QUALITY ASSURANCE PROJECT PLAN (QAPP)

Exploration Green Stormwater Wetland Water Quality Baseline Study

GLO Contract No. 23-020-005-DD599 Coastal Management Program Grant Cycle 27

Prepared by:
Texas A&M AgriLife Extension Service
Texas Community Watershed Partners
Stormwater Wetland Program

Prepared for:
Texas General Land Office
Texas Coastal Management Program

Effective Period: One year from date of final approval

Questions concerning this quality assurance project plan should be directed to:

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Commented [KAW1]: Add approval signature are for either: - - - - - Organization's Project Manager, Organization's QA Manager, EPA Project Manager, EPA QA Manager, Others, as needed (e.g., field operations manager, laboratory managers, State and other Federal agency officials)

Commented [CCT2R1]: If we decide to include signature page it should go after the organizational flow chart and include spaces for Jessica Chappell CMP PM, Christie Taylor Extension PM, and Charriss York Extension QAO.

Commented [KW3R1]: Added section titled "Approval Signatures"

Contents

Distribution List

Organizations and individuals which will receive copies of the approved QAPP and any subsequent revisions include:

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Title: Extension Program PM
Name: Charriss York
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List of Abbreviations

CMP…….. Coastal Management Program
DO…….. Dissolved Oxygen
EPA…… Environmental Protection Agency
Extension……...Texas A&M AgriLife Extension Services
GLO……General Land Office
NOAA…… National Oceanic and Atmospheric Association
NPS……Nonpoint Source
PM……..Project Manager
QA……..Quality Assurance
QAO……...Quality Assurance Officer
QAPP…….Quality Assurance Project Plan
SOP……Standard Operating Procedure
TCWP…… Texas Community Watershed Partners
TSS…….Total Suspended Solids

Project / Task Organization

The following is a list of organizations and individuals participating in the project with their specific roles and responsibilities:

GLO Coastal Management Program (CMP)

Jessica Chappell, CMP PM
Provides the primary point of contact between the Extension and CMP. Tracks and reviews deliverables to ensure that tasks in the workplan are completed as specified in the contract.

TAMU AgriLife Extension

Christie Taylor, Extension Program PM
The PM is the primary contact between the CMP and the Extension. The PM oversees the creation of all deliverables including the QAPP, any QAPP revisions as needed, progress reports, signage, reports, and web posts for the project. The PM oversees the collection of samples, reporting and analysis of data as outlined in the QAPP. Ensures that all staff involved in collections have been trained in collection procedure, programming of ISCO 6712 samplers, and use of YSI multiprobe for sample data collection. As well as ensuring all field documentation is handled properly and reported back to the PM.

Charriss York, Extension Program QAO
The QAO reviews the chain of custody forms a makes sure the transfers to the lab happen as specified in the QAPP. The QAO verifies the successful transfer of data from the lab to the Extension Program PM. The QAO enforces any corrective action, as required. Assures that all staff involved in the collection of samples are competent on ISCO 6712 and YSI multiprobe.

Kimberly Walls, Water Quality Student Intern
Student intern will calibrate and maintain all sampling equipment (both handheld and automated), label and collect samples from all three locations, contact lab courier and arrange for sample transport to the lab for analysis, including a documentation of chain of custody. The student intern will also ensure supplies (sample jars, ice, cooler, calibration solutions, field data sheets, etc.) are readily available for timely sample collection.
Student intern will assist with reviewing sample data and uploading lab reports to the webpage quarterly.

LAB

Lab Manager
Responsible for supervision of laboratory personnel involved in generating analytical data for this project. Responsible for ensuring that laboratory personnel involved in generating analytical data have adequate training and a thorough knowledge of all SOPs specific to the analyses or task performed and/or supervised. Responsible for oversight of all laboratory operations, ensuring that all QA/QC requirements are met, and documentation related to the analysis is completely and accurately reported. Responsible for ensuring laboratory corrective actions are implemented, documented, reported, and verified. Enforces corrective action, as needed.

