Appendix K to the Houston-Galveston Area Council Clean Rivers Program FY 2018/2019 Multi-Basin QAPP

Biological Monitoring at a Selected Location in the H-GAC Region

Prepared by the Houston-Galveston Area Council (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

3/29/19
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Clean Rivers Program

3/29/19
Kelly Rodibaugh Date
CRP Project Quality Assurance Specialist

3/29/2019
Cathy Anderson, Team Leader Date
Data Management and Analysis

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Kelly Rodibaugh Date
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Sharon Coleman Date
Acting Lead CRP Quality Assurance Specialist
Laboratory and Quality Assurance Section

Houston-Galveston Area Council (H-GAC)

Todd Running — Date 3/26/19
H-GAC Project Manager

Jean Wright — Date 3/26/19
H-GAC Quality Assurance Officer

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. Alternatively, additional signature blocks for primary sub-tier participants have been added to section A1. Signatures in section A1 will eliminate the need to 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.

ENVIRONMENTAL INSTITUTE OF HOUSTON – UNIVERSITY OF HOUSTON CLEAR LAKE (EIH)

3-27-19

Dr. George Guillen
EIH CRP Project Manager

Date

3-27-19

Jenny Oakley
EIH Field Quality Assurance Officer

Date

Eastex Environmental Laboratory

3/27/19

Daniel Bowen — Date
Eastex Laboratory Manager

3-27-19

Natalia Bondar — Date
Eastex Laboratory Quality Assurance Officer (QAO)

SS-A2 Table of Contents

List of Acronyms

As described in Section A2 of the multi-basin QAPP plus a few additions found only in this Appendix.

7Q2	Minimum 7-day, 2-year discharge
ADV	Acoustic Doppler Velocimeter
BLOBs	Binary Large Objects
DOC	Demonstration of Capability
DQO	Data Quality Objective
NELAC	National Environmental Lab Accreditation Conference
RBP	Rapid Bioassessment Protocol
RWA	Receiving Water Assessment
SS	Special Study
SWQMIS	Surface Water Quality Monitoring Information System
USGS	United State Geological Survey

SS-A3 Distribution List

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The Houston-Galveston Area Council 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, other units of government. 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 will ensure the documentation is available for review.

Sub-Tier Participating Organizations to receive copies of the Appendix include: The Environmental Institute of Houston and Eastex Environmental Laboratory

SS-A4 PROJECT / TASK ORGANIZATION

Description of Responsibilities

TCEQ

Sarah Eagle
CRP Work Leader
As described in the FY2018-2019 multi-basin QAPP, Section A4.

Kelly Rodibaugh
CRP Project Manager & Project Quality Assurance Specialist
As described in the FY2018-2019 multi-basin QAPP, Amendment #1.

Sharon R. Coleman
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Bill Hoffman
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Environmental Institute of Houston (EIH) University of Houston Clear Lake (UHCL)

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As described in the FY2018-2019 multi-basin QAPP, Section A4.

Jenny Oakley
CRP Data Manager, Field Supervisor & Quality Assurance Officer
As described in the FY2018-2019 multi-basin QAPP, Section A4.

Eastex Environmental Laboratory

Daniel Bowen
Laboratory Director - Eastex Environmental Laboratory (Contract Lab)
As described in the FY2018-2019 multi-basin QAPP, Section A4.

Natalia Bondar
Eastex Lab QAO
As described in the FY2018-2019 multi-basin QAPP, Section A4.

SS-A5 Problem Definition / Background

The primary goal of the H-GAC Clean Rivers Program is to provide the appropriate quality assured data to allow continuing assessment and management of water quality in the San Jacinto River Basin as well as four other basins located in the region. Objectives of this monitoring program include local participation in the collection and submittal of quality-assured data to assist the TCEQ in attaining reliable information concerning water quality conditions within the basin. Impairments and/or concerns are frequently carried forward due to the lack of current data sufficient enough to reassess a waterbody. To this end, H-GAC, in partnership with the Environmental Institute of Houston, University of Houston – Clear Lake (EIH), will be conducting biological monitoring and habitat assessments on one stream segment that had concerns carried forward in the *2014 Texas Integrated Report* approved by EPA in November 2015.

Assessment Unit (AU) 1009_02, is a perennial stream flowing from the US 290 to SH 249. This assessment unit has a high aquatic life use (ALU) designation but a concern for impaired microbenthic community in the 2014 Texas Integrated Report.

The purpose of this Special Study QAPP Appendix is to define the quality assurance processes with respect to this project. Data describing the physical, chemical, and biological characteristics of each waterbody will be collected.

This Special Study QAPP Appendix will be reviewed and approved by the TCEQ to ensure that data generated for the purposes described are scientifically valid and legally defensible. This review and approval process will also ensure that all project data submitted to SWQMIS have been collected, analyzed, and handled in ways that are consistent with existing protocol to ensure data quality compatibility.

SS-A6 Project / Task Description

EIH will conduct Aquatic Life Monitoring at one location in the San Jacinto River Basin (Basin 10). The selected site is located on Cypress Creek (Segment 1009). This site was selected because TCEQ's 2014 Integrated Report identified this site as being on the Water Bodies with Concerns for Use Attainment and Screening Levels. More data is needed to evaluate its current status. All sampling associated with this project will be completed between March 15, 2019, and June 30, 2019.

All monitoring will be conducted in accordance with TCEQ's *Surface Water Quality Monitoring Procedures Manual, Volume 1: Physical and chemical Monitoring Methods (RG-415, Revised August 2012)* and *Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014)* plus the applicable updates to Volume 1 & Volume 2. One sampling event will be conducted at the selected location. The one sampling event will be conducted during the non-critical index period between March 15, 2019, and June 30, 2019, as defined by TCEQ. The one sampling event will be completed when stream conditions reflect normal flow conditions. Data to be collected during the one sampling event will include field multi-probe parameters, diel (24-hour) measurements, routine water chemistry samples, flow measurements and observations, a fish survey, a benthic macroinvertebrate survey, and a stream physical habitat survey. Additionally, the following items will be submitted to the TCEQ with all data submittals: copies of field notes and forms, latitude/longitude coordinates of each reach, color photographs, and the required biological data documentation as described in the Surface Water Quality Monitoring Data Management Reference Guide (DMRG) (most recent version). All data and files submitted will conform to the requirements set forth in the DMRG. Biological data requirements are specifically addressed in chapter 12 of the DMRG which include the submission of Binary Large Object (BLOB) files. The data will be analyzed using the regional approach as outlined in the *Regionalization of the Index of Biotic Integrity for Texas Streams* currently used by the TCEQ. All new data will be submitted to TCEQ using this approved regional metrics format.

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 and/or the TCEQ QA Manager (or designee), 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 multi-basin 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 this Appendix by way of attachment and distributed to personnel on the distribution list by the H-GAC Project Manager.

SS-A7 Quality Objectives and Criteria

The overall goal of this project is for EIH to collect environmental data describing the physical, chemical, and biological characteristics of this one waterbody. TCEQ may use this data to compare against the assigned water quality standards for the stream segment and aquatic life use designations/dissolved oxygen (DO) criteria. The data will be provided to the TCEQ and may be used in future water quality assessments and/or to make water quality management decisions for this waterway.

During the one sampling event, EIH will collect field parameters, flow, and water samples to analyze for water quality parameters and bacteria. A sonde will be deployed to collect 24-hour data for the basic field parameters – temperature, conductivity, dissolved oxygen, and pH. Multi-parameter sondes will be deployed in accordance with the requirements outlined in *TCEQ's Surface Water Quality Monitoring (SWQM) Procedures, Volume 1: Physical and Chemical Monitoring Methods (RG-415, Revised August 2012)*. Additionally, EIH will collect habitat data, freshwater macrobenthic data per the rapid bio-assessment protocol (RBP), and freshwater nekton data according to procedures outlined in the most current *SWQM Procedures Manual, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014)*.

The one sampling event is to occur during the non-critical index period of March 15, 2019, through June 30, 2019 (as defined in the SWQM Procedures, Volume 2). Conditions during the sampling event should include stable, unscoured flow conditions, ideally when the flow is at or just above, the 7Q2 for the particular stream. If flow conditions are not stable or do not reflect baseline conditions, the sampling will be rescheduled. If an extreme weather event occurs, such as significant drought or heavy rains, or if the stream has been dry, the sampling event will be delayed for an appropriate amount of time as determined by the SWQM Procedures, Volume 2. Data will be assigned a "BS" monitoring type code, representing biased-season monitoring, when submitted to TCEQ.

EIH will perform biological monitoring complete with vouchering of individual, representative fish species collected during seining and shocking efforts. Fish data collected by seining will be reported separately from fish data collected by shocking. Collected aquatic invertebrates will be preserved and stored. Habitat assessment and diel data along with field parameters and observations, water chemistry and bacteriological samples and flow will be collected when biological monitoring is performed. All biological monitoring will be performed per TCEQ's *Surface Water Quality Monitoring Procedures, Volume 1: Physical and chemical Monitoring Methods (RG-415, Revised August 2012)* and

Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014) plus the applicable updates to Volume 1 & Volume 2.

- Fish collection methods will include both seining and electrofishing. All fish data will be collected and submitted by collection type (seining or shocking). If unable to employ multiple gear types, effort will be increased accordingly using the available gear. To obtain information on the composition and integrity of the fish community, all collected fish will be identified and enumerated to promote an accurate representation of the fish community.
- Benthic macroinvertebrates will be collected using the rapid bioassessment protocols (RBPs) approved by TCEQ. The qualitative collection methods employed will include 5-minute kicknets and snag sampling. At least one representative of each benthic macroinvertebrate taxon collected will be preserved and retained as a voucher specimen. There are no plans to sample depositional habitats such as pools.
- Habitat assessments will be conducted by completing the 3 TCEQ assessment forms:
    - Stream Physical Characteristics Worksheet – Part I;
    - Summary of Physical Characteristics of Water Body – Part II; and
    - Habitat Quality Index (HQI) – Part III.

The measurement performance specifications (MPS) to support the project purpose for a minimum data set are specified in the tables found in SS–Appendix A. The MPS tables have been modified to reflect actual parameters, methods, etc. employed by EIH and the contract lab. Procedures for laboratory analysis are in accordance with the most recently published edition of Standard Methods for the Examination of Water and Wastewater and 40 CFR 136.

