GILBERT SWAMP

WATERSHED ASSESSMENT

May | 2018

PREPARED FOR

Charles County

Department of Planning and

Growth Management

Watershed Protection and Restoration Program

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The Gilbert Swamp Watershed Assessment was a collaborative effort between Coastal Resources, Inc., KCI Technologies, Inc. and Charles County Department of Planning and Growth Management (PGM). The resulting report was authored by the following individuals from KCI Technologies, Inc. and Charles County.

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BayFAST	Bay Facility Assessment Scenario Tool
BMP	Best Management Practices
CBP	Chesapeake Bay Program
CIP	Capital Improvement Plan
EOS	Edge of Stream
EPA	U.S. Environmental Protection Agency
ESD	Environmental Site Design
FA	Future Allocation
MAST	Maryland Assessment Scenario Tool
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
SPSC	Step Pool Storm Conveyance
SW-WLA	Stormwater Wasteload Allocation
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WIP	Watershed Implementation Plan
WLA	Wasteload Allocation

1 INTRODUCTION

1.1 BACKGROUND

Charles County Department of Planning and Growth Management (PGM) has initiated a series of watershed assessments in response to requirements set forth by the Maryland Department of the Environment (MDE) in the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit (11-DP-3322 MD0068365), issued on December 26, 2014. The watershed assessments support the County's goals for healthy watersheds and natural resources, and also support progress towards satisfying several regulatory and permit requirements.

The Port Tobacco Watershed Assessment (KCI, 2015) was conducted in 2014 and served as the pilot assessment for the County's assessment methods. In 2015, the Mattawoman Creek (KCI, 2016b) and Lower Patuxent River (KCI, 2016a) watershed assessments were conducted and followed the methodologies and formats set forth in the Port Tobacco River watershed assessment. In 2016, the Zekiah Swamp, Gilbert Swamp, and Wicomico River watershed assessments were conducted. The Zekiah Swamp and Wicomico River assessment results are reported separately (KCI, 2018a and KCI, 2018b, respectively) from this Gilbert Swamp assessment report. The assessments build from the planning strategies included in the County's Phase II Watershed Implementation Plan (WIP) Strategy (February 2013). The WIP describes in broad terms the County's various non-agricultural source sectors (wastewater, urban stormwater, septic), their associated Total Maximum Daily Load (TMDL) load reduction targets, reduction strategies, costs of plan implementation and potential funding sources. The watershed assessments provide the next step in the planning process specifically for the urban stormwater sector regulated by the County's NPDES permit. The watershed assessments, through desktop and field assessment, identify watershed and water quality conditions and identify and prioritize specific restoration solutions to meet the County's watershed restoration goals.

1.2 WATERSHED DESCRIPTION

Gilbert Swamp is located in eastern Charles County, Maryland, and drains directly into the Wicomico River, which drains into the Potomac River, which ultimately drains to the Chesapeake Bay (Figures 1 and 2). The Town of Hughesville is located within the northern portion of the Gilbert Swamp watershed. Charlotte Hall is located within the eastern extent of the Charles County portion of the watershed. The Charles County/St. Mary's County line runs through the eastern extent of the watershed. Gilbert Swamp is approximately 11 miles long from the headwaters to confluence with the Wicomico River with approximately 39 square miles of its watershed contained within Charles County. Land use in the Charles County portion of the watershed is predominately forested (48%), with the remaining area devoted to developed land (25%) and agriculture (26%; MDP, 2010).

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

FIGURE 1: STUDY AREA LOCATION MAP

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

FIGURE 2: GILBERT SWAMP WATERSHED LOCATION

1.3 PREVIOUS WATERSHED STUDIES AND ASSESSMENTS

An effort to compile all previous watershed studies and plans is made prior to the current assessment to avoid redundancy and to include all planned projects in load reduction modeling. No previous studies or plans were identified that included specific planned watershed restoration projects for the load reduction modeling in Section 4.2. Gilbert Run is a largely rural watershed, thus studies, assessments and management strategies have primarily addressed agricultural issues.

Between 1960 and 1966, three dam and channelization construction permit applications for Gilbert Run flood control were submitted to the Maryland Commission of Geology, Mines and Water Resources, and subsequently the Maryland Department of Water Resources, by the Gilbert Run Public Watershed Association (Trinity and Jameson Lakes) and the Charles County Parks and Recreation Board (Gilbert Lake).

Construction of the three dams and 11.2 miles of channelization was complete by 1968. In 2002, the Charles County Government took over maintenance responsibility for Trinity and Jameson Lakes from the Gilbert Run Public Watershed Association, and both parties agreed to allow the channelization to "revert to nature."

Gilbert Run is part of the larger Wicomico River watershed, which was designated a State Scenic River in 1974. Almost a decade later, an interagency committee was formed by the State to coordinate research and management efforts in the Wicomico and its surrounding tributaries. The resulting *Wicomico Scenic River Study and Management Plan* was completed and adopted by Charles County in 1994. The objectives for the Gilbert Swamp watershed encourage federal, state and local government agencies to participate in a full environmental impact study of the Gilbert Run flood control project. To date, this study has not been initiated.

1.4 GOALS

1.4.1 WATERSHED ASSESSMENTS

The County's current round of watershed assessments will satisfy section IV.E.1 of the NPDES permit to develop detailed watershed assessments for the entire County by the end of the permit term (2019) with a focus on urban stormwater sources and restoration. The following schedule of assessments is being implemented:

- Port Tobacco – completed 2015;
- Mattawoman Creek and Lower Patuxent River – completed 2016;
- Zekiah Swamp, Gilbert Swamp, and Wicomico River – completed 2017; and
- Potomac River (upper, middle, lower) and Nanjemoy Creek – completed 2017.

The assessments identify management strategies that support several planning goals, including:

- Implementation of restoration efforts for twenty percent of the County's impervious area;

- Meeting Chesapeake Bay Total Maximum Daily Load (TMDL) stormwater load reduction targets; and
- Meeting TMDL targets for local waterway impairments, specifically stormwater waste-load allocations (SW-WLAs).

To accomplish these goals the assessments are structured to meet the following objectives:

- Characterize current water quality conditions;
- Characterize current stream and watershed conditions;
- Identify and rank water quality problems;
- Identify and prioritize water quality improvement projects;
- Estimate pollutant load reductions achievable with implementation of the plan and develop reduction milestones towards meeting SW-WLAs.

Because the primary goal of this current study is related to the urban stormwater sector and meeting the restoration goals of the NPDES permit, watershed elements such as rare, threatened and endangered species, coastal waterways, climate impacts, etc. while extremely important are outside of the scope of this current effort. These elements are addressed in other State and County planning efforts and the results of this study can be combined with those efforts to address a wider range of watershed features.

1.4.2 IMPERVIOUS RESTORATION

As a requirement of the NPDES MS4 Discharge Permit issued by MDE to Charles County, the County must treat 20% of remaining County-wide baseline untreated impervious acres by the end of the current permit term in December, 2019. Impervious accounting methodology is included in Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (MDE, 2014). Untreated impervious includes those areas where stormwater practices provide less than the current Maryland standard water quality volume for runoff from 1" of rainfall. Section 6.3 of this report describes the impervious credit achieved, with specificity for the Gilbert Swamp watershed. Charles County has developed a Restoration Plan (KCI, 2017), which outlines the requirements for County-wide watershed restoration activities and demonstrates ways to meet the TMDLs and 20% impervious surface restoration.

1.4.3 TMDLS

The total allowable load to a waterbody consists of two categories of sources: point sources (Wasteload Allocation or WLA) and non-point sources (Load Allocation or LA). Stormwater regulated by NPDES permits is regulated as a point source. In Maryland, MDE designates this allowable load as the SW-WLA. They may also include other components, a Margin of Safety (MOS) which has generally been included implicitly in the analysis and takes into account the uncertainty between the model and the actual environment, and a Future Allocation (FA) which is used to account for growth in wastewater point sources and is not frequently included.

There are no local TMDLs with SW-WLAs assigned to Charles County for the Gilbert Swamp watershed.

Chesapeake Bay TMDL

In December, 2010, the U.S. Environmental Protection Agency (EPA) published the Chesapeake Bay TMDL. The Bay TMDL, with a target completion date of 2025, sets limits on loading of three pollutants (nitrogen, phosphorus and sediment) delivered to the Bay from contributing segments, such as the Gilbert Swamp watershed.

The County's MS4 permit is requiring compliance with the Chesapeake Bay TMDL for the urban stormwater sector through the use of the 20% impervious surface treatment strategy, with a target completion date of 2019. Therefore, it is expected that the 20% goal and associated credit accounting will take precedence over the Bay TMDL loading goals and crediting. While not a requirement in the County's MS4 permit, the strategies provided in this plan have been modeled in order to calculate expected progress toward meeting the Bay TMDL reduction goals. It is expected that the 20% impervious surface treatment target will treat a portion of the Chesapeake Bay TMDL urban sector goal and that another impervious reduction target will be included in the County's next NPDES MS4 permit to achieve the remainder.

Charles County's Bay TMDL goal is defined at the County scale and is provided here in Table 1 with the reduction described in terms of both the loading reduction and the percent reduction. Section 6 of this report describes the reductions achieved, with more specificity for the Gilbert Swamp watershed. Additional information about County-wide restoration can be found in the County's Municipal Stormwater Restoration Plan (KCI, 2017).

TABLE 1: CHARLES COUNTY BAY TMDL STORMWATER GOALS

	TN- EOS (lbs/yr)	TP- EOS (lbs/yr)	TSS- EOS (lbs/yr)*
Bay TMDL Goal %	18.2%	37.7%	-
Bay TMDL Target Stormwater Reduction	42,759	7,554	-

*No target reduction for sediment. It is anticipated that by achieving the phosphorus goal, enough sediment will be removed to improve water quality.

2 WATERSHED ASSESSMENT METHODS

The following assessments were conducted throughout the Gilbert Swamp watershed:

- Upland Assessment
- Nutrient Synoptic Survey
- Stream Corridor Assessment

Property access permission letters were sent to all landowners within the target watershed with streams on their property. Passive permission was assumed through the letters, although landowners were given the opportunity to deny access to their properties. All properties targeted for assessments were able to be accessed as part of this effort as no site permissions were denied.

2.1 UPLAND ASSESSMENT

KCI assessed upland pollution sources and restoration opportunities using the methodology detailed in the Center for Watershed Protection's Unified Subwatershed and Site Reconnaissance Manual (CWP, 2004). These assessments included both the Neighborhood Source Assessment (NSA) and Hotspot Site Investigations (HSI). General procedures for each type of assessment are provided in the following sections.

2.1.1 NEIGHBORHOOD SOURCE ASSESSMENT

A Neighborhood Source Assessment (NSA) reconnaissance was conducted in residential neighborhood areas to evaluate pollution-producing behaviors. The NSA rates the potential severity and type of non-point source pollution from residential behaviors. It also provides an assessment of the influence of imperviousness for each site by providing an estimate of whether roof drainage is directed to cisterns, storm drains, impervious areas or pervious areas and the percent of driveways in the neighborhood that are impervious. Although MDE considers both paved and gravel/dirt driveways fully impervious, unpaved driveways do allow for some infiltration and were considered not fully impervious in this assessment.

A desktop analysis was performed in which all neighborhoods in the Gilbert Swamp watershed were identified and delineated. These neighborhoods were then categorized by similar characteristics, including house type (single family, townhouse, etc.), lot size, year built, and stormwater management era. Individual neighborhoods that characterized each category were selected for field visits so the assessment was conducted in a variety of residential areas that represent the different housing types found throughout each watershed. Neighborhoods were then rated on the Pollution Severity Index as either severe, high, moderate, or none based on their potential to generate pollutants. Neighborhoods were also rated on the Restoration Opportunity Index as either high, moderate, or low based on their potential for restoration opportunities.

2.1.2 HOTSPOT SITE INVESTIGATIONS

A Hotspot Site Investigation (HSI) was conducted to identify potential stormwater hotspots. Hot Spots for this plan are defined as commercial, industrial, institutional, municipal or transportation-related operations that typically produce high levels of stormwater runoff and pollutants, while presenting potential risk for spills, leaks or illicit discharges. These include gas stations, commercial car washes, vehicle and equipment maintenance facilities, and sites where pesticides, fertilizers, or industrial chemicals may be stored or used.

The HSI assessment was conducted at locations identified in the office from aerial photography and mapping layers in GIS, and was targeted towards business, commercial, and industrial sites in the urban areas of the watershed. Additionally, using available GIS layers, potential hot spot locations that received no or only partial stormwater management were prioritized. Field crews rated each hotspot on the likelihood that current activities at the site are causing stormwater runoff contamination. Appropriate follow-up actions for each hotspot, including education, retrofits, and referral for immediate enforcement were also noted.

2.2 NUTRIENT SYNOPTIC SURVEY

2.2.1 WATER QUALITY SAMPLING

Synoptic water quality sampling was performed across the Gilbert Swamp watershed. The sampling locations were selected by locating sites which represented the watershed and were easily accessible. Sites located on a stream that crossed under a road or other infrastructure were sampled upstream of the road so the structure was not directly impacting the flow and water quality. In some locations, a site was selected upstream and downstream of a confluence to show changes in the flow and water quality at the confluence. Sample collection did not occur within 24 hours after a rainfall event totaling more than 0.25 inches of precipitation. A sub-meter Trimble® GPS unit was used to navigate to each sample point. If a grab sample could not be collected at the original sampling point, the location was shifted upstream or downstream accordingly, and an additional GPS point was collected if the point was moved significantly. Sampling locations remained within the original sampling reach and were not moved downstream of a confluence that would include flow from any additional reaches. Site conditions (e.g. clarity, odor, condition of site) were recorded at each sampling site. Grab samples were collected from each site for laboratory analysis of water quality parameters. Samples were preserved on ice for transport immediately after they were collected. Three duplicate samples and one lab blank were collected for quality assurance purposes.

Environmental Testing Lab Inc.[1] completed all laboratory analysis according to standard, approved methods. A complete list of analytical parameters and methods, including detection limits, is presented in Table 2.

TABLE 2: WATER CHEMISTRY ANALYTICAL METHODS

Parameter	**Method**	**Detection Limit**	**Units**
Enterococcus (E. coli)	Colilert	1	MPN/100 ml
Ortho-phosphate Phosphorus	EPA 365.1	0.01	mg/L
TKN	EPA 351.2	0.5	mg/L
Nitrate + Nitrite	EPA 353.2	0.5	mg/L
Total Nitrogen	EPA 351.2 + 353.2	1	mg/L
Total Phosphorus	EPA 365.1	0.01	mg/L

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[1] 3430 Rockefeller Ct, Waldorf, MD 20602

Additional water quality measurements were collected *in situ* from each sampling site. Temperature, pH, specific conductivity, and dissolved oxygen were measured with a YSI ProPlus® multiprobe, and turbidity was measured with a Hach 2100 Turbidimeter. Optical brightener (fluorescent whitening agents) samples were collected in sample bottles wrapped in aluminum foil, and analyzed in the field using a Turner Designs AquaFluor® Handheld Flurometer configured with an Optical Brightener channel, following the California EPA Surface Water Ambient Monitoring Program's SOP (Burres, 2011). The Flurometer unit has a minimum detection limit of 0.5 ppm and a range of 0-30,000 ppm.

2.2.2 STREAM DISCHARGE MEASUREMENT

Stream discharge measurements were performed at each sampling site in conjunction with water quality sampling in order to calculate instantaneous baseflow pollutant loads. A suitable transect, one that approximates a "U" shaped channel, was located at each site for measuring stream discharge. Transects were selected to be free of irregularities that may create backflows and cross flows. A SonTek FlowTracker® Handheld Acoustic Doppler Velocimeter was used to collect a series of approximately 10 velocity measurements at regular intervals across the wetted width of the stream to determine instantaneous discharge. The measurements collected at regular intervals included depth (to the nearest 0.5 cm) and velocity (to the nearest 0.00 m/sec). Velocity was measured at 60% of the distance from the water surface to the bottom of the stream. Due to the difficulty of obtaining accurate discharge measurements of a stream with max depth below 0.2 feet with the flowmeter, discharge at low flow sites was obtained by measuring cross sectional area and using a float to measure velocity.

2.3 STREAM CORRIDOR ASSESSMENT

Stream corridor assessments (SCA) were conducted on carefully selected priority stream reaches throughout the watershed in order to rapidly assess stream corridors and identify potential restoration opportunities. Prior to performing the assessments, approximately 7.9 miles of stream reaches were prioritized using select GIS data elements as shown in Table 3 below. Approximately 11 miles of the mainstem of Gilbert Run was channelized in the 1960's, which has led to excessive downcutting of 12 feet or more. The mainstem was not included in SCA reach selection due to the agreement between Charles County Government and Gilbert Run Public Watershed Association to allow the channelization to "revert to nature."

KCI used the following general criteria for prioritizing stream reaches:

Criteria for selection:

- Topography – narrow, steep stream valleys and tortuous meander
- Vicinity to high density of stormwater infrastructure (outfalls, BMPs)
- Drainage area consists of untreated or undertreated impervious surfaces

Criteria for exclusion:

- Land use – adequate forest cover, wide riparian buffers
- Low density development and agriculture

TABLE 3: SCA REACH SELECTION AND EXCLUSION FACTORS

Data Element	Factors for selection	Factors for exclusion
Topography	Narrow, steep valleys and side slopes, tortuous meanders	Flat, wide floodplains
Stormwater infrastructure (outfalls, BMPs, BMP treated areas, Stormwater by Era)	Reaches downstream of untreated or undertreated areas	Reaches downstream of treated areas
Forest Cover	Lack of riparian buffer and forest	Adequate forest cover, wide riparian buffers
Development	Higher density development	Low density development and agriculture

Field crews conducted stream field investigations using standard SCA protocols as outlined in Stream Corridor Assessment Survey: SCA Survey Protocols (Yetman, 2001). Using the same methodology as other SCA surveys will allow for the results to be incorporated into, and directly compared against, other County and State assessment datasets. Property access permission letters were sent to all landowners within the target watershed with streams on their property. All of the properties targeted for assessments were able to be accessed as part of this effort.

The field investigation consisted of a two-person team walking the stream channel and conducting a visual assessment to locate problem areas and assess their severity and correctability. The field team collected information on channel alteration, erosion, exposed utility pipes, drainage pipe outfalls, fish barriers, inadequate buffers, construction in or near the stream, trash dumping, and recorded any unusual conditions. Representative sites were selected at locations representative of each stream segment. The general physical habitat condition was assessed at the representative sites using a modified version of the EPA's Rapid Bioassessment Protocols (Barbour et al., 1999). The assessment includes qualitative ratings for ten habitat parameters as well as information on wetted width, pool, run, and riffle depths, and channel substrate.

During the field assessment, points were given unique alphanumeric identifiers according to the stream reach and point type. This allowed each point to have a unique ID, for example, 001_IB001. A complete list of point types and corresponding alphanumeric identifiers used during the field assessments is included below:

- Erosion (ES)
- Exposed pipe (EP)
- Pipe outfall (PO)
- Inadequate buffer (IB)
- Fish barrier (FB)
- Trash dumping (TD)

- Channel alteration (CA)
- Unusual condition (UC)

A GPS location was recorded and a photograph was taken for each assessment point. Linear features (eroding banks, buffer impacts, and channel alteration) were documented with a GPS location at each end of the impact and a line feature was developed to better represent the full extent of the problem area. The assessment rated each feature on a 1 to 5 scale according to its severity, correctability, and accessibility; where a score of 1 is the most severe, but also the most correctible and the most accessible. The results were then compiled into a database which will be used to identify and prioritize areas for restoration actions.

In addition to the basic SCA set of impacts and assessments, KCI added an inventory of Potential BMP Locations, in which the field crew could identify up to five potential BMP types that could be implemented at any particular location. This reduced the need for additional field visits and property owner coordination. The potential BMP types included the following:

- Bioretention/raingarden
- Invasive plant control
- Outfall stabilization
- Riparian buffer enhancement or replacement
- Stormwater management pond
- Streambank stabilization
- Wetland creation
- Wetland restoration
- Floodplain reconnection

3 WATERSHED ASSESSMENT RESULTS

3.1 UPLAND ASSESSMENT

Upland assessments including both the NSA and HSI were completed on March 7, 2016. Field crews assessed a total of four neighborhoods and five hotspots in the Gilbert Swamp watershed.

3.1.1 NEIGHBORHOOD SOURCE ASSESSMENT

A total of four neighborhoods were assessed in the Gilbert Swamp watershed (Figure 3). General characteristics of each neighborhood are presented in Table 4. A complete record of NSA data is included in Appendix A.

TABLE 4: GENERAL CHARACTERISTICS OF NEIGHBORHOODS ASSESSED

Site ID	Neighborhood / Subdivision	LU Type	Lot Size (acres)	Age (Decade)	Curb & Gutter	% Imperv-ious	% Lawn	% Canopy
GI-NSA-1	Norwood Drive	Single Fam Detached	>1	1980	No	20	70	20
GI-NSA-2	Hillmeade Court	Single Fam Detached	>1	1990	No	20	70	10
GI-NSA-3	off Charles Street	Single Fam Detached	>1	1980-2000	No	30	45	20
GI-NSA-4	off Olivers Shop Road	Single Fam Detached	>1	1980-2000	No	10	80	50

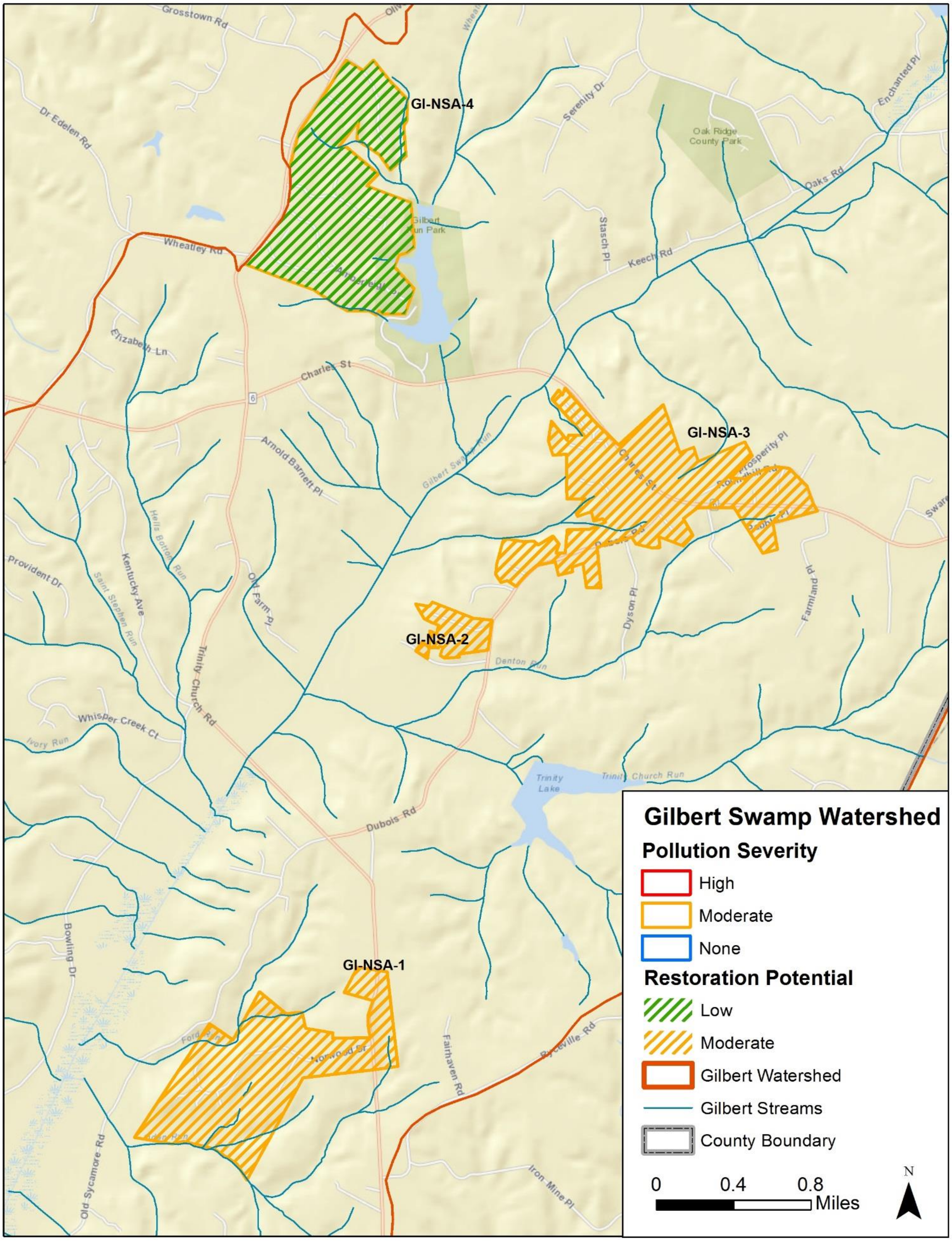


FIGURE 3: NEIGHBORHOOD SOURCE ASSESSMENT RESULTS

All four of the neighborhoods assessed received a ‘moderate’ pollution severity rating for the potential for nutrient pollution. The restoration potential was rated as ‘moderate’ for three neighborhoods and ‘low’ for one neighborhood (Table 5). The restoration potential is based off of an index that ranks specific neighborhood features using benchmark values (e.g., less than 10% of storm drains stenciled). Depending on the feature type, if more than five features fall above or below the benchmark value, the neighborhood is considered to have a ‘high’ restoration potential; three to five benchmarks will have a ‘moderate’ restoration potential; and, a neighborhood with a ‘low’ restoration potential will have two or fewer benchmarks. Rain barrels, rain gardens, and stormwater management retrofits were recommended at all neighborhoods.

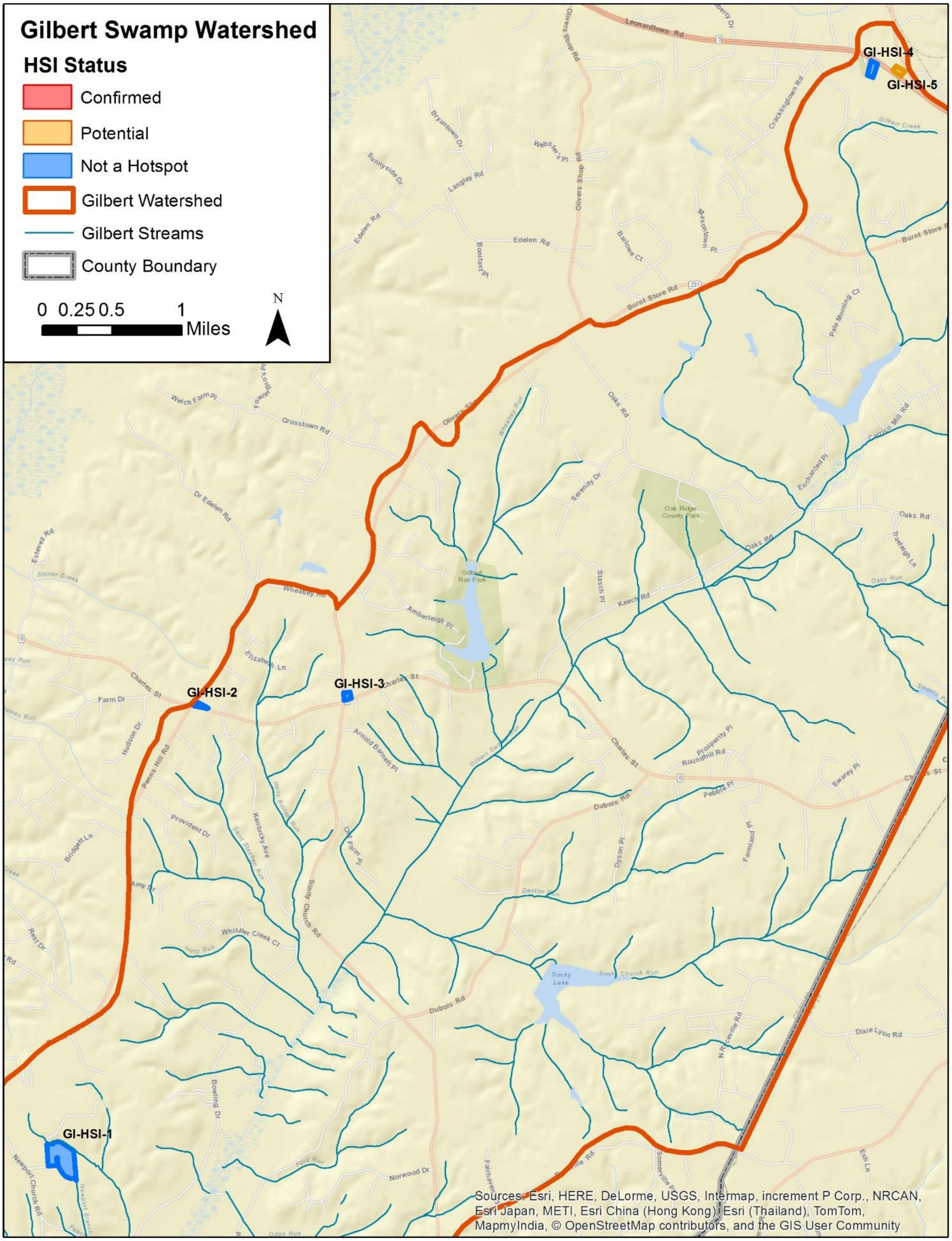
TABLE 5: NEIGHBORHOOD POLLUTION SEVERITY AND RESTORATION POTENTIAL

NSA Site ID	Neighborhood / Subdivision	Pollution Severity	Pollution Sources	Restoration Potential	Potential Action
GI-NSA-1	Norwood Drive	Moderate	Nutrients	Moderate	rain garden, rain barrels, swale retrofits
GI-NSA-2	Hillmeade Court	Moderate	Nutrients	Moderate	rain garden, rain barrels, swale retrofits
GI-NSA-3	off Charles Street	Moderate	Nutrients	Moderate	rain garden, rain barrels, swale retrofits
GI-NSA-4	off Olivers Shop Road	Moderate	Nutrients	Low	rain barrels, rain gardens, swale retrofits

3.1.2 HOTSPOT SITE INVESTIGATIONS

A total of five sites were investigated in the Gilbert Swamp watershed (Figure 4). The location, general description, and common operations (i.e., vehicle operations, outdoor materials, waste management, physical plant, turf/landscaping) of each site investigated are presented in Table 6. A complete record of HSI data is included in Appendix B.

