along rivers, streams and shorelines. Forest buffers help filter nutrients, sediments and other pollutants from runoff as

well as remove nutrients from groundwater. Riparian buffer plantings can be accomplished with minimal cost when volunteers from the community are engaged to participate. Community plantings are great ways to introduce the community to watershed restoration and therefore are among the most effective restoration strategies.

The recommended buffer width for riparian forest buffers is a minimum of 35 feet. Thirty-five feet is used in this plan for calculation of approximate planting area, cost, and the pollutant removal benefit.

5.1.2 Community-wide Programs

Several recommendations are made to implement community wide programs that are based on education and community engagement. Participation by watershed residents in practices that they can implement at their homes, businesses, schools and places of worship is crucial. These programs are generally referred to 'source control' strategies as they reduce or eliminate the pollutant at its source before it can enter the waterway. An estimate of 40% of the population of 3,950 households changing their habits based on educational programs is used for these benefits in the WTM Model.

Residential Lawn Care Education – Educate watershed residents on the impact of various lawn care practices on water quality. Excess fertilizer can runoff into waterways and be a significant source of nutrients, in addition to being potentially unnecessary and costly to the property owner. Topics would include soil testing, recommended fertilizer levels, non-phosphorus fertilizers, organic fertilizers, conversion of lawn to native vegetation, and mowing practices. Programs could be implemented or sponsored by the Ashley Cooper Stormwater Education Consortium (ACSEC).

Pet Waste Education – In many neighborhoods improperly disposed pet waste can be a source of fecal bacteria and nutrients, particularly from dogs. An outreach program to educate residents on the environmental and hygiene/health impacts of pet waste disposal can be implemented by Berkeley County or Carolina Clear. The program should be coupled with pet waste disposal stations, signage in high traffic dog walking areas, and possibly a local ordinance for removal and proper disposal of pet waste.

Septic System Education, Maintenance, and Upgrade – Septic systems, or 'on-lot' systems can be contributors of viruses, pathogens, and nitrogen to the groundwater and eventually to surface waters. Regular maintenance of these systems is necessary to ensure long-term operation and safe water supplies. Educational materials and workshops can be developed to present recommendations and explain existing local ordinances for septic tank pumping, drain field care and percolation testing, proper disposal of household hazardous waste, and general best management practices for proper maintenance and operation. Outreach should also include information on septic system upgrades to nitrogen removing best available technology (BAT), which can effectively cut nitrogen load from septic systems in half.



Figure 22 – Example cistern application

Programs could be organized by Berkeley County with support from SCDES.

Rain Barrels / Downspout Disconnect – Many towns and cities have traditionally used gutter and downspout systems to ‘connect’ stormwater from homes, businesses, schools to the storm drain system. Disconnecting these systems to direct rainwater from roofs to open grassy areas or to rain barrels and cisterns reduces the overall volume of stormwater runoff, conserves water use, reduces pollutants entering the stream, and provides clean water for gardens and everyday outside use. An education program can include rain barrel workshops to distribute rain barrels and instruct on their installation and use. Programs can be implemented by Berkeley County and the ACSEC. For more information, see Sections 4.6 Rainwater Harvesting and 4.7 Impervious Surface Disconnection in *Low Impact in Coastal South Carolina: A Planning and Design Guide*.

5.1.3 Municipal Programs

Watershed management strategies that can be either implemented by the local municipalities including Hanahan and Goose Creek, and/or by Berkeley County are described here. The recommendations in this section focus on stormwater system maintenance and elimination of illicit discharges. Illicit discharges are defined as water discharges to the municipal separate storm drain system that are not entirely composed of stormwater. That is, they are harmful and often illegal connections to the stormwater system from business or commercial activities. In some cases the recommendation may be to build on or add frequency to existing programs.

Street Sweeping – Street sweeping at regular intervals (monthly) can be a very effective method for reducing the runoff of many pollutants including nitrogen, sediment, oils, grease, and metals typically found in stormwater runoff from roadways. Sweeping should be targeted to most heavily traveled roads and areas most connected to the storm drain system. The WTM model recommends that approximately 50% of the roads in commercial and residential areas be swept every month.

Hot-Spot and Illicit Discharge Detection and Elimination (IDDE) – Dry weather flows discharging from storm drain systems can contribute significant loads to stream systems. Inspection and testing of water quality from outfalls, or from upland ‘hot-spots’ during dry weather can assist in the detection of inappropriate discharge entering the stream both from storm drains and from other pipes potentially conveying discharge. Hot-spots generally include commercial and industrial properties that may be specific sources of pollutants from poor housekeeping practices that allow pollutants to wash into the storm drain system. When an illicit discharge is found it can be tracked to its source for resolution. Discharge types can include sewage and septage flows, washwater flows such as laundry and car washing discharge, liquid waste such as oils and paints, landscape irrigation, dumpster runoff, and tap water. Although most outfalls in the focus area are mapped, mapping of the network of subsurface infrastructure components that forms the storm drain system which drains to the outfall in the vicinity of Yeamans Hall Plaza (where older commercial activity located) is recommended. It will also help to provide opportunities for water quality enhancements.

Catch Basin Cleaning – Berkeley County has a catch basin maintenance program which includes a rating as shown in the table below:

Table 15 – Catch Basin Maintenance Ratings

Rating (A, B, or C)	Description of Rating	Criteria for Rating	Number of Suggested Scheduled Cleanings
0	No Need for Maintenance	Outside the MS4 or Maintained by Another Entity	0
C	Very Low to no Need for Maintenance	•No Residences Directly Impacted •Pipe/Basin are not Connected to an Outfall Location •1 Pipe/Basin Requiring Maintenance	Less than A & B
C	Low to Minor Need for Maintenance	•1 Residence Impacted •Pipe/Basin are in a Upstream Location to an Outfall •1-2 Pipe/Basin Requiring Maintenance	Less than A & B
B	Moderate to Significant Need for Maintenance	•1-2 Residence Impacted •Pipe/Basin are Directly Adjacent an Outfall •2-4 Pipe/Basin Requiring Maintenance	Once every two years
B	High Need for Maintenance	•2-5 Residence Impacted •Pipe/Basin are Directly Adjoining an Outfall •4-5 Pipe/Basin Requiring Maintenance	Once every two years
A	Very High Need for Maintenance	•5 or more Residence Impacted • Pipe/Basin is the Outfall •5 or more Pipe/Basin Requiring Maintenance	Once annually

Most areas of Hanahan and Goose Creek where catch basins are cleaned are on a B or C schedule. State roads are not maintained at all by Berkeley County. It is recommended that all catch basins and inlets that are maintained by Berkeley County in this area are performed on an annual basis.

5.1.4 Flood Strategies

Management strategies selected for inclusion in the plan were in large part selected for their water quality and habitat improvement capabilities. However many of the strategies also provide some level of flood mitigation. A watershed based approach to reducing impacts from flooding - follows three general methods: 1. reduce runoff from both rural and urban land, 2. attenuate and store runoff and stream flow, and 3. provide flood capacity at critical infrastructure locations.

These activities can be quite useful for smaller out of bank and flooding events associated with the 1 and 2 year return intervals; however approaches to control the 10, 50, and 100 year flood would likely require larger control devices such as additional ponds, which are perhaps not warranted for Goose Creek below

the Reservoir. If flooding is determined to be a significant issue and needs to be dealt with more directly, a flood study with a hydrologic and hydraulic model will be required.

Runoff Reduction – Reducing the runoff at the source is accomplished by several different low impact development strategies that attempt to hold the water on the upland landscape and provide infiltration. Urban practices include reforestation; conversion of impervious surfaces to pervious cover such as meadow or forest; disconnection of downspouts; and installation of rain barrels, bioretention, infiltration devices (trenches), or pervious pavers or concrete. These practices are most useful for smaller rainfall events, but can become overwhelmed by larger storms.

Attenuation and Storage – Projects that attenuate and store flood flow in the upper watershed are recommended for areas in which property and infrastructure will allow for the necessary changes in the landscape. Stream restoration projects that reconnect the stream to the floodplain will provide storage in the upper watershed and reduce peak flows downstream. Spot-wise floodplain benching projects can also increase hydraulic storage along stream corridors where constraints may prevent full stream restoration, or where restoration may not be warranted. Similarly, creation of wetland systems can provide storage capacity as well as wildlife habitat. Riparian buffer plantings provide vegetation in the overbank zone that can slow and reduce flood flows.

Road Crossing Capacity – Murray Avenue, Railroad Avenue, North Rhett Avenue and Foster Creek Road hold the locations of most major culvert crossing for water that is flowing into Goose Creek and the Goose Creek Reservoir. There were no flooding issues noted during the course of this study, but there is one major crossing on Murray Avenue below the City of Hanahan Park and one on Foster Creek Road near Westminster Blvd that may have capacity issues. Monitoring of stream flow and floodstage in these areas is recommended.

5.2 Benefits

Each management strategy has its own set of watershed benefits. Benefits include estimated pollutant reductions, improvements to aquatic and riparian habitat, and community benefits such as improved aesthetics or access to recreational opportunities. Benefits for the *Restoration Projects* described above are explained in more detail in the concept plans that have been developed for each project. These have been included as Appendix C. Table 16 below presents the relative benefit of each practice as it relates to major benefit categories. The following section addresses the overall impact that the suite of management measures will have on water quality in terms of the pollutants that the practice reduces.

Table 16 – Watershed Benefits per Practice

Practice	Water Quality	Runoff Reduction	Channel Protection	Flood Control	Instream Habitat	Community Aesthetics	Community Engagement
Stabilized Crossing	●		●		○		
Stream Restoration	●		●	○	●	○	
Reforestation / Riparian Buffers	●		●		●	●	○
Bioretention	●	○	○	○		●	
Infiltration Trench	●	●		○			
Lawn Care Education	●				○	○	●
Pet Waste Education	●				○	●	●
Stream Clean Up					○	●	●
Septic System Education	●				○	○	●
Rain Barrels / Downspout Disconnect	○	●	○	○	○	●	●
Street Sweeping	●					●	
Hot Spot and IDDE	●					●	
Nutrient Management Plan	●				○	○	
Erosion and Sediment Control	●	○		○	○		
Culvert Upgrade			●	●	○		
Key: ● Primary benefit ○ Secondary benefit							

5.2.1 Pollutant Load Reductions

The Watershed Treatment Model (WTM), described in earlier sections, was used to calculate reductions for the four primary pollutants of concern – total nitrogen (TN), total phosphorus (TP), sediment as total suspended solids (TSS), and fecal coliform bacteria. The reductions are organized based on the major source categories listed in Table 15 below.

A scenario with future management strategies included was developed using watershed specific information and estimates regarding the level of implementation for the each of the management strategies described above. In brief, the scenario includes complete implementation of the restoration projects, and implementation of the community-wide programs and municipal programs. The results are presented in Tables 17 and 18 and in Figure 22.

Table 17 – Reduction of Pollutants with Implementation of Plan

Source	TN - lbs/year	TP - lbs/year	TSS - lbs/year	Fecal Coliform - billion/year
Urban Runoff	(21,572)	(5,134)	(742,857)	(301,017)
Septic Systems	(68)	(11)	(454)	(103)
SSOs	(5)	(1)	(32)	(36,663)
Illicit Connections	(147)	(29)	(1,010)	(104,367)
Active Construction	-	-	-	-
Channel Erosion	(1,018)	(272)	26,773	-
Rural	-	-	-	-
Forest	(1,875)	(150)	(75,000)	(9,000)
Water	-	-	-	-
Total Net Load	(24,071)	(5,496)	(788,495)	(451,150)

Table 18 – Percent Reduction of Pollutants with Implementation of Plan

Source	TN	TP	TSS	Fecal Coliform - billion/year
Urban Runoff	25.9%	34.9%	39.9%	17.0%
Septic Systems	100.0%	100.0%	100.0%	100.0%
SSOs	100.0%	100.0%	100.0%	100.0%
Illicit Connections	100.0%	100.0%	100.0%	100.0%
Channel Erosion	34.3%	9.2%	0.9%	0.0%
Rural	0.0%	0.0%	0.0%	0.0%
Forest	33.9%	33.9%	33.9%	33.9%
Water	0.0%	0.0%	0.0%	0.0%
Total Load	23.1%	29.2%	14.6%	23.2%

Reductions based on the current scenario indicate overall reductions of 23%, 29%, 15% and 23% for TN, TP, TSS, and fecal bacteria. Some specific results are described here:

Urban - the urban sources are controlled by stormwater retrofits and outreach programs for pet waste, lawn care, rain barrels, street sweeping, and IDDE. Implementation of the stormwater retrofits will have the greatest impact and is estimated to reduce TN by 24,071 lbs/year, TP by 5,496 lbs/year, TSS by 788,495 lbs/year and bacteria by 451,150 billion/year.

Channel Erosion – The largest percent reductions were estimated for the loads associated with stream channel impairment and improvements through stream restoration. In addition, the largest overall reductions in sediment are attributed to stream restoration by stabilizing eroding banks. Stream restoration has the added benefit of also improving instream and riparian habitat.

Rural Land – Load reductions attributed to rural lands were minimal as the focus of recommendations has been on livestock. Additional agriculturally based BMPs such as no-till farming practices, rotational grazing, and cover crops can be added to make additional reductions in pollutants.

5.3 Funding Requirements and Sources

Implementation of the recommendations included in the plan will require funding for program development, and for completion of the necessary design, permitting and constructions costs associated with each strategy. This section lays out some of these costs as well as options available for funding them.

5.3.1 Costs of Plan Implementation

A preliminary prioritization summary is provided in Tables 19 and 20. Detailed preliminary cost estimates for the proposed restoration projects are included in Appendix C. These projects are prioritized based on ownership of the parcel, proximity to receiving waters, project visibility and cost per impervious acre treated. Costs for restoration projects include the planning, design, surveying, environmental permitting, agency review, and construction costs. Project IDs located on public property are shown highlighted in Green. Costs are provided for each project and subtotaled for each project category.

Table 19 – Prioritized Stream Restoration Project Costs

Project ID	Length of Stream Restoration	Cost*	Cost/Impervious Acre Captured
SR2 - Hanahan Park	500 Linear Feet	\$300,000	\$3,822
SR3 - St James Park	300 Linear Feet	\$180,000	\$2,961
SR6 - City of Hanahan	800 Linear Feet	\$330,000	\$3,403
SR4 - St James III	700 Linear Feet	\$420,000	\$16,948
SR1 - Bettis Park	1500 Linear Feet	\$720,000	\$19,672
SR7 – OL Thompson	600 Linear Feet	\$330,000	\$1,525
SR8 - Kensington HOA	500 Linear Feet	\$300,000	\$5,408
SR9 - Rest Church	730 Linear Feet	\$438,000	\$628
SR10 - Mellard Dr.	200 Linear Feet	\$120,000	\$2,284
SR5 - Kapstone	415 Linear Feet	\$249,000	\$3,176
Stream restoration subtotal		\$3,087,000	

**Cost includes both design and construction fee*

Table 20 – Prioritized Basin Restoration Project Costs

Project ID	Project Type	Cost	Cost/Impervious Acre Treated
PR2 – Berkeley County Business Center Pond	Wet Stormwater Detention Basin	\$226,168	\$2,333
PR5 - Murray Ave Park	Wet Stormwater Detention Basin	\$127,468	\$1,626*
PR1 - Goose Creek Primary	Wet Stormwater Detention Basin	\$65,705	\$12,883
PR4 – Hanahan Rec Center	Wet Stormwater Detention Basin	\$32,807	\$12,061
PR3 – Hanahah Middle School	Wet Stormwater Detention Basin	\$65,293	\$21,337
RF6 – Goose Creek High	Dry Stormwater Detention Basin	\$153,913	\$45,944
RF1 - Goose Creek Primary	Bioretention Areas (Multi Purpose)	\$156,224	\$46,634
RF3 - Hanahah Middle School	Bioretention Areas (Multi Purpose)	\$145,660	\$48,553
RF2 - Hanahan High School	Bioretention Areas (Multi Purpose)	\$166,001	\$49,553
RF7 – Aims Elementary	Bioretention Areas (Multi Purpose)	\$154,826	\$51,609
RF4 - Hanahan Rec Center	Bioretention Areas (Multi Purpose)	\$74,672	\$54,906
RF5 - Hanahan Elementary	Bioretention Areas (Multi Purpose)	\$193,916	\$57,885
PR9 - Hanahan Elementary	Wet Stormwater Detention Basin	\$286,028	\$56,084
PR8 – Gold Cup Lake	Wet Stormwater Detention Basin	\$195,895	\$5,755
PR6 – St James Lake	Wet Stormwater Detention Basin	\$1,077,855	\$7,068
PR7 – Redeemer Drive	Wet Stormwater Detention Basin	\$83,374	\$3,474*
RF8 – Kapstone BioRetention	Bioretention Areas (Multi Purpose)	\$333,179	\$58,658
SW1 - Hanahan	Enhanced WQ Swale	\$178,789	\$3,432*
Stormwater retrofit subtotal		\$3,717,773	

*Projects not giving the full WQv

Developing cost estimates for the community based programs is difficult as projects can vary widely in scope, available resources, and necessary project elements. The Center for Watershed Protection (CWP) has derived unit costs for community outreach techniques and unit costs for neighborhood stewardship practices (CWP, 2005). The costs have been adjusted upward by 20% to account for inflation. To determine the extended cost, the median value of the cost range was used. It is assumed that meeting space to hold the various workshops would be a minimal cost (or even free); staff to prepare and run the workshop would be volunteers, and any necessary technical support from local governments would be available at no cost.

Table 21 – Community Based Programs Cost

Project Type	Cost	Unit	Quantity	Extended Cost
Workshop (general cost)				
Printed materials (fliers)	\$0.72-\$1.01	Per flier	200	\$173
Printed materials (tri-fold brochure)	\$1.60-\$2.40	Per brochure	200	\$480
Printed materials (maps / posters)	\$6.00-\$40.00	Per map	5	\$115
Newspaper ad in local paper	\$312-\$540	Per advertisement	1	\$426
Workshop space	\$200	Per workshop	1	\$200
Workshop staff	No cost	Per workshop	-	-
Workshop supplies and food	\$100-\$200	Per workshop	1	\$150
Per workshop				\$1,544
Residential Lawn Care Education				
Lawn Care Advice	\$2.10-\$3.84	Per household	100	\$297
Soil Testing	\$9.60-\$14.40	Per household	100	\$1,200
Workshop	\$1,543.80	Per workshop	1	\$1,544
Practice Total				\$3,041
Pet Waste Education				
Bag stations	\$400	Per station	2	\$800
Waste pick-up signage	\$100	Per sign	2	\$200
Workshop	\$1,543.80	Per workshop	1	\$1,544
Practice Total				\$2,544
Rain barrel / Downspout Disconnect				
Rain barrel distribution	\$50-\$60	Per barrel	50	\$2,750
Workshop	\$1,543.80	Per workshop	1	\$1,544
Practice Total				\$4,294
Septic System Education				
Septic System Inspections	\$180-\$312	Per household	50	\$12,300
Workshop	\$1,543.80	Per workshop	1	\$1,544
Practice Total				\$13,844

5.3.2 Funding Sources

Funding needed to implement components of the plan will vary depending on the type of strategy. Funding will come from current program resources, local and state government funding, and a variety of grants, cost share programs and private programs that focus on water quality, and environmental restoration. Examples of grant funding sources are the types of projects they may serve listed below in Table 22.

Table 22 – Funding Source Summary

Program	Funder/Partner	Program Goals or Outcomes
<i>Outreach and Education</i>		
Carolina Clear	Clemson Extension	Provide stormwater education, outreach, and public involvement opportunities.
Berkeley Soil & Water Conservation District	NRCS	Develop and implement programs to protect and conserve soil, woodland, riparian and wetland resources
ACE Basin NERR Coastal Training Program	NOAA/SCDNR	Provide science-based training to coastal decision makers to address resource management issues concerning local communities.
Office for Coastal Management	NOAA	OCM offers both instructor-led technical training in a classroom or online setting, as well as additional resources (self-guided courses, case studies, and other publications)
South Carolina Sea Grant Consortium		Generates and provides science-based information to enhance the practical use and conservation of coastal and marine resources that foster a sustainable economy and environment
Charleston Resilience Network		Network of organizations throughout Berkeley, Charleston and Dorchester Counties which a commitment to increasing resilience of critical infrastructure to episodic natural disasters and chronic coastal hazards

Table 22 – Funding Source Summary, cont.

Program	Funder/Partner	Program Goals or Outcomes
<i>Restoration, Conservation, and Stormwater</i>		
Non-point Source Implementation Program (Section 319)	SCDES/EPA	Assistance in implementing the Non-point Source Management Program for urban and agricultural runoff, natural channel design and streambank stabilization projects.
SC Rural Infrastructure Authority (RIA) Grants	SC RIA	Assist municipalities in keeping up with repairs or upgrades to aging or overburdened infrastructure
Five Star & Urban Waters Restoration Program	NFWF	Design and planning services for habitat, water quality, and social media campaigns
National Coastal Resilience Fund	NFWF	Invests in conservations projects that restore or expand natural features such as coastal marshes, wetlands, forests, rivers, and floodplains that minimize the impact of storms while also enhancing habitat for fish and wildlife
Healthy Watersheds Consortium	USEPA, NRCS, US Endowment	Assist municipalities in efforts to protect freshwater ecosystems and watersheds through the stewardship of existing landscape; includes implementation of large-scale watershed protection or green infrastructure.
*Sectoral Applications Research Program (SARP)	NOAA	Promote partnerships between climate science and decision-makers to provide assistance with water resources planning, including addressing urban areas' vulnerability to extreme hydrologic events.
*Urban Waters Small Grants Program	UWSG	Provide healthy and accessible urban waters with the goal of improving livability and economic health of the nearby community. Projects should address local water quality issues related to urban runoff pollution.
*Great Urban Parks Campaign	NRPA	Support green stormwater infrastructure projects in underserved communities that improve environmental quality, increase access to high quality park and recreation space, and create an engaged and empowered community
Land Trust Program	Lord Berkeley Conservation Trust	Open space and natural areas planning and acquisition
Community Recreation and Conservation Program	Berkeley County Parks and Recreation	Recreation, park, trail and conservation projects
Community Grants	SC Native Plant Society	Provides up to \$1,000 for projects that utilize native plants for restoration or education
<i>*indicates funding source that has been offered in the recent past, but is not currently funded. Keep in mind for future funding cycles.</i>		

5.3.3 Financing Mechanisms and Timelines

McCormick Taylor and KCI have identified 30 restoration projects that will advance the goals of the Goose Creek watershed. The Project Team has identified several potential funding programs and financing mechanisms that could support the implementation of these activities. The following ranked list suggests which of these might be appropriate pursuits based on a number of factors including the timing of the opportunity, the project(s) it could support, and the organizational capacity needed to pursue it.

1) Non-point Source Implementation Program (Section 319)

<https://SCDES.gov/environment/your-water-coast/watersheds-program/section-319-nonpoint-source-implementation-grants>

Source/Agency

Funding is allocated by the USEPA to SCDES for distribution to applicants. Availability of funds is dependent upon federal budgets.

Type of Funding Provided

Distributed funds are in the form of grants, with a match requirement of 40% non-federal monies to be provided by the applicant. They are issued as quarterly reimbursements.

Description of Eligibility

South Carolina public organizations such as state agencies, local governments, public universities, soil and water conservation districts, regional planning commissions, watershed organizations and nonprofit organizations are eligible to receive NPS grants. Most project proposals cover a geographic scope of one to four 12-digit Hydrologic Unit Codes (HUCs).

Minimum requirements for application consideration include:

1. Projects must implement an existing approved watershed-based plan that addresses EPA's nine elements for watershed planning for a waterbody that is included on the most recent 303(d) list or has an approved TMDL. Projects may implement a portion of a plan, or a complete plan.
2. On-the-ground BMP implementation must make up a minimum of 75% of the federal funds requested.
3. Projects must include a 40% non-federal cash or in-kind match.

Some activities recommended in a watershed-based plan may be considered eligible for funding or as match under a 319(h) grant if they represent efforts, approaches, or applications that go "above and beyond" any elements associated with a NPDES permit. For example, if the permit itemizes the installation of nine septic system replacements, funds to replace septic systems 10 and up would be above and beyond the permit requirement.

Application Process

Any organization applying for funding for activities within an area covered by an MS4 permit must request approval to apply.

To be considered, interested groups must submit an initial proposal form and can be requested via email to NPSGrants@dhec.sc.gov. The 2020 RFP will likely be released in February 2020. An example of the 2019 RFP can be found here:

<https://SCDES.gov/sites/default/files/media/document/319%20Implementation%20RFP%20Feb%202019.pdf>

The initial proposal materials will be used to screen for eligibility. Applicants who pass the initial screening will be invited to submit a full application. After SCDES receives your final proposal, you will be contacted to arrange an appointment to provide a short overview of your proposal and answer questions at 2600 Bull Street, Columbia, SC 29201.

2) SC Rural Infrastructure (RIA) Grants

<https://ria.sc.gov/grants/>

Source/Agency

The SC Rural Infrastructure Authority was established by the General Assembly under Title 11, Chapter 50 of the SC Code of Laws. The purpose of the RIA is to assist municipalities in keeping up with repairs and or upgrades to aging or overburdened infrastructure—aka, “basic infrastructure” such as stormwater and wastewater management facilities—through provision of grant funding.

Type of Funding Provided

Maximum amount of grant money awarded for a single project is \$500,000.00. These grant funds may be used to build, upgrade, improve or extend publicly owned water, sewer and storm drainage infrastructure throughout the state. Grant funds can only be used on construction activities, with a match requirement of 25% of the total project construction cost required by grantees in Tier I and II counties. In all cases, grantees must cover non-construction costs related to the project. The applicant is responsible for design, engineering, permitting, acquisition, legal and other non-construction costs associated with the project.

The grant period is 24 months from the date of award. Within this grant period, construction must be complete with a permit to operate issued; all project funds spent and documented; the project records reviewed by RIA staff; and the final close-out report approved.

Description of Eligibility

Local governments, special purpose and public service districts as well as public works commissions may apply directly to RIA for grant funding. Local governments may also apply for grant funding on behalf of not-for-profit water and sewer companies that serve the local government. For-profit utilities are not eligible for RIA grant funding.

Application Process

While grant application deadlines are generally in September and March of each year, specific due dates are announced at the beginning of the state’s fiscal year in July. Applications received after the announced deadline will be considered in the next funding round.

Application information can be found here: <https://ria.sc.gov/grants/how-to-apply/>

3) Five Star & Urban Waters Restoration Program

<https://www.nfwf.org/fivestar/Pages/home.aspx>

Source/Agency

The National Fish and Wildlife Foundation (NFWF) and the Wildlife Habitat Council (WHC) in cooperation with the US Environmental Protection Agency (EPA), USDA Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), FedEx, Southern Company, and Alcoa Foundation will award approximately \$1.7 million in grants nationwide. The Five Star and Urban Waters restoration grant program seeks to develop community capacity to sustain local natural resources by providing funding to local partnerships focused on improving water quality, watersheds, and the species and habitats they support. Projects include a variety of ecological improvements along with targeted community outreach, education and stewardship. Ecological improvements may include one or more of the following: wetland, riparian, forest and coastal habitat restoration; wildlife conservation, community tree canopy enhancement, **water quality monitoring and green infrastructure best management practices for managing run-off**. Projects should also increase access to the benefits of nature, reduce the impact of environmental hazards and engage local communities, particularly underserved communities, in project planning, outreach and implementation.

Type of Funding Provided

Awards of \$20,000 to \$50,000 are provided, with about 40-50 grants awarded per year. Grants should span one to two years in length; applications requesting more than \$30,000 should propose projects longer than one year. These grant funds must be matched 1:1 with non-federal funds.

Description of Eligibility

Eligible applicants include non-profit 501(c) organizations, state governmental agencies, local governments, municipal governments, Indian tribes, and educational institutions.

Grant funds may to be used to support ongoing efforts to comply with legal requirements, including permit conditions, mitigation, and settlement agreements. However, grant funds may be used to support projects that enhance or improve upon existing baseline compliance efforts.

Application Process

Applications are submitted through the NFWF Easygrants online system:

<https://easygrants.nfwf.org>

Program Priorities include (1) on-the-ground restoration; (2) environmental outreach, education & training; (3) community partnerships; (4) measureable results; and (5) sustainability.

NFWF requirements include:

1. Projects that reflect the Five Star and Urban Waters Program's overall goals for habitat, water quality, and species conservation. Projects must have specific, quantifiable performance metrics to evaluate project success.
2. Applicants are encouraged to create partnerships of five or more partnerships to implement the project and leverage additional funds. Partnerships will sustain the project after the life of the grant.

3. The project must advance an existing watershed or conservation plan or strategy.
4. Project must establish a clear need for the funds being requested and demonstrate that the activities would not move forward without the funding.
5. The project should identify the demographic characteristics of underserved or environmental justice communities benefitting from the project.
6. Projects must include plans for monitoring progress during and after the proposed project period.
7. Applicants must include a plan for maintenance to ensure that the desired benefits are achieved and that the project will be sustained after the life of the grant.

One application is submitted to NFWF for all sources of funding. The 2020 RFP will likely be released in November 2019. An example of the 2019 RFP can be found here:

<https://www.nfwf.org/fivestar/Pages/2019rfp.aspx>

4) Healthy Watersheds Consortium

Source/Agency

U.S. Endowment for Forestry and Communities, Natural Resources Conservation Service (NRCS) and the U.S. Environmental Protection Agency (USEPA). The goal of the HWC Grant Program is to “accelerate strategic protection of healthy, freshwater ecosystems and their watersheds”, with primary focus on prevention of land deterioration in the watershed by:

1. Developing funding mechanisms, plans, or other strategies to implement large-scale watershed protection, source water protection, green infrastructure, or related landscape conservation objectives;
2. Building the sustainable organizational infrastructure, social support, and long-term funding commitments necessary to implement large-scale protection of healthy watersheds; and
3. Supporting innovative or catalytic projects that may accelerate funding for or implementation of watershed protection efforts, or broadly advance this field of practice.

Type of Funding Provided

Grant funds have a match requirement of at least 25% of the total project cost. The match funds can include monies that have been donated by third-parties as well as allowable costs incurred by the applicant during the project. Up to \$1.29 million total is available to fund projects in three different categories (with award sizes ranging from \$50,000 to \$300,000). In 2019, priority will be given to proposals that maximize measureable outcomes for watershed protection, such as acres protected, progress toward protection goals, or degree of function protected.

Description of Eligibility

As stated in the current 2019 RFP, the following entities are eligible applicants:

- Not-for-profit 501(c)(3) organizations,
- For-profit companies,
- Tribes, intertribal consortia,

- Interstates, state, and local government agencies (including water utilities and wastewater facilities)
- Colleges and universities, and
- Public/private partnerships (desirable)

Applicants should focus on **protection and stewardship of existing landscape within the watershed**, as opposed to restoration of degraded habitat. This grant project will not fund infrastructure, restoration of riparian areas, point sources (effluent), or education/outreach. Projects should demonstrate a desire to achieve the following goals:

- Implement large-scale watershed protection, green infrastructure, or related landscape conservation objectives;
- Create sustainable land-use planning that protects healthy watersheds; and
- Demonstrate human health, recreation, and other benefits of healthy watersheds

Priority will be given to proposals that maximize measureable outcomes for watershed protection (e.g. acres protected, progress toward protection goals, degree of watershed function protected, etc.).

The Healthy Watershed Consortium Grant Program seeks protection at larger scales; the minimum scale considered for funding are projects at the HUC 8 subwatershed planning unit. For Berkeley County, this would be the Cooper River (03050201) watershed, which is significantly larger than the Goose Creek Focus Area. The County would need to demonstrate that any projects implemented at the smaller scale for this project would have measureable impacts at the larger HUC-8 watershed scale.

Application Process

The grant is awarded through a competitive application process. The 2019 Healthy Watersheds Consortium Request for Proposals is now closed. Sign up to receive email notifications to receive RFP updates. For more information, please contact Peter Stangel, Chief Operating Officer at email: peter@usendowment.org, (404) 915-2763.

5.4 Community Engagement

Development of the plan has included positive community engagement efforts to both inform the public about watershed issues and also to engage them to participate. The following sections describe efforts in place throughout the assessment and planning process, and the strategies for future outreach.

5.4.1 Advisory Group

Reducing pollution in a watershed often requires a multidisciplinary approach and often includes social, economic and/or cultural impacts. Therefore, it is important that the membership of a watershed advisory group reflect a balanced representation of the interests in the watershed, including members of Berkeley County staff and Council. The County could set up an application process and select a specific number of members for the advisory group.

Meetings will be held on a regular basis (e.g. monthly) and participation should be open to all interested parties and community members. Additionally, the Advisory Group would serve as the administrative entity for public outreach and education, overseeing and coordinating the efforts of partner organizations listed below with appropriate outreach strategies.

5.4.2 Partner Organizations

There are many other organizations with overlapping interests related to environmental protection, water quality, and education that would be good partners for executing the watershed plan for Goose Creek. These include, but are not limited to;

Government

- Charleston County
- City of Goose Creek
- Charleston Water System
- SCDES
- SCDNR

Environmental

- Charleston Waterkeeper
- Keep Berkeley Beautiful
- Berkeley Ducks Unlimited
- Robert Lunz Group Sierra Club
- SC Native Plant Society
- Lord Berkeley Conservation Trust

Educational

- Carolina Clear/Ashley Cooper Stormwater Education Consortium
- Berkeley Soil & Water Conservation District

Volunteer

- Tri-County Master Gardeners Association
- Coastal Master Naturalist Association
- Boy Scout and Girl Scout Troops

5.4.3 Outreach Strategies

The following strategies will be used to gain additional community support and involvement.

Website – Berkeley County can add a Goose Creek Watershed project page to its website. This would serve as a main hub of information to provide contact information, project description and details (cost, contractor, engineer, completion date, etc.), and updates to the project status (e.g. BMP construction). The website can refer users to other outreach strategies listed below.

Social Media – The County may elect to establish a Facebook, Twitter and/or Instagram account specifically for this Goose Creek Watershed project. This would be another means of providing quick updates to all interested parties without having to produce a formal update to the County's website.

Factsheets – The County could choose to develop its own version of stormwater related factsheets, or it could take advantage of the publications already available from Clemson University's Home & Garden Information Center's database of factsheets, including these specifically geared towards water: <https://hgic.clemson.edu/category/water/>

- Aquatic and Shoreline Plant Selection (HGIC 1709)
- Rainwater Harvesting Systems Guidance for Schoolyard Applications (HGIC 1729)
- Illicit Discharges and Water Pollution (HGIC 1850)
- Shorescaping Freshwater Shorelines (HGIC 1855)
- Life Along the Salt Marsh: Protecting Tidal Creeks with Vegetative Buffers (HGIC 1856)
- Bioretention Cells: A Guide for Your Residents (HGIC 1862)
- Introduction of Bioswales (HGIC 1863)

Media Coverage – Publicizing and reporting on activities related to the implementation of the Goose Creek Watershed Plan can be accomplished through broadcast and print news media outlets, such as the Berkeley Independent, the Berkeley Observer, and the Berkeley County focused coverage from WCBD.

Mailings – Direct mailings allow the County to fill potential information gaps (people who do not read the paper, participate in social media, or follow County government news). Fliers, postcards, and posters can all be used to inform residents in the Goose Creek watershed about the benefits of the proposed stormwater detention practices. The County could generate a list of the addresses of the residents in the watershed, which could be used to send invitations to meetings and workshops or provide other information about nonpoint source pollution outreach events (for example storm drain markings, construction of stormwater detention basins, etc.).

Community Meetings – Providing stakeholders, such as residents and business owners, in the Goose Creek watershed the opportunity to provide feedback and receive updates on aspects of this plan will greatly enhance the public's support of this work. Topics of meetings may include

- Overview of watershed, implementation strategy, and benefits
- Possible funding sources
- General stormwater education seminars (what is stormwater and why is it a problem)

Individual Outreach – Working with property owners in the Goose Creek watershed is a crucial link between the planning and implementation phases. Through the other education outreach/involvement opportunities listed in this section, it may be possible for the County to identify individuals who would be willing to participate in activities such as stream restoration, riparian buffer plantings, and other stormwater BMPs.

Workshops – Workshops related to specific measures that residents can implement on their property will both build support and provide the tools for individual action. Potential workshop topics are varied and may include lawn care, pet waste, septic system maintenance, native and invasive vegetation, and rain gardens. Many opportunities for workshops may already be available through the Ashley Cooper Stormwater Education Consortium (Carolina Clear) contract with Berkeley County.

Professional Training Opportunities – Training geared towards specific audiences (HOAs, landscapers, maintenance crews, etc.) will allow the County to prepare the “boots on the ground” in the Goose Creek Watershed to manage newly installed BMPs effectively. One example of a course offered through Clemson Extension is the *Master Pond Manager* certification: <https://www.clemson.edu/extension/water/hybrid-training/mpm/index.html>

5.5 Implementation Schedule

A schedule for implementation will provide a general roadmap for activities in the near-term (1-2 years), mid-term (3-5 years), and long term (5-10 years). Chief factors influencing the schedule include funding, willing participation from landowners, and priorities.

5.5.1 Priorities

Priorities for implementation are listed below from top to bottom. These watershed management priorities are generally consistent with the practices listed in Tables 15 and 20, and address many of the watershed issues identified in Section 3.2 Pollutant Loads. Based on this conclusion, the following actions, activities and programs will be the highest priority for implementation:

- Maintaining Riparian Buffers around Goose Creek and The Goose Creek Reservoir
- Outreach programs¹ (workshops for lawn care, pet waste, septic systems etc.)
- Pond and Stream Restoration Sites on Public Property
- Pond Restoration Sites that are HOA Owned
- Pond and Stream Restoration sites that are privately owned
- Runoff Reduction

In terms of geographic priority, the philosophy held by many resource managers, is to seek opportunities in the headwaters first and then move progressively further downstream. In this manner the benefits achieved in the most upstream portions of the watershed are realized through the entire length of the stream system moving downstream. Headwaters, because of their close connection to upland stressor

¹ Although not ranked highly, outreach programs provide an opportunity for Council members and volunteers to inform residents and business owners of activities that can measurably reduce pollution while increasing awareness of water resources.

sources are often the most impacted by development and by corollary may receive the most benefit from restorative actions. In general restoration in headwater and tributary areas can be less expensive than projects further downstream simply because the stream channel is smaller.

