

THE CITY OF KNOXVILLE TENNESSEE

NPDES Permit Annual Report



National Pollutant Discharge Elimination System
Stormwater Discharge Permit TNS068055
July 1, 2021 - June 30, 2022



Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report



Tennessee Department of
Environment and Conservation
Division of Water Resources
William R. Snodgrass Tennessee Tower,
312 Rosa L. Parks Avenue, Nashville,
Tennessee 37243, 888-891-8332

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

1. MS4 Information

Name of MS4: City of Knoxville	MS4 Permit Number: TNS068055	
Contact Person: David Hagerman, P.E.	Email Address: dhagerman@knoxvilletn.gov	
Telephone: (865) 215-3251	MS4 Program Web Address: www.knoxvilletn.gov	
Mailing Address: P.O. Box 1631, Suite 317, 400 Main Street		
City: Knoxville	State: Tennessee	ZIP code: 37902

Additional Contacts:

Thomas V. Clabo, P.E., Director (865) 215-2148 tclabo@knoxvilletn.gov
Department of Engineering
P.O. Box 1631, Suite 475, 400 Main Street, Knoxville, TN 37902

Chad Weth, Director (865) 215-2060 cweth@knoxvilletn.gov
Public Service Department
3131 Morris Avenue, Knoxville, TN 37909

What is the current population of your MS4? **From 2020 Census: 190,740**

What is the reporting period for this annual report? **July 1, 2021 to June 30, 2022**

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

2. Discharges to Water Bodies with Unavailable Parameters or Exceptional Tennessee Waters

- A. Does your MS4 discharge into waters with unavailable parameters (previously referred to as impaired) for pathogens, nutrients, siltation or other parameters related to stormwater runoff from urbanized areas as listed on TN's most current 303(d) list and/or according to the on-line state GIS mapping tool (tdeconline.tn.gov/dwr/)? If yes, attach a list. Yes No

See attached Table 2A.

- B. Are there established and approved TMDLs (<https://www.tn.gov/environment/program-areas/wr-water-resources/watershed-stewardship/tennessee-s-total-maximum-daily-load-tmdl-program.html>) with waste load allocations for MS4 discharges in your jurisdiction? If yes, attach a list. Yes No

When the current permit was issued, the following TMDLs had been approved:

- Fecal Coliform in First, Second, Third, and Goose Creek (Fort Loudoun Lake Watershed - HUC 06010201), and;
- Fecal Coliform in Baker, Fourth, and Williams Creek (Fort Loudoun Lake Watershed HUC 06010201).

The following TMDLs have been approved since the current permit was issued or added to City limits due to annexation:

- Siltation and Habitat Alteration in the Ft. Loudon Lake Watershed (HUC 06010201), approved in 2006, and;
- E. Coli in the Fort Loudon Lake Watershed (HUC 06010201), approved in 2017.
- Pathogens in the Lower Clinch Watershed (HUC 06010207), approved in 2005.
- Siltation and Habitat Alteration in the Lower Clinch Watershed (HUC 06010207), approved in 2006.
- E. coli in the Lower Clinch River Watershed (HUC 06010207), approved in 2017.

Additionally, in 2010 a proposed TMDL was approved and titled *Proposed Total Maximum Daily Loads (TMDLs) for Polychlorinated Biphenyls (PCBs) in the Fort Loudon Lake Reservoir, Fort Loudon Lake Watershed (HUC 06010201)*.

- C. Does your MS4 discharge to any Exceptional TN Waters (ETWs - http://environment-online.tn.gov:8080/pls/enf_reports/f?p=9034:34304:4880790061142)? If yes, attach a list.
 Yes No

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

- D. Are you implementing a specific Stormwater Management Plan (SWMP) to control pollutant discharges to waterbodies with unavailable parameters or ETWs? If yes, describe the specific practices: Yes No

The City of Knoxville continues to implement and comply with the SWMP as issued in the 2004 NPDES permit (TNS068055), including the Comprehensive Monitoring Program (MN) as modified and approved by TDEC (Tennessee Department of Environment and Conservation). The SWMP and modified MN program and included as Table 2D and Table 2E, respectively.

3. Public Education/Outreach and Involvement/Participation

- A. Have you developed a Public Information and Education plan (PIE)? Yes No

- B. Is your public education program targeting specific pollutants and sources, such as Hot Spots? If yes, describe the specific pollutants and/or sources targeted by your public education program:
 Yes No

- The Special Pollution Abatement Permit (SPAP) program targets specific hot spots known to produce pollutants not covered by first flush requirements, such as floatable debris and oil/grease. The program educates business on management and structural controls that can be used to prevent pollution.
- Signs have been installed at strategic locations throughout the City that are designed to educate the public on the water quality concerns, specifically E. coli and total Coliform bacteria, that can result from pet waste, feeding wild birds and sanitary sewer leakages.
- Educational programs for pesticides, herbicides, fertilizer, automotive fluids, etc., use have been implemented in conjunction with City's public education programs for collection and recycling of household hazardous waste (HHW).
- The 311 call center is advertised to increase the public's awareness of the City's role in water quality issues and to create a quick and anonymous method for citizens to report water quality concerns, like illicit dumping or industrial discharges.

- C. Do you have a webpage dedicated to your stormwater program? If yes, provide a link/URL:

Yes No: <http://www.knoxvilletn.gov/stormwater>

- D. Summarize how you advertise and publicize your public education, outreach, involvement and participation opportunities:

- The City advertises the 311 call center through stormwater pollution prevention educational handouts (e.g. magnets, pet waste bag dispensers, koozies, and brochures), as well as presentations, business cards, vehicles, signage, and correspondence with residents.
- The City advertises volunteer opportunities on the volunteer opportunities website (http://knoxvilletn.gov/residents/volunteer_opportunities) and on a shared website with other agencies.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

- The City manned an educational booth at the Knoxville 2022 Neighborhood Conference. Information regarding water quality and stormwater pollution prevention for homeowners was presented to the public.
 - The City published three articles on the blog and social media regarding water quality. The articles were titled; *Riverbank Restoration: Creative Landscape Architects and Gritty Planting Crews Create New Ecosystem*, *Catch a Catfish at Fountain City Park*, and *Before Fountain City Park Became a Knoxville Park, Stormwater Engineers Were Giving TLC to the Lake*. The blog can be found at: knoxvilletn.gov/blog. Additionally, water quality projects can often be found on the Public Improvement Projects webpage at: knoxvilletn.gov/projects.
 - The City mailed 650 letters as part of the National Flood Insurance Programs (NFIP) Community Rating System (CRS). The letters included text encouraging public involvement with water quality through reporting concerns to 311.
 - The City developed and maintains the Best Management Practices (BMP) Manual and the Land Development Manual (LDM). Both are updated on an as needed basis and are available on the stormwater engineering website. The BMP Manual explains requirements for stormwater pollution prevention and erosion control for homeowners and both commercial and industrial sites. The LDM was created to assist developers with meeting all design and construction requirements.
 - The City has a standard that requires a “No Dumping, Drains to River” message to be cast in all new curb irons, solid stormwater manhole/junction box covers, and manhole lids for stormwater treatment devices.
- E. *Summarize the public education, outreach, involvement and participation activities you completed during this reporting period:*
- The City’s Adopt-a-Stream program hosted six group cleanup events. Dozens of participants removed gross pollutants from approximately four miles of stream and riparian buffer.
 - Both City staff and volunteers continued to educate the public on the negative effects on water quality that result from feeding wild birds at Fountain City Lake. Educational efforts include permanent signage and updates on the City blog and Facebook page about the progress and struggles at the lake. Updated signage is expected to be installed during the current permit year.
 - No dumping signs were updated and many new sign locations were added.
 - Bacteria sampling has continued as part of watershed monitoring and adjacent to highly concentrated vagrant encampments in order to continue to evaluate the negative impact on streams in multiple watersheds. City staff provided education to those receptive and encouraged them not to use the water to bathe, perform other hygiene practices, or eliminate waste.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

F. Summarize any specific successful outcome(s) (e.g., citizen involvement, pollutant reduction, water quality improvement, etc.) fully or partially attributable to your public education and participation program during this reporting period:

- Water quality related blogs and social media posts were read by over 66,000 citizens.
- Adopt-A-Stream events removed gross pollutants from over four miles of stream and riparian buffer zones. A trailer equipped with creek cleaning supplies and wrapped with educational message is now available to the public to assist with adoption efforts. It has been a great success in the continued efforts to educate citizens about the importance of improving health of urban streams in the community.
- The City's Solid Waste Facility collected 115,086 pounds of household hazardous waste.
- Approximately 220,000 pet waste bags were dispensed from the City's pet waste bag stations located throughout the City.

4. Illicit Discharge Detection and Elimination, CFR 122.26 (d)(2)(iv)(B)

A. Have you developed and do you continue to update a storm drain system map that shows the location of system outfalls where the municipal storm drain system discharges into waters of the state? Yes No

See attached NPDES Permit Program Inventory Map.

B. If yes, does the map include inputs into the storm drain collection system, such as the inlets, catch basins, drop structures or other defined contributing points to the drainage area of that outfall, and general direction of stormwater flow? Yes No

The detailed inventory is maintained by City staff and managed by the Knoxville Geographic Information System (KGIS), which is funded by the City of Knoxville in partnership with Knox County and the Knoxville Utilities Board. The individual structures are not provided on the printed NPDES Permit Program Inventory Map due to scale. During this reporting period, the City retained a consultant to conduct a City-wide assessment and inventory of the stormwater system. The assessment will include invert data, flow direction, provide a current condition of the infrastructure, and include the ability to digitally attach inspection data to the assets.

C. How many outfalls have you identified in your storm drain system? 1,373

D. Do you have an ordinance, or other regulatory mechanism, that prohibits non-stormwater discharges into your storm sewer system? Yes No

E. Have you implemented a plan to detect, identify and eliminate non-stormwater discharges, including illegal disposal, throughout the storm sewer system? If yes, provide a summary: Yes No

In 1996, the City of Knoxville began implementation of the Illicit Discharge and Improper Disposal Program as a part of the SWMP. The program has been designed to detect and remove illicit and improper discharges to the Municipal Storm Drain System (MS4) as required by 40 CFR 122.26(d)(2)(iv)(B). The program includes the following sections:

- The Stormwater and Street Ordinance (effective June 20, 1997)

Specifically prohibits non-stormwater discharges and authorizes penalties up to \$5000 per day and provides water quality regulations for new development.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

- **Field Screening**

Since 1996, the Dry Weather Screening Program has been used to evaluate both randomly selected outfalls and high-risk outfalls. At least 150 outfalls are screened annually. Screening consists of four site visits per outfall over a 1 year period. If flow is present the water is tested for indicator pollutants using a field test kit. A summary table of the results of outfalls that had flow at the time of screening is included as Table 4E. A map showing the location of all screened outfalls is included as the NPDES Permit Program Inventory Map. This program has successfully located and removed many illicit discharges and illegal cross connections.

- **Investigation of the Storm Drain Mapping System**

The procedure for mapping, field surveys, and upstream source identification were developed and included in the Part 2 Application in Section 5.3.5. The City continues to utilize and continually update the procedure to maintain the effectiveness of the Illicit Discharge and Improper Disposal Program. During this reporting year, The City made over 225 mapping corrections and revisions to the storm drain mapping system.

- **Spill Response Program**

The City's Stormwater Division coordinates with the Knoxville Emergency Management Agency (KEMA), Knoxville Fire Department (KFD) Hazmat, and TDEC during emergency situations, including after hours and weekends. Each agency has specific roles to play during an emergency event. When discharges enter the MS4, the Stormwater Division assists with information gathering, investigations, GIS support, containment, remediation, follow-up monitoring, documentation, and enforcement when necessary.

- **Reporting of Illicit Discharges**

The City actively encourages citizens to report water quality concerns to the 311 call center. On March 11, 2021, the 311 call center debuted the My Knoxville App, which allows citizens to report water quality concerns through a smart phone app. The app allows users to easily add a location using Google Maps and has the ability to attach pictures or videos. The City advertises the 311 call center through stormwater pollution prevention educational handouts (e.g. magnets, pet waste bag dispensers, koozies, and brochures), as well as presentations, business cards, vehicles, signage, and routine correspondence with residents. In addition to 311 giving citizens the opportunity to report illicit discharges, the City also promotes public involvement through several educational programs, such as, the River Rescue, Adopt-A-Stream, an educational booth at the Neighborhood Conference, and routine training of Public Service, Engineering, and City Fleet departments.

- **Used Oil and Toxic Materials Program**

The City operates multiple recycling centers as well as the permanent Solid Waste Management Facility (SWMF), which serves to divert reusable products, collect and reuse or solidify paints, collect car batteries and fluids, divert selected acids and bases to wastewater treatment, bulk flammable materials, and pack miscellaneous materials for safe shipment and disposal.

F. How many illicit discharge related complaints were received this reporting period?

179 illicit discharge complaints were received during the reporting year. 66 were received as an illicit discharge complaint and 113 were received as a new construction erosion control complaint.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

G. How many illicit discharge investigations were performed this reporting period? **All illicit discharge complaints that were received resulted in an investigation and 220 outfalls were systematically screened through the Dry Weather Screening Program.**

H. Of those investigations performed, how many resulted in valid illicit discharges that were addressed and/or eliminated? **All valid complaints were addressed and eliminated as part of the initial field investigation. Of the 220 outfalls that were screened through the Dry Weather Screening Program, 12 illicit discharges were detected and addressed.**

5. Construction Site Stormwater Runoff Pollutant Control, CFR 122.26 (D)(2)(IV)(D)

A. Do you have an ordinance or other regulatory mechanism requiring:

Construction site operators to implement appropriate erosion prevention and sediment control BMPs consistent with those described in the TDEC EPSC Handbook? Yes No

Construction site operators to control wastes such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste? Yes No

Design storm and special conditions for unavailable parameters waters or exceptional Tennessee waters consistent with those of the current Tennessee Construction General Permit (TNR100000)? Yes No

B. Do you have specific procedures for construction site plan (including erosion prevention and sediment BMPs) review and approval? Yes No

C. Do you have sanctions to enforce compliance? Yes No

D. Do you hold pre-construction meetings with operators of priority construction activities and inspect priority construction sites at least monthly? Yes No

E. How many permits were issued for construction sites disturbing at least one acre or greater in your jurisdiction this reporting period? **33**

F. How many permits were issued for construction sites disturbing less than one acre or greater in your jurisdiction this reporting period? **1,944**

G. How many construction inspections were inspected this reporting period? **10,330**

H. How many construction related complaints were received this reporting period? **113**

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

6. Permanent Stormwater Management of Source Controls, CFR 122.26 (d)(2)(iv)(a)

- A. Do you have a regulatory mechanism (e.g. ordinance) requiring permanent stormwater pollutant removal for development and redevelopment projects? If no, have you submitted an Implementation Plan to the Division? Yes No

The 1997 Stormwater and Street Ordinance, updated November 2020, and the accompanying LDM.

- B. Does the ordinance or other regulatory mechanism require:

Site plan review and approval of new and re-development projects? Yes No

A process to ensure stormwater control measures (SCMs) are properly installed and maintained? Yes No

Permanent water quality riparian buffer zones? If yes, specify requirements: Yes No

The Stormwater and Street Ordinance requires a riparian buffer zone (RBZ) of 60 ft for drainage areas of greater than 1 square mile. A RBZ of 30 ft is allowed for drainage areas that are less than 1 square mile. The RBZ is measured from the top of the bank and extends perpendicularly for the length of the water body and is illustrated on KGIS. If a plat is required, the natural streamside buffer zone must be shown. The Ordinance does not allow any actively eroding creek banks to remain after development is complete. This may require the stream bank to be stabilized as part of the construction project. If stabilization is necessary, hard armor may only be used when bioengineering alternatives are not technologically feasible. The RBZ must be preserved post development.

- C. What is the threshold for development and redevelopment project plans plan review (e.g., all projects, projects disturbing greater than one acre, etc.)?

All disturbed areas greater than 10,000 ft² must submit an Erosion and Sediment Control Plan (ESC) that has been stamped by a design professional and calculations must be stamped by a registered professional engineer.

- D. How many development and redevelopment project plans were reviewed for this reporting period? **3,072**

- E. How many development and redevelopment project plans were issued permits? **1,977**

- F. How many enforcement actions were taken to address improper installation or maintenance?

289 Notices of Violation (NOVs) were issued for active construction site BMPs, 5 for active SPAP site BMPs, and 13 for illicit discharges. Verbal notifications are a routine part of our inspection process and are not included in this total.

- G. How many permanent, post-construction stormwater quality related inspections were performed during this reporting period? **203 SPAP inspections and 285 stormwater pond inspections were performed during the reporting year.**

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

- H. Do you have a system to inventory and track the status of all public and private SCMs installed on development and redevelopment projects? Yes No

Both public and private SCMs that were installed before 1997 are mapped using the KGIS database. Private SCMs that are installed after 1997 are mapped using the KGIS database, recorded using permanent maintenance agreements and/or covenants, and tracked using the SPAP program (used for Hot Spots only) and the Accela database. All Public SCMs installed after 1997 are mapped using KGIS and tracked using the Accela database.

- I. Does your program include an off-site stormwater mitigation or payment into public stormwater fund? If yes, specify. Yes No

7. Stormwater Management for Municipal Operations, CFR 122.26(d)(2)(iv)(C)

- A. As applicable, have annual visual inspections been performed at least once a year on each of the municipal industrial facilities (MIFs) listed below:

Solid Waste Management Facility (SWMF) on Elm Street?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
The Fleet Truck and Heavy Equipment garage on Loraine Street?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
The Fleet and Police Garage at Prosser Road?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
The Knoxville Area Transit (KAT) bus station on Magnolia Avenue?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
The KAT Transfer Station on Church Street?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

- B. Do you have a training program for employees responsible for municipal operations at facilities within the jurisdiction that handle, generate and/or store materials which constitute a potential pollutant of concern for MS4s? Yes No

If yes, are new applicable employees trained within six months, and existing applicable employees trained and/or retrained within the permit term? Yes No

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

8. Reviewing and Updating Stormwater Management Programs

- A. Describe any revisions to your program implemented during this reporting period including but not limited to: Modifications or replacement of an ineffective activity/control measure.

During this reporting year, the City implemented the second full year of the revised MN program. The program continues to become more effective and efficient as employees become more familiar with the Hydrolab equipment and software and further refine the invertebrate and bacteria monitoring procedures. Dry weather screening equipment was also updated from the previous reporting year. Quick result test strips for indication of ammonia, chlorine, copper, nitrate, and phosphate replaced more time consuming Chemetrics tests. Resulting in more efficient screening of outfalls.

Changes to the program as required by the division to satisfy permit requirements. **None**

Information (e.g. additional acreage, outfalls, BMPs) on newly annexed areas and any resulting updates to your program. **Three previously unknown outfalls were identified on existing City property and added to the current inventory.**

- B. In preparation for this annual report, have you performed an overall assessment of your stormwater management program effectiveness? If yes, summarize the assessment results, and any modifications and improvements scheduled to be implemented in the next reporting period.
 Yes No

The City of Knoxville proposed many changes in both the 2008 and the 2016 reapplication for permit TNS068055 to modify the current SWMP.

Enforcement Response Plan

- A. Have you implemented an enforcement response plan that includes progressive enforcement actions to address non-compliance, and allows the maximum penalties specified in TCA 68-221-1106? If no, explain. Yes No

The written Enforcement Response plan was developed by the City and reviewed by TDEC as part of the Tennessee Qualifying Local Program (QLP) approval process and can be found in the LDM as the "Qualified Local Program Construction General Permit".

- B. As applicable, identify which of the following types of enforcement actions (or their equivalent) were used during this reporting period; indicate the number of actions, the minimum measure (e.g., construction, illicit discharge, permanent stormwater management), and note those for which you do not have authority:

<u>Action</u>	<u>Construction</u>	<u>Permanent Stormwater</u>	<u>Illicit Discharge</u>	<u>In Your ERP?</u>			
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NOVs	# 289	# 5	# 13	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Administrative Penalties	# 14	#	#	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
Stop Work Orders	# 97	#	#	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

- C. Do you track instances of non-compliance and related enforcement documentation?
 Yes No
- D. What were the most common types of non-compliance instances documented during this reporting period?

Erosion prevention and sediment control at new construction sites were the most common type of violation.

9. Monitoring, Recordkeeping, and Reporting

- A. Summarize any analytical monitoring activities (e.g., planning, collection, evaluation of results) performed during this reporting period.

Findings and Conclusions from the Comprehensive Monitoring Program:

Goose Creek was selected as the second creek to be evaluated through the new comprehensive monitoring program. Initial monitoring/sampling sites were revised from the original scope due to field conditions. An additional location was added in the fourth quarter as a result of a portion of the creek with excessive algae growth during the creek walk. Goose creek analysis included, but was not limited to; 8 defined reaches consisting of 4.2 miles of creek walked and evaluated by city staff, 7 initial monitoring locations, increased to 8 in the fourth quarter, and 7 sites within the watershed where invertebrate surveys with habitat assessment were performed. Please see Appendix A for maps.

Water Quality Monitoring Summary:

The water quality monitoring was completed using Hydrolab Sondes and bacteria testing initially at seven strategic locations. This allowed for a comprehensive overview of the water quality in Goose Creek. This monitoring in tandem with the creek walk survey revealed a problem area, which expanded sampling to eight locations. The eighth being in a location dubbed as the "Chicken Tributary". We identified elevated levels of bacteriological pollution along this tributary, as well as elevated levels of green algae. We were unable to locate a point source for this pollution, but we are continuing our hunt for a possible sewer leak/leach into the surrounding area of the creek. There are several sewer lateral crossings over the creek that could be a possible culprit for the contamination.

The sonde data collected at Goose Creek revealed only elevated levels of Chloride after road salts were used for possible de-icing, at select locations. All other parameters sampled via Hydrolab Sonde were within accepted healthy limits, however, the creek does test above fishable/swimmable bacteria levels. See page 12 for sonde parameters, ranges, and explanations.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

Sonde Parameter	Units	Acceptable Range
Specific Conductivity	mS/cm	.15 - .50 (Conductivity @ 25°C)
Raw Conductivity	µS/cm	This is used to get Specific Conductivity (Conductivity @ measured temp)
DO	%SAT	>60
DO	mg/L	>5
TDS	g/L	<.5
Density kg/m3	kg/m3	Weight of water
Salinity	psu	<.5
Turbidity #	NTU	<100 Lower is better
NH4+	mg/L-N	<1
NO3-	mg/L-N	>0, <1
NH3 Total	mg/L-N	<1
Cl- mg/L	mg/L	<230
NH3	mg/L-N	<1

Conductivity - Indicator of water quality, can determine concentration of solutions, detect contaminants and determine the purity of water (mS/cm x1000 = µS/cm)

Density - Weight of the water in Kg per cubic meter

Salinity - Concentration of salts in the water

Turbidity - Water clarity, can be higher after rain events

NH3 + NH4 = NH3 Total - Lower is better

Cl - Measure of chloride in the water, mostly comes from road salts, less is better.

TDS – Total Dissolved Solids, Measured in the field.