Ambient Water Reporting Limits (AWRLs)

As described in Section A7 of the multi-basin QAPP

Precision

As described in Section A7 of the multi-basin QAPP

Bias

As described in Section A7 of the multi-basin QAPP.

Representativeness

Per the TCEQ *Surface Water Quality Monitoring Procedures Manual, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014),* biological organisms should be collected and identified in a manner that accurately reflects the biological community composition at the time of sampling. Bioassessment data should be collected during the index period with one event conducted during critical conditions; the prevailing theory being that if the standards attainment criteria are met during the most stressful conditions, it is expected that these criteria would be met during other seasons as well. One sampling event was conducted at this location in August 2017, the second sampling event at this location will be collected during the non-critical index period between March 15, 2019, and June 30, 2019. This monitoring site was chosen for this special study because of concerns carried forward from past Integrated Reports. The site represents conditions commonly found along the entire length of the waterway. The site is located in the middle of the segment and accessible with some effort. Investigators should find a good variety of microhabitats to sample while avoiding major tributaries and contaminant sources.

Comparability

As described in Section A7 of the multi-basin QAPP.

Completeness

As described in Section A7 of the multi-basin QAPP.

SS-A8 Special Training/Certification

As described in section A7 of the multi-basin QAPP. Additionally, EIH personnel have attended TCEQ's Biological Monitoring Training Course. EIH's field QAO (or their designee) evaluates and documents each employee's demonstration of capabilities for their personnel files. These records are shared with H-GAC and made available during the routine monitoring systems audits.

SS-A9 Documents and Records

As described in Section A9 of the multi-basin QAPP. Plus, EIH shall complete documentation required by Chapter 12 of the DMRG, in BLOB format. All data, including biological, will be entered into SWQMIS. Data and biological attachments will be submitted in the formats required by the DMRG (most recent version).

Table SS-A9.1. Project Documents and Records: Environmental Institute of Houston (EIH)

Document/Record for PL	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TCEQ/H-GAC/EIH	7	Paper
Field SOPs	H-GAC/EIH	7	Paper
Laboratory QA Manuals	Eastex Lab	7	Current version – electronic & paper; prior versions paper only
Laboratory SOPs	Eastex Lab	7	Current version – electronic & paper; prior versions paper only
Laboratory Staff Training Records	Eastex Lab	7	Paper
QAPP distribution documentation	EIH	7	Paper
Field staff training records	H-GAC	7	Paper
Field equipment calibration/maintenance logs	EIH	7	Paper
Field instrument printouts	EIH	7	Paper
Field notebooks or data sheets	H-GAC/EIH	7	Paper
Data Summary Packets	H-GAC/EIH	7	Paper
Chain of custody records	H-GAC/EIH & Eastex Lab	7	Paper
Laboratory calibration records	Eastex Lab	7	Paper
Laboratory instrument printouts	Eastex Lab	7	Paper
Laboratory data reports/results	Eastex Lab	7	Paper
Laboratory equipment maintenance logs	Eastex Lab	7	Paper
Corrective Action Documentation	H-GAC/EIH &/or Eastex Lab	7	Paper

SS-B1 Sampling Process Design

The data collection design is summarized in Table SS-B1.1 (Sample Design and Schedule) and Figures SS-B1a-c (Sample Site Maps). See Table SS-A7.1a-i for a list of all parameters being collected under each category.

Sample Design Rationale and Site Selection Criteria

Biological sampling will be conducted once during the non-critical Index Period of FY 2019 (March 15, 2019 through June 30, 2019) at one monitoring site located on Segment 1009. This segment has been identified as needing additional or more current information to reassess in a future Integrated Report. The station selected will have field, flow, bacteria, and conventional lab parameters collected. Diel monitoring will be conducted along with habitat, microbenthic community and fish community assessments.

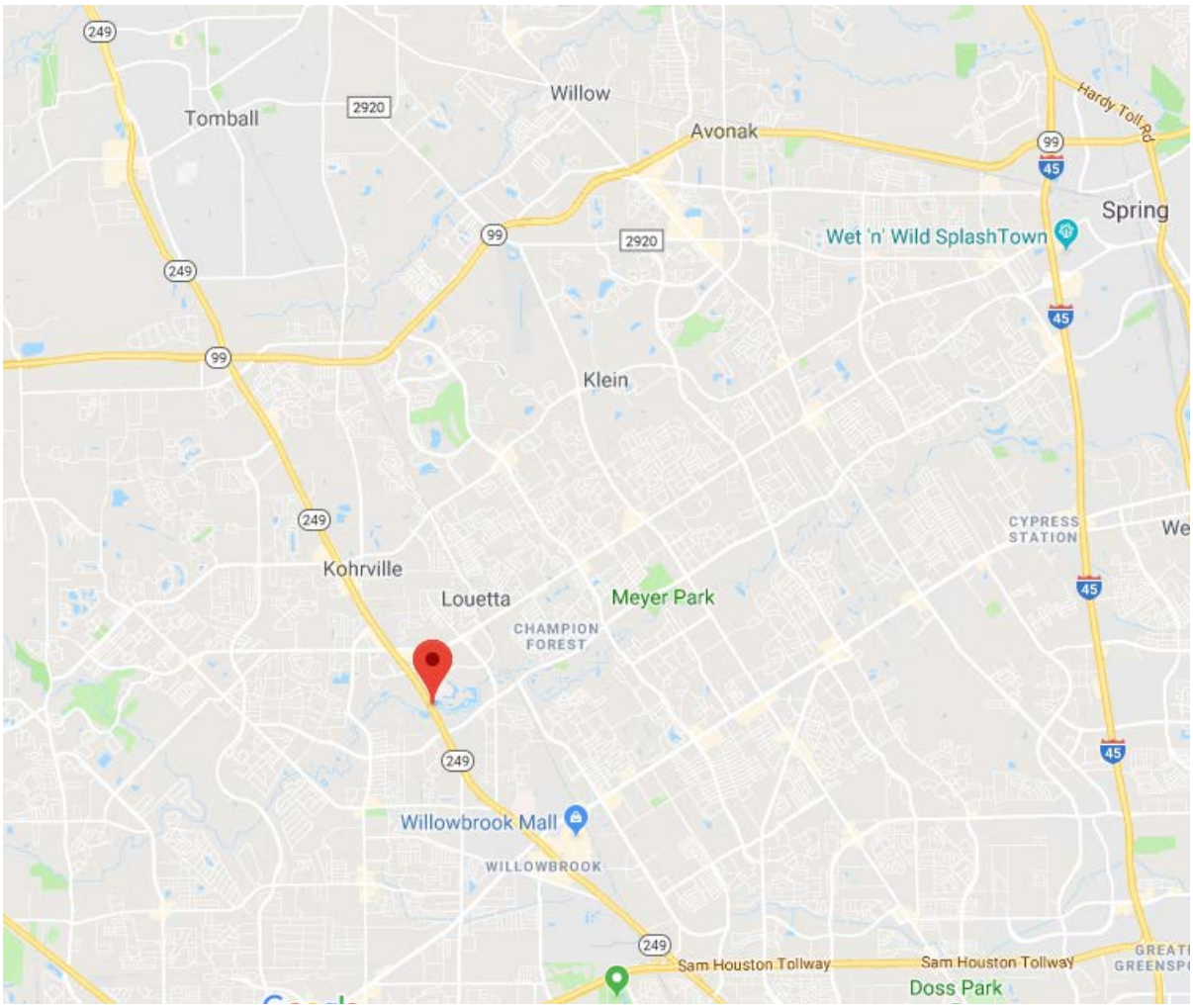
Table SS-B1.1 Sample Design and Schedule, FY 2019

Site Description	Station ID	Waterbody ID	Region	SE	CE	MT	24 hr DO	AqHab	Benthics	Nekton	Metal Water	Organic Water	Metal Sed	Organic Sed	Conventional Lab	Amb Tox Water	Amb Tox Sed	Bacteria	Flow	Fish Tissue	Field	Comments
CYPRESS CREEK AT SH 249 (Lat. 29.985556, Long. -95.570274)	11331	1009	12	HG	UI	BS	1	1	1	1					1			1	1		1	This special project is for FY2019 only