Of the five sites investigated, only one site (GI-HSI-5) was designated a ‘potential’ hot spot for discharging pollutants into stormwater runoff, due to the presence of vehicle operations, storage of materials outdoors, and lack of stormwater treatment practices (Table 6). All other sites were determined to be ‘not a hotspot’. Onsite non-residential retrofits were recommended at four sites. Specific recommendations for each site can be found in Table 6.



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

FIGURE 4: HOT SPOT INVESTIGATION RESULTS

TABLE 6: HOT SPOT INVESTIGATION LOCATIONS AND OPERATIONS

HSI Site ID	Location	Description	Vehicle Ops	Outdoor Materials	Waste Mgmt.	Physical Plant	Landscaping	HSI Status	Potential Action	Notes
GI-HSI-1	St. Mary's Church	church	No	No	Yes	Yes	Yes	Not a Hotspot	Onsite non-residential retrofit	tree planting, new SWM
GI-HSI-2	Cooksey's Store	gas station	No	Yes	Yes	Yes	Yes	Not a Hotspot	Include in future education effort; Onsite non-residential retrofit	Parking lot repair, lid on dumpster, oil storage, space for SWM behind adjacent commercial buildings
GI-HSI-3	Simpson's Corner store	convenience store	No	No	Yes	No	No	Not a Hotspot	Onsite non-residential retrofit	parking lot repair, room for SWM surrounding parking lot
GI-HSI-4	7627 Leonardtown Rd Shopping Center	shopping center	No	Yes	Yes	Yes	Yes	Not a Hotspot	Suggest a follow-up on-site inspection	open space in front of shopping center for SWM-half building and parking drains to wet pond
GI-HSI-5	Everything Amish	commercial	Yes	Yes	Yes	Yes	Yes	Potential	Suggest follow-up on-site inspection, pervious area restoration; Onsite non-residential retrofit	SWM could be placed towards front of property along MD-5

3.2 SYNOPTIC WATER QUALITY SURVEY

Synoptic water quality sampling was performed across the Gilbert Swamp watershed from March 18 to June 29, 2016. A total of 34 sites were visited (Figure 5) for water quality and discharge measurements; however, one site was within a swamp and therefore no discharge measurements were taken although a water quality grab sample was taken. There were four sites where access to property was denied once the field crew arrived to the property. Synoptic sampling occurred at least 24 hours after rainfall events totaling more than 0.25 inches.

3.2.1 STREAM DISCHARGE

Discharge measurements were collected at each site in conjunction with the collection of grab samples with the exception of the swamp site mentioned above. Results of flow measurements are shown in Table 9. One site had no flow present during site visits due to dry (i.e., intermittent flow) conditions. Overall, discharge values ranged from 0.05 to 13.42 cubic feet per second (cfs) for sites where samples were collected.

3.2.2 WATER QUALITY

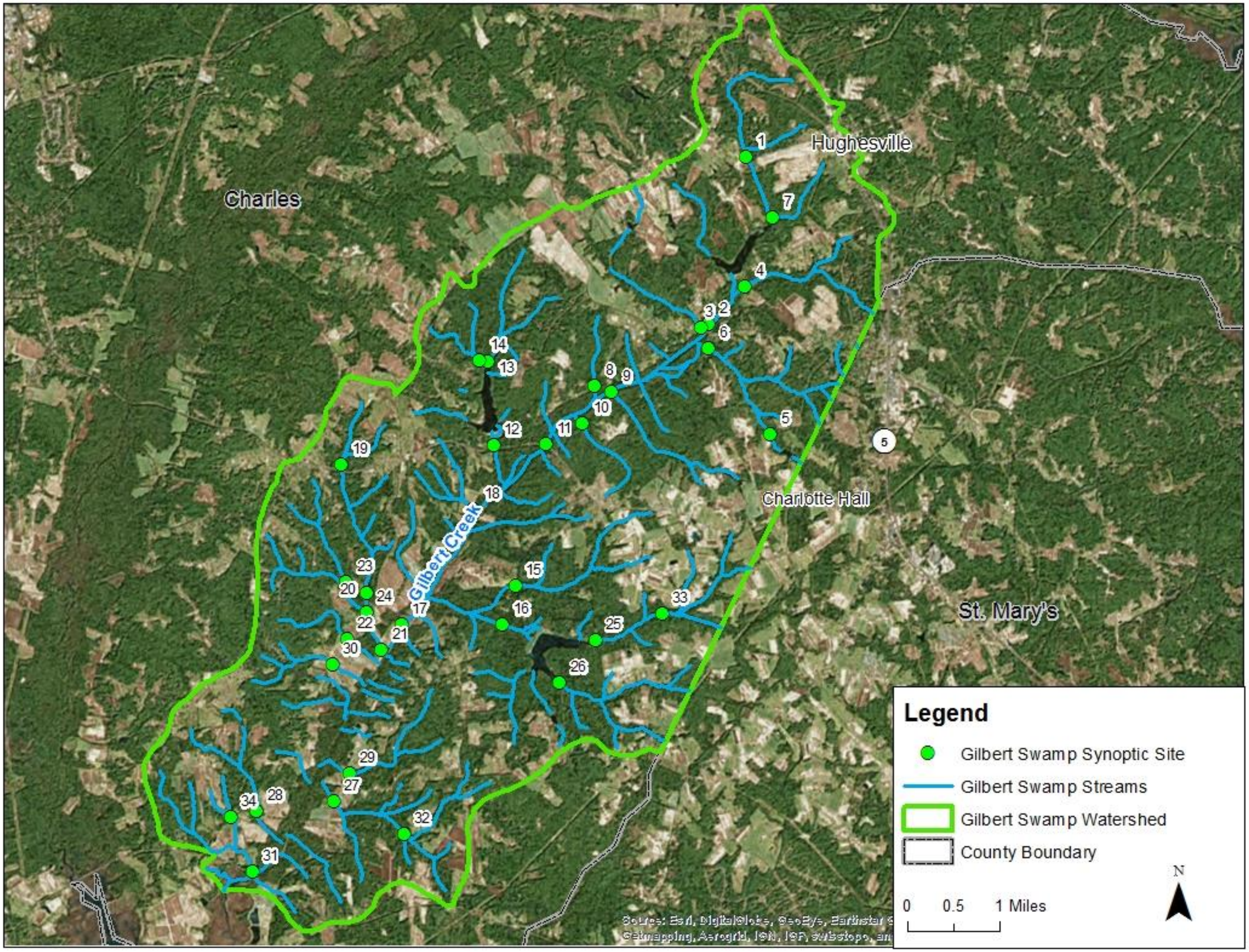
In situ water quality measurement results are presented in Table 9. Results of nutrients and bacteria baseflow concentrations and instantaneous load results, calculated using stream flow measurements, from water quality grab samples are presented in Figure 6 through Figure 10 and Table 10, which use color-coded nutrient ranges and ratings derived from Frink (1991; Table 7) and Southerland, et al. (2005; Table 8).

TABLE 7: NUTRIENT RANGES AND RATINGS FROM FRINK (1991)

Parameter	Baseline	Moderate	High	Excessive
Nitrate-Nitrite Concentration mg/L	<1	1 – 3	3 – 5	>5
Nitrate-Nitrite Yield kg/ha/day	<0.01	0.01 – 0.02	0.02 – 0.03	>0.03
Orthophosphate Concentration mg/L	<0.005	0.005 – 0.01	0.01 – 0.015	>0.015
Orthophosphate Yield kg/ha/day	<0.0005	0.0005 – 0.001	0.001 – 0.002	>0.002

TABLE 8: TOTAL NUTRIENT RANGES AND RATINGS FROM SOUTHERLAND ET AL.,(2005)

Parameter	Low	Moderate	High
Total Nitrogen mg/L	< 1.5	1.5 – 7.0	>7.0
Total Phosphorus mg/L	< 0.025	0.025 – 0.070	> 0.070



Source: Esri, DigitalGlobe, GeoEye, Earthstar G
Getmapping, Aerogrid, IGN, IGP, swisstopo, an

FIGURE 5: SYNOPTIC WATER QUALITY SURVEY SAMPLING LOCATIONS

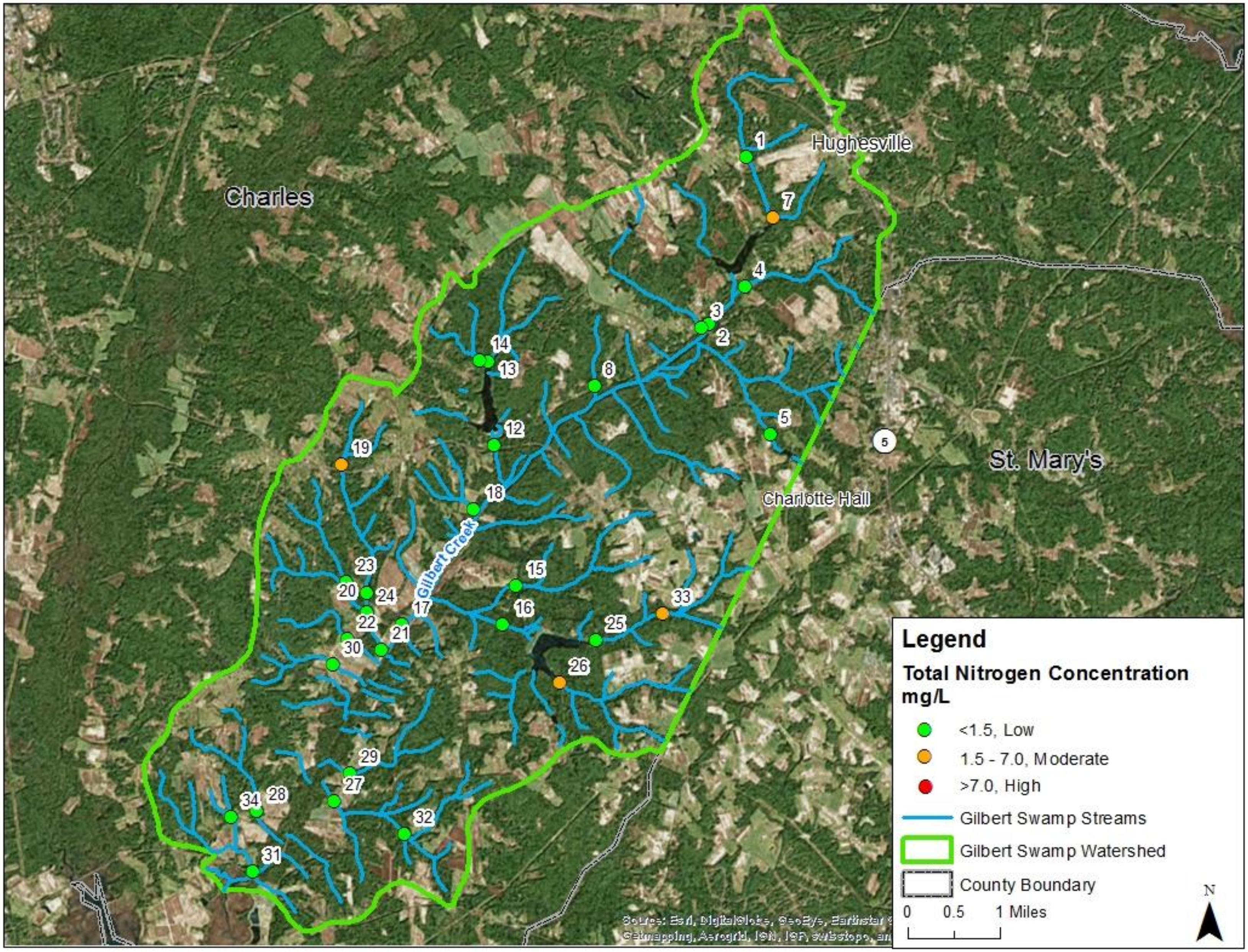


FIGURE 6: SYNOPTIC WATER QUALITY SURVEY SAMPLING RESULTS: TOTAL NITROGEN CONCENTRATION

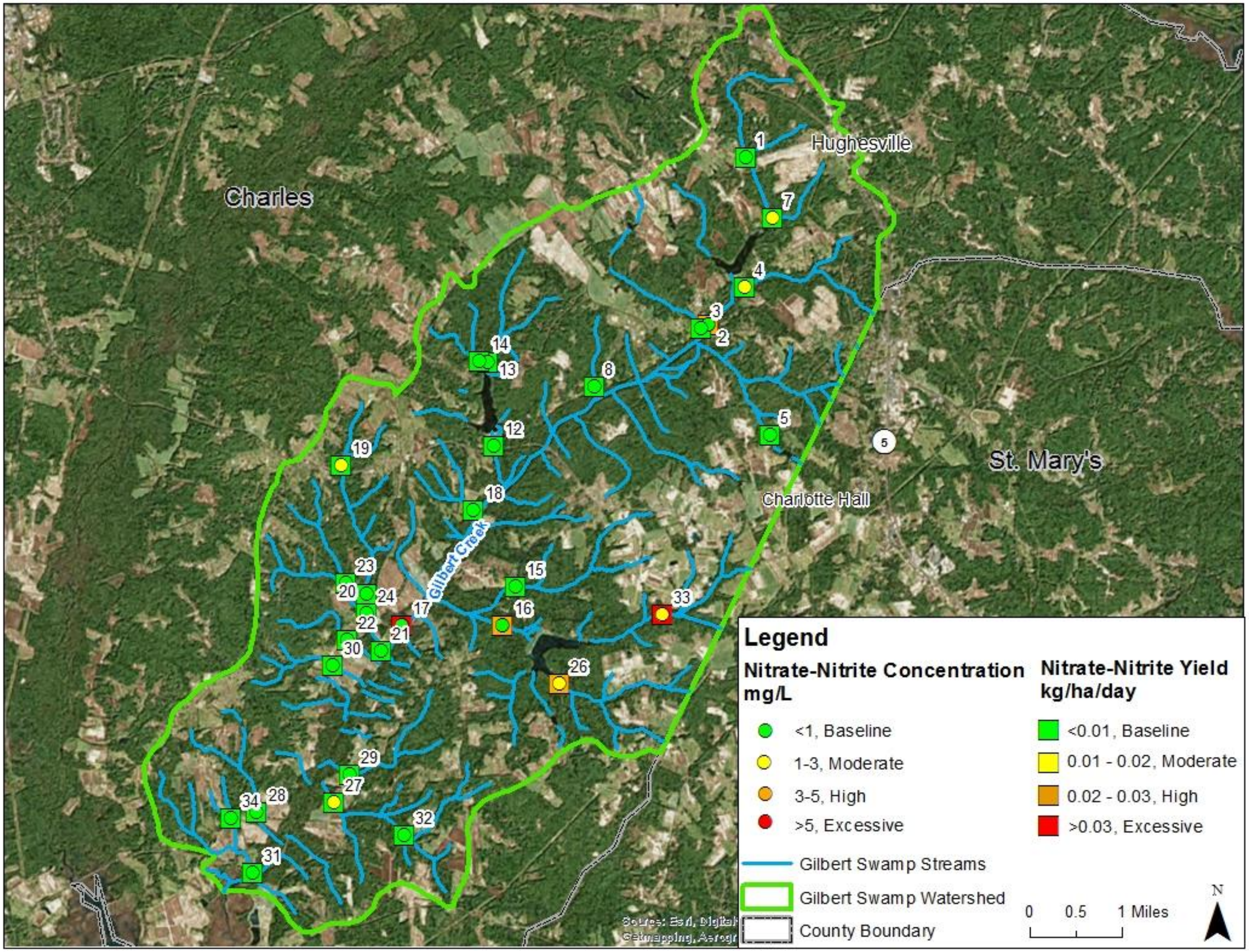


FIGURE 7: SYNOPTIC WATER QUALITY SURVEY SAMPLING RESULTS: NITRATE-NITRITE CONCENTRATION AND YIELD

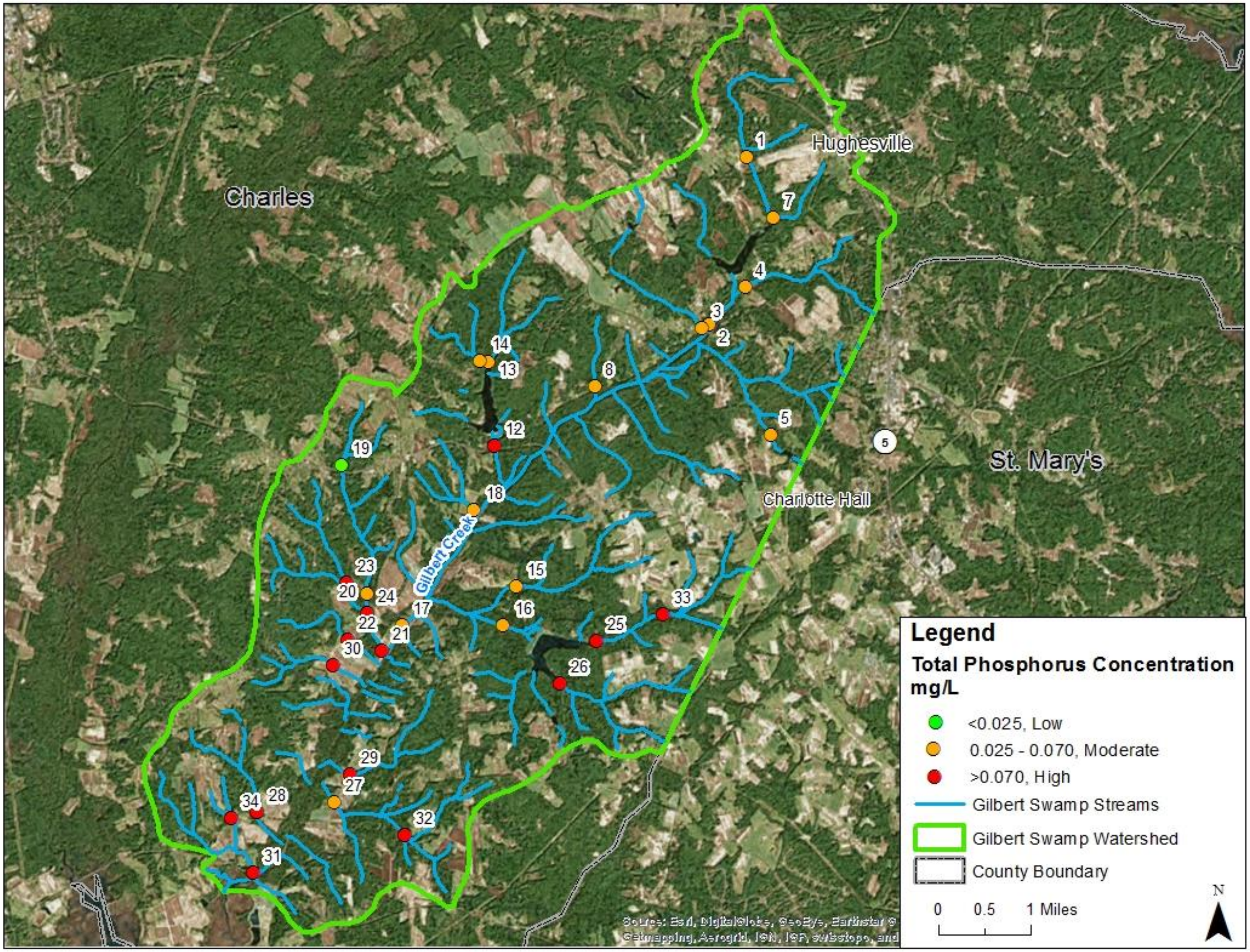


FIGURE 8: SYNOPTIC WATER QUALITY SURVEY SAMPLING RESULTS: TOTAL PHOSPHORUS CONCENTRATION

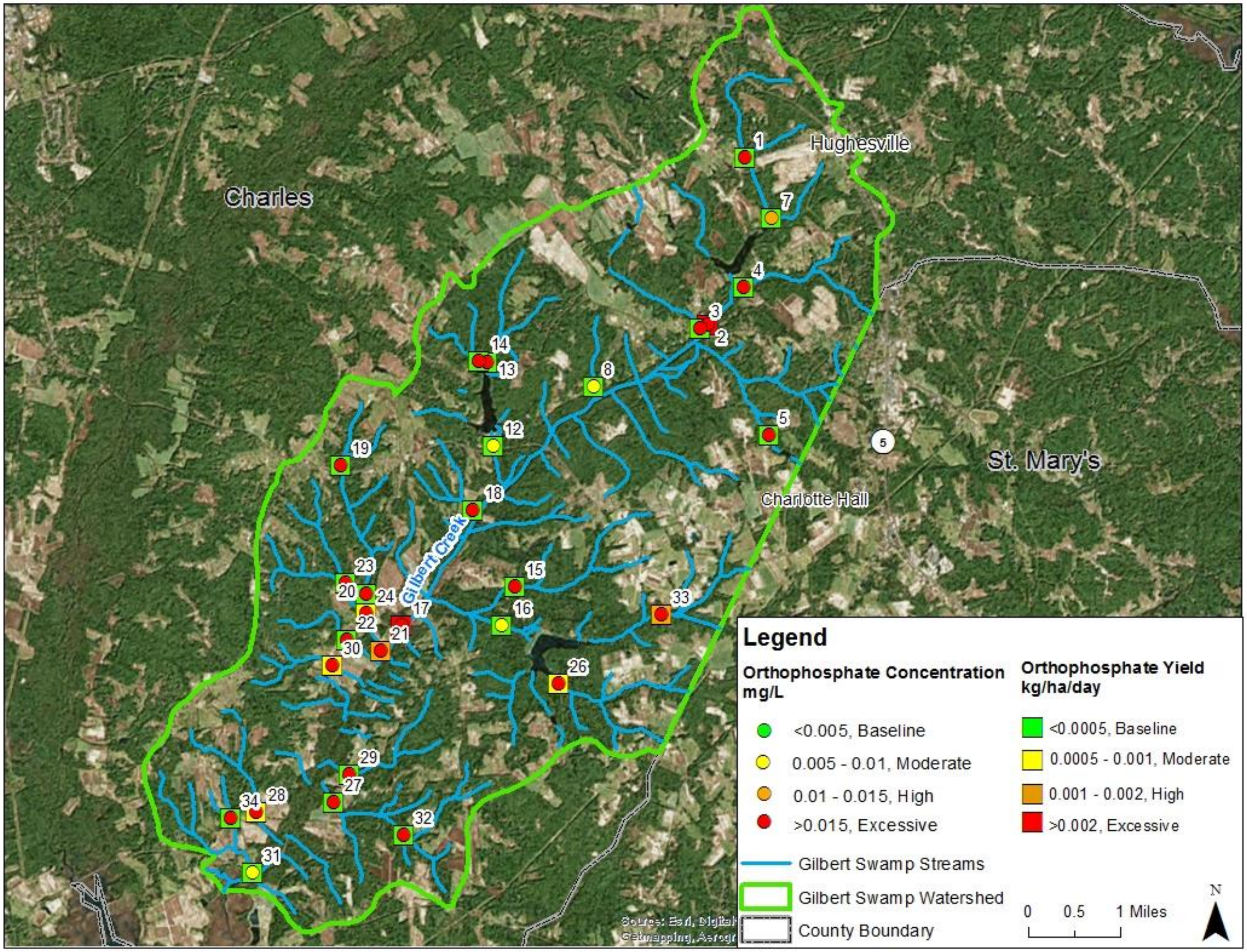
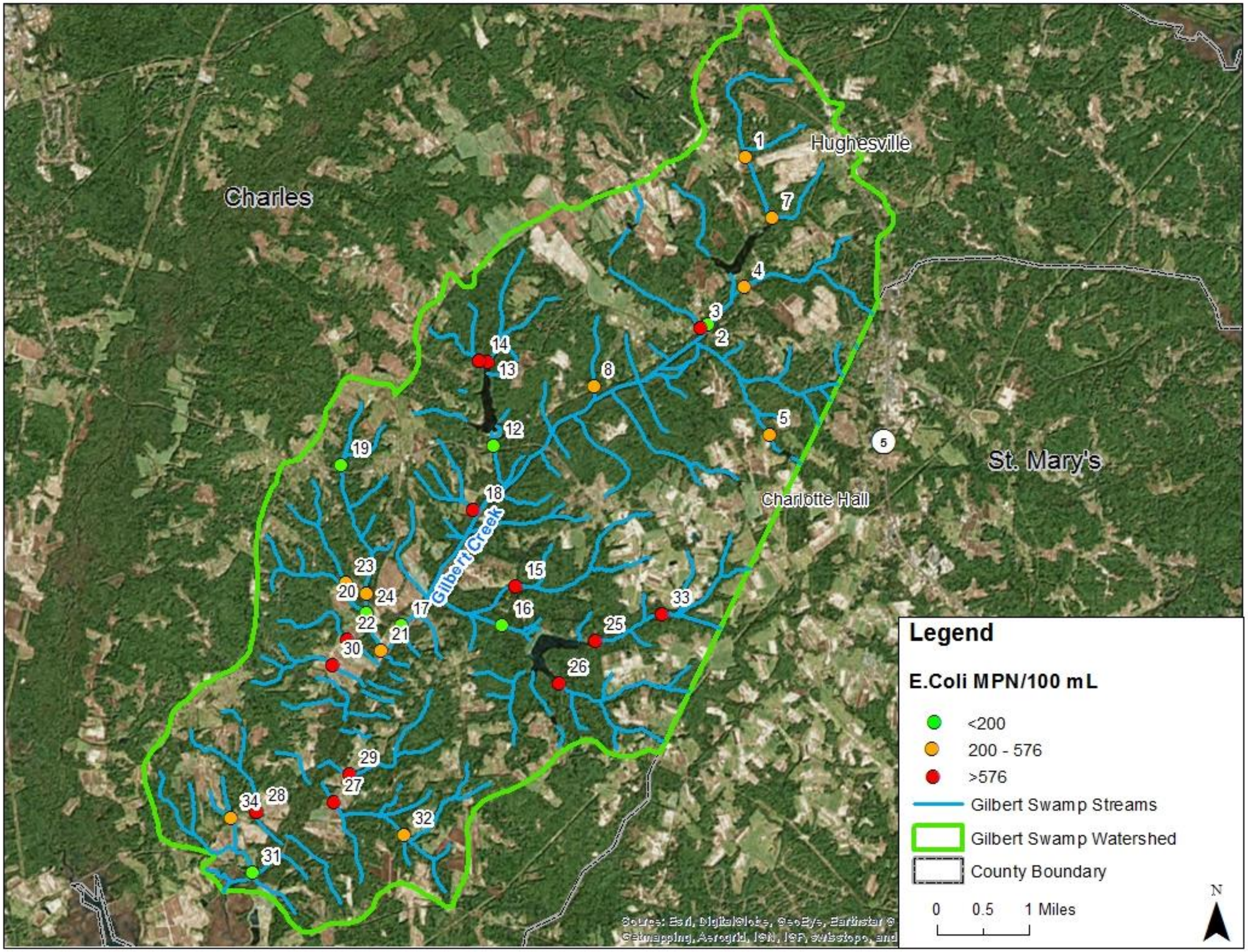


FIGURE 9: SYNOPTIC WATER QUALITY SURVEY SAMPLING RESULTS: ORTHOPHOSPHATE CONCENTRATION AND YIELD



Source: Esri, DigitalGlobe, GeoEye, Earthstar G
Getmapping, Aerogrid, IGN, IGP, swisstopo, and