Courier

Couriers are employed by the lab to collect and transport samples for analysis. Courier will schedule sample pick up and prepped reagent bottle deliveries with student intern or PM. Courier will provide chain of custody forms for each transfer of samples. Courier will deliver samples to the lab on ice within the specified hold times for each analysis to be run.

Figure 1.1 Project Organizational Chart- Lines of Communication

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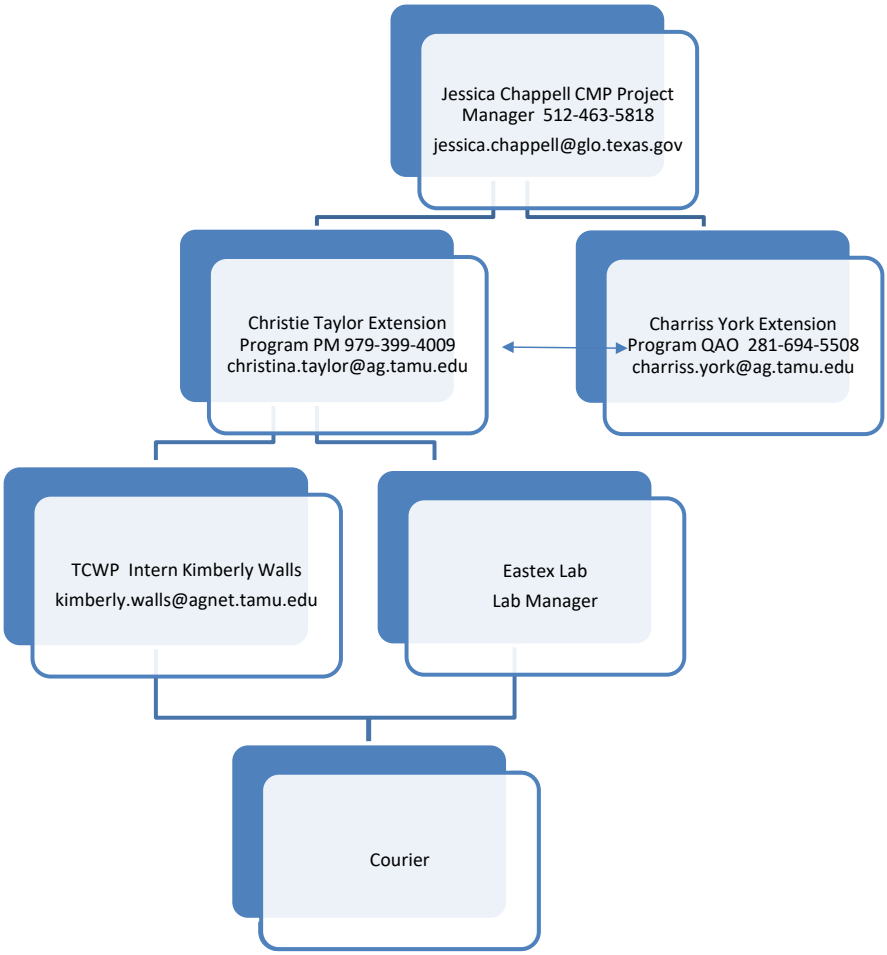

Approval Signatures

CMP PM Date

Extension PM Date

Extension QAO Date

PROJECT TITLE

Exploration Green Stormwater Wetland Water Quality Baseline Study

A. GENERAL DESCRIPTION OF STUDY:

A1. Problem:

Basins that incorporate stormwater wetlands can provide ecological benefits to water quality, habitat, and recreation. Currently, water quality data to assess the effectiveness of this type of stormwater treatment wetland is limited in the lower Galveston Bay watershed. Texas A&M AgriLife Extension Service has recently completed a study to test water quality treatment of storm events in three demonstration projects; however, there has not been a long-term or baseline study of water quality post-installation of stormwater wetlands in the area.