TSS – Total Suspended Solids, TSS = TDS + filtered solids

Stream Survey Summary:

Lower reaches 1 through 4 are impacted by sediment; in some locations high eroded sloughing banks are present. However, the majority of surrounding land use is park and residential resulting in an intact decent quality riparian buffer. The majority of reach one does contain legacy PCB pollution, originating from reach 6. These reaches display many of the same characteristics. Reach 2 is spring fed, and the source could not be located. The effluent of the pipe system where the spring daylight is adjacent to TDEC monitoring well for sub surface fuel plume. The upper portion of reach 5 has heavily sedimented substrate, and has long runs that contain deep muck deposits. The reach is also mixed with riffles of rocky substrate. The source was found to be a spring coming from a rock formation. Reach 6 is adjacent to the old Witherspoon Superfund site and runs thru several industrial properties. This is where the legacy PCB contamination begins. Reach 8 consists of a majority of roadside/yard channels, and is impacted by trash and vagrant activity, as are a few locations within the limits of Mary Vestal Park. See Appendix A for maps. See Appendix B for stream survey field sheets and some representative photos. Additional photos of all reaches surveyed available upon request.

Invertebrate and Habitat Summary:

Eight different invertebrate surveys were performed at seven different locations. The samples at all locations contained a variety of obligate and tolerant species, from most orders, varied family species. Mayflies, Caddisflies, and True flies (mostly midges) were abundant throughout. Beetles, Damselflies, and Dragon flies were present throughout. Megaloptera (Adler fly, Dobson fly, Fish fly) were not identified by City staff in Goose Creek at the sampling locations. Less desirable insects such as scuds, flat worms, and water mites were also present in most locations, but not common. Salamanders and crayfish were common in the stream segments sampled. Stone flies and Brush-Legged mayflies were found in one location, Avenue A. At West Blount Avenue a pair of Southern Two-lined Salamanders were found, with two clutches of eggs at different states of development. Heavily sedimented locations were not part of the invertebrate survey locations. See Appendix A for maps. See Appendix C for habitat assessment field forms and representative invertebrate photos. Additional photos and completed biorecon data sheets for all sampling events available upon request.

This type of fluid and reactive monitoring/sampling allows tailoring to each creek's specific needs to better locate pollutant sources, identify impacted segments, and plan improvements. The overall goal is to identify and remediate unavailable parameters of 303(d) listed streams to the point portions and/or parameters listed will be delisted. See Tables 10A.1a through 10A.1e for results and parameters. See tables 10A.2a through 10A.2f for bacteria results.

Municipal Industrial Facility Screening Summary:

The City collected wet weather grab samples from MIF outfalls that have pretreatment structures installed. In order to evaluate the effectiveness of the treatment units located at the Fleet Truck and Heavy Equipment garage and the SWMF, both pretreated and post treated grab samples were collected. Analytical laboratory data summaries for each of the sampling locations are included as Table 10A.3.

During the July 1, 2021 to June 30, 2022 monitoring period, a total average of 48.3 inches of rainfall was recorded. The City's five ISCO monitoring stations, two ISCO rain gauges, and one Weatherlink weather station recorded daily rainfall. Data is available on the City's Stormwater website:

https://knoxville.gov/government/city_departments_offices/engineering/stormwater_engineering_division/rainfall_data

The NPDES permit requires an estimate of the total urban runoff volume discharged by the City of Knoxville annually. The volume estimate is based on total average annual rainfall and the estimated imperviousness of different land uses. To estimate the imperviousness the City utilizes GIS to determine the approximate area of each land use within a watershed. The total average rainfall was determined by averaging the rainfall recorded during the year from the City's stormwater monitoring stations, rain gauge stations, and the National Weather Service data recorded at McGhee Tyson airport. The analysis for each watershed and the entire City is included as Table 10A.4.

B. *Summarize any non-analytical monitoring and remedial activities (e.g., planning, collection, evaluation of results) performed during this reporting period.*

- **Hot Spots**

The City has identified many common discharges from facilities that are not required to be permitted under the TDEC multi-sector general stormwater permit or individual NPDES permit programs. Rather than spend limited resources attempting to duplicate the efforts of TDEC and Environmental Protection Agency (EPA) by monitoring existing permitted facilities, the City added the SPAP program for those specific land-uses that have proven to have the potential to discharge polluted runoff. Section 22.5-37 of the Stormwater and Street Ordinance requires a SPAP on new development and redevelopment of projects for certain land uses, targeting the pollutants of concern for each land use. This program is used to eliminate gaps in the existing State and Federal permit programs through a local inspection program for otherwise non-permitted facilities.

Each of the SPAP facilities is required to have some type of structural stormwater treatment device (e.g., oil/water separator, catch basin inset, grass swale) and/or pollution prevention management controls. During the SPAP inspection, the City typically reviews the facilities maintenance records, provides technical advice on proper maintenance scheduling, and updates the City's industrial and commercial facilities database. Inspection of the SPAP facilities occurs systematically to ensure that the structural controls are maintained and the management controls are being followed.

Stormwater Quality compliance inspections for non-SPAP sites are conducted in response to specific complaints from citizens or tips from 311 calls. The City decides on a case-by-case basis whether this group of inspections will use education or enforcement to correct any problems found. In some cases, an existing facility that is not "new development" or undergoing "redevelopment" may be required to apply for a SPAP to correct violations.

Hot spots are also identified through the water quality monitoring program, as discovered through field investigation, sampling, and complaint response. Monitoring hot spots included Mead Quarry, Chilhowee Park, Davis Street Spring, and Williams Creek. Mead Quarry was tested in January 2022 in response to algae bloom. Bacteria results were very low and within recreational limits. The bloom was determined to be a natural occurrence due to the lake flipping, and not associated with additional bacteria pollution. Chilhowee Park's Lake Ottosee was tested twice during the winter during both dry and wet weather conditions. Bacteria was higher during dry weather and all results were above standards for recreational use. The source continues to be bird feces, as the lake is over populated with waterfowl. Davis Street spring continues to be contaminated with sewage despite multiple projects by KUB to attempt to eliminate the groundwater contamination. Fluctuations in bacteria levels do not appear to be greatly impacted by wet and/or dry conditions and E. Coli continues to be extremely high in the effluent regardless of flow rate. The spring discharge continues to be diverted into a sanitary manhole. Williams Creek was found to have high bacteria levels during the full suite monitoring. As a result, wet and dry weather bacteria samples were taken at strategic location along the creek in order to pinpoint the source.

A point source of the pollution was not found but is possibly linked to pumping of Lake Ottosee. Testing methods at the lab changed, and the last tests no longer included fecal coliform. Therefore, the high “greater than” result across the board made the testing useless in prioritizing the bacteria levels. The bacteria will continue to be monitored in the upcoming permit cycle.

- **TMDL Implementation**

Dilapidated metal stormwater pipes are continually identified and remediated using cured in place pipe (CIPP) lining technology. This technology allows the City to repair the dilapidated metal pipes without the need to dig and replace. This results in eliminating the risk of sediment discharge during construction, as well as eliminating sediment discharges from the rusted pipe that occur during storms. During this reporting period, the City lined 2083 feet of dilapidated pipe.

Vagrant encampments continue to severely impacted the health of City creeks. Impacts include, but are not limited to, high bacteria levels, loss of substrate habitat due to unnatural debris coverage, riparian buffer damage, creek bank instability due to loss of vegetation, biological hazards, needles, nutrients from food waste, chemicals, detergents, garbage dams, methamphetamine manufacturing, and increased flood potential. This significant pollution source has been identified in multiple watersheds throughout the city. Significantly impacted creeks include First Creek, Second Creek, Goose Creek, and Ten Mile Creek. Further monitoring, coordination with other agencies/departments, and remediation efforts will continue and hopefully expand in the future.

The City continues to remediate the pollutant hazard with removal of trash and other materials. Contractors were hired on an emergency remediation basis to remove trash, bulky items (creating flooding and habitat damage), and biohazards (needles and drug paraphernalia) from the creek and riparian buffer. Approximately 14 clean up efforts were conducted in First, Second, and Goose Creek utilizing over \$60,000 worth of emergency funds.

In the First Creek Watershed, Fountain City Lake has historically been a source of fecal coliform due to wildlife. The City’s efforts to educate the public on the negative impacts of feeding wildlife, as well as the physical removal of invasive aquatic plants, has resulted in water quality improvements that allowed TWRA to stock the lake with trout and catfish. TWRA’s stocking schedule can be found here:

<https://www.tn.gov/content/dam/tn/twra/documents/fishing/trout/winter-trout-schedule.pdf>

- **Municipal Industrial Facility Inspection Program**

The City has developed an inspection and pollution prevention program for municipal industrial facilities. Currently only five MIFs are operated by the City. These facilities include:

- The Solid Waste Management Facility (SWMF) on Elm Street,
- The Fleet Truck and Heavy Equipment garage on Loraine Street,
- The Fleet and Police Garage at Prosser Road,
- The Knoxville Area Transit (KAT) bus station on Magnolia Avenue, and
- The KAT Transfer Station on Church Street.

Each facility is currently evaluated and inspected regularly by Stormwater staff and will continue to be inspected at least annually in the future. The KAT Station is the newest of the MIFs and was built using LEED standards including stormwater quality treatment devices for the runoff.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

The inspection and monitoring program has been productive at all of the MIFs in the past. Structural and management BMPs have been installed to control pollution and improve the water quality of runoff from each facility. The SWMF has been retrofitted with structural controls to reduce the solids, sediment, hydrocarbons, and bacteria in the runoff from the paved areas. Additional water quality improvements have been constructed at the SWMF that include new grit/sediment sumps, floatables skimmers, grass swale, and low flow modifications to the detention pond.

- **Industrial Facility Inspection Program**

As part of the NPDES Permit for stormwater discharges associated with industrial activity, applicants are required to monitor, at least bi-annually, representative stormwater outfalls identified in the facilities' SWPPPs. Applicants must monitor in accordance with TDEC Rule 1200-4-10-.04. The Stormwater and Street Ordinance authorizes the City to require additional monitoring from industries not covered under the TDEC programs whenever necessary and requires all permit holders to submit a copy of their permit within 60 days of issuance. The City maintains this information and assess the impact of the monitored discharges on the water quality in the MS4.

If the City determines that additional data needs to be provided in the monitoring program for an industry (e.g., reports on additional parameters), requirements for an expanded program for subsequent monitoring events is coordinated with TDEC and/or the industrial discharger.

- **Permanent Maintenance Agreement Inspection Program**

Since 1997, permanent maintenance agreements and/or covenants have been required for all new stormwater detention facilities and special pollution abatement devices (e.g., oil/water separators and catch basin inserts). A covenant is defined in Section 22.5-34 of the Ordinance as a legal document entitled "Covenant for Permanent Maintenance of Stormwater Facilities," which replaced the original "agreement" referred to in the Part II application and Part IV of the permit. A covenant does not require the Mayor's signature or Council approval, and the end result for water quality protection and flood control is the same. Covenants are recorded in the office of the Knox County Register of Deeds. The City has also begun logging all non-SPAP facility SCMs with covenants into the Accela database for better tracking of inspections and maintenance.

The City retains the right to inspect the stormwater facilities to insure they are properly maintained; however, the responsibility for the maintenance of stormwater facilities remains with the property owner unless legally transferred to another person or entity by a properly recorded legal agreement. If the property owner does not maintain the facility properly, the City may perform the maintenance at the property owners expense. If the owner does not reimburse the City, the City may place a lien against the property for double the cost. To ensure access to the facility, a traversable access easement is required.

C. *If applicable, are monitoring records for activities performed during this reporting period submitted with this report.* Yes No

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

10. Fiscal Analysis

The Fiscal Analysis for this annual report lists the permit year budget sources and amounts along with estimates for the following permit year. Due to complexity, all of the support activities such as purchasing, payroll, legal support, information systems, fleet management, and human resources are not reflected. The below table presents the primary sources of funding for the City’s stormwater related activities.

Capital Funds	FY22 Actual	Proposed Funding FY23
Stormwater Engineering	\$1,320,039.33	\$14,069,146
Civil Engineering*	\$14,600,576	\$49,414,788
Operating Funds	FY22 Actual	FY23 Budget
Stormwater Engineering	\$3,010,330	\$3,295,300
PSD – Stormwater Related	\$4,607,810	\$4,640,223**
Household Hazardous Waste Facility and Recycling	\$2,198,729	\$2,686,735

* - Civil Engineering capital funded projects include stormwater quality and quantity components but also have unrelated expenses.

** - Estimated amount of stormwater related activities which are paid out of PSD general fund account.

Phase I Medium Municipal Separate Storm Drain System (MS4) Annual Report

11. Certification

This report must be signed by a ranking elected official or by a duly authorized representative of that person. See signatory requirements in sub-part VII (K) of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Indya Kincannon, Mayor

Printed Name and Title



Signature

Date

Annual reports must be submitted within 6 months after the end of the permit year to the Environmental Field Office (EFO) located at 3711 Middlebrook Pike, Knoxville TN 37921.

APPROVED AS TO FORM:

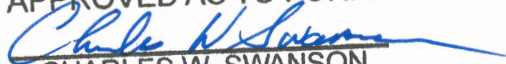

CHARLES W. SWANSON
LAW DIRECTOR

Table 2A

City of Knoxville Waters with Unavailable Parameters

Waterbody ID	Impacted Waterbody	County	Miles/Acres Impaired	Reason for Impairment/TMDL Priority	Pollutant Source
TN06010104 001_0100	LOVE CREEK	Knox	9.7 Miles	Nitrate+Nitrite Sediment/Siltation Other Anthropogenic Habitat Alterations Escherichia coli	L L L NA Urbanized High Density Area
TN06010104 001_1400	SWANPOND CREEK	Knox	16.3 Miles	Escherichia coli	NA Urbanized High Density Area
TN06010201 020_1000	FORT LOUDOUN RESERVOIR	Knox Loudon	14066 acres	PCBs	L Contaminated Sediment
TN06010201 020_2000	FORT LOUDOUN RESERVOIR	Knox	534 acres	Mercury PCBs	L NA Atmospheric Deposition Contaminated Sediment
TN06010201 066_0500	MCCALL BRANCH	Knox	1.73 Miles	Sediment/Siltation	L Urbanized High Density Area
TN060102010 20T_0100	TOLL CREEK	Knox	2.05 Miles	Alteration in Stream-Side or Littoral Vegetative Covers Sediment/Siltation	L L Urbanized High Density Area
TN060102010 89_0110	UNNAMED TRIB TO FLENNIKEN BRANCH	Knox	1.87 Miles	Chloride Sedimentation/Siltation	L L Landfills Urbanized High Density Areas
TN06010201 067_0100	EAST FORK THIRD CREEK	Knox	2.78 Miles	Sediment/Siltation Other Anthropogenic Habitat Alterations Escherichia coli	NA NA NA Urbanized High Density Area Collection System Failure
TN06010201 067_1000	THIRD CREEK	Knox	17.86 Miles	Nitrate+Nitrite Sediment/Siltation Other Anthropogenic Habitat Alterations Escherichia coli	L NA NA NA Land Development or Redevelopment Urbanized High Density Area Collection System Failure
TN06010201 080_0100	WHITES CREEK	Knox	10.2 Miles	Other Anthropogenic Habitat Alterations Escherichia coli Sediment/Siltation	NA NA L Urbanized High Density Area Streambank Modification
TN06010201 080_1000	FIRST CREEK	Knox	16.1 Miles	Nitrate+Nitrite Sediment/Siltation Other Anthropogenic Habitat Alterations Escherichia coli	L NA NA NA Urbanized High Density Area Collection System Failure
TN06010201 097_1000	SECOND CREEK	Knox	12.8 Miles	Other Anthropogenic Habitat Alterations Nitrate+Nitrite Sediment/Siltation Escherichia coli	NA L NA NA Urbanized High Density Area Collection System Failure
TN06010201 1330_1000	SINKING CREEK	Knox	4.1 Miles	Escherichia coli	NA Urbanized High Density Area
TN06010201 1334_0100	TEN MILE CREEK	Knox	12.74 Miles	Alteration in Stream-Side or Littoral Vegetative Covers Sediment/Siltation Escherichia coli	L L NA Urbanized High Density Area
TN06010201 340_1000	TURKEY CREEK	Knox	15.8 Miles	Sediment/Siltation Escherichia coli	NA NA Urbanized High Density Area
TN06010201 697_1000	FOURTH CREEK	Knox	14.9 Miles	Physical Substrate Habitat Alterations Escherichia coli	NA NA Urbanized High Density Area Channelization

Table 2A

City of Knoxville Waters with Unavailable Parameters

Waterbody ID	Impacted Waterbody	County	Miles/Acres Impaired	CAUSE / TMDL Priority	Pollutant Source
TN06010201 719_1000	WILLIAMS CREEK	Knox	2.8 Miles	Nitrate+Nitrite Other Anthropogenic Habitat Alterations Escherichia coli	L NA NA Urbanized High Density Area Collection System Failure
TN06010201 721_1000	BAKER CREEK	Knox	3.3 Miles	Nitrate+Nitrite Other Anthropogenic Habitat Alterations Escherichia coli	L NA NA Urbanized High Density Area Collection System Failure
TN06010201 723_1000	GOOSE CREEK	Knox	4.9 Miles	Sediment/Siltation Other Anthropogenic Habitat Alterations PCBs Escherichia coli	NA NA L NA Collection System Failure Urbanized High Density Area RCRA Hazardous Waste
TN06010207 011_0600	KNOB FORK	Knox	8.1 Miles	Nitrate+Nitrite Sediment/Siltation Other Anthropogenic Substrate Alterations Alteration in Stream-Side or Littoral Vegetative Cover Escherichia coli	L NA L L NA Urbanized High Density Area
TN06010207 011_0700	GRASSY CREEK	Knox	8.2 Miles	Sediment/Siltation Escherichia coli Alteration in Stream-Side or Littoral	NA NA L Urbanized High Density Area
TN06010207 011_2000	BEAVER CREEK	Knox	13.7 Miles	Escherichia coli Sediment/Siltation Physical Substrate Habitat Alteration in Stream-Side or littoral	NA NA L L Pasture Grazing Urbanized High Density Area Collection System Failure

Notes:

L - Low Priority

M - Medium Priority

H - High Priority

NA - Not Applicable

Table 2D

City of Knoxville SWMP

SCHEDULE FOR MAINTENANCE AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM OF STRUCTURAL AND SOURCE CONTROLS FOR REDUCING POLLUTANTS TO THE MUNICIPAL SEPARATE STORM SEWER SYSTEM

122.26 (d)(2)(iv)(A)

The Residential and Commercial Program (RC)

Code	Activity	Schedule
	<u><i>Maintenance Activities for Structural Controls</i></u>	
RC-1	-Continue existing maintenance programs from Part 2 application, pp.5-5 thru 5-8.	Ongoing
	-Develop improved stream restoration and channel maintenance program.	12 Months
	-Implement improved stream restoration and channel maintenance program.	24 Months
	-Require Standard Maintenance Agreement for on-site facilities.	Ongoing
	-Continue to coordinate with other agencies/organizations to develop, install, and maintain structural controls that prevent floating pollution (litter/oils/foam/etc) from entering the TN River	Ongoing
	-Require routine / major maintenance of BMP facilities.	Ongoing
	<u><i>Planning for New Development</i></u>	
RC-2	-Review original Stormwater & Streets Ordinance to evaluate possible improvements to existing water quality and quantity requirements for new development.	Immediately
	-Require "No Dumping" message cast into all curb irons and solid stormwater catch basin covers installed on new developments.	Immediately
	-Plan and site location for regional BMP facilities for area of new development.	Ongoing
	-Continue to review, update, and maintain guidance criteria for BMP's on City web page (http://www.ci.knoxville.tn.us/engineering/)	Ongoing
	<u><i>Maintenance for Public Streets, Roads, and Highways</i></u>	
RC-3	-Continue street maintenance activities outlined in Part 2 application, p.5-8	Ongoing
	-Evaluate current deicing program and study alternatives and improvements.	Ongoing
	<u><i>Evaluation of Flood Management Projects</i></u>	
RC-4	-Continue to evaluate regional BMP facilities for water quality retrofits.	Ongoing
	-Maintain existing GIS inventory of on-site BMP facilities, including newly constructed facilities.	Ongoing
	<u><i>Monitoring of Solid Waste Facilities</i></u>	
RC-5	-See City's management program for industrial areas.	See Code IN-3
	<u><i>Management of Pesticides, Herbicides, and Fertilizer</i></u>	
RC-6	- Evaluate possible improvements to existing public education program as part of illicit connection and improper disposal program. Educate City staff, public, etc.	12 Months
	- Reevaluate effect of fertilizers as part of the City's ongoing monitoring program.	60 Months
	<u><i>Annual Reporting</i></u>	
RC-7	- Annual reporting to TDEC concerning the progress of this program.	Within 6 months after the end of each year.

Table 2D

City of Knoxville SWMP

**SCHEDULE FOR MAINTENANCE AND IMPLEMENTATION OF
SWMP ELEMENTS AND PROGRAMS**

PROGRAM TO DETECT AND REMOVE ILLICIT AND
IMPROPER DISCHARGES TO THE MUNICIPAL STORM SEWER SYSTEM
122.26 (d)(2)(iv)(B)

The Illicit Discharges and Improper Disposal Program (ILL)

Code	Activity	Schedule
ILL-1	<u>Ordinances</u>	
	-Evaluate the prohibitions and exemptions of non-stormwater discharges in the original Stormwater & Streets Ordinance. Maintain authority for \$5000 penalty.	Immediately
	-Implement any new revisions to the Stormwater & Streets Ordinance.	6 Months
ILL-2	<u>Field Screening</u>	
	-Perform follow-up analysis at all high risk screening sites.	Ongoing
	-Investigate 150 field sites four times per year . (Including the repeat high parameter sites above.)	Ongoing
ILL-3	<u>Investigation of Storm Drain System</u>	
	- Implement procedures for mapping, field surveys and upstream source identification.	Ongoing
	-Evaluate and update enforcement procedures, policies, monitoring and inspections.	Ongoing
ILL-4	<u>Spill Response Program</u>	
	- Coordinate with Knoxville Emergency Response Team (KERT) and Tennessee Department of Environment and Conservation (TDEC).	Ongoing
ILL-5	<u>Reporting of Illicit Discharges and Public Education Program</u>	
	- Continue to maintain and monitor the "Water Quality Hotline" for public reporting.	Ongoing
	- Maintain public education program.	Ongoing
ILL-6	<u>Used Oil & Toxic Materials Program</u>	
	- Continue coordination of recycling program (managed by Solid Waste Division (SWD)).	Ongoing
	- Maintain and Operate household hazardous waste facility (managed by SWD).	Ongoing
ILL-7	<u>Annual Reporting</u>	
	- Annual reporting to TDEC concerning the progress of this program.	Within 6 months after the end of each year.