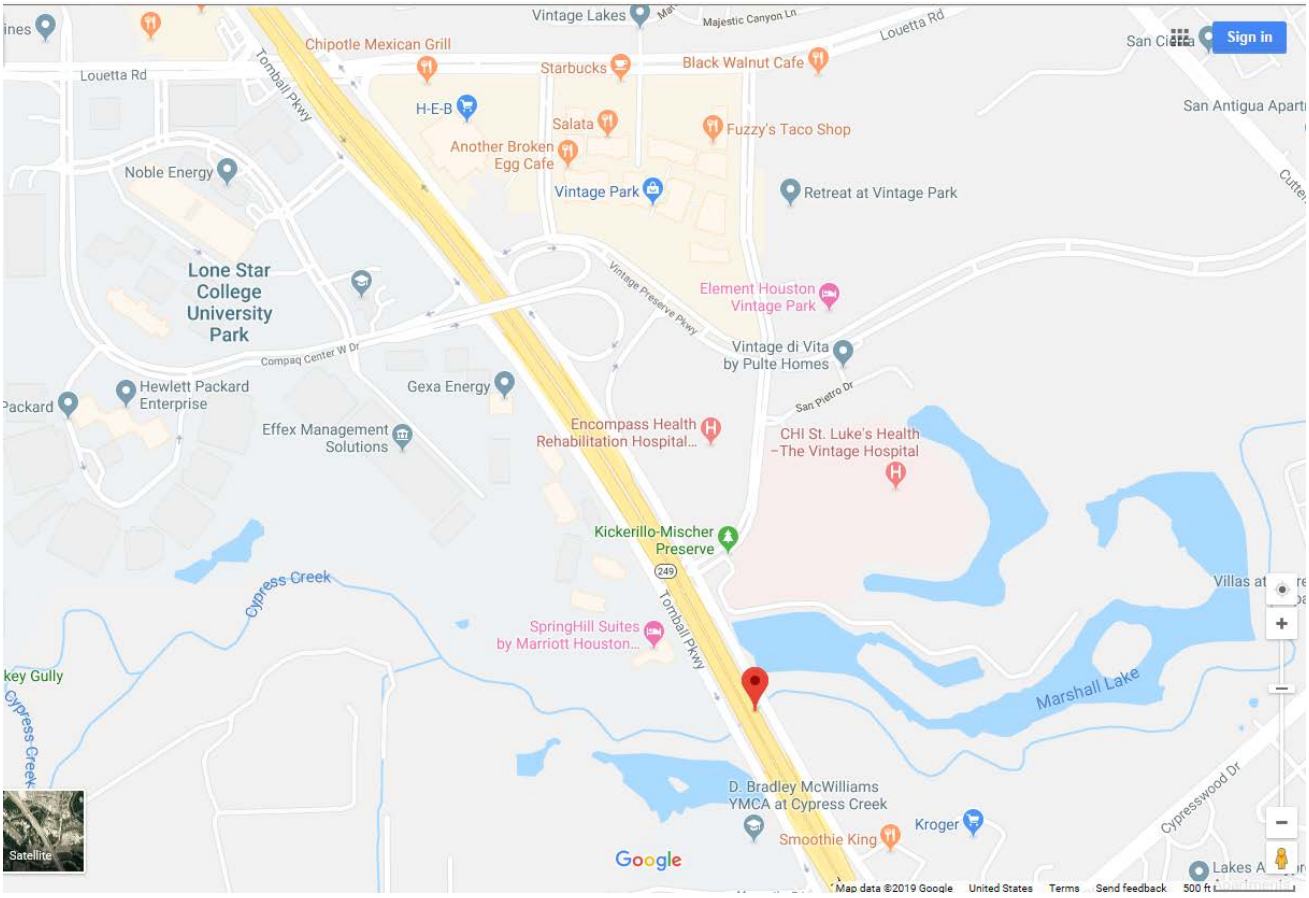
Figures SS-B1. Sampling Site Maps

Maps of station monitored by the EIH are provided below. The maps were generated using Goggle Maps. These maps are 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 these maps, contact the Jean Wright at 713-499-6660.

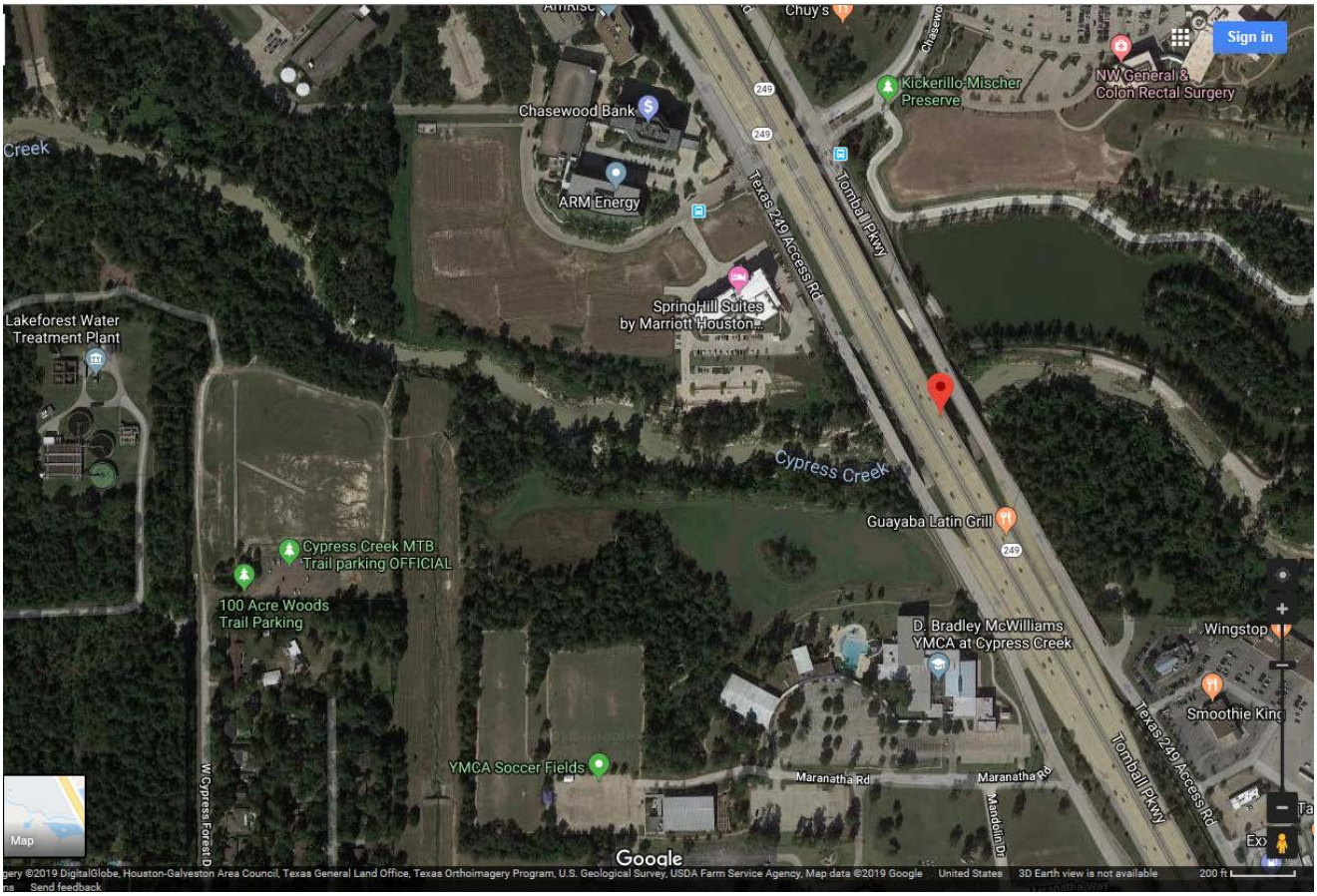
Figures SS-B1a. Sampling Station 11331 (Lat. 29.985556, Long. -95.570274) located on Cypress Creek at SH 249 south of Tomball, TX and west of I-45. (Zoomed out)



Figures SS-B1b. Sampling Station 11331 (Lat. 29.985556, Long. -95.570274) located on Cypress Creek at SH 249 south of Louetta Rd., south of Tomball, TX.



Figures SS-B1c. Sampling Station 11331 (Lat. 29.985556, Long. -95.570274) located on Cypress Creek at SH 249 (aerial close-up)



SS-B2 Sampling Methods

Field Sampling Procedures

Field sampling will be conducted using procedures documented in the TCEQ's *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods (RG-415, Revised August 2012)* and *Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014)*. Additional aspects outlined in Section B below reflect specific requirements for sampling under the Clean Rivers Program and/or provide additional clarification.

Field Monitoring and Conventional Water Quality Sampling Procedures
As described in Section B2 of the multi-basin QAPP, plus EIH investigators will deploy a multi-probe data sonde for a period of 24 hours to capture the diel variation in temperature, DO, pH, and specific conductance, following the guidance for 24-hour DO measurements in the *SWQM Procedures, Volume 1*.

Hydrologic Monitoring Procedures
Hydrologic monitoring will be conducted using the standard method described in TCEQ's *Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods (RG-415, Revised August 2012)*. This data will include an instantaneous discharge measurement that is collected during the sampling event.

Habitat Characterizations and Biological Monitoring Procedures
Habitat characterizations and biological monitoring will be conducted using procedures specified in TCEQ's *Surface Water Quality Monitoring Procedures Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014).* Benthic macroinvertebrate samples will be collected for qualitative analysis using RBP procedures. Macroinvertebrates collected using the standard D-frame kicknet method will be supplemented (and combined) with individuals attached to snags located in riffles and/or runs. Nekton samples will be collected using both seining and electrofishing techniques from all habitats present. Each site's nekton samples will be processed and kept separate so that data from electrofishing and seining will not be combined into one sample. "Time fished over a fixed distance" will be recorded for the site. Habitat characterization will consist of observations and measurements from at least 5 transects at the site. In addition, general qualitative observations about the entire reach where the biotic assessments are conducted will be recorded. Voucher specimens and photographs will be taken during the sampling event.

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

As described in Section B2 of the multi-basin QAPP.

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

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
TSS	water	Plastic	Cool to 4°C	1 L	7 days
Sulfate	water	Plastic	Cool to 4°C	100 ml[3]	28 days
Chloride	water	Plastic	Cool to 4°C	100 mL[3]	28 days
E. coli IDEXX Colilert[1]	water	Sterile Plastic w/ sodium thiosulfate	Cool to <6°C but not frozen	120 mL[4]	8 hours[1]
TKN	water	Plastic	Cool to 4°C H_2SO_4 to pH <2	500 mL[2]	28 days
Ammonia-N	water	Plastic	Cool to 4°C H_2SO_4 to pH <2	125 mL[2]	28 days
Nitrite + nitrate-N	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	125 mL[2]	28 days
Phosphorus-P, total	water	Plastic	Cool to 4°C H_2SO_4 to pH <2	125 mL[2]	28 days
Fish Vouchers	water	Plastic	10% Formalin in field, store in Formalin for at least one week, soak in fresh water each day for three days, transfer to 50% isopropyl alcohol or 75% ethanol for indefinite storage	As needed to submerge samples without crowding	7 days in Formalin, indefinite for isopropyl alcohol or ethanol
Benthic Macroinvertebrates	water	Plastic	If processing in the field, 70% ethanol or 40% isopropyl alcohol. If processing in the lab immediately after collection, 95% ethanol. If processing in the lab at least a week after collection, 10% Formalin. Transfer to 70% ethanol or 40% isopropyl alcohol for indefinite storage	As needed to submerge samples without crowding (no more than half full)	7 days in Formalin, indefinite for isopropyl alcohol or ethanol

1 *E.coli* samples analyzed by SM 9223-B should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.
2 Five tests are analyzed from one 1L plastic bottle.
3 One 500 mL plastic container is used to collect these three samples.
4. Maximum volume analyzed for E. coli is 50 ml allowing duplicate analyses from 1 container.

Sample Containers

As described in Section B2 of the multi-basin QAPP

Processes to Prevent Contamination

As described in Section B2 of the multi-basin QAPP

Documentation of Field Sampling Activities

As described in Section B2 of the multi-basin QAPP. Additional forms for biological field work, identification/ enumeration bench sheets, and tracking logs can be found in Appendix SS-B.

Recording Data

As described in Section B2 of the multi-basin QAPP.