FIGURE 10: SYNOPTIC WATER QUALITY SURVEY SAMPLING RESULTS: BACTERIA

TABLE 9: STREAM DISCHARGE MEASUREMENT AND IN SITU WATER QUALITY MEASUREMENT RESULTS

Station	Date	Area (Hectares)	Area (Acres)	Discharge (cfs)	Discharge (Ls)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Turbidity (NTU)	Optical Brightener (ppm)
GI-1	6/27/2016	660	1632.0	0.76	21.5	19.0	**6.25**	7.41	126.9	9.18	1.79
GI-2	6/27/2016	189	468.2	3.72	105.4	25.0	6.57	7.27	111.0	5.46	1.63
GI-3	6/27/2016	188	465.7	0.59	16.6	19.7	**6.33**	7.52	105.4	6.80	1.69
GI-4	6/27/2016	187	463.3	0.66	18.7	20.1	6.68	7.93	152.2	5.77	1.67
GI-5	6/29/2016	213	527.5	0.71	20.1	25.5	**6.28**	**4.51**	133.4	6.16	1.63
GI-6**	6/29/2016	-	-	-	-	-	-	-	-	-	-
GI-7	6/27/2016	186	460.8	0.20	5.6	18.9	**6.37**	6.87	153.4	5.77	1.24
GI-8	6/27/2016	190	470.7	0.17	4.9	19.4	**5.57**	8.22	48.4	3.22	0.98
GI-9**	6/29/2016	-	-	-	-	-	**-**	-	-	-	-
GI-10**	6/29/2016	-	-	-	-	-	**-**	-	-	-	-
GI-11**	6/29/2016	-	-	-	-	-	**-**	-	-	-	-
GI-12	6/27/2016	191	473.2	1.03	29.1	26.5	**6.11**	**2.61**	94.0	3.43	0.75
GI-13	6/29/2016	214	530.0	0.95	26.8	20.6	**5.60**	7.55	88.6	8.50	1.88
GI-14	6/29/2016	215	532.5	0.20	5.6	20.7	**6.03**	7.59	96.7	5.62	1.54
GI-15	6/27/2016	192	475.6	0.29	8.2	20.6	**6.13**	7.80	100.7	3.20	1.22
GI-16	6/28/2016	201	497.9	3.64	103.0	27.2	7.12	**3.77**	118.0	23.10	1.41
GI-17	6/28/2016	200	495.4	13.42	380.0	23.2	6.66	7.22	110.9	9.86	1.75
GI-18	6/29/2016	216	534.9	0.28	7.8	20.8	**6.10**	7.59	145.0	5.57	1.25
GI-19	3/25/2016	383	947.2	0.13	3.6	15.7	**6.12**	9.80	119.0	3.61	1.39
GI-20	6/28/2016	193	478.1	0.33	9.3	20.1	**6.22**	8.27	136.7	2.16	1.23
GI-21	6/28/2016	196	485.5	0.66	18.6	20.3	**6.31**	7.96	128.3	3.56	1.21
GI-22	6/28/2016	197	488.0	0.07	2.1	19.8	**5.77**	7.70	76.4	1.19	1.30
GI-23	6/28/2016	194	480.6	0.08	2.3	20.0	**6.25**	8.07	123.2	3.05	1.21
GI-24	6/28/2016	195	483.0	0.32	9.0	20.4	**6.37**	7.93	113.1	5.61	1.22
GI-25*	6/28/2016	202	500.3	-	-	23.1	**5.86**	**1.02**	171.1	34.40	2.32
GI-26	6/28/2016	203	502.8	1.30	36.7	20.6	**6.07**	6.68	120.5	13.90	1.80
GI-27	6/29/2016	210	520.1	0.70	19.9	19.3	**6.13**	7.50	105.4	4.51	1.53
GI-28	6/29/2016	209	517.6	0.49	13.8	20.6	**6.34**	7.16	86.3	5.56	1.42
GI-29	6/29/2016	211	522.6	0.32	9.1	19.8	**6.12**	7.92	92.7	3.66	1.50
GI-30	6/28/2016	198	490.5	1.05	29.8	20.6	**6.10**	6.77	84.8	10.70	1.55
GI-31	3/18/2016	127	313.8	0.88	24.9	12.5	**5.93**	9.43	127.0	7.49	0.73
GI-32	6/29/2016	212	525.0	0.36	10.2	19.5	**6.05**	8.11	103.1	5.72	1.31
GI-33	6/28/2016	204	505.3	1.48	42.0	21.4	6.52	7.00	150.7	22.30	1.95
GI-34	6/28/2016	199	492.9	0.05	1.4	20.2	**6.06**	6.73	116.3	7.08	1.72

Note: **bold** values indicate exceedances of COMAR standards or water quality thresholds. * indicates no discharge taken but water quality sampled. ** indicates denied access to property.

MDE has established acceptable water quality standards for each designated Stream Use Classification, which are listed in the *Code of Maryland Regulations (COMAR) 26.08.02.03-.03 - Water Quality*. The streams located in the Gilbert Swamp watershed are covered in *COMAR* in Sub-Basin 02-14-01: Lower Potomac River Area and are designated Use I waters. Specific designated uses for Use I streams include water contact sports, fishing, the growth and propagation of fish, agricultural water supply, and industrial water supply. The acceptable criteria for Use I waters are as follows:

- pH - 6.5 to 8.5
- DO - may not be less than 5 mg/l at any time
- Turbidity - maximum of 150 Nephelometric Turbidity Units (NTU's) and maximum monthly average of 50 NTU
- Temperature - maximum of 90°F (32°C) or ambient temperature of the surface water, whichever is greater
- E. coli – 576 MPN/100ml for *Infrequent Full Body Contact Recreation*.

For the majority of sites, *in situ* water quality parameters fell within COMAR limits for Use I streams. Only four sites in the Gilbert Swamp watershed had DO levels below the COMAR standard of 5.0 mg/L. Twenty-five sites in the Gilbert Swamp watershed had pH values below the minimum threshold of 6.5 SU, although pH values below 6.5 are common for this area. This is due to the South Coastal Plain having a low level of carbonate buffering, as found during the 1987 Maryland Synoptic Stream Chemistry Survey (International Science and Technology, Inc., 1988). Buffering capacity is determined by local geology (presence of carbonate or other compounds in soils and bedrock) and refers to the capability of water to neutralize acidity. All sites were within acceptable ranges for temperature and turbidity. Although MDE does not have a water quality standard for specific conductivity, Morgan et al. (2007) have reported biological impairment thresholds in Maryland of 247 µS/cm for benthic macroinvertebrates. There were no sites in the Gilbert Swamp watershed that had specific conductivity values exceeding the threshold for benthic macroinvertebrates.

Optical brighteners are whitening agents found in cleaning products such as laundry soaps and detergents, and can be found in toilet paper. Presence of optical brighteners in stream water can indicate illicit discharge of sewer systems and leaking septic tanks. The optical brightener results in the Gilbert Swamp watershed were generally inconclusive. The field fluorometer was calibrated with a 50 ppm laundry detergent solution, following the California EPA Surface Water Ambient Monitoring Program's SOP (Burres, 2011). According to this method, sample measurements below 5 ppm are considered negative for optical brightener. Field results ranged from 0.7 to 2.3 ppm, therefore it was concluded that none of the samples contained optical brighteners.

TABLE 10: WATER QUALITY GRAB SAMPLING RESULTS- NUTRIENT AND BACTERIA CONCENTRATIONS AND INSTANTANEOUS LOADS.

Station	Discharge (L/sec)	Ortho-P (mg/L)	TKN (mg/L)	Nitrate-Nitrite (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	E. Coli (MPN/100 ml)	Ortho-P (kg/H/day)	TKN (kg/H/day)	Nitrate-Nitrite (kg/H/day)	Total Nitrogen (kg/H/day)	Total Phosphorus (kg/H/day)
GI-1	21.5	0.020	0.25	0.55	0.8	0.06	298.1	0.00006	0.00070	0.00155	0.00225	0.00017
GI-2	105.4	0.250	0.5	0.55	0.8	0.04	100.8	0.01201	0.02402	0.02643	0.03844	0.00192
GI-3	16.6	0.020	0.25	0.4	0.8	0.05	866.4	0.00015	0.00190	0.00305	0.00610	0.00038
GI-4	18.7	0.030	0.25	1.1	0.8	0.06	330	0.00026	0.00215	0.00946	0.00688	0.00052
GI-5	20.1	0.020	0.7	0.55	0.8	0.04	261.3	0.00016	0.00570	0.00448	0.00652	0.00033
GI-6**	-	-	-	-	-	-	-	-	-	-	-	-
GI-7	5.6	0.010	0.25	1.7	1.7	0.04	360.9	0.00003	0.00065	0.00444	0.00444	0.00010
GI-8	4.9	0.005	0.25	0.55	0.8	0.03	203.5	0.00001	0.00056	0.00122	0.00178	0.00007
GI-9**	-	-	-	-	-	-	-	-	-	-	-	-
GI-10**	-	-	-	-	-	-	-	-	-	-	-	-
GI-11**	-	-	-	-	-	-	-	-	-	-	-	-
GI-12	29.1	0.005	0.9	0.55	0.8	0.15	124.6	0.00007	0.01182	0.00722	0.01051	0.00197
GI-13	26.8	0.020	0.25	0.5	0.8	0.04	>2419.6	0.00022	0.00270	0.00541	0.00865	0.00043
GI-14	5.6	0.020	0.25	0.55	0.8	0.04	2419.6	0.00004	0.00056	0.00122	0.00178	0.00009
GI-15	8.2	0.020	0.25	0.9	0.8	0.05	1986.3	0.00007	0.00092	0.00329	0.00293	0.00018
GI-16	103.0	0.005	1	0.55	0.8	0.06	16.9	0.00022	0.04416	0.02429	0.03533	0.00265
GI-17	380.0	0.020	1.2	0.55	0.8	0.05	145.5	0.00328	0.19651	0.09007	0.13101	0.00819
GI-18	7.8	0.040	0.25	0.5	0.8	0.05	980.4	0.00012	0.00078	0.00155	0.00249	0.00016
GI-19	3.6	0.210	0.25	1.5	1.5	0.02	115.3	0.00017	0.00020	0.00121	0.00121	0.00002
GI-20	9.3	0.080	0.25	0.6	0.8	0.05	488.4	0.00033	0.00104	0.00249	0.00332	0.00021
GI-21	18.6	0.220	0.25	0.4	0.8	0.11	235.9	0.00180	0.00204	0.00327	0.00653	0.00090
GI-22	2.1	0.060	0.25	0.55	0.8	0.09	1413.6	0.00006	0.00023	0.00050	0.00073	0.00008
GI-23	2.3	0.150	0.25	0.55	0.8	0.18	238.2	0.00015	0.00025	0.00055	0.00081	0.00018
GI-24	9.0	0.140	0.25	0.55	0.9	0.18	133.4	0.00056	0.00099	0.00218	0.00357	0.00071
GI-25*	-	0.140	0.25	1	0.8	0.23	>2419.6	-	-	-	-	-
GI-26	36.7	0.040	0.25	1.6	1.6	0.07	1986.3	0.00062	0.00389	0.02491	0.02491	0.00109
GI-27	19.9	0.040	0.25	1.2	0.8	0.06	920.8	0.00033	0.00204	0.00979	0.00653	0.00049
GI-28	13.8	0.110	0.25	0.5	0.8	0.14	1203.3	0.00062	0.00142	0.00284	0.00454	0.00079
GI-29	9.1	0.050	0.25	0.55	0.8	0.1	613.1	0.00019	0.00093	0.00206	0.00299	0.00037
GI-30	29.8	0.070	0.25	0.55	0.4	0.13	980.4	0.00091	0.00325	0.00715	0.00520	0.00169
GI-31	24.9	0.005	0.25	0.15	0.4	0.07	28	0.00008	0.00423	0.00254	0.00677	0.00118
GI-32	10.2	0.050	0.25	0.8	0.8	0.08	547.5	0.00021	0.00103	0.00331	0.00331	0.00033
GI-33	42.0	0.070	0.7	1.7	2.4	0.11	1553.1	0.00124	0.01242	0.03016	0.04259	0.00195
GI-34	1.4	0.080	0.25	0.55	0.8	0.15	547.5	0.00005	0.00015	0.00034	0.00049	0.00009

Note: * indicates no discharge taken but water quality sampled. ** indicates denied access to property

At this time, Maryland does not have specific numeric water quality criteria for nitrogen and phosphorus. To remain consistent with the Watershed Restoration Action Strategy report for Port Tobacco River Watershed (MDE, 2006), nutrient ranges and ratings for nitrate-nitrite and orthophosphate were derived from Frink (1991) and used for comparison of water quality results (Table 7). Total nitrogen and total phosphorus concentrations were compared to those provided by the Maryland Biological Stream Survey (Southerland, et al. 2005; Table 8).

Total nitrogen concentrations were low in all but three subwatersheds where they were moderate (Figure 6 and Table 10). Nitrate/nitrite concentrations were moderate in four subwatersheds (Figure 7 and Table 10). Baseline concentrations were found in the remaining subwatersheds (Figure 7 and Table 10). Instantaneous nitrate/nitrite yields were excessive in two subwatersheds, high in two subwatershed, and baseline in the remaining subwatersheds (Figure 7 and Table 10). Total phosphorus concentrations were high in five of ten subwatersheds, moderate in nine of ten subwatersheds, and low in only one subwatershed (Figure 8 and Table 10). Excessive concentrations of orthophosphate were found in nine of ten subwatersheds, which had values ranging from 0.005 mg/L to 0.250 mg/L (Figure 9 and Table 10). High concentrations were found in one of ten subwatersheds and moderate concentrations were found in four subwatersheds, however half the detection limit for orthophosphate (0.005) falls between the baseline and moderate ratings, therefore the four subwatersheds that were below the detection limit should be considered to have baseline levels.

Orthophosphates, also termed phosphates, are the reactive phosphates that are most readily used by biota. Measures of orthophosphates provide a good estimation of the amount of phosphorus available for algae and plant growth. Orthophosphates are found naturally but elevated values may indicate human sources which include fertilizers for both agricultural and residential use, cleaners, and wastewater sewage. Phosphorus bound to sediments is also released through erosional processes. The measured elevated concentrations were distributed throughout the entire watershed. The suite of restoration practices being implemented by the County provide solutions to elevated levels of orthophosphate, specifically stream restoration, BMP retrofit, and education on proper chemical disposal and fertilizer application. Many of the identified projects in the watershed are located in the areas identified with high orthophosphate levels.

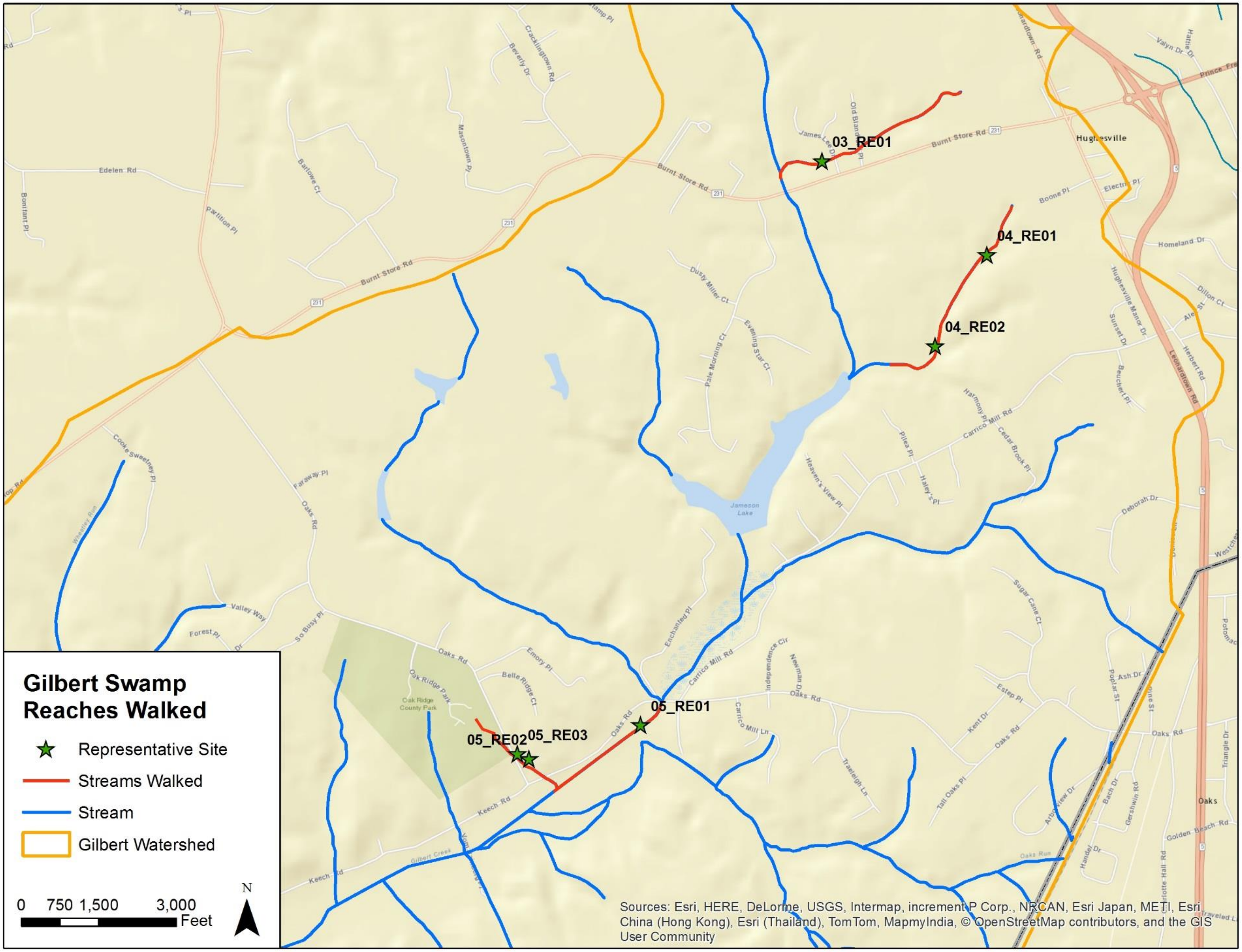
Elevated bacteria levels (*E. coli* > 576 mpn/100 ml; mpn = most probable number) were found in five of the ten subwatersheds, and seven subwatersheds had levels exceeding the standard for water contact recreation of 200 mpn/100 ml (Figure 10 and Table 10).

3.3 STREAM CORRIDOR ASSESSMENT

Field crews walked approximately 3.1 miles of mapped stream channels between March 17 and April 11, 2016. Figure 11Figure 11 shows the stream reaches walked by field crews and the location of the representative sites for each walked reach. Erosion sites, pipe outfalls, and buffer breaks were the most widespread and frequent problems identified. The total number of points identified and ranked by severity in each watershed can be found in Table 11. The majority of points were categorized as ‘moderate’ to ‘low’ severity. Only two points received a rating of ‘very severe’, while eight received a rating of ‘severe’. A more detailed discussion of each data point type follows. A complete dataset is included as Appendix C.

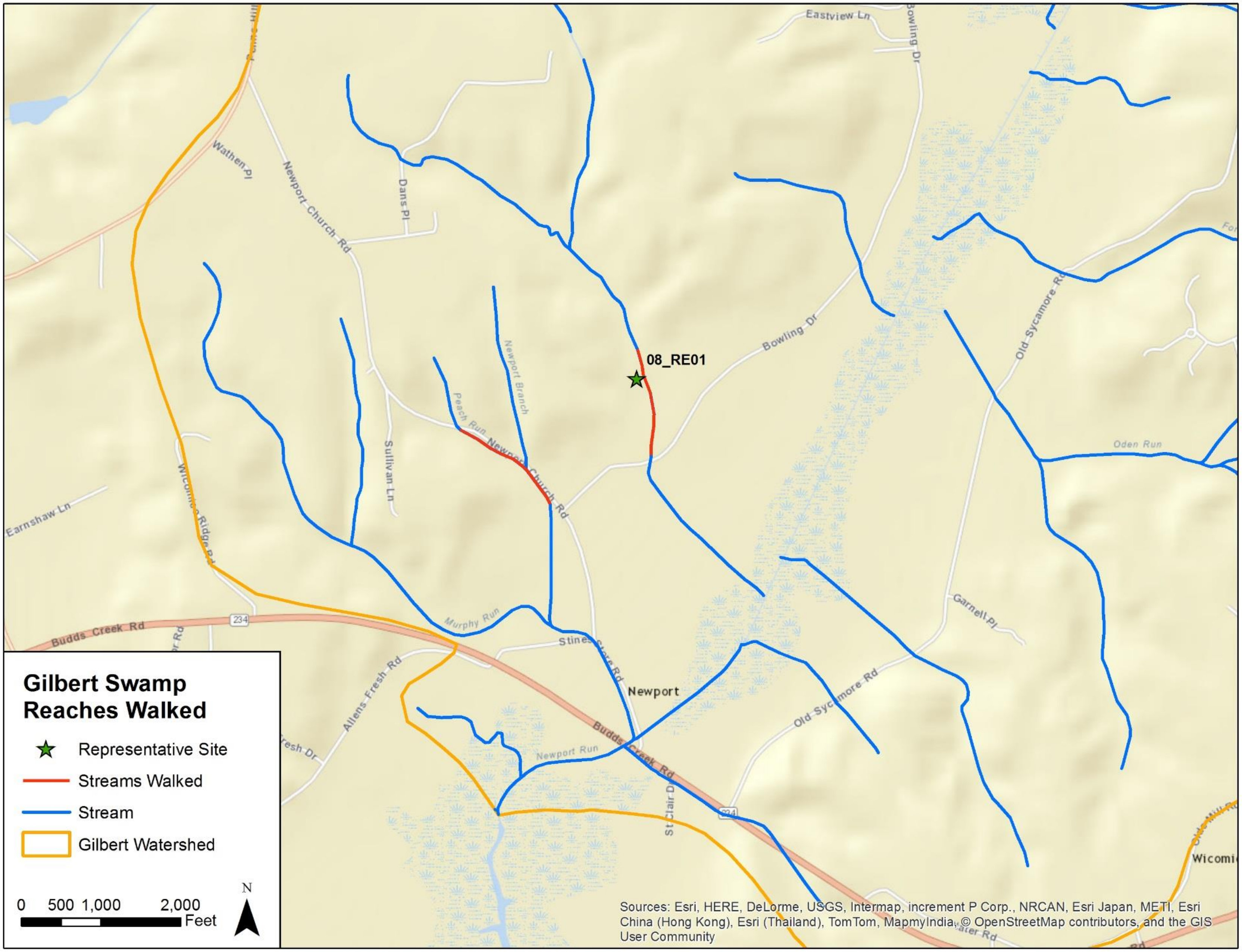
TABLE 11: WATERSHED DATA POINTS BY SEVERITY

Potential Problems	**Total**	**Very Severe**	**Severe**	**Moderate**	**Low**	**Minor**
Erosion (1.0 miles)	24	2	5	8	8	1
Buffer (0.8 miles)	5	0	0	1	3	1
Pipe Outfall	3	0	0	0	0	3
Fish Barrier	1	0	1	0	0	0
Trash	2	0	2	0	0	0
Channel Alteration	1	0	0	0	1	0
Construction	0	0	0	0	0	0
Exposed Pipe	0	0	0	0	0	0
Unusual Conditions	1	0	0	1	0	0
Total	***37***	2	8	10	12	5
Representative Sites	**7**					
Potential BMP Sites	**6**					



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

FIGURE 11: GILBERT SWAMP WATERSHED STREAM CORRIDOR ASSESSMENT REACHES WALKED AND REPRESENTATIVE SITES, NORTHERN REACHES



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

FIGURE 12: GILBERT SWAMP WATERSHED STREAM CORRIDOR ASSESSMENT REACHES WALKED AND REPRESENTATIVE SITES, SOUTHERN REACHES

Erosion Sites

Twenty-four erosion sites totaling 1.0 miles were identified. The stream erosion process was identified as widening for 88% of sites and downcutting for 12%. While collecting stream erosion data, field crews also attempted to determine the leading possible cause of erosion at each site. These potential causes included: an upstream road crossing, bends and slopes in the stream channel, upstream land use changes, below channelization, livestock, and pipe outfalls. The most commonly described possible causes for erosion was landuse change upstream (42%), followed by an upstream road crossing (29%). One site (R005_ES005) presented a threat to infrastructure. Locations of erosion sites can be found in Figure 14 and Figure 15 and Figure 16.

Inadequate Buffers

Inadequate buffers, defined as buffers less than 50 feet wide from the edge of the stream, were identified at five sites, totaling 0.8 miles of inadequate buffers. Approximately 80% of the inadequate buffer length identified was affecting only one side of the stream channel. Crop fields, lawn, and pavement were the most commonly identified types of land use where the stream buffer was found to be deficient. The location of reaches with inadequate buffers is displayed in Figure 14 and Figure 15 and Figure 16.

Pipe Outfalls

Three pipe outfall points were located and assessed. All three outfalls received a severity rating of ‘minor’, indicating that they typically do not have dry weather discharges nor appear to be causing localized erosion. All of the pipe outfalls were associated with stormwater conveyance, and any observed discharge was clear and odorless. Locations and severity of these points is shown in Figure 15.

Fish Barriers

Only one fish barrier was observed during the survey and was identified as a road crossing. The barrier received a severity rating of ‘severe’ and the road crossing was causing a 40 inch drop in elevation. The location and severity of the fish barrier is displayed in Figure 15.

Channel Alteration

Channel alteration impacts were only found at one site, but this site totaled approximately 829 feet in length. The channel alteration site had a severity rating of ‘low’ and was a trapezoidal channel. Location of the channel alteration site can be found in Figure 15.

Unusual Conditions and Trash

There was one unusual condition/comment point identified in the study area and was collected to document excessive algae potentially caused by nearby ball fields.

Two trash dumping sites were identified. Both sites were rated ‘severe’, totaling 20 truck loads of trash. Neither of the sites could not be cleaned up by volunteers due to the presence of large metal pieces of trash. Point locations and severity scoring of unusual conditions and trash sites can be seen in Figure 14 and Figure 15.

In-Stream Construction

No in-stream construction sites were identified within the reaches walked.

Representative and Other Points

Representative points were taken at seven locations (Figure 11). Figure 13, below, presents the proportion of reaches in each assessment category for each habitat parameter, giving insight into the types of stream impacts creating the most degradation. In general, the modified qualitative RBP assessment at these sites revealed stream channels dominated by gravel substrates. Majority of the stream reaches had 'suboptimal' riparian vegetation and bank vegetation scores. A range of bank conditions were observed, with majority of the banks in the 'suboptimal' range, but two sites had bank condition ratings of 'poor'. Stream reaches with channel alteration were generally in good condition and few reaches received a 'poor' or 'marginal' rating. Majority of the sites had 'suboptimal' sediment deposition conditions. Channel flow status was good throughout the study area. A range of conditions were found for both velocity/depth diversity and embeddedness, but the majority of sites falling within the 'suboptimal' range. Shelter for fish was found to be 'marginal' for the majority of the sites, with no sites scoring in the 'optimal' range. Benthic substrate was generally rated 'suboptimal' throughout the majority of the reaches, but many reaches were found to have 'marginal' and 'poor' benthic substrate.

Stream channel erosion is a major factor leading to impaired habitat conditions. The majority of the identified erosion sites (88%) were described as channel widening processes. As the stream channels widen, the ability to effectively transport sediments (eroded bank material and from runoff over land) is reduced, leading to reduced scores for several habitat parameters including flow, velocity, embeddedness and macroinvertebrate habitat.

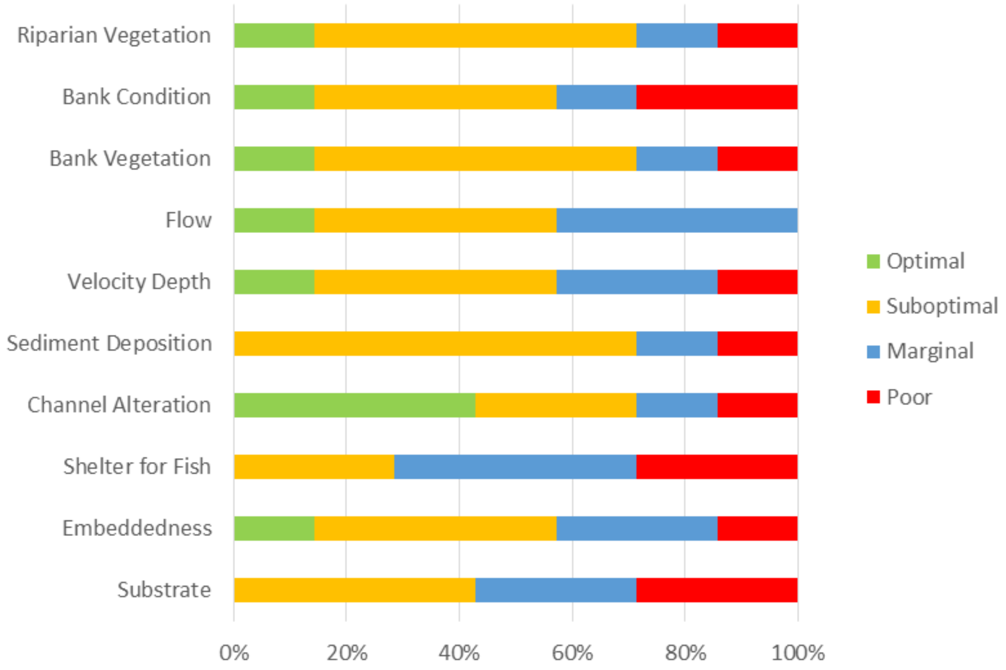


FIGURE 13: PROPORTION OF REACHES PER ASSESSMENT CATEGORY

Exposed Pipes

No exposed pipes were identified in the assessment.

