Appendix J to the Houston-Galveston Area Council (H-GAC) Multi-Basin Clean Rivers Program FY 2020/2021

Targeted Monitoring in 10 Selected Assessment Units (AUs)

Prepared by the H-GAC in cooperation with the Texas Commission on Environmental Quality (TCEQ)

Effective: Immediately upon approval by all parties

Questions concerning this QAPP should be directed to:
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SS-A1 Approval Page

Texas Commission on Environmental Quality

Water Quality Planning Division

Electronically Approved 10/22/2020

Rebecca DuPont, Work Leader Date
Clean Rivers Program

Electronically Approved 10/22/2020

Jenna Wadman Date
Project Manager, CRP

Electronically Approved 10/22/2020

Rebecca DuPont Date
Acting CRP Project Quality Assurance Specialist

Monitoring Division

Electronically Approved 10/22/2020

Dana Squires Date
Lead CRP Quality Assurance Specialist
Laboratory and Quality Assurance Section

Houston-Galveston Area Council (H-GAC)

Electronically Approved	10/22/2020	*Electronically Approved*	10/22/2020
Todd Running H-GAC Project Manager	Date	Jean Wright H-GAC Quality Assurance Officer	Date

The H-GAC will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or added appendices of this plan. Signatures in section A1 will eliminate the need for adherence letters to be maintained. The H-GAC will maintain this documentation as part of the project's quality assurance records, and will ensure the documentation is available for review.

See sample letter in Appendix SS-1 of this document.

Eastex Environmental Laboratory, Inc. (Coldspring, TX)

Electronically Approved 10/22/2020

Natalia Bondar Date
Eastex Lab Technical Director

Electronically Approved 10/22/2020

Tiffany Guerrero Date
Eastex Lab Quality Assurance Officer

SS-A2 Table of Contents

List of Acronyms

As described in Section A2 of the basin-wide QAPP plus the following:

BIG	Bacteria Implementation Group
CFU	Colony-Forming Unit of Bacteria
Geomean	Geometric Mean
GBEP	Galveston Bay Estuary Program
IDDE	Illicit Discharge Detection and Elimination
I-Plan	Implementation Plan
LU/LC	Land Use/Land Cover
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
OSSF	On-site Sewage Facility
PM	Project Manager
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WWTF	Wastewater Treatment Facility

SS-A3 Distribution List

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The H-GAC will provide copies of this project plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, subparticipants, or other units of government. The H-GAC will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and ensure the documentation is available for review. Sub-Tier participants & Laboratories which may assist with project and therefore will receive copies of this QAPP include:

- City of Houston, Houston Health Department & Laboratory
- Environmental Institute of Houston, University of Houston-Clear Lake
- Texas Research Institute for Environmental Studies & Laboratory
- Eastex Environmental Laboratory

SS-A4 PROJECT/TASK ORGANIZATION

Description of Responsibilities

TCEQ

Rebecca DuPont
CRP Work Leader
Responsible for Texas Commission on Environmental Quality (TCEQ) activities supporting the development and implementation of the Texas Clean Rivers Program (CRP). Responsible for verifying that the TCEQ Quality Management Plan (QMP) is followed by CRP staff. Supervises TCEQ CRP staff. Reviews and responds to any deficiencies, corrective actions, or findings related to the area of responsibility. Oversees the development of Quality Assurance (QA) guidance for the CRP. Reviews and approves all QA audits, corrective actions, reports, work plans, contracts, QAPPs, and TCEQ Quality Management Plan. Enforces corrective action, as required, where QA protocols are not met. Ensures CRP personnel are fully trained.

Dana Squires
Lead CRP Lead Quality Assurance Specialist
Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Assists program and project manager in developing and implementing quality system. Serves on planning team for CRP special projects. Coordinates the review and approval of CRP QAPPs. Prepares and distributes annual audit plans. Conducts monitoring systems audits of Planning Agencies. Concurs with and monitors implementation of corrective actions. Conveys QA problems to appropriate management. Recommends that work be stopped in order to safeguard programmatic objectives, worker safety, public health, or environmental protection. Ensures maintenance of QAPPs and audit records for the CRP.

Jenna Wadman
CRP Project Manager
Responsible for the development, implementation, and maintenance of CRP contracts. Tracks, reviews, and approves deliverables. Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Assists CRP Lead QA Specialist in conducting Basin Planning Agency audits. Verifies QAPPs are being followed by contractors and that projects are producing data of known quality. Coordinates project planning with the Basin Planning Agency Project Manager. Reviews and approves data and reports produced by contractors. Notifies QA Specialists of circumstances which may adversely affect the quality of data derived from the collection and analysis of samples. Develops, enforces, and monitors corrective action measures to ensure contractors meet deadlines and scheduled commitments.

Rebecca DuPont
Acting CRP Project Quality Assurance Specialist
Serves as liaison between CRP management and TCEQ QA management. Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program

Guidance, SOPs, QAPPs, QMP). Serves on planning team for CRP special projects and reviews QAPPs in coordination with other CRP staff. Coordinates documentation and implementation of corrective action for the CRP.

Houston-Galveston Area Council (H-GAC)

Todd Running
H-GAC Project Manager
Responsible for implementing and monitoring CRP requirements in contracts, QAPPs, and QAPP amendments and appendices. Coordinates basin planning activities and work of basin partners. Ensures monitoring systems audits are conducted to ensure QAPPs are followed by the H-GAC and basin partners and that projects are producing data of known quality. Ensures that basin partners are qualified to perform contracted work. Ensures CRP project managers and/or QA Specialists are notified of deficiencies and corrective actions, and that issues are resolved. Responsible for confirming that data collected are validated and are acceptable for reporting to the TCEQ.

Jean Wright
H-GAC Quality Assurance Officer
Responsible for coordinating the implementation of the HGAC CRP QA program. Responsible for writing and maintaining the Multi-Basin QAPP and monitoring its implementation. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for maintaining written records of basin partner commitment to requirements specified in this QAPP as needed. Responsible for identifying, receiving, and maintaining project QA records. Responsible for coordinating with the TCEQ QAS to resolve QA-related issues. Notifies the H-GAC Project Manager of particular circumstances which may adversely affect the quality of data. Coordinates and monitors deficiencies and corrective action. Coordinates and maintains records of data verification and validation. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Conducts monitoring systems audits on basin partners to determine compliance with project and program specifications, issues written reports, and follows through on findings. Ensures that field staff is properly trained and that training records are maintained.

Jessica Casillas
Acting H-GAC Data Manager
Responsible for ensuring that field and laboratory data collected by or submitted to H-GAC CRP are properly reviewed, verified, and validated. Responsible for the transfer of basin quality-assured water quality data to the TCEQ in the format described in the DMRG, most recent version. Maintains quality-assured data on H-GAC internet sites.

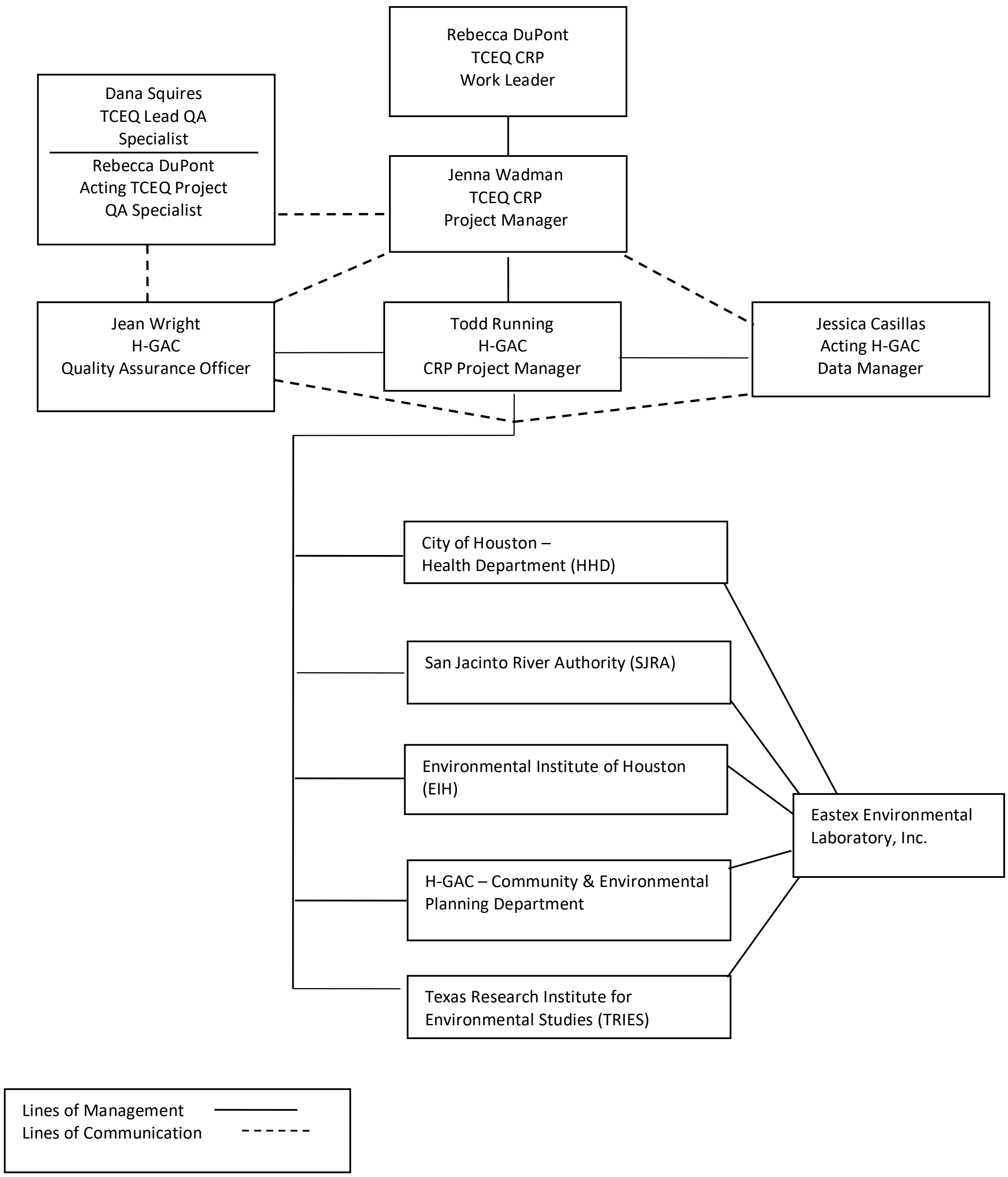
Eastex Environmental Laboratory (Eastex) (Coldspring, TX, facility only)

Natalia Bondar
Laboratory Technical Director - Eastex Environmental Lab (Contract Lab)
Responsible for the overall performance, administration, and reporting of analyses performed by Eastex Environmental Laboratory (Coldspring, TX). Responsible for supervision of laboratory personnel involved in generating analytical data for the project. Ensures that laboratory personnel have adequate training and a thorough knowledge of this QAPP and related SOPs. Responsible for oversight of all laboratory operations ensuring that all QA/QC requirements are met, documentation is complete and adequately maintained, and results are reported accurately.