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

As described in Section B2 of the multi-basin QAPP

SS-B3 Sample Handling and Custody

Sample Tracking

As described in Section B3 of the multi-basin QAPP.

Sample Labeling

As described in Section B3 of the multi-basin QAPP. Labeling of biological specimens will be completed as described in the TCEQ's *Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014).*

Sample Handling

As described in Section B3 of the multi-basin QAPP plus any special handling of biological samples will be conducted using procedures outlined in TCEQ's *Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416, Revised May 2014).*

Sample Tracking Procedure Deficiencies and Corrective Action

As described in Section B3 of the multi-basin QAPP.

SS-B4 Analytical Methods

The analytical methods, associated matrices, and performing laboratories are 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." Laboratory SOPs are consistent with EPA requirements, as specified in the method. Copies of laboratory QMs and SOPs are retained by Eastex Laboratory and are available for review by H-GAC or TCEQ upon request.

Standards Traceability

As described in Section B4 of the multi-basin QAPP.

Analytical Method Deficiencies and Corrective Actions

As described in section B4 of the multi-basin QAPP.

SS-B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the multi-basin QAPP.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the multi-basin QAPP.

Quality Control or Acceptability Requirements Deficiencies and Corrective Actions

As described in Section B5 of the multi-basin QAPP.

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

As described in Section B6 of the multi-basin QAPP.

SS-B7 Instrument Calibration and Frequency

As described in Section B7 of the multi-basin QAPP.

SS-B8 Inspection/Acceptance of Supplies and Consumables

As described in Section B8 of the multi-basin QAPP.

SS-B9 Acquired Data

As described in Section B9 of the multi-basin QAPP. Only data collected directly under this QAPP is submitted to the SWQMIS database.

SS-B10 Data Management

As described in Section B10 of the multi-basin QAPP.

Data Dictionary

Terminology and field descriptions are included in the most recent version of the DMRG. A table outlining the entities that will be used when submitting data under this QAPP is included below for the purpose of verifying which entity codes are included in this QAPP.

Name of Entity	Tag Prefix	Submitting Entity	Collecting Entity
Environmental Institute of Houston – University of Houston Clear Lake	I	HG	UI

SS-C1 Assessments and Response Actions

As described in Section C1 of the multi-basin QAPP.

Corrective Action

As described in Section C1 of the multi-basin QAPP.

SS-C2 Reports to Management

Reports to Planning Agency Project Management

As described in Section C2 of the multi-basin QAPP.

Reports to TCEQ Project Management

As described in Section C2 of the multi-basin QAPP.

Reports by TCEQ Project Management

As described in Section C2 of the multi-basin QAPP.

SS-D1 Data Review, Verification, and Validation

As described in Section D1 of the multi-basin QAPP.

SS-D2 Verification and Validation Methods

As described in Section D2 of the multi-basin QAPP.

SS-D3 Reconciliation with User Requirements

As described in Section D2 of the multi-basin QAPP.

SS-APPENDIX A – Measurement Performance Specifications

TABLE SS-A7.1a Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Field Parameters

Parameter	Units	Matrix	Method	Parameter Code	Lab
TEMPERATURE, WATER (DEGREES CENTIGRADE)	DEG C	water	SM 2550 B and TCEQ SOP V1	00010	Field
TRANSPARENCY, SECCHI DISC (METERS)	meters	water	TCEQ SOP V1	00078	Field
SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	us/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	Field
OXYGEN, DISSOLVED (MG/L)	mg/L	water	SM 4500-O G and TCEQ SOP V1	00300	Field
PH (STANDARD UNITS)	s.u	water	EPA 150.1 and TCEQ SOP V1	00400	Field
DAYS SINCE PRECIPITATION EVENT (DAYS)	days	other	TCEQ SOP V1	72053	Field
DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE	meters	water	TCEQ SOP V2	82903	Field
MAXIMUM POOL WIDTH AT TIME OF STUDY (METERS)***	meters	other	TCEQ SOP V2	89864	Field
MAXIMUM POOL DEPTH AT TIME OF STUDY(METERS)***	meters	other	TCEQ SOP V2	89865	Field
POOL LENGTH, METERS***	meters	other	TCEQ SOP V2	89869	Field
% POOL COVERAGE IN 500 METER REACH***	%	other	TCEQ SOP V2	89870	Field
WIND INTENSITY (1=CALM,2=SLIGHT,3=MOD.,4=STRONG)	NU	other	NA	89965	Field
PRESENT WEATHER (1=CLEAR,2=PTCLDY,3=CLDY,4=RAIN,5=OTHER)	NU	other	NA	89966	Field
WATER SURFACE(1=CALM,2=RIPPLE,3=WAVE,4=WHITECAP)	NU	water	NA	89968	Field
WATER ODOR (1=SEWAGE, 2=OILY/CHEMICAL, 3=ROTTEN EGGS, 4=MUSKY, 5=FISHY, 6=NONE, 7=OTHER (WRITE IN COMMENTS))	NU	water	NA	89971	Field
WATER COLOR 1=BRWN 2=RED 3=GRN 4=BLCK 5=CLR 6=OT	NU	water	NA	89969	Field

*** To be routinely reported when collecting data from perennial pools.

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.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TABLE SS-A7.1b Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Flow Parameters

Parameter	Units	Matrix	Method	Parameter Code	Lab
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	water	TCEQ SOP V1	00061	Field
FLOW SEVERITY:1=No Flow,2=Low,3=Normal,4=Flood,5=High,6=Dry	NU	water	TCEQ SOP V1	01351	Field
STREAM FLOW ESTIMATE (CFS)	cfs	Water	TCEQ SOP V1	74069	Field
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	other	TCEQ SOP V1	89835	Field

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.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

Table SS-A7.1c Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Conventional Parameters in Water

Parameter	Units	Matrix	Method	Parameter Code	TCEQ AWRL	LOQ	LOQ Check Sample %Rec	Precision (RPD of LCS/LCSD)	Bias %Rec. of LCS	Lab
RESIDUE, TOTAL NONFILTRABLE (MG/L)	mg/L	water	SM 2540D	00530	5	1	NA	NA	NA	Eastex
NITROGEN, AMMONIA, TOTAL (MG/L AS N)	mg/L	water	SM 4500 NH3 G	00610	0.1	0.1	70-130	20	80-120	Eastex
NITRITE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00615	0.05	0.05	70-130	20	80-120	Eastex
NITRATE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00620	0.05	0.05	70-130	20	80-120	Eastex
NITROGEN, KJELDAHL, TOTAL (MG/L AS N)	mg/L	water	SM 4500-N_{org} B or C and SM 4500-NH3 C	00625	0.2	0.2	70-130	20	80-120	Eastex
NITRITE PLUS NITRATE, TOTAL ONE LAB DETERMINED VALUE (MG/L AS N)	mg/L	water	SM 4500 - NO3 F	00630	0.05	0.04	70-130	20	80-120	Eastex
PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	mg/L	water	SM 4500 P E	00665	0.06	0.06	70-130	20	80-120	Eastex
CHLORIDE (MG/L AS CL)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00940	5	5	70-130	20	80-120	Eastex
SULFATE (MG/L AS SO4)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00945	5	5	70-130	20	80-120	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.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE SS-A7.1d Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Bacteriological Parameters in Water

Parameter	Units	Matrix	Method	Parameter Code	TCEQ AWRL	LOQ	LOQ Check Sample %Rec	Log Difference of Duplicates	Bias %Rec. of LCS	Lab
E. COLI, COLILERT, IDEXX METHOD, MPN/100ML	MPN/100 mL	water	SM 9223-B**	31699	1	1	NA	0.50*	NA	Eastex
E.COLI, COLILERT, IDEXX, HOLDING TIME	hours	water	NA	31704	NA	NA	NA	NA	NA	Eastex

* This value is not expressed as a relative percent difference. It represents the maximum allowable difference between the logarithm of the result of a sample and the logarithm of the duplicate result. See Section B5.

** E.coli samples analyzed by these methods should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

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.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE SS-A7.1e Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

24-Hour Parameters in Water

Parameter	Units	Matrix	Method	Parameter Code	Lab
TEMPERATURE, WATER (DEGREES CENTIGRADE), 24HR AVG	DEG C	Water	TCEQ SOP V1	00209	field
WATER TEMPERATURE, DEGREES CENTIGRADE, 24HR MAX	DEG C	Water	TCEQ SOP V1	00210	field
TEMPERATURE, WATER (DEGREES CENTIGRADE) 24HR MIN	DEG C	Water	TCEQ SOP V1	00211	field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR AVG	uS/cm	Water	TCEQ SOP V1	00212	field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR MAX	uS/cm	Water	TCEQ SOP V1	00213	field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR MIN	uS/cm	Water	TCEQ SOP V1	00214	field
PH, S.U., 24HR MAXIMUM VALUE	std. units	Water	TCEQ SOP V1	00215	field
PH, S.U., 24HR, MINIMUM VALUE	std. units	Water	TCEQ SOP V1	00216	field
WATER TEMPERATURE, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00221	field
SPECIFIC CONDUCTANCE, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00222	field
pH, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00223	field
DISSOLVED OXYGEN, 24-HOUR MIN. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89855	field
DISSOLVED OXYGEN, 24-HOUR MAX. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89856	field
DISSOLVED OXYGEN, 24-HOUR AVG. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89857	field
DISSOLVED OXYGEN, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	89858	field

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.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE SS-A7.1f Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Biological - Habitat