Potential Improvements (BMP Locations)

Six initial potential improvement sites were identified during the SCA fieldwork. Multiple improvements were recommended for several sites. Recommended BMP types include outfall stabilization (three sites), stream restoration (four sites), and bioretention/raingarden (two sites). The locations of these preliminary sites as well as the primary BMP type are displayed in Figure 17. These projects were further expanded and are presented in the following section.

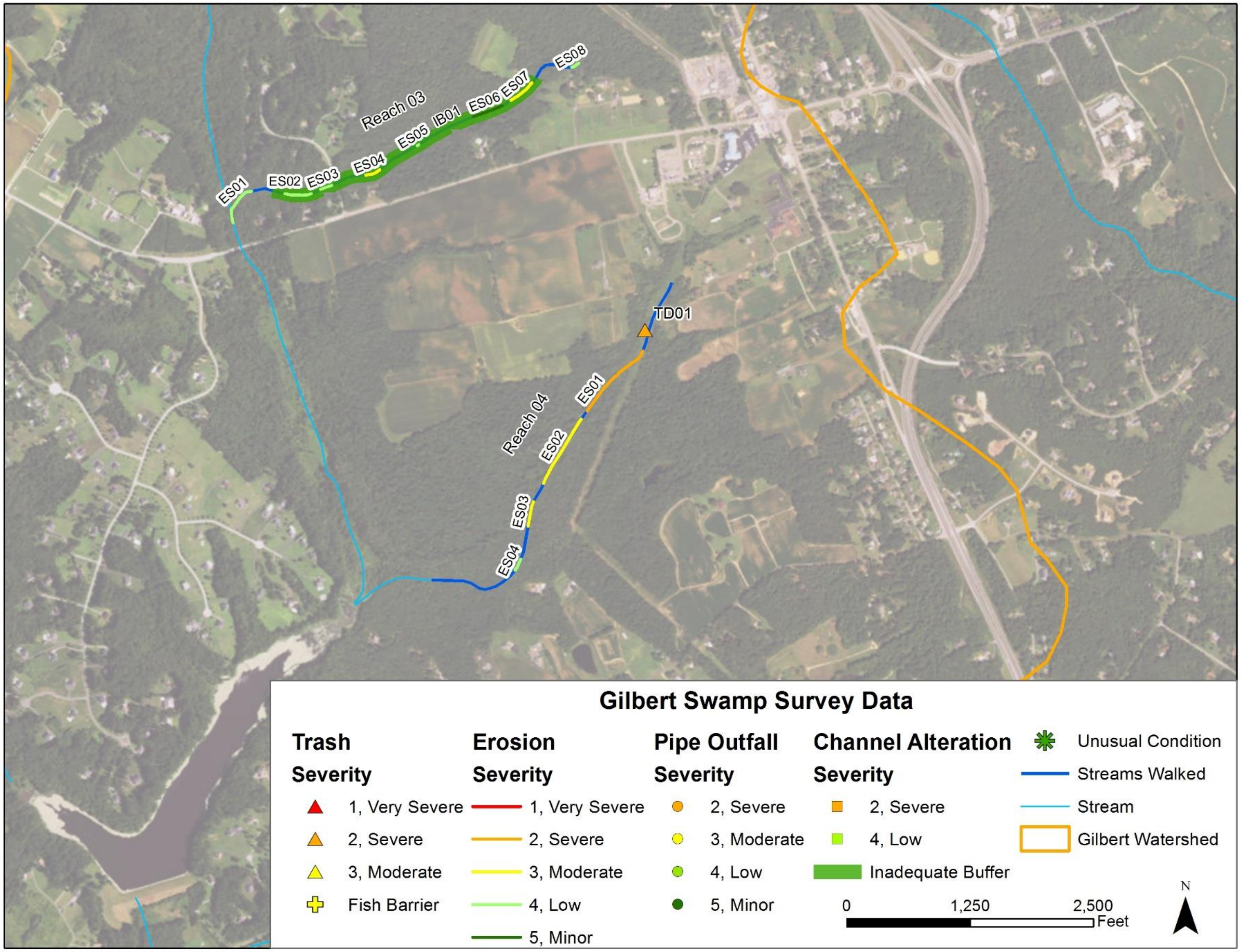


FIGURE 14: SURVEY DATA MAP SHOWING TRASH, PIPE OUTFALL, EROSION, FISH BARRIER, CHANNEL ALTERATION, UNUSUAL CONDITION, AND INADEQUATE BUFFER SITES, NORTHERN REACHES

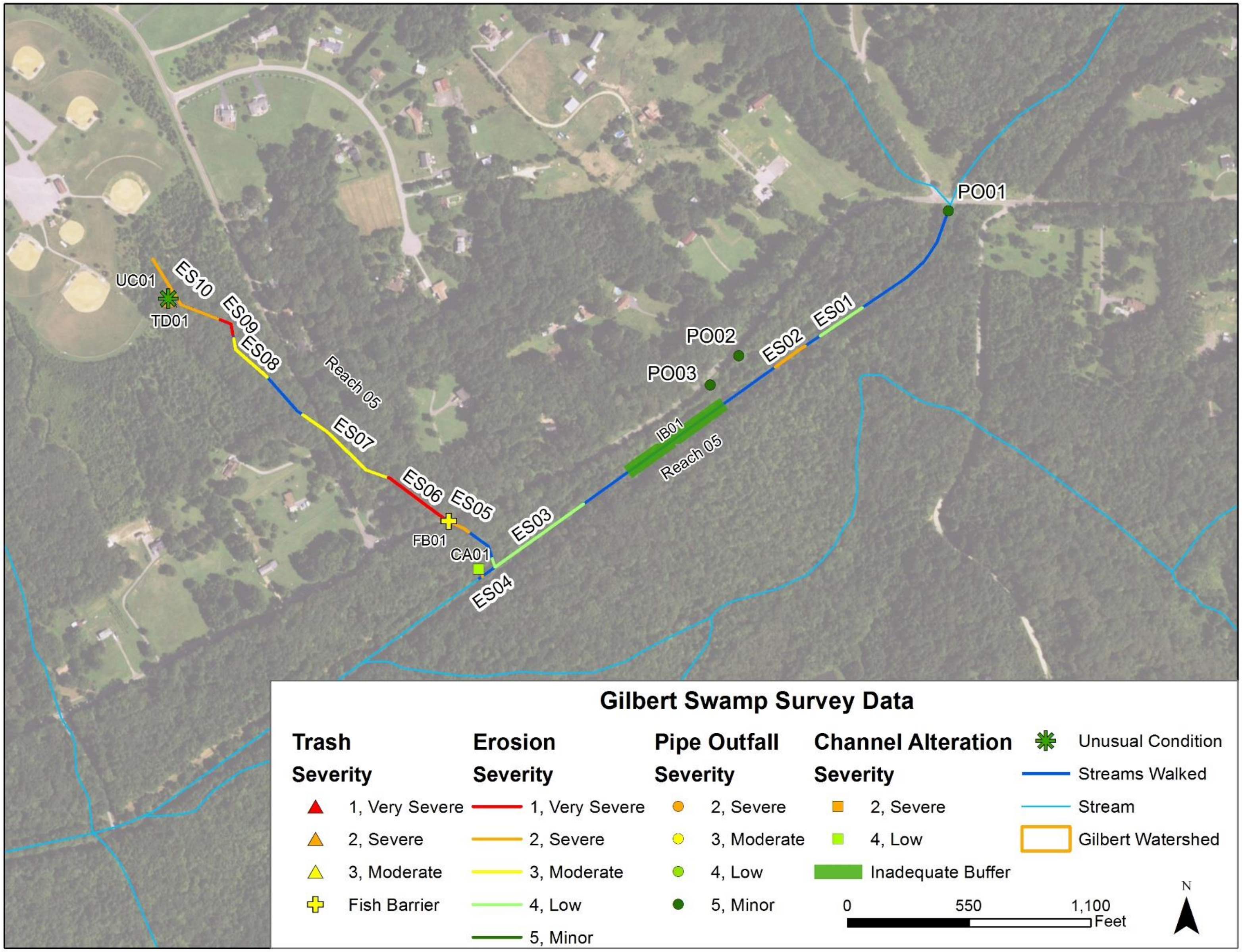


FIGURE 15: SURVEY DATA MAP SHOWING TRASH, PIPE OUTFALL, EROSION, FISH BARRIER, CHANNEL ALTERATION, UNUSUAL CONDITION, AND INADEQUATE BUFFER SITES, MIDDLE REACHES

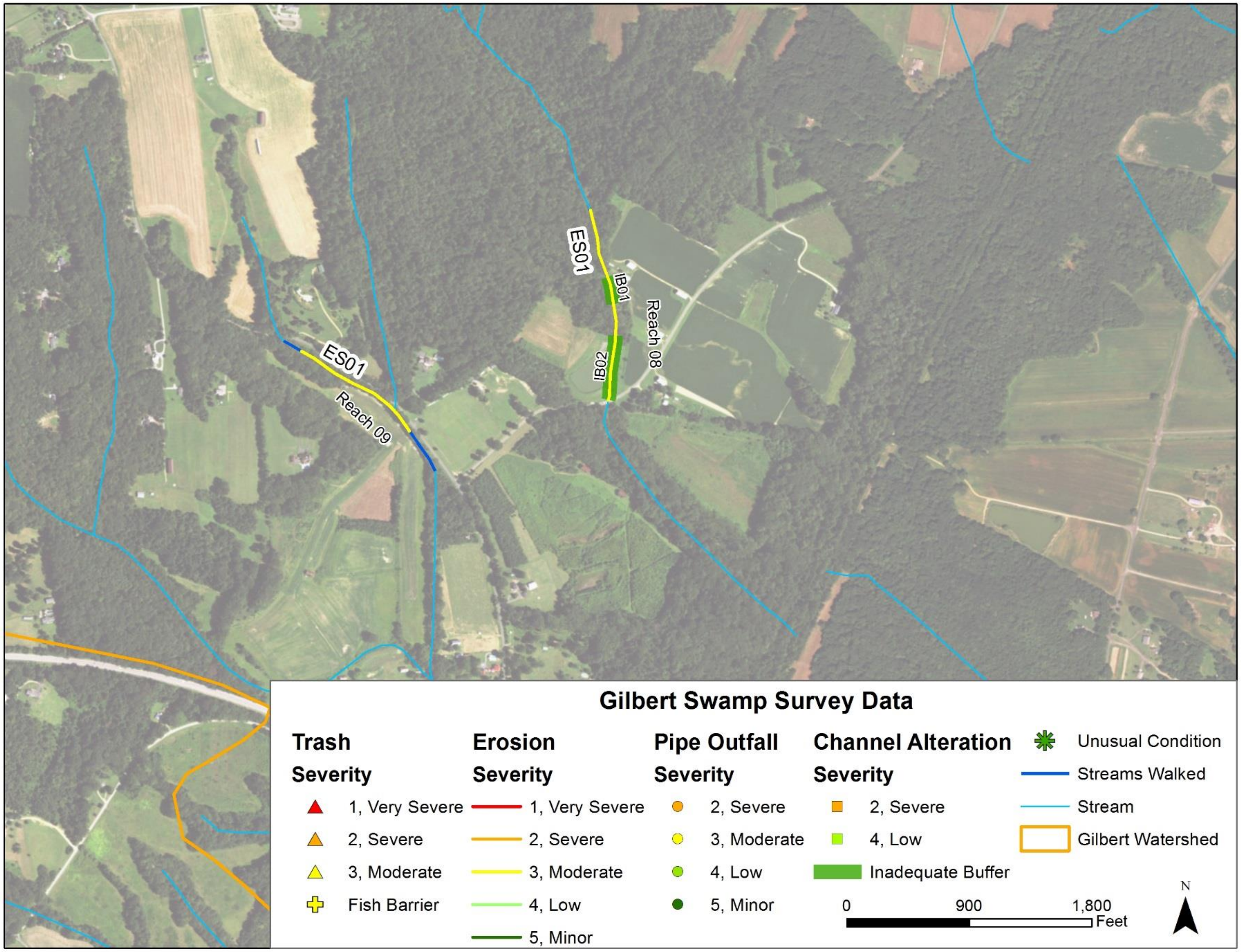
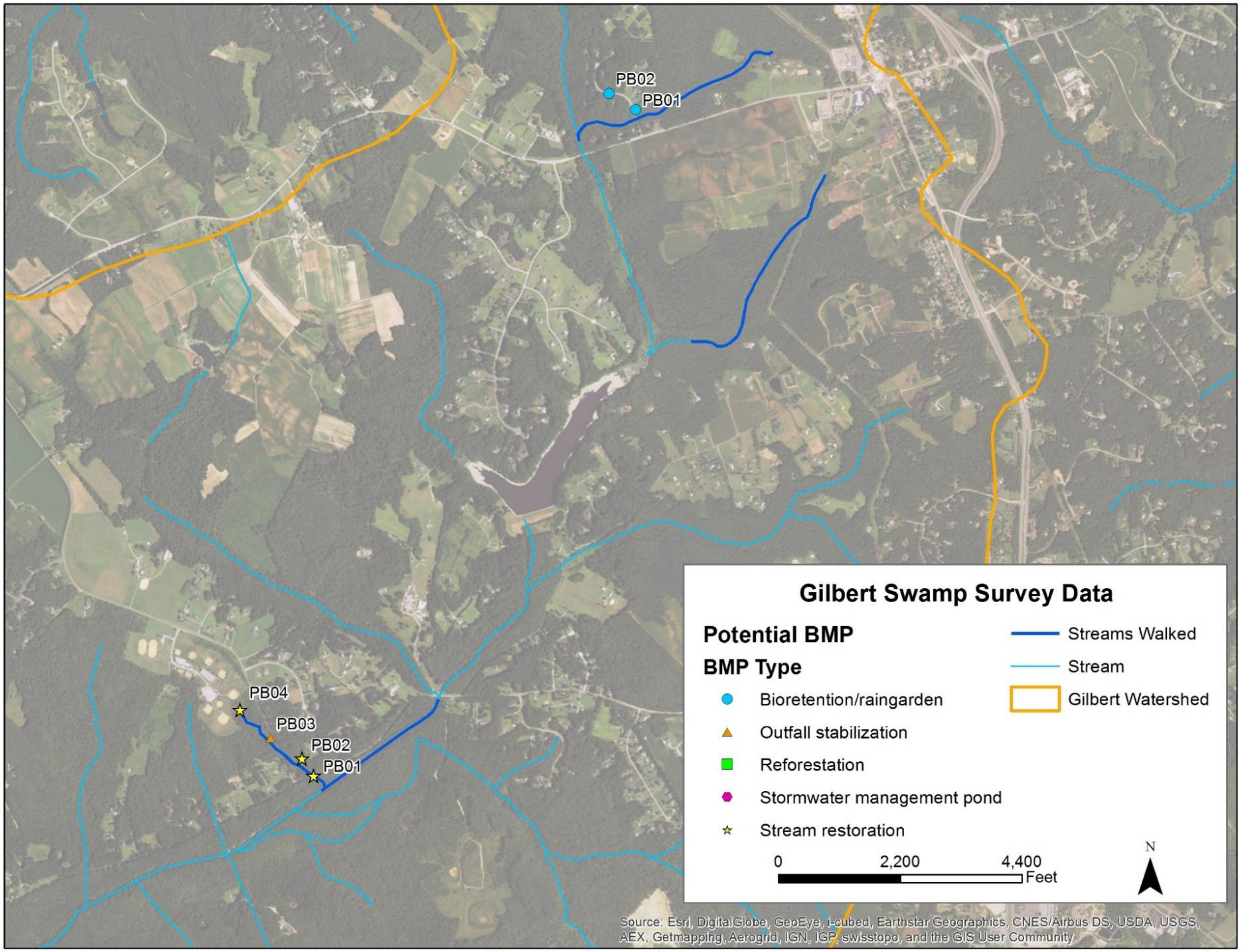


FIGURE 16. SURVEY DATA MAP SHOWING TRASH, PIPE OUTFALL, EROSION, FISH BARRIER, CHANNEL ALTERATION, UNUSUAL CONDITION, AND INADEQUATE BUFFER SITES, SOUTHERN REACHES



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

FIGURE 17: SURVEY DATA MAP SHOWING POTENTIAL BMP LOCATIONS, NORTHERN REACHES

4 POTENTIAL WATER QUALITY IMPROVEMENT PROJECTS

Results of the desktop and field watershed assessments were compiled and the results were analyzed to determine those specific areas of impairment most in need of restoration. Restoration measures were then developed according to the type and source of impact. The following section presents the methods and results for each restoration measure type which include both structural and non-structural practices and programs:

- Stream restoration;
- Shoreline erosion control;
- Stormwater BMPs (step pool stormwater conveyance (SPSC), bioretention, swale);
- Reforestation;
- Environmental site design;
- Street sweeping;
- Inlet cleaning;
- Trash clean-up;
- Homeowner practices (rain barrels, rain gardens, downspout disconnect).

Mapping of the site specific structural practices are included in Figure 18. Tables presenting cost, load reduction, and impervious credit associated with each of the proposed projects are included in each section below.

Tables are organized by project "Level". The County's identified structural projects have been organized in a tiered "Level" system to track their progress from project identification to concept, design, construction and completion. Level 8 projects are considered alternates and lower priority than those identified in levels 2-7 based primarily on factors related to cost per impervious acre treated. Level 5 projects were moved to Level 11 and include existing stormwater management facilities that were deprioritized due to revised MDE guidelines that may be credited as ISA baseline reductions. Level 9 projects are those identified by KCI that will need to be added to the full prioritization to determine which projects are most feasible, beneficial and cost effective. Projects that have been evaluated and deprioritized have been moved to Level 10.

- Level 1 – Completed
- Level 2 – In Construction
- Level 3 – In Full Design
- Level 4 – County Maintenance / Alternative BMP Projects
- Level 6 – Feasibility and Concept Design Projects (County NTP)
- Level 7 – Feasibility and Concept Design Projects (High Priority)
- Level 8 – Alternate Feasibility and Concept Design Projects (Low Priority)
- Level 9 – Additional Sites Identified in KCI Watershed Assessment
- Level 10 – Evaluated and Deprioritized
- Level 11 – SWM Facilities for Possible ISA Baseline Reduction

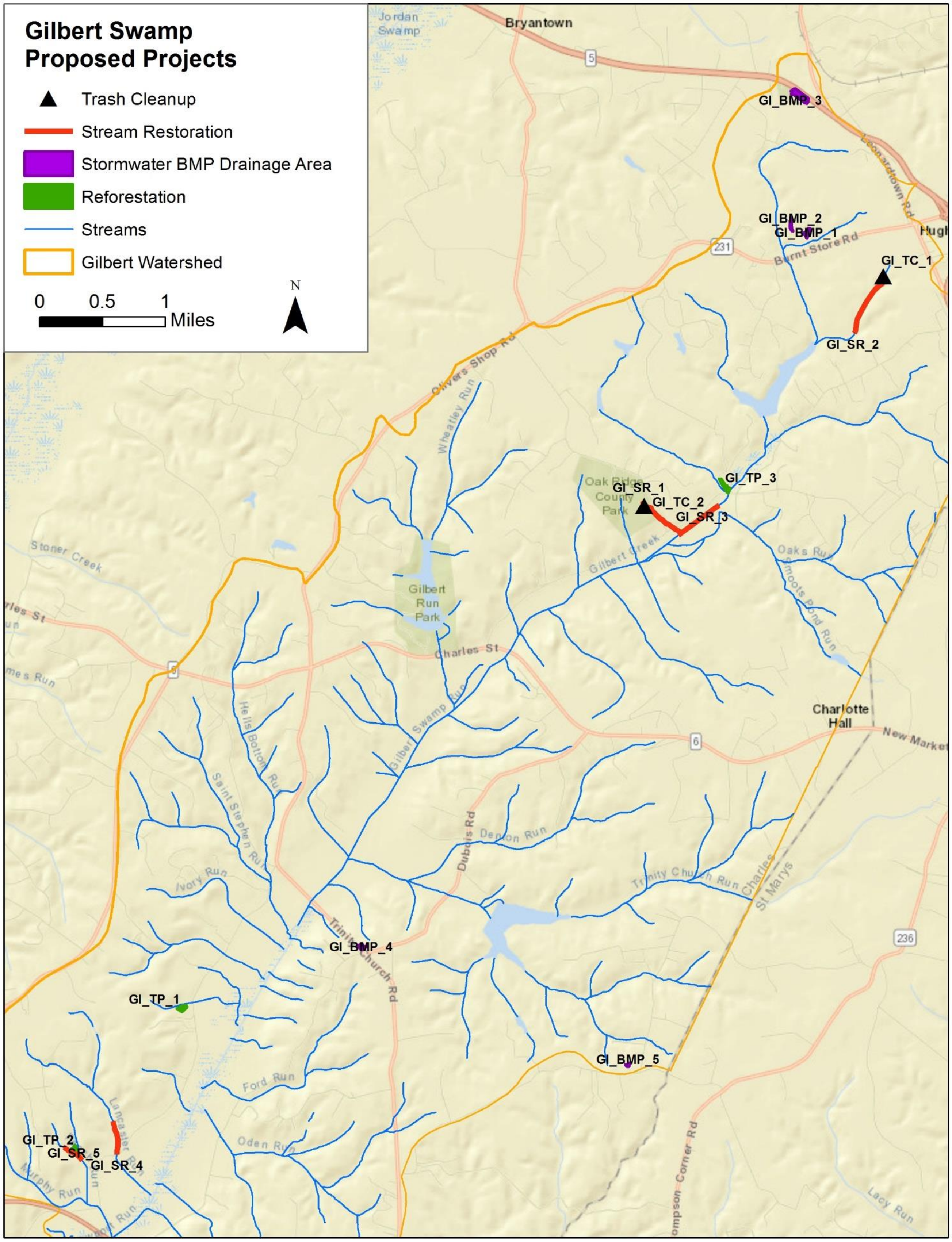


FIGURE 18: LOCATION OF GILBERT SWAMP WATERSHED POTENTIAL WATER QUALITY IMPROVEMENT PROJECTS

4.1 STREAM RESTORATION

Stream restoration opportunities were field identified during the SCA assessment. The SCA stream segments were selected based on the surrounding land use within their drainage areas; streams receiving a high percent of impervious area were selected to better identify stream reaches in need of restoration. The current condition of streams was assessed and locations of stream erosion were identified and mapped using GPS. The assessment rated each segment of stream erosion on a 1 to 5 scale according to its severity, correctability, and accessibility; where a score of 1 is the most severe, but also the most correctible and the most accessible. Priority areas in need of stream restoration were determined using these three scores. The site ranking criteria can be found in Table 12.

TABLE 12: STREAM RESTORATION AND PIPE OUTFALL SITE RANKING CRITERIA

Priority Ranking	Scores
High	Severity = 1 or 2 AND Correctability/Access = 1 - 4
Medium	Severity = 1 or 2 AND Correctability or Access = 5, OR Severity = 3 AND Correctability/Access = 1 - 4
Low	Severity = 1 or 2 AND Correctability AND Access = 5; OR Severity = 3 AND Correctability/Access = 5; OR Severity = 4 - 5
Very Low	Severity = 4 or 5 AND Correctability/Access = 5; OR Severity = 3 AND Correctability AND Access = 5

Next, high and medium priority erosion sites were identified and combined into stream restoration projects based on proximity to other erosion sites. Pipe outfall data collected during the SCA assessment was ranked according to the same methods used for stream restoration sites (Table 12). Pipe outfalls with high and medium priority rankings would have been selected and incorporated into nearby stream restoration projects, however no pipe outfalls were ranked as medium or high priority.

Five stream restoration projects were identified with a total length of approximately 9,252 linear feet (Table 13). Impacts to those streams include widening and downcutting.

A unit cost estimate of $645/ft was used to estimate the initial cost of the stream restoration projects and a cost factor per impervious acre treated was used to derive the total cost over 20 years (King and Hagan, 2011). It should be noted that economy of scale is not built in to this cost estimate. Larger stream restoration projects are likely estimated at a higher cost than actual project costs may be. Load reductions were calculated for total nitrogen, total phosphorus, and total suspended sediment for each restoration site with estimated removal efficiencies from *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014) which are shown in Tables 14 and 15.

TABLE 13: STREAM RESTORATION PROJECT DESCRIPTIONS

Restoration Site ID	SCA Reach	Length (ft)	Current Condition	Proposed Actions
GI_SR_1	05	2,193	Stream located downstream from park. Channel widened with localized areas of severe bank erosion on meander bends.	Stream bank and bed stabilization to repair bank erosion. Project includes stabilization of two short outfall channels.
GI_SR_2	04	2,509	Stream originates from a pond, downstream from a commercial complex. Channel widened with localized areas of severe bank erosion.	Stream bank and bed stabilization to repair bank erosion.
GI_SR_3	05	2,142	Stream runs parallel to Oaks Rd. Undercut banks and raw bank erosion throughout.	Stream bank and bed stabilization to repair bank erosion.
GI_SR_4	08	1,423	Located adjacent to agriculture fields. Channel widened with moderate bank erosion throughout.	Stream bank and bed stabilization to repair bank erosion.
GI_SR_5	09	985	Stream runs parallel to Newport Church Rd. Channel widened with localized areas of severe bank erosion on meander bends.	Stream bank and bed stabilization to repair bank erosion.

TABLE 14: STREAM RESTORATION REMOVAL EFFICIENCY AND IMPERVIOUS ACRE EQUIVALENT

Pounds Reduced per Linear Foot			Impervious Acre Equivalent per Linear Foot
TN	TP	TSS	
0.075	0.068	15	0.01

Source: MDE, 2014

TABLE 15: STREAM RESTORATION COST, IMPERVIOUS CREDIT, AND LOAD REDUCTION

Site ID	SCA Reach	Erosion length (ft)	Total Initial Cost	Total Cost Over 20 Years*	Imperv-ious Credit	Load Reduction (lbs/yr)		
						TN	TP	TSS
Level 9- KCI Projects								
GI_SR_1	05	2,193	$1,414,485	$1,805,278	21.9	164.5	149.1	32,895.0
GI_SR_2	04	2,509	$1,618,305	$2,065,409	25.1	188.2	170.6	37,635.0
GI_SR_3	05	2,142	$1,381,590	$1,763,294	21.4	160.7	145.7	32,130.0
GI_SR_4	08	1,423	$917,835	$1,171,414	14.2	106.7	96.8	21,345.0
GI_SR_5	09	985	$635,325	$810,852	9.9	73.9	67.0	14,775.0
Level 6- Alternate Feasibility and Concept Design Projects (NTP)								
Oak Ridge Park- West	N/A	3,200	$2,064,000	$2,476,800	32.00	240.0	217.6	48,000.0
Oak Ridge Park- East	N/A	2,000	$1,290,000	$1,548,000	20.00	150.0	136.0	30,000.0

*Total cost over 20 years was not provided for Level 6 projects, therefore a 20% factor was applied to estimate to calculate the additional cost needed over time.

4.2 SHORELINE EROSION CONTROL

Areas with significant shoreline erosion are typically identified using the Maryland DNR Maryland Coastal Atlas (DNR, 2016). Historic shoreline data and shoreline rate of change transects were used to search for shoreline with moderate (4 to 8 feet of erosion per year) and high (greater than 8 feet of erosion per year) erosion. Shoreline without adequate erosion transect data is also typically analyzed using the historic shoreline data to identify additional areas with significant erosion issues. Areas with artificial stabilization or bulkhead are typically excluded from this search. The Gilbert Swamp watershed does not contain any shorelines, therefore this analysis was not conducted and no potential shoreline restoration projects were identified.

4.3 STORMWATER BMPS

Sites to develop new or retrofit stormwater BMPs were identified as part of the watershed assessment and planning process. All assessments, including the resulting proposed stormwater BMPs and projected treatment, are included in the sections below.

4.3.1 WATERSHED ASSESSMENT STORMWATER BMP ANALYSIS

A desktop analysis was performed to compile a list of potential sites for stormwater management. Results from the investigation conducted prior to the stormwater (BMP) assessment, including the neighborhood source assessment, hot spot investigation, and stream corridor assessment, were reviewed for potential concurrent stormwater management opportunities. Several of these sites were selected for additional review to assess feasibility for stormwater management through structural or environmental site design (ESD) practices. The sites selected included neighborhoods with little to no existing stormwater management, as well as pipe outfalls requiring stabilization. A database containing geospatial information for existing Charles County stormwater facilities was also used to identify potential BMP retrofit sites.