For the Focus Area studied here, this philosophy could be further refined into two sets of priorities. One to reduce nutrient loading, which should be focused on the tributaries that drain to the Goose Creek Reservoir, and one to reduce bacteria loads, which should be focused on the tributaries below the dam.

5.5.2 Schedule and Milestones

A preliminary schedule for implementation of the activities discussed above is provided in Table 23.

Table 24 – Timeline of Implementation

Near Term (1-2 years)	Maintaining Riparian Buffers around Goose Creek and The Goose Creek Reservoir
	Outreach programs (workshops for lawn care, pet waste, septic systems etc.)
	Mapping of the closed stormwater drainage system
	Professional Training
Mid Term (3-5 years)	Pond and Stream Restoration Sites on Public Property
	Pond Restoration Sites that are HOA Owned
Long Term (5-10 years)	Pond and Stream Restoration sites that are privately owned
	Runoff Reduction

Milestones will include numbers of workshop held and citizens reached, numbers of ponds and stream length restored, and additional impervious areas receiving treatment.

5.6 Monitoring Program

Monitoring data for any water-body is a crucial element that can assist in determining current conditions, developing targeted management strategies, and tracking progress over time. Data available for MD039 is limited to SCDES sampling conducted from 1999 and 2009. It is recommended that additional monitoring be conducted to better pin-point sources of pollutants, to establish solid baseline of conditions and to track progress made towards attaining water quality standards and track changes in stream and watershed condition as implementation of restoration projects occurs, also known as adaptive management. Some specific recommendations are provided here:

Stream Monitoring – The stream sampling conducted by Berkeley County in 2018 can be repeated regularly to track trends in baseflow water quality and biological condition. Sampling should include collection and analysis of water quality grab samples.

Microbial Source Tracking – Sources of the *Enterococcus* bacteria counts throughout the watershed are cause for concern. Continuing to Implement a Microbial Source Tracking effort can identify the source of the bacteria (e.g. human, pets, and wildlife) which will then help managers control the problem. Source Tracking where Turkey Creek enters the Berkeley County MS4 Area will also help to determine if human sources are coming from the Berkeley County MS4 or are flowing through it from upstream.

Hot-Spot and IDDE Monitoring – As recommended in earlier sections as a management strategy, conducting hot-spot and stormwater outfall surveys will identify issues and provide follow-up data to determine issue resolution. Outfalls should be assessed for the color, clarity, and odor of any potential flow, and tested parameters could include bacteria, pH, detergents/surfactants, conductivity, hardness, fluorine, potassium, ammonia, and fluorescence. More data related to the discharge type and quality at these pipes will help managers target restoration activities.

6 Recommendations

Near term recommendations from Table 23 will help reduce nutrient loading into Goose Creek and the Goose Creek Reservoir are as follows;

- Ensure that the stormwater ponds in the Focus Area that are functioning continue to be maintained
- Keep the vegetated buffer around the reservoir intact
- Conduct the recommended outreach workshops specifically, strategies that homeowners should employ to keep nutrients out of the stormwater system
- Increase catch basin cleaning frequency in areas draining to the Goose Creek Reservoir

Near term recommendations from Table 23 that will help reduce bacteria loading into Goose Creek and the Goose Creek Reservoir are as follows;

- Sewer system assessment in the Focus Area to determine if there are any leaking pipes and manholes, particularly along stream and water crossings
- Determining the locations of any remaining septic systems and ensuring that they are maintained, or that the property owners connect to the sanitary sewer

Mapping the stormwater system in the older commercial areas of Hanahan, particularly the area around Yeamans Hall Road is recommended in order to gather data about the stormwater network and to determine the sources of any possible illicit discharges coming from within the Berkeley County MS4 area. There is no good information on this pipe network, how it discharges or what stormwater BMPs may exist in this area. Mapping this area will also help during future monitoring events to determine if nutrient and bacteria sources are coming from this area, or from further up the Turkey Creek watershed.

In the longer term, it is recommended that further evaluation of the retrofit, pond and stream restoration sites be undertaken in future phases of this management plan. This evaluation should include detailed estimates for permitting and preliminary construction drawings. Communication with the owners of the private pond and stream sites identified for restoration should also be started. Cooperation from these land owners will vary. Restoration of these BMPs will help to reduce both nutrient and bacterial loadings into Goose Creek and the Goose Creek Reservoir.

Berkeley County should also expand its maintenance program to include street sweeping and increased catch basin cleaning frequencies throughout the Focus Area. This will require significant capital investment, as well as operator salaries, but it will produce quantifiable numbers for pollutant removal that can be used in future reporting.

7 References

(CWP) Center for Watershed Protection. 2003. Impacts of impervious cover on aquatic ecosystems. Center for Watershed Protection, Ellicott City, Maryland. 142p.

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Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B., 2002, Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000)

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(USFWS) U. S. Fish and Wildlife Service. 2010. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. <http://www.fws.gov/wetlands/>; accessed 11 January 2013.

(SDHEC) South Carolina Department of Health and Environmental Control BMP Handbook. Available from: <http://www.SCDES.gov/Environment/WaterQuality/Stormwater/BMPHandbook/>

APPENDIX A – SAMPLING DATA

Rain Gauge3/15/2019 through 3/18/2019

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	3/16/2019	869	882	0.26
Total		869	882	0.26

Rain Gauge1/20/2019 through 1/23/2019

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	1/20/2019	635	692	1.14
Berkeley County_RainGauge_1009 E Recess Rd A	1/23/2019	693	696	0.06
Total		1328	1388	1.2

Rain Gauge10/5/2018 through 10/8/2018

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	10/5/2018	19334	19334	0.00
Berkeley County_RainGauge_1009 E Recess Rd A	10/7/2018	19335	19335	0.00
Total		38669	38669	0

Rain Gauge8/24/2018 through 8/27/2018

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	8/24/2018	19251	19252	0.02
Berkeley County_RainGauge_1009 E Recess Rd A	8/26/2018	19253	19253	0.00
Berkeley County_RainGauge_1009 E Recess Rd A	8/27/2018	19254	19254	0.00
Total		57758	57759	0.02

Rain Gauge7/21/2018 through 7/24/2018

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	7/21/2018	19202	19203	0.02
Berkeley County_RainGauge_1009 E Recess Rd A	7/22/2018	19204	19204	0.00

Berkeley County_RainGauge_1009 E Recess Rd A	7/23/2018	19205	19206	0.02
Berkeley County_RainGauge_1009 E Recess Rd A	7/24/2018	19207	19208	0.02
Total		76818	76821	0.06

Rain Gauge6/19/2018 through
6/22/2018

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A				0

Rain Gauge5/12/2018 through
5/15/2018

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	5/15/2018	17938	17939	0.02
Total		17938	17939	0.02

Rain Gauge4/17/2018 through
4/20/2018

Tag	Date	Min	Max	Rain in Inches
Berkeley County_RainGauge_1009 E Recess Rd A	4/17/2018	17679	17679	0.00
Total		17679	17679	0

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 04/23/18

Sampled: 04/20/18 13:55

Collected By: TS

Sample Matrix: WW

1 of 3

Received: 04/20/18 15:20

Received By: GHS

Sample Id: 0181424

Sample Number(s): 219101

Project Name: (None)

Location: Outfall WS3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
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Sample Type: Grab

Client Field pH

CLIENT

8.72

SU

04/20/18 13:55

TS

Enterococcus

SM 9230D-2007

18

MPN/100ml 04/20/18 15:30

MBL

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 04/23/18

Sampled: 04/20/18 14:20

Collected By: TS

Sample Matrix: WW

2 of 3

Received: 04/20/18 15:20

Received By: GHS

Sample Id: 0181424

Sample Number(s): 219102

Project Name: (None)

Location: Stream WS2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
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Sample Type: Grab

Client Field pH

CLIENT

7.57

SU

04/20/18 14:20

TS

Enterococcus

SM 9230D-2007

173

MPN/100ml

04/20/18 15:30

MBL

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 04/23/18

Sampled: 04/20/18 15:00

Collected By: TS

Sample Matrix: WW

3 of 3

Received: 04/20/18 15:20

Received By: GHS

Sample Id: 0181424

Sample Number(s): 219103

Project Name: (None)

Location: Tidal WS1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
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Sample Type: Grab					
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Client Field pH	CLIENT	6.79	SU	04/20/18 15:00	TS
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Enterococcus	SM 9230D-2007	35	MPN/100ml	04/20/18 15:30	MBL
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LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING
FIELD DATA SHEET/CHAIN OF CUSTODY

0181424

[illegible]

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING FIELD DATA SHEET/CHAIN OF CUSTODY

0181424

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>7</u> Date of Sample Set: <u>04/20/18</u> Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>120</u> (Must be a Min. 72 hours)	Outfall ID			
	<u>Outfall (WS3)</u>	<u>Stream (WS2)</u>	<u>Tide (WS2)</u>	
Time of Sample	<u>1:55 pm</u>	<u>2:20 pm</u>	<u>3:00 pm</u>	
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>25.4 °C</u>	<u>23.7 °C</u>	<u>24.2 °C</u>	<u> / °C</u>
Temperature upon receipt at Lab	<u>2 °C</u>	<u>2 °C</u>	<u>2 °C</u>	<u> °C</u>

Comments/General Field observations:

PH - WS3 8.72
PH - WS2 7.57
PH - WS3 6.79

Field Monitor Name: Theresa Simmons

Field Monitor Signature: 

Date: 04/20/18

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # 0181424

Discrepancies Noted

☐ Incomplete collection Information-Circle the discrepancies

Date	Time	Analysis Required	Matrix	Location
------	------	----------------------	--------	----------

☐ No collector's signature

☐ Incorrect preservatives for _____

☐ Incorrect sample container for _____

☐ No sample provided for _____

☐ Broken containers for _____

☐ Incorrect transport temperature

☐ No Chain of Custody provided with samples

☐ pH checked at Log In out of limit. pH adjusted to _____

☐ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

☒

No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Attn: Thurman Simmons

Report Date: 05/17/18

Sampled: 05/16/18 12:45

Collected By: TS

Sample Matrix: WW

1 of 3

Received: 05/16/18 13:50

Received By: GHS

Sample Id: 0181747

Sample Number(s): 219881

Project Name: (None)

Location: Outfall WS3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	6.94	SU	05/16/18 12:45	TS
Enterococcus	SM 9230D-2007	148	MPN/100ml	05/16/18 14:10	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Attn: Thurman Simmons

Report Date: 05/17/18

Sampled: 05/16/18 13:00

Collected By: TS

Sample Matrix: WW

2 of 3

Received: 05/16/18 13:50

Received By: GHS

Sample Id: 0181747

Sample Number(s): 219882

Project Name: (None)

Location: Stream WS2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.03	SU	05/16/18 13:00	TS
Enterococcus	SM 9230D-2007	816	MPN/100ml	05/16/18 14:10	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

*Soil, Water, Wastewater & Industrial Chemical Analysis*9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Attn: Thurman Simmons

Report Date: 05/17/18

Sampled: 05/16/18 13:20

Collected By: TS

Sample Matrix: WW

3 of 3

Received: 05/16/18 13:50

Received By: GHS

Sample Id: 0181747

Sample Number(s): 219883

Project Name: (None)

Location: Tidal WS1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	6.75	SU	05/16/18 13:20	TS
Enterococcus	SM 9230D-2007	199	MPN/100ml	05/16/18 14:10	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

0181747

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING FIELD DATA SHEET/CHAIN OF CUSTODY

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>2</u> Date of Sample Set: <u>05/16/18</u> Hours after Measured Rainfall Event (Greater than 0.4 inches): _____ (Must be a Min. 72 hours)	Outfall ID		
	WS3	WS2	WS1
Time of Sample	<u>12:45 PM</u>	<u>1:00 PM</u>	<u>1:20 PM</u>
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>28.6</u> °C	<u>27.5</u> °C	<u>28.8</u> °C
Temperature upon receipt at Lab	_____ °C	_____ °C	_____ °C

Comments/General Field observations: WS3 PH - 6.94

WS2 PH - 7.03

WS1 PH - 6.75

Field Monitor Name: Theresa Simon

Field Monitor Signature: [Signature]

Date: 05-16-18

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # 0181747

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies

Date Time Analysis
 Required Matrix Location

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

X

No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 06/25/18

Sampled: 06/22/18 09:05
Collected By: TS
Sample Matrix: WW
1 of 3

Received: 06/22/18 10:35
Received By: GHS

Sample Id: 0182210
Sample Number(s): 221016
Project Name: (None)
Location: Outfall WS3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.45	SU	06/22/18 09:05	TS
Enterococcus	SM 9230D-2007	31	MPN/100ml	06/22/18 11:00	MBL

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO. 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 06/25/18

Sampled: 06/22/18 09:20

Collected By: TS

Sample Matrix: WW

2 of 3

Received: 06/22/18 10:35

Received By: GHS

Sample Id: 0182210

Sample Number(s): 221017

Project Name: (None)

Location: Stream WS2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.90	SU	06/22/18 09:20	TS
Enterococcus	SM 9230D-2007	1203	MPN/100ml	06/22/18 11:00	MBL

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 06/25/18

Sampled: 06/22/18 09:40

Collected By: TS

Sample Matrix: WW

3 of 3

Received: 06/22/18 10:35

Received By: GHS

Sample Id: 0182210

Sample Number(s): 221018

Project Name: (None)

Location: Tidal WS1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.62	SU	06/22/18 09:40	TS
Enterococcus	SM 9230D-2007	1413	MPN/100ml	06/22/18 11:00	MBL

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING FIELD DATA SHEET/CHAIN OF CUSTODY

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>3</u> Date of Sample Set: <u>06-22-18</u> Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>192 hrs</u> (Must be a Min. 72 hours)	Outfall ID			
	WS3	WS2	WS1	
Time of Sample	9:05	9:20	9:40	
One-liter sampling bottle	Ø/N	Ø/N	Ø/N	Y/N
Bottles labeled with date and time	Ø/N	Ø/N	Ø/N	Y/N
Bottles labeled with sample location	Ø/N	Ø/N	Ø/N	Y/N
Samples put on ice after collection	Ø/N	Ø/N	Ø/N	Y/N
Sample temperature / Blank temperature at collection	28.9 / °C	28.0 / °C	29.2 / °C	/ °C
Temperature upon receipt at Lab	/ °C	/ °C	/ °C	/ °C

Comments/General Field observations: WS3 - pH 7.45

WS2 - pH 7.90

WS1 - pH 7.62

Field Monitor Name: Thermon Simmers

Field Monitor Signature: [Signature]

Date: 06-22-18

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING
FIELD DATA SHEET/CHAIN OF CUSTODY

[illegible]

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # 0182210

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies

Date	Time	Analysis Required	Matrix	Location
------	------	----------------------	--------	----------

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

X

No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Attn: Thurman Simmons

Report Date: 07/26/18

Sampled: 07/24/18 07:20

Collected By: TS

Sample Matrix: WW

1 of 3

Received: 07/24/18 12:57

Received By: GHS

Sample Id: 0182601

Sample Number(s): 221947

Project Name: (None)

Location: Outfall WS3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.32	SU	07/24/18 07:20	TS
Enterococcus	SM 9230D-2007	1300	MPN/100ml	07/24/18 14:50	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Attn: Thurman Simmons

Report Date: 07/26/18

Sampled: 07/24/18 09:10

Collected By: TS

Sample Matrix: WW

2 of 3

Received: 07/24/18 12:57

Received By: GHS

Sample Id: 0182601

Sample Number(s): 221948

Project Name: (None)

Location: Stream WS2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.46	SU	07/24/18 09:10	TS
Enterococcus	SM 9230D-2007	1553	MPN/100ml	07/24/18 14:50	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Attn: Thurman Simmons

Report Date: 07/26/18

Sampled: 07/24/18 08:55

Collected By: TS

Sample Matrix: WW

3 of 3

Received: 07/24/18 12:57

Received By: GHS

Sample Id: 0182601

Sample Number(s): 221949

Project Name: (None)

Location: Tidal WS1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Client Field pH	CLIENT	7.75	SU	07/24/18 08:55	TS
Enterococcus	SM 9230D-2007	>2420	MPN/100ml	07/24/18 14:50	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

0182601

FINAL

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING FIELD DATA SHEET/CHAIN OF CUSTODY

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>4</u>	Outfall ID			
	WS3	WS2	WS1	
Date of Sample Set: <u>7-27-16</u> Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>88 hrs</u> (Must be a Min. 72 hours)				
Time of Sample	<u>7:20 am</u>	<u>9:10 am</u>	<u>8:55 am</u>	
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>24.8</u> °C	<u>25.1</u> °C	<u>25.7</u> °C	<u> </u> °C
Temperature upon receipt at Lab	<u> </u> °C	<u> </u> °C	<u> </u> °C	<u> </u> °C

Comments/General Field observations: pH WS1 - 7.75

WS2 7.46

WS3 7.32

Field Monitor Name: Theresa Simmons

Field Monitor Signature: [Signature]

Date: 07-27-16

[Signature]

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # 0182601

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies

Date	Time	Analysis Required	Matrix	Location
------	------	----------------------	--------	----------

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

X

No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 08/30/18

Sampled: 08/29/18 13:30
Collected By: TS
Sample Matrix: SFW
1 of 3

Received: 08/29/18 14:40
Received By: MBL

Sample Id: 0183068
Sample Number(s): 223043
Project Name: (None)
Location: WS 3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
----------	--------	--------	-------	-----------	---------

Sample Type: Grab					
-------------------	--	--	--	--	--

Enterococcus	SM 9230D-2007	39	MPN/100ml	08/29/18 14:50	WJ
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LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tfs@tridentlabs.com

REPORT OF ANALYSIS

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 08/30/18

Sampled: 08/29/18 13:50

Collected By: TS

Sample Matrix: SFW

2 of 3

Received: 08/29/18 14:40

Received By: MBL

Sample Id: 0183068

Sample Number(s): 223044

Project Name: (None)

Location: WS 2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Enterococcus	SM 9230D-2007	1203	MPN/100ml	08/29/18 14:50	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 08/30/18

Sampled: 08/29/18 14:05

Collected By: TS

Sample Matrix: SFW

3 of 3

Received: 08/29/18 14:40

Received By: MBL

Sample Id: 0183068

Sample Number(s): 223045

Project Name: (None)

Location: WS 1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Enterococcus	SM 9230D-2007	107	MPN/100ml	08/29/18 14:50	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING FIELD DATA SHEET/CHAIN OF CUSTODY

0183068

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>5</u>	Outfall ID			
Date of Sample Set: <u>8-24-18</u>	<u>WS3</u>	<u>WS2</u>	<u>WS1</u>	
Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>201</u> (Must be a Min. 72 hours)	<u>WS1: 3pm 1:56pm 2:05pm</u>			
Time of Sample	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>28.3</u> °C	<u>26.7</u> °C	<u>28.9</u> °C	<u>1</u> °C
Temperature upon receipt at Lab	<u>1</u> °C	<u>1</u> °C	<u>1</u> °C	<u>1</u> °C

Comments/General Field observations:

WS3 - pH 8.17
WS2 - pH 7.85
WS1 - pH 7.80

Tide type: ebb to mid

Field Monitor Name: Therese SimonsField Monitor Signature: [Signature]Date: 8-27-18

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING
FIELD DATA SHEET/CHAIN OF CUSTODY[illegible]

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # 0183068

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies
Date Time Analysis Matrix Location
Required

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

X

No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane, Ladson, South Carolina 29456

Telephone (843) 871-4999, Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 10/10/18

Sampled: 10/08/18 12:15

Collected By: TS

Sample Matrix: SFW

1 of 3

Received: 10/08/18 13:32

Received By: MBL

Sample Id: 0183506

Sample Number(s): 224086

Project Name: (None)

Location: WS 1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
----------	--------	--------	-------	-----------	---------

Sample Type: Grab

Enterococcus

SM 9230D-2007

>2420

MPN/ml

10/08/18 13:50

WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 10/10/18

Sampled: 10/08/18 11:55
Collected By: TS
Sample Matrix: SFW
2 of 3

Received: 10/08/18 13:32
Received By: MBL

Sample Id: 0183506
Sample Number(s): 224087
Project Name: (None)
Location: WS 2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
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Sample Type: Grab					
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Enterococcus	SM 9230D-2007	1203	MPN/ml	10/08/18 13:50	WJ
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LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

*Soil, Water, Wastewater & Industrial Chemical Analysis*9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 10/10/18

Sampled: 10/08/18 11:45

Collected By: TS

Sample Matrix: SFW

3 of 3

Received: 10/08/18 13:32

Received By: MBL

Sample Id: 0183506

Sample Number(s): 224088

Project Name: (None)

Location: WS 3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
----------	--------	--------	-------	-----------	---------

Sample Type: Grab					
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Enterococcus	SM 9230D-2007	461	MPN/ml	10/08/18 13:50	WJ
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LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

0183506

**BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING
FIELD DATA SHEET/CHAIN OF CUSTODY**

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>6</u> Date of Sample Set: <u>10-8-18</u> Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>0.1</u> (Must be a Min. 72 hours)	Outfall ID			
	<u>WS1</u>	<u>WS2</u>	<u>WS3</u>	
Time of Sample	<u>12:15</u>	<u>11:55</u>	<u>11:45</u>	
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>27.7</u> °C	<u>26.9</u> °C	<u>27.1</u> °C	<u> </u> °C
Temperature upon receipt at Lab	<u> </u> °C	<u> </u> °C	<u> </u> °C	<u> </u> °C

Comments/General Field observations: WS3 - 7.23
WS2 - 7.19
WS1 - 7.15

Tide Type - Flood - ebb

Field Monitor Name: Theresa Simmons Field Monitor Signature: [Signature] Date: 10-08-18

QJCC 10-9-18

[illegible]

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # **0183506**

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies

Date Time Analysis Matrix Location
 Required

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

☒ No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tis@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 01/25/19

Sampled: 01/23/19 13:50
Collected By: CLIENT
Sample Matrix: SFW
1 of 3

Received: 01/23/19 15:05
Received By: MBL

Sample Id: 0190292
Sample Number(s): 227296
Project Name: (None)
Location: WS 1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Enterococcus	SM 9230D-2007	260	MPN/ml	01/23/19 15:25	WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 01/25/19

Sampled: 01/23/19 13:30

Collected By: CLIENT

Sample Matrix: SFW

2 of 3

Received: 01/23/19 15:05

Received By: MBL

Sample Id: 0190292

Sample Number(s): 227297

Project Name: (None)

Location: WS 2

ANALYSIS**METHOD****RESULT UNITS****DATE/TIME ANALYST**

Sample Type: Grab

Enterococcus

SM 9230D-2007

144

MPN/ml

01/23/19 15:25

WJ

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 01/25/19

Sampled: 01/23/19 13:15
Collected By: CLIENT
Sample Matrix: SFW
3 of 3

Received: 01/23/19 15:05
Received By: MBL

Sample Id: 0190292
Sample Number(s): 227298
Project Name: (None)
Location: WS 3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
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Sample Type: Grab					
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Enterococcus	SM 9230D-2007	150	MPN/ml	01/23/19 15:25	WJ
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LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING
FIELD DATA SHEET/CHAIN OF CUSTODY

0190292

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>7</u>	Outfall ID			
Date of Sample Set: <u>1-23-19</u>				
Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>0.6</u> (Must be a Min. 72 hours)				
Time of Sample	<u>WS1</u>	<u>WS2</u>	<u>WS3</u>	
	<u>1:50pm</u>	<u>1:30pm</u>	<u>1:15pm</u>	
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>15.4 /</u> °C	<u>13.7 /</u> °C	<u>16.6 /</u> °C	<u>/</u> °C
Temperature upon receipt at Lab	<u>/</u> °C	<u>/</u> °C	<u>/</u> °C	<u>/</u> °C

Comments/General Field observations: WS3 4.01

WS2 8.08

WS1 8.21

Field Monitor Name: Theresa S. Jones Field Monitor Signature: [Signature] Date: 1-23-19

Trident Labs, Inc. Chain of Custody Discrepancy Report

0190292

Chain of Custody # _____

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies

Date	Time	Analysis Required	Matrix	Location
------	------	----------------------	--------	----------

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

X

No discrepancies noted

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

*Soil, Water, Wastewater & Industrial Chemical Analysis*9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept

212 Oakley Plantation Drive

Moncks Corner, SC 29461

Report Date: 03/19/19

Sampled: 03/18/19 11:20

Collected By: TS

Sample Matrix: SFW

1 of 3

Received: 03/18/19 13:40

Received By: MBL

Sample Id: 0190944

Sample Number(s): 228825

Project Name:

Location: WS 3

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Enterococcus	SM 9230D-2007	152	MPN/ml	03/18/19 14:10	DRM

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO. 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane Δ Ladson, South Carolina 29456Telephone (843) 871-4999 Δ Fax (843) 875-2266e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 03/19/19

Sampled: 03/18/19 12:15
Collected By: TS
Sample Matrix: SFW
2 of 3

Received: 03/18/19 13:40
Received By: MBL

Sample Id: 0190944
Sample Number(s): 228826
Project Name:
Location: WS 2

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Enterococcus	SM 9230D-2007	397	MPN/ml	03/18/19 14:10	DRM

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**TRIDENT LABS SERVICES, INC.**

ANALYTICAL LABORATORY

Soil, Water, Wastewater & Industrial Chemical Analysis

9104 Canvas Lane △ Ladson, South Carolina 29456

Telephone (843) 871-4999 △ Fax (843) 875-2266

e-mail: tls@tridentlabs.com**REPORT OF ANALYSIS**

Berkeley County Engineering Dept
212 Oakley Plantation Drive
Moncks Corner, SC 29461

Report Date: 03/19/19

Sampled: 03/18/19 12:30

Collected By: TS

Sample Matrix: SFW

3 of 3

Received: 03/18/19 13:40

Received By: MBL

Sample Id: 0190944

Sample Number(s): 228827

Project Name:

Location: WS 1

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Enterococcus	SM 9230D-2007	613	MPN/ml	03/18/19 14:10	DRM

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

**BERKELEY COUNTY DRY WEATHER SCREENING SAMPLING
FIELD DATA SHEET/CHAIN OF CUSTODY**

0190944

Form must be filled out and a copy retained at the County Engineering Department as part of the monitoring record. Fill out the following table completely.

Sampling Event No.: <u>6</u>	Outfall ID			
Date of Sample Set: _____ Hours after Measured Rainfall Event (Greater than 0.1 inches): <u>0.041</u> (Must be a Min. 72 hours)	<u>WS3</u>	<u>WS2</u>	<u>WS1</u>	
Time of Sample	<u>11:20 am</u>	<u>12:15 pm</u>	<u>12:30 pm</u>	
One-liter sampling bottle	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with date and time	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Bottles labeled with sample location	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Samples put on ice after collection	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>	<u>Y/N</u>
Sample temperature / Blank temperature at collection	<u>18.1</u> °C	<u>16.1</u> °C	<u>18.5</u> °C	<u> </u> °C
Temperature upon receipt at Lab	<u> </u> °C	<u> </u> °C	<u> </u> °C	<u> </u> °C

Comments/General Field observations: ph WS3 - 8.5
WS2 7.86
WS1 8.0

Field Type
"Feb"
"Feb"
"Feb"

Field Monitor Name: Thermon Simmons Field Monitor Signature: [Signature] Date: 03.18.19

Trident Labs, Inc. Chain of Custody Discrepancy Report

Chain of Custody # 0190944

Discrepancies Noted

_____ Incomplete collection Information-Circle the discrepancies

Date	Time	Analysis Required	Matrix	Location
------	------	----------------------	--------	----------

_____ No collector's signature

_____ Incorrect preservatives for _____

_____ Incorrect sample container for _____

_____ No sample provided for _____

_____ Broken containers for _____

_____ Incorrect transport temperature

_____ No Chain of Custody provided with samples

_____ pH checked at Log In out of limit. pH adjusted to _____

_____ Other _____

Corrective Action

Client Notified By _____

Date _____

Time _____

Contact _____

Corrective Action Taken

X

No discrepancies noted

Sample#	H1800013	H1800014
Received Date	10/9/2018	

DIAGNOSTIC REPORT

Contact:

Kelsey Gagnon**Berkeley County Stormwater Management
212 Oakley Plantation Dr****Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
thurman.simmons@berkeleycountysc.g

Submitter :

Plant and Pest Diagnostic Clinic

**Plant Problem Clinic
511 Westinghouse Road
Pendleton SC 29670**Phone
864-646-2133Fax
864-646-2178Email
ppclnc@clermson.edu

Diagnosis and Recommendations

Sample #	Field ID	Host/Habitat
H1800013	WS1	River; Stream; creek; waterway (Aquatic habitat)
H1800014	WS2	River; Stream; creek; waterway (Aquatic habitat)

Above sample(s) have been diagnosed/identified with the following diagnosis/ID(s)

Sample #	List of Diagnosis/ID(s)
H1800013	Confirmed for Bacteria identification (Bacteroides sp./spp.)
H1800014	Confirmed for Bacteria identification (Bacteroides sp./spp.)

Water Lab
Clemson University MPPD Lab
511 Westinghouse Rd
Pendleton SC 29670
Telephone : 864-646-2133

Diagnosed By :
Curt Colburn (gcolbur@clermson.edu)
Completed Date: 10/16/2018

Sample#
H1800013 - H1800014

Final Report: (Sample # H1800013)

Pathogens detected:

Bacteroides bacteria (bovine) Detected: 8.0×10^1 CFU per 100 ml

Bacteroides bacteria (canine) Not detected

Bacteroides bacteria (human) Detected: 4.5×10^2 CFU per 100 ml

Bacteroides bacteria (swine) Not detected

Bacteroides bacteria have host-specific distributions and were used for the real-time PCR DNA targets. Members of the Bacteroidales taxonomic order are genetic targets for molecular methods due to their high abundance in feces, as well as their low potential for regrowth in the environment.

These results have been attained by using professionally acquired assays and equipment. Sampling techniques, best practices, sample preservation, weather, and other factors may influence the integrity of the sample, and thus, the results. Individual samples and one-time sampling events are insufficient for management decision-making.

Water Lab
Clemson University MPPD Lab
511 Westinghouse Rd
Pendleton SC 29670
Telephone : 864-646-2133

Diagnosed By :
Curt Colburn (gcolbur@clemson.edu)
Completed Date: 10/16/2018

Sample#

H1800013 - H1800014

Final Report: (Sample # H1800014)

Pathogens detected:

Bacteroides bacteria (bovine) Not detected

Bacteroides bacteria (canine) Not detected

Bacteroides bacteria (human) Detected: 2.5×10^1 CFU per 100 ml

Bacteroides bacteria (swine) Not detected

Bacteroides bacteria have host-specific distributions and were used for the real-time PCR DNA targets. Members of the Bacteroidales taxonomic order are genetic targets for molecular methods due to their high abundance in feces, as well as their low potential for regrowth in the environment.

These results have been attained by using professionally acquired assays and equipment. Sampling techniques, best practices, sample preservation, weather, and other factors may influence the integrity of the sample, and thus, the results. Individual samples and one-time sampling events are insufficient for management decision-making.

Water Lab
Clemson University MPPD Lab
511 Westinghouse Rd
Pendleton SC 29670
Telephone : 864-646-2133

Diagnosed By :
Curt Colburn (gcolbur@clemson.edu)
Completed Date: 10/16/2018

Sample#

H1800013 - H1800014

DIAGNOSTIC REPORT

Contact:

Thurman Simmons
Berkely County Stormwater Mgmt.
212 Oakley Plantation Dr.

Moncks Corner SC 29461

Phone
843-719-2691

Fax

Email
thurman.simmons@berkeleycountysc.gov

Sample#	H1900001
Field ID	WS1
Host	River; Stream; creek; waterway
Received Date	1/24/2019
County	Berkeley
State	SC

Submitter :

Berkeley Co. Stormwater Kelsey Gagnon
Berkeley Co. Stormwater Mgmt.
212 Oakley Plantation Dr.
Moncks Corner SC 29461

Phone
843-719-2691

Fax

Email
kelsey.gagnon@berkeleycountysc.gov

Diagnosis and Recommendations

Host/Habitat	River; Stream; creek; waterway (Aquatic habitat)
List of Diagnosis/ID(s)	
Confirmed for Bacteria identification (Bacteroides sp./spp.)	

Final Report

Pathogens detected:

Bacteroides bacteria (bovine) Not detected

Bacteroides bacteria (canine) Not detected

Bacteroides bacteria (human) Detected: 2×10^3 CFU per 100 ml

Bacteroides bacteria (swine) Not detected

Bacteroides bacteria have host-specific distributions and were used for the real-time PCR DNA targets. Members of the Bacteroidales taxonomic order are genetic targets for molecular methods due to their high abundance in feces, as well as their low potential for regrowth in the environment.

These results have been attained by using professionally acquired assays and equipment. Sampling techniques, best practices, sample preservation, weather, and other factors may influence the integrity of the sample, and thus, the results. Individual samples and one-time sampling events are insufficient for management decision-making.

Water Lab
 Clemson University MPPD Lab
 511 Westinghouse Rd
 Pendleton SC 29670
 Telephone : 864-646-2133

Diagnosed By :
 Curt Colburn (gcolbur@clemson.edu)
 Completed Date: 2/18/2019

Sample#

H1900001

DIAGNOSTIC REPORT

Contact:

Thurman Simmons**Berkely County Stormwater Mgmt.
212 Oakley Plantation Dr.****Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
thurman.simmons@berkeleycountysc.gov

Sample#	H1900002
Field ID	WS2
Host	River; Stream; creek; waterway
Received Date	1/24/2019
County	Berkeley
State	SC

Submitter :

Berkeley Co. Stormwater Kelsey Gagnon

**Berkeley Co. Stormwater Mgmt.
212 Oakley Plantation Dr.
Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
kelsey.gagnon@berkeleycountysc.gov

Diagnosis and Recommendations

Host/Habitat	River; Stream; creek; waterway (Aquatic habitat)
List of Diagnosis/ID(s)	
Not Detected for Bacteria identification (Bacteroides sp./spp.)	

Final Report

Pathogens detected:

Bacteroides bacteria (bovine) Not detected*Bacteroides* bacteria (canine) Not detected*Bacteroides* bacteria (human) Detected: 4.5×10^2 CFU per 100 ml*Bacteroides* bacteria (swine) Not detected

Bacteroides bacteria have host-specific distributions and were used for the real-time PCR DNA targets. Members of the Bacteroidales taxonomic order are genetic targets for molecular methods due to their high abundance in feces, as well as their low potential for regrowth in the environment.

These results have been attained by using professionally acquired assays and equipment. Sampling techniques, best practices, sample preservation, weather, and other factors may influence the integrity of the sample, and thus, the results. Individual samples and one-time sampling events are insufficient for management decision-making.

Water Lab Clemson University MPPD Lab 511 Westinghouse Rd Pendleton SC 29670 Telephone : 864-646-2133	Diagnosed By : Curt Colburn (gcolbur@clemson.edu) Completed Date: 2/18/2019
---	---

This diagnosis or identification is based only on the sample and its accompanying information. Because of this, the findings may not apply to the entire watershed.

Sample#

H1900002

DIAGNOSTIC REPORT

Contact:

Thurman Simmons**Berkely County Stormwater Mgmt.
212 Oakley Plantation Dr.****Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
thurman.simmons@berkeleycountysc.gov

Sample#	H1900007
Field ID	WS1
Host	River; Stream; creek; waterway
Received Date	3/19/2019
County	Berkeley
State	SC

Submitter :

Berkeley Co. Stormwater Kelsey Gagnon

**Berkeley Co. Stormwater Mgmt.
212 Oakley Plantation Dr.
Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
kelsey.gagnon@berkeleycountysc.gov

Diagnosis and Recommendations

Host/Habitat	River; Stream; creek; waterway (Aquatic habitat)
List of Diagnosis/ID(s)	
Confirmed for Bacteria identification (Bacteroides sp./spp.)	

Final Report

Pathogens detected:

Bacteroides bacteria (bovine) Not detected*Bacteroides* bacteria (canine) Not detected*Bacteroides* bacteria (human) Detected: 2.5 x10⁴ CFU per 100 ml*Bacteroides* bacteria (swine) Not detected

Bacteroides bacteria have host-specific distributions and were used for the real-time PCR DNA targets. Members of the Bacteroidales taxonomic order are genetic targets for molecular methods due to their high abundance in feces, as well as their low potential for regrowth in the environment.

These results have been attained by using professionally acquired assays and equipment. Sampling techniques, best practices, sample preservation, weather, and other factors may influence the integrity of the sample, and thus, the results. Individual samples and one-time sampling events are insufficient for management decision-making.

Water Lab
Clemson University MPPD Lab
511 Westinghouse Rd
Pendleton SC 29670
Telephone : 864-646-2133

Diagnosed By :
Curt Colburn (gcolbur@clemson.edu)
Completed Date: 4/3/2019

Sample#

H1900007

This diagnosis or identification is based only on the sample and its accompanying information. Because of this, the findings may not apply to the entire watershed.