Texas Community Watershed Partners (TCWP) as part of the TAMU AgriLife Extension proposes to develop this QAPP as a standard water quality monitoring protocol and sample three stormwater wetland segments designed by LAN and CLCWA with technical assistance from TCWP within Exploration Green. Exploration Green Conservation and Recreation Area is transforming the defunct Clear Lake Golf Course into a stormwater detention facility with five segments ("Phases") each containing an open water feature, wetland shelves, habitat island, and walking trails. The 200-acre site receives stormwater runoff from an approximately 2000-acre predominantly suburban watershed, which is itself in the Armand Bayou watershed, 303 (d) listed as impaired by the US EPA. Water quality sampling will occur at Phases 1, 3, and 4 to represent water quality at various levels of phase completion. Phase 1 is a 14-acre lake containing 6 acres of wetlands planted from 2016-2018. Phase 3 is connected to Phase 2 and is split into Phases 3A and 3B. Phase 3A is a 16.6-acre detention pond that has completed construction as of 2021 with ongoing planting planned throughout the summer of 2023. Phase 3B is an 11.3-acre pond with construction at 95% completion. Phase 4 is a 22.5-acre pond connected to Phase 1 that has completed construction as of 2021. Wetland planting on the phase is ongoing with a total of 1,500 plants planted as of the date of this document.

Figure A1.1 Sampling Location

Commented [KAW5]: Map locations need updating

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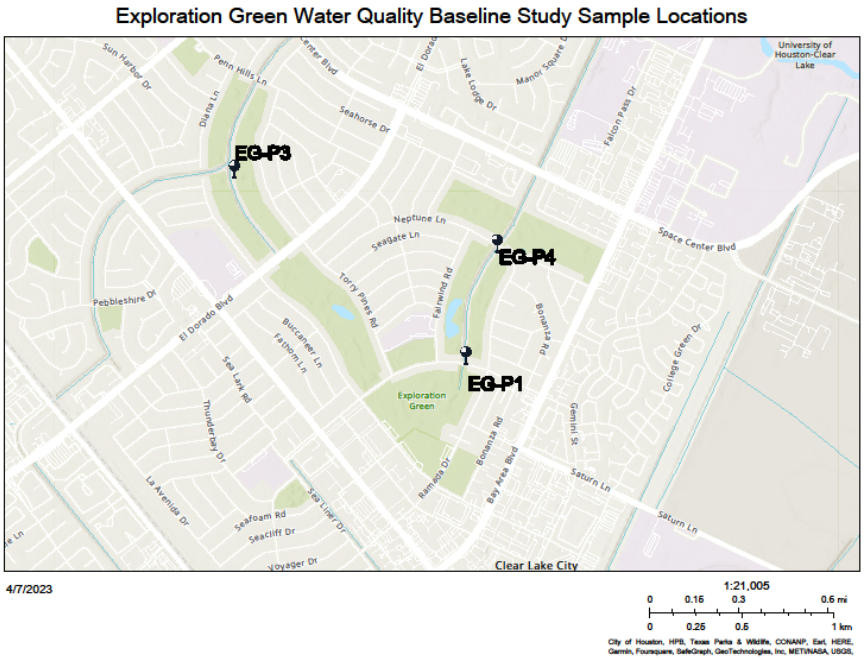

A2. Background:

Extension and project partners are designing and implementing stormwater wetland demonstration projects in various basin types and watersheds. In contrast to the standard detention basin, basins that incorporate stormwater wetlands can provide a multiplicity of benefits: water quality, wildlife habitat, aesthetics, and recreation. The stormwater wetlands are designed to retain water for about 48-72 hours (about 3 days) post-storm event to allow them to remove debris, sediments and harmful chemicals and bacteria before the water is released downstream and into Galveston Bay. However, there have not been enough studies of these designs' effectiveness on improving water quality.