After an initial desktop review, a field visit was then conducted for each site. Sites with limited opportunity for stormwater management were noted, but not evaluated further. Sites that displayed potential for stormwater management retrofit or improvement were documented through photographs, field map annotation, and field reconnaissance forms. Existing site conditions, including ownership, existing stormwater management, site drainage, and conveyance, were recorded. Details that may not be readily available in GIS format, such as adjacent land use, access constraints, potential permitting considerations, and potential utility conflicts were also noted. Finally, a preliminary stormwater BMP proposed treatment option, purpose, and location was established for each site.

Following the field visit, the potential stormwater BMP sites were inventoried, and field information was corroborated and/or expanded upon using a variety of additional resources such as County as-built records and County spatial data. With additional supporting information, the potential sites were again queried for conditions that might eliminate the project from consideration completely.

Planning-level drainage areas were then delineated to the remaining selected potential stormwater BMP sites in ArcGIS using stormdrain shapefiles, two-foot contour data, and orthophotography, as well as field-observed drainage patterns. An impervious area layer was created by merging building, roadway, and driveway shapefiles and then clipped to each drainage area to establish the acres of impervious area draining to each site.

To determine the water quality volume (WQv) required at each retrofit site, procedures from MDE 2000 Maryland Stormwater Design Manual were used including the following equation:

$$WQv = \frac{(0.05+0.009*I)(A)}{12}$$

where:

I = Percent impervious cover
A = Drainage area (in acres)
I = Percent impervious cover

Once the MDE required water quality volume was established for each potential site, the proposed BMP type was finalized, and an estimate of the WQv provided was completed for each retrofit.

The BMP facility types that were identified include bioretention and dry swale. Table 16Table 16 below includes a brief discussion of the existing site conditions and the proposed site improvements. Table 17 contains a summary of the impervious area treated by the proposed BMP types. BMP drainage areas are displayed in Figure 18Figure 18.

TABLE 16: PROPOSED SWM BMP PROJECTS

Site ID	Existing Conditions	Proposed Improvements
GI_BMP_1	Existing grass channel adjacent to driveway. Roadside culverts drain into turf area before joining stream. Topography creates good confinement at proposed BMP	Dry Swale
GI_BMP_2	Existing grass channel adjacent to driveway. Roadside culverts drain into turf area before joining stream.	Dry Swale
GI_BMP_3	Existing pond. All stormdrains lead to pond, potential for treatment of rooftop and parking lot runoff before entering pond. Evidence of pooling water and erosion at culvert inlet.	Dry Swale
GI_BMP_4	Parking lot currently drains into a turf area adjacent to the parking lot on a church property.	Bioretention
GI_BMP_5	Located at a water tower facility. Portions of impervious area drains to front gate area where proposed bioretention is located. Small drainage area. Limited access to site.	Bioretention

TABLE 17: AREA TREATED BY SWM BMP PROJECTS PER TYPE

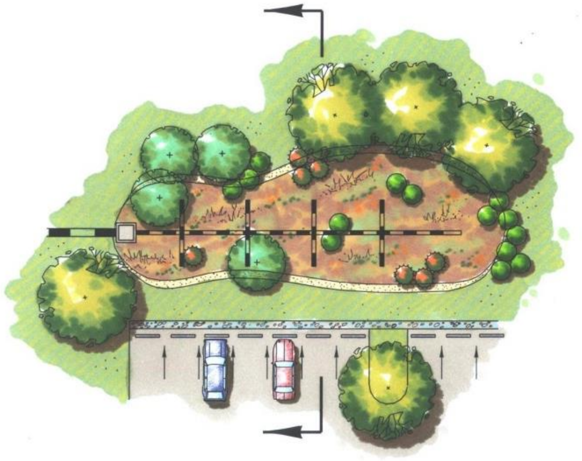
Treatment Type	Restoration Site IDs	Total Drainage Area (ac)	Impervious Area Treated (ac)
Bioretention	GI_BMP_4	0.8	0.4
	GI_BMP_5	0.3	0.3
Dry Swale	GI_BMP_1	1.4	0.2
	GI_BMP_2	0.7	0.1
	GI_BMP_3	4.3	0.5
	Total	**7.5**	**1.5**

The following provides a general description of each of the stormwater BMP treatment types.

Bioretention

A bioretention area combines open space with SWM through the use of landscaping and permeable soils to treat runoff from parking lots and urban areas. The permeable soils filter suspended sediments and some pollutants from the runoff while the landscaping promotes evapotranspiration of the runoff and uptake of nutrients.

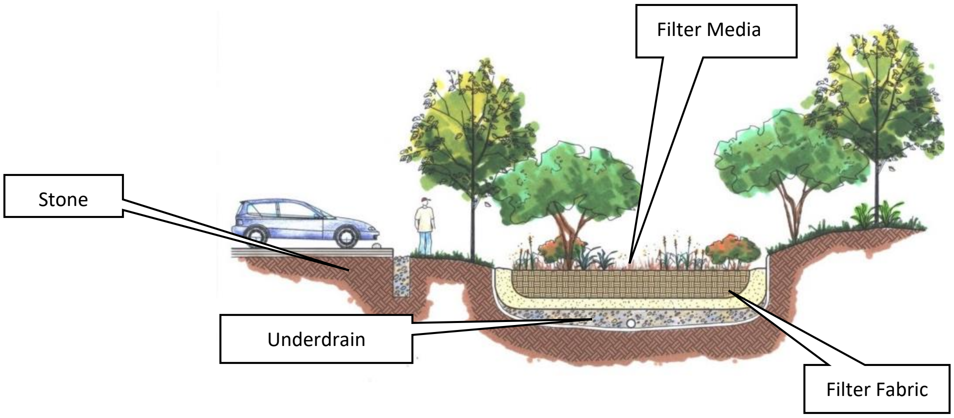
Bioretention areas generally consist of a stone diaphragm, filter fabric, filter media, landscaping, and an underdrain system. The stone diaphragm reduces the velocity of the runoff from the impervious surface that is entering the facility and also removes suspended material that may clog the filter media. The underdrain system is a perforated pipe system that collects the water that has filtered through the permeable media and transports it to a downstream open channel or connects into a nearby storm drain.



Plan view of bioretention area

The landscaping in a bioretention area is also very important. The plants chosen are native plant species that are tolerant of standing water. A wide variety of trees, shrubs, and herbaceous plants are selected for varying levels of vegetative uptake, for encouragement of various wildlife species, and for improved aesthetics. The permeable soil in the bioretention area is approximately 2.5 feet to 4 feet deep with 3 inches of mulch above it.

The ponding within the bioretention area is typically 6 inches to 12 inches. There is generally a catch basin or weir provided within the ponding area that is used for overflow when the ponding area reaches its maximum volume.



Cross section view of Bioretention area

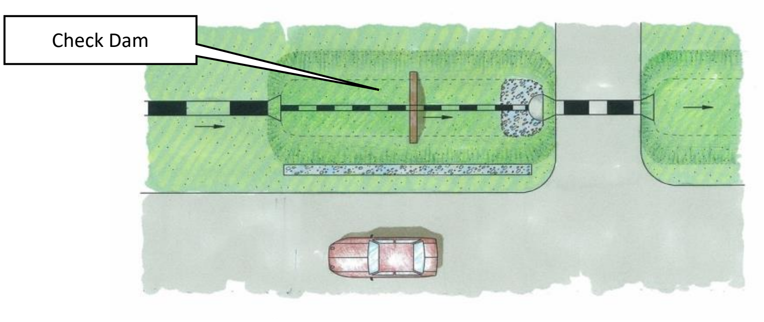
There were two opportunities for bioretention identified within the Gilbert Swamp watershed, including GI_BMP_4 and GI_BMP_5. Both of these sites are located on commercial and/or industrial properties, adjacent to parking lot. The drainage areas to these sites vary in size, but the potential bioretention areas would provide treatment for even small drainage areas with high amounts of imperviousness. Obvious limitations include obtaining permission from property owners and confirming potential for utilities impacts.

Dry Swales

A dry swale is an open channel used to convey drainage and promote the filtering of stormwater runoff. Dry swales, which are used to treat WQv, may also contain an underdrain beneath the filter material to ensure runoff is conveyed away within 48 hours.

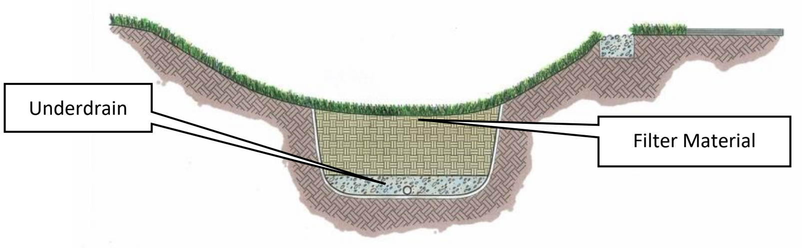
A dry swale contains filter material, an underdrain system, and check dams. The filter material is typically 2.5 feet of permeable soil underlain by a gravel bed surrounding an underdrain system consisting of a perforated pipe. The pipe conveys the filtered water to the downstream channel or a local storm drain.

A check dam is a small dam used within the channel to temporarily pool water, which promotes deposition of sediment, increases filtration through the filter media, and reduces flow velocities. Check dams allow channels to have a longitudinal slope of up to 4% and still provide WQv with non-erosive flow velocities.



Plan view of Dry Swale

The side slopes of a dry swale are typically designed to be flatter than 3:1. The vegetative cover usually consists of grass with some riprap at swale inlets and outlets. The bottom width of the dry swale is between two feet and eight feet and the maximum ponding depth is 18 inches.



Cross section of Dry Swale

Three opportunities for a dry swales were identified in the Gilbert Swamp watershed, GI_BMP_1, GI_BMP_2, and GI_BMP_3. Two sites are located within residential areas and one is located within a commercial area.

TABLE 18: STORMWATER BMP RUNOFF DEPTH TREATED, IMPERVIOUS TREATED, LOAD REDUCTION, AND COST

Site ID	BMP Type	Impervious Acres Treated*	Runoff Depth	Load Reduction (lbs/yr)			Total Initial Costs**	Total Costs Over 20 Years
				TN	TP	TSS		
GI_BMP_1	Swale	0.2	1.5	5.4	0.5	157.2	$8,008	$11,397
GI_BMP_2	Swale	0.1	2.0	2.7	0.2	87.5	$5,060	$7,201
GI_BMP_3	Swale	0.5	0.4	10.5	0.9	300.5	$23,848	$33,940
GI_BMP_4	Bioretention	0.3	0.8	2.9	0.4	156.3	$67,417	$78,471
GI_BMP_5	Bioretention	0.3	1.2	1.5	0.3	113.2	$48,182	$56,081
	Subtotal	1.4	NA	23.0	2.3	814.7	$152,514	$187,090

*Impervious credit in acres.

**Cost estimates from King and Hagan, 2011.

4.4 REFORESTATION

Potential reforestation sites were searched for during the SCA assessment performed in March and April 2016, however these sites were limited to the stream segments walked during the SCA assessment. A GIS desktop assessment was performed to supplement the SCA identified reforestation projects. The desktop assessment focused first on the opportunity to plant riparian buffers. Using the most recent available aerial photography, stream reaches without adequate 50 foot buffer on both banks were identified. Streams within land use areas categorized as agriculture were excluded from this search. Next, tree planting opportunities larger than 0.25 acres (as required by MDE in *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* Guidance, 2014) outside of riparian areas were identified. Targeted property types include property owned by the Charles County Board of Education, parks, other Charles County owned sites, and church parcels. Due to the limitations associated with a desktop assessment, these sites should be visited and confirmed as appropriate planting sites. Some sites may have constraints not identified during the desktop assessment.

A total initial cost estimate of $11,000/acre and a total cost over 20 years of $19,069 was used to estimate the cost of reforestation projects (King and Hagan, 2011). It should be noted that economy of scale is not built in to this cost estimate. While there are very few large reforestation projects identified, larger projects will likely cost less than estimated here due to economy of scale. Load reductions were calculated for total nitrogen, total phosphorus, and total suspended sediment for the site with estimated removal efficiencies from *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (Table 19; MDE, 2014). These efficiencies assume a survival rate of 100 trees/acre or greater with at least 50% of trees having a two inch diameter or greater (4.5 feet above ground; MDE, 2014). Three potential reforestation sites were identified, totaling 4.1 acres (Table 20).

TABLE 19: REFORESTATION BMPS EFFICIENCY AND IMPERVIOUS ACRE EQUIVALENT

BMP	Efficiency Per Acre			Impervious Acre Equivalent
	TN	TP	TSS	
Reforestation on Pervious Urban	66%	77%	57%	0.38
Impervious Urban to Forest	71%	94%	93%	1.00

Source: MDE, 2014

TABLE 20. REFORESTATION SITE COST, IMPERVIOUS CREDIT, AND LOAD REDUCTION

Site ID	SCA Reach ID	Property type	Area (acres)	Total Initial Cost	Total Cost Over 20 Years	Impervious Credit	Load Reduction (lbs/year)		
							TN	TP	TSS
GI_TP_1	N/A	Residential stream buffer	1.4	$15,400	$26,697	0.5	5.3	0.3	62.9
GI_TP_2	N/A	Residential stream buffer	1.0	$11,000	$19,069	0.4	3.8	0.2	44.9
GI_TP_3	N/A	Hughesville Correctional Campus entrance	1.7	$18,700	$32,417	0.6	6.4	0.4	76.4
Total			4.1	$45,100	$78,183	1.6	15.5	0.9	184.2

5 PROGRAMMATIC PRACTICES

Currently, the County performs several programmatic practices throughout the County's watersheds including the following: mechanical street sweeping and inlet cleaning, which are conducted continually throughout each fiscal year; trash clean-ups, which are organized on an as-needed basis and vary in location; and, homeowner practices, including rainwater harvesting, rain gardens, and downspout disconnection, which are generally reliant on homeowner participation.

Nutrient and sediment removal for both street sweeping and inlet cleaning under the existing program are calculated using fiscal year 2015 County data and the load reduction associated with the same yearly effort is modeled for future years, however no street sweeping occurred and only 1 inlet was cleaned within the Gilbert Swamp watershed in fiscal year 2015.

The potential to expand the County's trash clean-up program with the inclusion of sites identified during the SCA assessment is discussed in Section 5.1. Nutrient removals from planned homeowner practices, if implemented throughout the Gilbert Swamp watershed, are included in Section 5.2.

5.1 TRASH CLEAN-UPS

Areas in need of trash cleanup were field identified during the SCA assessment. Data collected at each site included the type of trash, an estimate of truckloads of trash, and if the site is a good opportunity for a volunteer clean-up. During the assessment, the sites were given scores for severity, correctability, and access. Using these scores, the sites were prioritized in the same way as stream restoration and pipe outfall sites. All sites found during the SCA assessment were recommended for trash clean-up due to the limited number of clean-up sites identified in the watershed.

Charles County's NPDES MS4 permit includes a requirement for Litter and Floatables (Section IV.D.4). The County currently operates an aggressive litter control program which utilizes three full-time crews who remove debris from County maintained right-of-way throughout the workweek. In addition, volunteers perform litter pickup on the weekends through community cleanups, the Adopt-A-Road Program, and annual Watershed Cleanup Events. Watershed cleanup events and volunteer opportunities are posted through the County's website (http://www.charlescountymd.gov/pw/environmental/litter-control-program).

Two sites were identified as suitable trash clean-up sites (Table 21). The cost of trash removal is dependent on the removal approach. None of the sites were determined to be suitable for a volunteer clean-up opportunity, which will increase trash removal costs. The cost of trash removal is estimated to be $1,000/site, for a total of $2,000 in the Gilbert Swamp watershed.

TABLE 21: TRASH CLEAN-UP SITES

Restoration Site ID	Type	Truck Loads	Volunteer Opportunity	Cost
GI_TC_1	Scrap metal	6	No	$1,000
GI_TC_2	Residential	4	No	$1,000
			Total	$2,000

5.2 HOMEOWNER PRACTICES

The implementation of homeowner practices is not only a cost effective strategy to supplement County restoration BMPs (e.g., stormwater BMPs, stream restoration, shoreline erosion control, etc.), but they also encourage the community to actively participate in cleaning up and taking ownership of the health of their watershed.

Nutrient removal from planned homeowner practices, including rainwater harvesting (i.e., rain barrels), rain gardens, and downspout disconnection (directing rainwater from downspout to lawn or pervious surface rather than to driveway or street), was calculated for each neighborhood assessed during the NSA reconnaissance and then projected to the watershed scale. The removal rates for 1 inch of rainfall treatment for this suite of homeowner BMPs are included in Table 22 (Goulet and Schueler, 2014). However, rainfall treatment varies based on site constraints, homeowner participation, and feasibility and often does not achieve the 1 inch rainfall treatment. Therefore, removal rates were calculated individually, by neighborhood, for each practice type based on specific site and design parameters in order to estimate total rain treatment and nutrient removal as shown in Table 23 and Table 24.

Impervious acre equivalencies for homeowner practices are also included in Table 22 (MDE, 2014). An impervious acre equivalent assumption was applied to each homeowner practice based on the associated modeling BMP type (rain barrel: impervious surface reduction, rain garden: bioretention/rain gardens, disconnection of rooftop runoff: impervious surface reduction).

TABLE 22: REMOVAL EFFICIENCIES FOR HOMEOWNER PRACTICES

Practice	**Efficiency Per Acre***		**Impervious Acre Equivalent**
	TN	**TP**	
Rain Barrel	28%	33%	0.75
Rain Garden	60%	70%	1.00
Downspout Disconnection	45%	52%	0.75

* based on treating the full 1 inch runoff

Sources: Goulet and Schueler, 2014; MDE, 2014

A series of assumptions were incorporated into the calculation of nutrient removal from homeowner practices, including the following:

General Assumptions

- Household participation per neighborhood:
    - Rain barrels = 30% of homes
    - Rain gardens = 10% of homes
    - Downspout Disconnections = 10% of homes
- Apartment or condominiums are not included in homeowner practices
- These practices will treat rooftop impervious area only
- Townhomes generally have 2 downspouts; Single-family homes generally have 4 downspouts – based on data collection during the NSA reconnaissance
- Total nitrogen and total phosphorus removed by each NSA neighborhood are standard removals that can be applied to additional neighborhoods identified as having similar housing densities, lot size, and forest cover in order to calculate total removal at the watershed scale.

Rain Barrel Assumptions

- Townhomes would use 1 rain barrel; Single-family homes would use 2 rain barrels
- Rain barrel capacity = 55 gal
- 50% of roof area will be treated, assuming an average roof size for the neighborhood

Rain Garden Assumptions

- Townhomes are not participating in the rain gardens strategy due to site limitations
- 50% of roof area will be treated
- Average rain garden depth = 8 in. as per Chesapeake Stormwater Network guidance (2013a)
- Engineering factor of 0.12 used to calculate Surface Area of rain garden as per Chesapeake Stormwater Network guidance (2013a)

Downspout Disconnection Assumptions

- Townhomes are not participating in the downspout disconnection strategy due to site limitations
- 1 downspout will be disconnected per single-family home

- Available pervious land measured in GIS between driveway and property line for a subset of households within each NSA neighborhood. As per Chesapeake Stormwater Network guidance, available pervious land area should be >10 feet in width with a length no less than 40 feet (2013b).
- An 'Average' infiltration ranking with an infiltration factor of 0.5 was applied to all NSA neighborhoods.

Nutrient removal and impervious credit for rain barrel and rain garden practices for each NSA neighborhood, projection by neighborhood type, and watershed total are shown in Table 23 and Table 24.

Estimated costs for each homeowner practice are also included in the following tables. While some costs may be the responsibility of individual homeowners, the County is currently working with partners to subsidize costs and is in the process of securing additional funding for further support.

For the rain barrel practice, a cost of $60/barrel plus $25/fixtures and attachments was used to calculate an estimated cost of $71,910 for implementation in the Gilbert Swamp watershed. The County currently covers 50% of costs for home owners who participate in the rain barrel practice. According to the University of Connecticut Cooperative Extension System, rain garden costs may vary from a minimum cost of $5/sq ft of rain garden size - $45/sq ft of rain garden size dependent on soil removal costs, soil amendments, need for a contractor, and planting size (http://nemo.uconn.edu/raingardens/calculator.htm). An initial cost estimate of $25/sq ft of rain garden size and a total cost of $613,271 is projected for implementing the rain garden practice in the Gilbert Swamp watershed. Downspout disconnection was not determined to be a feasible option due to the high percentage of downspouts already disconnected in this watershed; therefore, this practice is not included in estimated costs. A grant program with Chesapeake Bay Trust and the County was initiated in FY 2016 for non-profit organizations to help alleviate homeowner practice costs in which the County provides 50% credit for these practices from funding provided by the annual stormwater remediation fee.

TABLE 23: PROJECTED NUTRIENT REMOVAL AND IMPERVIOUS CREDIT FROM PLANNED RAIN BARRELS

NSA ID	Neighbor-hood Type	# of Rain Barrels Needed*	50% of Average Roof Area to Treat (sq ft)	Rainfall Depth Treated (in)	% Removal Based on Total Rain Treatment		Lbs Reduced per NSA Neighborhood		Total # of Similar Neighbor-hoods in watershed	Total # of Homes	Total Lbs Reduced		Treated Imperv-ious Acres	Cost
					TN	TP	TN lbs/yr	TP lbs/yr			TN lbs/yr	TP lbs/yr		
GI-NSA-1	Single Family	163	1,459	0.12	15%	17%	0.8	0.2	4	82	3.1	0.7	0.2	$13,872
GI-NSA-2	Single Family	48	1,089	0.16	19%	23%	0.2	0.0	4	24	0.9	0.2	0.1	$4,080
GI-NSA-3	Single Family	264	1,525	0.12	14%	17%	1.2	0.3	4	132	5.0	1.1	0.4	$22,440
GI-NSA-4	Single Family	371	1,307	0.14	16%	19%	1.2	0.2	6	185	7.0	1.5	0.6	$31,518
Total		**846**	**5,380**				**3.4**	**0.7**	**18**	**423**	**16.0**	**3.5**	**1.3**	**$71,910**

*assuming 1 rain barrel per townhome and 2 rain barrels per single family home

TABLE 24. PROJECTED NUTRIENT REMOVAL AND IMPERVIOUS CREDIT FROM PLANNED RAIN GARDENS

NSA ID	Neighbor-hood Type	50% of Average Roof Area to Treat (sq ft)	Rainfall Depth Treated (in)	% Removal Based on Total Rain Treatment		Lbs Reduced per NSA Neighborhood		Total # of Similar Neighbor-hoods in watershed	Total # of Homes	Total Lbs Reduced		Treated Imperv-ious Acres	Cost
				TN	TP	TN lbs/yr	TP lbs/yr			TN lbs/yr	TP lbs/yr		
GI-NSA-1	Single Family	1,459	1.0	60%	70%	1.0	0.2	4	27	4.2	0.9	0.9	$124,037
GI-NSA-2	Single Family	1,089	1.0	60%	70%	0.2	0.0	4	8	0.9	0.2	0.2	$27,225
GI-NSA-3	Single Family	1,525	1.0	60%	70%	1.8	0.4	4	44	7.0	1.5	1.5	$209,633
GI-NSA-4	Single Family	1,307	1.0	60%	70%	1.4	0.3	6	62	8.5	1.8	1.9	$252,376
Total									**141**	**20.6**	**4.4**	**4.5**	**$613,271**

5.3 SEPTIC PRACTICES

Although septic strategies including connections, pump outs, and upgrades do not receive nutrient and sediment load reduction credits towards SW-WLAs for the urban stormwater sector, they do count towards impervious acre credit and were included in the County's impervious accounting (Section 6.3). According to MDE guidance (MDE, 2014) each septic connection achieves an impervious equivalent of 0.39 ac, each pump-out achieves an impervious acre equivalent of 0.03 ac and each septic upgrade achieves an impervious acre equivalent of 0.26 ac (Table 25).

Table 26 shows impervious credit for septic connections, pump outs, and upgrades through fiscal year 2017. There were no septic connections and 10 septic upgrades in the Gilbert Swamp watershed. Septic pumping is an annual practice that is credited on a rolling five year period for pump-outs occurring outside the Chesapeake Bay Critical Area and a three year period for pump-outs occurring with the Critical Area. There was one septic pump-out within the Critical Area between FY15 and FY17 and 239 pump-outs outside the Critical Area between FY13 and FY17. Estimated costs of septic connections, pump outs and upgrades are $42,330/connection (LimnoTech, 2013), $117/pump out (Charles County data), and $13,000/upgrade (MDE, 2011). Total costs for septic practices in the Gilbert Swamp watershed is $158,080 (Table 26). Total cost over 20 years for annual septic practices are also included in Table 26 and were calculated by multiplying initial cost per year by 20 years. The County currently administers a Bay Restoration Fund (BRF) Septic System Grant Program through the Health Department that provides financial assistance to homeowners for septic system upgrades or connections to the public sewer system (https://www.charlescountymd.gov/news-releases/septic-system-upgrade-assistance-available). The County also has a septic pump-out reimbursement program to encourage residents to use this practice (https://www.charlescountymd.gov/pgm/planning/watershed/septic-system-pump-out-reimbursement-program).

TABLE 25: SEPTIC EFFICIENCIES AND IMPERVIOUS AREA EQUIVALENCIES

Practice	Efficiency Per Practice*		Impervious Acre Equivalent
	TN	TP	
Septic Pumping	0%	0%	0.03
Septic Denitrification	0%	0%	0.26
Septic Connections	0%	0%	0.39

* No credit given to septic practices for Urban MS4 source sector.

Source: MDE, 2014

TABLE 26: POLLUTANT REMOVAL AND IMPERVIOUS CREDIT FROM SEPTIC PRACTICES

Practice	Number	Cost	Total Cost over 20 Years	Lbs Reduced / yr**			Impervious Credit (Ac)
				TN	TP	TSS	
Connection	0	$0	N/A	0.0	0.0	0.0	0.0
Pumping inside Critical Area*	1	$117	$780	0.0	0.0	0.0	0.3
Pumping outside Critical Area*	239	$27,963	$111,852	0.0	0.0	0.0	7.2
Denitrification	10	$130,000	N/A	0.0	0.0	0.0	2.6

*Pumping is an annual practice. Practices within Critical Area are credited on a rolling three year period (FY15-FY17), practices outside Critical Area are credited on a rolling five year period (FY13-FY17). Cost over 20 years calculated by multiplying initial costs per year by 20 years.

** No credit given to septic practices for Urban MS4 source sector.

6 TREATMENT SUMMARY

6.1 EXISTING BMPS – ACTUAL IMPLEMENTATION

Charles County maintains a database of stormwater urban restoration BMP facilities and water quality and capital improvement projects (WQIP and CIP) in addition to tracking homeowner, septic, and operational practices. Current BMP implementation through the end of the fiscal year 2017 (June 30, 2017) in the Gilbert Swamp watershed are shown in Table 27.

TABLE 27: CURRENT RESTORATION BMP IMPLEMENTATION THROUGH JUNE 2017 IN THE GILBERT SWAMP WATERSHED

BMP	Unit	Gilbert Swamp 2017 Current Implementation*
Inlet Cleaning	# of pipes	0
Street Sweeping	miles swept	0
Wet Pond	acres	0
Underground Storage Chamber	acres	0
Dry Swale	acres	0
Filterra	acres	0
SPSC	acres	0
Rain Garden	acres	0
Septic Connections	connection	0
Septic Pump outs	pump-outs	240
Septic Upgrades	upgrade	10

*Includes all of the County's restoration BMPs through June 2017. Annual BMPs are only counted in the year in which they occur.

6.2 PLANNED IMPLEMENTATION

Table 28 presents the planned implementation of BMPs described in sections 4 and 5 of this report.

TABLE 28: BMP IMPLEMENTATION - PLANNED LEVELS

BMP	Unit	Gilbert
Bioretention	impervious acre	0.7
Created wetland	acre	0
Downspout Disconnection - Homeowner Practice	# of homes participating	0
Rain Barrels - Homeowner Practice	# of homes participating	423
Rain Gardens - Homeowner Practice	# of homes participating	141
Dry Swale	impervious acre	0.8
Filtering Practices	impervious acre	0
Infiltration basin	impervious acre	0
Inlet Cleaning	# of pipes	0
Organic Filter	impervious acre	0
Pond Retrofit	impervious acre	0
Reforestation	acres	4.1
Septic Connections	connection	0
Septic Pump outs	pump outs	105
Septic Upgrades	upgrade	2
Sheetflow to Conservation	impervious acre	0
Step Pool Stormwater Conveyance Systems	impervious acre	0
Stream Restoration	linear feet	14,452
Street Sweeping	miles swept	0
Submerged Gravel Wetland	impervious acre	0
Wet Pond	impervious acre	0

6.3 IMPERVIOUS CREDIT

As a requirement of the NPDES MS4 Discharge Permit issued by MDE to Charles County on December 26, 2014, the County must treat 20% of remaining baseline untreated impervious acres by 2019. Impervious acres treated within the Gilbert Swamp watershed will count towards this goal.

Table 29 shows impervious treatment achieved by planned strategies described in this report for the Gilbert Swamp watershed.