Tiffany Guerrero
Eastex Lab QAO
Responsible for the overall quality control and quality assurance of analyses performed by Eastex Environmental Laboratory (Coldspring, TX). Monitors the implementation of the QM/QAPP within the laboratory to ensure complete compliance with QA data quality objectives, as defined by this QAPP. Coordinates and monitors deficiencies and corrective actions. Conducts in-house audits to ensure compliance with written SOPs and to identify potential problems. Responsible for supervising and verifying all aspects of the QA/QC in the laboratory.

Project Organization Chart

Figure SS-A4.1. Organization Chart - Lines of Communication



SS-A5 Problem Definition/Background

Clean Rivers Program (CRP) routine monitoring data is analyzed each year as part of the Houston-Galveston Area Council (H-GAC) Basin Summary/Basin Highlights Reporting process. Bacteria continues to be the most prevalent pollutant in the H-GAC CRP Basins. The Bacteria Implementation Group (BIG), which was formed in 2008 and oversees the TMDL Implementation Plan, required that H-GAC produce a list of the water bodies with the highest bacteria concentrations in the BIG project area and conduct targeted monitoring that would help identify sources of bacteria in the BIG project area. That monitoring was conducted several years ago under a grant from the Galveston Bay Estuary Program (GBEP) and was highly successful. While many large sources of bacteria were discovered and have been fixed or are scheduled to be fixed, stakeholders throughout the region have an interest in conducting more of this type of sampling due to its positive impact on water quality.

In the 2020-2021 fiscal years, H-GAC CRP, using information from previous Basin Highlights/Summary Reports and the BIG annual reports, will address selected waterways to refine our spatial understanding of where extremely high bacterial concentrations are found in these waterways. The project will be fully documented to demonstrate the value of a prioritized watershed and targeted monitoring approach.

SS-A6 Project/Task Description

In 2019, H-GAC analyzed bacteria data to develop a list of the water bodies within H-GAC's CRP Basins with the highest bacteria concentrations. A seven-year geometric mean (geomean) analysis defining the severity of impairment was performed on two levels. First, the TCEQ-delineated individual assessment units (AUs) were ranked from highest geomean to lowest geomean. Secondly, the seven-year geomean per individual sample stations was calculated to help with ranking. After the data analysis was completed, H-GAC ranked water bodies at the AU level using the highest geomean relative to the state standards for contact recreation. The AUs were prioritized based upon a comparison between the geomeans and the state water quality standards. See Phase 1 for how this was calculated.

This project will use data collected through both direct and non-direct means. To simplify and monitor progress, this project has been split into three phases.

Phase 1

In 2019, H-GAC conducted a data analysis of all impaired waterbodies in its CRP basins to identify the AUs with the highest bacterial contamination. The data analysis used previously collected ambient monitoring data gathered by H-GAC and its local partners through the quality-assured Texas Clean Rivers Program (CRP) and TCEQ Surface Water Quality Monitoring (SWQM) Program. These data were downloaded from SWQMIS to ensure only approved, quality assured data were used. Data analysis produced a list of AUs that were prioritized based upon the geometric mean calculated for the most recent seven-year period in comparison with the state water quality standards for contact recreation. The list was first ranked from highest to lowest geomeans, then organized into categories of those AUs with geomeans greater than 20 times the standard, 15-20 times the standard, 10-15 times the standard, 5-10 times the standard, and less than 5 times the standard. Next, H-GAC staff conducted a cursory desk review using general GIS Aerial Image Review to identify which AU catchment areas could be categorized as urban, sub-urban, or rural land cover/land use and which AUs appeared to have accessibility to the stream for field investigations. H-GAC's desk review was based upon five criteria: bacteria level, waterway accessibility, use level, implementation opportunities, and percent of impervious land cover. Using the 2014 release of the National Land Cover Database, urban catchment areas were identified as having approximately 70% or more impervious cover; suburban catchment areas showed approximately 40 – 60% impervious land cover; while rural catchment areas had less than 30% impervious land cover.

During Phase 1, local monitoring partners and other stakeholders were invited to participate in a work group to share their extensive knowledge of the subject AUs and catchment areas. Input from that work group allowed H-GAC to further refine the targeted AUs selected for this project. Local CRP partners, City of Houston Health Department (HHD) or Drinking Water Operations (DWO), Environmental Institute of Houston (EIH), or the San Jacinto River Authority (SJRA), may be asked to participate alongside H-GAC in the windshield and monitoring surveys of the selected AUs or be subcontracted to perform all field related activities.

Following input from the workgroup, ten impaired water bodies (AUs) were selected and prioritized for conducting windshield surveys of the catchment area and, finally, field sampling. Other potential contributing variables identified during monitoring will be included in the final report and made into recommendations to the BIG or other Implementation Plans (I-Plans).

Phase 2

Based on the prioritization, ten watersheds will be monitored during dry weather conditions. For this project, dry weather sampling is defined as sampling dates or periods of time following a 72-hour antecedent dry period. Phase 2 of this targeted monitoring project will include an intensive desktop review, a windshield survey of each AU catchment area, and sampling of the AU from primary road crossings. The results of the initial phase 2 monitoring will indicate where the intensive monitoring should begin.

The intensive monitoring will require H-GAC or its sub-contractor to survey each waterway and document all discharges with dry weather flows. However, no MS4 permitted outfalls will be sampled during this project. Only ambient water upstream or downstream of a dry weather flow will be sampled.

When there is more than one ambient water monitoring station located on an AU, the data for each site will be reviewed individually and then compared against each site to determine where targeted monitoring should begin. The area where the highest bacteria concentration is found will be where field monitoring will be initiated first. Eventually, samples may be collected throughout the AU to identify sources. Where there is only one monitoring site per AU, ambient water quality monitoring will be conducted throughout the AU. Sampling in each AU upstream and downstream of potential sources will help to further refine source identification. Sample locations will be identified using GPS and logged into the GPS for use in reporting and to potentially return to the location for later re-testing. All lab samples will be analyzed at one of H-GAC's CRP NELAP approved labs.

Phase 3
All efforts will be fully documented in a final report about the success of this project as well as lessons learned.

Amendments to the Appendix

Amendments to the Special Study Appendix may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods. Requests for amendments will be directed from the H-GAC Project Manager to the CRP Project Manager electronically. Amendments are effective immediately upon approval by the H-GAC Project Manager, the H-GAC QAO, the CRP Project Manager, the CRP Lead QA Specialist, the CRP Project QA Specialist, and additional parties affected by the amendment. Amendments are not retroactive. No work shall be implemented without an approved Special Study Appendix or amendment prior to the start of work. Any activities under this contract that commence prior to the approval of the governing QA document constitute a deficiency and are subject to corrective action as described in section C1 of the basin-wide QAPP. Any deviation or deficiency from this QAPP which occurs after the execution of this QAPP should be addressed through a Corrective Action Plan (CAP). An Amendment may be a component of a CAP to prevent future recurrence of a deviation. Amendments will be incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list by the H-GAC Project Manager.

SS-A7 Quality Objectives and Criteria

Existing data from other sources will be acquired and used as described in Section B9. Data will also be collected directly for this project but not submitted to TCEQ's SWQMIS database.

The purpose of the water quality monitoring described in this QAPP is to collect bacteria samples in impaired AUs found in ten prioritized watersheds, identify potential sources of bacteria, and monitor water quality post-source identification to determine if there are improvements.

This project is an example of systematic watershed monitoring, which is defined by sampling that is planned for a short duration (1 to 2 years) and is designed to: screen waters that would not normally be included in the routine monitoring program, monitor at sites to check the water quality situation, and investigate areas of potential concern. Due to the limitations regarding these data (e.g., not temporally representative, limited number of samples), the data will be used to determine whether various locations have values exceeding the TCEQ's water quality standards for bacteria but will not be submitted to SWQMIS.

Bacteria samples will be collected following procedures established under the CRP. Bacteria samples will be processed at a NELAP certified lab. The list of lab parameters can be found in Table SS-A7.1

below.

The measurement performance specifications to support the project objectives are specified in Table SS-A7.1.

Table SS-A7.1 - Measurement Performance Specifications

Parameter	Units	Matrix	Method	PAREMETER CODE	AWRL	Limit of Quantitation (LOQ	PRECISION (RPD of LCS/LCSD)	BIAS (% Rec. of LCS)	LOQ CHECK SAMPLE %Rec	Lab
Bacteria Parameters (Water)										
E. COLI, COLILERT, IDEXX METHOD, MPN/100ML	MPN/100 mL	water	Colilert**	31699	1	1	NA	0.50*	NA	Eastex
E. COLI, COLILERT, IDEXX, HOLDING TIME	hours	water	NA	31704	NA	NA	NA	NA	NA	Eastex

References:
United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)

Ambient Water Reporting Limits (AWRLs)

As described in Section A7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Precision

As described in Section A7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Bias

As described in Section A7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Representativeness

Routine data collection will not be the sampling goal for this project. Rather, targeted bacteria monitoring will be conducted in 10 AUs for the purpose of evaluating the quality of water in the selected waterways. Ambient samples, not from point sources, will be collected upstream and downstream of suspect dry weather flows to determine the influence of each dry weather flow on the bacteria concentration of the water body into which said dry weather flows occur. Bacteriological measurements are considered representative of true environmental conditions at each location at that specific time.

Comparability

As described in Section A7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Completeness

As described in Section A7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-A8 Special Training/Certification

As described in section A7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version. CRP staff are experienced in collecting bacteria samples.