Parameter	Units	Matrix	Method	Parameter Code	Lab
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	Water	TCEQ SOP V2	00061	Field/EIH
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field/EIH
STREAM TYPE; 1=PERENNIAL 2=INTERMITTENT S/PERENNIAL POOLS 3=INTERMITTENT 4=UNKNOWN	NU	Water	NA/Calculation	89821	Field/EIH
STREAMBED SLOPE (M/KM)	M/KM	Other	NA/Calculation	72051	Field/EIH
AVERAGE PERCENTAGE INSTREAM COVER	%	Other	TCEQ SOP V2	84159	Field/EIH
STREAM ORDER	NU	Water	TCEQ SOP V2	84161	Field/EIH
NUMBER OF LATERAL TRANSECTS MADE	NU	Other	TCEQ SOP V2	89832	Field/EIH
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	Other	TCEQ SOP V2	89835	Field/EIH
TOTAL NUMBER OF STREAM BENDS	NU	Other	TCEQ SOP V2	89839	Field/EIH
NUMBER OF WELL DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89840	Field/EIH
NUMBER OF MODERATELY DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89841	Field/EIH
NUMBER OF POORLY DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89842	Field/EIH
TOTAL NUMBER OF RIFFLES	NU	Other	TCEQ SOP V2	89843	Field/EIH
DOMINANT SUBSTRATE TYPE(1=CLAY,2=SILT,3=SAND,4=GRAVEL,5=COBBLE,6=BOULDER,7=BEDROCK,8=OTHER)	NU	Sediment	TCEQ SOP V2	89844	Field/EIH
AVERAGE PERCENT OF SUBSTRATE GRAVEL SIZE OR LARGER	%	Other	TCEQ SOP V2	89845	Field/EIH
AVERAGE STREAM BANK EROSION (%)	%	Other	TCEQ SOP V2	89846	Field/EIH
AVERAGE STREAM BANK SLOPE (DEGREES)	deg	Other	TCEQ SOP V2	89847	Field/EIH
HABITAT FLOW STATUS, 1=NO FLOW, 2=LOW,3=MOD,4=HIGH	NU	Other	TCEQ SOP V2	89848	Field/EIH
AVERAGE PERCENT TREES AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89849	Field/EIH
AVERAGE PERCENT SHRUBS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89850	Field/EIH
AVERAGE PERCENT GRASS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89851	Field/EIH
AVERAGE PERCENT CULTIVATED FIELDS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89852	Field/EIH
AVERAGE PERCENT OTHER AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89853	Field/EIH
AVERAGE PERCENTAGE OF TREE CANOPY COVERAGE	%	Other	TCEQ SOP V2	89854	Field/EIH
DRAINAGE AREA ABOVE MOST DOWNSTREAM TRANSECT*	km2	Other	TCEQ SOP V2	89859	Field/EIH
REACH LENGTH OF STREAM EVALUATED (M)	m	Other	NA/Calculation	89884	Field/EIH
AVERAGE STREAM WIDTH (METERS)	M	Other	TCEQ SOP V2	89861	Field/EIH
AVERAGE STREAM DEPTH (METERS)	M	Other	TCEQ SOP V2	89862	Field/EIH

TABLE SS-A7.1f Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Biological - Habitat

Parameter	Units	Matrix	Method	Parameter Code	Lab
MAXIMUM POOL WIDTH AT TIME OF STUDY (METERS)	M	Other	TCEQ SOP V2	89864	Field/EIH
MAXIMUM POOL DEPTH AT TIME OF STUDY(METERS)	M	Other	TCEQ SOP V2	89865	Field/EIH
AVERAGE WIDTH OF NATURAL RIPARIAN VEGETATION (M)	M	Other	TCEQ SOP V2	89866	Field/EIH
AVERAGE WIDTH OF NATURAL RIPARIAN BUFFER ON LEFT BANK (M)	M	Other	NA/Calculation	89872	Field/EIH
AVERAGE WIDTH OF NATURAL RIPARIAN BUFFER ON RIGHT BANK (M)	m	Other	NA/Calculation	89873	Field/EIH
AESTHETICS OF REACH(1=WILD 2=NAT. 3=COMM. 4=OFF.)	NU	Other	TCEQ SOP V2	89867	Field/EIH
NUMBER OF STREAM COVER TYPES	NU	Other	TCEQ SOP V2	89929	Field/EIH
LAND DEVELOP IMPACT (1=UNIMP,2=LOW,3=MOD,4=HIGH)	NU	Other	TCEQ SOP V2	89962	Field/EIH
RIPARIAN VEGETATION %; LEFT BANK - TREES	%	Other	NA/Calculation	89822	Field/EIH
RIPARIAN VEGETATION %; RIGHT BANK - TREES	%	Other	NA/Calculation	89823	Field/EIH
RIPARIAN VEGETATION %; LEFT BANK SHRUBS	%	Other	NA/Calculation	89824	Field/EIH
RIPARIAN VEGETATION %; RIGHT BANK - SHRUBS	%	Other	NA/Calculation	89825	Field/EIH
RIPARIAN VEGETATION %: LEFT BANK - GRASSES OR FORBS	%	Other	NA/Calculation	89826	Field/EIH
RIPARIAN VEGETATION %; RIGHT BANK - GRASSES OR FORBS	%	Other	NA/Calculation	89827	Field/EIH
RIPARIAN VEGETATION %: LEFT BANK - CULTIVATED FIELDS	%	Other	NA/Calculation	89828	Field/EIH
RIPARIAN VEGETATION %: RIGHT BANK - CULTIVATED FIELDS	%	Other	NA/Calculation	89829	Field/EIH
RIPARIAN VEGETATION %: LEFT BANK - OTHER	%	Other	NA/Calculation	89830	Field/EIH
RIPARIAN VEGETATION %: RIGHT BANK - OTHER	%	Other	NA/Calculation	89871	Field/EIH
AVAILABLE INSTREAM COVER HQI SCORE: 4=ABUNDANT 3=COMMON 2=RARE 1=ABSENT	NU	Other	NA/Calculation	89874	Field/EIH
BOTTOM SUBSTRATE STABILITY HQI SCORE: 4=STABLE 3=MODERATELY STABLE 2=MODERATELY UNSTABLE 1=UNSTABLE	NU	Other	NA/Calculation	89875	Field/EIH
NUMBER OF RIFFLES HQI SCORE: 4=ABUNDANT 3=COMMON 2=RARE 1=ABSENT	NS	Other	NA/Calculation	89876	Field/EIH
DIMENSIONS OF LARGEST POOL HQI SCORE: 4=LARGE 3=MODERATE 2=SMALL 1=ABSENT	NU	Other	NA/Calculation	89877	Field/EIH
CHANNEL FLOW STATUS HQI SCORE: 3=HIGH 2=MODERATE 1=LOW 0=NO FLOW	NU	Other	NA/Calculation	89878	Field/EIH
BANK STABILITY HQI SCORE: 3=STABLE 2=MODERATELY STABLE 1=MODERATELY UNSTABLE 0=UNSTABLE	NU	Other	NA/Calculation	89879	Field/EIH
CHANNEL SINUOSITY HQI SCORE: 3=HIGH 2=MODERATE 1=LOW 0=NONE	NU	Other	NA/Calculation	89880	Field/EIH

TABLE SS-A7.1f Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Biological - Habitat					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
RIPARIAN BUFFER VEGETATION HQI SCORE: 3=EXTENSIVE 2=WIDE 1=MODERATE 0=NARROW	NU	Other	NA/Calculation	89881	Field/EIH
AESTHETICS OF REACH HQI SCORE: 3=WILDERNESS 2=NATURAL AREA 1=COMMON SETTING 0=OFFENSIVE	NU	Other	NA/Calculation	89882	Field/EIH
HQI TOTAL SCORE	NU	Other	NA/Calculation	89883	Field/EIH
LENGTH OF STREAM EVALUATED (KM)	KM	Other	NA/Calculation	89860	Field/EIH
STREAMBED SLOPE (FT/FT)	FT/FT	Other	NA/Calculation	72052	Field/EIH
NO FLOW ISOLATED POOL: LARGEST POOL MAX WIDTH (M	M	Other	NA/Calculation	89908	Field/EIH
NO FLOW ISOLATED POOL: LARGEST POOL MAX LENGTH (	M	Other	NA/Calculation	89909	Field/EIH
NO FLOW ISOLATED POOL: LARGEST POOL MAX DEPTH (M	M	Other	NA/Calculation	89910	Field/EIH
NO FLOW ISOLATED POOL: SMALLEST POOL MAX DEPTH (	M	Other	NA/Calculation	89911	Field/EIH
NO FLOW ISOLATED POOL: SMALLEST POOL MAX WIDTH (	M	Other	NA/Calculation	89912	Field/EIH
NO FLOW ISOLATED POOL: SMALLEST POOL MAX LENGTH	M	Other	NA/Calculation	89913	Field/EIH
NO FLOW ISOLATED POOLS: NUMBER OF POOLS EVALUATED	NU	Other	NA/Calculation	89914	Field/EIH

* From USGS map.

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.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE SS-A7.1g Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Biological - Benthics (Quantitative)

Parameter	Units	Matrix	Method	Parameter Code	Lab
STREAM ORDER	NU	Water	TCEQ SOP V1	84161	Field/EIH
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field/EIH
QUANTITATIVE PROTOCOLS REGIONAL BENTHIC MACROINVERTEBRATE IBI SCORE	NS	Other	NA/Calculation	90085	Field/EIH
BENTHIC DATA REPORTING UNITS (1=NUMBER OF INDIVIDUALS IN SUB-SAMPLE, 2=NUMBER OF INDIVIDUALS/FT2, 3=NUMBER OF INDIVIDUALS/M2, 4=TOTAL NUMBER OF INDIVIDUALS IN SAMPLE)	NU	Other	TCEQ SOP V2	89899	Field/EIH
UNDERCUT BANK AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89921	Field/EIH
OVERHANGING BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89922	Field/EIH
GRAVEL BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89923	Field/EIH
SAND BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89924	Field/EIH
SOFT BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89925	Field/EIH
MACROPHYTE BED AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89926	Field/EIH
SNAGS AND BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89927	Field/EIH
BEDROCK STREAMBED AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89928	Field/EIH
MESH SIZE, ANY NET OR SIEVE, AVERAGE BAR (CM)	cm	Other	TCEQ SOP V2	89946	Field/EIH
BENTHIC SAMPLE COLLECTION METHOD (1=SURBER, 2=EKMAN, 3=KICKNET, 4=PETERSON, 5=HESTER DENDY, 6=SNAG, 7=HESS)	NU	Other	TCEQ SOP V2	89950	Field/EIH
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field/EIH
AREA OF SNAG SURFACE SAMPLED (SQ.MT)	m2	Other	TCEQ SOP V2	89975	Field/EIH
BENTHOS ORGANISMS -NONE PRESENT (0=NONE PRESENT)	NS	Other	TCEQ SOP V2	90005	Field/EIH
BENTHIC GATHERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90025	Field/EIH
TOTAL TAXA RICHNESS, BENTHOS	NU	Other	TCEQ SOP V2	90055	Field/EIH
TOTAL NUMBER OF INTOLERANT TAXA, BENTHOS	NU	Other	TCEQ SOP V2	90058	Field/EIH
CHIRONOMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90062	Field/EIH
TOLERANT BENTHOS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90066	Field/EIH