DIAGNOSTIC REPORT

Contact:

Thurman Simmons**Berkely County Stormwater Mgmt.
212 Oakley Plantation Dr.****Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
thurman.simmons@berkeleycountysc.gov

Sample#	H1900008
Field ID	WS2
Host	River; Stream; creek; waterway
Received Date	3/19/2019
County	Berkeley
State	SC

Submitter :

Berkeley Co. Stormwater Kelsey Gagnon

**Berkeley Co. Stormwater Mgmt.
212 Oakley Plantation Dr.
Moncks Corner SC 29461**Phone
843-719-2691

Fax

Email
kelsey.gagnon@berkeleycountysc.gov

Diagnosis and Recommendations

Host/Habitat	River; Stream; creek; waterway (Aquatic habitat)
List of Diagnosis/ID(s)	
Confirmed for Bacteria identification (Bacteroides sp./spp.)	

Final Report

Pathogens detected:

Bacteroides bacteria (bovine) Not detected*Bacteroides* bacteria (canine) Not detected*Bacteroides* bacteria (human) Detected: 3 x10³ CFU per 100 ml*Bacteroides* bacteria (swine) Not detected

Bacteroides bacteria have host-specific distributions and were used for the real-time PCR DNA targets. Members of the Bacteroidales taxonomic order are genetic targets for molecular methods due to their high abundance in feces, as well as their low potential for regrowth in the environment.

These results have been attained by using professionally acquired assays and equipment. Sampling techniques, best practices, sample preservation, weather, and other factors may influence the integrity of the sample, and thus, the results. Individual samples and one-time sampling events are insufficient for management decision-making.

Water Lab
Clemson University MPPD Lab
511 Westinghouse Rd
Pendleton SC 29670
Telephone : 864-646-2133

Diagnosed By :
Curt Colburn (gcolbur@clemson.edu)
Completed Date: 4/3/2019

Sample#

H1900008

EPA Storet Data

RL-08605

2/21/2008	9:54:00	EST	Dissolved oxygen (DO)	Total	8.47	mg/L
6/26/2008	11:07:00	EST	Dissolved oxygen (DO)	Total	6.34	mg/L
4/23/2008	10:20:00	EST	Dissolved oxygen (DO)	Total	9.53	mg/L
10/8/2008	10:21:00	EST	Dissolved oxygen (DO)	Total	5.3	mg/L
7/31/2008	9:50:00	EST	Dissolved oxygen (DO)	Total	4.02	mg/L
11/20/2008	10:03:00	EST	Dissolved oxygen (DO)	Total	9.46	mg/L
8/28/2008	9:47:00	EST	Dissolved oxygen (DO)	Total	5.76	mg/L
9/18/2008	10:08:00	EST	Dissolved oxygen (DO)	Total	4.51	mg/L
3/26/2008	10:53:00	EST	Dissolved oxygen (DO)	Total	7.64	mg/L
12/10/2008	10:15:00	EST	Dissolved oxygen (DO)	Total	9.24	mg/L
1/24/2008	10:20:00	EST	Dissolved oxygen (DO)	Total	11.33	mg/L
5/29/2008	9:55:00	EST	Dissolved oxygen (DO)	Total	5.34	mg/L
				Average	7.245	mg/L

12/10/2008	10:15:00	EST	Fecal Coliform	Total	2	#/100mL
11/20/2008	10:03:00	EST	Fecal Coliform	Total	2	#/100mL
10/8/2008	10:21:00	EST	Fecal Coliform	Total	2	#/100mL
9/18/2008	10:08:00	EST	Fecal Coliform	Total	2	#/100mL
8/28/2008	9:47:00	EST	Fecal Coliform	Total	2	#/100mL
6/26/2008	11:07:00	EST	Fecal Coliform	Total	2	#/100mL
5/29/2008	9:55:00	EST	Fecal Coliform	Total	8	#/100mL
4/23/2008	10:20:00	EST	Fecal Coliform	Total	3	#/100mL
2/21/2008	9:54:00	EST	Fecal Coliform	Total	17	#/100mL
1/24/2008	10:20:00	EST	Fecal Coliform	Total	80	#/100mL
				Average	12	#/100mL

6/26/2008	11:07:00	EST	Phosphorus	Total	0.19	mg/L
1/24/2008	10:20:00	EST	Phosphorus	Total	0.071	mg/L
9/18/2008	10:08:00	EST	Phosphorus	Total	0.13	mg/L
3/26/2008	10:53:00	EST	Phosphorus	Total	0.092	mg/L
4/23/2008	10:20:00	EST	Phosphorus	Total	0.12	mg/L
11/20/2008	10:03:00	EST	Phosphorus	Total	0.11	mg/L
7/31/2008	9:50:00	EST	Phosphorus	Total	0.23	mg/L
10/8/2008	10:21:00	EST	Phosphorus	Total	0.11	mg/L
2/21/2008	9:54:00	EST	Phosphorus	Total	0.064	mg/L
8/28/2008	9:47:00	EST	Phosphorus	Total	0.2	mg/L
5/29/2008	9:55:00	EST	Phosphorus	Total	0.19	mg/L
12/10/2008	10:15:00	EST	Phosphorus	Total	0.095	mg/L
				Average	0.1335	mg/L

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1/24/2008	10:05:00	EST	Dissolved oxygen (DO)	Total	13.24	mg/L
2/21/2008	9:43:00	EST	Dissolved oxygen (DO)	Total	8.2	mg/L
3/26/2008	10:40:00	EST	Dissolved oxygen (DO)	Total	6.9	mg/L
4/23/2008	10:15:00	EST	Dissolved oxygen (DO)	Total	9.49	mg/L
5/29/2008	9:44:00	EST	Dissolved oxygen (DO)	Total	5.06	mg/L
6/26/2008	10:46:00	EST	Dissolved oxygen (DO)	Total	8.48	mg/L
7/31/2008	9:36:00	EST	Dissolved oxygen (DO)	Total	5.75	mg/L
8/28/2008	9:39:00	EST	Dissolved oxygen (DO)	Total	5.32	mg/L
9/18/2008	9:56:00	EST	Dissolved oxygen (DO)	Total	5.7	mg/L
10/8/2008	10:11:00	EST	Dissolved oxygen (DO)	Total	6.32	mg/L
11/20/2008	9:49:00	EST	Dissolved oxygen (DO)	Total	9.2	mg/L
12/10/2008	10:04:00	EST	Dissolved oxygen (DO)	Total	9.38	mg/L
				Average	7.753333	mg/L

1/24/2008	10:05:00	EST	Fecal Coliform	Total	25	#/100mL
2/21/2008	9:43:00	EST	Fecal Coliform	Total	10	#/100mL
3/26/2008	10:40:00	EST	Fecal Coliform	Total	2	#/100mL
4/23/2008	10:15:00	EST	Fecal Coliform	Total	5	#/100mL
5/29/2008	9:44:00	EST	Fecal Coliform	Total	2	#/100mL
6/26/2008	10:46:00	EST	Fecal Coliform	Total	4	#/100mL
7/31/2008	9:36:00	EST	Fecal Coliform	Total	3	#/100mL
8/28/2008	9:39:00	EST	Fecal Coliform	Total	20	#/100mL
9/18/2008	9:56:00	EST	Fecal Coliform	Total	8	#/100mL
10/8/2008	10:11:00	EST	Fecal Coliform	Total	2	#/100mL
11/20/2008	9:49:00	EST	Fecal Coliform	Total	9	#/100mL
12/10/2008	10:04:00	EST	Fecal Coliform	Total	5	#/100mL
				Average	7.916667	#/100mL

1/24/2008	10:05:00	EST	Phosphorus	Total	0.068	mg/L
2/21/2008	9:43:00	EST	Phosphorus	Total	0.056	mg/L
3/26/2008	10:40:00	EST	Phosphorus	Total	0.084	mg/L
4/23/2008	10:15:00	EST	Phosphorus	Total	0.06	mg/L
5/29/2008	9:44:00	EST	Phosphorus	Total	0.12	mg/L
6/26/2008	10:46:00	EST	Phosphorus	Total	0.14	mg/L
7/31/2008	9:36:00	EST	Phosphorus	Total	0.15	mg/L
8/28/2008	9:39:00	EST	Phosphorus	Total	0.18	mg/L
9/18/2008	9:56:00	EST	Phosphorus	Total	0.084	mg/L
10/8/2008	10:11:00	EST	Phosphorus	Total	0.081	mg/L
11/20/2008	9:49:00	EST	Phosphorus	Total	0.1	mg/L
12/10/2008	10:04:00	EST	Phosphorus	Total	0.072	mg/L
				Average	0.099583	mg/L

SCDHEC WQMS RL-10104 2010

1/21/2010 9:36	Dissolved oxygen (DC	4.15 mg/l
2/4/2010 10:57	Dissolved oxygen (DC	7.19 mg/l
4/8/2010 13:06	Dissolved oxygen (DC	7.25 mg/l
5/13/2010 10:39	Dissolved oxygen (DC	4.88 mg/l
6/10/2010 9:37	Dissolved oxygen (DC	4.72 mg/l
7/28/2010 10:42	Dissolved oxygen (DC	0.1 mg/l
8/26/2010 12:21	Dissolved oxygen (DC	0.18 mg/l
9/23/2010 10:33	Dissolved oxygen (DC	6.4 mg/l
10/27/2010 11:43	Dissolved oxygen (DC	7.41 mg/l
11/22/2010 10:53	Dissolved oxygen (DC	7.13 mg/l
12/9/2010 12:42	Dissolved oxygen (DC	11.02 mg/l

1/21/2010 9:36	Fecal Coliform~~~~~	70 #/100ml
2/4/2010 10:57	Fecal Coliform~~~~~	30 #/100ml
3/22/2010 10:14	Fecal Coliform~~~~~	13 #/100ml
4/8/2010 13:06	Fecal Coliform~~~~~APHA~9221-E~~	
5/13/2010 10:39	Fecal Coliform~~~~~	4 #/100ml
6/10/2010 9:37	Fecal Coliform~~~~~	2 #/100ml
7/28/2010 10:42	Fecal Coliform~~~~~	910 #/100ml
8/26/2010 12:21	Fecal Coliform~~~~~	170 #/100ml
9/23/2010 10:33	Fecal Coliform~~~~~	12 #/100ml
10/27/2010 11:43	Fecal Coliform~~~~~	1600 #/100ml
11/22/2010 10:53	Fecal Coliform~~~~~	2 #/100ml
12/9/2010 12:42	Fecal Coliform~~~~~APHA~9221-E~~	

1/21/2010 9:36	Biochemical oxygen d	Present Be Final
2/4/2010 10:57	Biochemical oxygen d	Present Be Final
3/22/2010 10:14	Biochemical oxygen d	Present Be Final
4/8/2010 13:06	Biochemical oxygen d	3.5 Final
5/13/2010 10:39	Biochemical oxygen d	2.4 Final
6/10/2010 9:37	Biochemical oxygen d	2.5 Final
7/28/2010 10:42	Biochemical oxygen d	2.9 Final
8/26/2010 12:21	Biochemical oxygen d	Present Be Final
9/23/2010 10:33	Biochemical oxygen d	4.7 Final
10/27/2010 11:43	Biochemical oxygen d	3.2 Final
11/22/2010 10:53	Biochemical oxygen d	2 Final
12/9/2010 12:42	Biochemical oxygen d	2 Final

1/21/2010 9:36	Phosphoru	0.13 mg/l
2/4/2010 10:57	Phosphoru	0.1 mg/l
3/22/2010 10:14	Phosphoru	0.2 mg/l
4/8/2010 13:06	Phosphoru	0.1 mg/l
5/13/2010 10:39	Phosphoru	0.19 mg/l
6/10/2010 9:37	Phosphoru	0.24 mg/l
7/28/2010 10:42	Phosphoru	0.35 mg/l
8/26/2010 12:21	Phosphoru	0.23 mg/l
9/23/2010 10:33	Phosphoru	0.18 mg/l
10/27/2010 11:43	Phosphoru	0.12 mg/l
11/22/2010 10:53	Phosphoru	0.11 mg/l
12/9/2010 12:42	Phosphoru	0.068 mg/l

0.168167

SCDHEC WQMS R13132

1/29/2013 11:46	Biochemical oxygen	2.2	2.2 mg/l
2/7/2013 12:20	Biochemical oxygen	2.3	2.3 mg/l
3/7/2013 11:44	Biochemical oxygen	0	
4/4/2013 11:56	Biochemical oxygen	0	
5/2/2013 12:25	Biochemical oxygen	2	2 mg/l
6/6/2013 11:54	Biochemical oxygen	2.7	2.7 mg/l
7/18/2013 11:38	Biochemical oxygen	3.3	3.3 mg/l
8/1/2013 13:30	Biochemical oxygen	3.5	3.5 mg/l
9/12/2013 12:46	Biochemical oxygen	5.2	5.2 mg/l
10/3/2013 13:56	Biochemical oxygen	6.8	6.8 mg/l
11/14/2013 13:26	Biochemical oxygen	0	
12/16/2013 13:46	Biochemical oxygen	0	

1/29/2013 11:46	Dissolved oxygen (DO)~~~~~	10.93	10.93 mg/l
2/7/2013 12:20	Dissolved oxygen (DO)~~~~~	9.98	9.98 mg/l
3/7/2013 11:44	Dissolved oxygen (DO)~~~~~	9.95	9.95 mg/l
4/4/2013 11:56	Dissolved oxygen (DO)~~~~~	7.18	7.18 mg/l
5/2/2013 12:25	Dissolved oxygen (DO)~~~~~	7.25	7.25 mg/l
6/6/2013 11:54	Dissolved oxygen (DO)~~~~~	6.56	6.56 mg/l
7/18/2013 11:38	Dissolved oxygen (DO)~~~~~	8.23	8.23 mg/l
8/1/2013 13:30	Dissolved oxygen (DO)~~~~~	3.14	3.14 mg/l
9/12/2013 12:46	Dissolved oxygen (DO)~~~~~	10.13	10.13 mg/l
10/3/2013 13:56	Dissolved oxygen (DO)~~~~~	8.17	8.17 mg/l
11/14/2013 13:26	Dissolved oxygen (DO)~~~~~	7.86	7.86 mg/l
12/16/2013 13:46	Dissolved oxygen (DO)~~~~~	8	8 mg/l

1/29/2013 11:46	Temperature, water	11.93	11.93 deg C
9/12/2013 12:46	Temperature, water	13.25	13.25 deg C
11/14/2013 13:26	Temperature, water	11.16	11.16 deg C
2/7/2013 12:20	Temperature, water	16.36	16.36 deg C
3/7/2013 11:44	Temperature, water	21.65	21.65 deg C
4/4/2013 11:56	Temperature, water	26.6	26.6 deg C
5/2/2013 12:25	Temperature, water	29.89	29.89 deg C
6/6/2013 11:54	Temperature, water	27.65	27.65 deg C
7/18/2013 11:38	Temperature, water	29.09	29.09 deg C
8/1/2013 13:30	Temperature, water	25.15	25.15 deg C
10/3/2013 13:56	Temperature, water	14.22	14.22 deg C
12/16/2013 13:46	Temperature, water	13.63	13.63 deg C

1/29/2013 11:46	Phosphorus~~Total~	0.037	0.037 mg/l
2/7/2013 12:20	Phosphorus~~Total~	0.046	0.046 mg/l
3/7/2013 11:44	Phosphorus~~Total~	0.087	0.087 mg/l
4/4/2013 11:56	Phosphorus~~Total~	0.082	0.082 mg/l
5/2/2013 12:25	Phosphorus~~Total~	0.11	0.11 mg/l
6/6/2013 11:54	Phosphorus~~Total~	0.12	0.12 mg/l

7/18/2013 11:38	Phosphorus~~Total~	0.21	0.21 mg/l
9/12/2013 12:46	Phosphorus~~Total~	0.035	0.035 mg/l
10/3/2013 13:56	Phosphorus~~Total~	0.098	0.098 mg/l
12/16/2013 13:46	Phosphorus~~Total~	0.077	0.077 mg/l
8/1/2013 13:30	Phosphorus~~Total~	0	0
11/14/2013 13:26	Phosphorus~~Total~	0.037	0.037 mg/l

0.07825

1/29/2013 11:46	Escherichia coli~~~~~	Present Below Quantification Limit
2/7/2013 12:20	Escherichia coli~~~~~	Present Below Quantification Limit
3/7/2013 11:44	Escherichia coli~~~~~	Present Below Quantification Limit
4/4/2013 11:56	Escherichia coli~~~~~	2 2 #/100ml
5/2/2013 12:25	Escherichia coli~~~~~	4.1 4.1 #/100ml
6/6/2013 11:54	Escherichia coli~~~~~	3.1 3.1 #/100ml
7/18/2013 11:38	Escherichia coli~~~~~	4 4 #/100ml
8/1/2013 13:30	Escherichia coli~~~~~	88.8 88.8 #/100ml
9/12/2013 12:46	Escherichia coli~~~~~	2 2 #/100ml
10/3/2013 13:56	Escherichia coli~~~~~	162.4 162.4 #/100ml
11/14/2013 13:26	Escherichia coli~~~~~	2 2 #/100ml
12/16/2013 13:46	Escherichia coli~~~~~	9.8 9.8 #/100ml

1/29/2013 11:46
 2/7/2013 12:20
 3/7/2013 11:44
 4/4/2013 11:56
 5/2/2013 12:25
 6/6/2013 11:54
 7/18/2013 11:38
 8/1/2013 13:30
 9/12/2013 12:46
 10/3/2013 13:56
 11/14/2013 13:26
 12/16/2013 13:46

SCDHEC WQMS MD 039

1/3/2008	Dissolved oxygen (DO)	9.09	Final	9.09 mg/l
2/7/2008	Dissolved oxygen (DO)	8.74	Final	8.74 mg/l
3/4/2008	Dissolved oxygen (DO)	9.34	Final	9.34 mg/l
4/2/2008	Dissolved oxygen (DO)	8.27	Final	8.27 mg/l
5/13/2008	Dissolved oxygen (DO)	5.9	Final	5.9 mg/l
6/17/2008	Dissolved oxygen (DO)	4.29	Final	4.29 mg/l
7/2/2008	Dissolved oxygen (DO)	3.64	Final	3.64 mg/l
8/13/2008	Dissolved oxygen (DO)	3.84	Final	3.84 mg/l
9/11/2008	Dissolved oxygen (DO)	4.61	Final	4.61 mg/l
10/1/2008	Dissolved oxygen (DO)	4.99	Final	4.99 mg/l
11/4/2008	Dissolved oxygen (DO)	6.64	Final	6.64 mg/l
12/2/2008	Dissolved oxygen (DO)	9.18	Final	9.18 mg/l
2/18/2009	Dissolved oxygen (DO)	9.65	Final	9.65 mg/l
3/17/2009	Dissolved oxygen (DO)	6.39	Final	6.39 mg/l
4/6/2009	Dissolved oxygen (DO)	6.56	Final	6.56 mg/l
5/12/2009	Dissolved oxygen (DO)	5.26	Final	5.26 mg/l
6/16/2009	Dissolved oxygen (DO)	4.56	Final	4.56 mg/l
7/14/2009	Dissolved oxygen (DO)	4.55	Final	4.55 mg/l
8/11/2009	Dissolved oxygen (DO)	5.74	Final	5.74 mg/l
9/16/2009	Dissolved oxygen (DO)	3.53	Final	3.53 mg/l
11/17/2009	Dissolved oxygen (DO)	7.23	Final	7.23 mg/l

Conductivity	1/3/2008 9:11 EST	Water	289.5 umho/cm	28.95
Conductivity	2/7/2008 9:06 EST	Water	3225 umho/cm	322.5
Conductivity	3/4/2008 8:34 EST	Water	0.8 umho/cm	0.08
Conductivity	4/2/2008 10:09 EST	Water	533.8 umho/cm	53.38
Conductivity	5/13/2008 9:15 EST	Water	2072 umho/cm	207.2
Conductivity	6/17/2008 10:19 EST	Water	5971 umho/cm	597.1
Conductivity	7/2/2008 9:33 EST	Water	11454 umho/cm	1145.4
Conductivity	8/13/2008 9:21 EST	Water	11451 umho/cm	1145.1
Conductivity	9/11/2008 9:24 EST	Water	658.3 umho/cm	65.83
Conductivity	1/21/2009 9:41 EDT	Water	315 umho/cm	31.5
Conductivity	3/17/2009 9:02 EDT	Water	418.9 umho/cm	41.89
Conductivity	5/12/2009 9:17 EDT	Water	3434 umho/cm	343.4
Conductivity	7/14/2009 9:09 EDT	Water	173 umho/cm	17.3
Conductivity	8/11/2009 9:24 EDT	Water	311.1 umho/cm	31.11
Conductivity	9/16/2009 9:37 EDT	Water	15900 umho/cm	1590

1/3/2008 9:11	Temperature, water~~~~~APHA^	7.77 deg C
2/7/2008 9:06	Temperature, water~~~~~APHA^	15.15 deg C
3/4/2008 8:34	Temperature, water~~~~~APHA^	14.75 deg C
4/2/2008 10:09	Temperature, water~~~~~APHA^	18.43 deg C
5/13/2008 9:15	Temperature, water~~~~~APHA^	22.15 deg C
6/17/2008 10:19	Temperature, water~~~~~APHA^	29.33 deg C
7/2/2008 9:33	Temperature, water~~~~~APHA^	28.36 deg C
8/13/2008 9:21	Temperature, water~~~~~APHA^	28.56 deg C
9/11/2008 9:24	Temperature, water~~~~~APHA^	29.08 deg C
10/1/2008 9:10	Temperature, water~~~~~APHA^	23.7 deg C
11/4/2008 9:16	Temperature, water~~~~~APHA^	16.2 deg C
12/2/2008 9:13	Temperature, water~~~~~APHA^	12 deg C
1/21/2009 9:41	Temperature, water~~~~~APHA^	6.67 deg C
2/18/2009 9:56	Temperature, water~~~~~APHA^	11.77 deg C
3/17/2009 9:02	Temperature, water~~~~~APHA^	16.42 deg C
4/6/2009 9:10	Temperature, water~~~~~APHA^	19.8 deg C
5/12/2009 9:17	Temperature, water~~~~~APHA^	24.91 deg C
6/16/2009 9:13	Temperature, water~~~~~APHA^	27.76 deg C
7/14/2009 9:09	Temperature, water~~~~~APHA^	28.05 deg C
8/11/2009 9:24	Temperature, water~~~~~APHA^	30.7 deg C
9/16/2009 9:37	Temperature, water~~~~~APHA^	26.69 deg C
11/17/2009 9:57	Temperature, water~~~~~APHA^	17.1 deg C

1/3/2008 9:11	Fecal Coliform~	100	Final	100 #/100ml
2/7/2008 9:06	Fecal Coliform~	70	Final	70 #/100ml
3/4/2008 8:34	Fecal Coliform~	110	Final	110 #/100ml
4/2/2008 10:09	Fecal Coliform~	220	Final	220 #/100ml
5/13/2008 9:15	Fecal Coliform~	320	Final	320 #/100ml
6/17/2008 10:19	Fecal Coliform~	520	Final	520 #/100ml
7/2/2008 9:33	Fecal Coliform~	550	Final	550 #/100ml
8/13/2008 9:21	Fecal Coliform~	1600	Final	1600 #/100ml
9/11/2008 9:24	Fecal Coliform~	160	Final	160 #/100ml
10/1/2008 9:10	Fecal Coliform~	170	Final	170 #/100ml
11/4/2008 9:16	Fecal Coliform~	110	Final	110 #/100ml
12/2/2008 9:13	Fecal Coliform~	80	Final	80 #/100ml
1/21/2009 9:41	Fecal Coliform~	1200	Final	1200 #/100ml
2/18/2009 9:56	Fecal Coliform~	70	Final	70 #/100ml
3/17/2009 9:02	Fecal Coliform~	210	Final	210 #/100ml
4/6/2009 9:10	Fecal Coliform~	90	Final	90 #/100ml
5/12/2009 9:17	Fecal Coliform~	250	Final	250 #/100ml
6/16/2009 9:13	Fecal Coliform~	Present	Final	
7/14/2009 9:09	Fecal Coliform~	900	Final	900 #/100ml
8/11/2009 9:24	Fecal Coliform~	170	Final	170 #/100ml
9/16/2009 9:37	Fecal Coliform~	50	Final	50 #/100ml
11/17/2009 9:57	Fecal Coliform~	78	Final	78 #/100ml

1/3/2008 9:11	Phosphorus~~Tc	0.12	Final	0.12 mg/l
2/7/2008 9:06	Phosphorus~~Tc	0.09	Final	0.09 mg/l
3/4/2008 8:34	Phosphorus~~Tc	0.065	Final	0.065 mg/l
4/2/2008 10:09	Phosphorus~~Tc	0.059	Final	0.059 mg/l
5/13/2008 9:15	Phosphorus~~Tc	0.073	Final	0.073 mg/l
6/17/2008 10:19	Phosphorus~~Tc	0.12	Final	0.12 mg/l
7/2/2008 9:33	Phosphorus~~Tc	0.1	Final	0.1 mg/l
8/13/2008 9:21	Phosphorus~~Tc	0.099	Final	0.099 mg/l
9/11/2008 9:24	Phosphorus~~Tc	0.085	Final	0.085 mg/l
10/1/2008 9:10	Phosphorus~~Tc	0.076	Final	0.076 mg/l
11/4/2008 9:16	Phosphorus~~Tc	0.093	Final	0.093 mg/l
12/2/2008 9:13	Phosphorus~~Tc	0.094	Final	0.094 mg/l
1/21/2009 9:41	Phosphorus~~Tc	0.078	Final	0.078 mg/l
2/18/2009 9:56	Phosphorus~~Tc	0.074	Final	0.074 mg/l
3/17/2009 9:02	Phosphorus~~Tc	0.036	Final	0.036 mg/l
4/6/2009 9:10	Phosphorus~~Tc	0.062	Final	0.062 mg/l
5/12/2009 9:17	Phosphorus~~Tc	0.057	Final	0.057 mg/l
6/16/2009 9:13	Phosphorus~~Tc	0.074	Final	0.074 mg/l
7/14/2009 9:09	Phosphorus~~Tc	0.058	Final	0.058 mg/l
8/11/2009 9:24	Phosphorus~~Tc	0.099	Final	0.099 mg/l
9/16/2009 9:37	Phosphorus~~Tc	0.06	Final	0.06 mg/l
11/17/2009 9:57	Phosphorus~~Tc	0.064	Final	0.064 mg/l

APPENDIX B – POLLUTANT LOAD CALCULATION METHODS

Worksheet	Source Information	Analysis	Filename / Notes
Primary Sources	Area IA Concentrations Partitioning Coefficients Annual Rainfall Stream Length Soils Groundwater Depth	GIS for Project Area BC Design Manual Table 3.6 WTM Defaults 50 inches average in Hannahan GIS for Reservoir, creek and tribs in study area. GIS Data Estimate	8 for Goose Creek and Reservoir, 1 mile tributary to reservoir, 1.25 for turkey creek, 1.25, 1 other tribs
Secondary Sources			
General Sewage Use Data	Dwelling units Individuals/Dwelling Unit Wastewater characteristics	Data GIS provided by Berkeley County Sewer Data GIS provided by Berkeley County Sewer WTM Defaults	Residential properties clipped to watershed layer
OSDS	Unsewered Dwelling Units(% of total) % of Septic Systems <100' to waterway Soils System type Groundwater depth	Estimate NOT USED GIS Data GIS Data Estimate	In GIS from NRCS clipped to watershed boundary In GIS from NRCS clipped to watershed boundary
CSOs	All data	NOT USED	
SSOs	All data	Data provided by Berkeley County Sewer	
Illicit Connections	Fraction of Pop. Illicitly Connected Number of Businesses Connections and flow parameters Concentrations	Estimate Estimate from Berkeley County GIS Estimate WTM Defaults	
Urban Channel Erosion	Erosion method		
Livestock	All data	NOT USED	
Marinas	All data	NOT USED	
Road Sanding	All data	NOT USED	
Non-Stormwater Point Sources	All data	NOT USED	
Existing Management Practices			
Turf Practices	All data	WTM Default calculations	
Pet Waste	All data	WTM Default calculations	Existing program
E/SC		NOT USED	
Street Sweeping		NOT USED	
Structural SWM Bacteria Removal Efficiency	Structural SWM Removal Efficiency	Matched to BC SW Manual where possible, or default.	
	SWM Discounts	Capture Discount (D1) = 90%, based on 1" WQv Design Discount (D2) = 1.2 based on specific, legally binding design standards Maintenance Discount (D3) = 0.9 based on regular maintenance, specified and enforced	
	Riparian Buffers		
	Catch Basin Cleanouts	NOT USED	
	Marina Pumpouts	NOT USED	
Retrofit Worksheet	BMP type, DA, %I	WQv for Wet and Dry Ponds from Berkeley County SW Manual, WQv for bio-retention from SCDOT WQ Manual	
Stream Restoration Worksheet	All sources	Defaults / Chesapeake Bay Program 2012	
Future Management Practices	Residential Lawn Care Education Pet Waste Education Erosion and Sediment Control Street Sweeping Impervious Cover Disconnection Riparian Buffers Catch Basin Cleanouts Marina Pumpouts Urban Downsizing Redevelopment With Improvements Stormwater Retrofits Stream Restoration Illicit Connection Removal CSO Repair/ Abatement SSO Repair/ Abatement Septic System Education Septic System Repair Septic System Upgrade Septic System Retirement OSDS Point Source Reduction	Estimate Estimate Based on Berkeley County Program 1 street sweeper for future use NOT USED GIS Estimate Berkeley County Info NOT USED NOT USED NOT USED Linked to Retrofit Worksheet Linked to Stream Restoration Worksheet 100% NOT USED 100% Estimate Default Default Estimate NOT USED NOT USED	
New Development	All sources	NOT USED	

Blue cells need to be completed by the user. Green tabs require user input
Yellow cells have default or calculated values but may be substituted
Grey cells should generally not be changed
Purple Cells Reflect "Bottom Line" Loads or Load Reductions. Purple Tabs Summarize Loads from Other Sheets

PRIMARY SOURCES - Land Use		Concentrations						Annual Loading Rates				Annual Load						Annual Runoff Volume		
Watershed		Area (Acres)	Impervious Cover (%)	Turf Cover (%)	Concentrations			Annual Loading Rates				FC (# billion/acre)	Runoff (in/year)	Annual Load			Annual Runoff Volume			
Category	Detailed Description				TN (mg/l)	TP (mg/l)	TSS (mg/l)	FC (MPN/100 ml)	TN (lb/acre)	TP (lb/acre)	TSS (lbs/acre)			TN (lb/year)	TP (lb/year)	TSS (tss/year)	FC (# billion/year)	(ac-inches)	(acre-feet)	
Residential				0%	2.1	0.31	49	20000	0.9	0.1	21	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.1	0.31	49	20000	0.9	0.1	21	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
	Medium Density Residential	SFR	2,021.52	28.0%	58%	3.32	0.52	70	20000	13.6	2.1	288	375	18	27,582.0	4,320.1	581,547.5	757,261.7	36,760.3	3,063.4
	High Density Residential	Multifamily	179.74	44.0%	45%	2.1	0.24	97	20000	11.2	1.3	519	488	24	2,020.0	230.9	93,306.3	87,679.5	4,256.3	354.7
	Low Density Residential	Vacant Lots	181.33	8.6%	73%	3.32	0.52	70	20000	8.6	1.4	182	237	12	1,567.4	245.5	33,038.8	43,033.8	2,089.0	174.1
	Medium Density Residential	Mobile Home Park	124.87	44.0%	45%	3.32	0.52	70	20000	17.8	2.8	375	488	24	2,218.7	347.5	46,779.0	60,913.2	2,957.0	246.4
	High Density Residential	Townhome	1.52	44.0%	45%	2.1	0.24	97	20000	11.2	1.3	519	488	24	17.1	2.0	789.1	741.5	36.0	3.0
				0%	2.1	0.31	49	20000	0.9	0.1	21	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.1	0.31	49	20000	0.9	0.1	21	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.1	0.31	49	20000	0.9	0.1	21	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
Commercial				0%	2.1	0.22	43	20000	0.9	0.1	18	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
	Commercial	Commercial	114.30	72.0%	22%	2.1	0.33	77	20000	15.8	2.5	579	686	33	1,806.3	283.8	66,231.0	78,402.4	3,805.9	317.2
	Educational	Institutional	106.10	34.0%	53%	2.1	0.22	43	20000	9.6	1.0	197	417	20	1,019.5	106.8	20,874.6	44,249.5	2,148.0	179.0
	Institutional	Institutional	68.47	34.0%	53%	2.1	0.22	43	20000	9.6	1.0	197	417	20	657.9	68.9	13,471.1	28,555.8	1,386.2	115.5
Roadway				0%	2.1	0.22	43	20000	10.6	1.1	217	460	22	1,579.3	165.5	32,338.1	68,549.7	3,327.7	277.3	
				0%	2.3	0.26	134	20000	1.0	0.1	57	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
	Roadway	Roadway	837.37	80.0%	16%	2.3	0.43	141	20000	18.7	3.5	1149	743	36	15,689.4	2,933.2	961,830.5	621,782.1	30,183.6	2,515.3
				0%	2.3	0.25	134	20000	1.0	0.1	57	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
Industrial				0%	2.3	0.25	134	20000	1.0	0.1	57	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
	Industrial	Industrial	362.13	75.0%	20%	2.08	0.32	149	20000	16.1	2.5	1156	707	34	5,843.7	899.0	418,611.7	256,084.8	12,431.3	1,035.9
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
Forest				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
				0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0	
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81	20000	0.9	0.1	34	39	2	0.0	0.0	0.0	0.0	0.0	0.0		
			0%	2.2	0.25	81														

Partitioning Coefficients for Rural and Forest Land				
Pollutant	TN	TP	TSS	FC
Fraction as Storm Load	50%	70%	90%	100%

823.99

464.79

Watershed Data	
Annual Rainfall (inches)	59.2
Watershed Area (acres)	7547
Stream Length (miles)	12.50

Soils Information		Runoff Coefficients				Land-Use Specific Runoff Coefficients											
Soil Fraction(%)		Impervious	Turf	Forest	Rural	Active Construction	Mixed Forest (50% open to development)	Conservation Land	Marsh						Lawn		Forested Wetland
HYDROLOGIC SOIL GROUP																	
A Soils	0.7%	0.95	0.15	0.02	0.02	0.5											
B Soils	19.0%	0.95	0.20	0.03	0.03	0.5											
C Soils	43.6%	0.95	0.22	0.04	0.04	0.5											
D Soils	36.6%	0.95	0.25	0.05	0.05	0.5											
100.0%		0.950	0.227	0.042	0.042	0.500	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
DEPTH TO GROUNDWATER																	
<3 Feet	50.0%																
3-5 Feet	25.0%																
>5 Feet	25.0%																
100.0%																	

SECONDARY SOURCES

General Sewage Use Data				BC Sewer Accounts
Dwelling Units	3950	Individuals/Dwelling Unit	2.7	
		Water Use (gpcd)	70	
		Wastewater Characteristics		
		TN (mg/l)	60	
		TP (mg/l)	10	
		TSS (mg/l)	400	
		FC (MPN/100 ml)	10,000,000	

Nutrient Concentration in Stream Channels		
	Concentration	Enrichment Factor
Soil P (%)	0.050%	2
Soil TN (%)	0.050%	2

On-Site Sewage Disposal Systems						
Unsewered Dwelling Units(% of total)		1%	Failure Rates		10%	
% of Septic Systems <100' to waterway		0%				
Soils	Clay/Mixed Soils	Normal		Adjacent to Waterway		
		Bacteria decay		15%		
		Delivery ratio		100%		
		TN	TP	TSS	Bacteria (Billions)	
Untreated Sewage Delivered to Septic Systems		1362	227	9078	1030239	
System Type	% of Systems	TN Efficiency	TP Efficiency	TSS Efficiency	Bacteria Log Reduction	
Conventional	100%	28%	57%	72%	3.5	
Intermittent Sand Filter		55%	80%	92%	3.2	
Recirculating Sand Filter		64%	80%	90%	2.9	
Water Separation System		83%	30%	60%	3.0	
Other		0%	0%	0%	0.0	
Combined Efficiency		28%	57%	72%	3.5	
Adjusted Efficiency (density)		28%	57%	72%	3.5	
Current Septic System Management Medium. Inspection at installation, education to encourage ongoing maintenance.						
Typical Separation from Groundwater	5 Feet					
Density (#/acre)	<1/acre					
		TN	TP	TSS	Bacteria	
Removal by soil below the leach field		20%	100%	100%	100%	
		TN	TP	TSS	Bacteria	
Load to Surface		68.08636	11.34756	453.9024	103.0239	
Load to Groundwater		705.9090125	0	0	0	

Sandy <1/acre <3 Feet Low. No inspection at installation, no incentives or programs for ongoing maintenance.
Clay/Mixed Soils 1-2/acre 3-5 Feet Medium. Inspection at installation, education to encourage ongoing maintenance.
>2/acre 5 Feet High. Inspection at installation, ongoing inspection, incentives to correct failing systems.