SS-A9 Documents and Records

As described in Section A9 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

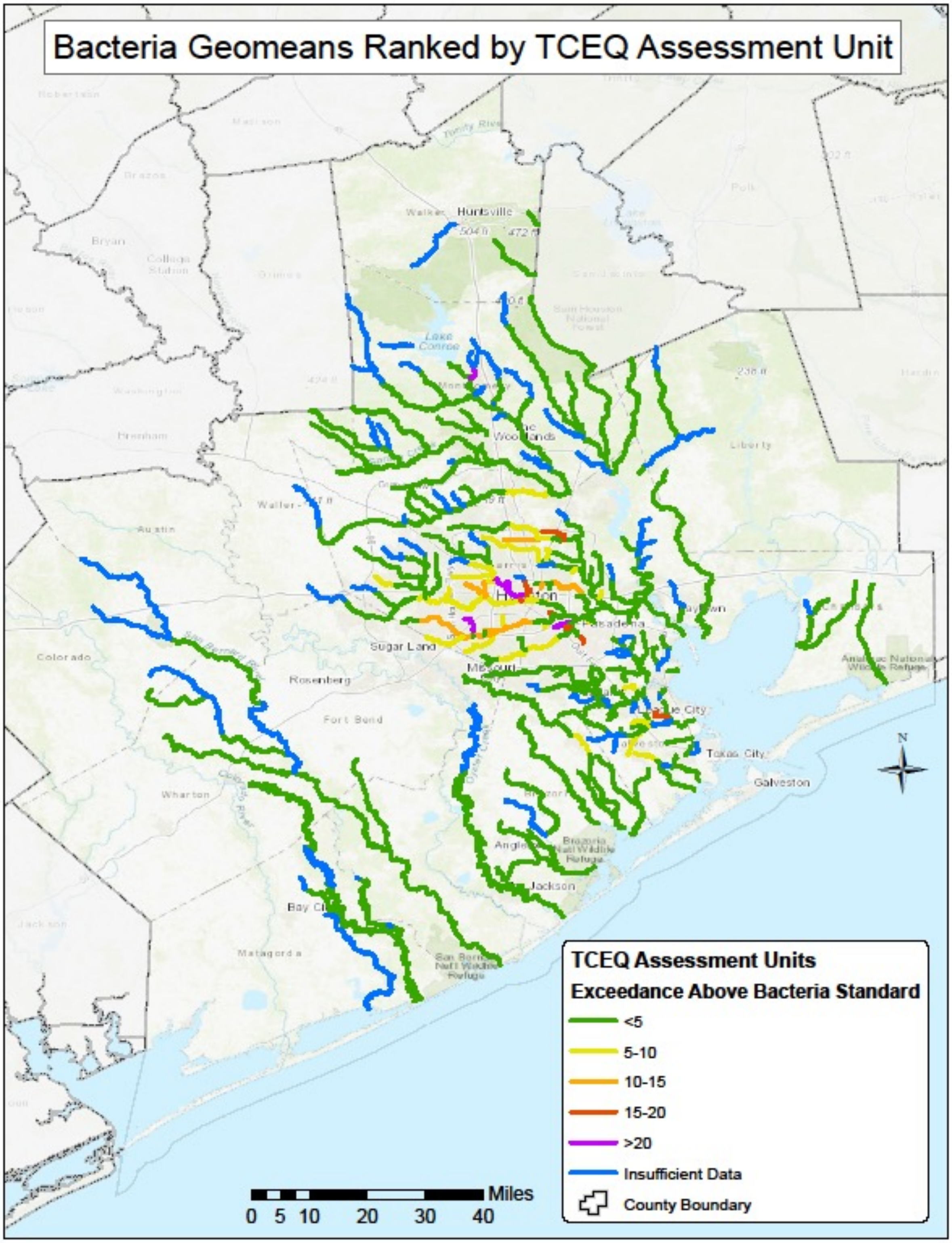
SS-B1 Sampling Process Design

Since identifying sources of bacteria is the primary goal of this special study, the number and location of samples to be collected will be determined during field reconnaissance. Whenever a dry weather flow is observed, field crews will collect ambient water samples upstream and downstream of each dry weather flow and test for bacteria concentrations. No 'end of pipe' sampling will be conducted. No field parameters are planned to be collected other than date, time, location of each discharge, and days since last significant rainfall. Photos may be taken to help identify the dry weather flow site in the future. Other than the initial bacteria sampling being conducted at major road crossings in the catchment area, there is no 'pre-determined' data collection design to be summarized in Table SS-B1 (Sampling Sites and Monitoring Frequencies). Samples will be collected upstream and downstream of the confluences with all tributaries to the main body of water being investigated. The sampling maps included in this QAPP show the waterbody and catchment area for each AU to be investigated. A map showing all sampling points will be developed as field work is completed and presented in the final report. The map presented in Figure SS-B1 shows all the impaired AUs and the range of impairment for each for the entire H-GAC region.

Figure SS-B1. Bacteria Geomeans Ranked by TCEQ Assessment Unit

A map of AUs considered for investigation and monitoring by the H-GAC or subcontractor is provided below. The map was generated by the H-GAC and is based upon how many times greater the seven-year means are relative to the state standard for contact recreation. The map is not related to number of individual events exceeding the state standards. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information concerning this map, contact Jessica Casillas at 713-993-4594.

Figure SS-B1. Bacteria Geomeans Ranked by TCEQ Assessment Unit



Using the two priority lists generated during the data analysis of the seven-year bacteria geomean for AUs and at individual sampling stations, H-GAC selected the AUs to be surveyed and investigated.

Fours AUs were selected to represent urban areas; four AUs were selected to represent suburban areas; and 2 AUs were selected to represent rural water bodies.

Sample Design Rationale and Site Selection Criteria-

H-GAC identified and ranked bacteria impaired water bodies in the H-GAC CRP basins. The list of all ranked AUs can be found in Appendix SS-2. The list of potential watersheds (AUs) was sorted according to the most recently calculated seven-year geometric mean in comparison with the state water quality standards for contact recreation. The fuchsia (pink) rows identify the AUs with geomeans determined to be greater than 20 times the standard, while the red colored rows were 15-20 times the standards, the orange rows were greater than 10-15 times the standards, the yellow rows were 5-10 times the standards, and the green rows were 1-5 times the standards.

During H-GAC's the initial review of GIS aerial maps, the catchment area of each AU was assigned a landcover type as being predominantly urban, sub-urban, or rural. At least four AUs were selected from each landcover type for further review and discussion. Following input from local partners and/or stakeholders, ten watersheds (AUs) were selected for investigation from the overall prioritization list. That reduced list includes the following AUs for investigation.

Table SS-B1. List of AUs for targeted monitoring project.

Predominant Landcover Type	AU ID	AU Name	Relative Bacteria Geomean	AU Length Miles
urban	1007T_01	Bintliff Ditch	24.46	3.9
urban	1017E_01	Unnamed tributary of White Oak Bayou	17.22	1.92
urban	1007U_01	Mimosa Ditch	15.37	1.9
urban	1016D_01	Unnamed Tributary of Greens Bayou (HCFCD ditch P133)	15.11	4.49
suburban	1004J_01	White Oak Creek	26.39	2.96
suburban	1103G_01	Unnamed Tributary of Gum Bayou	15.26	3.29
suburban	2432A_02	Mustang Bayou	11.68	5.08
suburban	1101D_01	Robinson Bayou (tributary of Clear Creek)	6.62	2.7
rural	1104_01	Dickinson Bayou Above Tidal	14.11	3.43
rural	1103E_01	Cedar Creek (tributary of Dickinson Bayou)	1.96	1.31

The following maps (Figures SS-B2 thru SS-B11) zoom into the specific locations of each AU targeted for investigation during this project and show the initial locations where bacteria sampling may be conducted during the windshield survey. The presence of flow and accessibility will be determined in the field during the survey.

Figure SS-B2. The catchment area for segment 1007T_01 (Bintliff Ditch) and possible locations for bacteria testing during the windshield survey.

TCEQ AU: 1007T_01 (Bintliff Ditch)

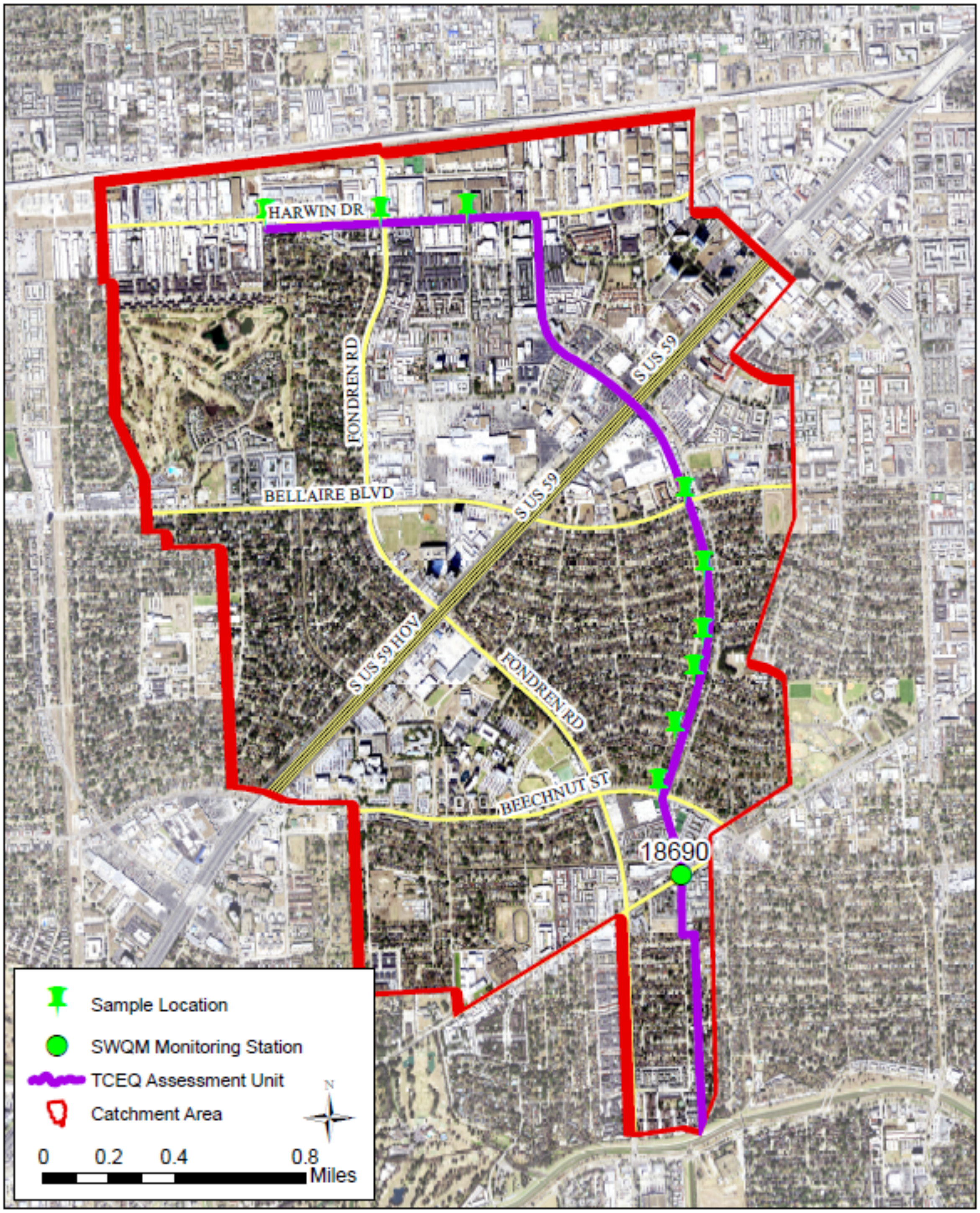


Figure SS-B3. The catchment area for segment 1017E_01 (Unnamed tributary of White Oak Bayou) and possible locations for bacteria testing during the windshield survey.