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.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE SS-A7.1h Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Biological - Benthics (Qualitative)					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
STREAM ORDER	NU	Water	TCEQ SOP, V1	84161	Field/EIH
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field/EIH
RAPID BIOASSESSMENT PROTOCOLS BENTHIC MACROINVERTEBRATE IBI SCORE	NS	Other	NA/Calculation	90081	Field/EIH
BENTHIC DATA REPORTING UNITS (1=NUMBER OF INDIVIDUALS IN SUB-SAMPLE, 2=NUMBER OF INDIVIDUALS/FT2, 3=NUMBER OF INDIVIDUALS/M2, 4=TOTAL NUMBER OF INDIVIDUALS IN SAMPLE)	NU	Other	TCEQ SOP V2	89899	Field/EIH
KICKNET EFFORT,AREA KICKED (SQ.METER)	m2	Other	TCEQ SOP V2	89903	Field/EIH
KICKNET EFFORT,MINUTES KICKED (MIN.)	min.	Other	TCEQ SOP V2	89904	Field/EIH
DEBRIS/SHORELINE SAMPLING EFFORT, MINUTES	min.	Other	TCEQ SOP V2	89905	Field/EIH
NUMBER OF INDIVIDUALS IN BENTHIC SAMPLE	NU	Other	TCEQ SOP V2	89906	Field/EIH
UNDERCUT BANK AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89921	Field/EIH
OVERHANGING BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89922	Field/EIH
GRAVEL BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89923	Field/EIH
SAND BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89924	Field/EIH
SOFT BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89925	Field/EIH
MACROPHYTE BED AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89926	Field/EIH
SNAGS AND BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89927	Field/EIH
BEDROCK STREAMBED AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89928	Field/EIH
MESH SIZE, ANY NET OR SIEVE, AVERAGE BAR (CM)	cm	Other	TCEQ SOP V2	89946	Field/EIH
BENTHIC SAMPLE COLLECTION METHOD (1=SURBER, 2=EKMAN, 3=KICKNET, 4=PETERSON, 5=HESTER DENDY, 6=SNAG, 7=HESS)	NU	Other	TCEQ SOP V2	89950	Field/EIH
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field/EIH
BENTHOS ORGANISMS -NONE PRESENT (0=NONE PRESENT)	NS	Other	TCEQ SOP V2	90005	Field/EIH
HILSENHOFF BIOTIC INDEX (HBI)	NU	Other	TCEQ SOP V2	90007	Field/EIH
NUMBER OF EPT INDEX	NU	Other	TCEQ SOP V2	90008	Field/EIH
DOMINANT BENTHIC FUNCTIONAL FEEDING GRP, % OF INDIVIDUALS	%	Other	TCEQ SOP V2	90010	Field/EIH
BENTHIC GATHERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90025	Field/EIH
BENTHIC PREDATORS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90036	Field/EIH
DOMINANT TAXON, BENTHOS PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90042	Field/EIH

TABLE SS-A7.1h Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake					
RATIO OF INTOLERANT TO TOLERANT TAXA, BENTHOS	NU	Other	TCEQ SOP V2	90050	Field/EIH
NUMBER OF NON-INSECT TAXA	NU	Other	TCEQ SOP V2	90052	Field/EIH
ELMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90054	Field/EIH
TOTAL TAXA RICHNESS, BENTHOS	NU	Other	TCEQ SOP V2	90055	Field/EIH
CHIRONOMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90062	Field/EIH
PERCENT OF TOTAL TRICHOPTERA INDIVIDUALS AS HYDROPSYCHIDAE	%	Other	TCEQ SOP V2	90069	Field/EIH

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.)
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE SS-A7.1i Measurement Performance Specifications for Environmental Institute of Houston (EIH) - University of Houston - Clear Lake

Biological - Nekton

Parameter	Units	Matrix	Method	Parameter Code	Lab
STREAM ORDER	NU	Water	TCEQ SOP V1	84161	Field/EIH
NEKTON TEXAS REGIONAL IBI SCORE	NS	Other	NA/Calculation	98123	Field/EIH
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field/EIH
SEINE, MINIMUM MESH SIZE, AVERAGE BAR, NEKTON,IN	IN	Other	TCEQ SOP V2	89930	Field/EIH
SEINE, MAXIMUM MESH SIZE, AVG BAR, NEKTON,INCH	IN	Other	TCEQ SOP V2	89931	Field/EIH
NET LENGTH (METERS)	M	Other	TCEQ SOP V2	89941	Field/EIH
ELECTROFISHING METHOD 1=BOAT 2=BACKPACK 3=TOTEBARGE	NU	Other	TCEQ SOP V2	89943	Field/EIH
ELECTROFISH EFFORT, DURATION OF SHOCKING (SEC)	SEC	Other	TCEQ SOP V2	89944	Field/EIH
SEINING EFFORT (# OF SEINE HAULS)	NU	Other	TCEQ SOP V2	89947	Field/EIH
COMBINED LENGTH OF SEINE HAULS (METERS)	M	Other	TCEQ SOP V2	89948	Field/EIH
SEINING EFFORT, DURATION (MINUTES)	MIN	Other	TCEQ SOP V2	89949	Field/EIH
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field/EIH
AREA SEINED (SQ METERS)	M2	Other	TCEQ SOP V2	89976	Field/EIH
NUMBER OF SPECIES, FISH	NU	Other	TCEQ SOP V2	98003	Field/EIH
NEKTON ORGANISMS-NONE PRESENT (0=NONE PRESENT)	NS	Other	TCEQ SOP V2	98005	Field/EIH
TOTAL NUMBER OF SUNFISH SPECIES	NU	Other	TCEQ SOP V2	98008	Field/EIH
TOTAL NUMBER OF INTOLERANT SPECIES, FISH	NU	Other	TCEQ SOP V2	98010	Field/EIH
PERCENT OF INDIVIDUALS AS OMNIVORES, FISH	%	Other	TCEQ SOP V2	98017	Field/EIH
PERCENT OF INDIVIDUALS AS INVERTIVORES, FISH	%	Other	TCEQ SOP V2	98021	Field/EIH
PERCENT OF INDIVIDUALS AS PISCIVORES, FISH	%	Other	TCEQ SOP V2	98022	Field/EIH
PERCENT OF INDIVIDUALS WITH DISEASE OR ANOMALY	%	Other	TCEQ SOP V2	98030	Field/EIH
TOTAL NUMBER OF NATIVE CYPRINID SPECIES	NU	Other	TCEQ SOP V2	98032	Field/EIH
PERCENT INDIVIDUALS AS NON-NATIVE FISH SPECIES (% OF COMMUNITY)	%	Other	TCEQ SOP V2	98033	Field/EIH
TOTAL NUMBER OF INDIVIDUALS SEINING	NU	Other	TCEQ SOP V2	98039	Field/EIH
TOTAL NUMBER OF INDIVIDUALS ELECTROFISHING	NU	Other	TCEQ SOP V2	98040	Field/EIH
TOTAL NUMBER OF BENTHIC INVERTIVORE SPECIES	NU	Other	TCEQ SOP V2	98052	Field/EIH
NUMBER OF INDIVIDUALS PER SEINE HAUL	NU	Other	TCEQ SOP V2	98062	Field/EIH
NUMBER OF INDIVIDUALS PER MINUTE ELECTROFISHING	NU	Other	TCEQ SOP V2	98069	Field/EIH
PERCENT INDIVIDUALS AS TOLERANT FISH SPECIES (EXCLUDING WESTERN MOSQUITOFISH)	%	Other	TCEQ SOP V2	98070	Field/EIH
TOTAL NUMBER OF INDIVIDUALS IN SAMPLE, FISH	NU	Other	TCEQ SOP V2	98023	Field/EIH
PERCENT OF INDIVIDUALS AS TOLERANTS, FISH	%	Other	TCEQ SOP V2	98016	Field/EIH

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.)
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TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

SS-APPENDIX B – Field and Bench Sheets for Aquatic Life Monitoring and Habitat Assessments

Environmental Institute of Houston, University of Houston-Clear Lake
Field Datasheets for Aquatic Life Monitoring and Habitat Assessments

Environmental Institute of Houston - University of Houston Clear Lake

Clean Rivers Program Field Datasheet

Station ID:_____ Date:_____ Sample Time: _____

Location:_____ Lat:_____ Long:_____

Collected By:_____

FIELD MEASUREMENTS (If < 1.5m deep - record @ 0.3m from surface; If ≥ 1.5m deep - perform profile @ 0.3m from bottom, @ middle, and @ 0.3m from surface)

	1	2	3	4	5
Temp (C)					
Conductivity (uS)					
Salinity (psu)					
DO (%sat)					
DO mg/L					
pH					
Depth (m)					

FIELD OBSERVATIONS

	TOTAL DEPTH (m)		PRESENT WEATHER	1-clear 2-partly cloudy 3-cloudy 4-rain 5-other
	WATER ODOR	1-sewage 2-oily/chemical 3-rotten egg 4-musky 5-fishy 6-none 7-other	FLOW SEVERITY	1-no flow 2-low 3-normal 4-flood 5-high 6-dry
	WATER SURFACE	1-calm 2-ripples 3-waves 4-whitecap	FLOW (cfs)	
	WIND INTENSITY	1-calm 2-slight 3-moderate 4-strong	FLOW METHOD	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler
	WATER COLOR	1-brownish 2-reddish 3-greenish 4-blackish 5-clear 6-other	SECCHI DISK appear (m)	
NA	TIDE STAGE	1-low 2-falling 3-slack 4-rising 5-high	SECCHI DISK disappear (m)	
	DAYS SINCE LAST SIG. RAINFALL		RECREATIONAL USE	1=1° observed, 2=2° observed, 3=non-contact observed, 4=1° evidence, 5=2° evidence, 6=non-contact evidence, 7=no evidence

WATER SAMPLES

☐ **FRESH** (Non-Tidal) ☐ *E. coli* ☐ **MARINE** (Tidal) ☐ *Enterococcus*

Container	Preservative	Analysis Requested	Comments
1L Plastic	Ice	TSS	
1L Plastic	Ice + 2mL H_2SO_4	NH_3, TPO_4, NO_2+NO_3	
500mL Plastic	Ice + 2mL H_2SO_4	TKN	
500mL Plastic	Ice	Cl, SO_4	
100mL Plastic	Ice + $N_2S_2O_3$ tablet	Bacteria (*E. coli*)	
~~4L Amber Plastic~~	~~Ice~~	~~Chlorophyll-a~~	

ADDITIONAL INFORMATION & REMARKS

* If site is dry or intermittent, determine if there is any pool with 500m reach, If pool(s) exists (> 10 m in length and 0.4m deep) record: Lat _____ Long_____ of largest pool in reach. Maximum pool width_____(m), Maximum pool depth _____ (m), Pool length _____(m), and percent pool coverage in 500m reach _____%.