Table 2D

City of Knoxville SWMP

SCHEDULE FOR MAINTENANCE AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM TO MONITOR AND CONTROL RUNOFF FROM TSD AND INDUSTRIAL FACILITIES SUBJECT TO SARA III, SECTION 313 122.26(d)(2)(iv)(C)

The Industrial and Related Facilities Program (IN)

Code	Activity	Schedule
<u>Ordinances</u>		
IN-1	<ul style="list-style-type: none"> - Evaluate possible revisions to the prohibitions and exemptions of non-stormwater discharges in the existing Stormwater & Streets Ordinance - Implement any new revisions to the Stormwater & Streets Ordinance. 	Immediately
		6 Months
<u>Inspection Element</u>		
IN-2	<ul style="list-style-type: none"> - Develop inspection program for non-permitted commercial facilities (i.e. restaurants, services stations, grocery stores, car lots, etc.) - Collect and analyze NOI's from Industrial Permit applicants. - Identify potential industrial discharges through Illicit Connection and Improper Disposal Program. (Both SW and non-SW discharges) - Review and update inspection program as part of Pollution Prevention Plans for Municipal Industrial Facilities. Conduct annual inspections at municipal industrial facilities. 	12 Months
		Ongoing
		Ongoing
		12 Months
<u>Monitoring Element</u>		
IN-3	<ul style="list-style-type: none"> - Collect monitoring data from industrial stormwater dischargers and/or from TDEC. Assess impacts to storm sewer system. - Develop an ongoing monitoring program at non-permitted commercial facilities using guidelines pursuant to 40 CFR 122.26(d)(2)(iv)(c)(2). Identify industrial pollutants & sources as applicable. - Implement the ongoing monitoring program at non-permitted commercial facilities and analyze the results from ongoing commercial monitoring program. - Maintain adequate legal authority to require monitoring and reports from TSDs and Industrial facilities subject to SARA Title III, Section 313. Request monitoring reports as necessary. - Evaluate and update the monitoring program for Municipal Industrial Facilities (MIFs) in each annual report. - Manage and conduct monitoring program at Municipal Industrial Facilities. 	Ongoing
		12 Months
		Begin after 12 Months
		Ongoing
		Annually
		12 Months
<u>Annual Reporting</u>		
IN-4	<ul style="list-style-type: none"> - Annual reporting to TDEC concerning the progress of this program. 	Within 6 months after the end of each year

Table 2D

City of Knoxville SWMP

SCHEDULE FOR MAINTENANCE AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM TO IMPLEMENT AND MAINTAIN BMP PLANS TO REDUCE CONSTRUCTION SITE RUNOFF TO THE MUNICIPAL STORM SEWER 122.26(d)(2)(iv)(D)

The Construction Site Runoff Program (CS)

Code	Activity	Schedule
<u>Site Planning</u>		
CS-1	<ul style="list-style-type: none"> - Review and update the original Stormwater & Streets Ordinance which requires construction sites greater than 10,000 sq.ft. to submit Erosion & Sediment (E&S) control plans. - Require site plans submittals per the City of Knoxville BMP manual. - Review & update minimum criteria for plan review and inspection checklist. - Continue Preconstruction Assistance Meetings with developer/contractors. 	Immediately
		Immediately
		Immediately
		Immediately
<u>BMP Requirements</u>		
CS-2	<ul style="list-style-type: none"> - Require Construction BMP's from the City of Knoxville BMP manual or equivalent. - Evaluate additional BMP requirements and design modifications. Maintain the updated BMP requirements on the City's web page. - Continue to require construction site "good housekeeping" practices. 	Immediately
		2nd half of each year
		Immediately
<u>Inspection / Enforcement</u>		
CS-3	<ul style="list-style-type: none"> - Continue expanded inspections to include smaller construction sites (single family); where feasible. - Implement routine site inspections on commercial and subdivision developments (e.g. rough grading, E&S control installation, final grading, and final stabilization). - Continue to require post-construction Development Certifications from licensed professional Engineers, and/or the appropriate design professional before bond release to insure the stormwater facilities were built as planned. - Maintain enforcement procedures, policies, and follow-up monitoring/inspections. 	Ongoing
		Ongoing
		Ongoing
		Ongoing
<u>Training Programs</u>		
CS-4	<ul style="list-style-type: none"> - Co-sponsor E & S Control Practice Seminars for all participants. - Continue to provide training for City plan review staff and inspectors. 	Annually
		Annually
<u>Annual Reporting</u>		
CS-5	<ul style="list-style-type: none"> - Annual reporting to TDEC concerning the progress of this program. 	Within 6 months after the end of each year

Table 2D

City of Knoxville SWMP

SCHEDULE FOR MAINTENANCE AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

**PROGRAM TO COLLECT QUANTITATIVE DATA TO DETERMINE THE IMPACTS OF URBAN STORMWATER ON THE NATURAL ENVIRONMENT
122.26(d)(2)(iii)(A)**

The Comprehensive Monitoring Program (MN)

Code	Activity	Schedule
<u>Seasonal Storm Event Monitoring</u>		
MN-1	<ul style="list-style-type: none"> - Maintain the Standard Operating Procedures (SOP) for the seasonal sampling program. - Maintain at least five (5) automatic monitoring stations at locations approved by TDEC. - Collect and analyze a minimum of twenty (20) flow weighted composite samples as listed below in accordance with 40 CFR 136 for all parameters except pH, which will be determined in the field at the time of sample collection. Parameters include: BOD5, COD5, suspended residue, dissolved residue, nitrate + nitrite N, ammonia, total kjeldahl N, total organic N, total phosphate, lead, zinc, and ph (field). - Collect and analyze five (5) wet weather bacteria samples (fecal coliform and <i>E.coli</i>). - Collect and analyze five (5) full-suite grab samples of: oil & grease, the pollutants listed in Tables II & III of 40 CFR Part 122 Appendix D (Volatiles, Pesticides, Acids, Base/Neutrals, Toxic Metals, Cyanide, and Total Phenols). 	Annually
		Ongoing
		Minimum of one per quarter per station annually.
		One sample/year/station
		One station per year.
<u>Dry Weather Screening & Industrial/Commercial Site Monitoring</u>		
MN-2	<ul style="list-style-type: none"> - Dry weather screening as described in ILL-2. - Implement Commercial/Industrial Monitoring Programs as described in IN-3. 	Annually
		Varies
<u>Ambient & Biological Monitoring</u>		
MN-3	<ul style="list-style-type: none"> - Continue Ambient sampling program at the five designated monitoring stations. All routine parameters shall be tested once per quarter per station. - Maintain the Biological Monitoring program that supplements the program administered by TVA. This program focuses on habitat assessments, bioassessments, etc. 	Quarterly
		Ongoing
<u>Training Programs</u>		
MN-4	<ul style="list-style-type: none"> - Maintain the Training Program for Staff and/or Volunteers. 	Ongoing
<u>Annual Reporting</u>		
MN-5	<ul style="list-style-type: none"> - Annual reporting to TDEC concerning the progress of this program. 	Within 6 months after the end of each year

Table 2E
City of Knoxville SWMP

**SCHEDULE FOR MAINTENANCE AND
IMPLEMENTATION OF SWMP ELEMENTS AND
PROGRAMS**

**PROGRAM TO COLLECT QUANTITATIVE DATA TO DERMINE THE IMPACTS
OF U RBAN STORMWATER ON THE NATURAL ENVIRONMENT
122.26(D)(2)(iii)(A)**

The Comprehensive Monitoring Program (MN)

Code	Activity	Schedule
	<u>Ambient and Wet Weather Monitoring</u>	
MN-1	Revise and maintain the Standard Operating Procedures (SOP) for the sampling program.	Annually
	Maintain at least five automatic monitoring stations to collect rainfall data, including at creek flow/depth measurements.	Ongoing
	Select "designated" creek/watersheds for in depth watershed monitoring. Watersheds will be rotated annually.	Annually
	Analyze samples with a hand held sonde (Hydrolab HL4 and HL7) within designated watershed for parameters including pH, temperature, dissolved oxygen, specific conductivity, raw conductivity, TDS, density, salinity, turbidity, ammonium, nitrate, total ammonia, ammonia, and chloride. A minimum of four (4) strategically located sampling locations selected along the designated creek segment. Sample collection will be targeted the same week of the given month and year.	Monthly
	Collect and analyze a bacteria samples (total coliform and E.coli) within designated watershed. One sample per designated sampling location per sampling event.	Monthly
	Creek and Hot Spot sampling and monitoring locations to be identified and investigated as determined necessary for point source pollutants.	Ongoing
	Collect and analyze full suite grab samples of: oil and grease, volatiles, pesticides, acids, base/neutrals, toxic metals, cyanide, and total phenols.	One Creek Annually
	<u>Dry Weather Screening & Industrial/Commercial Site Monitoring</u>	
MN-2	Dry weather screening as described in ILL-2	Annually
	Implement Commercial/Industrial Monitoring Program as described in IN-3.	Varies
	<u>Biological Monitoring</u>	
MN-3	Creek walk and stream surveys will be completed for the designated creek.	Annually
	Biological sampling and habitat assessment will be performed for designated stream. Identifications to be made by City staff. Macroinvertebrate sampling will occur monthly in combination with sonde/bacteria sampling at and/or near monitoring locations, spring thru fall. No sampling in winter.	Seasonally
	<u>Training Program & Analysis</u>	
MN-4	Maintain the Training Program for Staff and/or Volunteers.	Ongoing
	<u>Annual Reporting</u>	
MN-5	Annual reporting to TDEC concerning the progress of this program.	Annually

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
00-100-0236														
21/22	08/30/2021 10:25	1	Yes	5gpm +	7.5	0	0	0	0	0	Clear	No	No	No
21/22	08/30/2021 14:30	2	Yes	5gpm +	7.5	0	0	0	0	0	Clear	No	No	No
21/22	05/20/2022 10:30	3	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	05/20/2022 14:35	4	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
01-100-0230														
21/22	09/13/2021 10:10	1	No											
21/22	09/13/2021 14:25	2	No											
21/22	03/03/2022 09:50	3	Yes	15gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 13:50	4	Yes	15gpm	7.5	0	0	0	0	0	Clear	No	No	No
01-100-0550														
21/22	09/14/2021 10:00	1	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	09/14/2021 14:05	2	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 09:20	3	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 13:20	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
01-100-0830														
21/22	08/05/2021 11:30	1	Yes	5gpm	7.0	0.1	0	0	0	0	Clear	No	No	No
21/22	08/06/2021 08:15	2	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 11:10	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 15:10	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
01-200-0400														
21/22	09/13/2021 11:00	1	Yes	10gpm +	7.5	0	0	0	0	0	Clear	No	No	No
21/22	09/13/2021 15:10	2	Yes	10gpm +	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/17/2022 09:30	3	Yes	10gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/17/2022 13:30	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
01-200-0695														
21/22	09/14/2021 11:00	1	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	09/14/2021 15:10	2	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	02/16/2022 10:30	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/16/2022 14:30	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
01-200-0715														
21/22	09/15/2021 08:30	1	Yes	2gpm	7	1.5	0	0	0	0	Clear	Yes	No	No
21/22	09/15/2021 13:30	2	Yes	2gpm	7	1.5	0	0	0	0	Clear	No	No	No
21/22	02/16/2022 09:45	3	No											
21/22	02/16/2022 14:05	4	No											
01-300-0200														
21/22	09/13/2021 09:55	1	Yes	3gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	09/13/2021 14:10	2	Yes	3gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 10:25	3	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	03/03/2022 14:25	4	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
01-300-0395														
21/22	09/13/2021 10:30	1	Yes	2gpm	7	0	0	0	0	0	Clear	No	No	No
21/22	09/13/2021 14:40	2	Yes	2gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/17/2022 09:55	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/17/2022 14:00	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
01-400-0470														
21/22	08/12/2021 11:00	1	Yes	.5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	08/12/2021 15:00	2	Yes	.5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/17/2022 09:15	3	No											
21/22	02/17/2022 13:15	4	No											
01-400-0745														
21/22	09/15/2021 09:25	1	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	09/15/2021 13:45	2	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/16/2022 09:30	3	No											
21/22	02/16/2022 13:50	4	No											
01-400-0770														
21/22	09/15/2021 10:00	1	No											
21/22	09/15/2021 14:15	2	No											
21/22	02/16/2022 09:00	3	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	02/16/2022 13:30	4	Yes	10gpm	7.5	0	0	0	0	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
01-400-0812														
21/22	09/15/2021 10:50	1	Yes	5gpm	8	0	0	0	<.25	0	Clear	No	No	No
21/22	09/15/2021 15:00	2	Yes	5gpm	7.5	0	0	0	<.25	0	Clear	No	No	No
21/22	02/15/2022 10:05	3	Yes	10gpm	7.0	0	0	0	.25	0	Clear	No	No	No
21/22	02/15/2022 14:10	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
01-400-0820														
21/22	08/11/2021 11:30	1	Yes	15gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	08/11/2021 15:30	2	Yes	15gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/15/2022 09:45	3	Yes	15gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/15/2022 14:05	4	Yes	15gpm	7.0	0	0	0	0	0	Clear	No	No	No
01-500-0710														
21/22	09/15/2021 08:15	1	No											
21/22	09/15/2021 13:15	2	No											
21/22	02/16/2022 10:00	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/16/2022 14:15	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
02-100-0480														
21/22	09/17/2021 09:25	1	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	09/17/2021 14:30	2	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	03/21/2022 10:15	3	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	03/21/2022 14:20	4	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
02-300-0230														
21/22	12/02/2021 10:30	1	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	12/02/2021 14:40	2	Yes	10gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	03/22/2022 09:15	3	Yes	10gpm	7.0	0.5	0	0	0	0	Clear	No	No	No
21/22	03/22/2022 13:20	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
02-400-0290														
21/22	09/27/2021 10:20	1	Yes	3gpm	9	0	0	0	0.25	0	Clear	No	No	No
21/22	09/27/2021 14:40	2	Yes	3gpm	9	0	0	0	0.25	0	Clear	No	No	No
21/22	03/21/2022 11:25	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	03/21/2022 15:35	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
03-100-0114														
21/22	08/13/2021 08:50	1	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	08/13/2021 13:30	2	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	04/21/2022 10:30	3	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	04/22/2022 09:30	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
03-200-0409														
21/22	09/17/2021 11:00	1	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	09/17/2021 15:00	2	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	04/21/2022 10:00	3	Yes	2gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	04/22/2022 09:20	4	Yes	2gpm	7.0	0	0	0	0	0	Clear	No	No	No
03-200-0436														
21/22	09/27/2021 09:15	1	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	09/27/2021 13:15	2	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	04/21/2022 09:40	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	04/22/2022 09:00	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
03-200-0990														
21/22	09/28/2021 10:15	1	Yes	5gpm	7.5	0	0	0	<.25	0	Clear	No	No	No
21/22	09/28/2021 14:15	2	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	03/22/2022 10:00	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	03/22/2022 14:00	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
03-300-0660														
21/22	08/13/2021 10:20	1	Yes	2gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	08/13/2021 14:50	2	Yes	2gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	04/21/2022 09:20	3	Yes	2gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	04/22/2022 08:45	4	Yes	2gpm	7.5	0	0	0	0	0	Clear	No	No	No
03-300-0675														
21/22	08/13/2021 10:35	1	Yes	.1gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	08/13/2021 15:00	2	Yes	.1gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	03/28/2022 11:05	3	Yes	1gpm	7.0	0	0	0	0	0	Clear	Yes	No	Yes
21/22	03/28/2022 15:10	4	Yes	2gpm	7.0	0	0	0	0	0	Clear	Yes	No	Yes

Table 4E

Dry Weather Screening Outfalls with Flow

July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
04-200-0270														
21/22	09/30/2021 11:10	1	Yes	20gpm +	8	0	0	0	0	0	Clear	No	No	No
21/22	09/30/2021 15:10	2	Yes	20gpm +	9	0	0	0	0	0	Clear	No	No	No
21/22	04/22/2022 10:30	3	Yes	15gpm +	7.5	0	0	0	0	0	Clear	No	No	No
21/22	04/22/2022 14:30	4	Yes	15gpm +	7.5	0	0	0	0	0	Clear	No	No	No
04-300-0337														
21/22	09/30/2021 09:05	1	Yes	2gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	09/30/2021 13:40	2	Yes	2gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	04/25/2022 09:20	3	Yes	1gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	04/25/2022 13:30	4	Yes	1gpm	7.0	0	0	0	0	0	Clear	No	No	No
04-300-0345														
21/22	09/28/2021 11:10	1	Yes	10gpm +	7	2ppm	0	0	0	0	Clear	No	No	No
21/22	09/28/2021 15:10	2	Yes	10gpm +	7	2ppm	0	0	0	0	Clear	No	No	No
21/22	04/25/2022 10:00	3	Yes	5gpm	7.0	0.5	0	0	0	0	Clear	No	No	No
21/22	04/25/2022 14:00	4	Yes	5gpm	7.0	0.5	0	0	0	0	Clear	No	No	No
04-300-0359														
21/22	09/28/2021 10:50	1	No											
21/22	09/28/2021 14:50	2	No											
21/22	04/22/2022 09:50	3	Yes	8gpm	7.5	0	0	0	0	0.25	Clear	No	No	No
21/22	04/22/2022 14:00	4	Yes	8gpm	7.5	0	0	0	0	0	Clear	No	No	No
04-500-0160														
21/22	10/01/2021 10:10	1	Yes	<1gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	10/01/2021 14:10	2	Yes	<1gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	04/25/2022 10:35	3	No											
21/22	04/25/2022 14:40	4	No											
05-300-0035														
21/22	09/13/2021 11:30	1	Yes	3gpm	9	0	0	0	0.25	0	Clear	No	No	No
21/22	09/13/2021 15:30	2	Yes	3gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	01/25/2022 10:20	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/25/2022 14:20	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
06-100-0133														
21/22	09/08/2021 09:25	1	No											
21/22	09/08/2021 13:50	2	No											
21/22	01/14/2022 09:45	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/14/2022 13:50	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
06-100-0200														
21/22	09/08/2021 09:00	1	No											
21/22	09/08/2021 13:25	2	No											
21/22	01/14/2022 09:20	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/14/2022 13:20	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
06-400-0080														
21/22	09/08/2021 10:30	1	Yes	Low Flow	7.0	0	0	0	0	0	Clear	No	No	No
21/22	09/08/2021 15:00	2	Yes	Low Flow	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/13/2022 11:00	3	Yes	Low Flow	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/13/2022 15:20	4	Yes	Low Flow	7.0	0	0	0	0	0	Clear	No	No	No
07-100-0055														
21/22	10/20/2021 11:15	1	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	10/20/2021 15:15	2	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	02/11/2022 09:00	3	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/11/2022 13:00	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
07-100-0130														
21/22	10/20/2021 10:40	1	Yes	Low Flow	7.0	0.4	0	0	0	0	Clear	No	No	No
21/22	10/20/2021 14:45	2	Yes	Low Flow	7.0	0.4	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 11:35	3	Yes	3gpm	7.0	0.5	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 15:40	4	Yes	3gpm	7.0	0.5	0	0	0	0	Clear	No	No	No
07-200-0015														
21/22	10/20/2021 11:25	1	Yes	Low Flow	7.5	0	0	0	0	0	Clear	No	No	No
21/22	10/20/2021 15:25	2	Yes	Low Flow	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 11:50	3	Yes	Low Flow	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 15:50	4	Yes	Low Flow	7.0	0	0	0	0	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
10-200-0455														
21/22	10/12/2021 09:00	1	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	10/12/2021 13:20	2	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	05/11/2022 10:45	3	Yes	8gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	05/11/2022 15:00	4	Yes	8gpm	8.5	0	0	0	0	0	Clear	No	No	No
11-200-0600														
21/22	09/29/2021 09:50	1	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	09/30/2021 08:30	2	Yes	5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	01/26/2022 11:40	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/26/2022 15:45	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
12-100-0748														
21/22	09/13/2021 12:45	1	Yes	Drip	9	0.2	0	0	T	T	Clear	No	No	No
21/22	09/14/2021 08:15	2	Yes	Drip	8	T	0	0	T	T	Clear	No	No	No
21/22	06/14/2022 10:35	3	Yes	Drip	8.5	0	0	0	0	0	Foggy	No	No	No
21/22	06/14/2022 14:35	4	Yes	Drip	9	0	0	0	0	0	Foggy	No	No	No
12-200-0716														
21/22	10/01/2021 10:50	1	Yes	10gpm	8	0	0	0	0	.2	Clear	Yes	Yes	Yes
21/22	10/01/2021 15:00	2	Yes	10gpm	8.5	0	0	0	0	.1	Clear	Yes	Yes	Yes
21/22	06/14/2022 11:25	3	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	06/14/2022 15:30	4	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
12-200-0745														
21/22	10/01/2021 09:10	1	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	10/01/2021 13:30	2	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	06/14/2022 11:15	3	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	06/14/2022 15:15	4	Yes	3gpm	9	0	0	0	0	0	Clear	No	No	No
12-300-0749														
21/22	09/13/2021 12:05	1	Yes	5gpm at riffle	8.5	T	0	0	T	T	Slightly Milky	No	Yes	No
21/22	09/14/2021 08:25	2	Yes	5gpm at riffle	8.5	0	0	0	0.25	0	Slightly Milky	No	Yes	No
21/22	06/14/2022 10:40	3	Yes	5gpm at riffle	8.5	0	0	0	0	0	Foggy	No	No	No
21/22	06/14/2022 14:40	4	Yes	5gpm at riffle	8.5	0	0	0	0	0	Foggy	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
12-300-0753														
21/22	09/13/2021 12:30	1	Yes	2gpm +	8.5	0.1	0	0	0	0.25	Clear	No	No	Yes
21/22	09/14/2021 08:20	2	Yes	2gpm +	8.5	0.1	0	0	0	T	Clear	No	No	Yes
21/22	06/14/2022 10:30	3	Yes	3gpm	9	0	0	0	0	0	Clear	No	No	No
21/22	06/14/2022 14:30	4	Yes	3gpm	9	0	0	0	0	0	Clear	No	No	No
13-200-0255														
21/22	08/11/2021 11:10	1	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	08/11/2021 15:10	2	Yes	5gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	05/13/2022 10:50	3	Yes	5gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	05/13/2022 14:50	4	Yes	5gpm	8.5	0	0	0	0	0	Clear	No	No	No
13-200-0340														
21/22	10/13/2021 09:15	1	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	10/13/2021 13:30	2	Yes	3gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	05/13/2022 09:15	3	No											
21/22	05/13/2022 13:20	4	No											
13-300-0140														
21/22	10/14/2021 10:45	1	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	10/14/2021 14:55	2	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	05/18/2022 11:00	3	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	05/18/2022 15:00	4	Yes	10gpm	8	0	0	0	0	0	Clear	No	No	No
13-300-0150														
21/22	08/11/2021 10:40	1	Yes	.5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	08/11/2021 14:40	2	Yes	.5gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	05/18/2022 10:15	3	Yes	Low Flow	9	0	0	0	0	0.5	Clear	No	No	No
21/22	05/18/2022 14:15	4	Yes	Low Flow	8.5	0	0	0	0	0.5	Clear	No	No	No
13-300-0184														
21/22	08/10/2021 10:30	1	Yes	5gpm	7.5	.3	0	0	0	0	Clear	No	No	No
21/22	08/10/2021 14:30	2	Yes	5gpm	7.5	.3	0	0	0	0	Clear	No	No	No
21/22	05/18/2022 09:30	3	Yes	5gpm	7.0	0.5	0	0	.25	0	Clear	No	No	No
21/22	05/18/2022 13:45	4	Yes	5gpm	7.0	0.5	0	0	.25	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
13-300-0228														
21/22	08/11/2021 09:35	1	Yes	5gpm	7.5	1	0	0	2	0	Clear	No	No	No
21/22	08/11/2021 14:00	2	Yes	5gpm	7.0	0	0	0	2	0	Clear	No	No	No
21/22	05/18/2022 08:45	3	Yes	2gpm	7.0	0	0	0	.25	0.25	Clear	No	No	No
21/22	05/18/2022 13:00	4	Yes	2gpm	7.0	0	0	0	.25	0	Clear	No	No	No
13-300-0305														
21/22	10/13/2021 10:30	1	No											
21/22	10/13/2021 14:40	2	No											
21/22	05/13/2022 09:35	3	Yes	15gpm	8.5	0	0	0	.25	0.25	Muddy	No	No	No
21/22	05/13/2022 13:40	4	Yes	15gpm	8.5	0	0	0	.25	0.25	Muddy	No	No	No
31-100-0500														
21/22	09/13/2021 09:45	1	Yes	10gpm	9	0	0	0	0	0	Clear	No	No	No
21/22	09/13/2021 14:00	2	Yes	10gpm	8.5	0	0	0	0	0	Clear	No	No	No
21/22	01/26/2022 10:30	3	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/26/2022 14:30	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
31-500-0510														
21/22	09/13/2021 10:45	1	Yes	5gpm	9	0	0	0	.25	.25	Clear	No	No	No
21/22	09/13/2021 14:45	2	Yes	5gpm	8.5	0	0	0	0	.25	Clear	No	No	No
21/22	01/26/2022 09:50	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/26/2022 14:00	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
53-100-0075														
21/22	11/09/2021 10:55	1	Yes	8gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	11/09/2021 15:00	2	Yes	8gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 11:05	3	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 15:05	4	Yes	10gpm	7.0	0	0	0	0	0	Clear	No	No	No
53-100-0085														
21/22	11/09/2021 10:30	1	Yes	3gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	11/09/2021 14:30	2	Yes	3gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 10:45	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/09/2022 14:50	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No