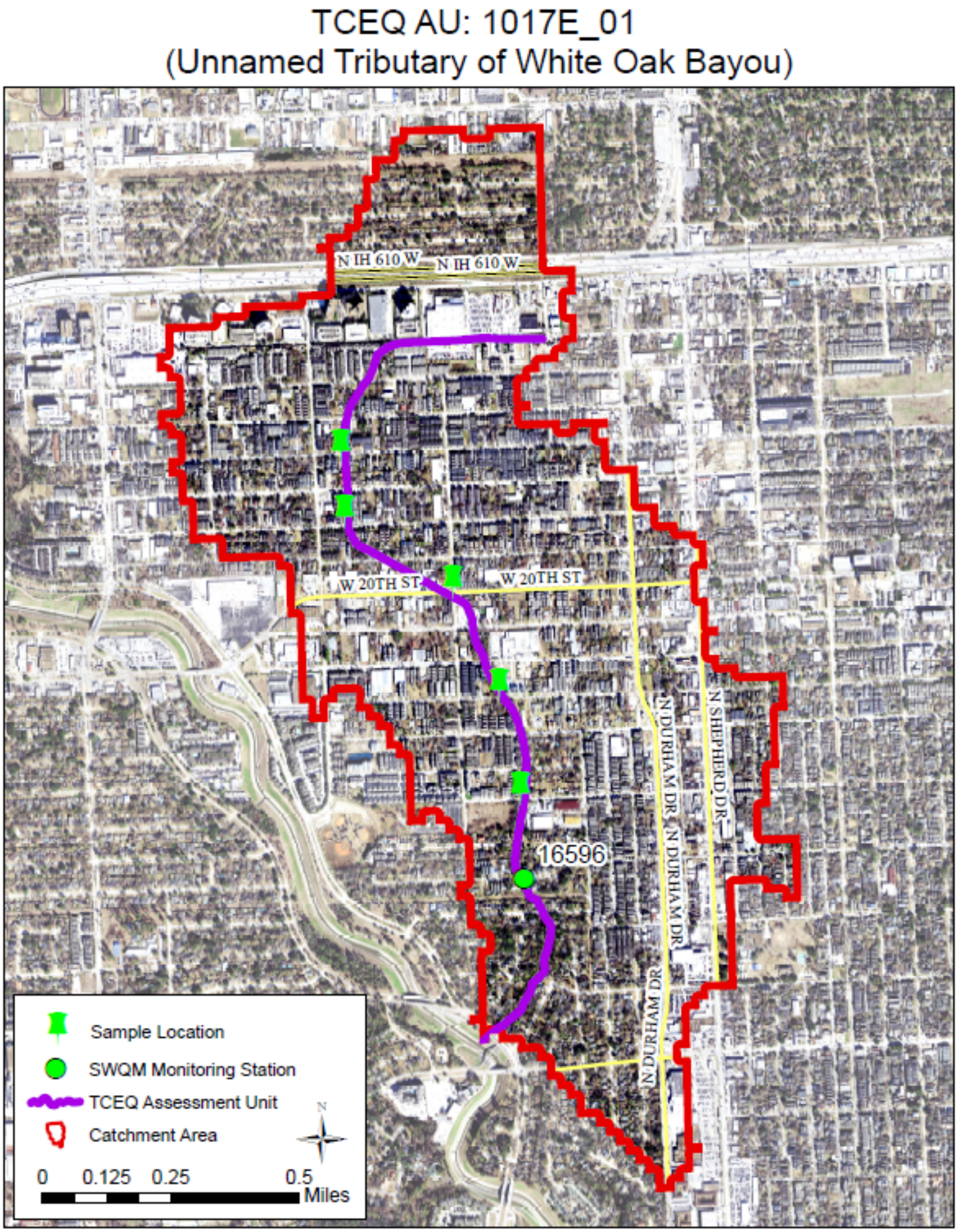


Figure SS-B4. The catchment area for segment 1007U_01 (Mimosa Ditch) and possible locations for bacteria testing during the windshield survey.

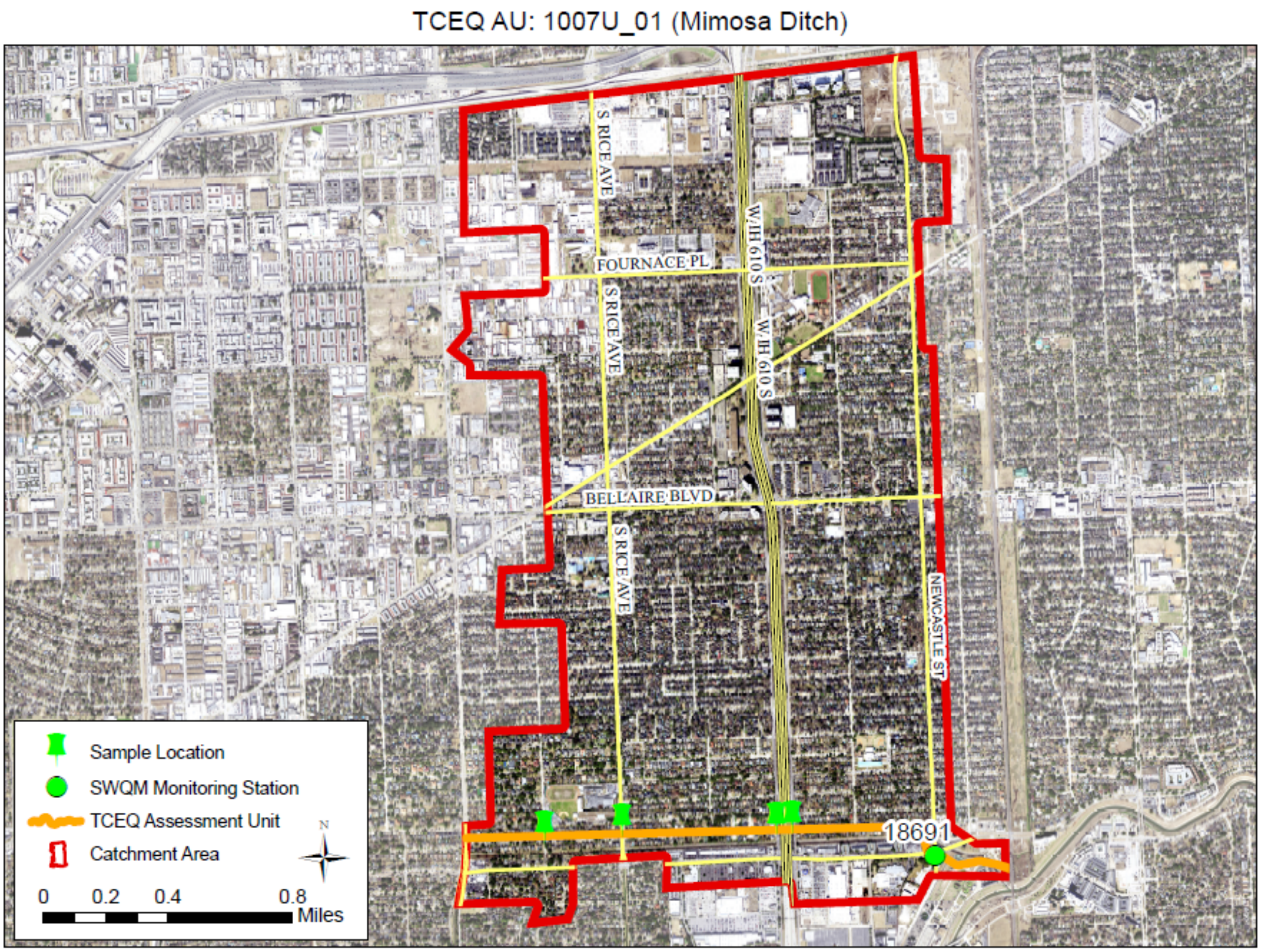


Figure SS-B5. The catchment area for segment 1016D_01 (Unnamed Tributary of Greens Bayou) and possible locations for bacteria testing during the windshield survey.

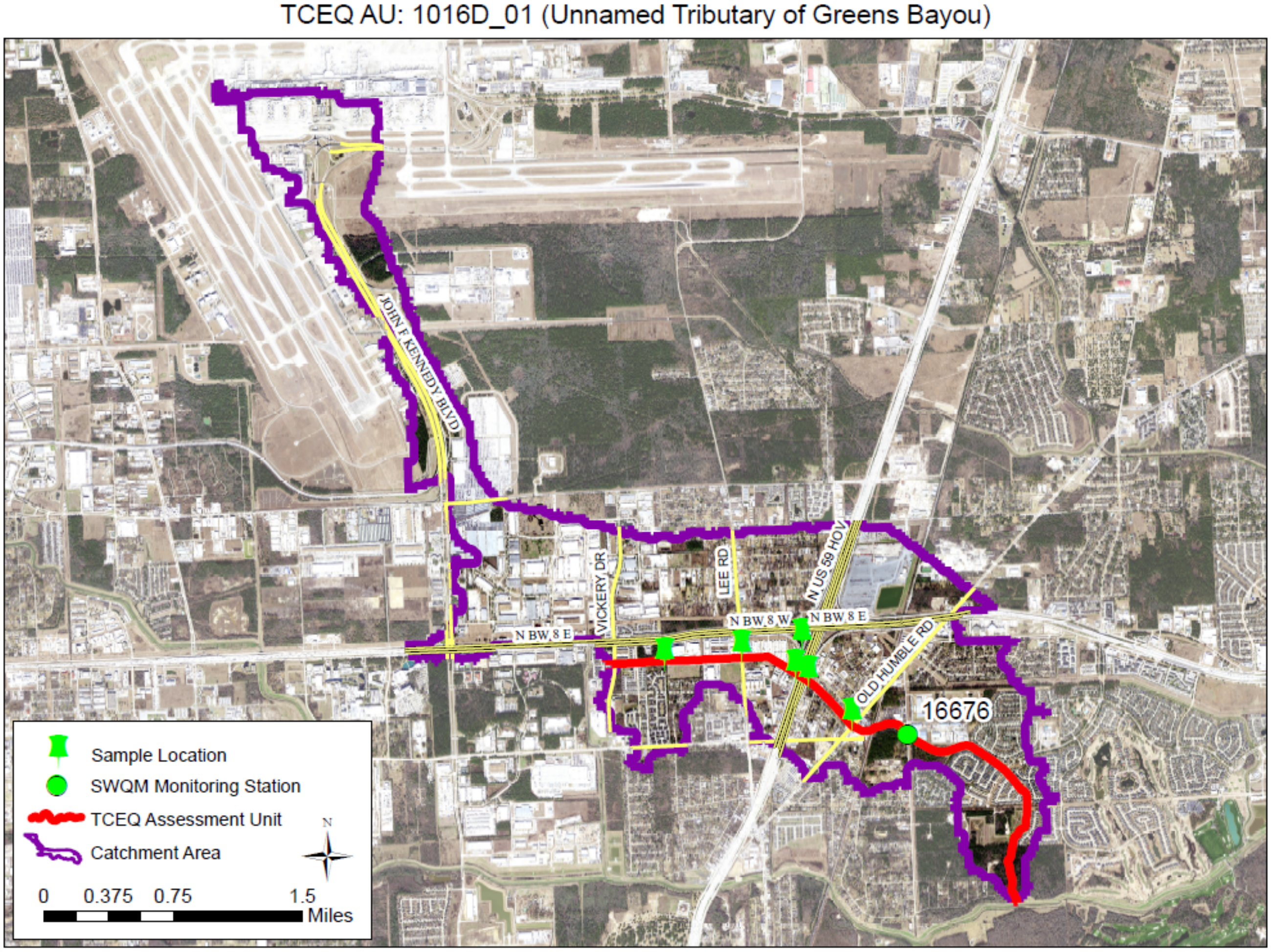


Figure SS-B6. The catchment area for segment 1004J_01 (White Oak Creek) and possible locations for bacteria testing during the windshield survey.