Texas Commission on Environmental Quality
Surface Water Quality Monitoring Program

Stream Flow (Discharge) Measurement Form

Stream:______ ___________________ _________ ______ ________________________ Date:________________

Station:_______ _________ _Task__ ____

Description:____ ___________________

Time Begin:______________ Time End:______________ Meter Type:_________________________ __________

Observers:______________________________ Stream Width:_____________ Section Width (W):_____________

Observations:____

____

Section Midpoint (ft) (m)	Section Depth (ft) (m) (cm) (D)	Observational Depth** (ft)(m)	Velocity (V)		Flow (Q) (m^3/s) (ft^3/s) Q = (W)(D)(V)
			At Point (ft/s)(m/s)	Average (ft/s)(m/s)	

m3/s x 35.3 =ft3/s

Total Flow (Discharge) (Σ Q)	*
Field Discharge (Σ Q)	

***See attached Discharge Summary**

Modified from: TCEQ-20117 (Rev. 04/22/2004)

Environmental Institute of Houston – University of Houston Clear Lake

Benthic Macroinvertebrate Collection Data

Stream Name:		**Date:**	**Time:**
Location of Site:		**TCEQ ID:**	
Latitude:	**Longitude:**	**County:**	
Collectors:			

Sampling Method: (1) Surber (2) Ekman (3) Kicknet (4) Peterseon (5) Hester-Dendy	**Habitat Type:** Riffle Run/Glide Snag Pool	
Snags/Shoreline Effort (min. picked)**:**	**Additional Method:**	
Mesh Size (cm):	**Total Area Kicked (m^2):**	**Sample Duration (min):**

COMPOSITION OF SAMPLE AREA	
Undercut bank (%):	
Overhanging brush (%):	
Gravel substrate (%):	
Sand substrate (%):	
Soft bottom (%):	
Macrophytes (%):	
Snags and brush (%):	
Bedrock (%):	

MICROHABITAT COMPOSITION OF KICKED SAMPLE AREA	
	Number of microhabitats sampled
Debris/Snags	
Vegetation Stands	
Rootwads	
Detritus/Leafpacks	
Other	
Comments:	

Observations / Comments:

Habitat order preference: (1) riffle, (2) run or glide, (3) snag, (4) pool
Microhabitat preference: cobble/gravel, debris (snags), emergent vegetation, rootwads, sand, bedrock
Snags/Shoreline effort: snags are only to be sampled after riffle & run habitats are eliminated (i.e. only if 5min duration not met during riffle/run effort)

Environmental Institute of Houston – University of Houston Clear Lake

Fish Collection Data

Scientific Collection Permit No. _____

Stream Name:	**Date:**	**Time:**
Location of Site:	**TCEQ ID:**	
Collectors:	**County:**	

SAMPLING METHOD

Electrofisher Type ☐ Boat ☐ Backpack ☐ Tote barge	**Range**: ☐ Low ☐ High		**Mode**: ☐ DC ☐ AC	
	Percent of Power:		**Pulses per Second**:	
	Volts:	**Frequency**:	**Amps**:	**Pulse Width**:

Seine	**Length (m):**	**Mesh Size (in.):**	**Duration (min):**
Gill Net	**Length (m):**	**Mesh Size (in.):**	**Duration (min):**
Trawl	**Width (m):**	**No. Hauls:**	**Duration (min):**
Cast Net	**Diameter (ft):**	**No. Casts:**	**Duration (min):**
Other			

SAMPLING RESULTS

Sample Method (S = seine, ES = electroshock)	**Sample Event No.**	**Habitat Type***	**Sample Duration** (S = min; ES = sec)	**Seine Haul Length (m)**	**Comments**

***Habitat type:** Riffle, Run/Glide, Pool

Environmental Institute of Houston – University of Houston Clear Lake

Fish Photo Voucher Report

Stream Name:	**Date:**	**Time:**
Collectors:	**Sci. Collect. Permit No.:**	

Sample Method (S = seine, ES = electroshock)	**Sample Event No.**	**Common Name *or* Scientific Name**	**Std. Length (mm)**	**Photograph Information**	**Mortality (Y/N)**
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	
				Yes Photo # **No**	

Stream Physical Characteristics Worksheet (overall characteristics)

Observers:	Date:	Time start: _____ Time end: _____
Current Weather Conditions:		
Stream Name:		TCEQ Segment:
Location of Site/TCEQ Site #:	Reach Length (km):	Number of Transects:
Observed Stream Uses:		
Stream Type (circle one): **Perennial** **Intermittent w/ perennial pools**		

Total Stream Bends	**# Well-defined**	**# moderately-defined**	**# poorly-defined**

Overall Aesthetics (circle one): **(1) Wilderness** **(2) Natural** **(3) Common** **(4) Offensive**	
Channel Obstructions or Modifications (describe):	☐ Flow recorded
Overall Channel Flow Status (circle one): **High** **Moderate** **Low** **No Flow**	Total no. riffles
Land Development Impact: **(1) Un-impacted** **(2) Low** **(3) Moderate** **(4) High**	Max. Pool Depth (m): Max. Pool Width (m): Pools cover _____% of the total reach.

Notes	**Stream Slope Along Evaluated Reach**		
	Circle U/S, D/S or extra	**Reading**	**Slope**
Site Map	**Point A** D/S U/S Extra		----------
	Point B D/S U/S Extra		
	Point C D/S U/S Extra		

IT IS RECOMMENDED THAT YOU WALK THE LENGTH OF THE STREAM BANK AND MARK OUT TRANSECTS AND 6M BOXES USING FLAGS. START HABITAT ASSESSMENT AT DOWNSTREAM-MOST TRANSECT (TRANSECT 1) AND WORK YOUR WAY BACK UP STREAM. THIS FORM SHOULD BE FILLED OUT DURING AND AFTER COMPLETION OF STREAM ASSESSMENT.

*__Reach Length = 40x average stream width (min. = 150m; max. = 500m)__

***Number of transects:** 150-300m reach = 5 (no greater than 75m apart); 301-500m = 6 (no greater than 100m apart)
To determine distance between transects: (Total reach length) / (# transects - 1) = X meters

***Stream type:** see quick reference guide

***Stream bends:** see quick reference guide *(counted while performing assessment)*

***Overall aesthetics:** see quick reference guide

***Channel obstructions or modifications:** fencing, log jams, culverts, low water bridges, channelization, levees, and concrete/rip-rap

***Channel flow status:** see quick reference guide, NOT TO BE CONFUSED WITH FLOW SEVERITY

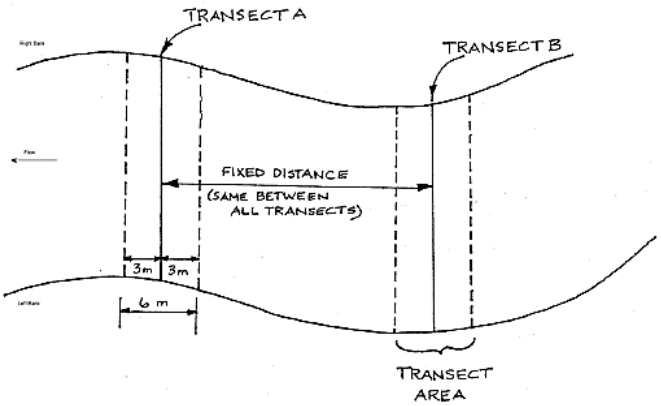
***Total number of riffle:** cumulative total of riffles within entire sample reach *(counted while performing assessment)*

***Land development impact:** see quick reference guide *(completed after performing assessment)*

***Maximum pool depth and width:** see quick reference guide for definition of pool *(measured while performing assessment)*

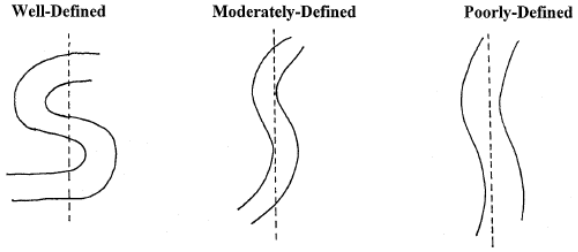
Quick Reference Guide and Definitions

Transect layout:



Stream type: Perennial: consistent flow throughout the year, though velocity and water level may change depending on season
Intermittent with perennial pools: may be dry at times of the year but pools persist throughout length of reach

Stream bends:



Overall aesthetics: Wilderness: landscape pristine; usually wooded/un-pastured; no evidence of human alteration (i.e. mowing, cutting, etc.)
Natural: trees/native veg. common; some alteration may be evident but minimal (i.e. field/pasture, buildings, etc.)
Common: fairly altered by man but not offensive (i.e. park, mowing/cutting, etc.); water clarity usually colored or turbid
Offensive: stream does not enhance aesthetics of landscape (littered, highly developed, etc.); water colored or very turbid

Channel flow status: High: water reaches base at both banks (<5% of substrate exposed)
Moderate: water fills >75% of available channel (<25% of substrate exposed)
Low: water fills 25-75% of channel and riffle substrates are mostly exposed
No flow: very little water in channel, mostly present as standing pools or stream is dry

Bank Slope: Place one end of survey rod at water's edge and lay it on the ground perpendicular to the stream channel; place clinometer on top of survey rod and record angle reading. If bank has many large irregularities, measure and determine average. If bank has many small irregularities, take one overall bank angle reading.