Failure: Default is 10%
Good Inspection: -5%
Bad Inspection: +10%
High GW +5%
High Density +5%

0.999684
0.999369
0.998741
0.999
0
0
0.999683772
0.999684 Discount Efficiency (Take 1/3 off, or 1 log) for density >1/acre

Discount Filtering in soils.
For TN: 0% for <3' 10% for 3-5' 20% for >5'
For TP: 50% for <3' 80% for 3-5' 100% for >5'
For TSS: 100% for <3' 100% for 3-5' 100% otherwise
For bacteria: 50% discount for sandy soils 50% discount for sand 50% discount for sandy soils

Overall Approach
For failing systems, just take raw sewage and apply by delivery ratios and bacteria decay rates
For non-failing systems, apply efficiency, then filtering below the leach field

SSOs				SSO Data SSO Data
Miles of Sanitary Sewer	90.2	Overflows/1,000 Miles of Sewer	33.26	
Fraction of Load as Storm Flow	50%	Volume per Overflow (gallons)	3,233	

CSOs			
Median Storm Event (inches)		# of CSOs/year	
Sewershed Area (acres)		Capacity of CS system (rainfall depth in inches)	0.1
Sewershed Impervious Cover (%)		Characteristics of CSOs	
		TN (mg/l)	10
		TP (mg/l)	2
		TSS (mg/l)	200
		FC (MPN/100 ml)	6,400,000

Illicit Connections				
Fraction of WS Population Illicitly Connected	0.1%			
# of Illicit Connections	3.95			
Number of Businesses	200	Estimate from BC GIS		
Fraction of Businesses with Illicit Connections	1%			
Fraction of Business Connections that are Wash Water Only	90%			
Wash Water Flow (gpd)	100			
Total Flow/business (gpd)	150			
		TN	TP	TSS
Wash Water Concentrations	15	10	150	0
Total Flow Concentrations	30	10	225	3,300,000

Urban Channel Erosion (Applies only to Stream Reaches in Urban Portions of the Watershed)	
Method (Select from List)	Method 1. Estimate based on typical estimates of channel erosion rates.
Method 1. Estimate based on typical estimates of channel erosion rates.	
Assessment of Channel Erosion	Moderate: 50% of watershed sediment load. Channels show signs of degradation, with some areas of severe channel erosion.
Method 2. Back calculate based on known watershed sediment loading.	
Total Watershed Loading (including Channel Erosion) in tons/year	N/A
Method 3. Estimate based on other sediment study results.	

Sediment Load from Channel Erosion (tons/year)	
--	--

Choice	Method 1	0.33333333
Method 1. Estimate basnnels largely armored, or stable.	1	
Method 2. Back calcula areas of severe channel erosion.	3	
Method 3. Estimate bas. areas of severe channel erosion.		

Livestock								
	Animals (#)	% Exposed to Runoff	N (lbs/animal/year)	N load	P (lbs/animal/year)	P Load	Bacteria (billions/animal/year)	Bacteria Load
Dairy Cattle		100%	175	0	30	0	2000	0
Layers		15%	0.9	0	0.4	0	88	0
Broilers		15%	0.8	0	0.2	0	88	0
Turkeys		15%	3	0	0.8	0	47	0
Pigs		100%	32	0	7.4	0	3200	0
Delivery Ratios			15%	0	10%	0	5%	0

Marinas			
berths		typical occupancy (fraction of season)	0.5
season length (days)		flow rates (gpcd)	8
		individuals per boat	2

Road Sanding			
Sand Application (lbs/year)	0	Delivery ratio for Closed Section Roads	0.9
Fraction of Roads that are Open Section		Delivery ratio for Open Section Roads	0.35

Non-Stormwater Point Sources									
	Flow (MGD)	N Concentration (mg/l)	N Load (lbs/year)	P Concentration (mg/l)	P Load (lbs/year)	TSS Concentration (mg/l)	TSS Load (lbs/year)	Bacteria Concentration	Bacteria Load (Billion/year)
Point Source 1			0		0		0		0
Point Source 2			0		0		0		0
Point Source 3			0		0		0		0
Point Source 4			0		0		0		0
Point Source 5			0		0		0		0
Point Source 6			0		0		0		0
Point Source 7			0		0		0		0
Point Source 8			0		0		0		0
Point Source 9			0		0		0		0
Point Source 10			0		0		0		0

Total Annual Loads		Pollutant Loads			
	N Load (lbs/year)	P Load (lbs/year)	TSS Load (lbs/year)	Bacteria Load (billion/year)	
Septic Systems - Surface	68.1	11.3	453.9	353.0	
SSOs	4.8	0.8	32.3	36,662.9	
CSOs	0.0	0.0	0.0	0.0	
Illicit Connections	147.1	29.1	1,010.1	104,307.4	
Channel Erosion	2,966.6	2,865.6	2,968,575.7	0.0	
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	
Marinas	0.0	0.0	0.0	0.0	
Road Sanding	0.0	0.0	0.0	0.0	
Point Source Discharges	0.0	0.0	0.0	0.0	
Total Secondary Load	3,186.6	3,007.8	2,968,071.9	141,133.3	
Total Secondary Load to Surface Waters					
Storm Load	2,969.0	2,967.0	2,966,591.8	18,331.4	
Non-storm Load	488.3	40.8	1,480.1	122,801.9	
Total Secondary Load to Groundwater					
Septic Systems - Subsurface	705.9	0.0	0.0	0.0	

Turf Condition and Management Practices - Residential			
Residential Turf Area	1434.13		
% of Lawns Bare/ Compacted	5		
Factors that Affect Nutrient Loading			
Typical # of Applications/Year	1.1		
% of Homes <10 Years Old	30		
% of Lawn Area "Highly Managed" (high input)	25		
Baseline (Recommended) Fertilizer Rate (N lb/acre)	150		
Estimated Average Fertilizer Application (N lb/acre)	2900		
		Analysis	
Form	% of Fertilizer Use (N Application)	N	P
Organic	20%	0.8	0.3
Soluble/Urea	30%	35	3
Slow Release	30%	24	5
Phosphorus Free	20%	10	0
Total Fertilizer Application Rate (Lb/year)	4,158,967	678903	
Fertilizer Loss	N	P	
Runoff (Lb/year)	33,773.7867	5,271.6	
Leachate (Lb/year)	755,854	31,274.6	
Total	789,628	36,546.3	
Turf Runoff Coefficient (Modified)	0.5000		

Turf Condition and Management Practices - Other			
Turf Category	Area (acres)	Management Compared to Residential Turf	
Commercial	189.4	Better management/ nutrient management	
Roadway	134.0	Better management/ nutrient management	
Industrial	72.4	Better management/ nutrient management	
Fertilizer Loss	N	P	
Runoff (Lb/year)	7,456.66	1,164	
Leachate (Lb/year)	166,879	6,905	
Total	174,336	8,069	

Pet Waste Education			
Program in Place?	yes		
Both			
# of dwelling units	3950		
Fraction of Households with a Dog	40%	Waste Production (lbs/dog-day)	0.32
Owners who Walk their Dogs (fraction)	50%	N Concentration (lb/lb)	0.23
Owners who Clean Up (fraction)	60%	N Delivery Factor	0.25
Fraction willing to change behavior	60%	P Concentration (lb/lb)	0.01
Awareness of Message (Fraction of Population)	25%	P Delivery Factor	0.75
		Bacteria Concentration(billion/lb)	10
		Bacteria Delivery Factor	0.05

Erosion and Sediment Control	
Program Efficiency	70%
Fraction of Building Permits Regulated	1
Installation/ Maintenance Discount	0.6

Street Sweeping							
Sweeper Type	Streets Swept (Acres) Residential	Streets Swept (Acres) Other Streets	Parking Lots Swept (acres)	Efficiencies - Residential		Efficiencies - Other roads	
Mechanical				Nutrients	TSS	Nutrients	TSS
Regenerative Air				24%	30%	4%	5%
Vacuum Assisted				61%	64%	18%	22%
Sweeping Frequency	monthly	monthly	monthly	62%	78%	63%	79%
Technique Discount	0.5						
monthly	0.6						
weekly	1						

Structural Stormwater Management Practices

Existing Loads to Surface Waters					
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)
Urban Land	83,357	14,713.16	1,861,312	1,769,385	9,654
Active Construction	296	59	201,328	-	188
SSOs	5	1	32	36,663	-
CSOs	-	-	-	-	-
Channel Erosion	2,967	2,967	2,966,576	-	-
Road Sanding	-	-	-	-	-
Forest	5,535	443	221,406	26,569	347
Rural Land	1,209	184	26,274	10,247	41
Livestock	-	-	-	-	-
Illicit Connections	147	29	1,010	104,367	-
Marinas	-	-	-	-	-
Point Source Discharges	-	-	-	-	-
OSDS	68	11	454	103	-
Open Water	10,547	412	127,718	-	-
Total Storm Load	100,541	18,590	5,379,862	1,824,532	10,230
Total Non-Storm Load	3,589	229	26,248	122,802	-
Total Load to Surface Waters	104,130	18,819	5,406,111	1,947,334	10,230

Existing Stormwater Load					
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)
Urban Land	83,357	14,713.16	1,861,312	1,769,385	9,654
Active Construction	296	59	201,328	-	188.23
SSOs	2	0	16	18,331	-
CSOs	-	-	-	-	-
Channel Erosion	2,967	2,967	2,966,576	-	-
Road Sanding	-	-	-	-	-
Forest	2,768	310	199,265	26,569	346.79
Rural Land	604	129	23,647	10,247	41.15
Livestock	-	-	-	-	-
Open Water	10,547	412	127,718	-	-
Total Storm Load	100,541	18,590	5,379,862	1,824,532	10,230

Existing Non-Storm Surface Discharges				
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year
Forest	2,768	133	22,141	0
Rural Land	604	55	2,627	0
SSOs	2	0	16	18,331
Illicit Connections	147	29	1,010	104,367
Marinas	-	-	-	-
Point Source Discharges	-	-	-	-
OSDS	68	11	454	103
Total Non-Storm Load	3,589	229	26,248	122,802

Existing Loads to Groundwater (Contributed from Urbanization). Note. Model does not deliver to receiving surface waters.			
	TN lb/year	TP lb/year	Fecal Coliform billion/year
Urban Land	976,137.6	43,183.1	14,183.1
OSDS	705.9	0.0	0.0
Total	976,843.5	43,183.1	14,183.1

- SR1 - Bettis Park
- SR2 - Hanahan Park
- SR3 - St James Park
- SR4 - St James III
- SR5 - Kapstone
- SR6 - City of Hanahan (BS)
- SR7 OL
- SR8 - Kensington HOA
- SR9 - Turkey Creek
- SR10 - Mellard Dr.

5645 LF Restored

Future Management Practices

Residential Lawn Care Education		
Awareness of Message (Fraction of Population)	40%	
Goals of the Program	Applied?	Ease of Implementation (Fraction that would Implement)
Reduce Fertilizer Use to Recommended Levels	yes	30%
Switch to Non-Phosphorus Fertilizer	yes	25%
Change to Organic Fertilizer	yes	10%
Add Soil Amendments to Lawns	yes	10%
Convert 25% of lawns to forest or native vegetation	yes	10%
No Fertilizer	yes	10%

Resulting Turf Condition and Management Practices - Residential			
Revised Residential Turf Area	1419.3		
Additional Residential Forest Area	14.3		
Revised Fertilizer Application (N lb/acre)	2234		
		Analysis	
	% of Fertilizer Use Application	N	P
Form	24%	0.8	0.3
Organic	23%	35	3
Soluble/Urea	23%	24	5
Slow Release	30%	10	0
Phosphorus Free	N	P	
Total Fertilizer Application Rate (Lb/year)	3,171,800	499974	
Fertilizer Loss	0.165547252		
Runoff (Lb/year)	23,828.10	3,182.4	
Leachate (Lb/year)	540,863	19,487.7	
Net Supplemental Load from Forest Runoff (lb/yr)	(27,965)	(22,659)	
Total	564,686	22,670	

Pet Waste Education			
Program? (Y/N)	yes		
Program Discounts		Waste Characteristics	
Number of households	3950	Waste Production (lbs/dog/day)	0.32
Fraction of Households with a Dog	40%	N Concentration (lb/lb)	0.23
Owners who Walk their Dogs (fraction)	50%	N Delivery Factor	0.25
Owners who Clean Up (fraction)	60%	P Concentration (lb/lb)	0.81
Fraction willing to change behavior	60%	P Delivery Factor	0.75
Awareness of Message (Fraction of Population)	40%	Bacteria Concentration(billion/lb)	10
		Bacteria Delivery Factor	0.05

Erosion and Sediment Control	
Program Efficiency	70%
Fraction of Building Permits Regulated	100%
Installation/ Maintenance Discount	60%

Street Sweeping							
Sweeper Type	Streets Swept (Acres)	Other Streets	Parking Lots Swept (acres)	Efficiencies - Residential		Efficiencies - Other roads	
Mechanical	Residential			Nutrients	TSS	Nutrients	TSS
Regenerative Air	0	0	0	24%	30%	4%	5%
Vacuum Assisted	0.0	334.9	0.0	61%	64%	18%	22%
Sweeping Frequency (M=monthly, W = Weekly)	monthly	monthly	monthly	62%	78%	63%	79%
Technique Discount	0.75			0%	0%	0%	0%

Impervious Cover Disconnection Program - Residential	
Program in Place?	no
Typical Roof Footprint (square feet)	2000
Fraction of Residential Land where Applicable	
Fraction of Population Reached	
Fraction Willing to Participate	10%

Riparian Buffers				
	Reservoir	Goose Creek	Tributaries	Buffer 4
Buffer Length (Miles)	10	10	6.5	0.0
Buffer Width (ft)	100	200	50	0
	Efficiency			
TN	TP	TSS	Bacteria	Runoff Reduction
15%	25%	65%	0%	75%
Treatability	2%			
Maintenance	0.9			

Catch Basin Cleanouts			
	Impervious Area Captured (Acres)	Efficiency	
Monthly Cleaning	0	Nutrients	TSS
Semi-Annual Cleaning	1597.972	15%	25%
		8%	20%
Disposal Discount	0.5		

Marina Pumpouts	
Number of Pumpouts	0
Total Number of Berths	0
Boats Served Per Station	0
Fraction of Owners Willing to Use	90%

"Urban Downsizing"							
	Acres Available	Acres Converted	TN lb/acre/year	TP lb/acre/year	TSS lb/acre/year	FC # billion/acre/year	Runoff (inches/year)
Land Use	181		18.66	3.54	182.26	237.33	21.56
Vacant Lots	2022		21.63	3.86	287.68	374.60	26.09
Multi-family	180		17.37	2.62	519.12	487.81	29.83
Vacant Lots	181		18.66	3.54	182.26	237.33	21.56
Commercial	114		18.87	3.15	579.45	685.94	36.37
Industrial	362		18.88	3.08	1155.97	707.16	37.07
		Acres Created	TN lb/acre/year	TP lb/acre/year	TSS lb/acre/year	FC # billion/acre/year	Runoff (inches/year)
Marsh	N/A		2.50	0.20	100.00	12.00	1.88
Lawn	N/A		4.60	0.70	100.00	39.00	1.88
Conservation Land	N/A		2.50	0.20	100.00	12.00	1.88
Conservation Land	N/A		2.50	0.20	100.00	12.00	1.88
Conservation Land	N/A		2.50	0.20	100.00	12.00	1.88
0	N/A	0	0.00	0.00	0.00	0.00	0.00

Redevelopment with Improvements	
Land to Be Redeveloped (Acres)	0
Average Impervious Cover Reduction (%)	

Average Turf Reduction (%)	
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Stormwater Retrofits (Use Stormwater Retrofit Worksheet to Document Practices)								
Retrofit Type	Total Area	Pollutant Reduction(lb/year)			Bacteria Reduction (billion/year)	Runoff Reduction (ac-ft/year)		
	Captured (Acres)	TN	TP	TSS				
BMP Type								
Rooftop Disconnection								
LID/ESD								
Green Roof	0.0	0.0	0.0	0.0	0.0	0.0		
Permeable Pavement	0.0	0.0	0.0	0.0	0.0	0.0		
Rooftop Disconnection	0.0	0.0	0.0	0.0	0.0	0.0		
Sheetflow to Open Space	0.0	0.0	0.0	0.0	0.0	0.0		
Raintanks and Cisterns	0.0	0.0	0.0	0.0	0.0	0.0		
Grass Channel	0.0	0.0	0.0	0.0	0.0	0.0		
STRUCTURAL (Matched to BCSW Manual)								
Wet Stormwater Detention Basin	1413.2	18859.4	4267.2	605551.4	501956.6	1632.0		
Dry Detention Basin	24.0	572.6	121.7	16562.7	14452.5	38.0		
Infiltration Trenches (Multi Purpose)	0.0	0.0	0.0	0.0	0.0	0.0		
Bioretention Areas (Multi Purpose)	57.7	1318.1	214.2	31286.9	28279.3	83.8		
Underground Detention	0.0	0.0	0.0	0.0	0.0	0.0		
Infiltration basins	0.0	0.0	0.0	0.0	0.0	0.0		
Sand Filters								
OTHER (Matched to BCSW Manual)								
Stormwater Wetlands								
Enhanced Grass Swales								
Engineered Devices	0.0	0.0	0.0	0.0	0.0	0.0		
0	0.0	0.0	0.0	0.0	0.0	0.0		
0	0.0	0.0	0.0	0.0	0.0	0.0		
Other Practice (User Defined)	0.0	0.0	0.0	0.0	0.0	0.0		
Total	1494.9	20750.07	4603.1	653401.0	544688.5	1753.7		

GW Load from Retrofit Practices

5163.0

58.2

0.0

757.3

Stream Restoration	
Select Assessment Option	
Option 2. Enter Removal from Stream Restoration Worksheet	
Option 1. Estimate Based on Miles of Stream Stabilized	
Portion of Total Stream Channel Unstable	20%
Miles of Unstable Channel	0.00
Miles of Stream Channel Stabilized	0.00
Flow control for small storms (%)	90%
Option 2. Data from Stream Restoration Worksheet	
Total Sediment Removal (lb/year)	84675
Total Phosphorus Removal (lb/year)	363.86
Total Nitrogen Removal (lb/year)	1129.00

1-Completed
0.00

2-Programmed
0.00

3-Identified
0.00

0.00

Cumulative
0.00

Illicit Connection Removal	
Fraction of System Surveyed	100%
Fraction of Repairs Made	100%

CSO Repair/ Abatement	
Target CSO Events after Repairs (#)	
Fraction Complete	

SSO Repair/ Abatement	
Goal (% Reduction)	100%
Fraction Complete	100%

Septic System Education	
Program? (Y/N)	yes
Awareness of Message (Fraction of Population)	40%
Fraction willing to change behavior	60%

systems
39.50

pumpouts
15.80

6.32

Septic System Repair	
Program? (y/n)	yes
Fraction Inspected	100%
Percent Willing to Repair	100.00%

Septic System Upgrade					
Program? (y/n)	yes				
Fraction Inspected	100%				
Fraction Willing to Upgrade	16.65%				
Enter Efficiencies if "Other"					
Upgrade System?	Other (Enter at Right)	TN Efficiency	TP Efficiency	TSS Efficiency	Bacteria Log Reduction
		Enter Value	Enter Value	Enter Value	3.5

Septic System Retirement (Convert to WWTP)					
Fraction of Systems Inspected	50%				
Number of Septic Systems Retired	19.75				
% Failing among Retired Systems. Cannot Exceed 20%	50%				
% w/in 100' of waterway among Retired Systems. Cannot Exceed 0%	0%				
WWTP Efficiency		TN Efficiency	TP Efficiency	TSS Efficiency	Bacteria Log Reduction
Treatment Plant Load		10%	10%	10%	10.0
		612.8	102.1	4085.1	0.0

On-Site Sewage Disposal Systems						
% of Septic Systems <100' to waterway	0.0%	Failure Rates		0.0%		
		Normal		Adjacent to Waterway		
Soils	Clay/Mixed Soils	Bacteria delivery		13%		
		N:P Delivery ratio		100%		
		TN	TP	TSS	Bacteria (Billions)	
Untreated Sewage Delivered to Septic Systems		681	113	4539	515120	
		TN Efficiency	TP Efficiency	TSS Efficiency	Bacteria Log Reduction	
System Type		% of Systems	28%	57%	72%	
Conventional		63.4%	57%	72%	3.5	
Intermittent Sand Filter		0.0%	50%	92%	3.2	
Recirculating Sand Filter		0.0%	64%	90%	2.9	
Water Separation System		0.0%	83%	60%	3.0	
Other (Enter at Right)		16.6%	Enter Value	Enter Value	Enter Value	
		23%	48%	60%	3.5	
Combined Efficiency		23%	48%	60%	3.5	
Adjusted Efficiency (density)		23%	48%	60%	3.5	
Density (#/acre)		<1/acre				
			TN	TP	TSS	Bacteria
Removal by soil below the leach field			20%	100%	100%	100%

		TN	TP	TSS	Bacteria
	Load to Surface	0	0	0	0
	Load to Groundwater	417.4194847	0	0	0

Point Source Reduction				
	N Reduction (lbs/year)	P Reduction (lbs/year)	TSS Reduction (lbs/year)	Bacteria Reduction (Billion/year)
Additional WWTP Load from Septic Conversion (Will be negative)	-613	-102.12804	-4085.1216	-3.1512E-05
Point Source 1				
Point Source 2				
Point Source 3				
Point Source 4				
Point Source 5				
Point Source 6				
Point Source 7				
Point Source 8				
Point Source 9				
Point Source 10				

Load Reductions for Future Management Practices					
	N (lbs/year)	P (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Lawn Care Education Surface	9978.7	2111.9	0.0	0.0	-2092.76
Lawn Care Education Groundwater	198926.8	3566.9			
Pet Waste Education	509.3	66.4		4429.1	
Erosion and Sediment Control	214.4	42.9	145789.6	0.0	
Street Sweeping	2024.4	329.0	137364.9	0.0	
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	
Structural Stormwater Management Practices	10501.5	2312.7	310026.5	270188.1	
Structural Stormwater Management Practices - Infiltration	-4366.5	-108.4	0.0	-12941.1	
Riparian Buffers	1215.7	223.0	36381.7	28659.3	145.55
Catch Basin Cleanouts	1247.6	135.6	181711.1	0.0	
Marina Pumpouts	0.0	0.0	0.0	0.0	
Urban Downsizing	0.0	0.0	0.0	0.0	0.00
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.00
Stormwater Retrofits	20750.1	4603.1	653401.0	544688.5	1753.73
Retrofits - Discharge to GW	-5163.0	-58.2	0.0	-757.3	
Illicit Connection Removal	147.1	29.1	1010.1	104367.4	
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	
SSO Repair/ Abatement	4.8	0.8	32.3	36662.9	
Septic System - Surface	68.1	11.3	453.9	103.0	
Channel Protection	1129.0	383.9	84675.0	0.0	
Point Source Reduction	-612.8	-102.1	-4085.1	0.0	
Total Reduction	236.575	13.548	1,546,761	975,400	-193
Total Reductions to Surface Water Loads					
Storm Load	236.970	13.609	1,549,366	852,598	-193
Non-storm Load	-395	-61	-2,605	122,802	0
Total Reductions to Groundwater Loads. Note: Negative values indicate an increase in load					
Lawn Care Education - Groundwater	198,927	3,566.90			
Riparian Buffers - Infiltration	-911	-47	0	-7,245	
Retrofits - Discharge to GW	-5,163	-58	0	-757	
OSDS - GW	288	0	0	0	
Groundwater Load	193,142	3,462	0	-8,002	

Load Reductions for Future Management Practices					
	N (lbs/year)	P (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Lawn Care Education Surface	9,978.7	2,111.9	0.0	0.0	
Pet Waste Education	191.0	24.9	0.0	1,660.9	
Erosion and Sediment Control	0.0	0.0	0.0	0.0	
Street Sweeping	2,024.4	329.0	137,364.9	0.0	
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	
Riparian Buffers	976.7	178.4	29,748.4	23,746.3	120.6
Catch Basin Cleanouts	623.8	67.8	90,855.6	0.0	
Marina Pumpouts	0.0	0.0	0.0	0.0	
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	20,750.1	4,603.1	653,401.0	544,688.5	1,753.7
Illicit Connection Removal	147.1	29.1	1,010.1	104,367.4	
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	
SSO Repair/ Abatement	4.8	0.8	32.3	36,662.9	
Septic System - Surface	68.1	11.3	453.9	103.0	
Stream Restoration	1,129.0	383.9	84,675.0	0.0	
Point Source Reduction	-612.8	-102.1	-4,085.1	0.0	
Total Net Reduction	35,290.9	7,638.0	993,456.0	711,229.0	1,874.3
Net Reductions to Surface Water Loads					
Storm Load	35,676.1	7,699.3	996,061.0	588,427.1	1,874.3
Non-storm Load	-395.2	-61.3	-2,605.0	122,801.9	0.0
Total Surface Water Reduction	35,280.9	7,638.0	993,456.0	711,229.0	1,874.3
Net Reductions to Groundwater Loads. Note: Negative values indicate an increase in load (e.g., infiltrating practices may cause an increase in groundwater loads)					
Lawn Care Education - Groundwater	198,926.8	3,566.9	0.0	0.0	
Riparian Buffers - Infiltration	-731.6	-37.4	0.0	-5,003.1	
Retrofits - Discharge to GW	-5,163.0	-58.2	0.0	-757.3	
OSDS - GW	288.5	0.0	0.0	0.0	
Net Groundwater Load Reduction	193,320.7	3,471.3	0.0	-6,760.4	

[illegible]

A Soils	B Soils	C Soils	D Soils
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Loads to Surface Waters with Projected New Development							
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)		
Urban Land	61,787.9	9,579.8	1,118,454.3	1,468,368.1	9,361.6	301016.63	1468265.07
Active Construction	296.1	59.2	201,328.4	0.0	188.2	0.00	
SSOs	0.0	0.0	0.0	0.0	0.0	36662.86	
CSOs	0.0	0.0	0.0	0.0	0.0	0.00	
Channel Erosion	1,949.0	2,694.2	2,993,348.8	0.0	0.0	0.00	
Road Sanding	0.0	0.0	0.0	0.0	0.0	0.00	
Forest	3,660.2	292.8	146,406.0	17,568.7	229.3	9000.00	
Rural Land	1,208.6	183.9	26,274.0	10,246.9	41.2	0.00	
Livestock	0.0	0.0	0.0	0.0	0.0	0.00	
Illicit Connections	0.0	0.0	0.0	0.0	0.0	104367.41	
Marinas	0.0	0.0	0.0	0.0	0.0	0.00	
Point Sources	612.8	102.1	4,085.1	0.0	0.0	0.00	
Septic Systems	0.0	0.0	0.0	0.0	0.0	103.02	
Open Water	10,547.1	412.0	127,718.5	0.0	0.0	0.00	
Total Storm Load	77,014.5	13,078.9	4,596,262.0	1,496,183.7	9,820.3	328348.06	
Total Non-Storm Load	3,047.1	245.1	21,353.1	0.0	0.0	122801.86	
Total Load to Surface Waters	80,061.6	13,324.0	4,617,615.1	1,496,183.7	9,820.3	451149.92	

Stormwater Load W/ND							
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)		
Urban Land	61787.9	9579.8	1118454.3	1468368.1	9361.6	301016.63	
Active Construction	296.1	59.2	201328.4	0.0	188.2	0.00	
SSOs	0.0	0.0	0.0	0.0	0.0	18331.43	
CSOs	0.0	0.0	0.0	0.0	0.0	0.00	
Channel Erosion	1949.0	2694.2	2993348.8	0.0	0.0	0.00	
Road Sanding	0.0	0.0	0.0	0.0	0.0	0.00	
Forest	1830.1	205.0	131765.4	17568.7	229.3	9000.00	
Rural Land	604.3	128.7	23646.6	10246.9	41.2	0.00	
Livestock	0.0	0.0	0.0	0.0	0.0	0.00	
Open Water	10547.1	412.0	127718.5	0.0	0.0	0.00	
Total Storm Load	77014.5	13078.9	4596262.0	1496183.7	9820.3	328348.06	

Non-Storm Surface Discharges w/ ND						
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year		
Forest	1,830.1	87.8	14,640.6	0.0	0.00	
Rural Land	604.3	55.2	2,627.4	0.0	0.00	
SSOs	0.0	0.0	0.0	0.0	18331.43	
Illicit Connections	0.0	0.0	0.0	0.0	104367.41	
Marinas	0.0	0.0	0.0	0.0	0.00	
Point Sources	612.8	102.1	4,085.1	0.0	0.00	
Septic Systems	0.0	0.0	0.0	0.0	103.02	
Total Non-Storm Load	3,047.1	245.1	21,353.1	0.0	122801.86	

Supplemental Loads to Groundwater (Contributed from Urbanization) with Projected New Development			
	TN lb/year	TP lb/year	Fecal Coliform billion/year
Urban Land	931,548.0	45,066.6	23,384.4
Septic Systems	417.4	0.0	0.0
Total	931,965.4	45,066.6	23,384.4

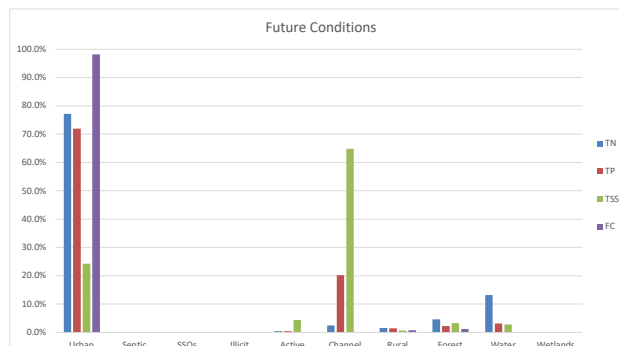
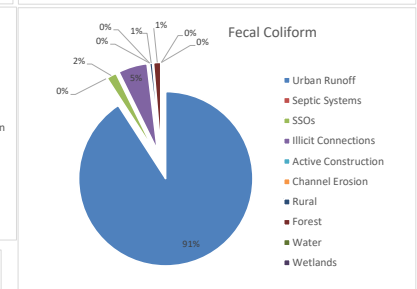
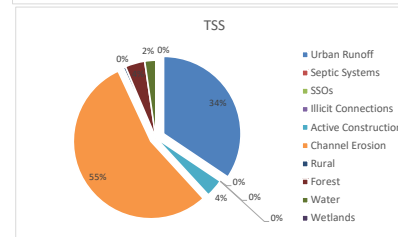
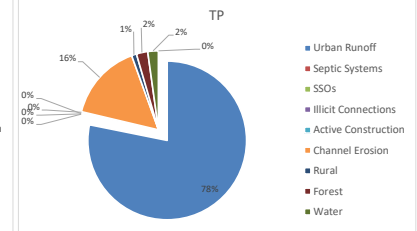
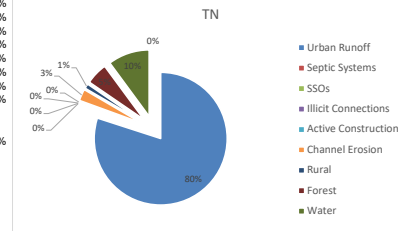
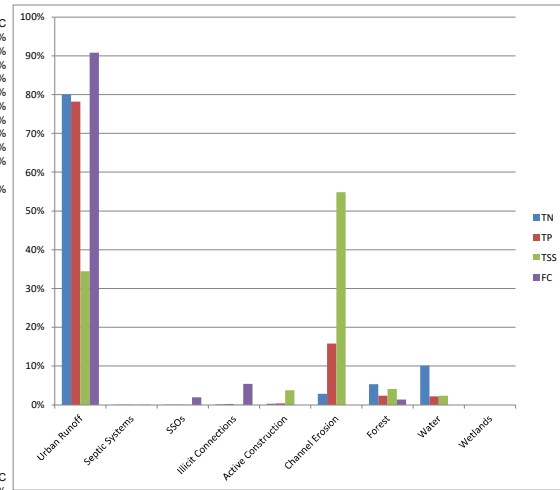
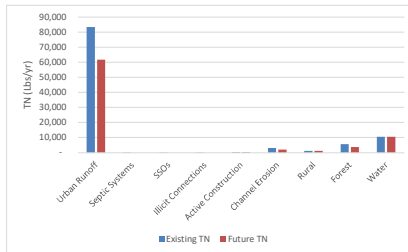
EXISTING CONDITIONS	Acres	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	FC (billion/yr)	Runoff (ac-ft)
URBAN SOURCES						
Urban Runoff	4,146.5	83,357	14,713	1,861,312	1,769,385	9,654
Septic Systems	68	5	11	454	103	-
SSOs	-	147	29	1,010	104,367	-
Illicit Connections	-	296	59	201,328	-	188
Active Construction	-	2,967	2,967	2,966,576	-	-
Channel Erosion	-	-	-	-	-	-
Road Sanding	-	-	-	-	-	-
TOTAL URBAN	4,146.5	86,839	17,780	5,030,712	1,910,518	9,843
Per Acre:		20.9	4.3	1,213.2	460.8	2.4
RURAL SOURCES						
Rural	262.7	1,209	184	26,274	10,247	41
Meadow	-	-	included w/ rural	-	-	-
Orchards / Vineyards	-	-	included w/ rural	-	-	-
CFOs	-	-	included w/ rural	-	-	-
Fallow	2,214.1	5,535	443	221,406	26,569	347
Forest	824.0	10,547	412	127,718	-	-
Water	-	-	included w/ forest	-	-	-
Wetlands	-	-	-	-	-	-
Livestock	-	-	-	-	-	-
TOTAL RURAL	3,300.8	17,291	1,039	375,398	36,816	388
Per Acre:		5.2	0.3	113.7	11.2	0.1
POINT SOURCES						
Municipal / Industrial	-	-	-	-	-	-
Marinas	-	-	-	-	-	-
TOTAL POINT SOURCES	-	-	-	-	-	-
TOTAL	7,447.3	104,130	18,819	5,406,111	1,947,334	10,230
		13.98	2.53	725.91	261.48	per acre

FUTURE CONDITIONS	Acres	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	FC (billion/yr)	Runoff (ac-ft)
URBAN SOURCES						
Urban Runoff	4,896.5	61,788	9,580	1,118,454	1,468,368	9,362
Septic Systems	-	-	-	-	-	-
SSOs	-	-	-	-	-	-
Illicit Connections	-	-	-	-	-	-
Active Construction	-	296	59	201,328	-	188
Channel Erosion	-	1,949	2,694	2,993,349	-	-
Road Sanding	-	-	-	-	-	-
TOTAL URBAN	4,896.5	64,033	12,333	4,313,132	1,468,368	9,550
RURAL SOURCES						
Rural	262.7	1,209	184	26,274	10,247	41
Pasture / Meadow	-	-	included w/ rural	-	-	-
Orchards/vineyards	-	-	included w/ rural	-	-	-
CFOs	-	-	included w/ rural	-	-	-
Fallow	1,464.1	3,660	293	146,406	17,569	229
Forest	824.0	10,547	412	127,718	-	-
Water	-	-	included w/ forest	-	-	-
Wetlands	-	-	-	-	-	-
Livestock	-	-	-	-	-	-
TOTAL RURAL	2,550.8	15,416	889	300,398	27,816	270
POINT SOURCES						
Municipal / Industrial	-	613	102	4,085	0	-
Marinas	-	-	-	-	-	-
TOTAL POINT SOURCES	-	613	102	4,085	0	-
TOTAL LOAD	7,447	80,062	13,324	4,617,615	1,496,184	9,820
		10.75	1.79	620.04	200.90	per acre

CHANGED LOADS EXISTING TO FUTURE	Acres	TN	TP	TSS	FC (billion/yr)	Runoff (ac-ft)
URBAN SOURCES						
Urban Runoff	750.0	(21,569)	(5,133)	(742,857)	(301,017)	(293)
Septic Systems	-	(68)	(11)	(454)	(103)	-
SSOs	-	(5)	(1)	(32)	(36,663)	-
Illicit Connections	-	(147)	(29)	(1,010)	(104,367)	-
Active Construction	-	-	-	-	-	-
Channel Erosion	-	(1,018)	(272)	26,773	-	-
Road Sanding	-	-	-	-	-	-
TOTAL URBAN	750.0	(22,806)	(5,447)	(717,581)	(442,150)	(293)
RURAL SOURCES						
Rural	-	-	-	-	-	-
Pasture / Meadow	-	-	included w/ rural	-	-	-
Orchards/vineyards	-	-	included w/ rural	-	-	-
CFOs	-	-	included w/ rural	-	-	-
Fallow	-	-	included w/ rural	-	-	-
Forest	(750.0)	(1,875)	(150)	(75,000)	(9,000)	(117)
Water	-	-	-	-	-	-
Wetlands	-	-	included w/ forest	-	-	-
Livestock	-	-	-	-	-	-
TOTAL RURAL	(750.0)	(1,875)	(150)	(75,000)	(9,000)	(117)
POINT SOURCES						
Municipal / Industrial	-	613	102	4,085	0	-
Marinas	-	-	-	-	-	-
TOTAL POINT SOURCES	-	613	102	4,085	0	-

EXISTING	AS PERCENT OF TOTAL			
	TN	TP	TSS	FC
Urban Runoff	80%	78%	34%	91%
Septic Systems	0%	0%	0%	0%
SSOs	0%	0%	0%	2%
Illicit Connections	0%	0%	0%	5%
Active Construction	0%	0%	0%	4%
Channel Erosion	3%	16%	55%	0%
Rural	1%	1%	0%	1%
Forest	5%	2%	4%	1%
Water	10%	2%	2%	0%
Wetlands	0%	0%	0%	0%
	100%	100%	100%	100%
Existing	Future			
TN	83,357	61,788		
Septic Systems	68	-		
SSOs	5	-		
Illicit Connections	147	-		
Active Construction	296	296		
Channel Erosion	2,967	1,949		
Rural	1,208.6	1,209		
Forest	5,535.2	3,660		
Water	10,547.1	10,547		

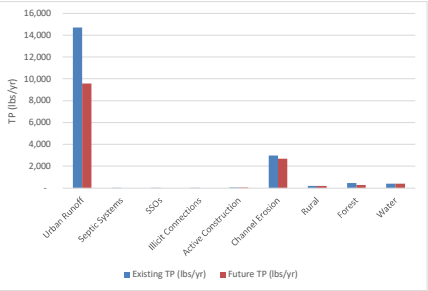
FUTURE	AS PERCENT OF TOTAL			
	TN	TP	TSS	FC
Urban Runoff	77.2%	71.9%	24.2%	98.1%
Septic Systems	0.0%	0.0%	0.0%	0.0%
SSOs	0.0%	0.0%	0.0%	0.0%
Illicit Connections	0.0%	0.0%	0.0%	0.0%
Active Construction	0.4%	0.4%	4.4%	0.0%
Channel Erosion	2.4%	20.2%	64.8%	0.0%
Rural	1.5%	1.4%	0.6%	0.7%
Forest	4.6%	2.2%	3.2%	1.2%
Water	13.2%	3.1%	2.8%	0.0%
Wetlands	0.0%	0.0%	0.0%	0.0%
	99.2%	99.2%	99.9%	100.0%



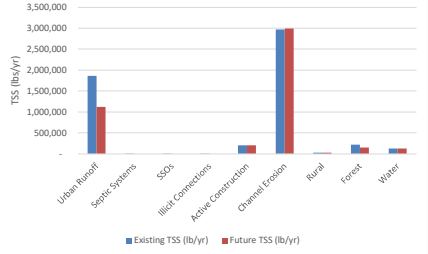
TOTAL LOAD - (24,069) (5,495) (788,495) (451,150) (410)

CHANGED LOADS						
EXISTING TO FUTURE						
EXISTING TO FUTURE	Acres	TN	TP	TSS	FC (billion/yr)	Runoff (ac-ft)
URBAN SOURCES						
Urban Runoff	750.0	-25.9%	-34.9%	-39.9%	-17.0%	(293)
Septic Systems		-100.0%	-100.0%	-100.0%	-100.0%	-
SSOs		-100.0%	-100.0%	-100.0%	-100.0%	-
Illicit Connections		-100.0%	-100.0%	-100.0%	-100.0%	-
Channel Erosion		-34.3%	-9.2%	0.9%	0.0%	-
Rural		-	-	-	-	-
Forest		-33.9%	-33.9%	-33.9%	-33.9%	-
Water		0.0%	0.0%	0.0%	0.0%	-
		TN	TP	TSS	FC (billion/yr)	
Urban Runoff		25.9%	34.9%	39.9%	17.0%	
Septic Systems		100.0%	100.0%	100.0%	100.0%	
SSOs		100.0%	100.0%	100.0%	100.0%	
Illicit Connections		100.0%	100.0%	100.0%	100.0%	
Channel Erosion		34.3%	9.2%	0.9%	0.0%	
Rural		0.0%	0.0%	0.0%	0.0%	
Forest		33.9%	33.9%	33.9%	33.9%	
Water		0.0%	0.0%	0.0%	0.0%	
TOTAL LOAD	-	23.1%	29.2%	14.6%	23.2%	

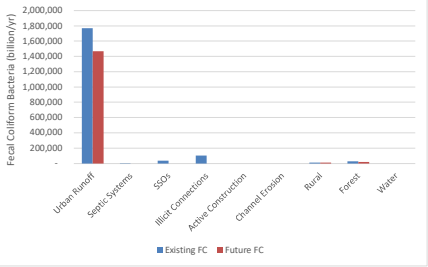
	Existing TP (lbs/yr)	Future TP (lbs/yr)
Urban Runoff	14,713	9,580
Septic Systems	11	-
SSOs	1	-
Illicit Connections	29	-
Active Construction	59	59
Channel Erosion	2,967	2,694
Rural	184	184
Forest	443	293
Water	412	412
TOTAL -	18,819	13,222



	Existing TSS (lb/yr)	Future TSS (lb/yr)
Urban Runoff	1,861,312	1,118,454
Septic Systems	454	-
SSOs	32	-
Illicit Connections	1,010	-
Active Construction	201,328	201,328
Channel Erosion	2,966,576	2,993,349
Rural	25,274	25,274
Forest	221,406	146,406
Water	127,718	127,718
TOTAL -	5,406,111	4,613,530



	Existing FC	Future FC
Urban Runoff	1,769,385	1,468,368
Septic Systems	103	-
SSOs	36,663	-
Illicit Connections	104,367	-
Active Construction	-	-
Channel Erosion	-	-
Rural	10,247	10,247
Forest	26,569	17,569
Water	-	-
TOTAL -	1,947,334	1,496,184



TMDL DATA

TMDL	N/A	
Approval Date		
Baseline Year		
LU Year for Modeling		
Counties:	FR - WQS	FR - MEP
Baseline Aggregate by County	0	
TMDL WLA by County		
TMDL Required Reduction		
TMDL Published % Reduction	0.0%	#DIV/0!
BST Human/Domestic %	50.0%	50.0%
MS4 Target % Reduction	0.0%	#DIV/0!
Modeled Baseline	1,947,334	1,947,334
Modeled WLA	1,947,334	
Modeled MPR		#DIV/0!
Modeled Required Reduction	0	#DIV/0!
Modeled Restoration Achieved - bn MPN/yr	711,229	711,229
Modeled Restoration Achieved - Percent	36.52%	36.52%
Progress Towards Percent Reduction Goal	#DIV/0!	#DIV/0!