For example, in one study of Mason Park marsh, the region's first constructed treatment wetland in Houston, TX results were inconclusive due to extreme drought [Guillen UHCL 2012]. The other study of this site was conducted by citizen science, but there are limited other studies of this type of constructed wetland in our area which to compare the data.

In a similar study of this BMP design from Pine Lake, Georgia, research shows that using wetlands and bioretention features reduce the amount of total coliform, E. coli, and conductivity thus improving the quality of water discharged from the stormwater wetland. This study collected water samples after storm events that occurred after a 48-hour antecedent dry period. They also collected influent and effluent samples at the same time [Styes, Zarus, and Ryan April 2015 Stormwater- Magazine].

As development increases, so does the requirement for drainage infrastructure, but currently, standard stormwater basins are ecologically and aesthetically bleak. Stormwater wetlands provide a method of combining multiple functions into a single site. Gaining data on the stormwater wetland practice is necessary as the technique is promoted for its multiplicity of benefits. The project will look at the water quality data aspect of the stormwater wetland BMP and provide quality and comparable data of common NPS parameters measured at the outflow sites of Exploration Green. The goal is to have a complete annual baseline through all seasons and rainfall conditions that can be compared to other water quality testing sites from BMP and non-BMP sites to gauge the effectiveness of the practice. Secondarily we would like to look at variations of data through establishment of the wetland shelves at the three sample locations and try to determine if there is any compounding effects as stormwater moves between the Phases before outfall into the natural receiving body of water.

All data from both field and lab analysis will be available on the TCWP website at the link provided https://tcwp.tamu.edu/stormwater/wetlands/stormwater-wetland-water-quality-monitoring-project/ and thus accessible for decision makers effecting change in drainage infrastructure planning. Stormwater wetland effects on water quality are documented in other areas of the U.S. and internationally, [Center for Watershed Protections' National Pollutant Removal Database for Stormwater Treatment Practices] but there is less documentation of Houston regional stormwater wetlands. Data from local demonstration projects can result in better buy-in by local decision makers.

A3. Project Task Description:

Project Objective:

The project will generate data of known and acceptable quality to accurately depict the amount of water quality improvements provided by the stormwater wetland of Exploration Green in Clear Lake.

Each of the three outfall locations at Exploration Green will be sampled through all seasons to provide data in variable weather and conditions. There will be one portable ISCO 6712 sampler at each of the three selected effluent sites within the phases of Exploration Green to collect samples. Handheld YSI multiparameter samples will be collected at each site. A total of 66 samples will be lab analyzed. One sample for each lab analyzed parameter will be collected biweekly from each of the three outfall locations, and each sample will be given a distinct number based on location and sample week. Parameters to be tested in biweekly lab samples include TSS, phosphate, ammonium, and bacteria levels. Samples will be collected by TCWP staff and transferred by courier to Eastex labs for analysis. Lab results will be delivered as both electronic and hard copies to the extension program PM and the extension program QAO. The lab results and analysis will be compiled by the extension program PM. Lab results and graphic representation of water quality changes will be uploaded to the designated webpage on the TCWP website (https://tcwp.tamu.edu/stormwater/wetlands/stormwater-wetland-water-quality-monitoring-project/) by the extension staff.

Handheld YSI samples will be collected weekly from April 2023 to February 2024. Parameters measured with the handheld unit will include water temperature, DO, conductivity, pH, and ammonium levels. The YSI will be calibrated weekly using the calibration technique described in the unit manual. All data will be recorded on the field data sheets. Rainfall events and flow levels will be recorded by the automated samplers and downloaded monthly by the PM. Rainfall amounts and flow levels will be updated to the website quarterly. Rainfall amounts and flow level data will be included on data sheets for corresponding sample dates.

Each parameter will be graphed as linear trend analysis.