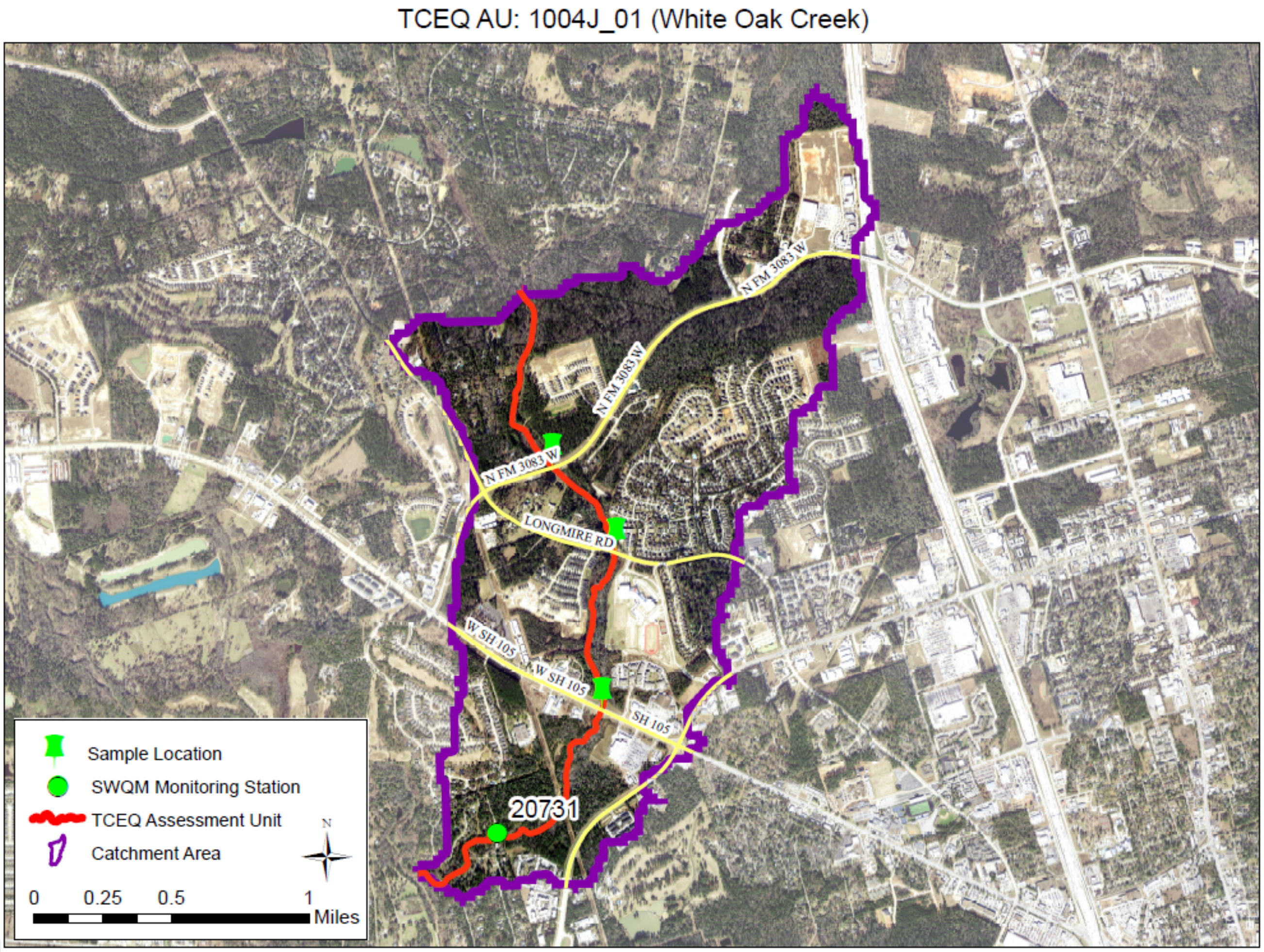


Figure SS-B7. The catchment area for segment 1103G_01 (Unnamed Tributary of Gum Bayou) and possible locations for bacteria testing during the windshield survey.

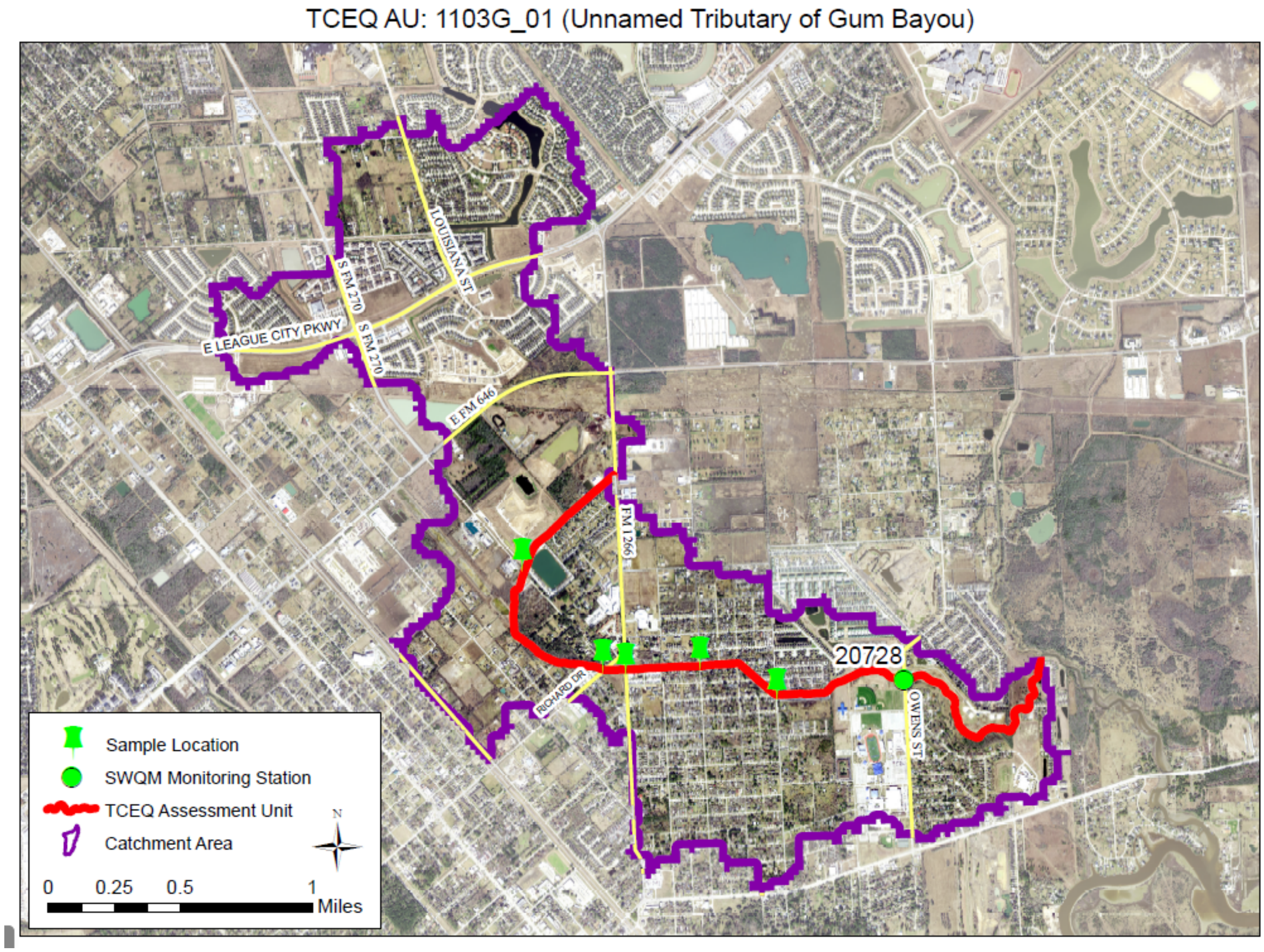


Figure SS-B8. The catchment area for segment 2432A_02 (Mustang Bayou) and possible locations for bacteria testing during the windshield survey.

TCEQ AU: 2432A_02 (Mustang Bayou)

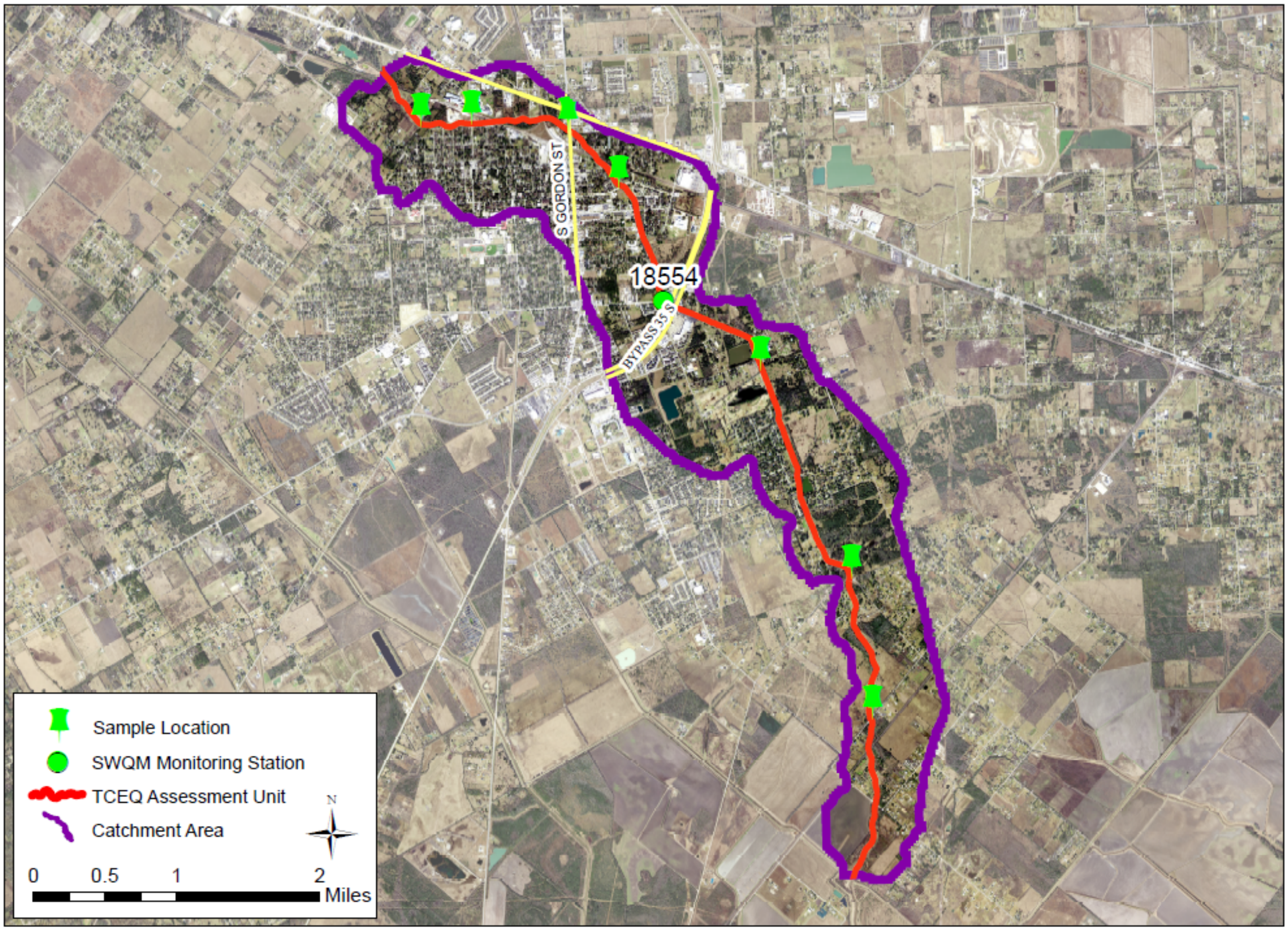


Figure SS-B9. The catchment area for segment 1101D_01 (Robinson Bayou) and possible locations for bacteria testing during the windshield survey.