Table 4E

Dry Weather Screening Outfalls with Flow
July 1, 2021 through June 30, 2022

Outfall/Permit Year	Visit Date	Visit #	Flow Yes/No	Flow Rate	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Color	Odor Yes/No	Surface Scum Yes/No	Oil Sheen Yes/No
53-100-0128														
21/22	08/12/2021 08:50	1	Yes	15gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	08/12/2021 13:10	2	Yes	15gpm	7.0	0	0	0	0	.1	Clear	No	No	No
21/22	02/08/2022 11:45	3	Yes	15gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/08/2022 15:45	4	Yes	15gpm	7.0	0	0	0	0	0	Clear	No	No	No
53-200-0170														
21/22	11/08/2021 09:20	1	No											
21/22	11/08/2021 13:40	2	No											
21/22	02/08/2022 11:00	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/08/2022 15:00	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
53-200-0240														
21/22	11/03/2021 10:20	1	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	11/03/2021 14:35	2	Yes	3gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	02/08/2022 10:00	3	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/08/2022 14:00	4	Yes	5gpm	7.0	0	0	0	0	0	Clear	No	No	No
53-500-0185														
21/22	08/12/2021 09:10	1	Yes	2gpm	7.5	0	0	0	0	0	Clear	No	No	No
21/22	08/12/2021 13:35	2	Yes	2gpm	8	0	0	0	0	0	Clear	No	No	No
21/22	02/08/2022 10:35	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	02/08/2022 14:40	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
79-500-0339														
21/22	10/15/2021 09:30	1	No											
21/22	10/15/2021 13:45	2	No											
21/22	01/28/2022 09:55	3	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No
21/22	01/28/2022 14:00	4	Yes	3gpm	7.0	0	0	0	0	0	Clear	No	No	No

Notes:

gpm - gallons per minute

su - standard unit

ppm - parts per million

mpn - most probable number

ml - mililiter

Table 10A.1a

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Avenue A																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	67.2	8.20	0.48	430.1	87.8	7.8	0.307	998.482	0.230	3.829	0.09571	1.0387	0.100	12.5570	0.000
	8/25/21	8/22/21	WET	66.9	8.06	0.51	453.1	88.4	7.9	0.325	998.528	0.250	4.198	0.10000	1.0988	0.100	13.0766	0.000
	9/29/21	9/22/21	DRY	61.9	8.21	0.49	412.1	88.1	8.4	0.314	999.038	0.240	13.507	0.10000	1.3944	0.106	12.4050	0.000
Average:				65.3	8.16	0.49	431.8	Ave	8.1	0.315	998.683	0.240	7.178	0.09857	1.1773	0.102	12.6795	ND
Q2	10/27/21	10/25/21	WET	53.4	8.06	0.49	373.0	84.8	8.9	0.316	999.710	0.240	4.207	0.07000	2.2900	0.070	16.7652	0.000
	11/23/21	11/22/21	WET	48.0	8.13	0.49	340.4	78.1	8.9	0.311	999.990	0.240	2.202	0.08000	2.3748	0.080	22.2632	0.000
	12/29/21	12/29/21	RAIN	59.3	8.03	0.46	376.2	78.0	7.6	0.296	999.260	0.221	19.647	0.16500	1.7450	0.169	12.4976	0.000
Average:				53.6	8.07	0.48	363.2	80.3	8.5	0.308	999.653	0.234	8.685	0.10500	2.1366	0.106	17.1753	ND
Q3	1/26/22	1/20/22	DRY	49.6	8.17	0.53	377.6	93.4	10.4	0.337	999.931	0.260	3.895	0.08033	3.1355	0.082	684.2862	0.000
	3/23/22	3/23/22	RAIN	60.0	7.67	0.48	396.5	89.1	8.5	0.309	999.200	0.233	20.952	SM	1.5778	SM	28.6749	SM
	4/19/22	4/18/22	WET	53.9	7.80	0.33	250.8	88.2	9.3	0.211	999.614	0.160	28.898	0.12000	1.6746	0.120	16.0746	0.000
Average:				54.5	7.88	0.45	341.7	90.2	9.4	0.286	999.582	0.218	17.915	0.10017	2.1293	0.101	243.0119	ND
Q4	5/4/22	5/1/22	DRY	61.3	7.83	0.46	388.3	89.7	8.6	0.297	999.079	0.230	12.215	0.10000	1.5031	0.100	16.8900	0.000
	5/25/22	5/23/22	WET	62.1	7.83	0.47	394.8	86.7	8.2	0.300	999.010	0.230	15.901	0.11493	1.4496	0.120	24.7897	0.000
	6/22/22	6/14/22	DRY	65.6	7.84	0.46	404.4	95.7	8.7	0.294	998.653	0.220	21.578	0.17486	1.2467	0.180	28.6551	0.000
Average:				63.0	7.83	0.46	395.8	90.7	8.5	0.297	998.914	0.227	16.565	0.12993	1.3998	0.133	23.4450	ND

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1b

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Beaver																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	70.7	8.32	0.48	446.6	85.0	7.3	0.307	998.069	0.230	0.298	0.090	1.040	0.100	16.901	0.010
	8/25/21	8/22/21	WET	70.9	8.30	0.49	460.5	84.1	7.2	0.315	998.054	0.240	3.191	0.131	1.066	0.140	19.288	0.010
	9/29/21	9/22/21	DRY	63.7	8.40	0.48	417.2	84.7	7.9	0.310	998.854	0.240	0.000	0.110	1.313	0.110	21.382	0.010
Average:				68.4	8.34	0.49	441.5	84.6	7.5	0.311	998.325	0.237	1.163	0.110	1.140	0.117	19.190	0.010
Q2	10/27/21	10/25/21	WET	52.6	8.20	0.49	367.7	81.1	8.6	0.315	999.756	0.240	0.000	0.082	2.746	0.090	33.131	0.000
	11/23/21	11/22/21	WET	45.2	8.07	0.47	314.3	74.6	8.8	0.299	1000.080	0.230	0.000	0.111	2.652	0.115	47.701	0.000
	12/29/21	125/29/21	RAIN	60.0	8.17	0.31	250.7	78.2	7.5	0.195	999.138	0.150	82.225	0.182	1.417	0.190	11.833	0.000
Average:				52.6	8.14	0.42	310.9	78.0	8.3	0.270	999.658	0.207	27.408	0.125	2.272	0.132	30.888	ND
Q3	1/26/22	1/20/22	DRY	45.6	8.24	0.50	340.5	107.0	12.6	0.322	1000.081	0.250	0.000	0.091	3.541	0.094	1264.222	0.000
	3/23/22	3/23/22	RAIN	59.9	7.53	0.34	280.0	87.5	8.4	0.218	999.165	0.168	32.307	SM	1.462	SM	35.748	15.311
	4/19/22	4/18/22	WET	53.2	7.60	0.34	255.8	83.5	8.9	0.217	999.661	0.160	14.626	0.170	1.816	0.170	21.446	0.000
Average:				52.9	7.79	0.39	292.1	92.7	10.0	0.252	999.635	0.193	15.644	0.131	2.273	0.132	440.472	5.104
Q4	5/4/22	5/1/22	DRY	63.1	7.80	0.44	371.6	83.9	7.8	0.279	998.898	0.210	3.764	0.128	1.422	0.130	20.493	0.000
	5/25/22	5/23/22	WET	65.0	7.84	0.43	375.1	79.5	7.3	0.275	998.705	0.210	8.401	0.148	0.148	0.148	0.148	0.148
	6/22/22	6/14/22	DRY	68.4	7.95	0.45	413.5	87.5	7.7	0.291	998.330	0.220	29.722	0.202	1.047	0.210	51.621	0.010
Average:				65.5	7.86	0.44	386.7	83.6	7.6	0.282	998.645	0.213	13.962	0.15945	0.8723	0.163	24.0873	0.053

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1c

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Chicken Trib																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET															
	8/25/21	8/22/21	WET															
	9/29/21	9/22/21	DRY															
Average:				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Q2	10/27/21	10/25/21	WET															
	11/23/21	11/22/21	WET															
	12/29/21	125/29/21	RAIN															
Average:				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Q3	1/26/22	1/20/22	DRY															
	3/23/22	3/23/22	RAIN															
	4/19/22	4/18/22	WET															
Average:				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Q4	5/4/22	5/1/22	DRY	62.4	7.83	0.48	403.7	86.6	8.2	0.305	998.983	0.230	3.245	0.10477	1.5926	0.110	17.8328	0.000
	5/25/22	5/23/22	WET	62.4	7.92	0.47	399.4	85.9	8.1	0.302	998.981	0.230	7.800	0.12000	1.4421	0.120	27.4440	0.000
	6/22/22	6/14/22	DRY	68.8	7.58	0.45	407.5	89.5	7.9	0.286	998.290	0.220	10.867	0.16939	1.2383	0.172	41.1045	0.000
Average:				64.5	7.78	0.47	403.5	87.3	8.1	0.298	998.751	0.227	7.304	0.13139	1.4244	0.134	28.7938	ND

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1d

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Mary Vestal Park																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	69.5	8.36	0.53	490.3	84.5	7.4	0.341	998.232	0.260	1.524	0.10000	1.4198	0.110	15.1436	0.010
	8/25/21	8/22/21	WET	69.3	8.34	0.56	513.4	87.1	7.6	0.358	998.274	0.270	0.042	0.15000	1.3002	0.160	24.0080	0.010
	9/29/21	9/22/21	DRY	62.9	8.42	0.53	451.8	87.7	8.2	0.339	998.950	0.260	1.110	0.12678	1.7054	0.130	20.4297	0.010
Average:				67.2	8.37	0.54	485.2	86.4	7.7	0.346	998.485	0.263	0.892	0.12559	1.4751	0.133	19.8604	0.010
Q2	10/27/21	10/25/21	WET	55.3	8.31	0.58	445.6	76.3	7.8	0.368	999.610	0.280	10.688	0.27508	8.5846	0.290	37.4476	0.010
	11/23/21	11/22/21	WET	47.9	8.16	0.49	344.8	78.3	8.9	0.316	999.996	0.240	0.003	0.16721	2.8451	0.170	38.3197	0.000
	12/29/21	125/29/21	RAIN	60.0	8.37	0.32	266.1	83.1	8.0	0.207	999.140	0.160	18.385	0.20000	1.7704	0.203	15.7147	0.010
Average:				54.4	8.28	0.46	352.2	79.2	8.3	0.297	999.582	0.227	9.692	0.21410	4.4000	0.221	30.4940	0.007
Q3	1/26/22	1/20/22	DRY	45.9	8.24	0.55	374.2	94.8	11.1	0.352	1000.090	0.270	0.000	0.13000	4.3548	0.133	2971.8979	0.000
	3/23/22	3/23/22	RAIN	58.3	7.67	0.34	275.6	84.5	8.3	0.219	999.300	0.170	40.065	SM	1.3502	SM	39.0728	14.063
	4/19/22	4/18/22	WET	53.2	7.82	0.40	303.2	87.0	9.2	0.258	999.690	0.200	13.409	0.45756	2.2358	0.465	25.6384	0.010
Average:				52.5	7.91	0.43	317.7	88.7	9.6	0.276	999.693	0.213	17.825	0.29378	2.6469	0.299	1012.2030	4.691
Q4	5/4/22	5/1/22	DRY	62.3	7.85	0.49	410.2	85.7	8.1	0.310	998.990	0.240	2.109	0.17172	1.5620	0.177	22.6702	0.000
	5/25/22	5/23/22	WET	63.9	7.81	0.47	406.7	83.6	7.8	0.302	998.828	0.230	5.506	0.21957	1.5026	0.225	36.3400	0.010
	6/22/22	6/14/22	DRY	66.4	7.95	0.50	445.9	91.3	8.3	0.322	998.584	0.240	3.042	0.22909	1.3718	0.238	74.2102	0.010
Average:				64.2	7.87	0.49	420.9	86.9	8.0	0.311	998.801	0.237	3.552	0.20679	1.4788	0.213	44.4068	0.007

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1e

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Maryville Pike																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	71.5	8.26	0.39	370.7	81.9	7.0	0.252	997.935	0.190	3.926	0.09000	1.0375	0.100	8.9907	0.010
	8/25/21	8/22/21	WET	71.4	8.20	0.39	364.5	78.6	6.7	0.248	997.949	0.188	11.743	0.13000	0.9700	0.132	11.1600	0.010
	9/29/21	9/22/21	DRY	63.3	8.33	0.39	337.4	79.2	7.4	0.252	998.863	0.190	3.337	0.10000	1.3659	0.105	12.1312	0.000
Average:				68.7	8.26	0.39	357.5	79.9	7.0	0.251	998.249	0.189	6.335	0.10667	1.1245	0.112	10.7607	0.007
Q2	10/27/21	10/25/21	WET	53.2	8.14	0.39	293.1	75.5	8.0	0.249	999.680	0.190	0.803	0.08000	2.4408	0.080	18.6255	0.000
	11/23/21	11/22/21	WET	44.9	7.87	0.38	252.6	69.8	8.3	0.241	1000.050	0.180	0.475	0.10966	2.5910	0.110	27.7829	0.000
	12/29/21	125/29/21	RAIN	59.3	8.10	0.26	208.9	71.3	6.9	0.164	999.179	0.123	50.484	0.18356	1.5788	0.190	10.7005	0.000
Average:				52.5	8.03	0.34	251.5	72.2	7.7	0.218	999.636	0.164	17.254	0.12441	2.2036	0.127	19.0363	ND
Q3	1/26/22	1/20/22	DRY	44.3	8.14	0.25	165.5	90.5	10.9	0.159	1000.017	0.120	4.018	0.14078	4.2384	0.145	1049.2230	0.000
	3/23/22	3/23/22	RAIN	58.0	7.44	0.41	324.9	76.8	7.5	0.259	999.344	0.198	40.100	SM	2.0006	SM	45.6025	14.719
	4/19/22	4/18/22	WET	52.8	7.72	0.00	2.6	83.0	8.9	0.002	999.560	0.010	14.276	0.15512	2.6172	0.160	26.4716	0.000
Average:				51.7	7.77	0.22	164.4	83.4	9.1	0.140	999.640	0.110	19.465	0.14795	2.9521	0.152	373.7657	4.906
Q4	5/4/22	5/1/22	DRY	62.7	7.73	0.37	315.8	76.8	7.2	0.238	998.910	0.180	5.206	0.11000	1.7129	0.110	16.0659	0.000
	5/25/22	5/23/22	WET	64.6	7.82	0.13	112.1	76.4	7.0	0.082	998.630	0.060	9.965	0.14000	1.4691	0.140	22.9373	0.000
	6/22/22	6/14/22	DRY	67.5	7.85	0.36	325.9	83.5	7.4	0.232	998.406	0.180	10.916	0.17969	1.1885	0.180	27.5440	0.010
Average:				64.9	7.80	0.29	251.2	78.9	7.2	0.184	998.649	0.140	8.696	0.14323	1.4568	0.143	22.1824	0.003

- ND: Analyte was not detected, or no data available
- #: HL4 parameter only
- *: HL7 parameter only
- Mapped sampling locations available in Appendix A
- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1f

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

South Knox Community Center																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	68.8	8.26	0.53	479.8	83.1	7.3	0.336	998.319	0.256	1.815	0.08000	1.3770	0.080	12.3979	0.000
	8/25/21	8/22/21	WET	69.7	8.23	0.52	482.9	84.7	7.4	0.335	998.203	0.250	0.636	0.11000	1.4840	0.112	17.2588	0.010
	9/29/21	9/22/21	DRY	63.5	8.26	0.51	440.1	82.4	7.7	0.328	998.888	0.250	0.000	0.09963	1.7506	0.100	16.1816	0.000
	Average:				67.3	8.25	0.52	467.6	83.4	7.5	0.333	998.470	0.252	0.817	0.09654	1.5372	0.097	15.2794
Q2	10/27/21	10/25/21	WET	53.0	8.14	0.52	392.6	79.4	8.4	0.335	999.744	0.260	0.000	0.08078	4.1023	0.089	26.0082	0.000
	11/23/21	11/22/21	WET	45.6	8.02	0.51	344.4	75.0	8.8	0.326	1000.085	0.250	0.054	0.10052	2.8731	0.102	31.2197	0.000
	12/29/21	125/29/21	RAIN	61.3	8.36	0.27	221.7	83.7	7.9	0.170	998.998	0.130	23.436	0.12000	1.4348	0.120	11.0248	0.000
	Average:				53.3	8.18	0.43	319.6	79.4	8.4	0.277	999.609	0.213	7.830	0.10043	2.8034	0.104	22.7509
Q3	1/26/22	1/20/22	DRY	46.3	8.29	0.55	373.8	100.3	11.7	0.350	1000.080	0.270	0.000	0.09000	4.4432	0.090	1818.4768	0.000
	3/23/22	3/23/22	RAIN	59.8	7.31	0.37	305.2	86.5	8.3	0.238	999.182	0.180	15.952	SM	1.4075	SM	38.8606	19.225
	4/19/22	4/18/22	WET	52.9	7.82	0.44	331.7	86.8	9.2	0.283	999.720	0.220	11.859	0.21542	2.1806	0.219	26.8244	0.000
	Average:				53.0	7.81	0.45	336.9	91.2	9.8	0.290	999.661	0.223	9.270	0.15271	2.6771	0.155	628.0540
Q4	5/4/22	5/1/22	DRY	62.2	7.82	0.49	412.3	85.6	8.1	0.312	999.010	0.240	2.275	0.12000	1.7594	0.120	22.1277	0.000
	5/25/22	5/23/22	WET	63.8	7.89	0.49	417.9	84.6	7.9	0.311	998.850	0.240	3.422	0.15000	1.6322	0.153	37.7619	0.000
	6/22/22	6/14/22	DRY	67.6	7.92	0.47	425.1	92.7	8.3	0.302	998.431	0.230	3.182	0.18075	1.2615	0.190	63.3103	0.010
	Average:				64.5	7.88	0.48	418.4	87.7	8.1	0.308	998.763	0.237	2.960	0.15025	1.5510	0.154	41.0667

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1g

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

W Blount Ave																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	70.9	8.05	0.67	622.0	62.1	5.3	0.426	998.115	0.326	0.000	0.13214	0.4552	0.140	22.2236	0.000
	8/25/21	8/22/21	WET	72.0	7.97	0.63	596.7	62.2	5.3	0.403	997.963	0.310	0.000	0.19018	0.7500	0.194	24.0512	0.006
	9/29/21	9/22/21	DRY	63.4	7.95	0.65	559.4	63.0	5.9	0.418	998.955	0.320	0.016	0.14000	0.8670	0.140	28.7688	0.000
Average:				68.8	7.99	0.65	592.7	62.4	5.5	0.416	998.344	0.319	0.005	0.15411	0.6907	0.158	25.0145	0.002
Q2	10/27/21	10/25/21	WET	51.3	7.81	0.65	478.9	64.2	6.9	0.418	999.893	0.320	0.354	0.10918	1.8497	0.110	39.8936	0.000
	11/23/21	11/22/21	WET	45.3	7.57	0.59	399.7	52.2	6.2	0.379	1000.122	0.290	0.000	0.14607	1.5118	0.147	44.1816	0.000
	12/29/21	125/29/21	RAIN	60.7	8.15	0.17	144.0	79.2	7.6	0.111	999.021	0.080	21.030	0.16000	0.9840	0.160	7.8432	0.000
Average:				52.4	7.84	0.47	340.9	65.2	6.9	0.303	999.679	0.230	7.128	0.13842	1.4485	0.139	30.6395	ND
Q3	1/26/22	1/20/22	DRY	46.4	8.09	0.34	231.9	88.3	10.3	0.216	999.988	0.160	0.000	0.10000	2.9759	0.100	1712.2195	0.000
	3/23/22	3/23/22	RAIN	60.2	6.95	0.36	294.6	73.6	7.0	0.229	999.139	0.170	19.933	SM	1.1809	SM	46.4586	6.751
	4/19/22	4/18/22	WET	55.8	7.54	0.53	410.1	77.9	8.0	0.337	999.560	0.260	4.131	0.22984	2.5557	0.230	35.0421	0.000
Average:				54.1	7.53	0.41	312.2	79.9	8.4	0.261	999.563	0.197	8.021	0.16492	2.2375	0.165	597.9067	2.250
Q4	5/4/22	5/1/22	DRY	64.1	7.49	0.40	348.7	62.2	5.7	0.258	998.782	0.200	1.542	0.17000	1.2584	0.170	29.0393	0.000
	5/25/22	5/23/22	WET	66.0	7.64	0.53	469.0	69.0	6.3	0.340	998.640	0.260	0.849	0.19000	1.1216	0.190	49.4119	0.000
	6/22/22	6/14/22	DRY	67.2	7.61	0.51	461.5	69.7	6.2	0.330	998.498	0.250	0.463	0.24415	0.6171	0.250	85.1766	0.000
Average:				65.8	7.58	0.48	426.4	66.9	6.1	0.309	998.640	0.237	0.951	0.20138	0.9990	0.203	54.5426	ND

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1h

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Young High Pike																		
	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	Turbidity #	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	NTU	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Q1	7/28/21	7/26/21	WET	67.1	8.21	0.48	429.8	88.4	7.9	0.307	998.486	0.230	0.000	0.10054	1.6195	0.110	17.1030	0.000
	8/25/21	8/22/21	WET	66.4	8.10	0.51	449.4	93.3	8.4	0.324	998.590	0.250	0.000	0.13017	1.3690	0.137	21.6464	0.000
	9/29/21	9/22/21	DRY	63.5	8.20	0.49	421.5	89.9	8.4	0.314	998.880	0.240	0.000	0.12000	1.7998	0.123	18.9010	0.010
Average:				65.7	8.17	0.49	433.6	90.5	8.2	0.315	998.652	0.240	ND	0.11690	1.5961	0.123	19.2168	0.003
Q2	10/27/21	10/25/21	WET	58.0	8.16	0.49	389.5	83.8	8.3	0.311	999.370	0.240	0.000	0.08000	2.6865	0.083	22.4143	0.000
	11/23/21	11/22/21	WET	52.5	8.00	0.50	372.2	77.4	8.3	0.319	999.765	0.242	0.000	0.08000	2.8703	0.080	28.8690	0.000
	12/29/21	125/29/21	RAIN	61.2	8.04	0.33	278.0	81.6	7.8	0.213	999.040	0.160	2.993	0.14083	1.7078	0.149	14.1088	0.000
Average:				57.2	8.07	0.44	346.6	80.9	8.1	0.281	999.392	0.214	0.998	0.10028	2.4216	0.104	21.7974	ND
Q3	1/26/22	1/20/22	DRY	54.9	8.16	0.54	412.8	101.7	10.6	0.343	999.624	0.260	0.000	0.09983	3.3930	0.100	767.8652	0.000
	3/23/22	3/23/22	RAIN	62.5	7.50	0.45	382.4	95.7	8.9	0.289	998.964	0.218	14.623	SM	2.0589	SM	38.6980	17.254
	4/19/22	4/18/22	WET	58.3	7.72	0.48	384.0	86.7	8.6	0.306	999.350	0.230	5.224	0.15000	3.1158	0.151	40.6708	0.000
Average:				58.6	7.79	0.49	393.1	94.7	9.4	0.312	999.313	0.236	6.615	0.12492	2.8559	0.125	282.4113	5.751
Q4	5/4/22	5/1/22	DRY	62.5	7.73	0.49	413.5	87.3	8.2	0.312	998.980	0.240	2.370	0.13014	2.3757	0.135	25.6339	0.000
	5/25/22	5/23/22	WET	63.4	7.80	0.48	413.7	86.6	8.1	0.309	998.880	0.230	2.851	0.14000	2.1530	0.142	38.3637	0.000
	6/22/22	6/14/22	DRY	65.0	7.76	0.48	422.3	92.8	8.5	0.310	998.729	0.239	2.358	0.35119	2.0300	0.360	58.6491	0.010
Average:				63.6	7.76	0.48	416.5	88.9	8.3	0.310	998.863	0.236	2.526	0.20711	2.1862	0.213	40.8822	0.003