To produce results in a timely manner, the water quality sampling project will follow the timeline described in Table A3.1

Table A3.1

Task	Project Milestones	Start	End
1.1	Develop QAPP	M1	M3
2.6	Begin sampling	M3	M13
3.3	Data reports posted to TCWP webpage and provided to GLO and partners quarterly	M6	M13
3.4	Present data	M13	M14
4.3	Final Report	M14	M14

A4. Quality Objectives and Criteria

The project objective is to evaluate and quantify the effectiveness of constructed stormwater wetlands on water quality. The purpose of collecting effluent samples biweekly is to verify that the water is being treated to a measurable degree during long-term capture by the wetland basin. This method is comparable to other studies of stormwater wetlands as best management practices.

Table A4.1: Quality Objectives

Procedure	Completeness	Precision	Representativeness	Comparability
Collect water quality samples using automated sampling equipment ISCO 6712 and YSI multiprobe in the field	It is the goal of this project to have 90% of all potential data available for use in reporting and analysis.	Adhering to the same protocols for each site demonstrated during each repetition.	Ensure the number of samples taken at each site is enough to accurately characterize the water quality conditions of corresponding site in each seasonal period at during representative rainfall and flow conditions.	Dedication to using approved sampling and analysis methods. Report data in standard units; according to known laboratory practices so data can be compared to other local SWQM data and national projects of similar BMPs.

A5. Special Training / Certifications

TCWP staff involved in the collection of samples will be trained in the ISCO 6712 set up and collection procedures, rain gauge, flow loggers and chain of custody procedures. Sample collecting staff will be trained in YSI sonde calibration protocols according to manufacturer's manual for calibration procedures. A list of trained TCWP staff will be maintained by the Extension QAO.

A6. Documents and Records

Records produced by this project will consist of data collection, monitoring, and analysis results. Progress reports on data collection, processing and analysis will be submitted quarterly.

Laboratory Test Reports must document the test results clearly and accurately. The data reports should include information necessary for the interpretation and validation of data. The requirements for reporting data are as follows:

- Name of client
- Sample name
- Sample matrix
- Date and time of collection
- Units of measure
- Date and time of sample receipt
- Date and time of sample analysis
- Indication of Method used for analysis
- Identification of samples that did not meet QA requirements and reason for removal

Data will be reported on the dedicated project webpage (https://tcwp.tamu.edu/stormwater/wetlands/stormwater-wetland-water-quality-monitoring-project/) on the TCWP website. Tabular and graphical representation of the data will be reported on the webpage quarterly as available for each of the three locations.

Data validation and QA checks will be conducted by the Extension QAO. Copies of data documentation generated by the Extension program project personnel will be stored in the GIFT Program One Drive cloud. Extension will ensure against catastrophic loss of data (e.g. physical damage/data loss due to fire or storm damage) by storing data backups at a secure location. The data report and web-based products will be organized according to sample site location. Hard copies will be kept in a waterproof/ fireproof safe.

The final assessment data report will be produced electronically and as a hard copy, and all files used to produce the report will be saved electronically by TAMU for at least five years and will be available for transfer to the CMP PM.

Table A6.1: Project Quality Assurance Documents and Records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	TAMU	5 years	Electronic/ Paper
Chain of Custody Forms, Field Notes, and Sample Results	TAMU	5 years	Electronic/ Paper
Quarterly Progress Reports, data collection, data monitoring, data analysis	TAMU	5 years	Electronic/ Paper
Presentations and white paper	TAMU	5 years	Electronic/ Paper
Final report	TAMU	5 years	Electronic/ Paper
All Backups	TAMU	1 year	Electronic

B. MEASUREMENT AND DATA ACQUISITION

B1. EXPERIMENTAL DESIGN

This project's experimental design aims to show the effectiveness of constructed stormwater wetlands as a BMP for improved water quality in stormwater detention. The three sites at Exploration Green are of varied sizes and at various stages of completion. The Phase 1 stormwater wetland was completed in Fall 2018, Phase 3A completed construction in Fall 2021planting is 95% completion as of the date of this document, and Phase 4 completed construction in Fall 2022 and wetland planting activities are ongoing at this time. The sites are in the sub-watershed of the Armand Bayou Watershed in Clear Lake.