SURFACE WATER**PRIMARY SOURCES**

Urban Land	2,047,254	
Forest	26,569	
Rural Land	10,247	
Open Water	0	
Active Construction	0	
Total	2,084,069	

SECONDARY SOURCES

SSOs	36,663	
CSOs	0	
Channel Erosion	0	
Road Sanding	0	
Livestock	0	
Illicit Connections	104,367	
Marinas	0	
Point Source Discharges	0	
OSDS	103	
Open Water	0	
Total	141,133	
NO BMP SURFACE WATER LOAD	2,225,203	

EXISTING SURFACE WATER LOAD REDUCTION

Turf Management - Surface	0	
Pet Waste Education	2,768	
Erosion and Sediment Control	0	
Street Sweeping	0	
Street Sweeping - Sanding	0	
Structural SWM Practices	270,188	
Riparian Buffers	4,913	
Catch Basin Cleanouts	0	
Marina Pumpouts	0	
Total Reduction	277,869	
TREATED SURFACE WATER LOAD	1,947,334	
PERCENT REDUCTION	12.5%	

FUTURE SURFACE WATER LOAD REDUCTION

Lawn Care Education Surface	0	
Pet Waste Education	1,661	0.2%
Erosion and Sediment Control	0	

Street Sweeping	0	
Street Sweeping - Sanding	0	
Riparian Buffers	23,746	3.3%
Catch Basin Cleanouts	0	
Marina Pumpouts	0	
Urban Downsizing	0	0.0%
Redevelopment With Improvements	0	
Stormwater Retrofits	544,688	76.6%
LID/ESD	0	
Green Roof	0	
Permeable Pavement	0	
Rooftop Disconnection	0	
Sheetflow to Open Space	0	
Raintanks and Cisterns	0	
Grass Channel	0	
STRUCTURAL (Matched to BCSW Manual)	0	
Wet Stormwater Detention Basin	501,957	0.0%
Dry Detention Basin	14,453	
Infiltration Trenches (Multi Purpose)	0	
Bioretention Areas (Multi Purpose)	28,279	
Underground Detention	0	
Infiltration basins	0	0.0%
Sand Filters	0	
OTHER (Matched to BCSW Manual)	0	
Stormwater Wetlands	0	
Enhanced Grass Swales	0	
Engineered Devices	0	
0	0	
0	0	
Illicit Connection Removal	104,367	14.7%
CSO Repair/ Abatement	0	
SSO Repair/ Abatement	36,663	5.2%
Septic System - Surface	103	0.0%
Stream Restoration	0	
Point Source Reduction	0	
NET RESTORATION REDUCTION	711,229	
NET RESTORATION LOAD	1,236,105	
PERCENT REDUCTION	36.52%	

GROUNDWATER

PRIMARY AND SECONDARY SOURCES

Septic Systems - Subsurface	0
Total Groundwater Load	0

EXISTING GROUNDWATER LOAD REDUCTION

Structural SWM Practices - Infiltration	-12,941
Riparian Buffers - Infiltration	-1,242
Total Reduction	-14,183

BASELINE GROUNDWATER LOAD	14,183
PERCENT REDUCTION	

FUTURE GROUNDWATER LOAD REDUCTION

Lawn Care Education - Groundwater	0
Riparian Buffers - Infiltration	-6,003
Retrofits - Discharge to GW	-757
OSDS - GW	0
Net Groundwater Load Reduction	-6,760
NET GW RESTORATION LOAD	14,183
PERCENT REDUCTION	-47.7%

Loads to Surface Waters with Future Practices						
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)	
Urban Land	48812.1	7398.1	949941.9	1199289.0	7779.9	570095.70
Active Construction	296.1	59.2	201328.4	0.0	188.2	0.00
SSOs	0.0	0.0	0.0	0.0	0.0	36662.86
CSOs	0.0	0.0	0.0	0.0	0.0	0.00
Channel Erosion	1837.6	2582.7	2881900.7	0.0	0.0	0.00
Road Sanding	0.0	0.0	0.0	0.0	0.0	0.00
Forest	5535.2	442.8	221406.0	26568.7	346.8	0.00
Rural Land	1208.6	183.9	26274.0	10246.9	41.2	0.00
Livestock	0.0	0.0	0.0	0.0	0.0	0.00
Illicit Connections	0.0	0.0	0.0	0.0	0.0	104367.41
Marinas	0.0	0.0	0.0	0.0	0.0	0.00
Point Sources	612.8	102.1	4085.1	0.0	0.0	0.00
Septic Systems	0.0	0.0	0.0	0.0	0.0	103.02
Open Water	10547.1	412.0	127718.5	0.0	0.0	0.00
Total Storm Load	64864.6	10890.7	4383801.5	1236104.6	8356.1	588427.13
Total Non-Storm Load	3984.6	290.1	28853.1	0.0	0.0	122801.86
Total Load to Surface Waters	68849.3	11180.9	4412654.6	1236104.6	8356.1	711228.99

Stormwater Load W/FP						
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)	
Urban Land	48,812.1	7,398.1	949,941.9	1,199,289.0	7,779.9	570095.70
Active Construction	296.1	59.2	201,328.4	0.0	188.2	0.00
SSOs	0.0	0.0	0.0	0.0	0.0	18331.43
CSOs	0.0	0.0	0.0	0.0	0.0	0.00
Channel Erosion	1,837.6	2,582.7	2,881,900.7	0.0	0.0	0.00
Road Sanding	0.0	0.0	0.0	0.0	0.0	0.00
Forest	2,767.6	310.0	199,265.4	26,568.7	346.8	0.00
Rural Land	604.3	128.7	23,646.6	10,246.9	41.2	0.00
Livestock	0.0	0.0	0.0	0.0	0.0	0.00
Open Water	10,547.1	412.0	127,718.5	0.0	0.0	0.00
Total Storm Load	64,864.6	10,890.7	4,383,801.5	1,236,104.6	8,356.1	588427.13

Non-Storm Surface Discharges w/ FP					
	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	
Forest	2,767.6	132.8	22,140.6	0.0	0.00
Rural Land	604.3	55.2	2,627.4	0.0	0.00
SSOs	0.0	0.0	0.0	0.0	18331.43
Illicit Connections	0.0	0.0	0.0	0.0	104367.41
Marinas	0.0	0.0	0.0	0.0	0.00
Point Sources	612.8	102.1	4,085.1	0.0	0.00
Septic Systems	0.0	0.0	0.0	0.0	103.02
Total Non-Storm Load	3,984.6	290.1	28,853.1	0.0	122801.86

Supplemental Loads to Groundwater (Contributed from Urbanization) with Future Practices Applied			
	TN lb/year	TP lb/year	Fecal Coliform billion/year
Urban Land	783105.4	39711.9	20943.4
OSDSs	417.4	0.0	0.0
Total	783522.8	39711.9	20943.4

New Development					Concentrations				Annual Loading Rates (including adjustment for turf management)					Load (Pre-BMP)				
Land Use	Additional Development (Acres)	Impervious Cover %	Turf Cover (%)		TN (mg/l)	TP (mg/l)	TSS (mg/l)	FC (MPN/100 ml)	TN lb/acre	TP lb/acre	TSS lb/acre	FC # billion/acre	Runoff (in/year)	TN (lb/year)	TP (lb/year)	TSS (lbs/year)	FC (# billion/year)	Runoff (acre-feet)
		0%	0%		2.10	0.3	49	20000	0.9	0.1	21	39	2	-	-	-	-	-
		0%	0%		2.10	0.3	49	20000	0.9	0.1	21	39	2	-	-	-	-	-
Medium Density Residential	SFR	500.0	28%	58%	3.32	0.5	70	20000	26.9	4.7	400	521	25	13,466	2,353	200,114	260,578	1,054
High Density Residential	Multifamily	260.0	44%	45%	2.10	0.2	97	20000	20.0	2.9	640	602	29	4,010	587	128,084	120,360	487
Low Density Residential	Vacant Lots		9%	73%	3.32	0.5	70	20000	25.5	4.6	325	423	21	-	-	-	-	-
Medium Density Residential	Mobile Home Park		44%	45%	3.32	0.5	70	20000	28.1	4.8	462	602	29	-	-	-	-	-
High Density Residential	Townhome		0%	0%	2.10	0.3	49	20000	0.9	0.1	21	39	2	-	-	-	-	-
			0%	0%	2.10	0.3	49	20000	0.9	0.1	21	39	2	-	-	-	-	-
			0%	0%	2.10	0.3	49	20000	0.9	0.1	21	39	2	-	-	-	-	-
			0%	0%	2.10	0.2	43	20000	0.9	0.1	18	39	2	-	-	-	-	-
Commercial			0%	0%	2.10	0.2	43	20000	0.9	0.1	18	39	2	-	-	-	-	-
Commercial	Commercial	50.0	72%	22%	2.10	0.3	77	20000	20.2	3.4	628	743	36	1,010	168	31,380	37,146	150
Educational	Institutional		34%	53%	2.10	0.2	43	20000	20.0	2.9	260	551	27	-	-	-	-	-
Institutional	Institutional		40%	48%	2.10	0.2	43	20000	20.0	2.8	274	582	28	-	-	-	-	-
Public	Institutional		0%	0%	2.30	0.3	134	20000	1.0	0.1	57	39	2	-	-	-	-	-
Roadway			80%	16%	2.30	0.4	141	20000	22.0	4.2	1212	783	38	-	-	-	-	-
Roadway	Roadway		0%	0%	2.30	0.3	134	20000	1.0	0.1	57	39	2	-	-	-	-	-
			0%	0%	2.30	0.3	134	20000	1.0	0.1	57	39	2	-	-	-	-	-
			0%	0%	2.30	0.3	134	20000	1.0	0.1	57	39	2	-	-	-	-	-
			0%	0%	2.30	0.3	134	20000	1.0	0.1	57	39	2	-	-	-	-	-
Industrial			0%	0%	2.20	0.3	81	20000	0.9	0.1	34	39	2	-	-	-	-	-
Industrial	Industrial		75%	20%	2.08	0.3	149	20000	20.1	3.3	1239	758	37	-	-	-	-	-
			0%	0%	2.20	0.3	81	20000	0.9	0.1	34	39	2	-	-	-	-	-
			0%	0%	2.20	0.3	81	20000	0.9	0.1	34	39	2	-	-	-	-	-
			0%	0%	2.20	0.3	81	20000	0.9	0.1	34	39	2	-	-	-	-	-
Forest									2.5	0.2	100	12	-	-	-	-	-	-
Forest/Rural Open	Mixed Forest (50% open to development)	-750.0							2.5	0.2	100	12	-	-	-	-	-	-
Forest/Rural Open	Conservation Land								2.5	0.2	100	12	2	(1,875)	(150)	(75,000)	(9,000)	(117)
MARSH	Marsh								2.5	0.2	100	12	2	-	-	-	-	-
Rural									4.6	0.7	100	39	-	-	-	-	-	-
									4.6	0.7	100	39	-	-	-	-	-	-
									4.6	0.7	100	39	-	-	-	-	-	-
									4.6	0.7	100	39	-	-	-	-	-	-
Forest/Rural Open	Lawn								4.6	0.7	100	39	2	-	-	-	-	-
									4.6	0.7	100	39	-	-	-	-	-	-
									4.6	0.7	100	39	-	-	-	-	-	-
Water/Wetland	Forested Wetland								4.6	0.7	100	39	2	-	-	-	-	-
Rural Not Modeled:									4.6	0.7	100	39	-	-	-	-	-	-
Active Construction		0.0							4.6	0.7	100	39	-	-	-	-	-	-
Watershed % Impervious Cover			29%															

Stormwater Controls on New Development and Construction

Program Discounts		Fraction of New Development Regulated	Capture Discount	Design Discount	Maintenance Discount	
		100%	90%	1.2	0.6	
Program Option		Option 1: Meet a specific Removal Percentage Target				
		TN	TP	TSS	FC	Runoff Volume
Target % Removal		40%	40%	80%	50%	10%
Target Load		0	0	0	0	0
		lb/acre/year		billion/acre/year		lb/year
Is Channel Protection Required?		Yes				
0		10764.10212		1916.915858	184406.233	265086.6393
		1019.827362				
		TN	TP	TSS	FC	Runoff Volume
Load Reduction (lb/year)		5510.386977	926.4932946	191065.111	149005.2516	109.5949188
Load to GW		330.3926205	18.16799577	0	2440.932658	

Data to Quantify Wastewater Loads

Septic Systems		
New Septic Customers (households)	Septic System Failure Rate	Septic System Efficiency
	10.00%	Highly Improved (Twice as Efficient)
SSOs		
Miles of Sewer Constructed	SSOs/Mile	
5	33	
CSOs		
% of Development on Combined Sewer		0
Illicit Connections		
% of new connections cross connected		0%
WWTP Dischargers: Only Report Discharges to WWTPs within the Watershed		
New Wastewater Customers (Households)		
	N	P
		TSS
		FC Log Reduction
Plant Efficiency	10%	10%
Load	0.0	0.0
		0.0
		0.0

Active Construction				
	Active Construction (net increase)	Program Efficiency	Fraction Regulated	Maintenance/Design
	0.0	70%	100%	0.6

Net Additional Loads					
Surface Waters	TN	TP	TSS	FC	Runoff
	lb/year	lb/year	lb/year	billion/year	ac-ft/year
Urban Land	12975.9	2181.7	168512.4	268079.1	1581.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	
CSOs	0.0	0.0	0.0	0.0	
Channel Erosion	111.4	111.4	111448.1		
Point Sources	0.0	0.0	0.0	0.0	
Illicit Discharges	0.0	0.0	0.0	0.0	
Forest	-1875.0	-150.0	-75000.0	-9000.0	-117.5
Rural Land	0.0	0.0	0.0	0.0	0.0
Septic Systems	0.0	0.0	0.0	0.0	
Groundwater					
Urban Land	148442.6	5354.8	0.0	2440.9	
Septic Systems	0.0	0.0	0.0	0.0	

APPENDIX C – RESTORATION CONCEPT PLANS

*PR1 & RF1 Goose Creek Primary School**Description*

Project Description	Restoration of the existing pond (PR1), and creation of 4 smaller Bioretention Areas (RF1)
Location	Goose Creek Primary School
BMP Type	Pond Restoration (PR1) and Bioretention (RF1)
Notes	Recommends forebay for existing pond, flumes into bioretention and tree plantings.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR1	27,225	0.5	5.1	273	62	8,364	High
RF1	11,852	1.0	3.35	157	25	4,168	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR1	\$65,705	\$12,883	\$3,486
RF1	\$153,754	\$45,897	\$3,875

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR1	Good	Not Probable	Berkeley County School District (Public)	Wooded	None
RF1	Good	Not Probable	Berkeley County School District (Public)	Wooded	Possible

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR1 - Goose Creek Primary

 Project Berkeley County GC WMP
 J.O. 171800951

 Site PR1 - Goose Creek Pri
 Task 1

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	15.00 ac	P_E	0.50 in
%I	34.0% percent	P_E from BC design procedure	
IA	5.10 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv = 27,225 cf	
		CY 1,008	

Volume		Source	
Ltop =	350 ft	GIS Measurement	
Wtop =	160 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	56,000 sf		
Abot =	50,024 sf		
Dmax =	2.0 ft	Estimate from GIS Mapping	
RS = Dmax/2 x (Abot + Atop)	106,024 cf	CY 3,927	
$P_{E\ ADR} = RS / WQv$	3.89	Treated depth for IA credit	
Q = 12 x RS/IA	5.73	Treated depth for pollutant removal	

Embankment Design		Existing		Source	
L =	Embankment Length	880	ft	Top perimeter from GIS	
H =	Embankment Height	4	ft	Dmax +2	
W =	Center Width	0	ft	Estimate	
s =	x:1 side slopes	3		Given by design criteria	
	Taper x-s	48	sf	X-section of slope	
	Ctr X-s H x W	0	sf	X-section of center	
	Total X-s	48	sf	X-section of embankment	
	Volume	1,564	cy		
	Footprint	12,320	sf		

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.39 AC	25% GIS Mapping	
Excavation	252 CY	25% WQv	
Embankment	- CY	0% volume	
Topsoil, 4"	523 SY	20% surface area	
Landscaping	523 SY	20% Embankment + 20% Atop	
Wetland Planting	- SY	0% N/A	
Riser Structure	1 LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1,898	SY	\$10.00	\$18,980
Excavation	252	CY	\$30.00	\$7,563
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	523	CY	\$4.00	\$2,091
Landscaping	523	SY	\$7.00	\$3,659
Wetland Planting	-	EA	\$22.00	\$0
Riser Structure	-	EA	\$10,000.00	\$0
Direct Construction Cost				\$32,292
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,000
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,000
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$3,796
Subtotal Indirect Cost				\$5,796
Net Construction Cost				\$38,088
Contingency	20%	of Net Cost		\$7,618
Base Construction Cost				\$45,705
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$20,000	\$20,000
Estimated Project Cost				\$65,705

Cost / Imp Ac: \$12,883

STORMWATER RETROFIT DESIGN AND ESTIMATE
BIORETENTION
RF1 - Goose Creek Primary

 Project Berkeley County GC W/
 J.O. 171800951

 Site **RF1 - Goose Creek f**
 Task 1

 By: FDP
 Checked: _____

 Date 4/29/2019
 Date _____

Required Volume		Source
DA	5.00 ac	P _E from ESD design procedure
%I	67.0% percent	
IA	3.35 ac	
WQv = first 1 inch of runoff from impervious areas located on the Project site.		
WQv = 12,161 cf		

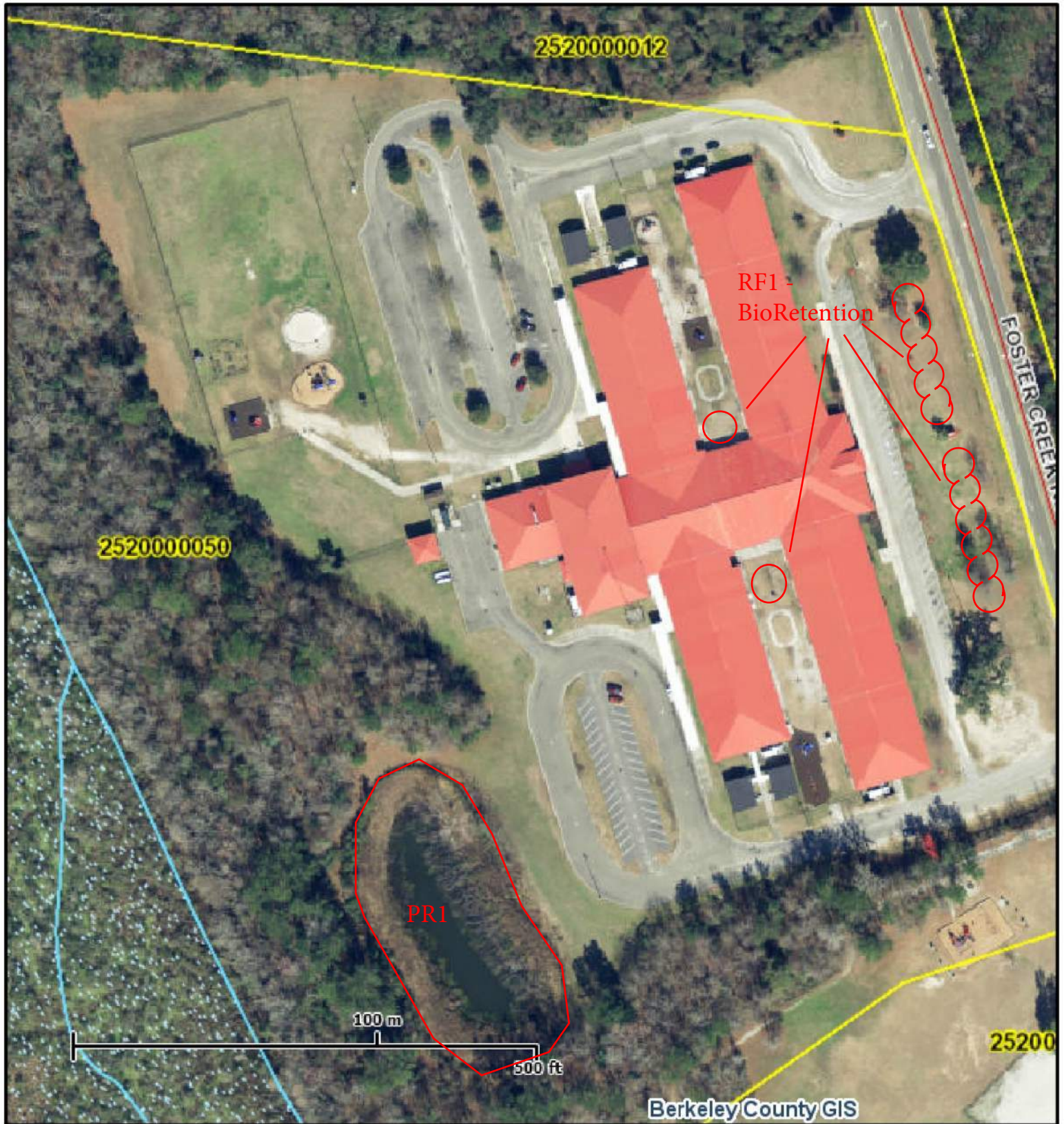
Bioretention Design			Source	
Filter	d _f =	2.0	ft	Filter bed depth
	k =	0.6	ft/day	Permeability coefficient (Bioretention soil)
	h _f =	1.0	ft	Water depth above filter bed
	t _f =	3.0	days	Filter bed drain time (Bioretention)
	n =	0.4		Porosity
Treatment	L =	365.0	ft	Measured length
Available	W =	25.0	ft	Measured width
	A _f = L x W	9,125	SF	Surface area
	RS = A _v x h _f /0.75	12,167	CF	Treatment volume
	P _{E ADR} = RS / WQ _v	-	in	Treated depth for IA credit
	Q = 12 x RS/IA	1.00	in	Treated depth for pollutant removal

Cost Estimate Quantities (Retrofit)			Source
Pavement Removal	-	CY	0% area x 12" pvmt
Excavation	1,267	CY	125% surface area x (d _f + 1 ft)
Gravel Jacket and Underdrain	338	CY	100% surface area x 1 ft
Bioretention Soil*	676	CY	100% surface area x d _f
Topsoil, 4"	1,267	SY	125% surface area
Landscaping	1,267	SY	125% surface area
Shrubs	507	EA	100% 1 per 2 SY surface area
Storm Drain	1	LS	

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	1,267	CY	\$20.00	\$25,340
Gravel Jacket and Underdrain	338	CY	\$40.00	\$13,520
Bioretention Soil*	676	CY	\$10.00	\$6,760
Topsoil, 4"	1,267	SY	\$4.00	\$5,068
Landscaping	1,267	SY	\$7.00	\$8,869
Shrubs	507	EA	\$22.00	\$11,154
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$80,711
Mobilization	5%	of Subtotal, Min	\$1,000	\$4,036
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$4,036
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$8,071
Subtotal Indirect Cost				\$16,142
Neat Construction Cost				\$96,853
Contingency	20%	of Net Cost		\$19,371
Base Construction Cost				\$116,224
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$156,224

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$46,634



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Friday, August 10, 2018



*PR2 Berkeley Business Center**Description*

Project Description	Restoration of the existing pond (PR2).
Location	Berkeley Business Center off North Rhett Avenue
BMP Type	Pond Restoration (PR2)
Notes	This pond also accepts drainage from areas on the West side of North Rhett Avenue. 54.1% imperviousness and 179.2 acre drainage area from Stream Stats. Annualized Maintenance cost not included.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR2	325,248	0.5	96.95	4,239	942	147,315	Low

Costs

Site ID	Cost	Cost / IA Treated
PR2	\$226,168	\$2,333

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR2	Good	Possible Wetland Impacts	Berkeley County Business Center	Industrial/Residential	None

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR2 BC Business Center

 Project Berkeley County GC WMP
 J.O. 171800951

 Site **PR2 BC Business Center**
 Task 1

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	179.20 ac	P_E	0.50 in
%I	54.1% percent	P_E from BC design procedure	
IA	96.95 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv =	325,248 cf
			12,046

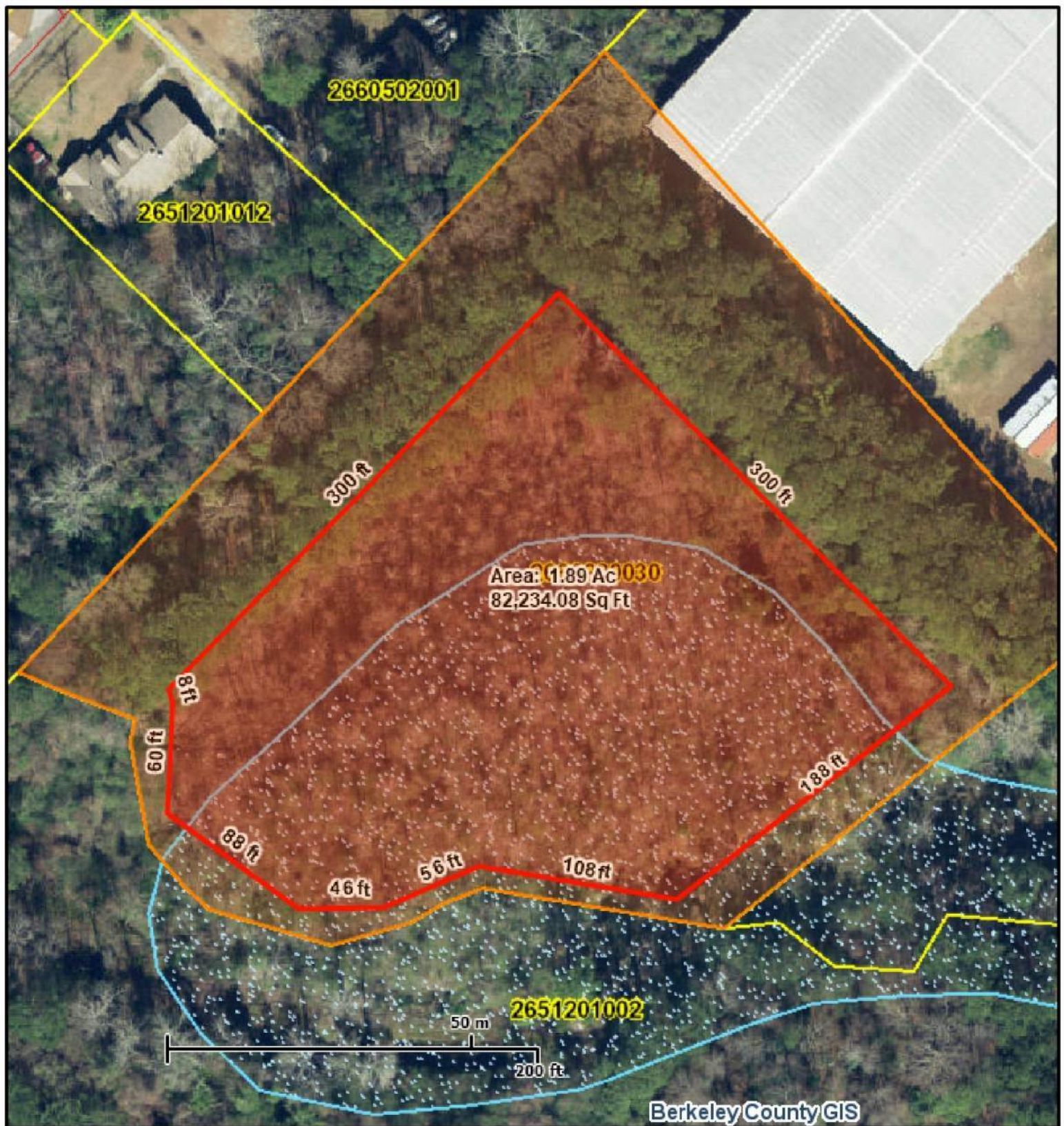
Volume		Source	
Ltop =	300 ft	GIS Measurement	
Wtop =	300 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	90,000 sf		
Abot =	82,944 sf		
Dmax =	2.0 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	172,944 cf		
$P_{E\ ADR} = RS / WQv$	0.53	Treated depth for IA credit	
Q = 12 x RS/IA	0.49	Treated depth for pollutant removal	
			6,405

Embankment Design		Existing		Source	
L =	Embankment Length	1200	ft	Top perimeter from GIS	
H =	Embankment Height	4	ft	Dmax +2	
W =	Center Width	4	ft	Estimate	
s =	x:1 side slopes	3		Given by design criteria	
	Taper x-s	48	sf	X-section of slope	
	Ctr X-s H x W	16	sf	X-section of center	
	Total X-s	64	sf	X-section of embankment	
	Volume	2,844	cy		
	Footprint	21,600	sf		

Cost Estimate Quantities (Retrofit)			Source	
Clear and Grub	0.64	AC	25%	As necessary
Excavation	3,012	CY	25%	WQv
Embankment	-	CY	0%	volume Assume embankment
Topsoil, 4"	-	SY	0%	N/A
Landscaping	880	SY	20%	Embankment + 20% Atop
Wetland Planting	-	SY	0%	N/A
Spillway Structure	1	LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	3,100	SY	\$10.00	\$31,000
Excavation	3,012	CY	\$30.00	\$90,347
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	-	CY	\$4.00	\$0
Landscaping	880	SY	\$7.00	\$6,160
Wetland Planting	-	EA	\$22.00	\$0
Spillway Structure	1	EA	\$10,000.00	\$10,000
Direct Construction Cost				\$137,507
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,550
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,550
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$6,200
Subtotal Indirect Cost				\$9,300
Net Construction Cost				\$146,807
Contingency	20%	of Net Cost		\$29,361
Base Construction Cost				\$176,168
Engr Design, Surveys, Permitting, CM	20% on NWI*	of Base, Min	\$50,000	\$50,000
Estimated Project Cost				\$226,168

Cost / Impervious Acre: \$2,333



Berkeley County GIS Online Mapping

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Monday, August 13, 2018



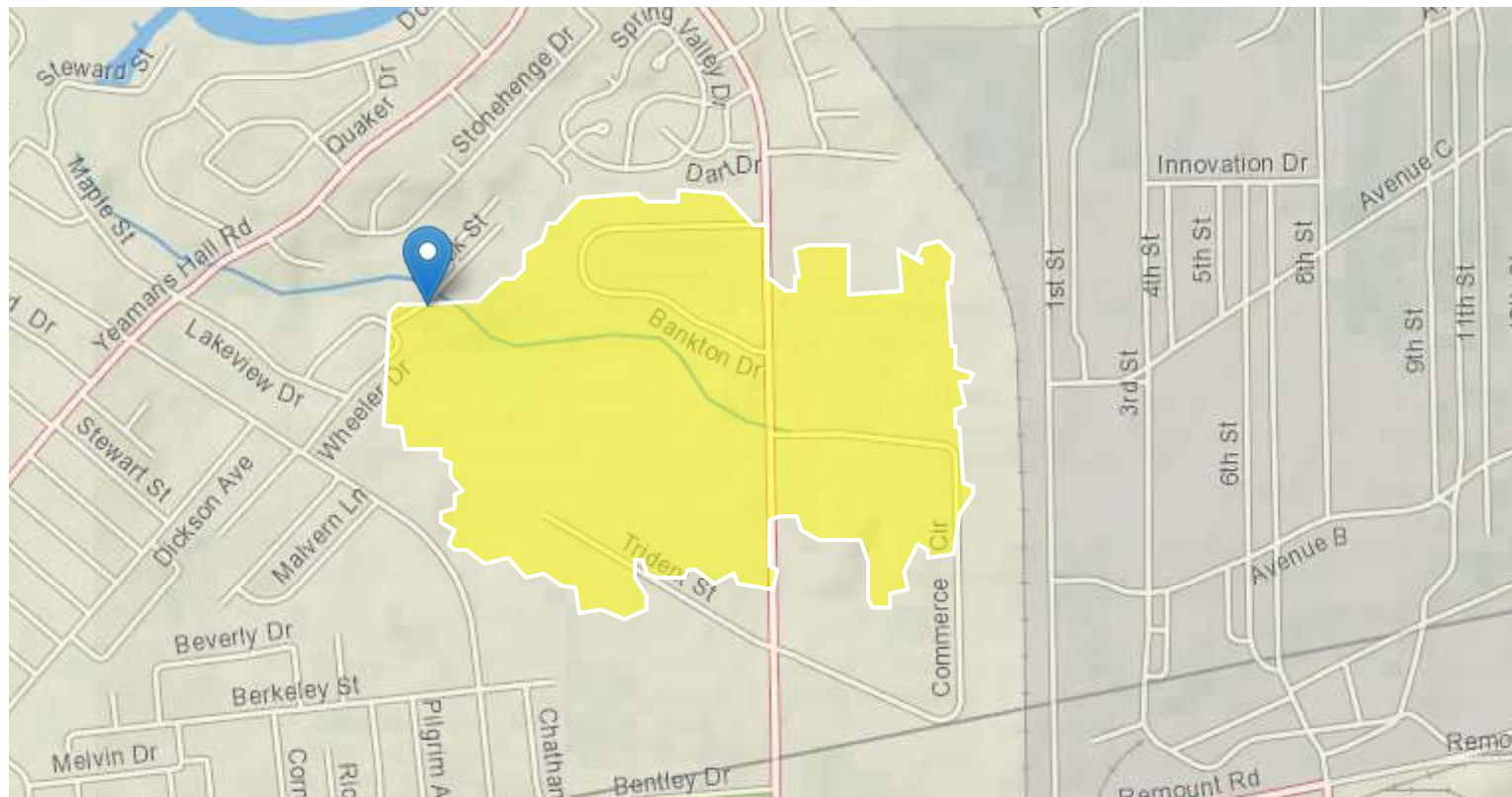
StreamStats Report BC Pond Restoration

Region ID: SC

Workspace ID: SC20180712181935068000

Clicked Point (Latitude, Longitude): 32.91232, -79.99328

Time: 2018-07-12 14:19:50 -0400



Restoration of Industrial Park Pond

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM30FT	Mean basin slope, based on slope percent grid	2.58	percent
DRNAREA	Area that drains to a point on a stream	0.28	square miles
ELEV	Mean Basin Elevation	31.3	feet
ELEVMAX	Maximum basin elevation	44.5	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	10.1	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.37	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.76	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	4.16	inches
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	93	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	1.099	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	54.1	percent
MINBELEV	Minimum basin elevation	8.6	feet
PRECIP	Mean Annual Precipitation	50.2	inches
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	74	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	0	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	4.131	percent