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.1i

Water Quality Monitoring Program (HL4 & HL7 Sonde) Analysis Summary - Goose Creek

July 1, 2021 through June 30, 2022

Hot Spots																	
Site	Date	Last Rain	72 Hour Precip**	Temp	pH	Specific Conductivity	Raw Conductivity	DO	DO	TDS	Density kg/m3	Salinity	NH4+ *	NO3- *	NH3 Total *	Cl- mg/L *	NH3 *
Units			in	°F		mS/cm	µS/cm	%SAT	mg/L	g/L	kg/m3	psu	mg/L-N	mg/L-N	mg/L-N	mg/L	mg/L-N
Meads Quarry Cave	3/21/22	3/16/22	DRY	65.2	8.49	0.00	1.4	135.5	12.5	0.001	998.533	0.010	SM	0.1391	782.543	49.3799	76.230
Meads Quarry Swimming Area	3/21/22	3/16/22	DRY	66.4	8.47	0.30	262.2	154.0	14.0	0.189	998.505	0.140	SM	0.1281	676.355	54.4846	65.995
Fuel Spring Upstream	4/21/22	4/10/22	DRY	60.5	7.88	0.38	317.8	103.5	10.1	0.246	999.126	0.190	0.14800	1.9038	0.150	17.9066	0.000
Fuel Spring Source	4/21/22	4/10/22	DRY	63.4	6.94	0.55	470.9	0.6	0.1	0.352	998.916	0.270	0.20973	0.2500	0.210	49.7377	0.000

- ND: Analyte was not detected, or no data available

- #: HL4 parameter only

- *: HL7 parameter only

- Mapped sampling locations available in Appendix A

- **: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.2a

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

Avenue A							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	67.0	8.20	2420.00	3300.0
	8/25/21	8/22/21	Rain	66.0	8.80	*	1455.0
	9/29/21	9/22/21	Dry	62.0	8.20	727.00	620.0
Q2	10/27/21	10/25/21	Rain	53.0	8.00	613.00	540.0
	11/23/21	11/22/21	Rain	48.0	8.10	222.00	311.0
	12/29/21	12/29/21	Wet	59.0	8.00	548.00	600.0
Q3	1/26/22	1/20/22	Dry	49.5	8.10	66.00	82.0
	3/23/22	3/23/22	Wet	60.0	7.80	291.00	500.0
	4/19/22	4/18/22	Wet	54.0	7.80	687.00	940.0
Q4	5/4/22	5/1/22	Rain	61.0	7.80	365.00	n/a
	5/25/22	5/23/22	Rain	62.0	7.70	291.00	n/a
	6/22/22	6/17/22	Dry	66.0	7.90	860.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2b

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

Beaver Dam							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	71.0	8.30	>2420	2182.0
	8/25/21	8/22/21	Rain	71.0	8.30	*	279.0
	9/29/21	9/22/21	Dry	64.0	8.40	145.00	197.0
Q2	10/27/21	10/25/21	Rain	63.0	8.20	194.00	227.0
	11/23/21	11/22/21	Rain	45.0	8.10	140.00	82.0
	12/29/21	12/29/21	Wet	60.0	7.90	>2420	3500.0
Q3	1/26/22	1/20/22	Dry	45.5	8.20	91.00	148.0
	3/23/22	3/23/22	Wet	60.0	7.70	980.00	700.0
	4/19/22	4/18/22	Wet	53.0	7.70	816.00	1020.0
Q4	5/4/22	5/1/22	Rain	63.0	7.80	345.00	n/a
	5/25/22	5/23/22	Rain	65.0	7.80	387.00	n/a
	6/22/22	6/17/22	Dry	68.0	8.00	1890.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2c

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

Chicken Trib							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1							
Q2							
Q3							
Q4	5/4/22	5/1/22	Rain	62.0	7.80	1553.00	n/a
	5/25/22	5/23/22	Rain	65.0	7.80	727.00	n/a
	6/22/22	6/17/22	Dry	67.0	7.80	1600.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2d

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

Mary Vestal Park							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	69.0	8.40	236.00	311.0
	8/25/21	8/22/21	Rain	69.0	8.30	*	1100.0
	9/29/21	9/22/21	Dry	63.0	8.40	461.00	500.0
Q2	10/27/21	10/25/21	Rain	55.0	8.30	157.00	167.0
	11/23/21	11/22/21	Rain	48.0	8.20	194.00	279.0
	12/29/21	12/29/21	Wet	60.0	8.20	1733.00	2000.0
Q3	1/26/22	1/20/22	Dry	46.0	8.20	73.00	82.0
	3/23/22	3/23/22	Wet	58.0	7.60	980.00	720.0
	4/19/22	4/18/22	Wet	53.0	7.80	1120.00	1140.0
Q4	5/4/22	5/1/22	Rain	62.0	7.80	249.00	n/a
	5/25/22	5/23/22	Rain	64.0	7.80	261.00	n/a
	6/22/22	6/17/22	Dry	66.0	7.90	200.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2e

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

Maryville Pike							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	71.0	8.30	461.00	640.0
	8/25/21	8/22/21	Rain	71.0	8.20	*	1818.0
	9/29/21	9/22/21	Dry	63.0	8.30	248.00	115.0
Q2	10/27/21	10/25/21	Rain	53.0	8.10	179.00	227.0
	11/23/21	11/22/21	Rain	45.0	7.80	111.00	66.0
	12/29/21	12/29/21	Wet	59.0	7.90	>2420	3500.0
Q3	1/26/22	1/20/22	Dry	44.0	8.10	345.00	148.0
	3/23/22	3/23/22	Wet	58.0	7.65	517.00	197.0
	4/19/22	4/18/22	Wet	53.0	7.70	649.00	560.0
Q4	5/4/22	5/1/22	Rain	63.0	7.80	186.00	n/a
	5/25/22	5/23/22	Rain	65.0	7.80	548.00	n/a
	6/22/22	6/17/22	Dry	67.5	7.90	200.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2f

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

South Knox Community Center							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	69.0	8.30	1733.00	1160.0
	8/25/21	8/22/21	Rain	70.0	8.20	*	1000.0
	9/29/21	9/22/21	Dry	64.0	8.30	921.00	867.0
Q2	10/27/21	10/25/21	Rain	53.0	8.10	1414.00	1120.0
	11/23/21	11/22/21	Rain	46.0	8.00	361.00	344.0
	12/29/21	12/29/21	Wet	61.4	8.20	>2420	5700.0
Q3	1/26/22	1/20/22	Dry	46.0	8.30	980.00	900.0
	3/23/22	3/23/22	Wet	60.0	7.60	2420.00	1727.0
	4/19/22	4/18/22	Wet	53.0	7.80	1986.00	1909.0
Q4	5/4/22	5/1/22	Rain	62.0	7.80	1046.00	n/a
	5/25/22	5/23/22	Rain	64.0	7.90	649.00	n/a
	6/22/22	6/17/22	Dry	66.5	7.90	1580.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2g

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

W Blount Ave							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	71.0	8.00	461.00	1364.0
	8/25/21	8/22/21	Rain	72.0	8.00	*	4000.0
	9/29/21	9/22/21	Dry	63.0	8.00	1046.00	900.0
Q2	10/27/21	10/25/21	Rain	51.0	7.80	921.00	980.0
	11/23/21	11/22/21	Rain	45.0	7.60	>2420	2200.0
	12/29/21	12/29/21	Wet	60.7	8.00	>2420	16000.0
Q3	1/26/22	1/20/22	Dry	46.0	8.10	167.00	98.0
	3/23/22	3/23/22	Wet	60.2	7.30	2420.00	1545.0
	4/19/22	4/18/22	Wet	55.0	7.50	1300.00	1020.0
Q4	5/4/22	5/1/22	Rain	64.0	7.40	1414.00	n/a
	5/25/22	5/23/22	Rain	66.0	7.60	1553.00	n/a
	6/22/22	6/17/22	Dry	67.0	7.60	1310.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2h

Water Quality Monitoring Program Bacteria Analysis Summary Goose Creek

June 1, 2021 through July 30, 2022

Young High Pike							
	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Units			inches	°F		mpn/ 100mL	cfu/ 100 mL
Q1	7/28/21	7/26/21	Rain	67.0	8.20	133.00	295.0
	8/25/21	8/22/21	Rain	66.0	8.00	*	410.0
	9/29/21	9/22/21	Dry	64.0	8.20	461.00	480.0
Q2	10/27/21	10/25/21	Rain	58.0	8.00	1046.00	740.0
	11/23/21	11/22/21	Rain	53.0	8.00	308.00	262.0
	12/29/21	12/29/21	Wet	61.0	7.90	548.00	600.0
Q3	1/26/22	1/20/22	Dry	45.0	8.20	613.00	800.0
	3/23/22	3/23/22	Wet	62.0	7.60	1553.00	1445.0
	4/19/22	4/18/22	Wet	58.0	7.70	727.00	560.0
Q4	5/4/22	5/1/22	Rain	62.0	7.70	411.00	n/a
	5/25/22	5/23/22	Rain	63.0	7.80	225.00	n/a
	6/22/22	6/17/22	Dry	65.0	7.80	5650.00	n/a

- ND: Analyte was not detected, or no data available

- *: Laboratory error prevented accurate count

Table 10A.2i

Water Quality Monitoring Program Bacteria Analysis Summary Misc. Hot Spots

June 1, 2021 through July 30, 2022

Mead Quarry							
Site	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Play Access	1/31/22	1/20/22	DRY	44.00	6.50	<1	<1
Cave Effluent	1/31/22	1/20/22	DRY	54.00	8.00	9.00	<1
Swimming Area	1/31/22	1/20/22	DRY	48.00	7.00	1.00	<1

Chilhowee Park							
Site	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Lake Ottosee	10/26/2021	10/25/2021	RAIN	n/a	n/a	345	420
Lake Ottosee	10/26/2021	10/25/2021	RAIN	n/a	n/a	214.00	311
Lake Ottosee	10/26/2021	10/25/2021	RAIN	n/a	n/a	285.00	246
Lake Ottosee	10/26/2021	10/25/2021	RAIN	n/a	n/a	326.00	420
Lake Ottosee 1	12/10/21	12/6/21	DRY	n/a	n/a	326.00	230
Lake Ottosee 2	12/10/21	12/6/21	DRY	n/a	n/a	1046.00	1060
Lake Ottosee 3	12/10/21	12/6/21	DRY	n/a	n/a	411.00	400
Lake Ottosee 4	12/10/21	12/6/21	DRY	n/a	n/a	770.00	900

Turkey Creek							
Site	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Turkey Creek Downstream	11/17/21	11/11/21	DRY	56.0	7.90	17	<1
Turkey Creek Midstream	11/17/21	11/11/21	DRY	58.0	8.20	30	<1
Turkey Creek Upstream	11/17/21	11/11/21	DRY	56.0	8.00	41	<1
Turkey Creek Mystery	11/17/21	11/11/21	DRY	64.0	7.50	8	16

Williams Creek							
Site	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Fecal Colif.
Full Suite Bacteria Test	4/26/22	4/26/22	WET	65.00	7	>2420	21000
Riverside Dr	4/28/22	4/26/22	RAIN	61.00	7.5	145	180
Brooks Ave	4/28/22	4/26/22	RAIN	62.00	8	172	197
S. Chestnut St	4/28/22	4/26/22	RAIN	64.00	8	326	180
Selma	4/28/22	4/26/22	RAIN	67.00	8.5	687	467
MLK	4/28/22	4/26/22	RAIN	65.00	8.5	6	<1
Riverside Dr	5/23/2022	5/23/2022	RAIN	64	7.5	>2420	n/a
Brooks Ave	5/24/2022	5/24/2022	RAIN	66.00	7	>2421	n/a
S. Chestnut St	5/25/2022	5/25/2022	RAIN	66.00	7	>2422	n/a
Selma	5/26/2022	5/26/2022	RAIN	69.00	7	>2423	n/a
Wilson Ave/Storm	5/27/2022	5/27/2022	RAIN	70.00	7	>2424	n/a
Louise	5/28/2022	5/28/2022	RAIN	70.00	7	>2425	n/a

Davis St							
Site	Date	Last Rain	72 Hour Precip	Temp	pH	E. Coli	Total Coliform
KUB Sampling Port	6/3/22	5/27/22	DRY	70.00	7	104620	>241960
KUB Sampling Port	6/9/22	6/8/22	RAIN	65.00	7	111990	>241961

- *: Rain= Rain during sampling, Wet= Rain in previous 72 hours, Dry= No rain in previous 72 hours

Table 10A.3

Laboratory Analysis Summary - Municipal Industrial Facility Wet Weather Program July 1, 2021 through June 30, 2022

Point Source Sample Site	Period/Unit	Date	Type	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	Oil/Grease	E. Coli	Fecal Colif.
Units					mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mpn/100mL	cfu/100mL
	<i>ANNUAL</i>																		
KAT	Treated Outfall	03/07/22	Grab	6.5	227.00	162.00	19.2	78	0.839	0.479	6.280	5.800	ND	0.1150	0.249	0.1300	ND	**	**
	E. Fifth	03/07/22	Grab	6.0	71.60	79.70	17.0	88	0.689	0.300	1.860	1.560	ND	0.1290	0.217	0.1090	ND	**	**
	Church (Bus)	03/07/22	Grab	6.0	48.10	50.3	24.1	59	0.299	ND	0.804	0.804	ND	0.0874	ND	ND	6.120	**	**
Lorraine Street Treatment Units	Pretreated	03/07/22	Grab	6.5	51.70	83.6	43.1	81	0.250	ND	1.150	0.967	ND	0.0790	0.140	0.0640	ND	**	**
	East Suntree	03/07/22	Grab	6.5	43.30	ND	4.2	39	ND	ND	0.586	0.462	ND	ND	ND	ND	ND	**	**
	West Baysaver	03/07/22	Grab	6.5	41.30	31.0	20.3	87	0.193	ND	1.030	1.030	ND	ND	0.149	ND	ND	**	**
	Yard East	03/07/22	Grab	6.8	59.00	46.5	19.0	128	0.198	ND	2.560	2.560	ND	ND	0.119	0.0560	ND	**	**
	CDS	03/07/22	Grab	6.5	49.30	99.5	255.0	269	0.327	1.930	3.090	1.160	0.0243	0.1500	0.267	0.0550	ND	**	**
Transfer Station	Pretreated	03/23/22	Grab	6.5	11.20	113.0	82.0	128	0.175	ND	2.330	2.330	0.0419	0.2940	0.301	0.1150	ND	548	1,364
	Treated	03/23/22	Grab	6.5	16.80	199	240	201	ND	ND	0.588	0.588	0.1320	0.5030	0.715	0.0970	ND	1,300	2,000
	Catch Basin	03/23/22	Grab	6.5	65.00	490.0	506.0	580	ND	ND	7.410	7.410	0.4460	1.1300	1.480	0.4740	ND	>2420	14,000
Prosser Rd	Treated Outfall	03/07/22	Grab	7.0	46.20	46.6	13.2	111	1.120	0.695	1.940	1.250	0.0050	0.4010	ND	ND	ND	**	**
Average:				6.5	60.88	127.4	103.6	154	0.454	0.851	2.469	2.160	0.1298	0.3209	0.404	0.1375	6.1	924.0	5788.0
*National NURP Study Average					11.9	90.8	N/A	N/A	N/A	N/A	2.350	3.310	0.18	0.176	0.16	N/A	N/A	N/A	N/A
*Characteristics of Urban Stormwater Range					1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	N/A	0.1 - 2.5	0.01 - 4.5	N/A	0.0 - 1.9	N/A	0.1 - 125	N/A	N/A	N/A	N/A

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

** Microbiological testing not needed at these locations.

-N/A: Not applicable.

-ND: Analyte was not detected.

Table 10A.4

Estimated Runoff From Major Watersheds Within the MS4

July 1, 2021 Through June 30, 2022

Watershed	Agricul./ Forest/ Vacant, Public Parks	Vacant (>10)	Rural Res.	Single Family Res.	Private Rec., Public Land	Multi-Family Res., Church	Insti-tutional	Mining, Office/ Service	Manu-facturing/ Whole-sale	Commer., Trans./ Utility/ Commun.	Major Roads/ Hwys/ ROWs	Under Const	Not Loaded	Total Acres in Watershed	Acres in the City Limits	Est. % Imperv-ious	C Value	Total Rainfall during 21/22 (in./yr)	Total Runoff for 21/22 (Mgal/yr)
Baker Cr.	412	2	107	640	90	77	32	1	1	3	269	13	27	1,674	1,674	32	0.41	48.3	896
East Fork	313	0	10	475	302	78	73	31	195	235	584	33	180	2,509	2,509	53	0.57	48.3	1,885
First Cr.	724	0	300	3,152	544	501	110	157	127	556	1,412	51	116	7,750	7,750	44	0.50	48.3	5,075
Fourth Cr.	965	57	423	2,026	468	406	93	206	201	568	881	61	414	6,769	5,920	41	0.48	48.3	3,708
Goose Cr.	639	40	126	669	213	67	8	21	77	131	327	34	29	2,381	1,755	35	0.43	48.3	985
Grassy Cr.	2,230	176	561	610	215	24	0	14	31	95	211	39	95	4,301	433	17	0.29	48.3	163
Holston R.	2,362	69	371	1,222	417	45	5	2	219	33	805	32	50	5,632	2,455	28	0.37	48.3	1,196
Inman Br.	563	33	214	138	4	12	0	0	0	0	145	0	34	1,143	99	21	0.31	48.3	41
Knob Cr.	1,719	195	481	843	125	84	1	19	1	29	296	4	169	3,966	989	19	0.30	48.3	395
Knob Fork	1,659	26	398	675	182	56	5	93	6	124	257	19	252	3,752	823	22	0.33	48.3	353
Love Cr.	1,735	102	505	1,625	311	212	51	94	178	408	1,038	46	103	6,408	5,090	36	0.44	48.3	2,946
Second Cr.	443	0	90	1,281	346	247	29	107	140	542	1,161	35	82	4,503	4,498	53	0.57	48.3	3,370
Sinking Cr.	1,614	146	459	1,266	284	90	17	33	31	267	881	12	347	5,447	2,434	33	0.41	48.3	1,325
Swanpond Cr.	3,892	303	833	604	121	36	4	79	240	232	457	65	285	7,151	499	19	0.30	48.3	199
Ten Mile Cr.	1,879	0	638	3,421	165	895	55	115	58	615	1,500	24	641	10,006	3,921	38	0.45	48.3	2,318
Third Cr.	1,757	79	436	3,003	406	512	184	124	225	443	1,252	98	220	8,739	8,417	37	0.45	48.3	4,933
TN River	7,197	503	2,269	4,681	2,910	403	187	72	170	238	990	121	1,113	20,854	8,232	22	0.33	48.3	3,535
Toll Cr.	535	69	154	222	42	26	1	0	37	4	93	42	4	1,229	767	22	0.32	48.3	325
Turkey Cr.	3,353	235	603	2,693	264	343	121	104	91	442	1,161	68	738	10,216	1,677	29	0.38	48.3	846
Whites Cr.	2,733	154	782	1,298	575	59	31	11	49	126	608	51	578	7,055	1,634	23	0.34	48.3	722
Williams Cr.	358	11	47	561	46	96	125	17	10	61	276	3	30	1,641	1,605	37	0.45	48.3	948
Woods Cr.	1,220	106	281	371	0	26	0	2	140	43	261	1	157	2,608	143	23	0.33	48.3	63
Sink-East	1,226	0		728	9	17	0	17	3	27	0	0	0	2,027	91	12	0.24	48.3	29
Beaver Cr	21,174	0	0	21,230	1,292	845	4	259	283	712	0	160	0	45,959	162	16	0.28	48.3	59
Tuckahoe	4,293	0	0	1,829	18	14	0	8	2	1	0	4	0	6,169	229	8	0.22	48.3	65
Fr. Broad riv	8,954	0	0	2,744	73	40	24	24	497	117	0	166	0	12,639	551	11	0.24	48.3	173
COK Total	73,949	2,306	10,088	58,007	9,422	5,211	1,160	1,610	3,012	6,052	14,865	1,182	5,664	192,528	64,357				36,554

The runoff from the major watersheds within the MS4 area was estimated by a formula in Camp Dresser & Mckee's Watershed Management Module. $Q = P \times C \times A$

where, P = total precipitation (inches/year) = 48.32 in./yr = 4.0267 ft./yr

C = land use area weighted runoff coefficient = $0.15 \times \text{pervious\%} + 0.95 \times \text{Impervious\%}$

A = drainage area (acres) = acres in watershed $\times (4.35E4 \text{ ft}^2/\text{acre}) = A_i \text{ ft}^2$

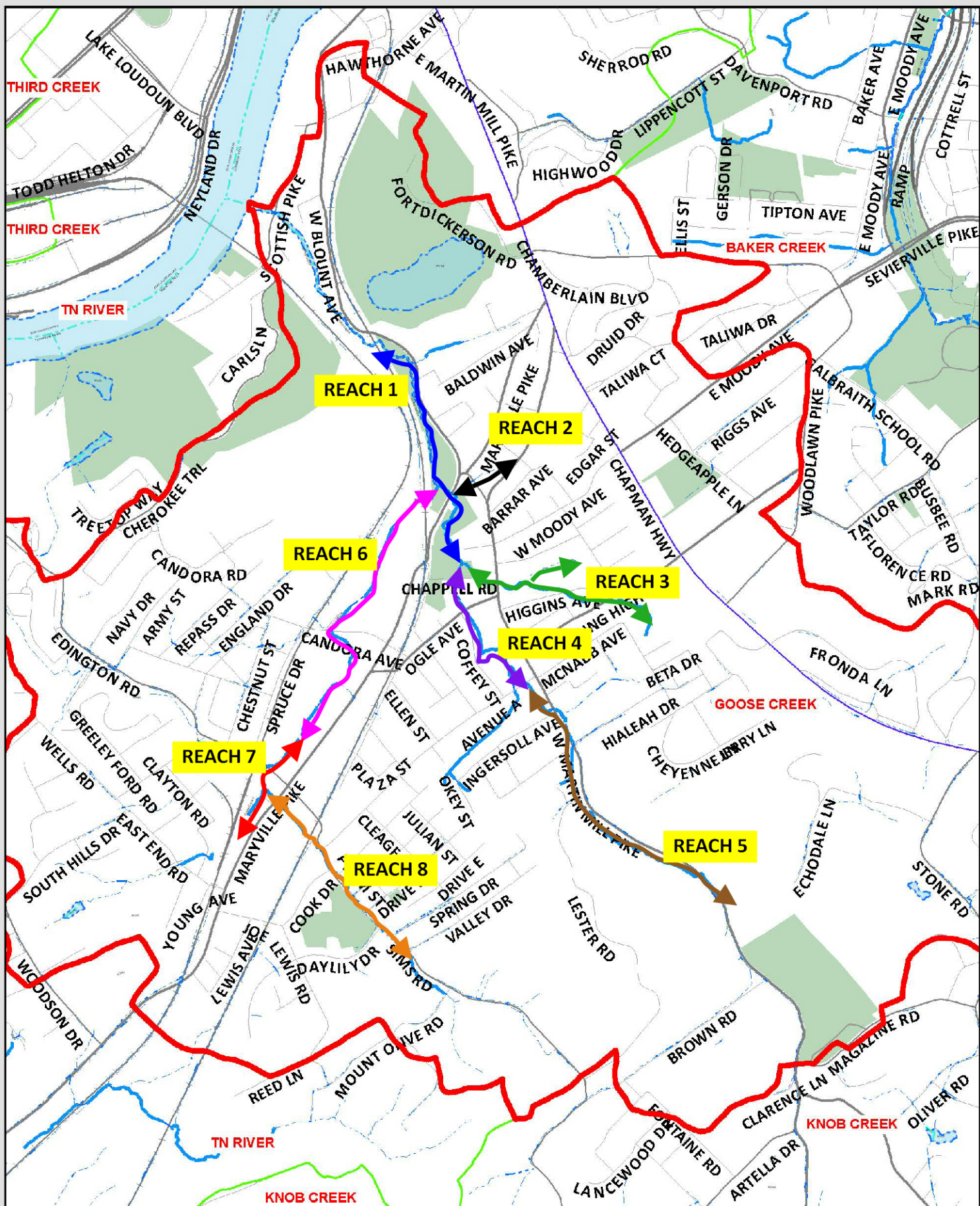
Q = total runoff rate = sum of each watershed's Q_i .