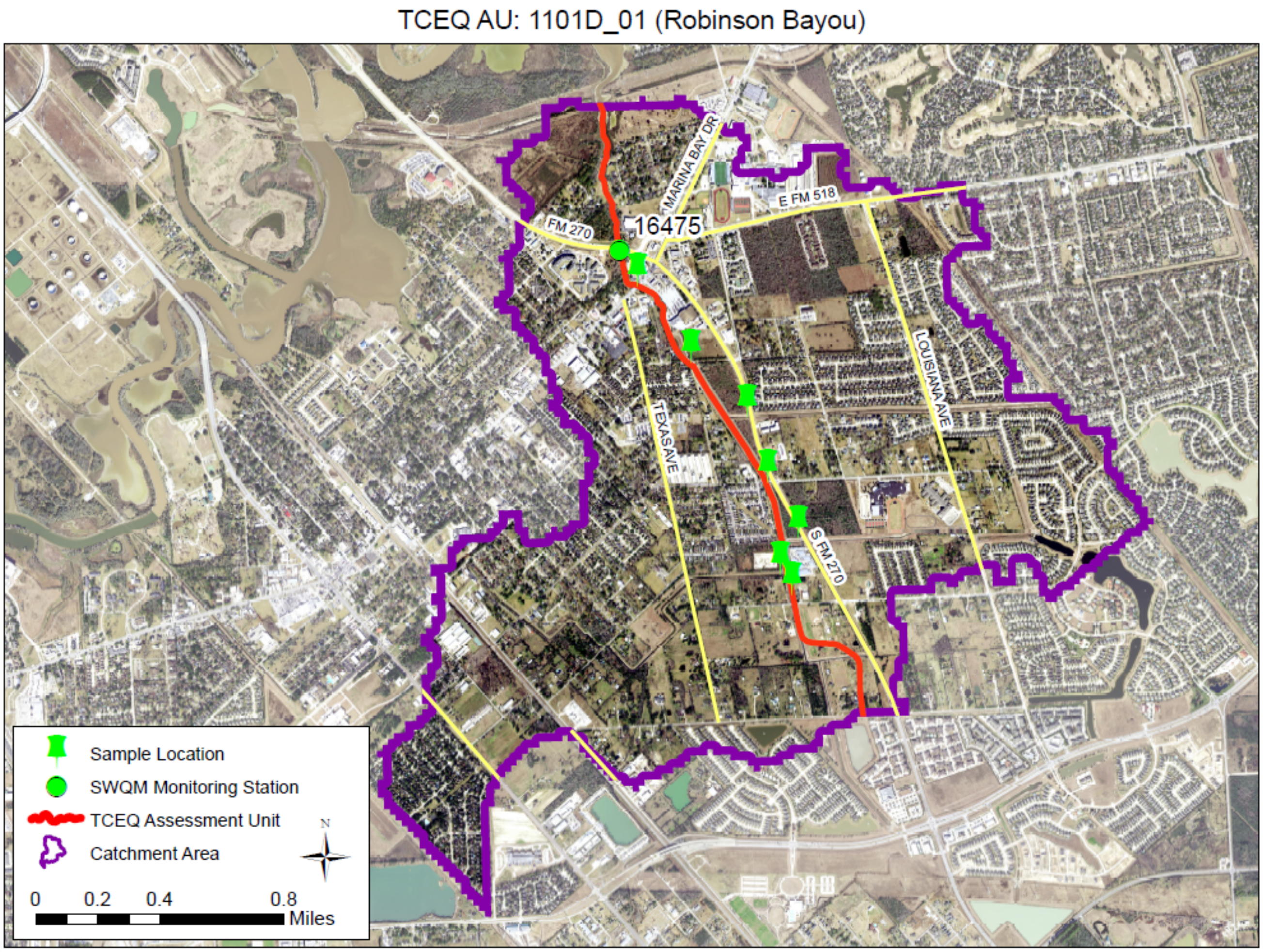


Figure SS-B10. The catchment area for segment 1104_01 (Dickinson Bayou Above Tidal) and possible locations for bacteria testing during the windshield survey.

TCEQ AU: 1104_01 (Dickinson Bayou Above Tidal)

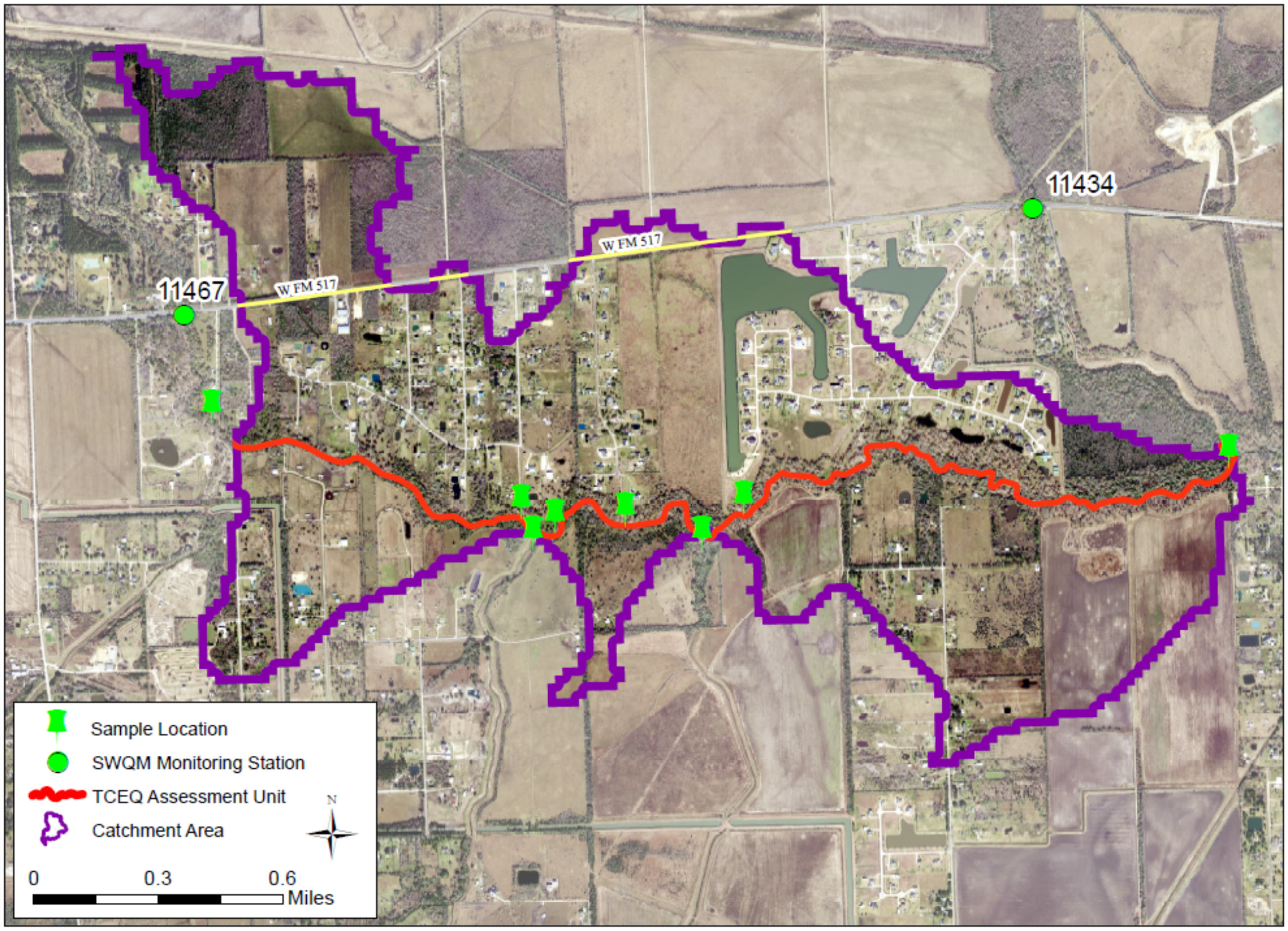
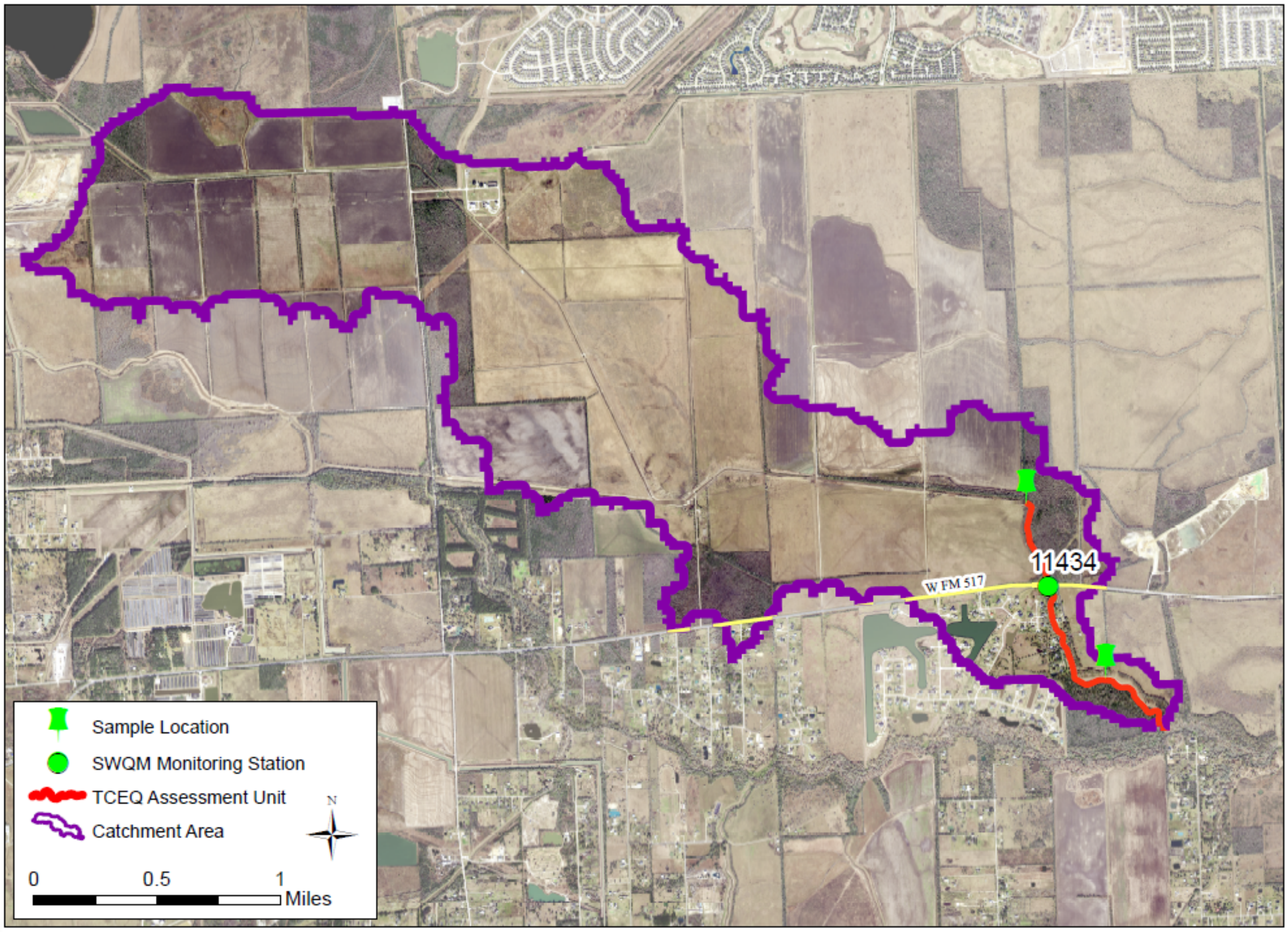