TABLE 29: GILBERT SWAMP IMPERVIOUS ACCOUNTING

Impervious Accounting	Gilbert Swamp
Baseline Impervious Treatment	
Total Impervious Area*	998.4 acres
County MS4 Impervious Area	552.9 acres
Impervious Treated	113.4 acres
Impervious Treated Percent	21%
Impervious Untreated	439.5 acres
Impervious Untreated Percent	79%
FY 17 Progress	
Impervious Treated	9.8 acres
Potential Impervious Treatment	
Operational Practices	0.0 acres
Septic Connections	0.0 acres
Septic Pump Outs	3.1 acres
Septic Upgrades	0.6 acres
Homeowner Practices	5.8 acres
Structural Practices	147.5 acres
Potential Impervious Treatment	**157.0 acres**
Summary of Projected Progress	
Impervious Untreated	439.5 acres
FY17 Progress- Impervious Treatment	9.8 acres
Potential Impervious Treatment	157.0 acres
Total Progress and Potential Treatment	166.8 acres
Percent of Untreated Impervious Treated	**38%**

*Impervious acres based on 2011 aerial photos (Vista, 2017).

6.4 LOCAL TMDL AND BAY TMDL BASELINE AND TARGET LOADS

6.4.1 LOCAL TMDLS

There are no local TMDLs for Gilbert Swamp watershed.

6.4.2 CHESAPEAKE BAY TMDL

The County's MS4 permit is requiring compliance with the Chesapeake Bay TMDL for the urban stormwater sector through the use of the 20% impervious surface treatment strategy. Therefore, it is expected that the 20% goal and associated credit accounting will take precedence over the Bay TMDL loading goals and crediting. While not a requirement in the County's MS4 permit, the strategies provided in this plan have been modeled in order to calculate expected progress toward meeting the Bay TMDL reduction goals.

Bay TMDL baseline and calibrated target loads are presented in Table 30. Modeling terminology is defined below.

- **Calibrated 2010 Baseline Loads**: The pollutant loads (i.e., nitrogen, phosphorus, and sediment) for the Bay TMDL baseline, as of 2010 in the Charles County MS4 source sector (SW-WLA), were determined using MAST, which calculates pollutant loads and reductions calibrated to the Chesapeake Bay Program Partnership Watershed Model v.5.3.2.
- **Target Percent Reductions**: Percent reductions assigned to Charles County Phase I MS4 stormwater sector (http://wlat.mde.state.md.us/ByMS4.aspx). If TP target is met, TSS target will be met.
- **Calibrated Target Reductions:** Target reduction calibrated MAST CBP v.5.3.2 by multiplying the reduction percent published by the calibrated baseline load. If TP target is met, TSS target will be met.
- **Calibrated TMDL WLA**: Allocated loads are calculated from the baseline levels, calibrated to CBP P5.3.2 as noted above, using the following calculation: Baseline – (Baseline x Target Percent Reduction); or, Baseline x (1 – Target Percent Reduction).

TABLE 30: BAY TMDL BASELINE AND TARGET LOADS

	TN-EOS (lbs/yr)	TP-EOS (lbs/yr)	TSS-EOS (lbs/yr)
Bay TMDL Baseline and Targets			
2010 Baseline Loads	235,070	20,037	5,739,174
Target Percent Reduction	18.2%	37.7%	-
Calibrated Target Reduction	42,759	7,554	-
Calibrated Bay TMDL WLA	192,311	12,483	-

6.5 BAY TMDL EXPECTED LOAD REDUCTIONS

This section provides a summary of pollutant load treatment from current and planned BMP implementation throughout the Gilbert Swamp watershed towards the Bay TMDL goals, including the restoration BMPs implemented through 2017 (presented in Section 6.1) and planned implementation (Section 6.2). Table 31 presents Bay TMDL progress and planned reductions.

Progress and planned reductions from the County's other watershed assessments, Port Tobacco River Watershed Assessment (KCI, 2015), Mattawoman Creek Watershed Assessment (KCI, 2016a), Lower Patuxent River Watershed Assessment (KCI, 2016b), Zekiah Swamp Watershed Assessment (KCI, 2017a), and Wicomico River Watershed Assessment (KCI, 2017b) are also included. Descriptions of the reductions are described below. It is important to note that loads for the Town of LaPlata are not included in baseline, progress, or planning loads for County-wide results as LaPlata is not considered part of the County's MS4 permit. Since LaPlata is located in the Port Tobacco and Zekiah Swamp watersheds, loads were disaggregated from both watersheds based on land area proportion for County-wide results. Planned accounting and modeling terminology is described below.

- **Restoration Reduction**: Load reductions from restoration BMPs with a built date after the baseline to 2016.
- **Restoration Reduction Percent**: The percent difference of the baseline load and the restoration reduction.
- **Reduction Remaining for Treatment**: The difference between the calibrated TMDL target reduction and restoration reduction.
- **Reduction Percent Remaining**: The difference between the Target Percent Reduction and Restoration Reduction Percent. This is the percent reduction left to be treated.
- **Planned Reductions**: The sum of loads treated by planned projects, organized by "Level":
  - Level 1 – Completed
  - Level 2 – In Construction
  - Level 3 – In Full Design
  - Level 4 – County Maintenance / Alternative BMP Projects
  - Level 6 – Feasibility and Concept Design Projects (County NTP)
  - Level 7 – Feasibility and Concept Design Projects (High Priority)
  - Level 8 – Alternate Feasibility and Concept Design Projects (Low Priority)
  - Level 9 – Additional Sites Identified in KCI Watershed Assessment
  - Level 10 – Evaluated and Deprioritized
  - Level 11 – SWM Facilities for Possible ISA Baseline Reduction

- **Reduction (Progress + Planned)**: The sum of loads treated from restoration BMPs with a built date after the baseline to 2016 (i.e., 2016 Progress Reductions) and Planned Reductions.
- **Reduction Percent (Progress + Planned)**: The percent difference of the baseline load and the Reduction (Progress + Planned).
- **Reduction Percent Towards Target Goal**: The percent difference of the calibrated target reduction and the Reduction (Progress + Planned).
- **Reduction Remaining for Treatment**: The difference between the calibrated target reduction and the Reduction (Progress + Planned).

TABLE 31: BAY TMDL PROGRESS AND PLANNED REDUCTIONS

	TN- EOS (lbs/yr)	**TP- EOS (lbs/yr)**	**TSS*- EOS (lbs/yr)**
Bay TMDL Baseline and Targets			
2010 Baseline Loads	235,070	20,037	5,739,174
Target Percent Reduction	18.2%	37.7%	-
Calibrated Target Reduction	42,759	7,554	-
Calibrated Bay TMDL WLA	192,311	12,483	-
2017 Progress Reductions			
Gilbert Swamp	*0.2*	*14.4*	*0.0*
Mattawoman Creek	*663.1*	*192.2*	*51,144.3*
Nanjemoy Creek	*166.0*	*159.3*	*280,400.9*
Patuxent River Lower	*56.8*	*58.3*	*89,546.1*
Port Tobacco River	*232.8*	*134.9*	*61,586.6*
Potomac River L Tidal	*1,117.6*	*929.3*	*1,827,996.7*
Potomac River M Tidal	*245.5*	*50.5*	*19,556.5*
Potomac River U Tidal	*120.5*	*108.6*	*217,985.0*
Wicomico River	*231.8*	*211.0*	*350,722.4*
Zekiah Swamp	*663.0*	*247.2*	*56,380.6*
Restoration Reductions	3,497.4	2,105.8	2,955,319.1
Planned Reductions			
Gilbert Level 9- KCI Structural and Homeowner Projects	*769.1*	*640.3*	*139,778.9*
Gilbert Level 2-8 Structural Projects	*390.0*	*353.6*	*78,000.0*
Gilbert Operational	*0.0*	*0.0*	*0.0*
Total Gilbert Planned Reductions	1,159.1	993.9	217,778.9
Total Other Watershed Reductions	28,684	7,920	3,704,996
Total County-wide Planned Reductions	29,843	8,914	3,922,775
Totals			
Reduction (Progress + Planned)	33,313	10,781	6,878,094
Reduction Percent (Progress + Planned)	14.2%	53.8%	-
Reduction Percent Towards Target Goal	77.9%	142.7%	-
Reduction Remaining for Treatment	9,446	0	-

*No target reduction for sediment. It is anticipated that by achieving the phosphorus goal, enough sediment will be removed to improve water quality.

Additional information about Gilbert Swamp and County-wide planned reductions can be found in the Charles County Municipal Stormwater Restoration Plan (KCI, 2017).

6.6 COST SUMMARY

A summary of project costs by project category is provided in Table 32. Costs for restoration projects include the planning, design, surveying, environmental permitting, agency review, and construction costs and were estimated using a variety of sources.

King and Hagan (2011) cost estimates were used for many restoration project types, including stream restoration, tree planting, and all stormwater management projects. Costs of street sweeping, inlet cleaning, and septic practices were calculated using costs from County data. Trash clean-up costs were assumed to be $1,000 per clean-up site. Cost per rain barrel was assumed to be $85. Rain gardens were assumed to be $25/ sq ft of rain garden. While some costs of these homeowner practices may be the responsibility of individual homeowners, the County is currently working with partners to subsidize costs and is in the process of securing additional funding for further support.

Additional information about costs of Gilbert Swamp and County-wide projects can be found in the Charles County Municipal Stormwater Restoration Plan (KCI, 2017).

TABLE 32: SUMMARY RESTORATION PROJECT COSTS

	Total Initial Cost	**Cost Over 20 Years***
Gilbert Swamp		
Level 9- KCI Projects	$6,167,154	$7,881,519
Stream Restoration	$5,967,540	$7,616,246
Stormwater Management	$152,514	$187,090
Reforestation	$45,100	$78,183
Trash Cleanups	$2,000	N/A
Level 2- In Construction	$0	$0
Level 3- Full Design	$0	$0
Level 5-8- Concept	$3,354,000	$4,024,800
Street Sweeping	$0	$0
Inlet Cleaning	$0	$0
Homeowner Practices	$685,180	N/A
Septic Practices	$55,089	$668,444
Total	**$10,261,423**	**$12,574,763**

*Annual practices cost over 20 years calculated by multiplying initial costs by 20 years. Annual practices include street sweeping, inlet cleaning, and septic pump outs. Cost over 20 years for annual practices does not account for inflation.

7 PRIORITIZATION

A complete description of the prioritization methods is included in Appendix D. This section provides a brief summary of the method and presents the results. The prioritization involved a matrix made up of a series of parameters, or metrics, which evaluated each project and allowed for discrimination between the facilities. There are three categories of metrics: project benefits, project constraints, and project costs. Metrics were selected using a pairwise comparison by the project team by comparing pairs of metrics to evaluate which has greater importance. From this analysis, the weight of each chosen metric was calculated. Next, the projects were scored for each metric. Quantitative metrics were scored based on results of the preliminary design and cost estimates (e.g. impervious area treated, pollutant removal). Other metrics were scored more qualitatively based on professional judgment and assessment of each project site (e.g. access constraints, public visibility/education/outreach). Each project was ranked based on the total score and the final prioritization was determined. The final prioritized list of projects is presented in Table 33 and Table 34.

TABLE 33: GILBERT SWAMP WATERSHED PRIORITIZATION RANKING BY PROJECT TYPE

Project ID	Project Type	Benefits Rank	Constraints Rank	Cost Rank	Total Score	Final Rank
GI_BMP_1	New BMP	7	8.5	2	18	2
GI_BMP_2	New BMP	10	8.5	1	20	4
GI_BMP_3	New BMP	8	12	3	23	6.5
GI_BMP_4	New BMP	9	4	15	28	11
GI_BMP_5	New BMP	11	7	7	25	10
GI_SR_1	Stream Restoration	1	11	11	23	6.5
GI_SR_2	Stream Restoration	4	15	12	31	14
GI_SR_3	Stream Restoration	2	13.5	9	25	9
GI_SR_4	Stream Restoration	5	13.5	10	29	12
GI_SR_5	Stream Restoration	3	10	8	21	5
GI_TP_1	Tree Planting	13	5	6	24	8
GI_TP_2	Tree Planting	12	3	4	19	3
GI_TP_3	Tree Planting	6	1	5	12	1
GI_TC_1	Trash Cleanup	15	6	13.5	35	15
GI_TC_2	Trash Cleanup	14	2	13.5	30	13

TABLE 34: GILBERT SWAMP WATERSHED PRIORITIZATION FINAL RANKING

Project ID	Project Type	Final Rank
GI_TP_3	Tree Planting	1
GI_BMP_1	New BMP	2
GI_TP_2	Tree Planting	3
GI_BMP_2	New BMP	4
GI_SR_5	Stream Restoration	5
GI_BMP_3	New BMP	6.5
GI_SR_1	Stream Restoration	6.5
GI_TP_1	Tree Planting	8
GI_SR_3	Stream Restoration	9
GI_BMP_5	New BMP	10
GI_BMP_4	New BMP	11
GI_SR_4	Stream Restoration	12
GI_TC_2	Trash Cleanup	13
GI_SR_2	Stream Restoration	14
GI_TC_1	Trash Cleanup	15

The project prioritization results provide a starting point for the County's planning process of project implementation. Table 34 presents the potential projects listed by final ranking. The highest ranked projects (lower final rank numbers) in general provide the greatest benefits with the least constraints and project costs, relative to all other potential projects. These projects should be first priority to achieve the greatest load reductions to meet Bay restoration goals. In general, reforestation and new BMP projects ranked very high due to their relatively low cost and low constraints. Beyond these projects, there is a diversity of high priority projects including stream restorations and trash cleanups.

As noted in Section 6, the planned projects summarized above will have an implementation target of 2025 to align with Bay restoration goals. Feasibility studies of the planned strategies may reveal that some existing structures identified for retrofitting or enhancement or that new restoration strategies may not be feasible candidates for future projects and may be eliminated from consideration. The County will take an adaptive management approach and will reevaluate treatment needs as feasibility studies progress. The County will continue to track the overall effectiveness of the various BMP strategies and will adapt the suite of solutions based on the results. In addition, new technologies are continuously evaluated to determine if the new technologies allow more efficient or effective pollution control.

Support, cooperation, and participation from the citizens of Charles County are very important for the successful implementation of restoration projects, especially homeowner practices. Treatment in all of the Charles County watersheds is imperative for Bay restoration by providing the load reductions presented in Section 6.4.2.

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APPENDIX A – NEIGHBORHOOD SOURCE ASSESSMENT DATA

Neighborhood Source Assessment **NSA**

WATERSHED: GILBERT	**SUBWATERSHED:**	**UNIQUE SITE ID:** GI-NSA-1	
DATE: 3/7/16	**ASSESSED BY:** SB/AW	**CAMERA ID:**	**PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ____________ Neighborhood Area (acres) ____

If unknown, address (or streets) surveyed:

Norwood Drive

Homeowners Association? ☐ Y ☐ N ☒ Unknown If yes, name and contact information: ____________

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached <¼ ¼ ½ 1 [✓ >1] acre ☐ Mobile Home Park

Estimated Age of Neighborhood: 30 years	Percent of Homes with Garages: 100 % With Basements 100 %	**INDEX***
Sewer Service? ☐ Y ☒ N		●
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	**Percentage**	**Comments/Notes**	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	20		
B2. % of lot with grass cover	70		●
B3. % of lot with landscaping (e.g., mulched bed areas)	10		◆
B4. % of lot with bare soil	0		○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy	20		◆
B6. Evidence of permanent irrigation or "non-target" irrigation	0		○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 20		○
	Med: 80		
	Low: ____		
B8. Outdoor swimming pools? ☒Y ☐N ☐ Can't Tell Estimated # 1			○
B9. Junk or trash in yards? ☐ Y ☒N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	100		
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☒ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer	0		◇ ○
D2. Downspouts are directed to impervious surface	20		
D3. Downspouts discharge to pervious area	80		
D4. Downspouts discharge to a cistern, rain barrel, etc.	0		
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☒ Y ☐ N			◆
E. COMMON AREAS			
E1. Storm drain inlets? ☐ Y ☒ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ________			○
E2. Storm water pond? ☒ Y ☐ N Is it a ☐ wet pond or ☒ dry pond? Is it overgrown? ☒ Y ☐ N What is the estimated pond area? ☒ <1 acre ☐ about 1 acre ☐ > 1 acre			◆
E3. Open Space? ☐ Y ☒ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other ________			○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ________

Describe Recommended Actions:

RAIN BARRELS + GARDENS
SWALE RETROFITS

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☑ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☑ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

WATERSHED: GILBERT	**SUBWATERSHED:**	**UNIQUE SITE ID:** GI-NSA-2	
DATE: 3/7/16	**ASSESSED BY:** JB/AW	**CAMERA ID:**	**PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ____________ Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed:
off DuBois Rd

Homeowners Association? ☐ Y ☒ N ☐ Unknown If yes, name and contact information: ____________

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) < ¼ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached <¼ ¼ ½ 1 [✓ >1] acre ☐ Mobile Home Park

Estimated Age of Neighborhood: 20 years	Percent of Homes with Garages: 100 % With Basements 100 %		**INDEX***
Sewer Service? ☐ Y ☒ N			●
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%			○
Record percent observed for each of the following indicators, depending on applicability and/or site complexity	**Percentage**	**Comments/Notes**	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	20		
B2. % of lot with grass cover	70		●
B3. % of lot with landscaping (e.g., mulched bed areas)	10		◆
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy	10		◆
B6. Evidence of permanent irrigation or "non-target" irrigation	0		○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 60		●
	Med: 40		
	Low: ____		
B8. Outdoor swimming pools? ☐ Y ☐ N ☒ Can't Tell Estimated # ____			○
B9. Junk or trash in yards? ☐ Y ☐ N ☒ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☒ N/A			
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☒ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer	0		◆ ○
D2. Downspouts are directed to impervious surface	30		
D3. Downspouts discharge to pervious area	70		
D4. Downspouts discharge to a cistern, rain barrel, etc.	0		
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☒ Y ☐ N			◆
E. COMMON AREAS			
E1. Storm drain inlets? ☐ Y ☒ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ______			○
E2. Storm water pond? ☒ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☒ <1 acre ☐ about 1 acre ☐ > 1 acre INFILTRATION			◇
E3. Open Space? ☐ Y ☒ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: *(check all that apply)* ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other ______			○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ______

Describe Recommended Actions:

RAIN GARDENS + BARRELS

SWALE RETROFIT

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☑ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☑ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

Neighborhood Source Assessment **NSA**

WATERSHED: GILBERT	**SUBWATERSHED:**	**UNIQUE SITE ID:** GL-NSA-3	
DATE: 3 / 7 / 16	**ASSESSED BY:** SB/AW	**CAMERA ID:**	**PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ______ Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed:
off Charles St.

Homeowners Association? ☐ Y ☒ N ☐ Unknown If yes, name and contact information: ______

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) < ¼ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached <¼ ¼ ½ 1 [✓ >1] acre ☐ Mobile Home Park

			INDEX*
Estimated Age of Neighborhood: 30 years Percent of Homes with Garages: 90 % With Basements 100 %			
Sewer Service? ☐ Y ☒ N			●
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%			○
Record percent observed for each of the following indicators, depending on applicability and/or site complexity	**Percentage**	**Comments/Notes**	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	30		
B2. % of lot with grass cover	45		○
B3. % of lot with landscaping (e.g., mulched bed areas)	10		◆
B4. % of lot with bare soil	5		○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy	20		◆
B6. Evidence of permanent irrigation or "non-target" irrigation	0		○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 20		○
	Med: 80		
	Low: ____		
B8. Outdoor swimming pools? ☒ Y ☐ N ☐ Can't Tell Estimated # 2			●
B9. Junk or trash in yards? ☐ Y ☒ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	100		
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☒ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer	0		◇ ○
D2. Downspouts are directed to impervious surface	30		
D3. Downspouts discharge to pervious area	70		
D4. Downspouts discharge to a cistern, rain barrel, etc.	0		
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☒ Y ☐ N			◆

E. COMMON AREAS	
E1. Storm drain inlets? ☐ Y ☒ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty	◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ______________	○
E2. Storm water pond? ☒ Y ☐ N Is it a ☐ wet pond or ☒ dry pond? Is it overgrown? ☒ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre	◆
E3. Open Space? ☐ Y ☒ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N	○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N	
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS	
Based on field observations, this neighborhood has significant indicators for the following: *(check all that apply)* ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other ______________	○

Recommended Actions

Specific Action

☒ Onsite retrofit potential?
☑ Better lawn/landscaping practice?
☐ Better management of common space?
☐ Pond retrofit?
☐ Multi-family Parking Lot Retrofit?
☐ Other action(s) ______________________

Describe Recommended Actions:

RAIN GARDEN, RAIN BARREL
SWALE RETROFITS

Initial Assessment

NSA Pollution Severity Index

☐ Severe (More than 10 circles checked)
☐ High (5 to 10 circles checked)
☑ Moderate (Fewer than 5 circles checked)
☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

☐ High (More than 5 diamonds checked)
☑ Moderate (3-5 diamonds checked)
☐ Low (Fewer than 3 diamonds checked)

NOTES:

Neighborhood Source Assessment

NSA

WATERSHED: GILBERT	**SUBWATERSHED:**	**UNIQUE SITE ID:** G1-NSA-4	
DATE: 3 / 7 / 16	**ASSESSED BY:** SB/AW	**CAMERA ID:**	**PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ______ Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed:

off Oliver Shop

Homeowners Association? ☐ Y ☒ N ☐ Unknown If yes, name and contact information: ______

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) < ¼ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached <¼ ¼ ½ 1 [✓ >1] acre ☐ Mobile Home Park

		INDEX*
Estimated Age of Neighborhood: 40 years	Percent of Homes with Garages: 100% With Basements 100%	
Sewer Service? ☐ Y ☒ N		○
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	**Percentage**	**Comments/Notes**	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	10		
B2. % of lot with grass cover	80		●
B3. % of lot with landscaping (e.g., mulched bed areas)	10		◆
B4. % of lot with bare soil	0		○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy	50		◇
B6. Evidence of permanent irrigation or "non-target" irrigation	0		○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 20		○
	Med: 70		
	Low: 10		
B8. Outdoor swimming pools? ☒ Y ☐ N ☐ Can't Tell Estimated # 5			●
B9. Junk or trash in yards? ☐ Y ☒ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	100		
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? ____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☒ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer	0		◇ ○
D2. Downspouts are directed to impervious surface	10		
D3. Downspouts discharge to pervious area	90		
D4. Downspouts discharge to a cistern, rain barrel, etc.	0		
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☑ Y ☐ N			◆
E. COMMON AREAS			
E1. Storm drain inlets? ☐ Y ☒ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ________________			○
E2. Storm water pond? ☐ Y ☒ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre			◇
E3. Open Space? ☐ Y ☒ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: *(check all that apply)* ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other ________________			○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☐ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ________________________

Describe Recommended Actions:

RAIN GARDENS
RAIN BARRELS
SWALE RETROFITS

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☑ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☑ Low (Fewer than 3 diamonds checked)

NOTES:

APPENDIX B – HOT SPOT INVESTIGATION DATA

Hotspot Site Investigation **HSI**

WATERSHED: GILBERT	**SUBWATERSHED:**		**UNIQUE SITE ID:** GI-HSI-1
DATE: 3/7/16	**ASSESSED BY:** SB/AW	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___° ____' ____" **LONG** ___° ____' ____"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: ____________
St. Mary's Church

SIC code (if available): ____________

NPDES Status: ☒ Regulated ☐ Unregulated ☐ Unknown

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

Basic Description of Operation:
CHURCH

INDEX*

B. VEHICLE OPERATIONS ☒ **N/A** *(Skip to part C)* — **Observed Pollution Source?** ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: _______

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☒ **N/A** *(Skip to part D)* — **Observed Pollution Source?** ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: _______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☐ **N/A** *(Skip to part E)* — **Observed Pollution Source?** ☐

D1. Type of waste *(check all that apply)*: ☒ Garbage ☐ Construction materials ☐ Hazardous materials ●

D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○
GOOD

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ **N/A** *(Skip to part F)* — **Observed Pollution Source?** ☐

E1. Building: Approximate age: 50 yrs. Condition of surfaces: ☒ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☒ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age 20 yrs. Condition: ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☒ Paved/Concrete ☒ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☒ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☒ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☒ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)*

Observed Pollution Source? ☐

F1. % of site with: Forest canopy 20 % Turf grass 75 % Landscaping 5 % Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☒ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☒ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☒ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☒ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☒ Y ☐ N ☐ Unknown If yes, please describe: BIORETENTION ○

G2. Are private storm drains located at the facility? ☐ Y ☒ N ☐ Unknown TREATS 1/2 PROPERTY ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☑ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☒ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ______________________
☒ Schedule a review of storm water pollution prevention plan

Notes:

- TREE PLANTING
- NEW SWM

Hotspot Site Investigation **HSI**

WATERSHED: GILBERT	**SUBWATERSHED:**		**UNIQUE SITE ID:** G1-HSI-2
DATE: 3/7/16	**ASSESSED BY:** SB/AW	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___° ____' ____" **LONG** ___° ____' ____"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: Cooksey's Store

SIC code (if available): __________

NPDES Status: ☒ Regulated ☐ Unregulated ☐ Unknown

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

Basic Description of Operation: GAS STATION

	INDEX*
B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)* — **Observed Pollution Source?** ☐	
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)* — **Observed Pollution Source?** ☐	
C1. Are loading/unloading operations present? ☐ Y ☒ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☒ Y ☐ N ☐ Can't Tell If yes, are they ☒ Liquid ☐ Solid Description: FOOD OIL Where are they stored? ☐ grass/dirt area ☒ concrete/asphalt ☐ bermed area	●
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☒ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☒ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☒ N ☐ Can't Tell HALF COVERED	○
C6. Are liquid materials stored *without* secondary containment? ☒ Y ☐ N ☐ Can't Tell	●
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☒ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)* — **Observed Pollution Source?** ☐	
D1. Type of waste *(check all that apply)*: ☒ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition *(check all that apply)*: ☒ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ N/A *(Skip to part F)* — **Observed Pollution Source?** ☐	
E1. Building: Approximate age: 50 yrs. Condition of surfaces: ☒ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☒ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age 20 yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☒ Breaking up ●
Surface material ☒ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☒ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☒ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☒ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)*

Observed Pollution Source? ☐

F1. % of site with: Forest canopy ____% Turf grass 80 % Landscaping 20 % Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☒ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☒ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☒ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☒ Y ☐ N ☐ Can't Tell ●

G. STORM WATER INFRASTRUCTURE ☒ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☑ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☒ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☒ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ______________________
☐ Schedule a review of storm water pollution prevention plan

Notes:

- PARKING LOT REPAIR
- LID ON DUMPSTER
- OIL STORAGE
- SPACE FOR SWM BEHIND ADJACENT COMMERCIAL BUILDINGS

Hotspot Site Investigation **HSI**

WATERSHED: GILBERT	**SUBWATERSHED:**		**UNIQUE SITE ID:** GI-HSI-3
DATE: 3/7/16	**ASSESSED BY:** SB/AW	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___° ____' ____" **LONG** ___° ____' ___"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: Simpson's Corner Store

SIC code (if available): __________

NPDES Status: ☒ Regulated ☐ Unregulated ☐ Unknown

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous: ☐ Golf Course ☐ Marina ☐ Animal Facility

Basic Description of Operation: corner store

	INDEX*
B. VEHICLE OPERATIONS ☒ **N/A** *(Skip to part C)* — **Observed Pollution Source?**	☐
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: __________	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☒ **N/A** *(Skip to part D)* — **Observed Pollution Source?**	☐
C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______ Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ **N/A** *(Skip to part E)* — **Observed Pollution Source?**	☐
D1. Type of waste *(check all that apply)*: ☒ Garbage ☐ Construction materials ☐ Hazardous materials	●
D2. Dumpster condition (*check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing GOOD	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☒ **N/A** *(Skip to part F)* — **Observed Pollution Source?**	☐
E1. Building: Approximate age: 70 yrs. Condition of surfaces: ☒ Clean ☐ Stained ☐ Dirty ☐ Damaged	○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☒ N ☐ Don't know	○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age 30 yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☒ Breaking up
Surface material ☒ Paved/Concrete ☒ Gravel ☐ Permeable ☐ Don't know ●

E3. Do downspouts discharge to impervious surface? ☒ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☒ N ☐ Don't know ●

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☒ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☒ N/A *(skip to part G)*

Observed Pollution Source? ☐

F1. % of site with: Forest canopy ____% Turf grass _____ % Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☒ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☒ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☒ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☑ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

- ☐ Refer for immediate enforcement
- ☐ Suggest follow-up on-site inspection
- ☐ Test for illicit discharge
- ☐ Include in future education effort
- ☐ Check to see if hotspot is an NPDES non-filer
- ☒ Onsite non-residential retrofit
- ☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: ____________________
- ☐ Schedule a review of storm water pollution prevention plan

Notes:

- PARKING LOT REPAIR
- ROOM FOR SWM SURROUNDING PARKING LOT

Hotspot Site Investigation **HSI**

WATERSHED: GILBERT	**SUBWATERSHED:**	**UNIQUE SITE ID:** GI - HSI - 4
DATE: 3 / 7 / 16	**ASSESSED BY:** SB/AW **CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___° ____' ____" **LONG** ___° ____' ____"	**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: 7627 Leonardtown Rd Shopping Center