TableB1.1 Location Description

Location	Site	Latitude Longitude	Sample code	Start Date	End Date	Mode of Sampling	Sample Matrix	Monitoring Frequency
Exploration Green Park Phase 1	Effluent	**To Be Recorded at Time of Install**	EG-P1-#	Apr. 2023	Feb. 2024	Automatic and handheld	water	Weekly-Biweekly
Exploration Green Park Phase 3	Effluent	**To Be Recorded at Time of Install**	EG-P3-#	Apr. 2023	Feb. 2024	Automatic and handheld	water	Weekly-Biweekly
Exploration Green Park Phase 4	Effluent	**To Be Recorded at Time of Install**	EG-P4-#	Apr. 2023	Feb. 2024	Automatic and handheld	water	Weekly-Biweekly

Commented [KAW7]: Include location descriptions of Exploration Green phases for outflow sampling

This experiment will monitor water quality parameters at the effluent sites of each basin location. Automated samplers will be located at the effluent sites and sample biweekly for one year according to

the schedule provided in Table B1.1. Up to 22 samples for lab analysis will be collected at each site biweekly with additional parameters measured from a handheld sampling device weekly. Rainfall amounts will be measured using an ISCO 674 tipping bucket rain gauge and water flow levels measured with an ISCO 730 bubble flow meter. Rainfall amount and flow amount will be recorded on the field collection data form at time of sample collection. ISCO 6712 automated sampler data logs will be downloaded monthly on the last Friday of each month by the Extension PM.

B1.2 Experimental Method Summary by Location

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Location	Outflow Volume	Outflow Pollutant Concentration
Exploration Green Nature Park Phase 1	Measured with ISCO 6712 automated sampler triggered to collect weekly. A composite sample will be taken every week in a 9L bottle. Flow volume will be recorded from the ISCO 730 bubble flow meter. Rainfall amount will be measured from the ISCO 674 tipping bucket rain gauge.	Direct laboratory measurements of composite samples analyzed biweekly. A YSI ProQuatro handheld multiparameter meter will be used to measure additional parameters onsite weekly with a YSI Professional Plus being used as needed.
Exploration Green Nature Park Phase 3	Measured with ISCO 6712 automated sampler triggered to collect weekly. A composite sample will be taken every week in a 9L bottle. Flow volume will be recorded from the ISCO 730 bubble flow meter. Rainfall amount will be measured from the ISCO 674 tipping bucket rain gauge.	Direct laboratory measurements of composite samples analyzed biweekly. A YSI ProQuatro handheld multiparameter meter will be used to measure additional parameters onsite weekly with a YSI Professional Plus being used as needed.
Exploration Green Nature Park Phase 4	Measured with ISCO 6712 automated sampler triggered to collect weekly. A composite sample will be taken every week in a 9L bottle. Flow volume will be recorded from the ISCO 730 bubble flow meter. Rainfall amount will be measured from the ISCO 674 tipping bucket rain gauge.	Direct laboratory measurements of composite samples analyzed biweekly. A YSI ProQuatro handheld multiparameter meter will be used to measure additional parameters onsite weekly with a YSI Professional Plus being used as needed.

B2. SAMPLING METHODS

Field Sampling Procedures

Field sampling data will be documented on Field Data Reporting Form (Appendix B). For all sampling visits, location id, sampling time, sampling date, sample collector's name and signature, rainfall amount, sample volumes, preservatives added to samples are recorded. A YSI Professional Series multiprobe will be used to measure dissolved oxygen (DO), specific conductance, pH, and water temperature and ammonium levels in standard measurements. Measurements will be saved in the device log and downloaded monthly. This data will be recorded on the field data reporting form weekly as a backup. Values for measured field parameters are recorded on the Field Data Reporting Form and the field data notebook (Rite in the Rain All-Weather Journal) should also include any visual observations, and time since the last recorded rainfall event, etc. Basic rules for recording information for this project are:

1. Legible writing in indelible, waterproof ink with no write-overs,
2. Changes should be made by crossing out original entry with 1 single line, entering the change and initial and date corrections,
3. Closeouts on incomplete pages with an initialed and dated diagonal line.
4. Paper copies are collected in the water quality sampling binder and reviewed by PM and QAO before being scanned.
5. All forms are scanned for electronic backup and uploaded to the website.