Figure SS-B11. The catchment area for segment 1103E_01 (Cedar Creek a tributary of Dickinson Bayou Above Tidal) and possible locations for bacteria testing during the windshield survey.

TCEQ AU: 1103E_01 (Cedar Creek)



If multiple stations are currently monitored by TCEQ and/or H-GAC CRP partners within an AU, H-GAC will begin investigating the area between existing stations that shows the greatest bacteria concentration increases from site to site. If there is only one station on an AU, the entire AU will be surveyed and investigated to look for and identify potential sources of pollution. In all cases, investigations will begin downstream and work upstream to minimize contamination due to disturbing the substrate.

SS-B2 Sampling Methods

Field Sampling Procedures

As described in section B2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version, with one exception. Field sampling will be conducted in accordance with the latest versions of the TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012 (RG-415) with the exception of samples being collected within the mixing zone (page 2-9). The goals of this project require data that demonstrates the effect of dry weather flows on bacteria concentrations in water bodies with bacteria impairments. This data will not be submitted to SWQMIS and therefore will not be available for use in water quality assessments by the TCEQ.

Sample volume, container types, minimum sampling volume, preservation requirements, and holding time requirements

As shown in Table SS-B2 below.

Table SS-B2. Sample Storage, Preservation, and Handling Requirements

Parameter	Matrix	Container	Minimum Sample Volume	Preservation	Holding Time
E.coli	water	Sterile Plastic	100	Placed on ice to cool to <6°C but not frozen (bottles are pre-dosed with sodium thiosulfate by manufacturer)	8 hours*
Enterococci	water	Sterile Plastic	100	Placed on ice to cool to <6°C but not frozen (bottles are pre-dosed with sodium thiosulfate by manufacturer)	8 hours

*E. coli samples should always be processed as soon as possible and incubated no later than 30 hours from time of collection.

Sample Containers

As described in Section B2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Processes to Prevent Contamination

As described in Section B2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Documentation of Field Sampling Activities

Field sampling activities are documented on the field sheet presented in SS-2-Appendix 3. The following will be recorded for all sampling locations and different visits:

- Sampling Date
- Sampling Time
- Sampling Conducted By
- Waterbody Surveyed
- Outfall Location
- Site ID
- Longitude
- Latitude
- # of Day Since Last Significant Rainfall
- Rainfall Accumulation in last 3 days (inches)
- Material of outfall pipe/source
- Inner Diameter of Pip
- Depth of Water flowing from outfall pip
- Comments or Field Observations
- Photos – Yes or No

Recording Data

As described in Section B2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Sampling Method Requirements or Sampling Process Design Deficiencies, and Corrective Action

As described in Section B2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version

SS-B3 Sample Handling and Custody

Chain-of–Custody

As described in Section B3 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Sample Labeling

As described in Section B3 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Sample Handling

As described in Section B3 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Sample Tracking Procedure Deficiencies and Corrective Action

As described in Section B3 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-B4 Analytical Methods

The analytical methods, associated matrices, and performing laboratory is listed in Table SS-A7.1 of section SS-A7. The authority for analysis methodologies under CRP is derived from the 30 Tex. Admin. Code Ch. 307, in that data generally are generated for comparison to those standards and/or criteria. The Standards state "Procedures for laboratory analysis must be in accordance with the most recently published edition of the book entitled Standard Methods for the Examination of Water and Wastewater, the TCEQ Surface Water Quality Monitoring Procedures as amended, 40 CFR 136, or other reliable procedures acceptable to the TCEQ, and in accordance with chapter 25 of this title." Copies of laboratory SOPs are retained by the laboratory and are available for review by H-GAC and the TCEQ upon request. Laboratory SOPs are consistent with EPA requirements, as specified in the method.

Standards Traceability

As described in Section B4 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Analytical Method Deficiencies and Corrective Actions

As described in section B4 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Quality Control or Acceptability Requirements Deficiencies and Corrective Actions

As described in Section B5 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-B6 Instrument/Equipment Testing, Inspection, and Maintenance

As described in Section B6 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-B7 Instrument Calibration and Frequency

As described in Section B7 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-B8 Inspection/Acceptance of Supplies and Consumables

As described in Section B8 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-B9 Acquired Data

No data collected directly under this QAPP will be submitted to the SWQMIS database. The data source(s) presented in Section B9 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version, may be used for this project. Only data collected directly under this Appendix will be submitted in the data table of this project's final report. The National land Cover Database 2001 (or most recent release) may be used during data analysis.

SS-B10 Data Management

As described in Section B10 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version

Data Dictionary

Terminology and field descriptions, as they are presented in the DMRG, or most recent version, do not apply to the data collected under this QAPP. Data results will be included in the final report but no data is being submitted to SWQMIS.

SS-C1 Assessments and Response Actions

As described in Section C1 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Corrective Action

As described in Section C1 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-C2 Reports to Management

Reports to H-GAC Project Management

As described in Section C2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

Reports to TCEQ Project Management

In addition to including updates in the quarterly progress reports, the project final report will follow the special study report outline found in the Texas Clean Rivers Program FY2020-2021 Guidance Exhibit 3A as well as the following items.

- A brief written report including a background, description of project tasks, description of methodology for determining locations for sampling, and results of all sampling events
- Pictures taken during sampling events
- Notes taken during sampling events and windshield surveys
- Overview maps of sampling locations
- A table of all project data including notes

Reports by TCEQ Project Management

As described in Section C2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-D1 Data Review, Verification, and Validation

As described in Section D1 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-D2 Verification and Validation Methods

As described in Section D2 of the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version.

SS-D3 Reconciliation with User Requirements

Data produced in this project, and data collected by other organizations (e.g., local partners, subcontractors, USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Sample results from upstream and downstream of dry weather discharges will be compared against each other and against water quality standards for contact recreation. Regardless, no data collected during this special study will be submitted to SWQMIS.

APPENDIX SS-1: Example Letter to Document Adherence to the QAPP Appendix J by subcontractors/subparticipants

Please print on letterhead before signing and sending to H-GAC

DATE: *date*

TO: Jean Wright, H-GAC CRP QAO
H-GAC
3555 Timmons Lane, Suite 120
Houston, TX 77027

FROM: *name*
organization

RE: Appendix J to the H-GAC Multi-Basin QAPP, September 5, 2019, Final Version Fiscal Year 2020-2021 CRP QAPP

I acknowledge receipt of the "Appendix J of the H-GAC Multi-Basin QAPP, September 5, 2019." I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria. My signature on this document signifies that I have read and approved the document contents pertaining to my program. Furthermore, I will ensure that all staff members participating in CRP activities will be required to familiarize themselves with the document contents and adhere to them as well.

Please sign and return this form by date.

____

Name Date
Job Title

Note: Copies of the signed forms will be sent by the H-GAC to the TCEQ CRP Project Manager within 60 days of TCEQ approval of the QAPP.

APPENDIX SS-2: Analytical Results of Bacteria Data Analyzed for Impaired AUs, Comparing the 7-year Geomean to that of the State Contact Recreation Water Quality Standards

Geomean Ranking**	AU ID	AU Name	Parameter
30.65	1017_04	Whiteoak Bayou Above Tidal	E. Coli
29.03	1007T_01	Bintliff Ditch	E. Coli
28.63	1007I_01	Plum Creek Above Tidal	E. Coli
25.27	1004J_01	White Oak Creek	E. Coli
22.51	1017E_01	Unnamed Tributary of White Oak Bayou	E. Coli
19.53	1013C_01	Unnamed Non-Tidal Tributary of Buffalo Bayou Tidal	E. Coli
17.60	1007K_01	Country Club Bayou Above Tidal	E. Coli
17.47	1007H_01	Pine Gully Above Tidal	E. Coli
17.02	1007F_01	Berry Bayou Above Tidal	E. Coli
16.78	1016D_01	Unnamed Tributary of Greens Bayou	E. Coli
15.85	1103G_01	Unnamed Tributary of Gum Bayou	Enterococci
15.11	1013A_01	Little White Oak Bayou	E. Coli
14.53	1007R_04	Hunting Bayou Above Tidal	E. Coli
13.75	1007U_01	Mimosa Ditch	E. Coli
12.67	1007B_01	Brays Bayou Above Tidal	E. Coli
12.34	0901A_01	Cary Bayou immediately upstream of Raccoon Drive bridge in Baytown	Enterococci
12.24	1007R_01	Hunting Bayou Above Tidal	E. Coli
12.22	1014O_01	Spring Branch	E. Coli
11.67	1016C_01	Unnamed Tributary of Greens Bayou	E. Coli
11.57	1014M_01	Newman Branch (Neimans Bayou)	E. Coli
9.86	1017_03	Whiteoak Bayou Above Tidal	E. Coli
9.48	2432A_02	Mustang Bayou	E. Coli
9.44	1101C_01	Cow Bayou	Enterococci
8.29	2424A_05	Highland Bayou	Enterococci
7.91	1007S_01	Poor Farm Ditch	E. Coli
7.86	1017B_02	Cole Creek	E. Coli
7.81	1007E_01	Willow Waterhole Bayou Above Tidal	E. Coli
7.69	1007G_01	Kuhlman Gully Above Tidal	E. Coli
7.61	1007_05	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
7.58	1007D_03	Sims Bayou Above Tidal	E. Coli
7.10	1017D_01	Unnamed Tributary of Whiteoak Bayou	E. Coli
6.58	1007O_01	Unnamed Tributary of Buffalo Bayou	E. Coli
6.57	1009_04	Cypress Creek	E. Coli
6.37	1007D_02	Sims Bayou Above Tidal	E. Coli
6.21	1017A_01	Brickhouse Gully/Bayou	E. Coli
6.18	1006J_01	Unnamed Tributary of Halls Bayou	E. Coli
6.04	1006D_02	Halls Bayou	E. Coli
5.78	1103F_01	Unnamed Tributary of Dickinson Bayou Tidal	Enterococci
5.76	1103C_01	Geisler Bayou	Enterococci
5.70	1006_05	Houston Ship Channel Tidal	Enterococci
5.70	1013_01	Buffalo Bayou Tidal	Enterococci
5.65	1014N_01	Rummel Creek	E. Coli
5.60	1007C_01	Keegans Bayou Above Tidal	E. Coli