Gently sloping bank (angle <90°): can be read directly off clinometer
Vertical bank (angle = 90°): If vertical portion ≥3.0m, record vertical measurement; if vertical portion ≤0.3m, measure vertical portion as well as angle at the top and average readings
Undercut bank (angle >90°): place survey rod flush against roof, invert clinometer for reading; subtract value from 180°

Reach Slope: Using surveyor's level (SL) and stadia rod collect a minimum of 2 observations: one at upstream-most portion or reach and one at downstream-most portion. If there are lots of bends to the reach, you may have to take multiple readings. If you have to move the SL at any point, re-shoot most recently recorded point from new SL location and continue from there. To obtain overall slope: subtract the upstream reading from the downstream reading.

Example 1: Point A (D/S) reading = 4.655m; Point B (U/S) reading = 4.455m: 4.655m – 4.455m = 0.20m

Example 2: Point A (D/S) = 4.655m; Point B (extra) = 4.505m; Point C (U/S) = 4.445m

Point A – Point B = 4.655m – 4.505m = 0.15m
Point B – Point C = 4.505m – 4.455m = 0.05m

Stream Bed Slope Over Evaluated Reach:
0.15m + 0.05m = 0.20m

Habitat type: Riffle: shallow portion of stream characterized by rapidly moving, turbulent water consistently flowing downstream
Run: relatively shallow portion of stream characterized by fast-moving, non-turbulent flow consistently flowing downstream
Glide: characterized by slow-moving, laminar flow; velocity is slow but uniform across channel w/o eddies
Pool: water velocity is slow, depth greater than riffle, run, or glide (often contain eddies with varying directions of flow)

Dominant substrate type:
Clay/Silt = <0.06mm
Sand = 0.06-2.00mm
Gravel = 2.01-60mm
Cobble = 6.0-25.0cm
Boulders = 25.1-45cm
Large Boulders = >45cm
Bedrock = exposed bedrock (typically unbroken, large sections)

Stream Physical Characteristics – Transect 1 (bottom of reach)

Date: _____ **TCEQ Site #:** _____

Location of Transect: N _____._____ (at center of transect) W _____._____		**Distance from top of reach (m)**	
Channel Flow Status (circle one): High Moderate Low No Flow		**Stream Width (m)**	
RB Slope (°)	**RB Erosion Potential (%)**	**LB Slope (°)**	**LB Erosion Potential (%)**

Stream Depths (at points across transect) (m) [Thalweg (m): _____]											**Avg. depth (m)**

Habitat Type (circle one)	**Dominant Substrate Type (circle one)**	**Substrate gravel or larger (%)**
Riffle Run Glide Pool	Clay Silt Sand Gravel Cobble Boulder Bedrock Other (Description: _____)	

Macrophytes (circle one) Abundant Common Rare Absent	**Algae (circle one)** Abundant Common Rare Absent

Width of Natural Buffer (m)		**Riparian Vegetation Types – RB (%)**			**Riparian Vegetation Types – LB (%)**		
RB		**Trees**	**Shrubs**	**Grass**	**Trees**	**Shrubs**	**Grass**
LB		**Cultivated Fields**	**Other**		**Cultivated Fields**	**Other**	

# Instream Cover Types	**Instream Cover (%)**	**Tree Canopy Cover (%)**				
Photographs ☐ Data sheet ☐ U/S ☐ LB ☐ D/S ☐ RB		**RB**	**CR**	**CL**	**LB**	**Total**

Notes

TRANSECT 1 IS AT BOTTOM OF SAMPLE REACH (FARTHEST AWAY FROM LOCATION OF WATER QUALITY SAMPLES) AND TRANSECT LINES SHOULD BE PERPENDICULAR TO STREAM FLOW. LEFT/RIGHT BANK DETERMINED BY STREAM FLOW (LOOKING DOWNSTREAM).

***Definitions**

Channel flow status: see quick reference guide
Stream width: measure only wetted width of channel (water's edge to water's edge)
Slope: see quick reference guide
Erosion potential: measured along and 3m adjacent to either side of transect; 100% = totally bare, 0% = covered by thick vegetation/hard rock
Stream depth: measured at 11 equally spaced locations along transect (beginning and ending at water's edge)
Habitat type: see quick reference guide
Dominant substrate type: see quick reference guide
Substrate gravel or larger: estimated percentage of substrate along and 3m adjacent to either side of transect
Macrophytes and algae: determine presence along and 3m adjacent to either side of transect; estimate abundance
Width of natural buffer: distance from water to edge of natural vegetation, road, mowed grass, etc.; record up to 20m (if more, record as >20m)
Instream cover types: determine number of physical structures which provide shelter for fish and benthic macroinvertebrates
Examples: woody debris, rood wads, leaf packs, gravel or > substrate, artificial cover, undercut banks, vegetation, etc.
Percent instream cover: estimate percentage of instream cover along and 3m adjacent to either side of transect (3-D within water column)
Tree canopy cover: hold densitometer 0.3m above water surface; each out of 17; Total % = (RB+CR+CL+LB)/68; 0% = open, 100% complete cover

TAKE PHOTOGRAPHS AT EVERY TRANSECT ALONG THE REACH!

EASTEX ENVIRONMENTAL LAB, INC.

P.O. Box 1089 — Coldspring, TX 77331 — (936) 653-3249 * (800) 525-0508

P.O. Box 631375 — Nacogdoches, TX 75963-1375 — (936) 569-8879 * FAX (936) 569-8951

ANALYSIS REQUESTED

Company: Environmental Institute of Houston

Address: 2700 Bay Area Blvd, Box 540, Houston TX 77058

Attn: Jenny Oakley

Phone#: 281-283-3947

Fax#: 281-283-3953 **Email:** oakley@uhcl.edu

P.O. #

Bill to: **Attn:**

Address:

Phone: **Email:**

Remarks:

Sampler's Name (print) | **Sampler's Signature**

Project Number | **Project Name:**

Sample ID | Spec. Cond (µS)	Date	Time	C or G	DO	pH	Cl_2	Flow	Temp	Matrix	Containers: Tot #	Size	Type	Pres	*E. coli* (100mL, $Na_2S_2O_3$)	Cl, SO_4 (500mL)	TSS (1000mL)	NH_3, T PO_4, NO_2 +NO_3 (1000mL, H_2SO_4)	TKN (500mL, H_2SO_4)						
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															
|			G						WW															

Relinquished By:	Date	Time	Received By:	Date	Time	Received Iced: YES / NO
Relinquished By:	Date	Time	Received By:	Date	Time	Received Iced: YES / NO
Relinquished By:	Date	Time	Received By and/or Checked in By:	Date	Time	Received Iced: YES / NO
LAB USE ONLY Sample Condition Acceptable: YES / NO		Temp ˚ C	Logged In By:	Date	Time	
Alternate Check In:	Date	Time				

Environmental Institute of Houston, University of Houston-Clear Lake Benchtop Datasheets for Aquatic Life Monitoring and Habitat Assessments

Project & Location:_____

Date:	Time:	Employee name:
Battery Voltage:		Sonde Type and Serial No.

Calibration

Function	Temp. of Standard	Value of Standard	Initial Reading	Calibrated to	Comments
Specific conductance ≥1,000 µS/cm					Zero Check ☐Pass ☐Fail; Value =
Conductivity cell constant					Range 5.0 ± 0.5
pH calibrated (~7)					
pH mv for pH 7 solution					Range 0 ± 50 mv
pH slope (~ 4/10)					
pH mv for pH 10 pH mv for pH 4					Range: -130 to -230 mv Range: 130 to 230 mv
Dissolved oxygen (%sat) *					
Dissolved oxygen charge					Range 25 to 75
Dissolved oxygen gain					Range 0.7 to 1.4
Optional Sensors (include parameter: turbidity, etc.)					

DATA NEEDED FOR DISSOLVED OXYGEN CALIBRATION

Altitude (A) =_____feet above msl Barometric pressure _____ inches _____ mm

Barometric Pressure (BP) Options	Barometric Pressure Formulas
Barometer	Barometric pressure (inches) _____ × 25.4 = BP _____mm
From local source after correction (CBP)	BP _____mm = CBP _____mm – 2.5 (altitude ____/100)
Estimated from altitude only	BP _____ mm= 760 mm - 2.5 (altitude _____/100)
DO % saturation standard calculation *	**DO% sat Standard = Absolute BP mm Hg/760 × 100**

Deployment Checklist (required for data logging only)

Logging interval: Yes No	SDI-12 Autosleep enabled: Yes No	RS 232 autosleep enabled: Yes No	DO warm-up time:	Battery volts in Sonde (days):	Available memory in Sonde (days):

Post-Calibration Check

Date:	Time:	Employee Name:
Battery Voltage:		Sonde Type and Serial No.

Function	Temp. of Standard	Value of Standard	Initial Reading	Pass Post-Cal?	Comments
Specific conductance				☐Yes ☐No	
pH calibrated (~7)				☐Yes ☐No	
pH slope (~ 4/10)				☐Yes ☐No	
Dissolved oxygen (%sat) *				☐Yes ☐No	
Optional Sensors (include parameter: turbidity, etc.)				☐Yes ☐No	
				☐Yes ☐No	

Location of Deployment, Routine Run, or Special Study:	Date/Time Deployed:	Date/Time Retrieved:
Use(circle one): 24-hour	Continuous	Grab

MAINTENANCE—Refer to Chapter 8 for maintenance requirements—Perform temperature check along with regular maintenance. The laboratory thermometer must be checked against NIST traceable thermometer annually.

Sensor	**Date**	**Initials**	**Maintenance Completed**
pH			
DO			
Specific Conductance			

Annual NIST traceable check	Date:	NIST Temp:	Lab Thermometer Temp:	Correction Factor:
Maintenance temperature check	Date:	Sonde Temp:	Lab Thermometer Temp:	

Factory maintenance/repair notes:

TCEQ-20116 (Rev. 03/01/2012)

EIH/UHCL Benthic Macroinvertebrate Laboratory Bench Sheet

Site ID:	
Name of identifier:	
Location of collection:	Method of collection:
Date of collection:	
Initials and date sorting completed:	
Date identification/enumeration completed:	

Scientific Name	Number of Individuals
Total Number of Individuals	

Modified from: TCEQ-20232 (rev. 10/21/2005)

EIH/UHCL Fish Laboratory Bench Sheet

Site ID:

Location of collection:

Date of collection:

Gear Type: _____ Replicate: _____ of _____

Name of identifier:

Date identification/enumeration completed:

Scientific Name	Number of Individuals
Total number of individuals	

Modified from: TCEQ-20236 (rev. 10/21/2005)