Automated Sampling Procedures

Automated samplers will be programmed in accordance with manufacturer user guides for automatic sampler data collection. Sample bottles and coolers for sample storage and sample pick up will be provided by the lab. Sample types, container types, minimum sample volume, preservation requirements and hold times are specified in Table B2.1. Samples will be collected in one large composite sample and separated into the appropriate sample containers for transport to the lab. Samples will be bagged by sample site for secondary containment and ease of transport. Then the courier will be contacted to pick up samples.

Table B2.1 Sampling Protocol

Parameter	Matrix	Sample Type	Container	Preservation	Sample Volume	Hold Time
E. coli	water	composite	Sterile, plastic	Sodium Thiosulfate <60 C	100ml	24 hours*
TSS	water	composite	Plastic or glass	<60C	1000ml	7 days
Total Phosphorus	water	composite	Plastic or glass	Sulfuric acid <60 C	500ml	28 days
Ammonia as N	water	composite	Plastic or glass	Sulfuric acid <60 C	500ml	28 days

- Bacteria hold time for storm water runoff samples in automated samplers collected for non-EPA regulatory purposes.(Daren Harmel, et al, Environ Monit Assess 2016)

B3. SAMPLE HANDLING AND CUSTODY

Sample Labeling

Samples from the field are labelled on the container with an indelible marker. Label includes:

1. Site identification
2. Date and time collected
3. Preservative added, if applicable
4. Sample type (i.e. analysis) to be performed

Sample Handling

Samples are collected at the field site by AgriLife Extension staff and then labeled and appropriately preserved for laboratory analysis. Once preserved, the samples will be packaged in coolers by field staff according to laboratory specifications.

Samples will be transferred from TCWP to Eastex lab by courier. Samples analyzed by the laboratory will be documented on a chain of custody (COC) from that laboratory. A copy of the COC and custody procedures from the participating laboratory is found in Appendix C.

Upon receipt, the condition of the samples, including any abnormalities or departures from the standard condition will be recorded. All samples will have a traceable COC. Every sample accepted will be logged into a secure electronic database. Each sample is given a unique Lab ID number listed on the report. Samples that do not meet volume, preservation, hold time, and temperature requirements will be qualified, and the Extension PM will be contacted for guidance. All samples requiring thermal preservation are considered acceptable if the arrival temperature is within +/- 20 C of required temperature of the method specified range. Where applicable the lab verifies chemical preservation using readily available techniques prior to or during sample preparation or analysis. Samples are handled and prepared as directed in the lab's analytical SOP for each analysis. Laboratory SOPs will be provided as an appendix to this QAPP.

B4. ANALYTICAL METHODS

Analytical methods are provided as an appendix to this document. The following tables summarizes the parameters, with appropriate codes, to be analyzed and the party responsible for the analysis. Method of analysis and limits of quantification and appropriate precision percentages and specified in Table B4.1.

Table B4.1 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 STANDARD %Rec	Lab
Field Parameters (Water Column)										
Rainfall	Inches	Water	gauge	46529	NA	NA	NA	NA	NA	Field
pH	pH. units	water	YSI multiprobe	00400	NA	NA	NA	NA	NA	Field
DO	mg/L	water	YSI multiprobe	00300	NA	NA	NA	NA	NA	Field
Conductivity	uS/cm	water	YSI multiprobe	00094	NA	NA	NA	NA	NA	Field
Flow	Gallons	water	ISCO flow meter		NA	NA	NA	NA	NA	Field
Temperature	^{0}C	Water	YSI multiprobe		NA	NA	NA	NA	NA	Field
Conventional Parameters (Water)										
Ammonia-N	mg/L	water	SM 4500-N G	00610	0.1	0.02	20	80-120	70-130	Eastex
T-PO4-P	mg/L	water	SM 4500-P E	00665	0.06	0.06	20	80-120	70-130	Eastex
E. coli		water	Idexx Laboratories Colilert 18	31699	1	NA	0.5	NA	NA	Eastex
TSS	mg/L	water	SM2540 D	00530	4	1	20	80-120	NA	Eastex