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

SIC code (if available): __________

Basic Description of Operation: Shopping center - church - doctor office - Insuance

NPDES Status: ☒ Regulated ☐ Unregulated ☐ Unknown

	INDEX*
B. VEHICLE OPERATIONS ☒ **N/A** *(Skip to part C)* **Observed Pollution Source?**	☐
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ **N/A** *(Skip to part D)* **Observed Pollution Source?**	☑
C1. Are loading/unloading operations present? ☐ Y ☒ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell	○
C2. Are materials stored outside? ☒ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☒ Solid Description: BUILDING MATERIALS Where are they stored? ☐ grass/dirt area ☒ concrete/asphalt ☐ bermed area	●
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☒ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☒ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☒ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☒ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☒ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ **N/A** *(Skip to part E)* **Observed Pollution Source?**	☑
D1. Type of waste *(check all that apply)*: ☒ Garbage ☐ Construction materials ☐ Hazardous materials	●
D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing GOOD	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ **N/A** *(Skip to part F)* **Observed Pollution Source?**	☐
E1. Building: Approximate age: 20 yrs. Condition of surfaces: ☒ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age 20 yrs. Condition: ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☒ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☒ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☒ N ☐ Don't know ●

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☒ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ **N/A** *(skip to part G)* **Observed Pollution Source?** ☑

F1. % of site with: Forest canopy ____% Turf grass _____ % Landscaping 50% Bare Soil 50% ? ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low NONE ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☒ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☒ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☒ Y ☐ N ☐ Can't Tell ●

G. STORM WATER INFRASTRUCTURE ☐ **N/A** *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☒ Y ☐ N ☐ Unknown If yes, please describe: HALF BUILDING DRAINS TO WET POND ○

G2. Are private storm drains located at the facility? ☐ Y ☒ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☑ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☒ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☒ Schedule a review of storm water pollution prevention plan

Notes: OPEN SPACE IN FRONT OF SHOPPING CENTER FOR SWM - HALF BUILDING + PARKING DRAINS TO WET POND

Hotspot Site Investigation **HSI**

WATERSHED: GILBERT | **SUBWATERSHED:** | **UNIQUE SITE ID:** GI-HSI-5

DATE: 3/7/16 | **ASSESSED BY:** SB/AW | **CAMERA ID:** | **PIC#:**

MAP GRID: | **LAT** ___° ____' ____" **LONG** ___° ____' ____" | **LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: EVERYTHING AMISH

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

SIC code (if available): __________

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Basic Description of Operation: furniture + crafts

	INDEX*
B. VEHICLE OPERATIONS ☐ **N/A** *(Skip to part C)* — **Observed Pollution Source?**	☑
B1. Types of vehicles: ☒ Fleet vehicles ☐ School buses ☐ Other: ________	
B2. Approximate number of vehicles: 6	
B3. Vehicle activities *(circle all that apply)*: [✓ Maintained] Repaired Recycled [✓ Fueled] Washed [✓ Stored]	●
B4. Are vehicles stored and/or repaired outside? ☐ Y ☒ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☒ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☒ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☒ Y ☐ N ☐ Can't Tell	●
B7. Are fueling areas directly connected to storm drains? ☐ Y ☒ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☒ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ **N/A** *(Skip to part D)* — **Observed Pollution Source?**	☑
C1. Are loading/unloading operations present? ☒ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell	●
C2. Are materials stored outside? ☒ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______ Where are they stored? ☒ grass/dirt area ☐ concrete/asphalt ☐ bermed area	●
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☒ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☒ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☒ Y ☐ N ☐ Can't Tell	●
C6. Are liquid materials stored *without* secondary containment? ☒ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☒ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ **N/A** *(Skip to part E)* — **Observed Pollution Source?**	☑
D1. Type of waste *(check all that apply)*: ☒ Garbage ☐ Construction materials ☐ Hazardous materials	●
D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ **N/A** *(Skip to part F)* — **Observed Pollution Source?**	☐
E1. Building: Approximate age: 10 yrs. Condition of surfaces: ☒ Clean ☐ Stained ☐ Dirty ☐ Damaged	○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☒ N ☐ Don't know	○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age 10 yrs. Condition: ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☒ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☒ Y ☐ N ☐ Don't know ☐ None visible ●
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☒ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)*

Observed Pollution Source? ☑

F1. % of site with: Forest canopy ____% Turf grass 90 % Landscaping 10 % Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☒ Medium ☐ Low ●

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☒ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☒ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☒ Y ☐ N ☐ Can't Tell ●

G. STORM WATER INFRASTRUCTURE ☒ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☒ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☒ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☑ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☒ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☒ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ______________________
☐ Schedule a review of storm water pollution prevention plan

Notes: SWM COULD BE PLACED TOWARDS FRONT OF PROPERTY ALONG MD-5

APPENDIX C – STREAM CORRIDOR ASSESSMENT DATA

Inadequate Buffer

SITE ID	FIELD DATE	PHOTO	BANK	UNSHADED	WIDTH LEFT	WIDTH RIGHT	LENGTH LEFT	LENGTH RIGHT	LANDUSE LEFT	LANDUSE RIGHT	RECENTLY ESTABLISHED	LIVESTOCK	SEVERITY	CORRECTABILITY	ACCESS	WETLAND	LIVESTOCK
03_IB01	3/24/2016	R003_IB01.jpg	Left	Neither	25	>50	150	0	Lawn	Forest	No	No	4	3	3	4	NO
03_IB02	3/24/2016	R003_IB02.jpg, R003_IB02_2.jpg	Left	Neither	20	>50	1000	0	Lawn	Forest	No	No	4	2	3	4	NO
05_IB01	3/24/2016	R005_IB01.jpg	Right	Neither	>50	40	0	1000	Forest	Paved	No	No	4	5	2	5	NO
08_IB01	4/11/2016	R008_IB01.jpg	Left	Neither	25	>50	100	0	Crop Field	Forest	No	No	5	2	2	0	NO
08_IB02	4/11/2016	R008_IB02.jpg, R008_IB02_2.jpg	Both	Both	0	0	300	300	Lawn	Lawn	No	No	3	1	2	0	NO

Channel Alteration

SITE ID	FIELD DATE	PHOTO	TYPE	TYPE DESCRIPTION	BOTTOM WIDTH	LENGTH (FT)	PERENNIAL	SEDIMENTATION	VEG IN CHANNEL	ROAD CROSSING	LENGTH ABOVE ROAD (FT)	LENGTH BELOW ROAD (FT)	SEVERITY	CORRECTABILITY	ACCESS
05_CA01	3/24/2016	R005_CA01.jpg, R005_CA01_2.jpg	Earth Channel	trapezoidal channel	150	2500	Yes	No	No	Above	0	2500	4	4	3

Erosion Site

SITE ID	FIELD DATE	PHOTO	TYPE	TYPE DESCRIPTION	POSSIBLE CAUSE	CAUSE DESCRIPTION	LENGTH (FT)	HEIGHT (FT)	LAND USE LEFT	LAND USE RIGHT	INFRASTRUCTURE THREATENED?	SEVERITY	CORRECTABILITY	ACCESS
03_ES01	3/24/2016	R003_ES01.jpg, R003_ES01_2.jpg	Widening		Below Road Crossing		200	3	Forest	Forest	No	4	4	3
03_ES02	3/24/2016	R003_ES02.jpg, R003_ES02_2.jpg	Widening		Below Road Crossing		400	3	Forest	Forest	No	4	3	3
03_ES03	3/24/2016	R003_ES03.jpg, R003_ES03_2.jpg	Widening		Below Road Crossing		400	3	Forest	Forest	No	4	3	2
03_ES04	3/24/2016	R003_ES04.jpg, R003_ES04_2.jpg	Widening		Below Road Crossing		30	3	Forest	Forest	No	3	3	2
03_ES05	3/24/2016	R003_ES05.jpg	Widening		Bend at steep slope		20	5	Forest	Forest	No	4	3	2
03_ES06	3/24/2016	R003_ES06.jpg. R003_ES06_2.jpg	Widening		Land Use Change Upstream		500	2	Forest	Forest	No	5	3	4
03_ES07	3/24/2016	R003_ES07.jpg, R003_ES07_2.jpg	Widening		Below Road Crossing		900	4	Forest	Forest	No	3	3	3
03_ES08	3/24/2016	R003_ES08.jpg	Widening		Land Use Change Upstream		90	4	Lawn	Forest	No	4	3	4
04_ES01	3/24/2016	R004_ES01.jpg, R004_ES01_2.jpg, R004_ES01_3.jpg	Widening		Land Use Change Upstream		1000	4	Forest	Forest	No	2	4	4
04_ES02	3/24/2016	R004_ES02.jpg,R004_ES02_2.jpg	Widening		Land Use Change Upstream		1000	4	Forest	Forest	No	3	3	4
04_ES03	3/24/2016	R004_ES03.jpg, R004_ES03_2.jpg	Widening		Land Use Change Upstream		800	3	Forest	Forest	No	3	3	5
04_ES04	3/24/2016	R004_ES04.jpg	Widening		Bend at steep slope		25	5	Forest	Forest	No	4	4	5
05_ES01	3/24/2016	R005_ES01.jpg	Widening		Below Road Crossing		200	4	Forest	Forest	No	4	3	3
05_ES02	3/24/2016	R005_ES02.jpg	Widening		Other	below confleunce	55	8	Forest	Forest	No	2	3	3
05_ES03	3/24/2016	R005_ES03.jpg, R005_ES03_2.jpg	Widening		Below Channelization		800	3	Forest	Forest	No	4	3	2
05_ES04	3/24/2016	R005_ES04.jpg	Widening		Below Channelization		50	8	Forest	Forest	No	2	3	3
05_ES05	3/24/2016	R005_ES05.jpg, R005_ES05_2.jpg, R005_ES05_3.jpg	Downcutting	headcutting channel	Below Road Crossing		350	8	Forest	Forest	Yes	2	3	2
05_ES06	3/24/2016	R005_ES06.jpg,R005_ES06_2.jpg	Widening		Land Use Change Upstream		500	8	Forest	Forest	No	1	3	3
05_ES07	3/24/2016	R005_ES07.jpg, R005_ES07_2.jpg, R005_ES07_3.jpg	Downcutting		Livestock		300	6	Forest	Forest	No	3	4	3
05_ES08	3/24/2016	R005_ES08.jpg, R005_ES08_2.jpg	Widening		Land Use Change Upstream		200	3	Forest	Forest	No	3	3	3
05_ES09	3/24/2016	R005_ES09.jpg	Widening		Bend at steep slope		100	15	Forest	Forest	No	1	4	3
05_ES10	3/24/2016	R005_ES10.jpg, R005_ES10_2.jpg	Downcutting		Land Use Change Upstream		300	8	Forest	Forest	No	2	3	3
08_ES01	4/11/2016	R008_ES01.jpg, R008_ES01_2.jpg	Widening		Land Use Change Upstream		1000	3	Crop Field	Forest	No	3	3	2
09_ES01	4/11/2016	R009_ES01.jpg	Widening		Land Use Change Upstream		1000	5	Other	Forest	No	3	3	2

Fish Barrier

SITE ID	FIELD DATE	PHOTO	BLOCKAGE	TYPE	TYPE DESCRIPTION	REASON	DROP (INCHES)	DEPTH (INCHES)	SEVERITY	CORRECTABILITY	ACCESS
05_FB01	3/24/2016	R005_FB01.jpg	Total	Road Crossing	perched culvert	Too High	40	0	2	3	2

Pipe Outfall

SITE ID	FIELD DATE	PHOTO	OUTFALL TYPE	PIPE TYPE	LOCATION OF PIPE	DIAMETER (INCHES)	CHANNEL WIDTH (FT)	DISCHARGE	COLOR	ODOR	SEVERITY	CORRECTABILITY	ACCESS
05_PO01	3/24/2016	R005_PO01.jpg	Stormwater	Concrete Pipe	Left Bank	24	0	No			5	5	1
05_PO02	3/24/2016	R005_PO02.jpg	Stormwater	Corrugated Metal	Left Bank	15	0	Yes	Clear	None	5	5	1
05_PO03	3/24/2016	R005_PO03.jpg	Stormwater	Corrugated Metal	Right Bank	18	0	Yes	Clear	None	5	5	1

Potential BMP

SITE ID	FIELD DATE	PHOTO	BMP TYPE	BMP TYPE 2	BMP TYPE 3	COMMENTS
03_PB01	3/24/2016	R003_PB01.jpg	Bioretention/raingarden			potential retrofit opportunity on both sides of road
03_PB02	3/24/2016	R003_PB02.jpg	Bioretention/raingarden			potential bmp retrofit on either side of rd
05_PB01	3/24/2016	R005_PB01.jpg	Stream restoration	Outfall stabilization	Streambank stabilization	headcutting channel below road crossing
05_PB02	3/24/2016	R005_PB02.jpg	Stream restoration			extensive bank erosion
05_PB03	3/24/2016	R005_PB03.jpg	Outfall stabilization	Streambank stabilization		severe headcut from road drainage
05_PB04	3/24/2016	R005_PB04.jpg	Stream restoration	Outfall stabilization		severe headcutting

Representative Site

SITE ID	FIELD DATE	PHOTO	SUBSTRATE	EMBEDDEDNESS	SHELTER FOR FISH	CHANNEL ALTERATION	SEDIMENT DEPOSITION	VELOCITY DEPTH	FLOW	VEGETATION	BANK CONDITION	RIPARIAN VEGETATION	RIFFLE WIDTH (IN)	RUN WIDTH (IN)	POOL WIDTH (IN)	RIFFLE DEPTH (IN)	RUN DEPTH (IN)	POOL DEPTH (IN)	BOTTOM TY PE
03_RE01	3/24/2016	R003_RE01.jpg	Suboptimal	Suboptimal	Marginal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	48	48	60	1	4	8	Gravel
04_RE01	3/24/2016	R004_RE01.jpg	Marginal	Marginal	Marginal	Suboptimal	Suboptimal	Suboptimal	Marginal	Suboptimal	Marginal	Marginal	36	36	60	2	6	8	Gravel
04_RE02	3/24/2016	R004_RE02.jpg	Suboptimal	Suboptimal	Suboptimal	Optimal	Suboptimal	Optimal	Optimal	Optimal	Optimal	Optimal	48	48	60	2	6	12	Gravel
05_RE01	3/24/2016	R005_RE01.jpg	Marginal	Marginal	Marginal	Poor	Suboptimal	Marginal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	144	144	144	4	12	12	Gravel
05_RE02	3/24/2016	R005_RE02.jpg	Poor	Poor	Poor	Suboptimal	Poor	Poor	Marginal	Marginal	Poor	Suboptimal	36	36	50	1	2	5	Gravel
05_RE03	3/24/2016	R005_RE03.jpg	Poor	Optimal	Poor	Marginal	Suboptimal	Marginal	Marginal	Poor	Poor	Poor	12	12	12	1	1	10	Other
08_RE01	4/11/2016	R008_RE01.jpg	Suboptimal	Suboptimal	Suboptimal	Optimal	Marginal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	48	48	56	1	6	18	Gravel

Trash Dumping

Site ID	FIELD DATE	PHOTO	TYPE	TYPE DESCRIPTION	TRUCK LOADS	EXTENT	VOLUNTEER PROJECT?	OWNER TYPE	SEVERITY	CORRECTABILITY	ACCESS
04_TD01	3/24/2016	R004_TD01.JPG	Other	scrap metal	6	Large Area	No	Unknown	2	3	5
05_TD01	3/24/2016	R005_TD01.JPG, R005_TD01_2.JPG	Residential		4	Large Area	No	Unknown	2	3	0

Unusual Condition

SITE ID	FIELD DATE	PHOTO	TYPE	DESCRIPTION	POTENTIAL CAUSE	SEVERITY	CORRECTABILITY	ACCESS	COMMENT
05_UC01	3/24/2016	R005_UC01.jpg	Unusual Condition	Excessive Algae	ballfields	3	Unknown	2	

APPENDIX D – PRIORITIZATION METHODS

Project Prioritization Methods

To support County environmental manager's resource allocation decision making process, a prioritization was developed for the Gilbert Swamp subwatershed projects identified in this report. The results indicate which projects are the most beneficial and cost effective relative to the set of projects identified.

The prioritization involved a matrix made up of a series of parameters, or metrics, which evaluated each proposed project and allowed for discrimination between the projects. Each metric was scored for each project, either qualitatively or quantitatively as appropriate. Weighting factors were applied to metrics that were deemed the most critical, and the sum of the weighted scores determined the highest priority projects to implement.

The approach included scoring and ranking of the project benefits, constraints and costs. Including factors of feasibility and cost is necessary because the potential exists for the most beneficial project to also be relatively less feasible. It might be the most expensive project, have limited access, utility conflicts, or require disturbance to natural resources.

The following describes the methods used.

Metric Evaluation

The prioritization uses a series of metrics, or indicators, that describe various attributes of a project. A series of candidate metrics was developed for each of the three categories: Benefits, Constraints, and Cost. Metrics evaluated by the project team are listed in Table 1 with a brief description of each.

Table 1: Candidate Prioritization Metrics

Metric	Description
Project Benefits	
Quantity Control	Level of quantity control (cfs/ac)
Water Quality Treatment	Rainfall Depth Treated (in)
Pollutant Removal	TN, TP, and TSS removed (lb) based on modeling
Groundwater Recharge	Amount of recharge based on level of expected infiltration
Channel Protection	Based on proposed level of quantity control and downstream stability
Channel Stabilization	Level of channel stabilization provided will be dependent on channel condition and type of project
Water/Stream Temperature	Does project reduce receiving water temperature?
Instream Habitat Improvement	Does project provide or improve instream habitat?
Riparian Habitat Improvement	Does project provide or improve riparian habitat?
Wetland Habitat Improvement	Does project provide or improve wetland habitat?
Fish Passage	Does project reduce or eliminate barriers to fish passage?
Public Visibility/Education/Outreach	Is project in close proximity to public places?
Community Aesthetic Improvement	Does the project improve community appearance?
Public Safety Improvement	Is there a public safety issue that is addressed by the project?
Combined Benefit	Are there multiple projects in close proximity that together provide a larger cumulative benefit?
Impervious Area Treated	Area of impervious surface treated (acres)
Proximity to MS4	Does the project receive MS4 drainage?
Project Constraints	

Metric	Description
Access	Are there constraints to access – mature trees, infrastructure, steep slopes?
Permitting	Are there significant permitting issues – wetland/forest disturbance?
Maintenance Requirements	What is the level of maintenance involved – frequency, expense, equipment?
Ownership	Is ownership of the parcels involved held publicly or privately? Are private owners cooperative?
Adjacent Land Use	Are adjacent properties compatible with the type of potential project?
Design/Construction	Do the site layout, topography, elevations allow for a design that maximizes benefit and is constructible?
Public Safety	Does the project create a public safety hazard?
Existing Utility Conflicts	Are there existing underground or overhear utilities conflicting with the design? Are the private or public?
Fish Passage	Does the project introduce or make worse a barrier to fish passage?
Project Cost	
Total Life Cycle Cost	Total life cycle cost of the project
Cost per Impervious Area Treated	Total cost of the project divided by the impervious area treated, dollars per acre
Cost per Pollutant Removed	Total cost of the project divided by the amount of pollutant removed, dollars per lb of TP, TN, TSS

Candidate metrics were evaluated for inclusion based on the following attributes:

Duplication. Selected metrics are not duplicative of one another. Results of the prioritization can be skewed if two or more metrics are evaluating very similar project factors.

Project Goals and Objectives. Selected metrics are linked to the overall project goal and objectives. The primary goals of the current projects are to maximize impervious surface treatment and pollutant removal, therefore metrics linked to those goals would be important to include. Secondary goals include items such as habitat improvement and stream channel protection. The linkage to project goals is also accounted for in the metric weighting which is described below.

Relative Management Importance. The suite of candidate metrics was evaluated by County resource managers to determine the factors that were most important to them. To evaluate the suite, a pairwise comparison was used. Results of the comparison were also used to derive the metric weights.

Each metric was analyzed by the project team by comparing pairs of metrics to evaluate which has greater importance. The project team included representatives from Charles County Department of Planning and Growth Management. Each metric is evaluated individually against all of the other metrics and the evaluator selects one by one, which metric has greater importance. The results are tabulated for each metric category (benefits, constraints, costs). Metrics with the greatest number of selections represent those that were felt overall to be the most important. Results are presented in Figures 1-3.

Figure 1: Project Benefits Metric

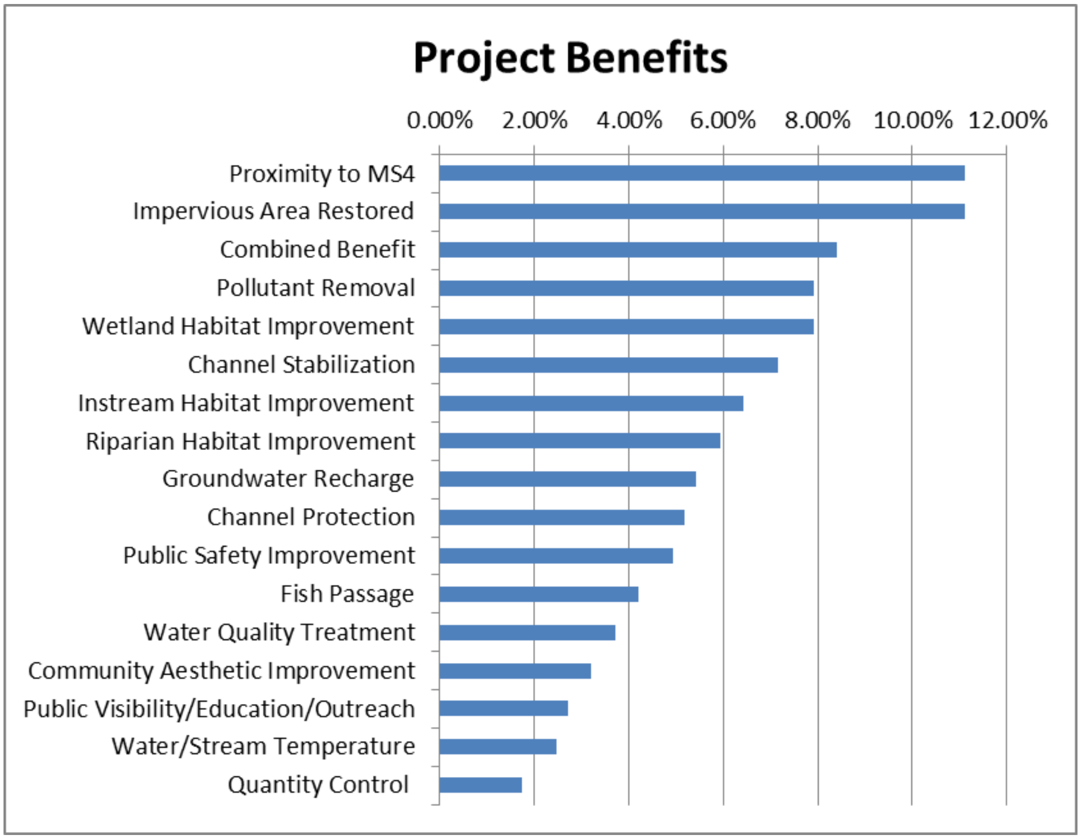


Figure 2: Project Constraints Metric Weights

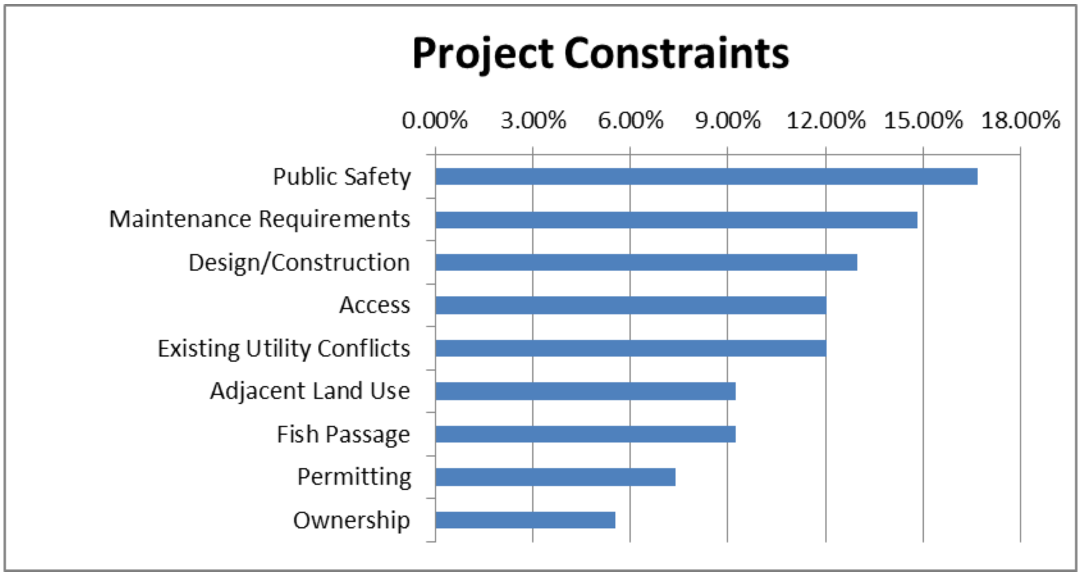
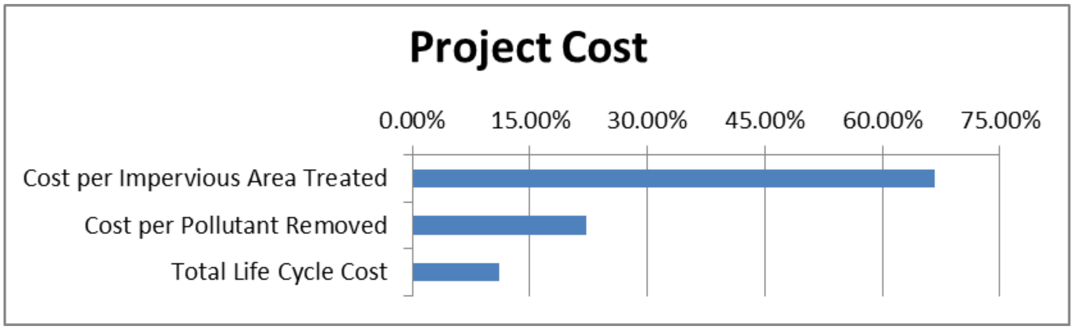


Figure 3: Project Cost Metric Weights



Metric Selection Results

Based on the evaluation described above, a final list of selected metrics was derived. Selected metrics are listed below in order of importance by category. Two constraint metrics (fish passage and public safety) and two benefits metrics (quantity control and public safety improvement) were not used due to their lack of discrimination potential between projects.

Project benefit:

- proximity to MS4
- impervious area treated
- combined benefit
- pollutant removal
- wetland habitat improvement
- channel stabilization
- instream habitat improvement
- riparian habitat improvement
- groundwater recharge
- channel protection
- fish passage
- water quality treatment
- community aesthetics improvement
- public visibility/education/outreach
- water/stream temperature

Project constraint:

- maintenance requirements
- design/construction
- access
- existing utility conflicts
- adjacent land use
- permitting
- ownership

Project cost:

- cost per impervious acre treated
- cost per pollutant removed
- total life cycle cost

Metric Weighting Factors

Weighting factors were developed and applied to allow resource managers to impart the relative importance of the selected metrics into the prioritization. For example, if pollutant load reduction is far more critical in selection versus impervious surface treatment, then it would be more highly weighted. Weights were developed within each of the three categories (benefit, constraints, and cost). Results of the pairwise comparison were totaled and the proportion of the result for each metric of the total was used as the final weight (Table 2).

Table 2: Weighting Factor Results

Metric	Final Weight
Proximity to MS4	11.17%
Impervious Area Restored	11.17%
Combined Benefit	8.44%
Pollutant Removal	7.94%
Wetland Habitat Improvement	7.94%
Channel Stabilization	7.20%
Instream Habitat Improvement	6.45%
Riparian Habitat Improvement	5.96%
Groundwater Recharge	5.46%
Channel Protection	5.21%
Public Safety Improvement	4.96%
Fish Passage	4.22%
Water Quality Treatment	3.72%
Community Aesthetic Improvement	3.23%
Public Visibility/Education/Outreach	2.73%
Water/Stream Temperature	2.48%
Quantity Control	1.74%
Total	100%
Public Safety	16.67%
Maintenance Requirements	14.81%
Design/Construction	12.96%
Access	12.04%

Metric	Final Weight
Existing Utility Conflicts	12.04%
Adjacent Land Use	9.26%
Fish Passage	9.26%
Permitting	7.41%
Ownership	5.56%
Total	100%
Cost per Impervious Area Treated	66.67%
Cost per Pollutant Removed	22.22%
Total Life Cycle Cost	11.11%
Total	100%

Scoring

Quantitative metrics were scored based on results of the preliminary design and cost estimates (e.g. impervious area treated, pollutant removal). Other metrics were scored more qualitatively based on professional judgment and assessment of each project site (e.g. access constraints, public visibility/education/outreach).