Total estimated runoff for 2020/2021 Reporting Period = 36,554 Mgal/yr

Approximate area and land use for each watershed was determined through the City's GIS. Total yearly rainfall amount was determined by averaging the amount of rain collected from the City's five monitoring stations located throughout the city (refer to map in Appendix E). Runoff coefficient (C) was calculated by adding 15 % of the pervious fraction to 95% of the impervious fraction in each watershed. This assumes that the fraction of rainfall producing runoff is 15% and 95% from pervious and impervious surfaces respectively. The summary of the runoff calculations are provided in the table above. Calculations for some of the watersheds were left out due to the insignificant amount of runoff that would be produced.

Appendix A

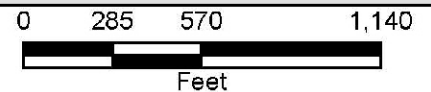
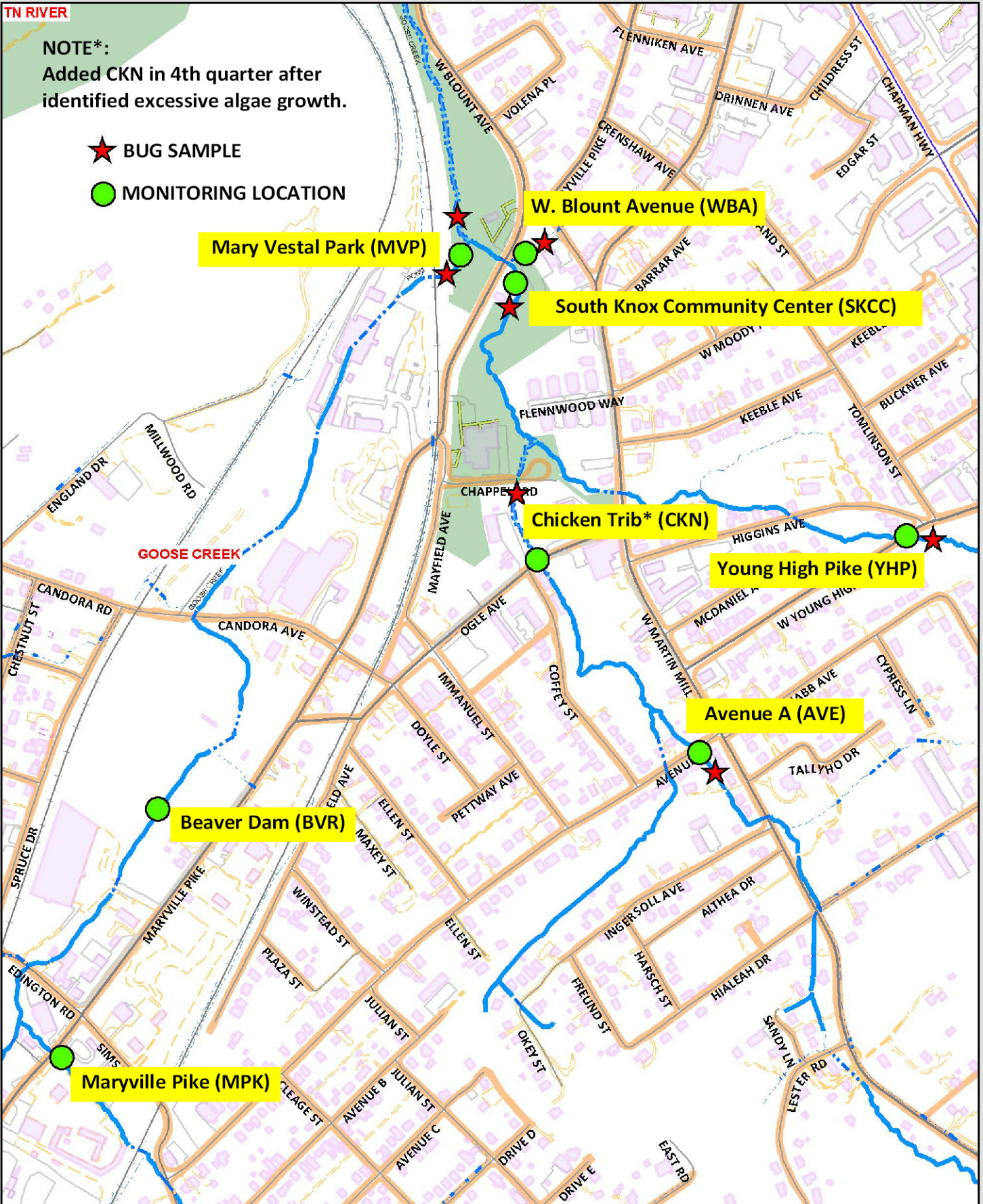
Goose Creek Maps



NOTE*:
Added CKN in 4th quarter after
identified excessive algae growth.

★ BUG SAMPLE

● MONITORING LOCATION



Appendix B

Stream Surveys

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 1	Downstream Limits: 3127 W Blount Ave
Date: 4/8/2022	DS Elevation: 811
Time: 8:20	Upstream Limits: 4013 W Martin Mill Pike
Length: 3679	US Elevation: 817
Description / Notes:	

Weather:

Previous 48 hours Precipitation:	Slight	Approx. Air Temperature (F°): 41
Last Precipitation Date:	4/7/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Flat	Avg. Stream Width:	Medium (3-10 yd.)
Slope: 0.002 ft/ft 0.20%	Max. Stream Depth:	Deep (0.6 - 1 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach:	75	Notes:
-------------------------------------	----	--------

Stream Bank Characteristics:

Bank Height:	High Water Mark:			
feet	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Steep Terrain	Sloughing	Bluff;Wall	
RDB Bank Slope:	Steep Terrain	Undercut	Sloughing	Bluff;Wall

Channel Characteristics:

Manmade Modifications:	Channelized	Bridge	Dam	
Sediment Deposits:	High	High	High	
Sediment Type:	Silt	Mud	Clay	
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	Bacteria	Notes: One small oil sheen, no source found		
Algae:	Moderate	Notes:		
Algae Type:	Filamentous	Green		

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Cobble	Gravel	Silt
Dominate 2:	Gravel	Sand	Mud - Muck
Dominate 3:	Bedrock	Silt	Clay
Dominate 4:	Boulders		

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Park	Residential		

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Impoundment	Homeless Camps	Riparian Loss	Habitat Alteration
Disturbance 2:	Substrate Alteration		Channelization	
Disturbance 3:			Garbage;Trash	
Disturbance 4:			Sedimentation	

Other Stream Information and Stressors:

Beaver activity noticed downstream of the PCB trib. Bank height up to 6ft at mulitple incised locations. High water mark varied throughout reach due to channel width and obstructcons.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 1	Participant 3: Mark Dills



Photo: 1DU

Description:



Photo: 1ID

Description:



Photo: 1JU

Description:



Photo: 1OU

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 2	Downstream Limits: 436 Maryville Pike
Date: 3/30/2022	DS Elevation: 822
Time: 8:15	Upstream Limits: 3817 W Martin Mill Pike
Length: 750	US Elevation: 828
Description / Notes: Spring fed trib with TDEC monitoring facility	

Weather:

Previous 48 hours Precipitation: None	Approx. Air Temperature (F°): 48
Last Precipitation Date: 3/23/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Flat	Avg. Stream Width:	Very Small (<1.5 yd.)
Slope: 0.008 ft/ft	Max. Stream Depth:	Shallow (<0.3 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach: 50	Notes: Typically on the southern slope
---	--

Stream Bank Characteristics:

Bank Height: Varies	High Water Mark: Varies			
	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Steep Terrain	Undercut	Sloughing	
RDB Bank Slope:	Steep Terrain	Undercut	Sloughing	

Channel Characteristics:

Manmade Modifications:	Bridge	Rip Rap	Channelized	Cement
Sediment Deposits:	Slight	Slight		
Sediment Type:	Silt	Mud		
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	Oil Sheen	Notes: Monitoring well for fuel plume on this tributary.		
Algae:	Slight	Notes:		
Algae Type:	Filamentous			

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Gravel	Sand	Cobble
Dominate 2:	Cobble	Gravel	Sand
Dominate 3:	Boulders	Cobble	Silt
Dominate 4:		Detritus	

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential	Commercial		

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Garbage;Trash	Substrate Alteration	Habitat Alteration	Channelization
Disturbance 2:	Sedimentation		Riparian Loss	
Disturbance 3:				
Disturbance 4:				

Other Stream Information and Stressors:

Spring fed, source unknown, discharging effluent from stormwater infrastructure. There is TDEC monitoring well for petroleum plume. Bank heights were commonly 2 ft + or - throughout the reach. High water mark varied throughout reach due to channel width and obstructions.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 2	Participant 3: Mark Dills



Photo: 2AU

Description:



Photo: 2CU

Description:



Photo: 2DD

Description:



Photo: 2EU

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 3A	Downstream Limits: 522 Chapel Rd
Date: 3/30/2022	DS Elevation: 824
Time: 9:00	Upstream Limits: 4409 Chapman HWY
Length: 2430	US Elevation: 850
Description / Notes:	

Weather:

Previous 48 hours Precipitation:	None	Approx. Air Temperature (F°): 60
Last Precipitation Date:	4/23/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Low	Avg. Stream Width:	Small (1.5 - 3 yd.)
Slope: 0.011 ft/ft 1.1%	Max. Stream Depth:	Medium (0.3 - 0.6 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach:	80	Notes: No canopy in back yards, mowed grass in buffer zone
--	----	--

Stream Bank Characteristics:

Bank Height:	High Water Mark:			
feet	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Steep Terrain	Bluff;Wall	Sloughing	
RDB Bank Slope:	Steep Terrain	Gentle Slope	Sloughing	Bluff;Wall

Channel Characteristics:

Manmade Modifications:	Bridge	Channelized	Rip Rap	
Sediment Deposits:	Slight	Slight		
Sediment Type:	Silt	Mud		
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	None	Notes:		
Algae:	Slight	Notes:		
Algae Type:	Filamentous	Green		

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Cobble	Cobble	Cobble
Dominate 2:	Gravel	Gravel	Sand
Dominate 3:	Boulders	Sand	Silt
Dominate 4:	Bedrock	Boulders	

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential	Park	Commercial	

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Garbage;Trash	Homeless Camps	Riparian Loss	
Disturbance 2:	Sedimentation		Habitat Alteration	
Disturbance 3:	Substrate Alteration		Channelization	
Disturbance 4:				

Other Stream Information and Stressors:

Homeless camps at bottom of reach near the park. Spring activity feeding the upper reach, headwater at top of trib is a 54" RCP. Bank heights varied throughout reach, ranging from 1-2 ft. High water mark varied throughout reach due to channel width and obstructions.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 3A	Participant 3: Mark Dills



Photo: 3ABU

Description:

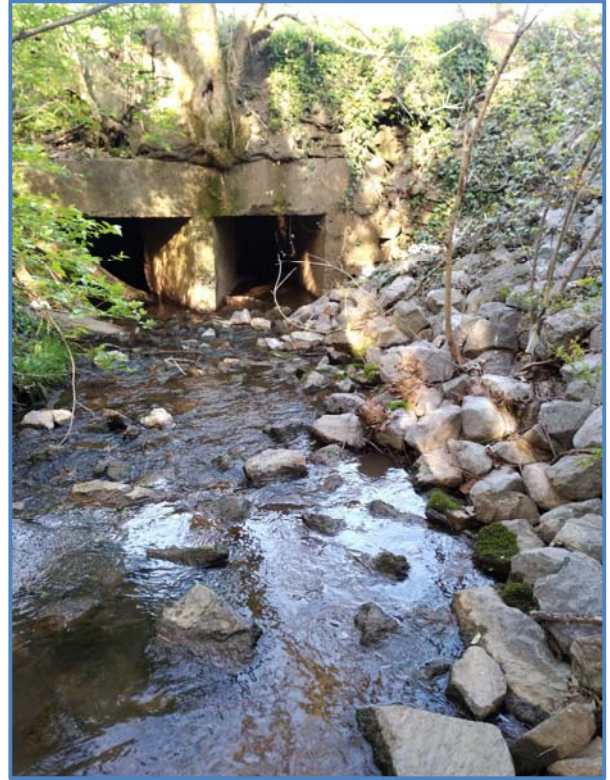


Photo: 3ADD

Description:



Photo: 3AMU

Description:



Photo: 3AQD

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: Reach 3B	Downstream Limits: 413 Higgins Ave
Date: 3/30/2022	DS Elevation: 833
Time: 9:35	Upstream Limits: 156 Keeble Ave
Length: 545	US Elevation: 842
Description / Notes:	

Weather:

Previous 48 hours Precipitation: None	Approx. Air Temperature (F°): 62
Last Precipitation Date: 3/23/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Low	Avg. Stream Width:	Small (1.5 - 3 yd.)
Slope: 0.017ft/ft 1.7%	Max. Stream Depth:	Shallow (<0.3 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach: 90	Notes: Mostly wooded back yards
---	---------------------------------

Stream Bank Characteristics:

Bank Height: Varies	High Water Mark: Varies			
	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Undercut	Sloughing	Deeply Incised	
RDB Bank Slope:	Undercut	Sloughing	Deeply Incised	

Channel Characteristics:

Manmade Modifications:	Channelized	Rip Rap		
Sediment Deposits:	Moderate	Moderate		
Sediment Type:	Mud	Clay		
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	None	Notes:		
Algae:	Slight	Notes: Only in downstream portion		
Algae Type:	Green			

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Gravel	Gravel	Clay
Dominate 2:	Cobble	Sand	Mud - Muck
Dominate 3:	Sand	Clay	Silt
Dominate 4:		Detritus	

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential			

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:			Garbage;Trash	Channelization
Disturbance 2:			Riparian Loss	Substrate Alteration
Disturbance 3:			Habitat Alteration	
Disturbance 4:				

Other Stream Information and Stressors:

Bank height varies, 2-5+ft, sheer walls with heavy erosion. High water mark varied throughout reach due to channel width and obstructions.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 3B	Participant 3: Mark Dills



Photo: 3BGU

Description:



Photo: 3BHUR

Description:



Photo: 3BIU

Description:



Photo: 3BID

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 4	Downstream Limits: 130 Chappell Road
Date: 4/8/2022	DS Elevation: 823.5
Time: 10:20	Upstream Limits: 517 Avenue A
Length: 1990	US Elevation: 843
Description / Notes: This reach had a lot of algae growth. No point source determined on walk. Further investigation required.	

Weather:

Previous 48 hours Precipitation:	Slight	Approx. Air Temperature (F°): 45
Last Precipitation Date:	4/7/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Low	Avg. Stream Width:	Small (1.5 - 3 yd.)
Slope: 0.010 ft/ft	Max. Stream Depth:	Medium (0.3 - 0.6 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach:	90	Notes: By the house the underbrush is gone and allows light into the canopy.
--	----	--

Stream Bank Characteristics:

Bank Height: varies	High Water Mark: varies			
	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Steep Terrain	Sloughing	Gentle Slope	Bluff; Wall
RDB Bank Slope:	Steep Terrain	Sloughing	Gentle Slope	Bluff; Wall

Channel Characteristics:

Manmade Modifications:	Channelized	Bridge		
Sediment Deposits:	High	Moderate		
Sediment Type:	Silt	Mud		
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	None	Notes:		
Algae:	Choking	Notes: Lots of algae started in this reach, blanketing the substrate at times.		
Algae Type:	Filamentous	Green		

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Cobble	Gravel	Sand
Dominate 2:	Gravel	Sand	Silt
Dominate 3:	Boulders	Mud - Muck	Clay
Dominate 4:			Mud - Muck

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential	Park	Commercial	

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Impoundment	Homeless Camps	Riparian Loss	Channelization
Disturbance 2:		Garbage; Trash		Habitat Alteration
Disturbance 3:		Substrate Alteration		
Disturbance 4:				

Other Stream Information and Stressors:

Bank height averaged about 24 inches except where slopes where significant, top of banks on alternate side much lower, i.e. the top of the hill was not the top of bank. High water mark varied throughout reach due to channel width and obstructions. Extreme algae growth for the majority of this reach from Chappell Road to WWC confluence downstream of Avenue A. Investigation possible sources of nutrients.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 4	Participant 3: Mark Dills

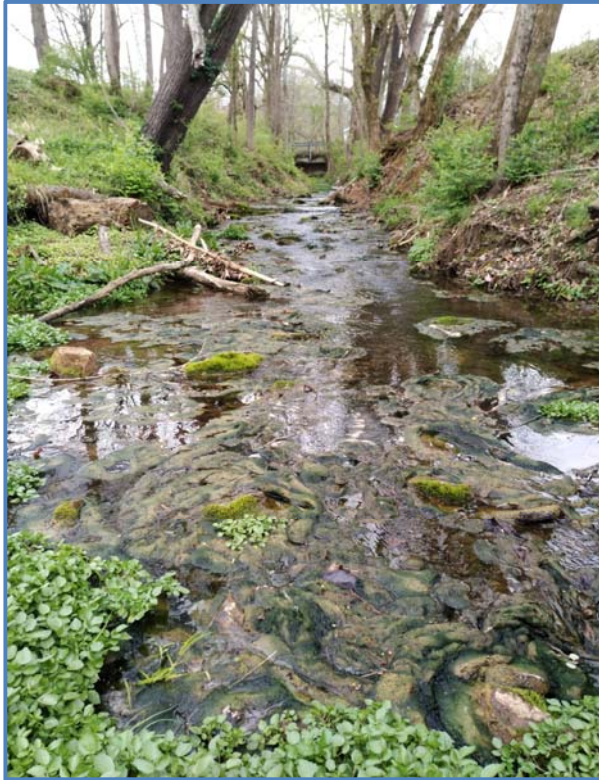


Photo: 4CU

Description:

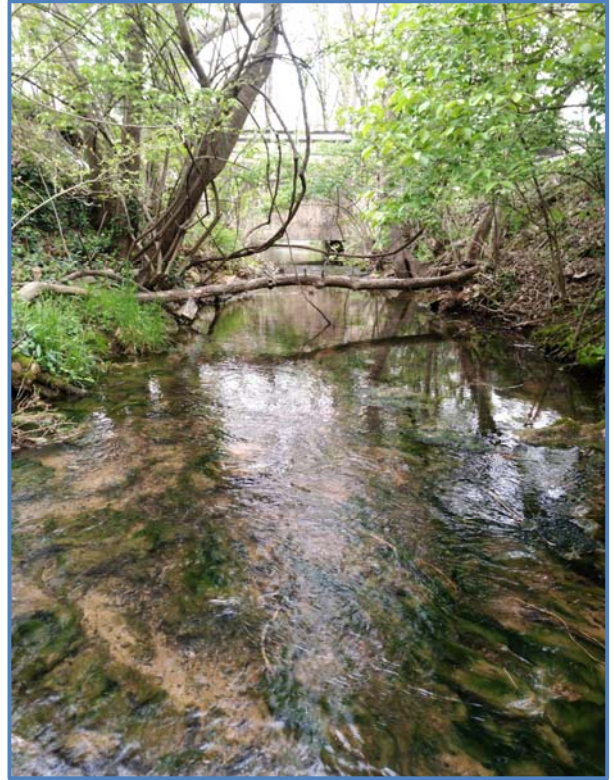


Photo: 4ED

Description:



Photo: 4GU

Description:



Photo: 4HU

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 5	Downstream Limits: 4501 W. Martin Mill Pike
Date: 5/5/2022	DS Elevation: 844
Time: 8:00	Upstream Limits: 4962 W. Martin Mill Pike
Length: 4,832	US Elevation: 897
Description / Notes:	

Weather:

Previous 48 hours Precipitation: None	Approx. Air Temperature (F°): 56
Last Precipitation Date: 5/1/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Low	Avg. Stream Width:	Very Small (<1.5 yd.)
Slope: .011 ft/ft	Max. Stream Depth: 1.10%	Shallow (<0.3 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach: 50	Notes:
--	--------

Stream Bank Characteristics:

Bank Height: varies	High Water Mark: varies			
	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Gentle Slope	Undercut	Sloughing	Bluff;Wall
RDB Bank Slope:	Gentle Slope	Undercut	Sloughing	Bluff;Wall

Channel Characteristics:

Manmade Modifications:	Channelized	Bridge	Dam	
Sediment Deposits:	Excessive	Excessive		
Sediment Type:	Silt	Mud		
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	Bacteria	Notes:		
Algae:	Slight	Notes:		
Algae Type:	Green			

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Cobble	Silt	Silt
Dominate 2:	Gravel	Detritus	Clay
Dominate 3:	Bedrock	Cobble	Mud - Muck
Dominate 4:	Sand		Detritus

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential	Urban	Hay;Fields	Forest

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Garbage;Trash	Riparian Loss	Channelization	Sedimentation
Disturbance 2:	Impoundment	Substrate Alteration	Habitat Alteration	
Disturbance 3:	Homeless Camps			
Disturbance 4:				

Other Stream Information and Stressors:

Lower middle upper sections of this reach have distinctive characteristics to themselves. The lower reach is residential and lawns. The middle is wooded, heavily silted, almost to the point of creating a dead zone. The siltation was such that it significantly impacted bug habitat, no fish were seen, only snails observed. Upper reach was wooded, had cobble and bedrock in the substrate to the source, a spring. Bank height throughout the residential section was fairly consistent, about 24 inches or less. Through the middle and upper reach the channel had more sinuosity, with varied bank heights, one side being high one side being low, typically throughout, ie. there was a height differential of the left and right bank, alternating. High water mark varied throughout reach due to channel width and obstructions.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 5	Participant 3: Mark Dills



Photo: 5BU

Description:

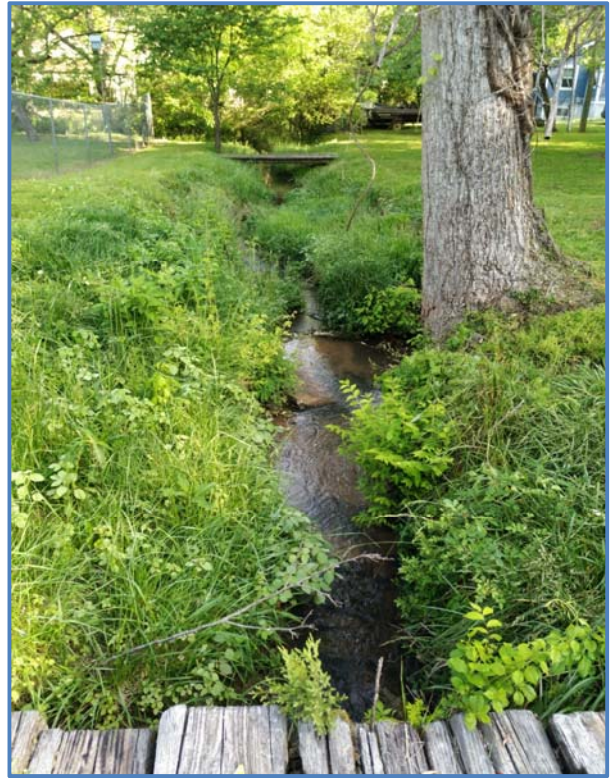


Photo: 5KD

Description:



Photo: 5XD

Description:



Photo: 5BBD

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 6	Downstream Limits: 401 Maryville Pike
Date: 6/8/22 & 6/23/22	DS Elevation: 818
Time: 9:00 AM	Upstream Limits: 1015 Maryville Pike
Length: 3,861	US Elevation: 845
Description / Notes:	

Weather:

Previous 48 hours Precipitation: None	Approx. Air Temperature (F°): 75
Last Precipitation Date: 6/17/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Flat	Avg. Stream Width:	Small (1.5 - 3 yd.)
Slope: .007 ft/ft	0.70%	Max. Stream Depth: Medium (0.3 - 0.6 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach:	90	Notes: Dense canopy and overgrowth for majority of reach.
--	----	---

Stream Bank Characteristics:

Bank Height: Varies	High Water Mark: Varies			
	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Gentle Slope	Undercut	Sloughing	Bluff;Wall
RDB Bank Slope:	Undercut	Gentle Slope	Bluff;Wall	Steep Terrain

Channel Characteristics:

Manmade Modifications:	Bridge	Rip Rap	Cement	Channelized
Sediment Deposits:	High	High	Moderate	
Sediment Type:	Silt	Mud	Sludge	
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	None	Notes:		
Algae:	Slight	Notes: Mainly located on Rogers Group Property (no cover)		
Algae Type:	Green			

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Cobble	Cobble	Mud - Muck
Dominate 2:	Gravel	Silt	Silt
Dominate 3:	Boulders	Boulders	Cobble
Dominate 4:		Sand	Detritus

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Industry	Hay;Fields	Forest	Residential

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Impoundment	Riparian Loss	Channelization	Substrate Alteration
Disturbance 2:	Garbage;Trash		Sedimentation	Habitat Alteration
Disturbance 3:	Homeless Camps			
Disturbance 4:				

Other Stream Information and Stressors:

One small beaver dam observed at upper end of reach. This reach is part of the Witherspoon property, and sediment is contaminated with PCBs. There is a significant amount of marble scattered throughout the riparian zone and within the creek adjacent to Candor Marble Mill (historical). A portion of the reach has historical industrial/manufacturing property that is growing back to nature, but is not an original buffer. Bank heights were commonly 2-4 ft throughout the reach. High water mark varied throughout reach due to channel width and obstructions.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 6	Participant 3: Mark Dills



Photo: 6DU

Description:



Photo: 6JU

Description:



Photo: 6PD

Description:



Photo: 6TD

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 7	Downstream Limits: 1017 Maryville Pike
Date: 5/2/2022	DS Elevation: 845
Time: 13:30	Upstream Limits: 1137 Maryville Pike
Length: 1259	US Elevation: 855
Description / Notes:	

Weather:

Previous 48 hours Precipitation: Moderate	Approx. Air Temperature (F°): 77
Last Precipitation Date: 5/1/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Low	Avg. Stream Width:	Small (1.5 - 3 yd.)
Slope: .008 ft/ft	0.80%	Max. Stream Depth: Medium (0.3 - 0.6 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach:	85	Notes:
-------------------------------------	----	--------

Stream Bank Characteristics:

Bank Height:	High Water Mark:			
feet	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Steep Terrain	Gentle Slope	Undercut	Bluff;Wall
RDB Bank Slope:	Steep Terrain	Sloughing	Bluff;Wall	Gentle Slope

Channel Characteristics:

Manmade Modifications:	Channelized	Bridge	Rip Rap	
Sediment Deposits:	Moderate	Moderate	Moderate	Slight
Sediment Type:	Silt	Mud	Clay	Sand
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	Surfactant	Notes:		
Algae:	Slight	Notes:		
Algae Type:	Green			

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Gravel	Gravel	Silt
Dominate 2:	Boulders	Sand	Sand
Dominate 3:	Cobble	Cobble	Gravel
Dominate 4:	Sand	Clay	

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential	Commercial	Industry	

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Sedimentation	Garbage;Trash	Riparian Loss	
Disturbance 2:		Sedimentation	Channelization	
Disturbance 3:				
Disturbance 4:				

Other Stream Information and Stressors:

Short section of creek un-walkable due to being completely fenced in, no canopy cover over stream in that section.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 7	Participant 3: Mark Dills



Photo: 7BU

Description:



Photo: 7D

Description:



Photo: 7GU

Description:



Photo: 7NU

Description:

TDEC-DWR Stream Survey Field Sheet

STREAM SURVEY INFORMATION (Revised COK 5/27/2021)

Project: Water Quality Monitoring 2021-2022	Organization: City of Knoxville Stormwater
Watershed: Goose Creek	Activity Type: Creek Walk
HUC12: 060102010204	Ecoregion: 67f

Reach:

Name: 8	Downstream Limits: 1109 Maryville Pike
Date: 3/29/2022	DS Elevation: 850
Time: 13:00	Upstream Limits: 4815 Sims Rd
Length: 3065	US Elevation: 892
Description / Notes: From Maryville Pike along Sims Rd to the county boundary	

Weather:

Previous 48 hours Precipitation: None	Approx. Air Temperature (F°): 55
Last Precipitation Date: 3/23/2022	Approx. Water Temperature (F°):

Physical Characteristics:

Gradient: Low	Avg. Stream Width:	Very Small (<1.5 yd.)
Slope: 0.014 ft/ft	Max. Stream Depth: 1.4%	Shallow (<0.3 yd.)

Light Penetration:

% Canopy Cover Estimated for Reach: 50	Notes: Major portion along stream along roadside
---	--

Stream Bank Characteristics:

Bank Height: Varies	High Water Mark: Varies			
	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
LDB Bank Slope:	Sloughing	Bluff;Wall	Gentle Slope	Steep Terrain
RDB Bank Slope:	Sloughing	Gentle Slope	Steep Terrain	

Channel Characteristics:

Manmade Modifications:	Channelized	Rip Rap	Bridge	Dam
Sediment Deposits:	Moderate	Moderate		
Sediment Type:	Silt	Clay		
Turbidity:	Slight	Notes:		
Foam/Surface Sheen:	None	Notes:		
Algae:	Slight	Notes:		
Algae Type:	Filamentous			

Dominate Substrate: (> 25%) Select up to 4:

	Riffle	Run	Pool
Dominate 1:	Gravel	Silt	Mud - Muck
Dominate 2:	Cobble	Sand	Clay
Dominate 3:	Bedrock	Gravel	Silt
Dominate 4:		Cobble	Sand

Surrounding Land Uses (Select up to 4):

Landuse 1	Landuse 2	Landuse 3	Landuse 4
Residential	Industry	Road;Hwy;RR	Forest

If applicable, choose up to 4 disturbances from the dropdown boxes below the appropriate severity of the impact.

Observed Human Disturbances:	Slight	Moderate	High	Extreme
Disturbance 1:	Impoundment	Substrate Alteration	Habitat Alteration	Garbage;Trash
Disturbance 2:	Homeless Camps		Riparian Loss	Channelization
Disturbance 3:				
Disturbance 4:				

Other Stream Information and Stressors:

Lots of trash/litter. Industrial site with possible pollution source. Some natural bedrock substrate. At the downstream end of the reach, bank heights were up to 2ft, but not common. In the rest of the reach, the bank hights were more consisten throughout, ranging up to 24". High water mark varied throughout reach due to channel width and obstructons.

STREAM SURVEY INFORMATION TDEC-DWR Stream Survey Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby
Name: Reach 8	Participant 3: Mark Dills



Photo: 8CU

Description:

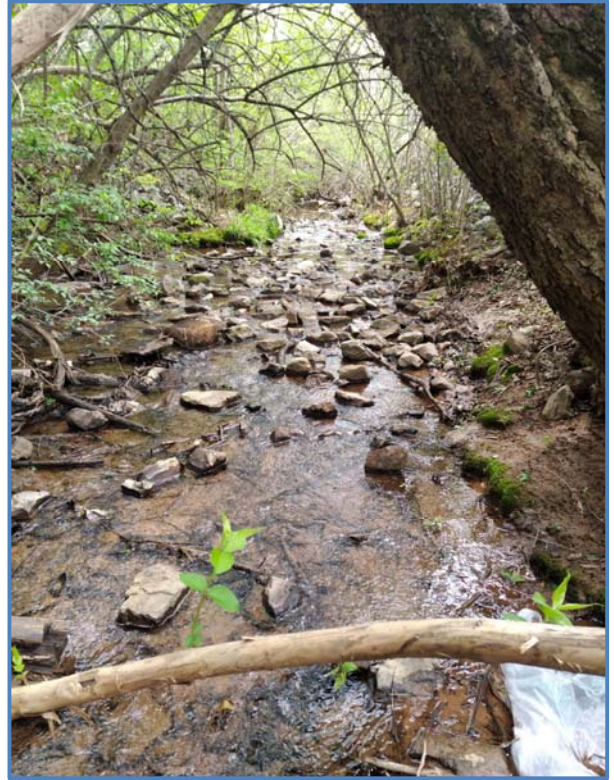


Photo: 8FU

Description:



Photo: 8JU

Description:



Photo: 8MD

Description:

Appendix C

Invertebrate Surveys

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	8/27/2021		Time:		
Monitoring Location:	AVENUE A				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment	Scored a little higher because of aquatic plants in the channel and at edge of banks																				
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					

6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.		
	Score	10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment						
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.		
	Score	16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment						
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
	Score (Left Bank)	8	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	8	10 9	8 7 6	5 4 3	2 1 0	
Comment						
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)		
	Score (Left Bank)	2	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	2	10 9	8 7 6	5 4 3	2 1 0	
Comment						
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.		
	Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	5	10 9	8 7 6	5 4 3	2 1 0	
Comment						
Total Score: 108		Ecoregion:			Drainage Area:	

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby



Date: 8/27/2021
Location: Avenue A



Date: 8/27/2021
Location: Avenue A



Date: 8/27/2021
Location: Avenue A



Date: 8/27/2021
Location: Avenue A

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	4.29.22		Time:		
Monitoring Location:	CHICKEN TRIBUTARY				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					

6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.	
Score	12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.	
Score	17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
Score (Left Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	9	10 9	8 7 6	5 4 3	2 1 0
Comment					
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)	
Score (Left Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Comment					
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.	
Score (Left Bank)	3	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Comment					
Total Score:	142	Ecoregion:			Drainage Area:

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby



Date: 4/29/2022
Location: Chicken Tributary



Date: 4/29/2022
Location: Chicken Tributary



Date: 4/29/2022
Location: Chicken Tributary



Date: 4/29/2022
Location: Chicken Tributary

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	MULTIPLE		Time:		
Monitoring Location:	MARY VESTAL PARK				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment	Base flow is not bank full flow for this segment of creek.																				

6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.	
Score	8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment	This segment of creek appears to have a lot of historical channelization, and long straight segments in places.				
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.	
Score	17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Comment					
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)	
Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	3	10 9	8 7 6	5 4 3	2 1 0
Comment					
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.	
Score (Left Bank)	9	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Comment	Located in Mary Vestal Park.				
Total Score:	122	Ecoregion:			Drainage Area:

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby



Date: 4/22/2022
Location: Mary Vestal Park



Date: 4/22/2022
Location: Mary Vestal Park



Date: 7/30/2021
Location: Mary Vestal Park



Date: 7/30/2021
Location: Mary Vestal Park

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	3/25/2022		Time:		
Monitoring Location:	MARY VESTAL TRIBUTARY				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					

6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.	
Score	8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.	
Score	15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
Score (Left Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	3	10 9	8 7 6	5 4 3	2 1 0
Comment					
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)	
Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	3	10 9	8 7 6	5 4 3	2 1 0
Comment					
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.	
Score (Left Bank)	9	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	9	10 9	8 7 6	5 4 3	2 1 0
Comment					
Total Score:	118	Ecoregion:			Drainage Area:

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby



Date: 3/25/2022
Location: Mary Vestal Trib



Date: 3/25/2022
Location: Mary Vestal Trib



Date: 3/25/2022
Location: Mary Vestal Trib



Date: 3/25/2022
Location: Mary Vestal Trib

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	8/27/2021		Time:		
Monitoring Location:	SOUTH KNOX COMMUNITY CENTER				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

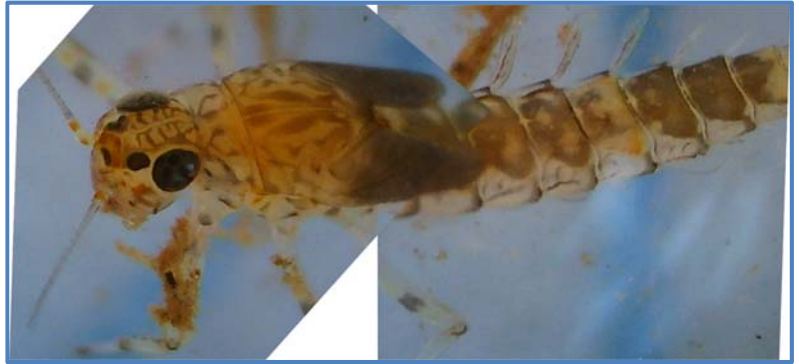
		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment	Scored a little higher because of aquatic plants in the channel and at edge of banks																				
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					

6. Channel Alteration	Channelization, dredging or rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.		
	Score	10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment						
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.		
	Score	16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment						
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
	Score (Left Bank)	8	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	8	10 9	8 7 6	5 4 3	2 1 0	
Comment						
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)		
	Score (Left Bank)	2	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	2	10 9	8 7 6	5 4 3	2 1 0	
Comment						
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.		
	Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	5	10 9	8 7 6	5 4 3	2 1 0	
Comment						
Total Score: 108		Ecoregion:			Drainage Area:	

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby

Date: 8/27/2021
Location:
South Knox Community Center.
Composite Image.



Date: 8/27/2021
Location: South Knox Community Center. Composite Image.



Date: 8/27/2021
Location: South Knox Community Center.



Date: 8/27/2021
Location: South Knox Community Center.

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	3/25/2022		Time:		
Monitoring Location:	WEST BLOUNT AVENUE				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					

6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.	
Score	7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment	Downstream of the petroleum monitoring well				
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.	
Score	15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
Score (Left Bank)	7	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	8	10 9	8 7 6	5 4 3	2 1 0
Comment					
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)	
Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	2	10 9	8 7 6	5 4 3	2 1 0
Comment					
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.	
Score (Left Bank)	2	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	4	10 9	8 7 6	5 4 3	2 1 0
Comment					
Total Score:	122	Ecoregion:			Drainage Area:

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby



Date: 3/25/2022
Location: West Bount Avenue



Date: 3/25/2022
Location: West Blount Avenue



Date: 3/25/2022
Location: West Bount Avenue



Date: 3/25/2022
Location: West Bount Avenue

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS

Complete this habitat assessment if **SQKICK** is collected.

(See Macroinvertebrate SOP - Protocol E for detailed descriptions and rank information)

DWR Station ID:					Habitat Assessment By:					
Monitoring Location Name:	GOOSE CREEK				Date:	7/30/2021		Time:		
Monitoring Location:	YOUNG HIGH PIKE				Field Log Number:					
HUC:	60102010204	WS Group:		Ecoregion:	67f	QC:		<input type="checkbox"/>	Consensus	

Habitat Type: HG

If QA/QC 2 habitats are completed independently, check box above.

See most recent [Macroinvertebrate SOP](#) Protocol D-1 for specific instructions for completing this information.

For each habitat parameter, type score or select from blue dropdown box. Add comments if needed in row below score.

		Optimal					Suboptimal					Marginal					Poor				
1. Epifaunal Substrate/ Available Cover		Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
Score	11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
2. Embeddedness of Riffles		Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
Score	16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
3. Velocity/ Depth Regime		All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
4. Sediment Deposition		Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
Score	15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					
5. Channel Flow Status		Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
Score	16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comment																					

6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.	
Score	14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
7. Frequency of re-oxygenation zones Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.	
Score	18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comment					
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
Score (Left Bank)	8	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	9	10 9	8 7 6	5 4 3	2 1 0
Comment					
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)	
Score (Left Bank)	2	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Comment					
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.	
Score (Left Bank)	5	10 9	8 7 6	5 4 3	2 1 0
Score (Right Bank)	8	10 9	8 7 6	5 4 3	2 1 0
Comment					
Total Score:	142	Ecoregion:			Drainage Area:

Invertebrate Sampling COK Stream Sampling Photo Sheet

Project: Water Quality Monitoring 2021-2022	Participant 1: George Nennstiel
Watershed: Goose Creek	Participant 2: Charissa Oglesby



Date: 7/30/2021
Location: Young High Pike



Date: 7/30/2021
Location: Young High Pike



Date: 7/30/2021
Location: Young High Pike



Date: 7/30/2021
Location: Young High Pike

Appendix D

Full Suite Sample: Williams Creek

City of Knoxville-SW Management

Sample Delivery Group: L1486519
Samples Received: 04/27/2022
Project Number:
Description: Stormwater Full Suite

Report To: Charissa Oglesby
City-County Bldg 400 Main St
Room 303D
Knoxville, TN 37902

Entire Report Reviewed By:



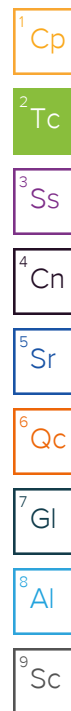
Stacy Kennedy
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

Pace Analytical National12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page	1
Tc: Table of Contents	2
Ss: Sample Summary	3
Cn: Case Narrative	4
Sr: Sample Results	5
GRAB WILLIAMS CREEK FULL SUITE L1486519-01	5
Qc: Quality Control Summary	10
Gravimetric Analysis by Method 2540 C-2011	10
Gravimetric Analysis by Method 2540 D-2015	11
Wet Chemistry by Method 1664A	12
Wet Chemistry by Method 350.1	13
Wet Chemistry by Method 351.2	14
Wet Chemistry by Method 353.2	15
Wet Chemistry by Method 365.4	16
Wet Chemistry by Method 410.4	17
Wet Chemistry by Method 420.4	18
Wet Chemistry by Method 4500CN E-2016	19
Wet Chemistry by Method 4500P E-2011	20
Wet Chemistry by Method 5210 B-2016	21
Mercury by Method 245.1	22
Metals (ICP) by Method 200.7	23
Volatile Organic Compounds (GC/MS) by Method 624.1	25
Pesticides (GC) by Method EPA 608.3	27
Polychlorinated Biphenyls (GC) by Method EPA-608.3	30
Semi Volatile Organic Compounds (GC/MS) by Method 625.1	31
Gl: Glossary of Terms	36
Al: Accreditations & Locations	37
Sc: Sample Chain of Custody	38



SAMPLE SUMMARY

GRAB WILLIAMS CREEK FULL SUITE L1486519-01 WW

Collected by: Trey N
 Collected date/time: 04/26/22 08:30
 Received date/time: 04/27/22 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Gravimetric Analysis by Method 2540 C-2011	WG1857948	1	05/03/22 11:57	05/03/22 16:13	SJF	Mt. Juliet, TN
Gravimetric Analysis by Method 2540 D-2015	WG1856113	1	04/28/22 20:20	04/29/22 00:15	SJF	Mt. Juliet, TN
Wet Chemistry by Method 1664A	WG1856476	1	04/29/22 17:57	05/01/22 16:35	IJC	Mt. Juliet, TN
Wet Chemistry by Method 350.1	WG1856042	1	05/03/22 11:01	05/03/22 11:01	SL	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1858600	1	05/06/22 09:18	05/07/22 11:46	LDT	Mt. Juliet, TN
Wet Chemistry by Method 353.2	WG1857625	1	05/02/22 21:29	05/02/22 21:29	CAT	Mt. Juliet, TN
Wet Chemistry by Method 365.4	WG1860315	1	05/06/22 09:18	05/07/22 11:23	LDT	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG1858392	1	05/04/22 12:04	05/04/22 17:02	JAR	Mt. Juliet, TN
Wet Chemistry by Method 420.4	WG1860286	1	05/11/22 07:54	05/11/22 16:00	CAT	Mt. Juliet, TN
Wet Chemistry by Method 4500CN E-2016	WG1857967	1	05/05/22 07:05	05/05/22 14:01	LDT	Mt. Juliet, TN
Wet Chemistry by Method 4500P E-2011	WG1855167	1	04/27/22 16:18	04/27/22 16:18	AW	Mt. Juliet, TN
Wet Chemistry by Method 5210 B-2016	WG1855105	1	04/27/22 13:59	05/02/22 10:22	ABA	Mt. Juliet, TN
Mercury by Method 245.1	WG1857957	1	05/09/22 09:12	05/10/22 14:03	ABL	Mt. Juliet, TN
Metals (ICP) by Method 200.7	WG1855547	1	05/03/22 18:49	05/05/22 01:55	CCE	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 624.1	WG1855518	1	04/27/22 23:39	04/27/22 23:39	JHH	Mt. Juliet, TN
Pesticides (GC) by Method EPA 608.3	WG1855214	1	04/28/22 12:58	04/29/22 21:38	AMM	Mt. Juliet, TN
Polychlorinated Biphenyls (GC) by Method EPA-608.3	WG1855214	1	04/28/22 12:58	04/29/22 21:38	AMM	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 625.1	WG1856671	1	04/30/22 05:02	04/30/22 19:12	JNJ	Mt. Juliet, TN

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Stacy Kennedy
Project Manager

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

⁸ Al

⁹ Sc

Additional Information - Results for field analyses are not accredited to ISO 17025

Analyte	Result	Units
pH (On Site)	7	su
Temperature (on-site)	65	deg F

Gravimetric Analysis by Method 2540 C-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Dissolved Solids	104		10.0	1	05/03/2022 16:13	WG1857948

Gravimetric Analysis by Method 2540 D-2015

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Suspended Solids	37.7	<u>J3</u>	7.15	1	04/29/2022 00:15	WG1856113

Wet Chemistry by Method 1664A

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Oil & Grease (Hexane Extr)	ND		5.88	1	05/01/2022 16:35	WG1856476

Wet Chemistry by Method 350.1

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Ammonia Nitrogen	ND		0.250	1	05/03/2022 11:01	WG1856042

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	ND		0.250	1	05/07/2022 11:46	WG1858600

Wet Chemistry by Method 353.2

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Nitrate-Nitrite	0.524		0.100	1	05/02/2022 21:29	WG1857625