*PR3 & RF3 Hanahan Middle School**Description*

Project Description	Restoration of the existing pond (PR3), and creation of up to 5 smaller Bioretention Areas (RF3)
Location	Hanahan Middle School
BMP Type	Pond Restoration (PR3) and Bioretention (RF3)
Notes	Recommends swales into bioretention and tree plantings as well.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR3	32,670	1.0	3.06	422	90	12,215	High
RF3	10,709	1.0	3.00	148	24	3733	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR3	\$65,293	\$21,337	\$3,457
RF3	\$142,326	\$47,442	\$3,875

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR3	Good	Not Probable	Berkeley County School District (Public)	Residential	None
RF3	Slightly Limited to smaller equipment	Not Probable	Berkeley County School District (Public)	Residential	Possible

STORMWATER RETROFIT DESIGN AND ESTIMATE
DRY POND
PR3 - Hanahan Middle

 Project Berkeley County GC WMP
 J.O. 171800951

 Site **PR3 - Hanahan Middle**
 Task 1

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	9.00 ac	P_E	1.00 in
%I	34.0% percent	P_E from BC design procedure	
IA	3.06 ac	WQv = the first 1 inch of runoff from the entire area draining to the pond	
		WQv =	32,670 cf
			CY 1,210

Volume		Source	
Ltop =	130 ft	GIS Measurement	
Wtop =	130 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	16,900 sf		
Abot =	13,225 sf		
Dmax =	2.5 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	37,656 cf	CY 1,395	
$P_{E\ ADR} = RS / WQv$	1.15	Treated depth for IA credit	
Q = 12 x RS/IA	3.39	Treated depth for pollutant removal	

Embankment Design		Existing	Source
L =	Embankment Length	500 ft	Top perimeter from GIS
H =	Embankment Height	4 ft	Dmax +2
W =	Center Width	0 ft	Estimate
s =	x:1 side slopes	3	Given by design criteria
	Taper x-s	48 sf	X-section of slope
	Ctr X-s H x W	0 sf	X-section of center
	Total X-s	48 sf	X-section of embankment
	Volume	889 cy	
	Footprint	7,000 sf	

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.55 AC	100%	Field Observation
Excavation	303 CY	25%	WQv
Embankment	- CY	0%	volume
Topsoil, 4"	231 SY	20%	surface area
Landscaping	231 SY	20%	Embankment + 20% Atop
Wetland Planting	- SY	0%	N/A
Riser Structure	1 LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	2,656	SY	\$10.00	\$26,560
Excavation	303	CY	\$20.00	\$6,050
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	231	CY	\$4.00	\$923
Landscaping	231	SY	\$7.00	\$1,615
Wetland Planting	-	EA	\$22.00	\$0
Riser Structure	-	EA	\$10,000.00	\$0
Direct Construction Cost				\$35,147
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,328
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,328
Erosion / Sediment Control	15%	of Subtotal, Min	\$1,000	\$3,984
Subtotal Indirect Cost				\$6,640
Net Construction Cost				\$41,787
Contingency	25%	of Net Cost		\$10,447
Base Construction Cost				\$52,234
Engr Design, Surveys, Permitting, CM	25%	of Base, Min	\$10,000	\$13,059
Estimated Project Cost				\$65,293

Cost / Imp Ac: \$21,337

STORMWATER RETROFIT DESIGN AND ESTIMATE

BIORETENTION

RF3 - Hanahan Middle School

Project Berkeley County GC W/
J.O. 171800951

Site **RF3 - Hanahan Midd**
Task 1

By: FDP
Checked: _____

Date 4/29/2019
Date _____

Required Volume		Source
DA	5.00 ac	P _E from ESD design procedure
%I	60.0% percent	
IA	3.00 ac	
WQv = first 1 inch of runoff from impervious areas located on the Project site.		
WQv = 10,890 cf		

Bioretention Design		Source
Filter	d _f = 2.0 ft	Filter bed depth
	k = 0.6 ft/day	Permeability coefficient (Bioretention soil)
	h _f = 1.0 ft	Water depth above filter bed
	t _f = 3.0 days	Filter bed drain time (Bioretention)
	n = 0.4	Porosity
Treatment	L = 327.0 ft	Reflects Overall Area
Available	W = 25.0 ft	of all BioRetention Cells
	A _f = L x W	Surface area
	RS = A _v x h _f /0.75	Treatment volume
	P _{E ADR} = RS / WQv	Treated depth for IA credit
	Q = 12 x RS/IA	Treated depth for pollutant removal

Cost Estimate Quantities (Retrofit)		Source
Pavement Removal	- CY	0% area x 12" pvmt
Excavation	1,135 CY	125% surface area x (d _f + 1 ft)
Gravel Jacket and Underdrain	303 CY	100% surface area x 1 ft
Bioretention Soil	606 CY	100% surface area x d _f
Topsoil, 4"	1,135 SY	125% surface area
Landscaping	1,135 SY	125% surface area
Shrubs	455 EA	100% 1 per 2 SY surface area
Storm Drain	1 LS	

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	1,135	CY	\$20.00	\$22,700
Gravel Jacket and Underdrain	303	CY	\$40.00	\$12,120
Bioretention Soil	606	CY	\$10.00	\$6,060
Topsoil, 4"	1,135	SY	\$4.00	\$4,540
Landscaping	1,135	SY	\$7.00	\$7,945
Shrubs	455	EA	\$22.00	\$10,010
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$73,375
Mobilization	5%	of Subtotal, Min	\$1,000	\$3,669
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$3,669
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$7,338
Subtotal Indirect Cost				\$14,675
Neat Construction Cost				\$88,050
Contingency	20%	of Net Cost		\$17,610
Base Construction Cost				\$105,660
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$145,660

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$48,553



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Friday, August 10, 2018



*PR4 & RF4 Hanahan Rec Center**Description*

Project Description	Restoration of the existing pond (PR4), and creation of a smaller Bioretention Area (RF4)
Location	City of Hanahan Recreational Center
BMP Type	Pond Restoration (PR4) and Bioretention (RF4)
Notes	Recommends flume into bioretention and tree plantings as well.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR4	14,520	0.5	2.72	146	33	4,461	High
RF4	5,169	1.0	1.36	79	13	1,692	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR4	\$32,807	\$12,061	\$3,409
RF4	\$74,672	\$54,906	\$2,875

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR4	Good	Not Probable	City of Hanahan	Public	None
RF4	Good	Not Probable	City of Hanahan	Public	Not Likely

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR4 - Hanahan Rec Center

 Project Berkeley County GC WMP
 J.O. 171800951

 Site **PR4 - Hanahan Rec Ce**
 Task 1

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	8.00 ac	P _E	0.50 in
%I	34.0% percent	P _E from BC design procedure	
IA	2.72 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv = 14,520 cf	
		CY 538	

Volume		Source	
Ltop =	150 ft	GIS Measurement	
Wtop =	175 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	26,250 sf		
Abot =	22,494 sf		
Dmax =	2.0 ft	Estimate from GIS Mapping	
RS = Dmax/2 x (Abot + Atop)	48,744 cf	CY 1,805	
P _E ADR = RS / WQv	3.36	Treated depth for IA credit	
Q = 12 x RS/IA	4.94	Treated depth for pollutant removal	

Embankment Design		Existing	Source
L =	Embankment Length	530 ft	Top perimeter from GIS
H =	Embankment Height	4 ft	Dmax +2
W =	Center Width	0 ft	Estimate
s =	x:1 side slopes	3	Given by design criteria
	Taper x-s	48 sf	X-section of slope
	Ctr X-s H x W	0 sf	X-section of center
	Total X-s	48 sf	X-section of embankment
	Volume	942 cy	
	Footprint	7,420 sf	

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.19 AC	25%	GIS Mapping
Excavation	134 CY	25%	WQv
Embankment	- CY	0%	volume
Topsoil, 4"	282 SY	20%	surface area
Landscaping	282 SY	20%	Embankment + 20% Atop
Wetland Planting	- SY	0%	N/A
Riser Structure	0 LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	935	SY	\$10.00	\$9,350
Excavation	134	CY	\$20.00	\$2,689
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	282	CY	\$4.00	\$1,126
Landscaping	282	SY	\$7.00	\$1,971
Wetland Planting	-	EA	\$22.00	\$0
Riser Structure	-	EA	\$10,000.00	\$0
Direct Construction Cost				\$15,136
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,000
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,000
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$1,870
Subtotal Indirect Cost				\$3,870
Net Construction Cost				\$19,006
Contingency	20%	of Net Cost		\$3,801
Base Construction Cost				\$22,807
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$10,000	\$10,000
Estimated Project Cost				\$32,807

Cost / Impervious Acre: \$12,061

STORMWATER RETROFIT DESIGN AND ESTIMATE

BIORETENTION

RF4 - Hanahan Rec Center

Project Berkeley County GC W/
J.O. 171800951

Site RF4 - Hanahan Rec C
Task 1

By: FDP
Checked: _____

Date 4/29/2019
Date _____

Required Volume		Source
DA	4.00 ac	P_E from ESD design procedure
%I	34.0% percent	
IA	1.36 ac	
WQv = first 1 inch of runoff from impervious areas located on the Project site.		
WQv = 4,937 cf		

Bioretention Design		Source
Filter	$d_f =$	2.0 ft Filter bed depth
	$k =$	0.6 ft/day Permeability coefficient (Bioretention soil)
	$h_f =$	1.0 ft Water depth above filter bed
	$t_f =$	3.0 days Filter bed drain time (Bioretention)
	$n =$	0.4 Porosity
Treatment	$L =$	100.0 ft Measured length
Available	$W =$	40.0 ft Measured width
	$A_f = L \times W$	4,000 SF Surface area
	$RS = A_v \times h_f / 0.75$	5,333 CF Treatment volume
	$P_{E\text{ ADR}} = RS / WQv$	- in Treated depth for IA credit
	$Q = 12 \times RS / IA$	1.08 in Treated depth for pollutant removal

Cost Estimate Quantities (Retrofit)		Source
Pavement Removal	- CY	0% area x 12" pvmt
Excavation	556 CY	125% surface area x ($d_f + 1$ ft)
Gravel Jacket and Underdrain	148 CY	100% surface area x 1 ft
Bioretention Soil	296 CY	100% surface area x d_f
Topsoil, 4"	556 SY	125% surface area
Landscaping	556 SY	125% surface area
Shrubs	223 EA	100% 1 per 2 SY surface area
Storm Drain	1 LS	

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	556	CY	\$20.00	\$11,120
Gravel Jacket and Underdrain	148	CY	\$40.00	\$5,920
Bioretention Soil	296	CY	\$10.00	\$2,960
Topsoil, 4"	556	SY	\$4.00	\$2,224
Landscaping	556	SY	\$7.00	\$3,892
Shrubs	223	EA	\$22.00	\$4,906
Storm Drain	-	LS	\$10,000.00	\$0
Direct Construction Cost				\$31,022
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,551
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,551
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$3,102
Subtotal Indirect Cost				\$6,204
Neat Construction Cost				\$37,226
Contingency	20%	of Net Cost		\$7,445
Base Construction Cost				\$44,672
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$30,000	\$30,000
Estimated Project Cost				\$74,672

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$54,906



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Friday, August 10, 2018



*PR5 City of Hanahan Park Pond**Description*

Project Description	Restoration of the existing pond (PR5).
Location	Hanahan Park off Murray Avenue
BMP Type	Pond Restoration (PR5)
Notes	Drainage Area of 313.6 acres from Stream Stats. Minimum imperviousness of 25% used. Includes mucking and enlarging the pond, and modifying the outlet structure. Areas of the Park also used in pond WQv calculation.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR5	28,175	0.075	78.4	63	16	2,066	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR5	\$127,468	\$1,626	\$4,304

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR5	Good	Possible Wetland Impacts	City of Hanahan	Residential	Possible Sewer Conflicts

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR5 - City of Hanahan

 Project Berkeley County GC WMP
 J.O. 17180095101

 Site PR5 - City of Hanahan
 Task _____

 By FDP
 Checked _____

 Date 4/29/2018
 Date _____

Required Volume				Source		
DA	313.60	ac	P _E	0.50	in	P _E from BC design procedure
%I	25.0%	percent				
IA	78.40	ac	WQv = the first ½ inch of runoff from the entire area draining to the pond			
		Actual WQv =	42,689	cf	(first 0.075 inch of runoff)	1581
		Target WQv =	569,184			

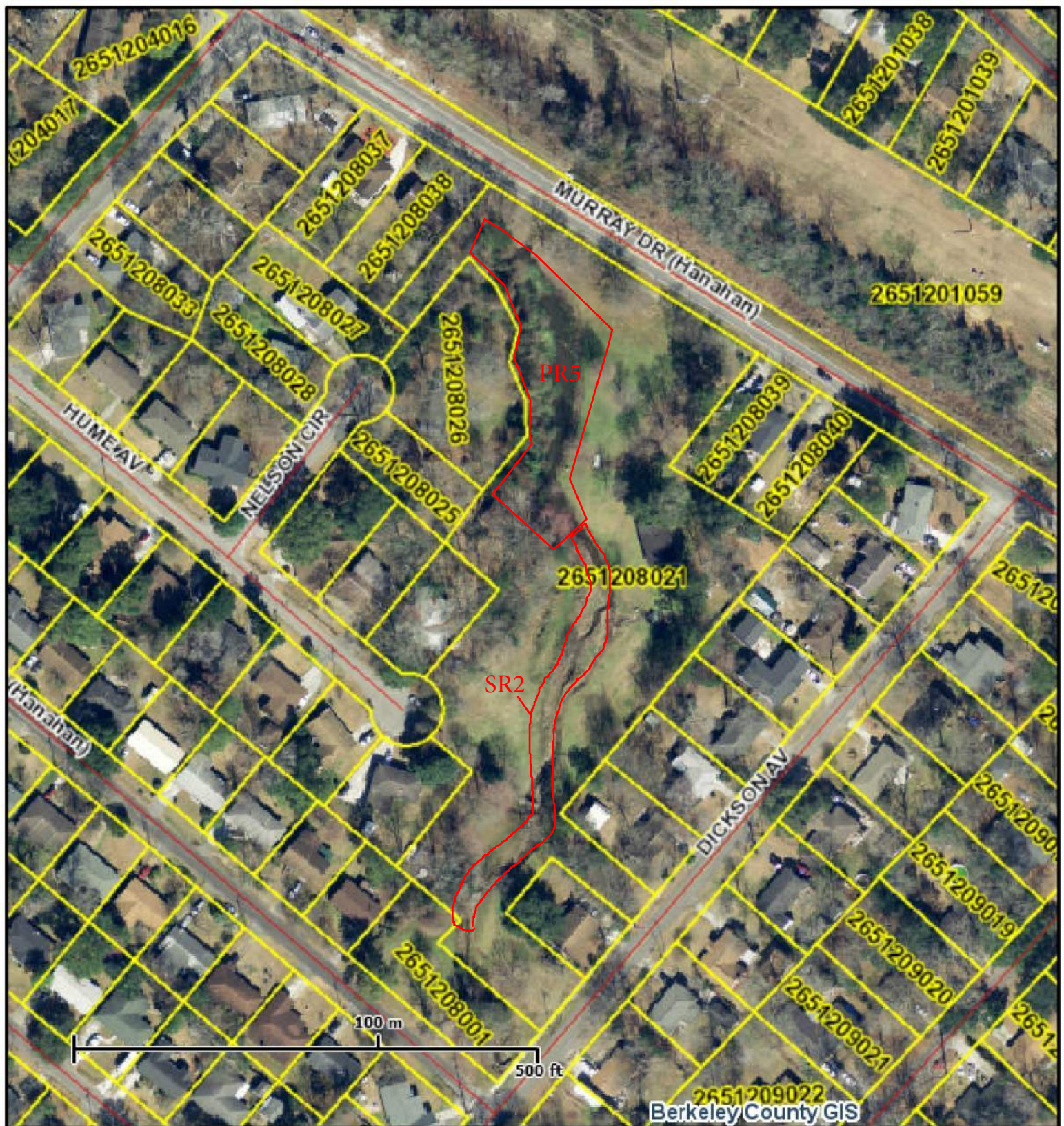
Volume		Source	
Ltop =	250 ft	GIS Measurement	
Wtop =	65 ft	GIS Measurement	
Spond =	2 :1	Side slope w/ matting	
Atop =	16,250 sf		
Abot =	12,614 sf		
Dmax =	3.0 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	43,296 cf		CY 1604
P _{E ADR} = RS / WQ _v	1.01	Treated depth for IA credit	
Q = 12 x RS/IA	0.15	Treated depth for pollutant removal	

Embankment Design			Existing		Source	
L =	Embankment Length		600	ft	Top perimeter from GIS	
H =	Embankment Height		4	ft	Dmax +2	
W =	Center Width		0	ft	Estimate	
s =	x:1 side slopes		2		Field Estimate	
	Taper x-s		32	sf	X-section of slope	
	Ctr X-s	H x W	0	sf	X-section of center	
	Total X-s		32	sf	X-section of embankment	
	Volume		711	cy		
	Footprint		6,000	sf		

Cost Estimate Quantities (Retrofit)			Source	
Clear and Grub	0.13	AC	25% top area + embankment 50% WQv 25% volume Increase Size 20% surface area ~300 LF on V 20% Embankment + 20% Atop 25% Atop	
Excavation	791	CY		
Embankment	178	CY		
TRM	206	SY		
Landscaping	206	SY		
Wetland Planting	451	SY		
Control Structure	1	LS		

Cost Estimate						
ITEM	QUANTITY	UNITS		UNIT COST	TOTAL	
Clear and Grub	618	SY		\$10.00	\$6,180	
Excavation	791	CY		\$30.00	\$23,716	
Embankment	178	CY		\$50.00	\$8,889	
TRM	206	CY		\$30.00	\$6,167	
Landscaping	206	SY		\$7.00	\$1,439	
Wetland Planting	451	EA		\$22.00	\$9,931	
Control Structure	1	EA	Concrete Weir	\$5,000.00	\$5,000	
Direct Construction Cost					\$61,321	
Mobilization	5%		of Subtotal, Min	\$1,000	\$1,000	
Ancillary Items	5%		of Subtotal, Min	\$1,000	\$1,000	
Erosion / Sediment Control	20%		of Subtotal, Min	\$1,000	\$1,236	
Subtotal Indirect Cost					\$3,236	
Net Construction Cost					\$64,557	
Contingency	20%		of Net Cost		\$12,911	
Base Construction Cost					\$77,468	
Engr Design, Surveys, Permitting, CM	20%		of Base, Min	\$50,000	\$50,000	
Estimated Project Cost					\$127,468	

Cost / Impervious Acre: \$1,626



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Thursday, August 9, 2018



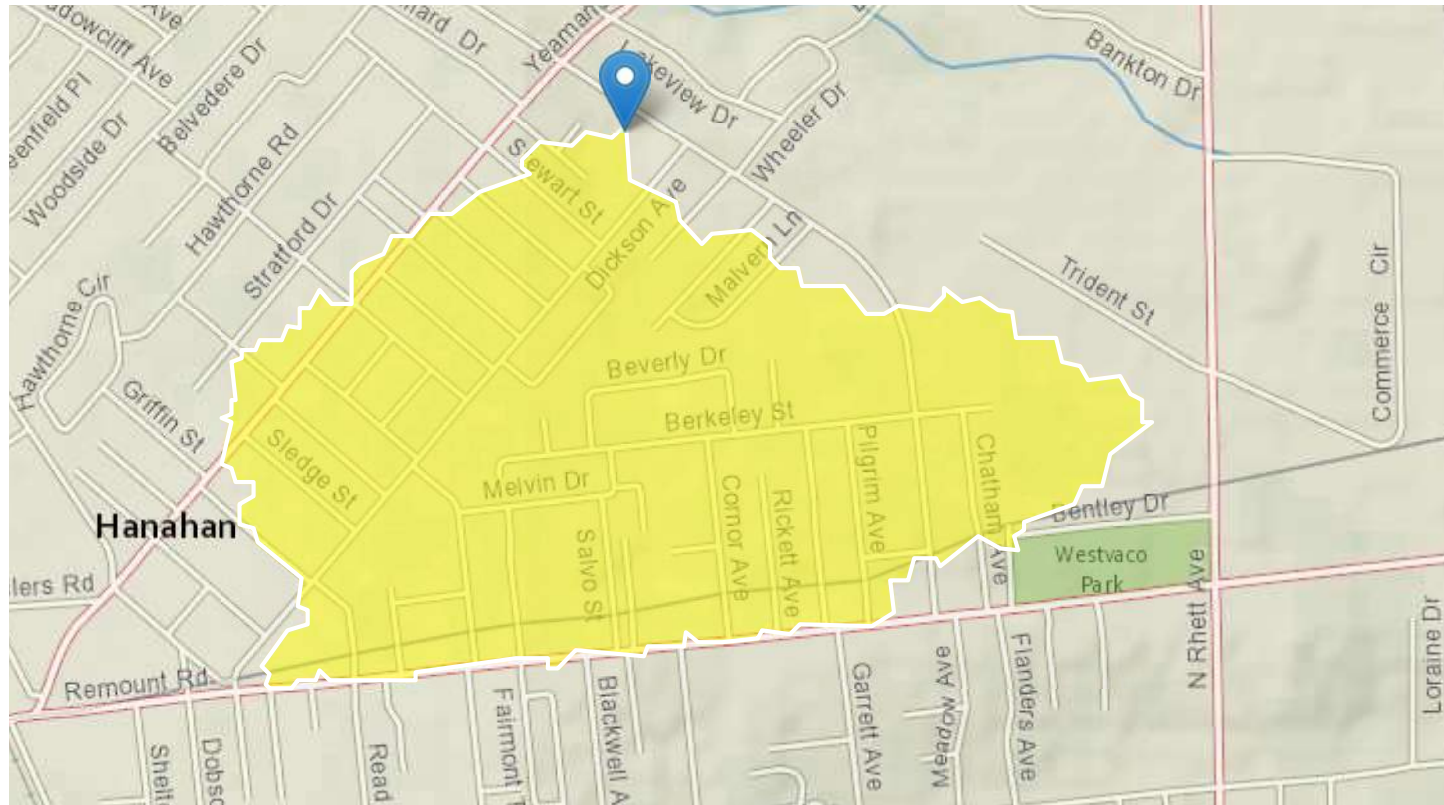
StreamStats Report City of Hanahan Park

Region ID: SC

Workspace ID: SC20180712180157009000

Clicked Point (Latitude, Longitude): 32.91052, -79.99834

Time: 2018-07-12 14:02:12 -0400



Drainage to pond area above Murray Drive

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.49	square miles
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	10.1	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.37	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.76	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	4.16	inches
LC01FOREST	Percentage of forest from NLCD 2001 classes 41-43	3.895	percent
LC01IMP	Percent imperviousness of basin area 2001 NLCD	23.91	percent
LC06DEV	Percentage of land-use from NLCD 2006 classes 21-24	94.025	percent
LC06FOREST	Percentage of forest from NLCD 2006 classes 41-43	3.895	percent
LC06IMP	Percentage of impervious area determined from NLCD 2006 impervious dataset	24.23	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	94	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	24.4	percent
MINBELEV	Minimum basin elevation	4.36	feet
PRECIP	Mean Annual Precipitation	50.3	inches
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	56.9	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	7.76	percent
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0.711	percent

*PR6 St. James Lake Restoration**Description*

Project Description	Restoration and retrofit of existing pond (PR6).
Location	Foster Creek Road
BMP Type	Pond Restoration (PR6)
Notes	Drainage Area of 500 Acres and 30.5% Impervious from Stream Stats. Includes mucking 50% of the WQV out of the pond and fixing the outlet structure. This lake is privately owned, but it serves public roads and multiple neighborhoods.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR6	907,500	0.5	152.5	9,390	2,150	282,156	Medium

Costs

Site ID	Cost	Cost / IA Treated	Annual Maintenance Cost
PR6	\$1,077,855	\$7,068	\$28,907

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR6	Limited in areas; Unknown what easements exist	Possible Wetland Impacts	Private - St. James Lake Corp	Residential	Not Probable

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR6 - St. James Lake

 Project Berkeley County GC WMP
 J.O. 17180095101

 Site **PR6 - St. James Lake**
 Task Berkeley County GC WMP

 By FDP
 Checked

 Date 4/29/2019
 Date

Required Volume		Source	
DA	500.00 ac	P_E	0.50 in
%I	30.5% percent	P_E from BC design procedure	
IA	152.50 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv =	907,500 cf
			CY 33,611

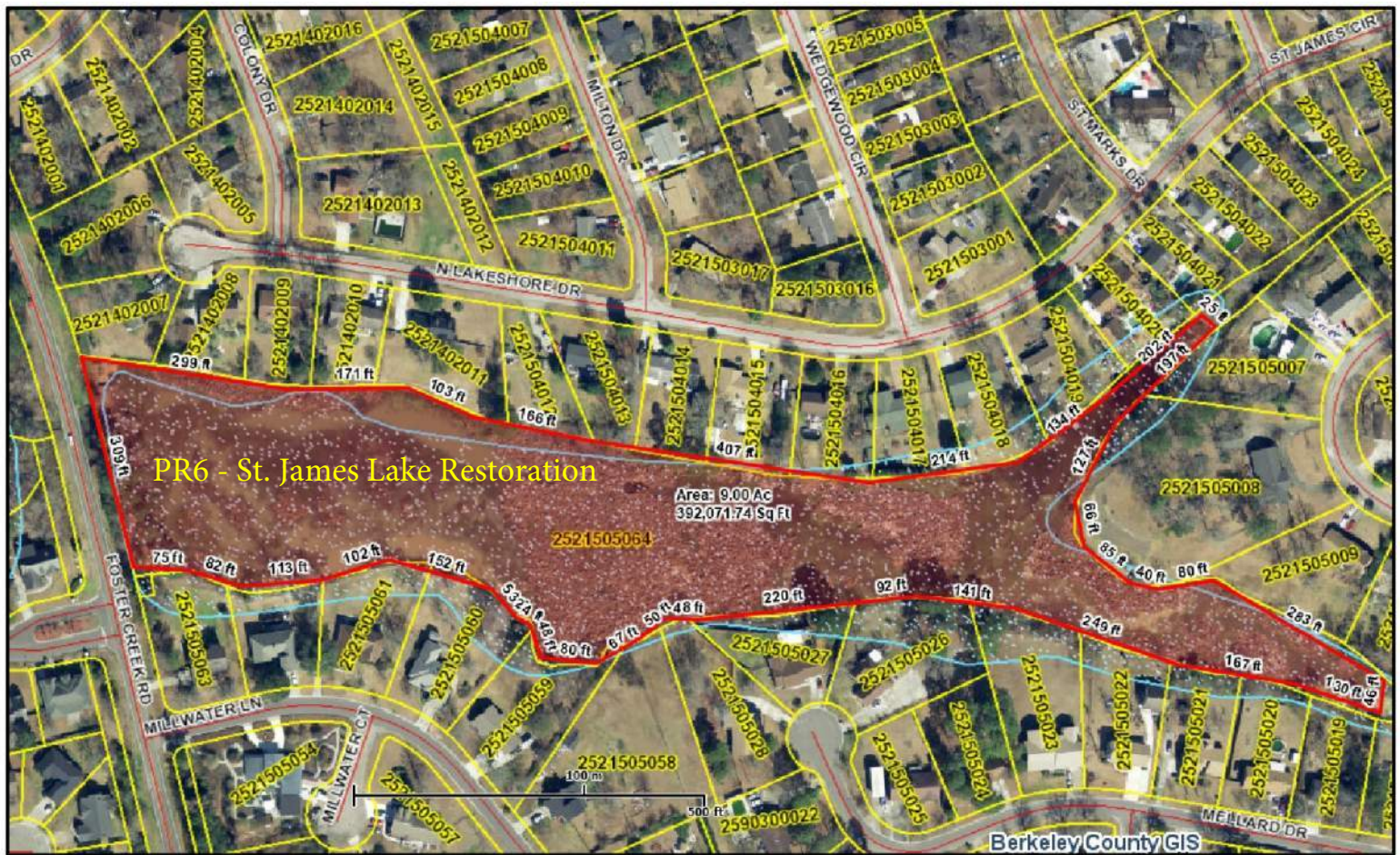
Volume		Source	
Ltop =	1200 ft	GIS Measurement	
Wtop =	253 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	303,600 sf		
Abot =	277,770 sf		
Dmax =	3.0 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	872,055 cf	CY 32,298	
$P_{E\ ADR} = RS / WQv$	0.96	Treated depth for IA credit	
Q = 12 x RS/IA	1.58	Treated depth for pollutant removal	

Embankment Design		Existing	Source
L =	Embankment Length	5000 ft	Top perimeter from GIS
H =	Embankment Height	4 ft	Dmax +2
W =	Center Width	0 ft	Estimate
s =	x:1 side slopes	3	Given by design criteria
	Taper x-s	48 sf	X-section of slope
	Ctr X-s H x W	0 sf	X-section of center
	Total X-s	48 sf	X-section of embankment
	Volume	8,889 cy	
	Footprint	70,000 sf	

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.86 AC	10%	As necessary
Excavation	16,806 CY	50%	WQv
Embankment	- CY	0%	volume
Topsoil, 4"	2,905 SY	20%	surface area
Landscaping	2,905 SY	20%	Embankment + 20% Atop
Wetland Planting	6,747 SY	20%	As necessary
Spillway Structure/forebay	1 LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	4,151	SY	\$10.00	\$41,510
Excavation	16,806	CY	\$30.00	\$504,167
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	2,905	CY	\$4.00	\$11,620
Landscaping	2,905	SY	\$7.00	\$20,334
Wetland Planting	6,747	EA	\$22.00	\$148,427
Spillway Structure/forebay	1	EA	\$10,000.00	\$10,000
Direct Construction Cost				\$736,057
Mobilization	5%	of Subtotal, Min	\$1,000	\$2,076
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$2,076
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$8,302
Subtotal Indirect Cost				\$12,453
Net Construction Cost				\$748,510
Contingency	20%	of Net Cost		\$149,702
Base Construction Cost				\$898,212
Engr Design, Surveys, Permitting, CM	20% on NWI*	of Base, Min	\$50,000	\$179,642
Estimated Project Cost				\$1,077,855

Cost / Impervious Acre: \$7,068



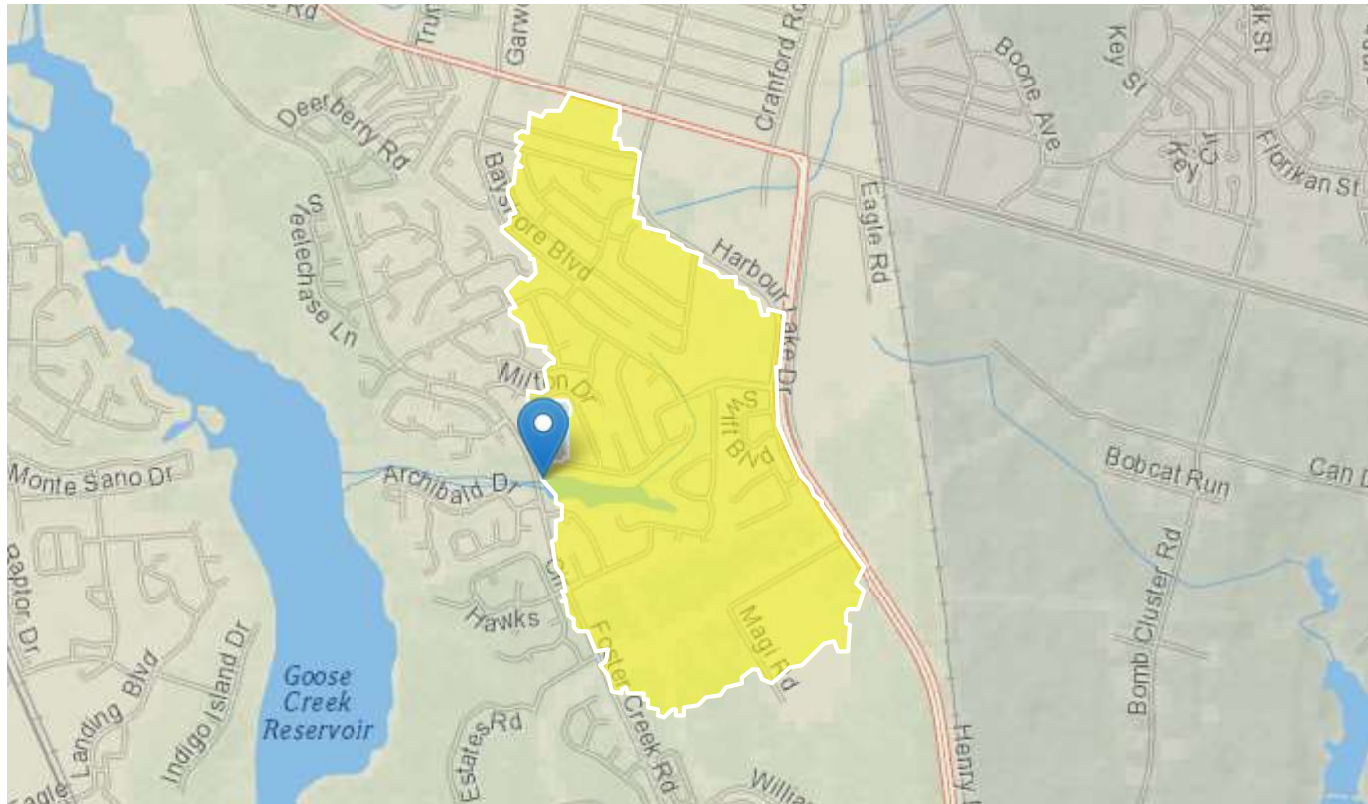
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Monday, August 13, 2018



Region ID: SC
Workspace ID: SC20180712185032022000
Clicked Point (Latitude, Longitude): 32.95760, -80.01641
Time: 2018-07-12 14:50:47 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM30FT	Mean basin slope, based on slope percent grid	2.17	percent
DRNAREA	Area that drains to a point on a stream	0.78	square miles
ELEVMAX	Maximum basin elevation	43.2	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	10.1	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.35	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.73	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	4.15	inches
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	81.7	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	10.659	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	30.5	percent
MINBELEV	Minimum basin elevation	9.74	feet
PRECIP	Mean Annual Precipitation	50.3	inches
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	4.83	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	0.37	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	2.701	percent

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*PR7 Redeemer Drive Wet Pond Restoration**Description*

Project Description	Restoration of pond area (PR7).
Location	Redeemer Drive on 2 private parcels
BMP Type	Wet Pond Restoration (PR7)
Notes	Drainage Area of 96 Acres from Stream Stats. Minimum of 25% Impervious used. Pond can treat 0.1", not the full 0.5" due to size. Includes mucking out of the pond, wetland plantings and adding an outlet structure. This area is not listed on the NWI.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR7	34,848	0.1	24	133	34	4,317	Medium

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR7	\$83,374	\$3,474	\$4,110

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR7	Good	Possible Wetland Impacts	Private Residence	Residential	Not Probable

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR7 - Redeemer Drive

 Project Berkeley County GC WMP
 J.O. 17180095101

 Site **PR7 - Redeemer Drive**
 Task _____

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume			Source	
DA	96.00 ac	P _E	0.50 in	P _E from BC design procedure
%I	25.0% percent			
IA	24.00 ac			
WQv = the first ½ inch of runoff from the entire area draining to the pond Actual WQv = 34,848 cf (First 0.1 inches draining to pond) 1291 Target WQv = 174,240 = 0.5" from drainage area				

Volume			Source	
Ltop =	150 ft			GIS Measurement
Wtop =	100 ft			GIS Measurement
Spond =	2 :1			Side slope
Atop =	15,000 sf			From GIS Measurement
Abot =	12,600 sf			From slope
Dmax =	2.5 ft			Estimate from field observation
RS = Dmax/2 x (Abot + Atop)	34,500 cf			1278
P _{E ADR} = RS / WQv	0.99			Treated depth for IA credit
Q = 12 x RS/IA	0.40			Treated depth for pollutant removal

Embankment Design			Source	
L =	Embankment Length	454 ft		Top perimeter from GIS
H =	Embankment Height	3.5 ft		Dmax +1
W =	Center Width	0 ft		Estimate
s =	x:1 side slopes	2		Field Estimate
	Taper x-s	25 sf		X-section of slope
	Ctr X-s H x W	0 sf		X-section of center
	Total X-s	25 sf		X-section of embankment
	Volume	412 cy		
	Footprint	4,086 sf		