Each project was assigned a score between 1 and 5 for each metric. Projects evaluated to have the most benefit received a score of 5, and those with the least benefit were given a score of 1. Constraints were evaluated in a similar fashion such that projects with more constraints were scored a 1, and those with the least were given a score of 5.

Project Benefits

Proximity to MS4 and impervious acres restored were both given the highest weight. Proximity to MS4 scores were determined based on the proximity of the site to MS4 drainage. Areas receiving MS4 drainage received the highest scores and projects in agricultural land use received lower scores. Impervious acres restored scores were calculated by ranking the projects by impervious acres restored and then calculating the corresponding score.

Combined benefit scores were calculated based on the number of projects within close proximity. Clustered projects received higher scores than isolated projects.

Pollutant removal scores were calculated by using the modeled total nitrogen, phosphorus, and sediment load reduction to rank each project. The ranking was then used to calculate a score for each project.

Wetland, riparian, and in-stream habitat scores were calculated based on the habitat benefit from each project. Generally, stream restoration projects received higher scores in these categories. Projects near or within wetlands got a higher wetland habitat score. Stream restoration and SPSC projects that would have tree planting associated with the project received higher scores for riparian habitat. All stream restoration projects received the highest score of 5 for in-stream habitat.

Channel stabilization was scored based on the type of project and level of increased channel stabilization anticipated. Stream restoration and SPSC projects were given scores of 5 and 4, respectively, however all other projects have no potential increased channel stability and were given scores of 1.

Groundwater recharge was calculated for the stormwater management projects and scores were calculated based on these values. No other project type would provide groundwater recharge.

Channel protection was scored based on the type of project and level of increased channel protection. SPSC projects increase channel protection, therefore would be given a higher score of 5, and all other projects received scores of 1.

Each project was scored according to the potential improvement to public safety that the project would achieve. No projects were found to have any associated public safety improvement aspects and all projects received a score of 1.

Projects that would address fish passage issues received higher scores for the fish passage metric. If a stream restoration site specifically had a fish passage issue identified, it would receive the highest score of 5. However, even if no specific fish passage issue was identified, stream restoration projects should generally improve fish passage, therefore stream restoration projects were all given scores of 2. All other project types received scores of 1.

Water quality treatment scores were calculated by ranking the projects by rainfall depth treated and then calculating the corresponding score.

Community aesthetic improvement scores were calculated based on the anticipated improvement of community appearance. Projects such as trash cleanups, stream restoration, and reforestation in highly visible areas received higher scores. Stormwater management projects were scored based on the project type and anticipated appearance of the facility and associated plantings.

Public visibility/education/outreach scores were calculated based on the project’s proximity to public areas that could provide educational opportunities for the community.

Water/stream temperature was scored based on project type. Stream restoration projects received higher scores if tree planting would be associated with the project. All reforestation projects received the highest score of 5. Stormwater management projects generally received moderate scores with the exception of the wet ponds, which would provide no benefit to water temperature.

Projects were scored according to their potential for quantity control (cfs/acre). No projects were found to have associated quantity control benefits and all projects received a score of 1.

Project Constraints

Design and construction constraints, such as site layout, topography, and elevations, were analyzed for each project. Projects that were identified as having steep slopes, nearby infrastructure, or other design and construction constraints received lower scores.

The degree of maintenance required for each project was estimated. Biorentention and infiltration basin projects generally require more maintenance and received lower scores, while trash cleanups, reforestation, and stream restoration projects generally require less maintenance and received higher scores.

Existing utility conflicts were assessed and scored. Majority of the projects did not have utility conflicts, however sites that were found to have underground and overhead electric, cable or telephone lines and subsequently received lower scores in this metric.

Ease of access was analyzed for each site. The presence of paved access roads or trails, or proximity to existing roads or parking lots was considered and scored accordingly.

Permitting requirements was evaluated for each project. Stream restoration projects generally require extra permitting and received lower scores than the projects such as reforestation and trash cleanups.

Site ownership was identified and scored. Projects on private property received lower scores than those on public property.

Lastly, adjacent land use was determined and scored. Adjacent properties with land use not compatible with the project type received lower scores.

Project Costs

Project costs were calculated and ranked for each project in three categories: life cycle cost, cost per pollutant reduced, and cost per impervious area. Scores were calculated for each category and then averaged for the final project cost score.

Results

Weighting factors were applied to the scores for each metric. Total scores were then summed for each project for both the benefit and constraint categories and the projects ranked within each category. Projects were also ranked according to the cost metrics, including total project cost, cost per pollutant removed, and cost per impervious acre treated. A ranking for each metric category was assigned based on the results. The final ranking incorporates the results of the category rankings. The final prioritized lists of projects for Gilbert Swamp are presented in Table 3. Projects listed by final rank are presented in

Table 4.

Table 3: Gilbert Swamp Prioritization Ranking by Project Type

Project ID	Project Type	Benefits Rank	Constraints Rank	Cost Rank	Total Score	Final Rank
GI_BMP_1	New BMP	7	8.5	2	18	2
GI_BMP_2	New BMP	10	8.5	1	20	4
GI_BMP_3	New BMP	8	12	3	23	6.5
GI_BMP_4	New BMP	9	4	15	28	11
GI_BMP_5	New BMP	11	7	7	25	10
GI_SR_1	Stream Restoration	1	11	11	23	6.5
GI_SR_2	Stream Restoration	4	15	12	31	14
GI_SR_3	Stream Restoration	2	13.5	9	25	9
GI_SR_4	Stream Restoration	5	13.5	10	29	12
GI_SR_5	Stream Restoration	3	10	8	21	5
GI_TP_1	Tree Planting	13	5	6	24	8
GI_TP_2	Tree Planting	12	3	4	19	3
GI_TP_3	Tree Planting	6	1	5	12	1
GI_TC_1	Trash Cleanup	15	6	13.5	35	15
GI_TC_2	Trash Cleanup	14	2	13.5	30	13

Table 4: Gilbert Swamp Prioritization Final Ranking

Project ID	Project Type	Final Rank
GI_TP_3	Tree Planting	1
GI_BMP_1	New BMP	2
GI_TP_2	Tree Planting	3
GI_BMP_2	New BMP	4
GI_SR_5	Stream Restoration	5
GI_BMP_3	New BMP	6.5
GI_SR_1	Stream Restoration	6.5
GI_TP_1	Tree Planting	8
GI_SR_3	Stream Restoration	9
GI_BMP_5	New BMP	10
GI_BMP_4	New BMP	11
GI_SR_4	Stream Restoration	12
GI_TC_2	Trash Cleanup	13
GI_SR_2	Stream Restoration	14
GI_TC_1	Trash Cleanup	15

Note: Lowest numerical value for each rank category is the highest ranked project

APPENDIX E – PUBLIC REVIEW AND COMMENT

Appendix E: Public Review and Comment

A public meeting was held on February 26, 2018 to present the methods and results of five Watershed Assessments: Gilbert Swamp, Zekiah Swamp, Wicomico River, Potomac River, and Nanjemoy Creek. Charles County solicited public review and comments on the five draft Watershed Assessments reports through this public meeting, followed by a 30-day public comment period. The public comments received and responses given are documented below, in addition to report edits made as a result of the public comment.

The assessments and slide show are posted on the County's website:
https://www.charlescountymd.gov/pgm/planning/watershed/watershed-assessments

The February 26, 2018 meeting video can be found at:
http://www.charlescounty.org/apps/mediacenter/public/listEventsPublic.jsp

February 26, 2018 Public Meeting Comment Summary:

Question 1: Is the same methodology used for all the County watershed assessments?
Answer 1: Yes, the Port Tobacco River Watershed Assessment was the pilot and laid out the methods, which were then carried out through the remainder of the assessments.
Additional Clarification 1: In Section 1.1 (Background), reports state that Port Tobacco served as pilot assessment for assessment methods.

Question 2: What I noticed is that you are sampling a certain percentage of the feeder streams and I'm not quite sure how you picked those, but my concern is that you don't have any sampling points in the main channel. If there is a problem that is caused by a couple of feeder streams that haven't been sampled, how do you know you don't have a problem if you haven't sampled the main channel?
Answer 2: We sampled the feeder streams to identify where there are sources of pollutants entering the main channel. MDE does core sampling in a lot of the receiving waters in the Bay and tidal estuaries. In our scope we're focusing on urban stormwater runoff, so we look further up in the watershed to capture results higher in the watershed to understand where those sources may be, so we can apply solutions.

Question 3: So this is not a true watershed wide assessment, this is only a stormwater watershed assessment?
Answer 3: That is correct, we focused on urban stormwater.

Question 4: There's nothing in here about submerged aquatic vegetation and the state of its health or coverage. There is a problem in Nanjemoy Creek, where the SAV has been gone for a good four years, and I was hoping this study would tell us why.
Answer 4: The tidal water was not a focus, but they are all connected, so the stormwater system delivers water down to the receiving waters. It is true that pollutants coming into the receiving waters will affect SAVs. But, an analysis of SAV population or a study of the receiving water was not in the scope of this study.

Question 5: The Nanjemoy Creek Watershed study said there was not a big turbidity problem, but there is in the tidal estuary, as I was previously able to see deep into Nanjemoy Creek, and don't anymore.
Answer 5: Based on the points we sampled on feeder streams, there was not a turbidity problem. But there may be a turbidity problem in the receiving waters, which was outside of the scope of our study.

Question 6: How do you know you pick the right feeder streams to analyze?
Answer 6: We have certain resources that we allocated across the watershed and tried to pick up as many feeder streams as we could. We use the same density of sampling that was used by the Maryland Department of Natural Resources in the Watershed Restoration Action Strategy methodology and then distribute them across the watershed to pick up as many feeder streams as we could. This synoptic sampling is trying to get out a real quick snapshot of some problem areas that need to be addressed, but it's not a long-term characterization.
Additional Clarification 6: In Section 2.2.1 (Water Quality Sampling), the site selection process is explained.

Question 7: The Nanjemoy Watershed report mentions that Pisgah Park is not a source of pollution basically. It's pretty good over there, but it doesn't say anything about the closed landfill. Do we have any problems whatsoever with discharges from the Pisgah Landfill?
Answer 7: The landfill itself is contained according to regulations. Semiannual monitoring of the gas and wells is ongoing.
Follow-up Response 7: I want the public to be aware of streams, and why we're drawing a line there.
Additional Clarification 7: Monitoring summary for Pisgah Landfill can be found here: http://www.mde.state.md.us/programs/LAND/MarylandBrownfieldVCP/Documents/www.mde.state.md.us/assets/document/brownfields/charleslandfill.pdf

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Question 8: In Tayloes Neck neighborhood, it says 30% of the driveways are pervious, and I would say that's right if you are counting gravel. Now I was told that the County does not count gravel as pervious, however this study is, so which is it?
Answer 8: There's a small amount of infiltration going through the gravel so we counted as pervious for this study. For the Stormwater Management Ordinance gravel is counted as impervious, because of the small amount of infiltration, the stormwater practices would account for most of the rain runoff.
The Neighborhood Source Assessment method we are using was developed by the Center for Watershed Protection (CWP), and it handles paved driveways differently than gravel. However, because some water infiltrates, we counted as pervious. For Maryland Department of Environment purposes, both are counted as impervious.
Edit to Report: Added text to Section 2.1.1 (Neighborhood Source Assessment) "Although MDE considers both paved and gravel/dirt driveways fully impervious, unpaved driveways do allow for some infiltration and were considered not fully impervious in this assessment."

Question 9: I just want to ensure that the County is consistent, whether it's for watershed studies or zoning studies that we are counting gravel driveways the same. Which is it?
Answer 9: For the study we are following the CWP procedures and the code is following MDE regulations. The assessment method is just trying to differentiate how much infiltration is occurring in

neighborhoods based on the driveway types. For development review, in most cases, the gravel driveways are considered impervious.

Follow-up Response 9: It seems like there is an inconsistency.

Answer 9: There are some variations, especially with Critical Area implementation, and we can look into that for you and get back to you separately.

Question 10: Can the slide show be posted to BoardDocs?

Answer 10: Yes, it will be posted.

Question 11: What is the action the Planning Commission is expected to take after the open comment period is closed?

Answer 11: This is just a public information meeting, so no action is necessary. We want to get your input, your suggestions, things you've identified, as well as the public to get their comments.

Question 12: From Section 6.3, can you explain what impervious credit as a unit of measure based on impervious surface that has been treated?

Answer 12: When we are talking about credits, we are really talking about acres. There are currently about 7,000 acres of impervious that is considered untreated. The goal that is set by that 20% goal is about 1,400 acres of restoration, so we use credit and acres interchangeably, but the unit of measure is acres.

Question 13: So when you talk about impervious credits, that's the number of acres we have provided stormwater management for?

Answer 13: Correct.

Question 14: What is a downspout disconnect?

Answer 14: It is making sure your downspout is not sending rainwater into the driveway or street, and making sure your rainwater is going out onto your lawn or pervious surface, where that water can infiltrate.

Edit to Report: Added clarifying text to Section 5.2 (Homeowner Practices): "directing rainwater from downspout to lawn or pervious surface rather than to driveway or street".

Question 15: Rain barrels are mentioned throughout as a way for homeowners to help, at Planning Commission meeting earlier this year an applicant testified that rain barrels were not advisable due to the potential to spread Zika virus. Can you comment on this?

Answer 15: If the rain barrel is maintained properly and has the proper screens on it, and emptied regularly, it should not have a healthy mosquito population growing inside of it.

Question 16: The inconsistency with the way impervious surface with gravel driveways needs to be addressed.

Answer 16: Noted.

Question 17: In Section 5.3, Septic Practices, according to MDE 2014 guidance, each septic connection achieves a .03 credit, what's that mean?
Answer 17: With stormwater management practices such as a wet pond, dry pond, etc., you know how much water is draining there and being treated, and you also know a certain amount of nitrogen and phosphorus is being removed by those facilities. Other practices like septic systems are not directly treating impervious surfaces, but has a nitrogen equivalent reduction, so it's taking the nitrogen reduction and converting it over to an impervious surface equivalent.
Edit to Report: Edited text in Section 5.3 (Septic Practices) from "impervious credit" to "impervious acre credit".

Question 18: If I have a Best Available Technology septic system for my home, then my home gets credited for 0.39 acres?
Answer 18: If an existing system is upgraded to Best Available Technology, then yes it gets credit. If it's a newly installed BAT system on a new home, then it doesn't get credited.

Question 19: As a requirement of the NPDES MS4 discharge permit issued to Charles County, the County must treat 20% of the impervious acre baseline, or 1,400 acres by 2019. How is it possible to achieve that?
Answer 19: The County is working on this goal and has a robust capital improvements program managed by the Department of Public Works. So we have the capital projects, which include rain gardens, stormwater management ponds, stream restoration, and shoreline erosion control restoration. And then we also have robust street sweeping and inlet cleaning programs, and we have goals we are trying to achieve with our septic programs. So we are working towards the goal of 1,400 acres by December 2019.

Question 20: What happens if the goals are not met?
Answer 20: One example is Montgomery County, which was not able to meet that goal, and if you go to MDE's website there is a draft consent decree posted between MDE and Montgomery County. The decree includes requirements, if a jurisdiction does not meet the permit, and could include a monetary fine, supplementary environmental projects, and other items.

Question 21: Does the county have to meet the 20% restoration on a watershed by watershed basis or for example, if a particular watershed like Mattawoman was blown, and say 20% restoration is achieved in certain watersheds but not others, would the consent decree be for one watershed only?
Answer 21: The decrees are issued for a county as a whole.

Question 22: The Planning Commission has a work session coming up on the Capital Improvement Project budget, so that would be the one section in the budget that is on NPDES?
Answer 22: Yes.

Question 23: What is the difference between calibrated targets and calibrated Bay TMDL waste load allocations, as shown on page 102 in the Potomac River Watershed Assessment?

Answer 23: Each TMDL is developed using models, older TMDLs use older models. The most current model is the Bay Program 5.3 model, so the older information needs to be moved into the newer model to add practices and have the most current information. Calibration is taking the older information and bringing it into the newer model.
Edit to Report: Edited "Calibrated 2010 Baseline Loads" definition in Section 6.4.2 (Chesapeake Bay TMDL) to "The pollutant loads (i.e., nitrogen, phosphorus, and sediment) for the Bay TMDL baseline, as of 2010 in the Charles County MS4 source sector (SW-WLA), were determined using MAST, which calculates pollutant loads and reductions calibrated to the Chesapeake Bay Program Partnership Watershed Model v.5.3.2."

Question 24: When I did the addition for the restoration of these five watersheds it's about 44 million dollars. What is the fine if we do not meet it?
Answer 24: We don't know for sure, but for the Montgomery County consent decree, they achieved 10% of the required 20%, and it's our understanding there was an approximate $300,000 dollar fine and supplemental projects, with some of the monetary fine possibly being used for projects.
Follow-up Response 24: The fine's a lot lower than the total cost.
Answer 24: Noted

Question 25: How long have we been working to get to the 2017 progress reductions, which is not that many acres?
Answer 25: The County's first planning efforts were started under the 2002 permit in 2002, and the first construction project was started in 2006.

Question 26: Is your educated guess, that we will make these targets by 2019?
Answer 26: We don't know. There has been a ramp up of progress in Maryland as programs are developed. The original goal of 10% was bumped up to 20% and there has been a lot more focus on hitting those goals in the last five or six years. Initially the first permit the County had was for the Development District, so the first 10 or so years were focused on the Mattawoman and portions of the Zekiah and upper Port Tobacco watersheds. Just in the past few years, have we been looking at the other watersheds, such as Gilbert, Wicomico, and Nanjemoy. Since those areas are just now being investigated, not a lot of progress has been made there. Additionally, under the first permit the goal was only about 260 acres, and since the permit was expanded the goal is now 1,400 acres, plus.

Question 27: What's the difference between the implementation target of 2025 and the permit date of 2019?
Answer 27: The 20% goal will get counties part way there, which is the estimation. Then there will be another permit term, following this permit term, which will have similar restoration conditions, that will lead up to the 2025 Bay TMDL target. The 2019 date is not the end of the restoration requirements.
Edit to Report: Edited Section 1.4.3 (TMDLs) to specify Bay TMDL target completion date of 2025 and 20% impervious surface treatment strategy target completion date of 2019. Also added text "It is expected that the 20% impervious surface treatment target will treat a portion of the Chesapeake Bay TMDL urban sector goal and that another impervious reduction target will be included in the County's next NPDES MS4 permit to achieve the remainder."

Question 28: Is it necessary to do more than the 20% impervious restoration to meet the 2025 Bay TMDL goals?
Answer 28: The pollutant load reduction estimates, are shown in the assessments on charts, to show how much progress is expected with all the projects implemented. Some goals are exceeded, and others are not. All of these projects will go toward the 20% goal and also help us get to the 2025 goal.

Question 29: So the funding sources for the restoration is the Bay Restoration Fund, Stormwater Remediation Funds, and plus money put in by the County for capital projects.
Answer 29: Yes, but the stormwater remediation fee funds the capital projects.

Question 30: How is the stormwater remediation fee implemented in Charles County?
Answer 30: The county has a flat fee for all improved properties. So the fee is evenly distributed.

Question 31: So a small half acre lot pays the same fee as the St. Charles mall?
Answer 31: Yes, as long as there are improvements on the property such as a building or driveway the fee is the same.

Question 32: So if the fee is equal, then there's not much incentive for homeowners to put in a rain barrel or rain garden, correct because they wouldn't get a reduction?
Answer 32: There is a fee reduction program, where if you install a rain barrel or other stormwater infiltration practice, the fee would be reduced for three years. The fee reduction could be renewed if you keep the practice in place.

Question 33: Is how the stormwater fee program administered up to the County Commissioners?
Answer 33: Yes.

Question 34: On pages 15 and 18 of the Potomac River Watershed Assessment, a couple of land owners denied access to their properties for the water quality synoptic samplings and one for the stream corridor assessment. Are those the same properties?
Answer 34: That would have to be checked, because notification letters were sent out separately for the water quality sampling and the stream corridor assessment.

Question 35: What is carbonate buffering? The assessments say the low pH is due to the coastal plain having a low level of carbonate buffering.
Answer 35: Depending on the soil structure and soil geology, some soils will buffer changes in pH more strongly than others, so they are more likely to be in a neutral state. Many areas in Maryland's coastal plain, especially in Charles, Calvert, and Anne Arundel counties have this situation, where backwater, slower water, and swampy conditions will naturally have a lower pH and lower dissolved oxygen levels. The assessment is pointing out that this is a natural background condition, and not from a human induced stressor.

Edit to Report: Added text to Section 3.2.2 (Water Quality): "Buffering capacity is determined by local geology (presence of carbonate or other compounds in soils and bedrock) and refers to the capability of water to neutralize acidity."

Question 36: The field work sheets on pages 112 and 116, say Cobb Island and Swan Point do not have sewer service, and I believe they both do.
Answer 36: Correct, both communities have sewer service. This will be corrected on the field sheets.
Edit to Report: Edited datasheets to indicate presence of sewer service.

Question 37: In 2013 there was a problem with coal ash leaching from the coal ash dump site in Faulkner and affecting the Wicomico River. Do water samples show if this continues to be a problem?
Answer 37: The Maryland Department of the Environment delisted that impairment caused by the coal ash dump, after resampling quite extensively. See the Zekiah Swamp Water Quality Assessment Metals, 2006.

Question 38: In the discussion of optical brighteners, field results range from 0.4 to 4.9 ppm, therefore it was concluded that none of the samples contained optical brighteners. The discussion also said, if there were optical brighteners it could indicate septic failures. Since optical brighteners were not found, does that mean that there are not septic failures, or just not where you sampled it?
Answer 38: Correct, it doesn't mean that there are not septic failures in other locations, that were not sampled. Also because this is a one-time sample, it doesn't mean that there's not septic failures at other times.

Question 39: Approximately how many letters did you send to landowners that you were going to test their water?
Answer 39: There were 313 sites visited for these five watershed assessments, so we sent out at least 313 letters.

Question 40: Did you get permission to go onto that land to test before you went, and did they have to respond?
Answer 40: Letters were sent to individual property owners and we requested denials from those that didn't want their property included.

Question 41: What was your benchmark in the assessment, in terms of a guideline of where things were and where you have gone. Years ago there was some question on the models in terms of their accuracy. In other words, what was the water quality before in relationship to what is it now?
Answer 41: There is not much before monitoring data collected at the county level in many of these watersheds because, the NPDES permit monitoring only recently expanded from the Development District to the entire county. So for these rural watersheds, it is the first time the county has gone out to sample water quality.
In terms of benchmarks we use literature values to determine thresholds. We also use values from the Maryland Department of Natural Resources, Maryland Biological Stream Survey which has sampled thousands of sites across the state, and done studies to determine the relationship between biological

conditions, the stream health condition and the water quality levels that they are finding in those streams, so we can use those thresholds that they've developed to determine whether the sites we are sampling now are impaired.

Question 42: Would it also be fair that the Soil Conservation District (SCD) is there for technical assistance in relationship to stream bank erosion and a lot of other things associated with the Watershed Implementation Plan?
Answer 42: The assessments focused on areas in close proximity to the municipal storm sewer system, so not getting too far away from the urban stormwater infrastructure and into the agricultural areas. The Charles SCD working with the Maryland Department of Agriculture is handling the agriculture sector which has similar types of restoration requirements. However, the County has worked with the SCD to assist in review of urban stream restoration projects that have come in through the development review permitting system. The SCD has provided a lot of technical advice on these and it has been very helpful.

Question 43: The report speaks to "margin of safety," but doesn't explain what that is. Could you explain that?
Answer 43: There is some uncertainty in the models used to determine the pollutant reductions required to meet the Total Maximum Daily Loads, so there is a margin of safety built in, or added to the required reductions, to have a conservative approach in ensuring that water goals are met.
Edit to Report: Added text (in bold) to Section 1.4.3 (TMDLs): They may also include other components, a Margin of Safety (MOS) which has generally been included implicitly in the analysis **and takes into account the uncertainty between the model and the actual environment,** and a Future Allocation (FA) which is used to account for growth in wastewater point sources and is not frequently included.

Question 44: There was mention of septic grant program. Could you explain that and how it is funded?
Answer 44: There are a couple of grant programs with the septics. There is the Bay Restoration Fund, that awards up to $20,000 to connect your septic to a public sanitary sewer, and it also awards up to $20,000 to upgrade existing septics to best available technology for nitrogen removal. Then there is also a pumping program that is funding through the County's Environmental Service Fund, which reimburses up to 50% of the cost of pumping every three years. So that is to encourage pumping and maintenance of onsite septics.

Question 45: Related to fish barriers, what is the health of the fish at this point, and what is the impact of what we are doing on aquatic life?
Answer 45: These assessments did not assess fish health, but in general terms, impacts from untreated impervious surfaces include discharging warm water or too much water causing erosive forces, and in turn causing sediment, which covers the spawning areas that fish use in the stream. These impacts from development are referred to as, urban toxic syndrome. All of these things combined can really degrade in-stream health, and certainly fish are impacted by this toxic soup that is generated from urban stormwater. That being said, the percent impervious coverage in Charles County is still very low compared to Baltimore County or Prince Georges County and others, which have extremely high levels of impervious cover, 50% or greater, and are dealing with very impaired watersheds. In a lot of ways Charles County watersheds are in very good health because the percent impervious is less than 10%,

less than 5%. The Mattawoman Creek has been called out as the third best watershed in the state in terms of fish diversity. So improvements we are making here will hopefully keep it that way.

Question 46: The Constraints section refers to public safety, but I couldn't find an example. Could you explain how that impedes restoration?
Answer 46: On a site by site basis, we want to make sure that any project we are implementing would not create a public safety concern. So we looked at it both as a benefit, if there is an existing public safety concern and we can remedy that through a restoration project, we'll count that as a benefit. But also look on the other side to be sure the project doesn't introduce a public safety concern.
Additional Clarification 46: Examples of public safety concerns include a dam or steep slope. Sites that had public safety concerns that would be remedied through the proposed project would rank higher in the prioritization analysis, while projects that may have created public safety issues would rank lower in the prioritization analysis. Ultimately, none of the assessed sites had public safety constraints or benefits, therefore this metric was eliminated. This is explained in the Prioritization Methods Appendix.

Question 47: With the impervious surfaces, the recharge areas are very important. Do we know where our recharge areas are as we develop the county so we're not compounding the problem?
Answer 47: Recharge areas are everywhere. This is the water that naturally infiltrates the soil and into the shallow groundwater and into the deep groundwater and recharge those aquifers. When you put impervious surface on top of that the water will not infiltrate and runs off to the stream very quickly. So any site we can convert back to pervious, forest, stream buffer system, or even the stormwater facilities that infiltrate, will allow for that groundwater recharge.

Question 48: How are we dealing with the climate change aspect to make our waters much more healthier?
Answer 48: The biggest thing we can do here is to reduce urban stressors, and make the watersheds more resilient to those changes that may come about through climate change. It's basically adding stressor upon stressor to the system. If we have stormwater runoff, development, impervious surfaces, removal of trees, and then we add climate change, that could be the one thing that could break the back. So if we can eliminate or reduce these stressors, it helps make the system as a whole more resilient to climate change.

Question 49: I want to thank you for asking about climate change and how we can help the streams. And I think he mentioned trees, and that really is the most important thing and the only way we can keep the water clean. It's kind of a fantasy to deforest thousands and thousands of acres and replace that with impervious surface and lawns that have pesticide and fertilizer treatment, and think that we are going to keep our streams viable for fish life. I don't really want to compare Charles County with areas that have 50% impervious surface. If we can keep impervious below 10% it will cost us all a lot less in restoration. The most efficient and cheapest way to keep our streams clean is to maintain forest cover. We may want to start, instead of allowing developments to clear cut, to maintain that 10% impervious surface, and clear only enough to accommodate a house and a driveway, because it's the only way we will be able to afford it. It always costs everybody downstream a lot more when these rain events occur, and we know they are going to occur a lot more with climate change. And that's the only way to avoid that urban toxic syndrome. I did want to bring up that down in King George County,

Virginia they require that septics be pumped out every five years, and you must send them a receipt, and I think that would be a good thing here in Charles County. I think a lot of people here in Charles County buy homes and don't know how to take care of the septic systems, and then they fail. That's something that should be included in the real estate sale. We could have a mandatory pump out every five years, like King George is doing. I would like to find out why Nanjemoy Creek is not getting a TMDL, but I'm not sure if it helps as we are not meeting the TMDL in Mattawoman Creek. And yes in 1984 Mattawoman Creek was named the most productive tributary of the Chesapeake Bay. But even though we are supposed to be taking care of our watersheds it has declined, and I know you all have heard Dr. Long speak, and seen his presentations. And we do have a benchmark from Captain John Smith came up the Chesapeake and he could see to the bottom, and oysters were the size of dinner plates, and there were so many fish they were trying to scoop them up with hands, and we had 800 pound Sturgeons. So we do have a benchmark, I just hope we don't continue to fail, while we are saying we are trying to help. We have the solutions we just have to implement them. Thank you.
Answer 49: Noted.