Wet Chemistry by Method 365.4

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Phosphorus, Total	0.111		0.100	1	05/07/2022 11:23	WG1860315

Wet Chemistry by Method 410.4

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
COD	40.6		20.0	1	05/04/2022 17:02	WG1858392

Wet Chemistry by Method 420.4

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Total Phenol by 4AAP	ND		0.0400	1	05/11/2022 16:00	WG1860286

Wet Chemistry by Method 4500CN E-2016

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

Wet Chemistry by Method 4500CN E-2016

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Cyanide	ND		0.00500	1	05/05/2022 14:01	WG1857967

Wet Chemistry by Method 4500P E-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Phosphate,Ortho	0.346	<u>J6</u>	0.0300	1	04/27/2022 16:18	WG1855167

Wet Chemistry by Method 5210 B-2016

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
BOD	9.73	<u>B1 K9</u>	3.33	1	05/02/2022 10:22	WG1855105

Mercury by Method 245.1

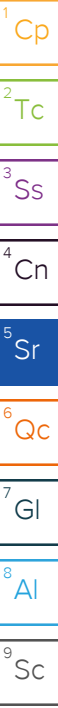
Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Mercury	ND		0.000200	1	05/10/2022 14:03	WG1857957

Metals (ICP) by Method 200.7

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Antimony	ND		0.0100	1	05/05/2022 01:55	WG1855547
Arsenic	ND		0.0100	1	05/05/2022 01:55	WG1855547
Beryllium	ND		0.00200	1	05/05/2022 01:55	WG1855547
Cadmium	ND		0.00200	1	05/05/2022 01:55	WG1855547
Chromium	ND		0.0100	1	05/05/2022 01:55	WG1855547
Copper	ND		0.0100	1	05/05/2022 01:55	WG1855547
Lead	ND		0.00500	1	05/05/2022 01:55	WG1855547
Nickel	ND		0.0100	1	05/05/2022 01:55	WG1855547
Selenium	ND		0.0100	1	05/05/2022 01:55	WG1855547
Silver	ND		0.00500	1	05/05/2022 01:55	WG1855547
Thallium	ND		0.0100	1	05/05/2022 01:55	WG1855547
Zinc	ND		0.0500	1	05/05/2022 01:55	WG1855547

Volatile Organic Compounds (GC/MS) by Method 624.1

Analyte	Result	Qualifier	RDL	Dilution	Analysis date / time	Batch
Acrolein	ND		0.0500	1	04/27/2022 23:39	WG1855518
Acrylonitrile	ND		0.0100	1	04/27/2022 23:39	WG1855518
Benzene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Bromodichloromethane	ND		0.00100	1	04/27/2022 23:39	WG1855518
Bromoform	ND		0.00100	1	04/27/2022 23:39	WG1855518
Bromomethane	ND		0.00500	1	04/27/2022 23:39	WG1855518
Carbon tetrachloride	ND		0.00100	1	04/27/2022 23:39	WG1855518
Chlorobenzene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Chlorodibromomethane	ND		0.00100	1	04/27/2022 23:39	WG1855518
Chloroethane	ND		0.00500	1	04/27/2022 23:39	WG1855518
2-Chloroethyl vinyl ether	ND		0.0500	1	04/27/2022 23:39	WG1855518
Chloroform	ND		0.00500	1	04/27/2022 23:39	WG1855518
Chloromethane	ND		0.00250	1	04/27/2022 23:39	WG1855518
1,2-Dichlorobenzene	ND		0.00100	1	04/27/2022 23:39	WG1855518
1,3-Dichlorobenzene	ND		0.00100	1	04/27/2022 23:39	WG1855518
1,4-Dichlorobenzene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Dichlorodifluoromethane	ND		0.00500	1	04/27/2022 23:39	WG1855518
1,1-Dichloroethane	ND		0.00100	1	04/27/2022 23:39	WG1855518



Volatile Organic Compounds (GC/MS) by Method 624.1

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
1,2-Dichloroethane	ND		0.00100	1	04/27/2022 23:39	WG1855518
1,1-Dichloroethene	ND		0.00100	1	04/27/2022 23:39	WG1855518
trans-1,2-Dichloroethene	ND		0.00100	1	04/27/2022 23:39	WG1855518
1,2-Dichloropropane	ND		0.00100	1	04/27/2022 23:39	WG1855518
cis-1,3-Dichloropropene	ND		0.00100	1	04/27/2022 23:39	WG1855518
trans-1,3-Dichloropropene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Ethylbenzene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Methylene Chloride	ND		0.00500	1	04/27/2022 23:39	WG1855518
1,1,2,2-Tetrachloroethane	ND		0.00100	1	04/27/2022 23:39	WG1855518
Tetrachloroethene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Toluene	ND		0.00100	1	04/27/2022 23:39	WG1855518
1,1,1-Trichloroethane	ND		0.00100	1	04/27/2022 23:39	WG1855518
1,1,2-Trichloroethane	ND		0.00100	1	04/27/2022 23:39	WG1855518
Trichloroethene	ND		0.00100	1	04/27/2022 23:39	WG1855518
Trichlorofluoromethane	ND		0.00500	1	04/27/2022 23:39	WG1855518
Vinyl chloride	ND		0.00100	1	04/27/2022 23:39	WG1855518
Total Xylenes	ND		0.00300	1	04/27/2022 23:39	WG1855518
(S) Toluene-d8	99.9		80.0-120		04/27/2022 23:39	WG1855518
(S) 4-Bromofluorobenzene	97.6		80.0-120		04/27/2022 23:39	WG1855518
(S) 1,2-Dichloroethane-d4	92.5		70.0-130		04/27/2022 23:39	WG1855518

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

Pesticides (GC) by Method EPA 608.3

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Aldrin	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Alpha BHC	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Beta BHC	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Delta BHC	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Gamma BHC	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Chlordane	ND		0.00500	1	04/29/2022 21:38	WG1855214
4,4-DDD	ND		0.0000500	1	04/29/2022 21:38	WG1855214
4,4-DDE	ND		0.0000500	1	04/29/2022 21:38	WG1855214
4,4-DDT	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Dieldrin	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Endosulfan I	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Endosulfan II	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Endosulfan sulfate	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Endrin	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Endrin aldehyde	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Endrin ketone	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Heptachlor	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Heptachlor epoxide	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Hexachlorobenzene	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Methoxychlor	ND		0.0000500	1	04/29/2022 21:38	WG1855214
Toxaphene	ND		0.000500	1	04/29/2022 21:38	WG1855214
gamma-Chlordane	ND		0.0000500	1	04/29/2022 21:38	WG1855214
alpha-Chlordane	ND		0.0000500	1	04/29/2022 21:38	WG1855214
(S) Decachlorobiphenyl	67.5		10.0-144		04/29/2022 21:38	WG1855214
(S) Tetrachloro-m-xylene	90.4		10.0-135		04/29/2022 21:38	WG1855214

Polychlorinated Biphenyls (GC) by Method EPA-608.3

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
PCB 1016	ND		0.000500	1	04/29/2022 21:38	WG1855214
PCB 1221	ND		0.000500	1	04/29/2022 21:38	WG1855214
PCB 1232	ND		0.000500	1	04/29/2022 21:38	WG1855214
PCB 1242	ND		0.000500	1	04/29/2022 21:38	WG1855214
PCB 1248	ND		0.000500	1	04/29/2022 21:38	WG1855214
PCB 1254	ND		0.000500	1	04/29/2022 21:38	WG1855214
PCB 1260	ND		0.000500	1	04/29/2022 21:38	WG1855214
Total PCBs	ND		0.000500	1	04/29/2022 21:38	WG1855214
(S) Decachlorobiphenyl	70.6		10.0-144		04/29/2022 21:38	WG1855214
(S) Tetrachloro-m-xylene	93.9		10.0-135		04/29/2022 21:38	WG1855214

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Acenaphthene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Acenaphthylene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Anthracene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Benzidine	ND		0.0100	1	04/30/2022 19:12	WG1856671
Benzo(a)anthracene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Benzo(b)fluoranthene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Benzo(k)fluoranthene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Benzo(g,h,i)perylene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Benzo(a)pyrene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Bis(2-chloroethoxy)methane	ND		0.0100	1	04/30/2022 19:12	WG1856671
Bis(2-chloroethyl)ether	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,2-Oxybis(1-Chloropropane)	ND		0.0100	1	04/30/2022 19:12	WG1856671
4-Bromophenyl-phenylether	ND		0.0100	1	04/30/2022 19:12	WG1856671
2-Chloronaphthalene	ND		0.00100	1	04/30/2022 19:12	WG1856671
4-Chlorophenyl-phenylether	ND		0.0100	1	04/30/2022 19:12	WG1856671
Chrysene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Dibenz(a,h)anthracene	ND		0.00100	1	04/30/2022 19:12	WG1856671
3,3-Dichlorobenzidine	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,4-Dinitrotoluene	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,6-Dinitrotoluene	ND		0.0100	1	04/30/2022 19:12	WG1856671
1,2-Diphenylhydrazine	ND		0.0100	1	04/30/2022 19:12	WG1856671
Fluoranthene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Fluorene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Hexachlorobenzene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Hexachloro-1,3-butadiene	ND		0.0100	1	04/30/2022 19:12	WG1856671
Hexachlorocyclopentadiene	ND		0.0100	1	04/30/2022 19:12	WG1856671
Hexachloroethane	ND		0.0100	1	04/30/2022 19:12	WG1856671
Indeno(1,2,3-cd)pyrene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Isophorone	ND		0.0100	1	04/30/2022 19:12	WG1856671
Naphthalene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Nitrobenzene	ND		0.0100	1	04/30/2022 19:12	WG1856671
n-Nitrosodimethylamine	ND		0.0100	1	04/30/2022 19:12	WG1856671
n-Nitrosodiphenylamine	ND		0.0100	1	04/30/2022 19:12	WG1856671
n-Nitrosodi-n-propylamine	ND		0.0100	1	04/30/2022 19:12	WG1856671
Phenanthrene	ND		0.00100	1	04/30/2022 19:12	WG1856671
Benzylbutyl phthalate	ND		0.00300	1	04/30/2022 19:12	WG1856671
Bis(2-ethylhexyl)phthalate	ND		0.00300	1	04/30/2022 19:12	WG1856671
Di-n-butyl phthalate	ND		0.00300	1	04/30/2022 19:12	WG1856671
Diethyl phthalate	ND		0.00300	1	04/30/2022 19:12	WG1856671
Dimethyl phthalate	ND		0.00300	1	04/30/2022 19:12	WG1856671
Di-n-octyl phthalate	ND		0.00300	1	04/30/2022 19:12	WG1856671
Pyrene	ND		0.00100	1	04/30/2022 19:12	WG1856671

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

Semi Volatile Organic Compounds (GC/MS) by Method 625.1

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		0.0100	1	04/30/2022 19:12	WG1856671
4-Chloro-3-methylphenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
2-Chlorophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,4-Dichlorophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,4-Dimethylphenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
4,6-Dinitro-2-methylphenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,4-Dinitrophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
2-Nitrophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
4-Nitrophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
Pentachlorophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
Phenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
2,4,6-Trichlorophenol	ND		0.0100	1	04/30/2022 19:12	WG1856671
(S) Nitrobenzene-d5	70.9		15.0-314		04/30/2022 19:12	WG1856671
(S) 2-Fluorobiphenyl	53.2		22.0-127		04/30/2022 19:12	WG1856671
(S) p-Terphenyl-d14	34.2		29.0-141		04/30/2022 19:12	WG1856671
(S) Phenol-d5	15.3		8.00-424		04/30/2022 19:12	WG1856671
(S) 2-Fluorophenol	19.1		10.0-120		04/30/2022 19:12	WG1856671
(S) 2,4,6-Tribromophenol	40.8		10.0-153		04/30/2022 19:12	WG1856671

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

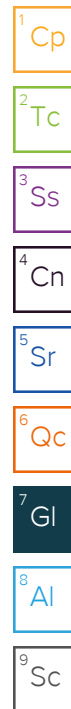
Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier Description

B1	The blank depletion was greater than the recommended maximum depletion of 0.2mg/L.
J3	The associated batch QC was outside the established quality control range for precision.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
K9	Test replicates show more than 30% difference between high and low values.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.



ACCREDITATIONS & LOCATIONS

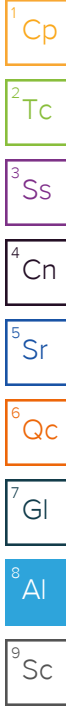
Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico ¹	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina ¹	DW21704
Georgia	NELAP	North Carolina ³	41
Georgia ¹	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1,6}	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1,4}	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas ⁵	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ⁶ Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

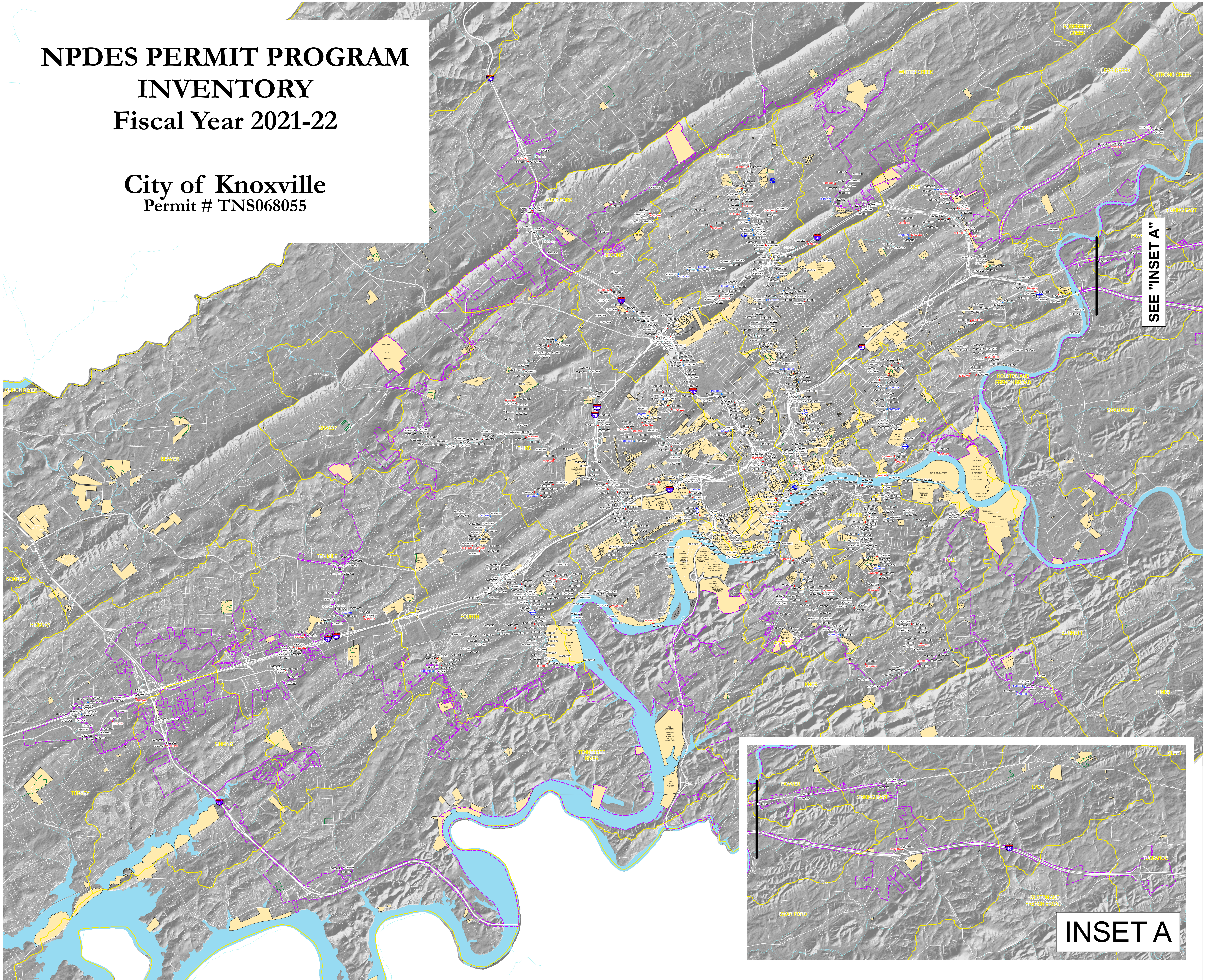
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.



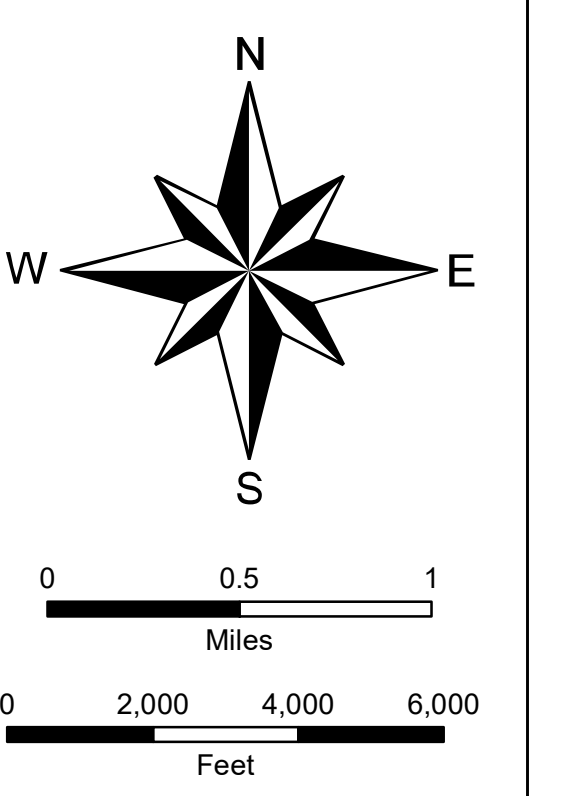
NPDES PERMIT PROGRAM INVENTORY Fiscal Year 2021-22

City of Knoxville
Permit # TNS068055

- Dry
- Wet
- Not Sampled
- Sampling Station
- Rain Gauge
- Knoxville Corporate Limits
- Watershed Basins
- Public Lands
- Waterbodies
- Creeks & Streams
- Knox County Boundary



SEE "INSET A"



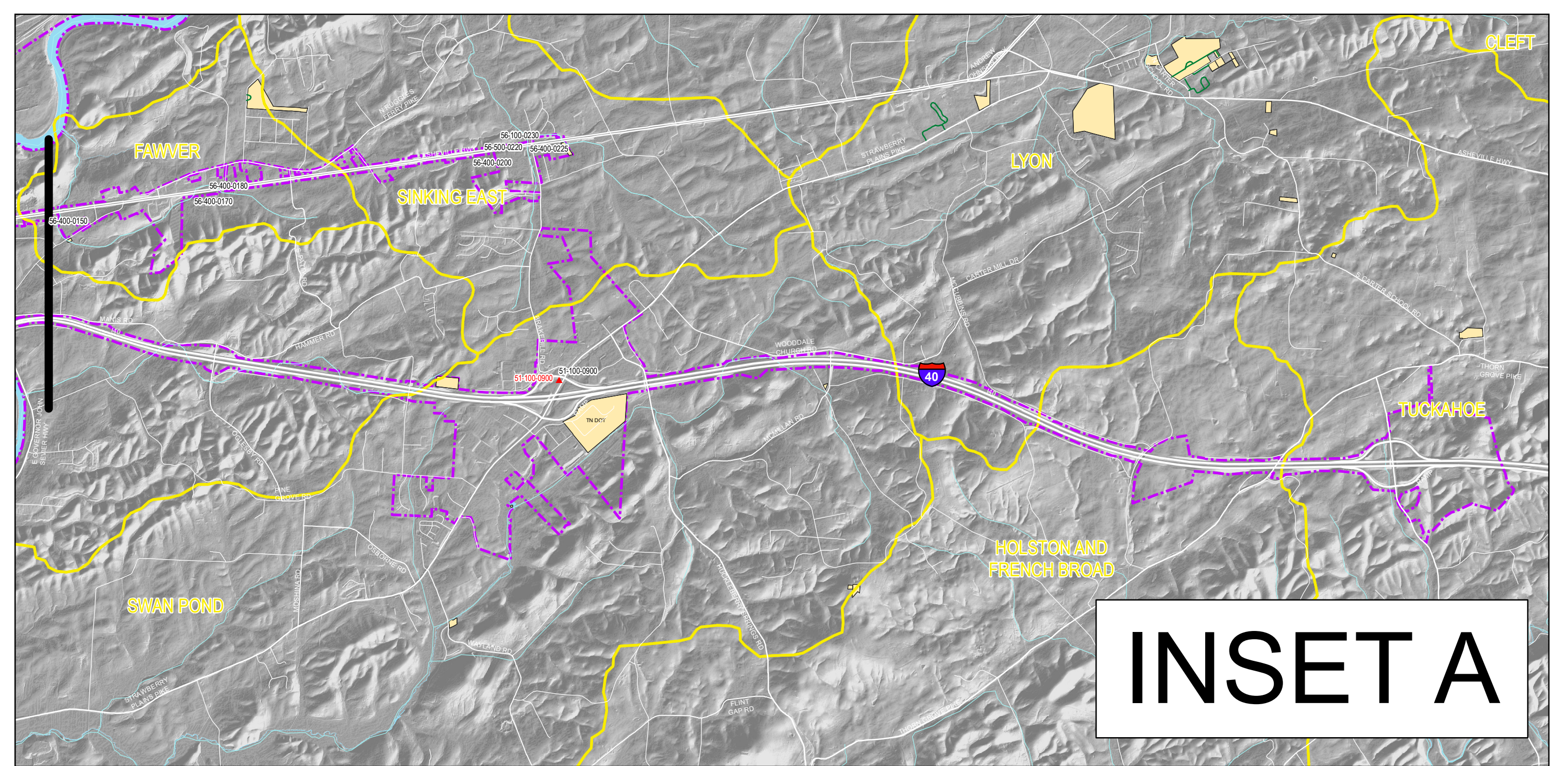
Date Created: 11/30/2022
Created By: R. Taylor

MAP DATA TAKEN FROM
AERIAL SURVEY OF KNOXVILLE
AND KNOX COUNTY. THIS MAP IS
INTENDED TO MEET NATIONAL MAP
ACCURACY STANDARDS AT THE
COMPILATION SCALE

DISCLAIMER
This map product was prepared from a Geographic Information System (GIS) jointly established by the City of Knoxville, Knox County, and the Knoxville Utilities Board for their internal purposes only, and was not designed or intended for general use by members of the public. The KGIS Policy Board, its employees, agents and personnel, make no representation or warranty as to its accuracy, and in particular, its accuracy as to labeling, dimensions, contours, property boundaries, or placement or location of any map features thereon. The KGIS Policy Board, its employees, agents and personnel, MAKE NO WARRANTY OF MERCHANTABILITY OR WARRANTY FOR FITNESS OF USE FOR A PARTICULAR PURPOSE. EXPRESS OR IMPLIED FOR FITNESS OF USE for a particular purpose, express or implied with respect to this map product. Any use of this map product, and further covenants and agrees to hold personnel, harmless from and against any damage, loss, or liability arising from any use of the map product.

Independent verification of all data contained on this map product should be obtained by any user of this map product. The KGIS Policy Board, its employees, agents and personnel, disclaims, and shall not be held liable for any and all damage, loss or liability, whether direct, indirect, or consequential which arises or may arise from this map product or the use thereof by any person or entity.

This map product has been copyrighted by the KGIS Policy Board. The KGIS Policy Board hereby reserves all rights therein, and neither this map product, nor any portion thereof, may be reproduced in any form or by any means without the express written authorization of KGIS Policy Board or its agents.



INSET A