5.49	1014_01	Buffalo Bayou Above Tidal	E. Coli
5.41	1006I_01	Unnamed Tributary of Halls Bayou	E. Coli
5.27	1014H_02	South Mayde Creek	E. Coli
5.11	1016_02	Greens Bayou Above Tidal	E. Coli
4.96	1103A_01	Bensons Bayou	Enterococci
4.86	1305B_01	Caney Creek Above Water Hole Creek	E. Coli
4.71	1102F_01	Mary's Creek Bypass	E. Coli
4.70	2432D_01	Persimmon Bayou	Enterococci
4.69	1113D_01	Willow Springs Bayou	E. Coli
4.57	1007W_01	Harris County Flood Control Ditch D 138	E. Coli
4.52	1017_02	Whiteoak Bayou Above Tidal	E. Coli
4.50	1101D_02	Robinson Bayou	Enterococci
4.34	1014K_01	Turkey Creek	E. Coli
4.23	1017F_01	Rolling Fork Creek	E. Coli
4.14	1007D_01	Sims Bayou Above Tidal	E. Coli
4.12	1007R_03	Hunting Bayou Above Tidal	E. Coli
4.06	1301_01	San Bernard River Tidal	Enterococci
3.99	1006D_01	Halls Bayou	E. Coli
3.93	1102B_01	Mary's Creek/ North Fork Mary's Creek	E. Coli
3.88	2422B_01	Double Bayou West Fork	Enterococci
3.85	2421B_01	Little Cedar Bayou	Enterococci
3.85	1007B_02	Brays Bayou Above Tidal	E. Coli
3.82	1006F_01	Big Gulch Above Tidal	E. Coli
3.80	1007_06	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
3.71	1302A_01	Gum Tree Branch	E. Coli
3.70	1007R_02	Hunting Bayou Above Tidal	E. Coli
3.61	1009_03	Cypress Creek	E. Coli
3.60	2432C_01	Halls Bayou Tidal	Enterococci
3.59	1101A_01	Magnolia Creek	E. Coli
3.55	2424C_01	Marchand Bayou	Enterococci
3.54	2432E_01	New Bayou	Enterococci
3.47	1014C_01	Horsepen Creek	E. Coli
3.32	2431A_01	Moses Bayou	E. Coli
3.32	1007L_01	Unnamed Tributary of Brays Bayou	E. Coli
3.29	1014L_01	Mason Creek	E. Coli
3.27	1007_04	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
3.14	0901_01	Cedar Bayou Tidal	Enterococci
3.06	1007M_01	Unnamed Tributary of Hunting Bayou	E. Coli
3.05	1101_03	Clear Creek Tidal	Enterococci
3.04	1014H_01	South Mayde Creek	E. Coli
3.01	1103D_01	Gum Bayou	Enterococci
2.96	1007N_01	Unnamed Tributary of Sims Bayou	E. Coli
2.90	1103_04	Dickinson Bayou Tidal	Enterococci
2.89	1016A_03	Garners Bayou	E. Coli
2.87	1107_01	Chocolate Bayou Tidal	Enterococci
2.87	1007_08	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
2.84	1009_02	Cypress Creek	E. Coli
2.84	1007V_01	Unnamed Tributary of Hunting Bayou	E. Coli
2.82	1006H_01	Spring Gully Above Tidal	E. Coli

2.70	1014K_02	Turkey Creek	E. Coli
2.67	2422D_01	Double Bayou East Fork	Enterococci
2.66	1003_03	East Fork San Jacinto River	E. Coli
2.65	2425B_01	Jarbo Bayou	Enterococci
2.59	1007_02	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
2.58	1007_07	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
2.48	1016_03	Greens Bayou Above Tidal	E. Coli
2.47	1006_03	Houston Ship Channel Tidal	Enterococci
2.41	1014E_01	Langham Creek	E. Coli
2.36	1102_04	Clear Creek Above Tidal	E. Coli
2.36	1102D_01	Turkey Creek	E. Coli
2.29	1101B_01	Chigger Creek	E. Coli
2.25	2424A_03	Highland Bayou	Enterococci
2.24	1016_01	Greens Bayou Above Tidal	E. Coli
2.23	1103E_01	Cedar Creek	E. Coli
2.15	1014B_01	Buffalo Bayou/Barker Reservoir	E. Coli
2.08	1101_02	Clear Creek Tidal	Enterococci
2.06	2432A_03	Mustang Bayou	E. Coli
2.06	1009D_01	Spring Gully	E. Coli
2.05	1103B_01	Bordens Gully	E. Coli
2.05	1110_01	Oyster Creek Above Tidal	E. Coli
2.04	2431C_01	Unnamed Tributary to the Southern Arm of Moses Lake (West)	Enterococci
2.02	1008J_01	Brushy Creek	E. Coli
2.02	1009C_01	Faulkey Gully	E. Coli
2.01	1104_02	Dickinson Bayou Above Tidal	E. Coli
1.97	1103_02	Dickinson Bayou Tidal	Enterococci
1.97	1014A_01	Bear Creek	E. Coli
1.96	1006_07	Houston Ship Channel Tidal	Enterococci
1.96	1105C_01	Austin Bayou Above Tidal	E. Coli
1.96	1008_04	Spring Creek	E. Coli
1.95	1008H_01	Willow Creek	E. Coli
1.90	1105B_01	Austin Bayou Tidal	Enterococci
1.90	1113_03	Armand Bayou Tidal	Enterococci
1.90	1009_01	Cypress Creek	E. Coli
1.87	1008_03	Spring Creek	E. Coli
1.87	1113E_01	Big Island Slough	E. Coli
1.85	1113B_01	Horsepen Bayou Tidal	Enterococci
1.84	1017_01	Whiteoak Bayou Above Tidal	E. Coli
1.81	1109_01	Oyster Creek Tidal	Enterococci
1.72	2432A_01	Mustang Bayou	E. Coli
1.71	1007_01	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
1.70	1102A_02	Cowart Creek	E. Coli
1.66	1102_02	Clear Creek Above Tidal	E. Coli
1.65	1008_02	Spring Creek	E. Coli
1.63	1110_02	Oyster Creek Above Tidal	E. Coli
1.62	1010_03	Caney Creek	E. Coli
1.62	1302_01	San Bernard River Above Tidal	E. Coli
1.62	1009E_01	Little Cypress Creek	E. Coli

1.59	1304_01	Caney Creek Tidal	Enterococci
1.59	1006B_01	Carpenters Bayou	Enterococci
1.58	1003_01	East Fork San Jacinto River	E. Coli
1.57	1105E_01	Brushy Bayou	E. Coli
1.53	1008A_01	Mill Creek	E. Coli
1.52	1102_03	Clear Creek Above Tidal	E. Coli
1.51	1105_01	Bastrop Bayou Tidal	Enterococci
1.50	1015A_01	Mound Creek	E. Coli
1.49	1304_02	Caney Creek Tidal	Enterococci
1.47	1004E_02	Stewarts Creek	E. Coli
1.46	1302B_01	West Bernard Creek	E. Coli
1.46	1008I_01	Walnut Creek	E. Coli
1.45	1010_02	Caney Creek	E. Coli
1.42	1010_04	Caney Creek	E. Coli
1.40	1011_02	Peach Creek	E. Coli
1.39	1017C_01	Vogel Creek	E. Coli
1.38	1008C_01	Lower Panther Branch	E. Coli
1.36	2424G_01	Highland Bayou Diversion Canal	Enterococci
1.36	1103_01	Dickinson Bayou Tidal	Enterococci
1.36	1302D_01	Peach Creek	E. Coli
1.36	1004_02	West Fork San Jacinto River	E. Coli
1.34	1007A_01	Canal C-147	E. Coli
1.33	1108_01	Chocolate Bayou Above Tidal	E. Coli
1.31	1302_03	San Bernard River Above Tidal	E. Coli
1.27	1302E_01	Mound Creek	E. Coli
1.25	1113A_01	Armand Bayou Above Tidal	E. Coli
1.25	1113C_01	Unnamed Tributary to Horsepen Bayou	E. Coli
1.24	1003_02	East Fork San Jacinto River	E. Coli
1.23	1006_06	Houston Ship Channel Tidal	Enterococci
1.23	1016B_01	Unnamed Tributary of Greens Bayou	E. Coli
1.21	1008E_01	Bear Branch	E. Coli
1.20	1011_01	Peach Creek	E. Coli
1.19	1016A_02	Garners Bayou	E. Coli
1.15	1002_06	Lake Houston	E. Coli
1.13	1304A_01	Linnville Bayou	E. Coli
1.11	1004_01	West Fork San Jacinto River	E. Coli
1.10	1007_03	Houston Ship Channel/Buffalo Bayou Tidal	Enterococci
1.07	1305_02	Caney Creek Above Tidal	E. Coli
1.07	1006_01	Houston Ship Channel Tidal	Enterococci
1.05	1008C_02	Lower Panther Branch	E. Coli
1.03	2432B_01	Willow Bayou	E. Coli
1.03	2411_01	Sabine Pass	Enterococci
1.01	1105A_03	Flores Bayou	E. Coli

** This table is colored based upon the ranking of the geometric mean compared to the state water quality standards for contact recreation.

APPENDIX SS-3: Field Sheet for Illicit Flow Monitoring

H-GAC – Targeted Monitoring Data Sheet

Date: ______/______/______ Sampling Conducted by:________________________________

Time (military):____________ Waterbody Surveyed:________________________________

Outfall Location: ____

____ Site ID:____________________

Latitude		Material of outfall pipe	1 – concrete; 2 – PVC; 3 – metal; 4 - other	
Longitude		Describe 'Other' pipe material		
# of Days Since Last Significant Rainfall		Inner Diameter of Pipe	Inches	
Rainfall accumulation in last 3 days (inches)		Depth of Water flowing from outfall pipe	Inches	

Comments or Other Field Observation	

Photographs taken: Yes / No

Computer File Name and Pathway:____

BACTERIA ANALYSIS – UPSTREAM

Distance upstream of dry weather flow:______________ Bacteria results:____________________

BACTERIA ANALYSIS – DOWNSTREAM

Distance downstream of dry weather flow: ______________ Bacteria results:____________________

Referral? Yes No Referral ID____________________

Data Entry: Date & Initials____________________ Data Entry Checked: Date & Intials____________________

Updated: September 10, 2020