Cost Estimate Quantities (Retrofit)			Source	
Clear and Grub	0.11 AC		25%	top area + embankment
Excavation	323 CY		25%	WQv
Embankment	- CY		0%	volume
Topsoil, 4"	197 SY		25%	surface area
Landscaping	197 SY		25%	Embankment + 20% Atop
Wetland Planting	417 SY		25%	Atop
Riser Structure	1 LS			

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	530	SY	\$10.00	\$5,300
Excavation	323	CY	\$20.00	\$6,453
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	197	CY	\$4.00	\$787
Landscaping	197	SY	\$7.00	\$1,378
Wetland Planting	417	EA	\$22.00	\$9,167
Riser Structure	1	EA	\$10,000.00	\$10,000
Direct Construction Cost				\$33,085
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,000
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,000
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$1,060
Subtotal Indirect Cost				\$3,060
Net Construction Cost				\$36,145
Contingency	20%	of Net Cost		\$7,229
Base Construction Cost				\$43,374
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$83,374

Cost / Impervious Acre: \$3,474

PR7 - Redeemer Drive Wet Pond Restoration



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Wednesday, August 15, 2018



*PR8 Gold Cup Lake Wet Pond Restoration**Description*

Project Description	Restoration of wet pond area (PR8).
Location	Lakeside Drive
BMP Type	Wet Pond Restoration (PR8)
Notes	Drainage Area of 134 Acres and 25.4% Impervious from Stream Stats. Includes mucking out of the pond, adding a forebay, wetland plantings and repairing the outlet structure. This area is listed on the NWI. This lake is privately owned, but it serves public roads and multiple neighborhoods.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR8	243,210	0.5	34.04	2,632	606	76,823	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR8	\$195,895	\$5,755	\$9,755

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR8	Good	Possible Wetland Impacts	Private - Gold Cup Lake Corp	Residential	None

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
PR8 - Gold Cup Lake

 Project Berkeley County GC WMP
 J.O. 171800951

 Site **PR8 - Gold Cup Lake**
 Task 1

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	134.00 ac	P_E	0.50 in
%I	25.4% percent	P_E from BC design procedure	
IA	34.04 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv =	243,210 cf
			CY 9,008

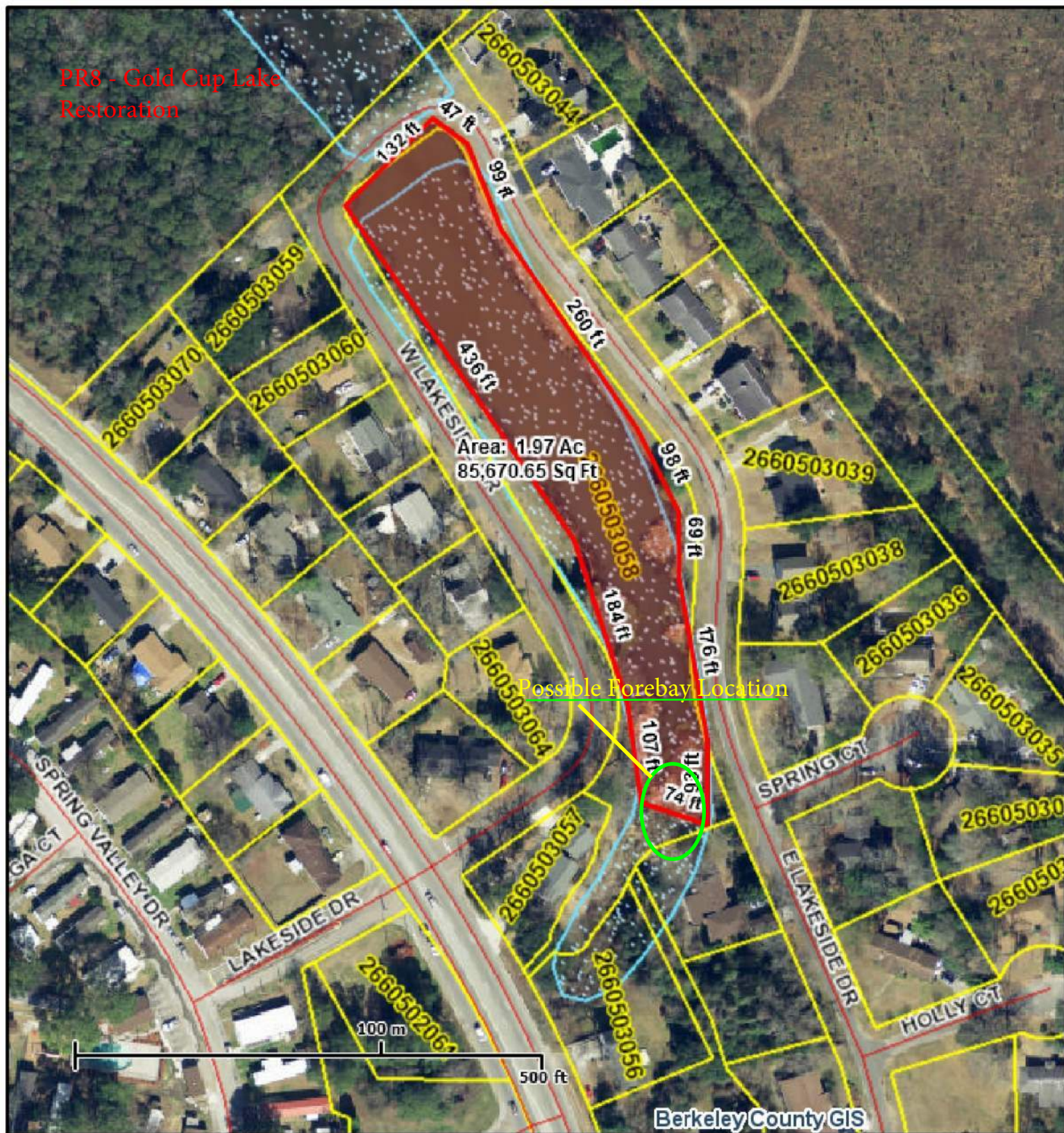
Volume		Source	
Ltop =	700 ft	GIS Measurement	
Wtop =	130 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	91,000 sf		
Abot =	76,384 sf		
Dmax =	3.0 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	251,076 cf	CY 9,299	
$P_{E\text{ ADR}} = RS / WQv$	1.03	Treated depth for IA credit	
Q = 12 x RS/IA	2.03	Treated depth for pollutant removal	

Embankment Design		Existing	Source
L =	Embankment Length	2000 ft	Top perimeter from GIS
H =	Embankment Height	4 ft	Dmax +2
W =	Center Width	0 ft	Estimate
s =	x:1 side slopes	3	Given by design criteria
	Taper x-s	48 sf	X-section of slope
	Ctr X-s H x W	0 sf	X-section of center
	Total X-s	48 sf	X-section of embankment
	Volume	3,556 cy	
	Footprint	28,000 sf	

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.27 AC	10%	As Necessary
Excavation	2,252 CY	25%	WQv
Embankment	- CY	0%	volume
Topsoil, 4"	1,027 SY	20%	surface area
Landscaping	1,027 SY	20%	Embankment + 20% Atop
Wetland Planting	- SY	0%	Atop
Riser Structure / Forebay	2 LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1,322	SY	\$10.00	\$13,220
Excavation	2,252	CY	\$30.00	\$67,558
Embankment	-	CY	\$50.00	\$0
Topsoil, 4"	1,027	CY	\$4.00	\$4,107
Landscaping	1,027	SY	\$7.00	\$7,187
Wetland Planting	-	EA	\$22.00	\$0
Riser Structure / Forebay	2	EA	\$10,000.00	\$20,000
Direct Construction Cost				\$112,072
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,000
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,000
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$2,644
Subtotal Indirect Cost				\$4,644
Net Construction Cost				\$116,716
Contingency	25%	of Net Cost		\$29,179
Base Construction Cost				\$145,895
Engr Design, Surveys, Permitting, CM	25% on NWI*	of Base, Min	\$50,000	\$50,000
Estimated Project Cost				\$195,895

Cost / Impervious Acre: \$5,755



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Wednesday, August 15, 2018



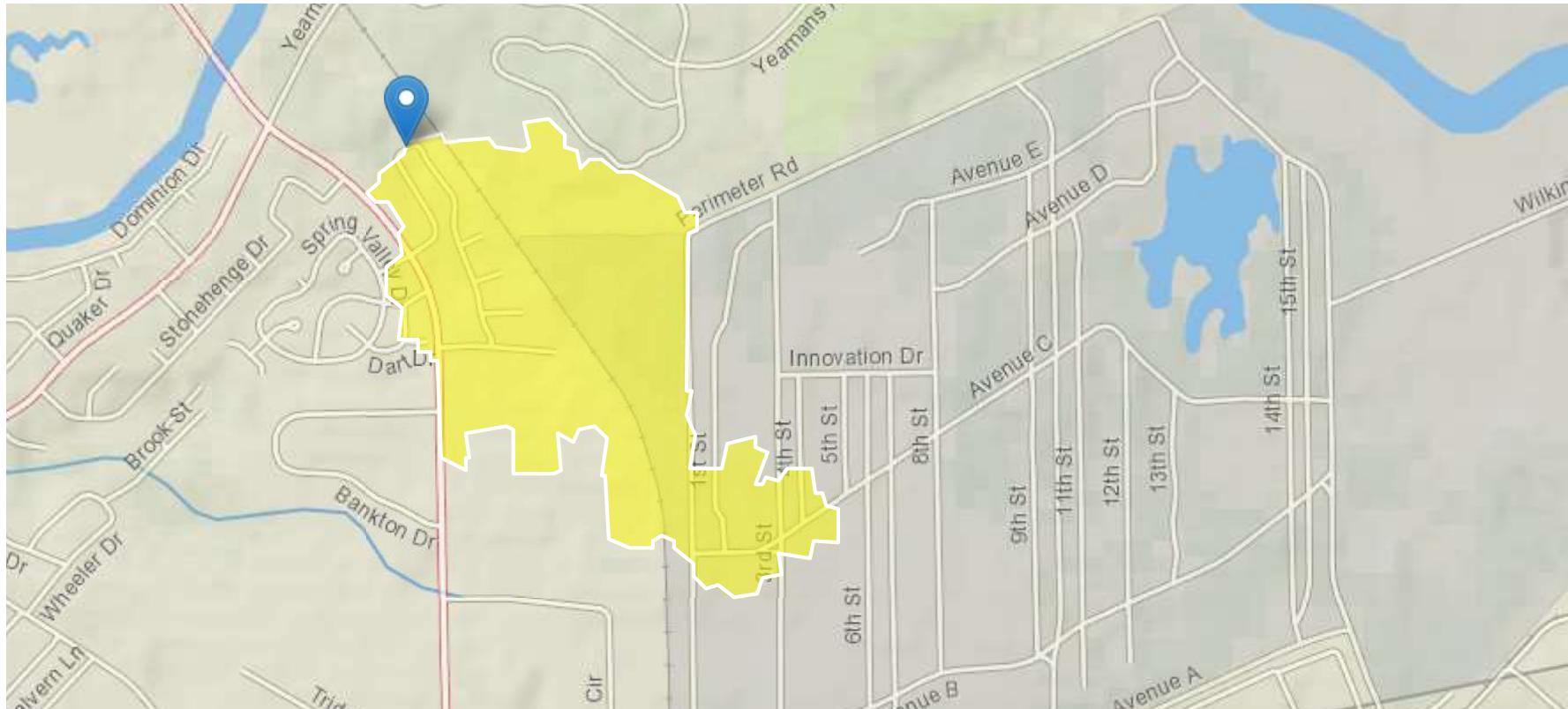
StreamStats Report Lakeview Pond

Region ID: SC

Workspace ID: SC20180712182647651000

Clicked Point (Latitude, Longitude): 32.91922, -79.98673

Time: 2018-07-12 14:27:01 -0400



Gold Cup Lake Corp

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM30FT	Mean basin slope, based on slope percent grid	4.24	percent
DRNAREA	Area that drains to a point on a stream	0.21	square miles
ELEV	Mean Basin Elevation	28.6	feet
ELEVMAX	Maximum basin elevation	44.2	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	10.1	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.36	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.76	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	4.16	inches
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	62.6	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	21.942	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	25.4	percent
MINBELEV	Minimum basin elevation	1.02	feet
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	15	percent
PRECIP	Mean Annual Precipitation	50.2	inches
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	56.1	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	0	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0.12	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	1.606	percent

*PR9 Hanahan Elementary School – Dry Pond Restoration**Description*

Project Description	Restoration of 2 Dry Ponds
Location	Hanahan Elementary School, Mabeline Road
BMP Type	Pond Restoration (PR9)
Notes	The two existing dry ponds the site appear to be poorly maintained. This would offer an educational benefit as well as treat the water before being released into the Reservoir.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
PR9	54,450	1.0	5.1	150	32	4,347	Medium

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
PR9	\$286,028	\$56,084	\$12,784

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
PR9	Good	Not Probable	Berkeley County School District (Public)	Residential / Public	Not Probable

STORMWATER RETROFIT DESIGN AND ESTIMATE
DRY POND
PR9 - Hanahan Elementary

 Project Berkeley County GC WI
J.O. 171800951

 Site **PR9 - Hanahan Elem**
 Task 1

 By FDP
 Checked _____

 Date 5/13/2019
 Date _____

Required Volume			Source		
DA	15.00	ac	P _E	1.00	in
%I	34.0%	percent	P _E from ESD design procedure		
IA	5.10	ac	WQv = first 1 inch of runoff from the entire site.		
			WQv = 54,450 cf		

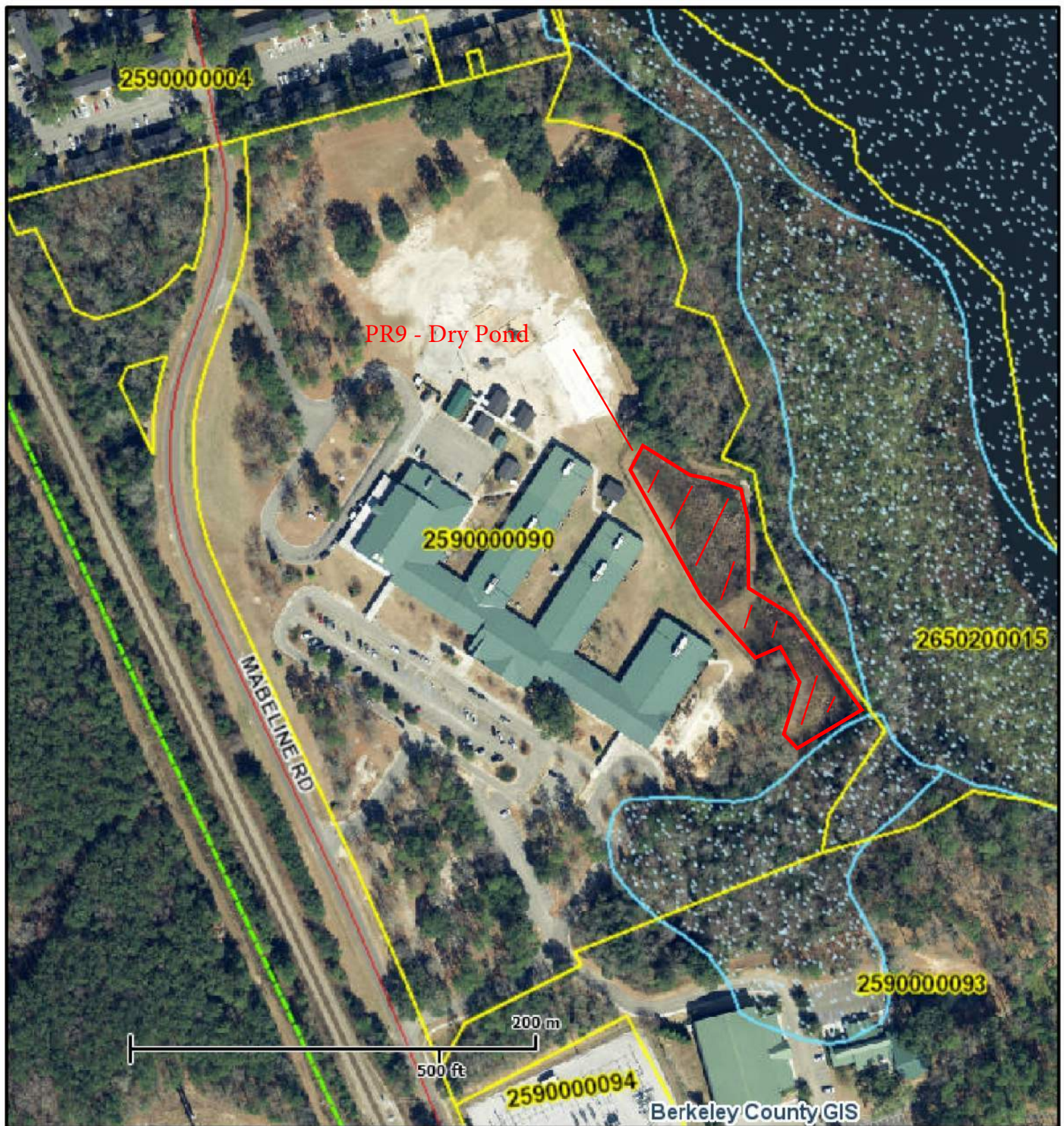
Volume			Source		
Ltop =	500	ft	Reflects overall area measured from GIS		
Wtop =	100	ft	Reflects overall area measured from GIS		
Spond =	3	:1	Side slope		
Atop =	50,000	sf			
Abot =	42,944	sf			
Dmax =	2.0	ft	Estimate from GIS Imaging		
RS = Dmax/2 x (Abot + Atop)	92,944	cf			
P _{E ADR} = RS / WQv	1.71		Treated depth for IA credit		
Q = 12 x RS/IA	5.02		Treated depth for pollutant removal		

Embankment Design			Existing	Source	
L =	Embankment Length	1000	ft	Top perimeter from design sketch	
H =	Embankment Height	4	ft	Dmax +2	
W =	Center Width	0	ft	Given by design criteria	
s =	x:1 side slopes	3		Given by design criteria	
	Taper x-s	48	sf	X-section of slope	
	Ctr X-s H x W	0	sf	X-section of center	
	Total X-s	48	sf	X-section of embankment	
	Volume	1,778	cy		
	Footprint	14,000	sf		

Cost Estimate Quantities (Retrofit)			Source	
Clear and Grub	0.37	AC	25% top area + embankment	
Excavation	504	CY	25% WQv	
Embankment	-	CY	0% volume	
Topsoil, 4"	667	SY	25% surface area	
Landscaping	667	SY	25% Embankment + 20% Atop	
Wetland Planting	5,556	SY	100% Atop	
Riser Structure	1	LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1,778	SY	\$10.00	\$17,780
Excavation	504	CY	\$40.00	\$20,167
Embankment	-	CY	\$70.00	\$0
Topsoil, 4"	667	CY	\$4.00	\$2,667
Landscaping	667	SY	\$7.00	\$4,667
Wetland Planting	5,556	EA	\$22.00	\$122,222
Riser Structure	1	EA	\$10,000.00	\$10,000
Direct Construction Cost				\$177,502
Mobilization	5%	of Subtotal, Min	\$1,000	\$1,000
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$1,000
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$3,556
Subtotal Indirect Cost				\$5,556
Net Construction Cost				\$183,058
Contingency	25%	of Net Cost		\$45,765
Base Construction Cost				\$228,823
Engr Design, Surveys, Permitting, CM	25%	of Base, Min	\$50,000	\$57,206
Estimated Project Cost				\$286,028

Cost / Imp Ac: \$56,084



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Friday, August 10, 2018



*Ind1 North Pointe Industrial Park Wet Ponds**Description*

Project Description	Restoration of the 2 existing wet ponds (Ind1).
Location	North Pointe Industrial Park on North Pointe Industrial Blvd.
BMP Type	Pond Restoration (Ind1)
Notes	These ponds are privately owned and maintained, and are included due to noticeable sediment accumulation. They only serve the industrial park area. Annual maintenance costs are not included.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
Ind1	188,760	0.5	78	1,237	264	49,850	Low

Costs

Site ID	Cost	Cost / IA Treated
Ind1	\$139,237	\$1,785

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
Ind1	Good	None	North Pointe/Center Pointe Property Owners	Industrial/Residential	None

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
Ind1 - North Rhett Ind Park
*** 2 Ponds**

 Project Berkeley County GC WMP
 J.O. 17180095101

 Site Ind1 - North Rhett Ind I
 Task Berkeley County GC WMP

 By FDP
 Checked _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	63.00 ac	P_E	0.50 in
%I	75.0% percent	P_E from BC design procedure * 2 Ponds	
IA	47.25 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv = 114,345 cf CY 4,235	

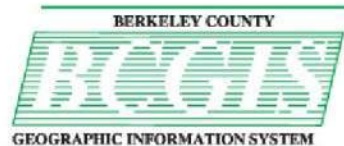
Volume		Source	
Ltop =	600 ft	GIS Measurement	
Wtop =	150 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	90,000 sf		
Abot =	81,144 sf		
Dmax =	2.0 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	171,144 cf	CY 6,339	
$P_{E\ ADR} = RS / WQv$	1.50	Treated depth for IA credit	
Q = 12 x RS/IA	1.00	Treated depth for pollutant removal	

Embankment Design		Existing		Source	
L =	Embankment Length	3400 ft		Top perimeter from GIS	
H =	Embankment Height	4 ft		Dmax +2	
W =	Center Width	0 ft		Estimate	
s =	x:1 side slopes	3		Given by design criteria	
	Taper x-s	48 sf		X-section of slope	
	Ctr X-s H x W	0 sf		X-section of center	
	Total X-s	48 sf		X-section of embankment	
	Volume	6,044 cy			
	Footprint	47,600 sf			

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.63 AC	20% top area + embankment (As r	
Excavation	1,059 CY	25% WQv	
Embankment	- CY	0% volume	
Topsoil, 4"	- SY	10% surface area	
Landscaping	- SY	0% N/A	
Wetland Planting	- SY	0% N/A	
Riser Structure	1 LS		

Cost Estimate					
ITEM	QUANTITY	UNITS		UNIT COST	TOTAL
Clear and Grub	1,529	SY	* 0.34 Acres	\$10.00	\$15,290
Excavation	1,059	CY		\$30.00	\$31,763
Embankment	-	CY		\$50.00	\$0
Topsoil, 4"	-	CY		\$4.00	\$0
Landscaping	-	SY		\$7.00	\$0
Wetland Planting	-	EA		\$22.00	\$0
Riser Structure	-	EA		\$10,000.00	\$0
Direct Construction Cost					\$47,053
Mobilization	5%		of Subtotal, Min	\$1,000	\$1,000
Ancillary Items	5%		of Subtotal, Min	\$1,000	\$1,000
Erosion / Sediment Control	20%		of Subtotal, Min	\$1,000	\$3,058
Subtotal Indirect Cost					\$5,058
Net Construction Cost					\$52,111
Contingency	20%		of Net Cost		\$10,422
Base Construction Cost					\$62,533
Engr Design, Surveys, Permitting, CM	20%		of Base, Min	\$40,000	\$40,000
Estimated Project Cost					\$102,533

* 2 Ponds Cost / Impervious Acre: \$2,170



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Wednesday, August 15, 2018



*Ind2 North Rhett Industrial Park Wet Ponds**Description*

Project Description	Restoration of the 2 existing wet ponds (Ind2).
Location	North Rhett Industrial Park off Henry Brown Blvd.
BMP Type	Pond Restoration (Ind2)
Notes	These ponds are privately owned and maintained, and are included due to noticeable sediment accumulation. They only serve the industrial park area. Annual maintenance costs are not included.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
Ind2	114,345	0.5	47	749	160	30,198	Low

Costs

Site ID	Cost	Cost / IA Treated
Ind2	\$102,533	\$2,170

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
Ind2	Good	None	North Rhett Land LLC	Industrial/Residential	None

STORMWATER RETROFIT DESIGN AND ESTIMATE
WET POND
Ind2 - North Rhett Ind Park
*** 2 Ponds**

 Project Berkeley County GC WMP
 J.O. 17180095101

 Site Ind2 - North Rhett Ind I
 Task Berkeley County GC WMP

 By FDP
 Checked

 Date 4/29/2019
 Date

Required Volume		Source	
DA	63.00 ac	P_E	0.50 in
%I	75.0% percent	P_E from BC design procedure * 2 Ponds	
IA	47.25 ac	WQv = the first ½ inch of runoff from the entire area draining to the pond	
		WQv = 114,345 cf CY 4,235	

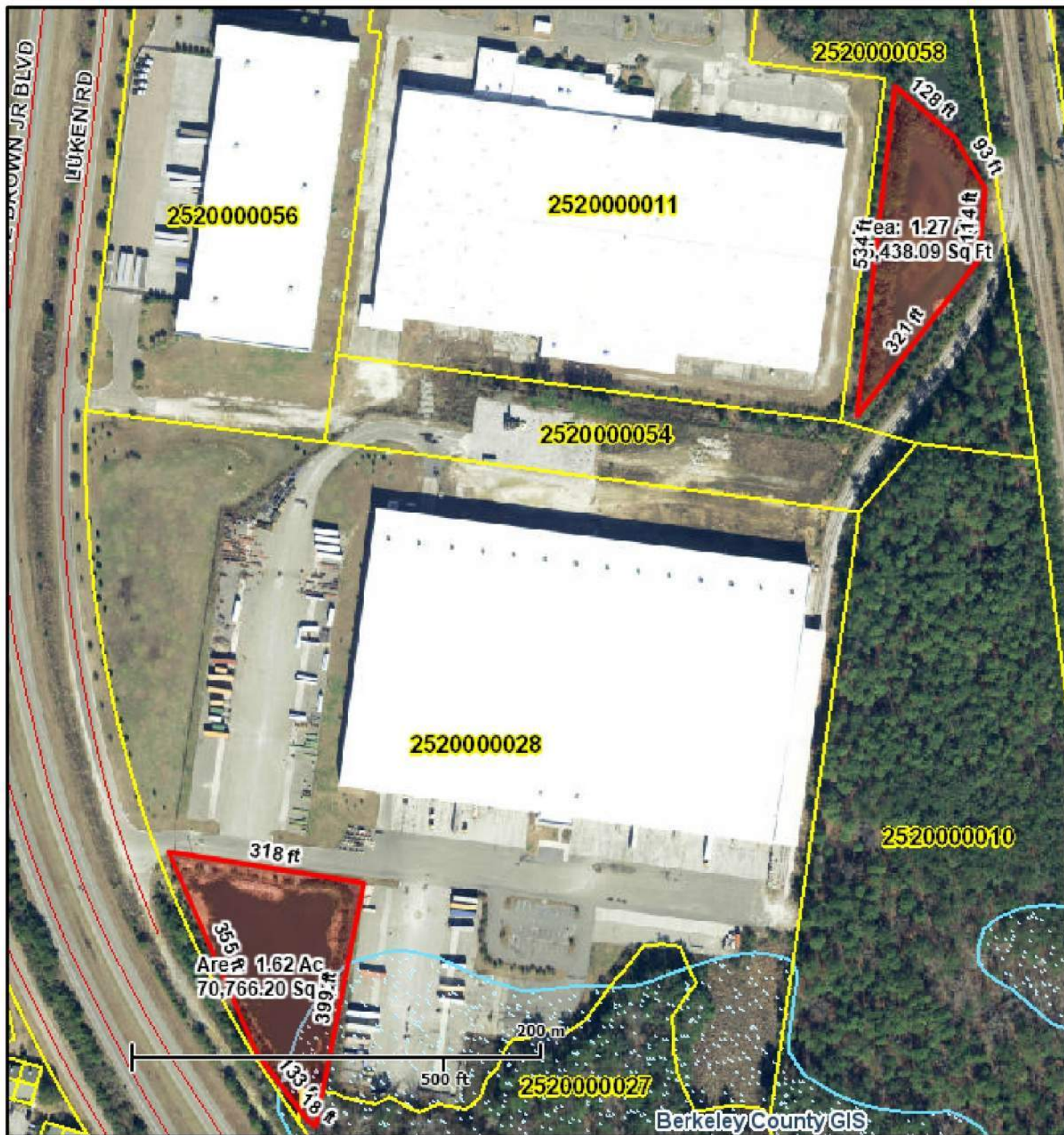
Volume		Source	
Ltop =	600 ft	GIS Measurement	
Wtop =	150 ft	GIS Measurement	
Spond =	3 :1	Side slope	
Atop =	90,000 sf		
Abot =	81,144 sf		
Dmax =	2.0 ft	Estimate from field observation	
RS = Dmax/2 x (Abot + Atop)	171,144 cf	CY 6,339	
$P_{E\ ADR} = RS / WQv$	1.50	Treated depth for IA credit	
Q = 12 x RS/IA	1.00	Treated depth for pollutant removal	

Embankment Design		Existing	Source
L =	Embankment Length	3400 ft	Top perimeter from GIS
H =	Embankment Height	4 ft	Dmax +2
W =	Center Width	0 ft	Estimate
s =	x:1 side slopes	3	Given by design criteria
	Taper x-s	48 sf	X-section of slope
	Ctr X-s H x W	0 sf	X-section of center
	Total X-s	48 sf	X-section of embankment
	Volume	6,044 cy	
	Footprint	47,600 sf	

Cost Estimate Quantities (Retrofit)		Source	
Clear and Grub	0.63 AC	20% top area + embankment (As r	
Excavation	1,059 CY	25% WQv	
Embankment	- CY	0% volume	
Topsoil, 4"	- SY	10% surface area	
Landscaping	- SY	0% N/A	
Wetland Planting	- SY	0% N/A	
Riser Structure	1 LS		

Cost Estimate					
ITEM	QUANTITY	UNITS		UNIT COST	TOTAL
Clear and Grub	1,529	SY	* 0.34 Acres	\$10.00	\$15,290
Excavation	1,059	CY		\$30.00	\$31,763
Embankment	-	CY		\$50.00	\$0
Topsoil, 4"	-	CY		\$4.00	\$0
Landscaping	-	SY		\$7.00	\$0
Wetland Planting	-	EA		\$22.00	\$0
Riser Structure	-	EA		\$10,000.00	\$0
Direct Construction Cost					\$47,053
Mobilization	5%	of Subtotal, Min		\$1,000	\$1,000
Ancillary Items	5%	of Subtotal, Min		\$1,000	\$1,000
Erosion / Sediment Control	20%	of Subtotal, Min		\$1,000	\$3,058
Subtotal Indirect Cost					\$5,058
Net Construction Cost					\$52,111
Contingency	20%	of Net Cost			\$10,422
Base Construction Cost					\$62,533
Engr Design, Surveys, Permitting, CM	20%	of Base, Min		\$40,000	\$40,000
Estimated Project Cost					\$102,533

* 2 Ponds Cost / Impervious Acre: \$2,170



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Wednesday, August 15, 2018



*RF2 Hanahan High School**Description*

Project Description	Creation of 4 Bioretention Areas (RF2)
Location	Hanahan High School, Murray Blvd.
BMP Type	Bioretention (RF2)
Notes	Recommends flumes into bioretention in parking areas and tree plantings.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
RF2	11,852	1.0	3.35	157	25	4168	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
RF2	\$166,001	\$49,553	\$3,875

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
RF2	Good	Not Probable	Berkeley County School District (Public)	Residential	Possible

STORMWATER RETROFIT DESIGN AND ESTIMATE
BIORETENTION
RF2 - Hanahan High School

 Project Berkeley County GC W/
 J.O. 171800951

 Site **RF2 - Hanahan High**
 Task 1

 By: FDP
 Checked: _____

 Date 4/29/2019
 Date _____

Required Volume		Source	
DA	5.00 ac	P_E	1.00 in
%I	67.0% percent	P_E from SCDOT design procedure	
IA	3.35 ac	WQv = first 1 inch of runoff from impervious areas located on the Project site.	
		WQv = 12,161 cf	

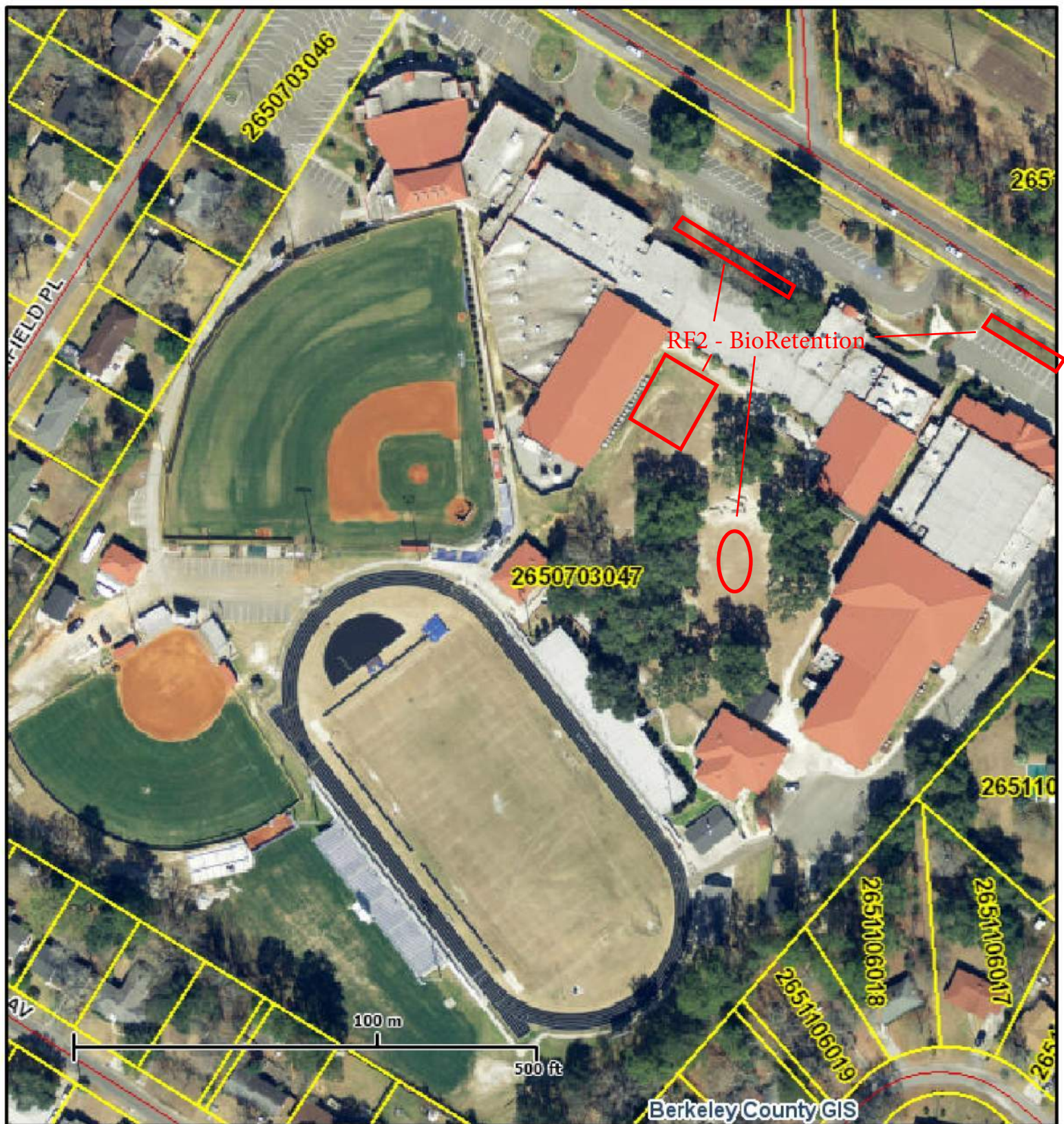
Bioretention Design		Source	
Filter	$d_f =$	2.0 ft	Filter bed depth
	$k =$	0.6 ft/day	Permeability coefficient (Bioretention soil)
	$h_f =$	1.0 ft	Water depth above filter bed
	$t_f =$	3.0 days	Filter bed drain time (Bioretention)
	$n =$	0.4	Porosity
Treatment	$L =$	400.0 ft	Measured length Reflects Over
Available	$W =$	25.0 ft	Measured width
	$A_f = L \times W$	10,000 SF	Surface area
	$RS = A_v \times h_f / 0.75$	13,333 CF	Treatment volume
	$P_{E\text{ ADR}} = RS / WQv$	- in	Treated depth for IA credit
	$Q = 12 \times RS / IA$	1.10 in	Treated depth for pollutant removal

Cost Estimate Quantities (Retrofit)		Source	
Pavement Removal	-	CY	0% area x 12" pvmt
Excavation	1,389	CY	125% surface area x ($d_f + 1$ ft)
Gravel Jacket and Underdrain	370	CY	100% surface area x 1 ft
Bioretention Soil	741	CY	100% surface area x d_f
Topsoil, 4"	1,389	SY	125% surface area
Landscaping	1,389	SY	125% surface area
Shrubs	556	EA	100% 1 per 2 SY surface area
Storm Drain	1	LS	

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	1,389	CY	\$20.00	\$27,780
Gravel Jacket and Underdrain	370	CY	\$40.00	\$14,800
Bioretention Soil	741	CY	\$10.00	\$7,410
Topsoil, 4"	1,389	SY	\$4.00	\$5,556
Landscaping	1,389	SY	\$7.00	\$9,723
Shrubs	556	EA	\$22.00	\$12,232
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$87,501
Mobilization	5%	of Subtotal, Min	\$1,000	\$4,375
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$4,375
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$8,750
Subtotal Indirect Cost				\$17,500
Neat Construction Cost				\$105,001
Contingency	20%	of Net Cost		\$21,000
Base Construction Cost				\$126,001
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$166,001

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac \$49,553



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Friday, August 10, 2018



*RF5 Goose Creek High School – New BioRetention**Description*

Project Description	Creation of 4 new Bioretention Areas (RF5)
Location	Goose Creek High School, Red Bank Road
BMP Type	Bioretention (RF5)
Notes	Recommends flumes into bioretention where necessary and tree plantings.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
RF5	12,161	1.0	3.35	157	25	4,168	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
RF5	\$193,916	\$57,885	\$3,375

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
RF5	Good	Not Probable	Berkeley County School District (Public)	Residential / Commercial	Not Probable

STORMWATER RETROFIT DESIGN AND ESTIMATE

BIORETENTION

RF5 - Goose Creek HS New BioRetention Cells

Project Berkeley County GC W
J.O. 171800951

Site RF5 - Goose Creek HS
Task Berkeley County GC W

By: FDP
Checked: _____

Date 4/29/2019
Date _____

Required Volume		Source
DA	5.00 ac	P _E from ESD design procedure
%I	67.0% percent	
IA	3.35 ac	
WQv = first 1 inch of runoff from impervious areas located on the Project site.		
WQv = 12,161 cf		

Bioretention Design			Source
Filter	$d_f =$	2.0 ft	Filter bed depth
	$k =$	0.6 ft/day	Permeability coefficient (Bioretention soil)
	$h_f =$	1.0 ft	Water depth above filter bed
	$t_f =$	3.0 days	Filter bed drain time (Bioretention)
	$n =$	0.4	Porosity
Treatment	$L =$	500.0 ft	Reflects overall area of all Cells
Available	$W =$	25.0 ft	Reflects overall area of all Cells
	$A_f = L \times W$	12,500 SF	Surface area
	$RS = A_v \times h_f / 0.75$	16,667 CF	Treatment volume
	$P_{E\ ADR} = RS / WQ_v$	- in	Treated depth for IA credit
	$Q = 12 \times RS / IA$	1.37 in	Treated depth for pollutant removal

Cost Estimate Quantities (Retrofit)			Source
Pavement Removal	-	CY	0% area x 12" pvmt
Excavation	1,736	CY	125% surface area x (d _f + 1 ft)
Gravel Jacket and Underdrain	463	CY	100% surface area x 1 ft
Bioretention Soil	926	CY	100% surface area x d _f
Topsoil, 4"	1,736	SY	125% surface area
Landscaping	1,736	SY	125% surface area
Shrubs	695	EA	100% 1 per 2 SY surface area
Storm Drain	1	LS	

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	1,736	CY	\$20.00	\$34,720
Gravel Jacket and Underdrain	463	CY	\$40.00	\$18,520
Bioretention Soil	926	CY	\$10.00	\$9,260
Topsoil, 4"	1,736	SY	\$4.00	\$6,944
Landscaping	1,736	SY	\$7.00	\$12,152
Shrubs	695	EA	\$22.00	\$15,290
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$106,886
Mobilization	5%	of Subtotal, Min	\$1,000	\$5,344
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$5,344
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$10,689
Subtotal Indirect Cost				\$21,377
Neat Construction Cost				\$128,263
Contingency	20%	of Net Cost		\$25,653
Base Construction Cost				\$153,916
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$193,916

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$57,885

*RF6 Goose Creek High School - Retrofit**Description*

Project Description	Retrofit of 2 Dry Ponds into Bioretention Areas (RF6)
Location	Goose Creek High School, Red Bank Road
BMP Type	Bioretention (RF6)
Notes	Recommends flumes into bioretention in parking area and tree plantings.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
RF6	12,161	1.0	3.35	112	16	2,558	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
RF6	\$153,913	\$45,944	\$3,375

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
RF6	Good	Not Probable	Berkeley County School District (Public)	Residential / Commercial	Not Probable

STORMWATER RETROFIT DESIGN AND ESTIMATE

BIORETENTION

RF6 - Goose Creek HS Retrofit of Dry Ponds

Project Berkeley County GC W\
J.O. 171800951

Site RF6 - Goose Creek HS
Task Berkeley County GC W\

By: FDP
Checked:

Date 4/29/2019
Date

Required Volume		Source
DA	5.00 ac	P _E from ESD design procedure
%I	67.0% percent	
IA	3.35 ac	
WQv = first 1 inch of runoff from impervious areas located on the Project site.		
WQv = 12,161 cf		

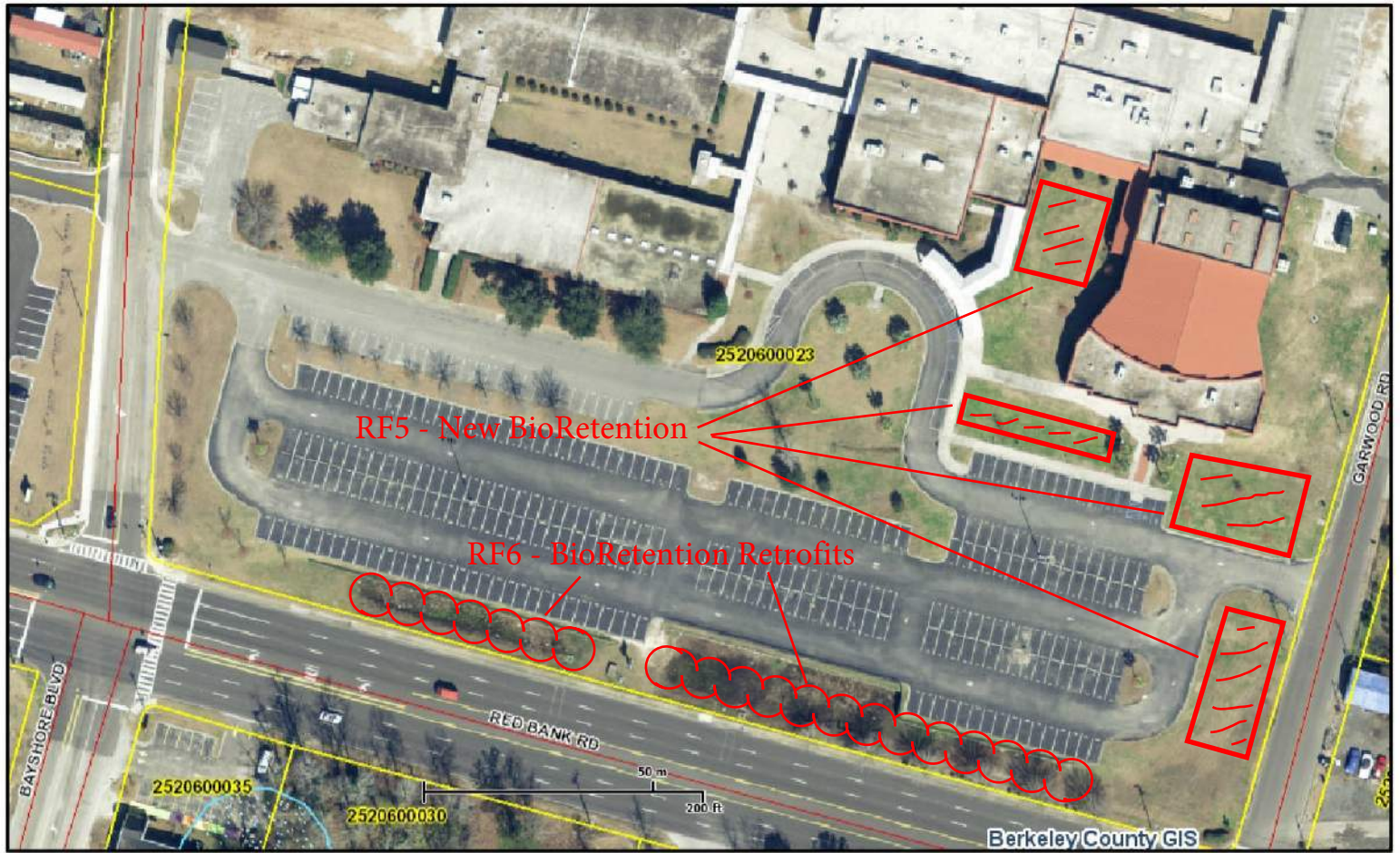
Bioretention Design			Source
Filter	$d_f =$	2.0 ft	Filter bed depth
	$k =$	0.6 ft/day	Permeability coefficient (Bioretention soil)
	$h_f =$	1.0 ft	Water depth above filter bed
	$t_f =$	3.0 days	Filter bed drain time (Bioretention)
	$n =$	0.4	Porosity
Treatment	$L =$	500.0 ft	GIS Measurement
Available	$W =$	25.0 ft	GIS Measurement
	$A_f = L \times W$	12,500 SF	Surface area
	$RS = A_v \times h_f / 0.75$	16,667 CF	Treatment volume
	$P_{E\ ADR} = RS / WQ_v$	- in	Treated depth for IA credit
	$Q = 12 \times RS / IA$	1.37 in	Treated depth for pollutant removal

Cost Estimate Quantities (Retrofit)		Source
Pavement Removal	- CY	0% area x 12" pvmt
Excavation	347 CY	25% surface area x (d _f + 1 ft)
Gravel Jacket and Underdrain	463 CY	100% surface area x 1 ft
Bioretention Soil	926 CY	100% surface area x d _f
Topsoil, 4"	1,736 SY	125% surface area
Landscaping	1,736 SY	125% surface area
Shrubs	695 EA	100% 1 per 2 SY surface area
Storm Drain	1 LS	

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	347	CY	\$20.00	\$6,940
Gravel Jacket and Underdrain	463	CY	\$40.00	\$18,520
Bioretention Soil	926	CY	\$10.00	\$9,260
Topsoil, 4"	1,736	SY	\$4.00	\$6,944
Landscaping	1,736	SY	\$7.00	\$12,152
Shrubs	695	EA	\$22.00	\$15,290
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$79,106
Mobilization	5%	of Subtotal, Min	\$1,000	\$3,955
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$3,955
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$7,911
Subtotal Indirect Cost				\$15,821
Neat Construction Cost				\$94,927
Contingency	20%	of Net Cost		\$18,985
Base Construction Cost				\$113,913
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$153,913

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$45,944



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Friday, August 10, 2018



*RF7 Aims Elementary School - Retrofit**Description*

Project Description	Creation of 2 Bioretention Areas (RF7)
Location	Aims Elementary School, Red Bank and Howe Hall Road
BMP Type	Bioretention (RF7)
Notes	Recommends swales into bioretention in and tree plantings.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
RF7	10,890	1.0	3.00	158	26	3,733	Medium

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
RF7	\$154,826	\$51,609	\$3,875

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
RF7	Good	Not Probable	Berkeley County School District (Public)	Residential / Commercial	Not Probable

STORMWATER RETROFIT DESIGN AND ESTIMATE

BIORETENTION

RF7 - Aims Elementary

Project Berkeley County GC W\
J.O. 171800951

Site RF7 - Aims Elementary
Task Berkeley County GC \

By: FDP
Checked:

Date 4/29/2019
Date

Required Volume		Source	
DA	6.00 ac	P_E	1.00 in
%I	50.0% percent	P_E from ESD design procedure	
IA	3.00 ac	WQv = first 1 inch of runoff from impervious areas located on the Project site.	
		WQv =	10,890 cf

Bioretention Design		Source	
Filter	$d_f =$	2.0	ft
	$k =$	0.6	ft/day
	$h_f =$	1.0	ft
	$t_f =$	3.0	days
	$n =$	0.4	
Treatment	$L =$	300.0	ft
Available	$W =$	30.0	ft
	$A_f = L \times W$	9,000	SF
	$RS = A_v \times h_f / 0.75$	12,000	CF
	$P_{E\text{ADR}} = RS / WQv$	-	in
	$Q = 12 \times RS / IA$	1.10	in
		Treated depth for pollutant removal	

Cost Estimate Quantities (Retrofit)			Source	
Pavement Removal	-	CY	0%	area x 12" pvmt
Excavation	1,250	CY	125%	surface area x ($d_f + 1$ ft)
Gravel Jacket and Underdrain	333	CY	100%	surface area x 1 ft
Bioretention Soil*	667	CY	100%	surface area x d_f
Topsoil, 4"	1,250	SY	125%	surface area
Landscaping	1,250	SY	125%	surface area
Shrubs	500	EA	100%	1 per 2 SY surface area
Storm Drain	1	LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	1,250	CY	\$20.00	\$25,000
Gravel Jacket and Underdrain	333	CY	\$40.00	\$13,320
Bioretention Soil*	667	CY	\$10.00	\$6,670
Topsoil, 4"	1,250	SY	\$4.00	\$5,000
Landscaping	1,250	SY	\$7.00	\$8,750
Shrubs	500	EA	\$22.00	\$11,000
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$79,740
Mobilization	5%	of Subtotal, Min	\$1,000	\$3,987
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$3,987
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$7,974
Subtotal Indirect Cost				\$15,948
Neat Construction Cost				\$95,688
Contingency	20%	of Net Cost		\$19,138
Base Construction Cost				\$114,826
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$40,000	\$40,000
Estimated Project Cost				\$154,826

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$51,609



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Friday, August 10, 2018



*RF8 Kapstone BioRetention Areas**Description*

Project Description	Addition of 2 Bioretention Areas (RF8)
Location	Powerline Right-of-Way, Dennis Drive near Murray Drive
BMP Type	Bioretention (RF8)
Notes	Site receives drainage from 22.7 acre area according to StreamStats. Minimum imperviousness of 25% is used. Equipment access up and down the right of way must be preserved.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
RF8	20,618	1.0	5.68	348	59	7,067	High

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
RF8	\$333,179	\$58,658	\$4,000

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
RF8	Good	Not Probable	Kapstone Charleston Kraft LLC (Private)	Residential	Possible / Overhead Power on site and Gas Line in the area

STORMWATER RETROFIT DESIGN AND ESTIMATE

BIORETENTION

RF8 - Kapstone BioRetention

Project Berkeley County GC W/
J.O. 171800951

Site RF8 - Kapstone Biof
Task Berkeley County GC \

By: FDP
Checked:

Date 4/29/2019
Date

Required Volume			Source	
DA	22.70 ac	P_E	1.00 in	P_E from ESD design procedure
%I	25.0% percent			
IA	5.68 ac	WQv = first 1 inch of runoff from impervious areas located on the Project site.		
		WQv =	20,618 cf	

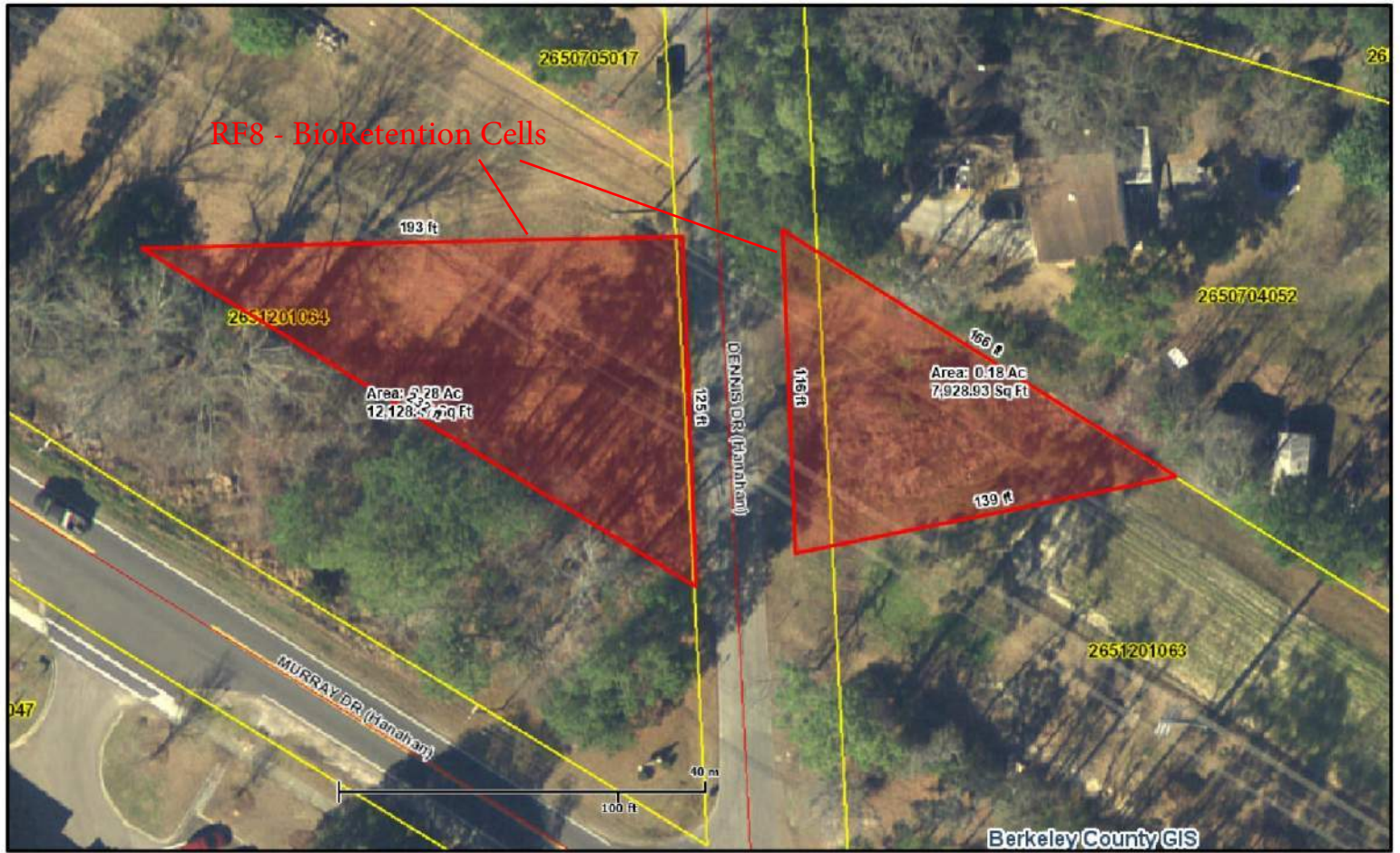
Bioretention Design			Source	
Filter	$d_f =$	2.0 ft	Filter bed depth	
	$k =$	0.6 ft/day	Permeability coefficient (Bioretention soil)	
	$h_f =$	1.0 ft	Water depth above filter bed	
	$t_f =$	3.0 days	Filter bed drain time (Bioretention)	
	$n =$	0.4	Porosity	
Treatment	$L =$	200.0 ft	Two Cells	
Available	$W =$	100.0 ft	Reflects overall area of both Cells	
	$A_f = L \times W$	20,000 SF	Surface area	
	$RS = A_v \times h_f / 0.75$	26,667 CF	Treatment volume	
	$P_{E\text{ ADR}} = RS / WQv$	- in	Treated depth for IA credit	
	$Q = 12 \times RS / IA$	1.29 in	Treated depth for pollutant removal	

Cost Estimate Quantities (Retrofit)			Source	
Pavement Removal	-	CY	0%	area x 12" pvmt
Excavation	2,778	CY	125%	surface area x ($d_f + 1$ ft)
Gravel Jacket and Underdrain	741	CY	100%	surface area x 1 ft
Bioretention Soil	1,481	CY	100%	surface area x d_f
Topsoil, 4"	2,778	SY	125%	surface area
Landscaping	2,778	SY	125%	surface area
Shrubs	1,112	EA	100%	1 per 2 SY surface area
Storm Drain	1	LS		

Cost Estimate				
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	-	CY	\$100.00	\$0
Excavation	2,778	CY	\$30.00	\$83,340
Gravel Jacket and Underdrain	741	CY	\$40.00	\$29,640
Bioretention Soil	1,481	CY	\$10.00	\$14,810
Topsoil, 4"	2,778	SY	\$4.00	\$11,112
Landscaping	2,778	SY	\$7.00	\$19,446
Shrubs	1,112	EA	\$22.00	\$24,464
Storm Drain	1	LS	\$10,000.00	\$10,000
Direct Construction Cost				\$192,812
Mobilization	5%	of Subtotal, Min	\$1,000	\$9,641
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$9,641
Erosion / Sediment Control	10%	of Subtotal, Min	\$1,000	\$19,281
Subtotal Indirect Cost				\$38,562
Neat Construction Cost				\$231,374
Contingency	20%	of Net Cost		\$46,275
Base Construction Cost				\$277,649
Engr Design, Surveys, Permitting, CM	20%	of Base, Min	\$50,000	\$55,530
Estimated Project Cost				\$333,179

*Compost @ 8 CY from Bees Ferry Landfill

Cost / Imp Ac: \$58,658



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Wednesday, August 15, 2018



Bio Retention Kapstone

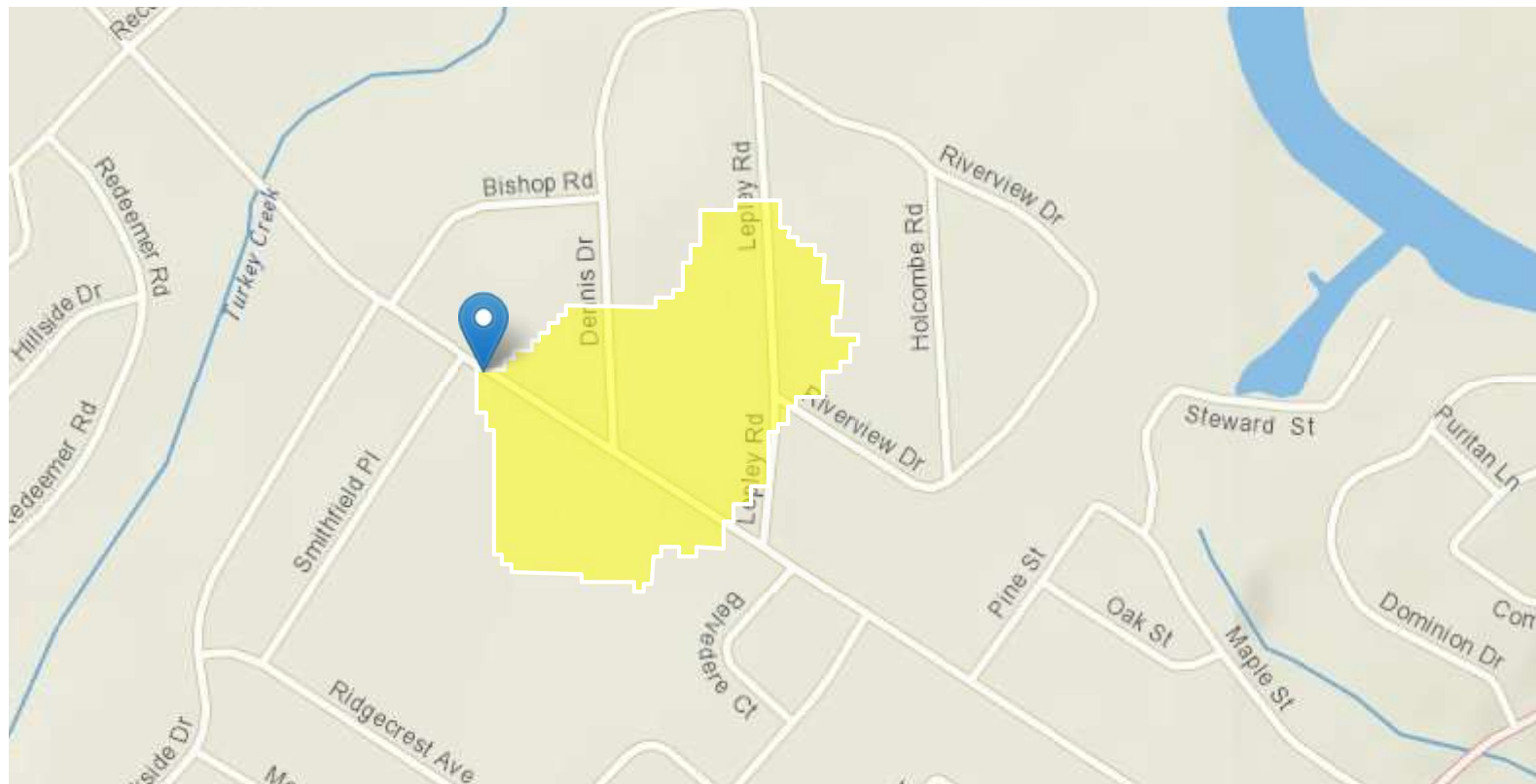
Murray Ave

Region ID: SC

Workspace ID: SC20180803201359900000

Clicked Point (Latitude, Longitude): 32.91661, -80.00871

Time: 2018-08-03 16:14:21 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM30FT	Mean basin slope, based on slope percent grid	3.97	percent
DRNAREA	Area that drains to a point on a stream	0.0355	square miles
ELEV	Mean Basin Elevation	25.2	feet
ELEVMAX	Maximum basin elevation	46.1	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	10.1	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.36	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.75	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	4.16	inches
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	88.8	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	0	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	23.3	percent
MINBELEV	Minimum basin elevation	11.2	feet
PCTREG1	Percentage of drainage area located in Region 1	0	percent
PCTREG2	Percentage of drainage area located in Region 2	0	percent
PCTREG3	Percentage of drainage area located in Region 3	0	percent
PCTREG4	Percentage of drainage area located in Region 4	100	percent
PCTREG5	Percentage of drainage area located in Region 5	0	percent
PRECIP	Mean Annual Precipitation	50.4	inches
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	0	percent

Parameter Code	Parameter Description	Value	Unit
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	92.4	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent

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Application Version: 4.2.1

*SW1 Hanahan BL Parcel Swale – Water Quality Swale Retrofit**Description*

Project Description	Enhancement of approximately 1000 feet of existing drainage ditch/swale into a water quality swale (SW1)
Location	Parallel to Belvedere Drive, between Loftis Road and Sedgfield Drive
BMP Type	Dry Swale / Water Quality Swale
Notes	This parcel is listed as 'BL' meaning that there is no known owner. It is located in a transmission easement for powerlines. There is an existing swale on the parcel that the old commercial district in Hanahan drains to. This swale then outfalls into Turkey Creek by Ridgecrest Avenue. It drains 122 acres that is 42.7% impervious according to StreamStats. This swale would only infiltrate about 10% of the water quality volume for the drainage area due to its size. Access for maintenance vehicles must be preserved.

Benefits

Site ID	WQv (cf)	P _E ADR (in)	IA Treated (ac)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Public Visibility
WL1	18,909	0.1	52.1	22	3	911	Low

Costs

Site ID	Cost	Cost / IA Treated	Annualized Maintenance Cost
WL1	\$178,789	\$3,432	\$5,250

Constraints

Site ID	Access	Permitting	Ownership	Adjacent Land Use	Existing Utility Conflicts
WL1	Good	Not Probable	Blank Parcel	Residential / Commercial	Overhead Power / Other utilities may exist



STORMWATER RETROFIT DESIGN AND ESTIMATE
DRY SWALE TEMPLATE
SW1 - BL Parcel near Belvedere Drive

Project Berkeley County GC W Site SW1 - BL Parcel near By FDP Date 4/29/2019
 J.O. 171800951 Task Berkeley County GC Checked _____ Date _____

Required Volume

DA	122.00 ac	P_E	1.00 in	P_E from ESD design procedure
%I	42.7% percent			
IA	52.09 ac	WQv = first 1 inch of runoff from impervious areas located on the Project site.		
				WQv = 18,909 cf (0.1" from impervious surface)
				WQv = 189,087 Full 1" WQV for impervious surface

Swale Design

L =	1,050 ft	Source	Total length from mapping
b =	14 ft		Bottom width from mapping
D =	2.0 ft		Filter bed depth
p =	40.0 %		Porosity
z1 =	3.0 :1		Left side slope estimate
z2 =	3.0 :1		Right side slope estimate
t = $b + 2 \times z \times d/2$	20.0 ft		Top width
S =	2.0 %		Longitudinal slope from mapping
CD = $L \times S / d$	11		No. of check dams =
d =	2 ft		Check dam height
l =	100 ft		Length behind check dam
Vcd = $[d^2 \times l \times (z1+z2) + 3 \times b \times d \times l]$	1,800 cf		Volume behind check dam
RS = Vcd x CD	19,800 cf		Treatment volume
$P_{E\ ADR} = RS / WQv$	1.05 in		Treated depth for IA credit
Q = 12 x RS/IA	0.10 in		Treated depth for pollutant removal

Check V

Vtemp = $0.75 \times WQv$	14,182 cf	
Vtreated = Vprovided	1 cf	REVISE

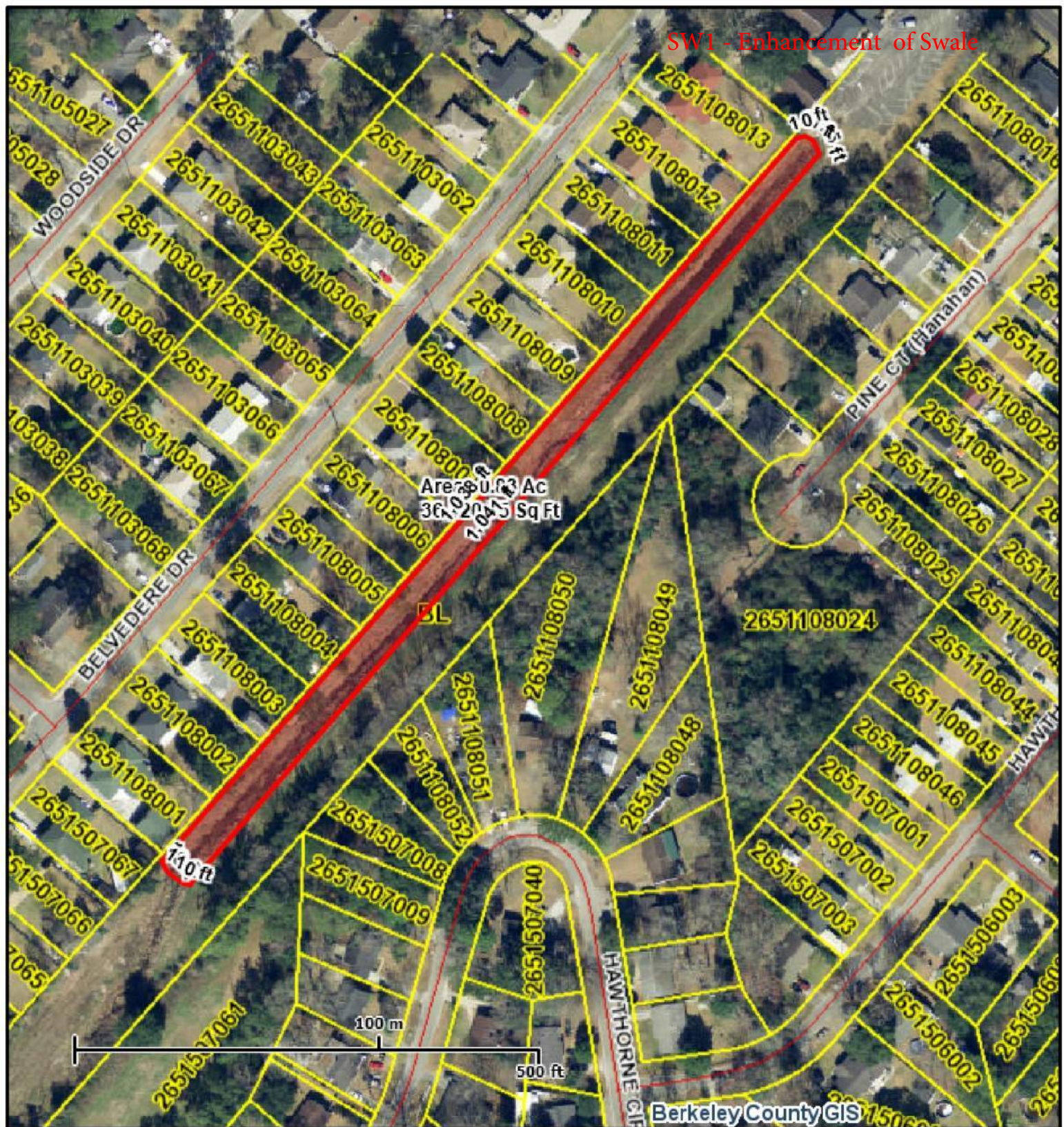
Cost Estimate Quantities (Retrofit)

Pavement Removal	7	SY	100% L x b x 8" pavement
Excavation	681	CY	125% L x b x (D+1)1 ft
Gravel Jacket and Underdrain	544	CY	100% L x b x 1 ft
Filter Media	1,089	CY	100% L x b x D
Topsoil, 4"	389	CY	100% L x t x 0.5 ft
Landscaping	2,333	SY	125% L x t

Cost Estimate

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Pavement Removal	7	SY	\$100.00	\$700
Excavation	681	CY	\$30.00	\$20,430
Gravel Jacket and Underdrain	544	CY	\$40.00	\$21,760
Filter Media	1,089	CY	\$20.00	\$21,780
Topsoil, 4"	389	CY	\$4.00	\$1,556
Landscaping	2,333	SY	\$7.00	\$16,331
Direct Construction Cost				\$82,557
Mobilization	5%	of Subtotal, Min	\$1,000	\$4,128
Ancillary Items	5%	of Subtotal, Min	\$1,000	\$4,128
Erosion / Sediment Control	20%	of Subtotal, Min	\$1,000	\$16,511
Subtotal Indirect Cost				\$24,767
Net Construction Cost				\$107,324
Contingency	20%	of Net Cost		\$21,465
Base Construction Cost				\$128,789
Engr Design, Surveys, Permitting,	20%	of Base, Min	\$50,000	\$50,000
Estimated Project Cost				\$178,789

Cost / Imp Ac: \$3,432



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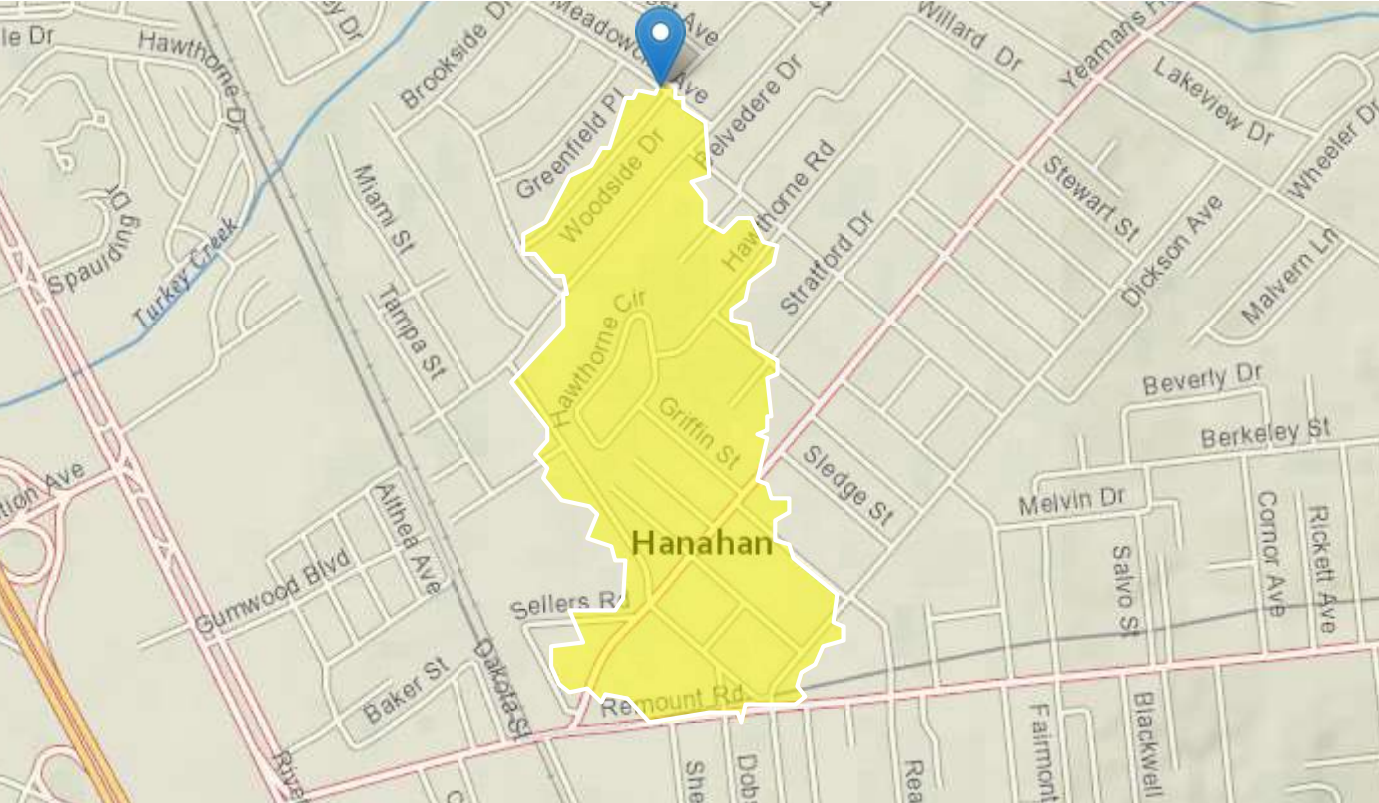
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Monday, August 13, 2018



StreamStats Report - BL Parcel for Enhanced Grass Swale GCWMP

Region ID: SC
Workspace ID: SC20180810192838259000
Clicked Point (Latitude, Longitude): 32.91148, -80.00909
Time: 2018-08-10 15:28:53 -0400



Drains Old Hanahan around Remout and Yeamans

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM30FT	Mean basin slope, based on slope percent grid	1.71	percent
DRNAREA	Area that drains to a point on a stream	0.19	square miles
ELEV	Mean Basin Elevation	37.7	feet

Parameter Code	Parameter Description	Value	Unit
ELEVMAX	Maximum basin elevation	48.4	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	10.1	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.36	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.75	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	4.16	inches
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	100	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	0	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	42.7	percent
LFPLENGTH	Length of longest flow path	1.06	miles
MINBELEV	Minimum basin elevation	14.9	feet
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
PRECIP	Mean Annual Precipitation	50.3	inches
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	0	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	92.9	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent

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