B5. QUALITY CONTROL

B5.1 Instrument/ Equipment testing, inspection and maintenance

Automated sampler testing and maintenance are reference at the following locations:
ISCO 6712: http://www.isco.com/manuals/UP001DT6.pdf

ISCO 730 Bubble Module: http://www.isco.com/manuals/UP001ATF.pdf

YSI ProQuatro handheld multiparameter meter:
https://www.ysi.com/File%20Library/Documents/Manuals/606962-ProQuatro-User-Manual-English.pdf

Commented [KW9]: Updated probe manual to YSI ProQuatro

YSI Professional Plus handheld multiprobe:
http://www.ysi.com/File%20Library/Documents/Manuals/605596-YSI-ProPlus-User-Manual-RevD.pdf

Equipment records are kept on all field equipment and a supply of critical spare parts is maintained by the AgriLife Extension Field Supervisor.

All laboratory tools, gauges, instruments, equipment testing, and maintenance requirements are contained within the laboratory QAMs. Testing and maintenance records are maintained and available.

B5.2 Instrument Calibration and Frequency

All instruments and devices used in obtaining environmental data will be calibrated prior to use. Calibration methods are contained in the manufacturer's instruction manuals referenced above. YSI multiprobes will be calibrated before sampling, following protocols outlined in the YSI manual.

Calibration procedures for laboratory equipment will be kept by the Eastex labs.

B5.3 Inspection / Acceptance of Supplies and Consumables

The laboratory QA officer and laboratory technical director oversee all required checks of supplies and chemicals and assure all records are complete. These include all routine and non-routine maintenance activities and reference material verifications.

Field sampling equipment is tested by extension staff before use; any changes or calibrations are noted in the field notebook and field data reporting sheets.

All sample bottles are provided by Eastex and undergo inspection before they are delivered to the Extension office.

Probe calibration solutions are maintained per manufacturer suggestions. The reagents are catalogued as they are received and used.

B6. Data Management

Field staff will visit sites biweekly to collect samples. On each visit notes will be made on the field data recording sheets and the field notebook. If no samples are collected or there is a problem with their collection, the visit will be recorded into the field notebook. If visits are made to calibrate, maintenance, or otherwise check the equipment these site visits will also be recorded in the field notebook.

Samples collected on-site will be labelled for transportation to the laboratory. Site name, time of collection, comments and other data will be copied from field notebook to COC. The COC and sample bottles will be submitted to laboratory analyst with relinquishing and receiving signatures on COC filled out by the field researcher.

All field data sheets will be scanned into electronic format. Field data will be transferred or manually entered into an electronic spreadsheet. The spreadsheet will be created using Microsoft Excel software. The spreadsheet will be stored in the GIFT One Drive file and shared with the Extension PM and QAO. All files will be backed up monthly to an external hard drive. The QAO will check 10 percent of all the manually recorded spreadsheet entries to the field records to ensure there were no transcription errors. The tables, charts and graphs created from the data analysis will be uploaded to the dedicated webpage quarterly.

All paper records and electronic files will be stored for at least five years by the Extension office.

.C. Assessments and Oversight

C1. Assessments and Response Actions

The following table identifies the types of assessments and response actions for project activities applicable to this QAPP.

Deficiencies are any deviations from the QAPP or equipment manual protocols. Deficiencies may invalidate resulting data and may require corrective action. Corrective action may include samples being discarded and recollected. Deficiencies are documented in the field logbook, field data sheets, etc. by field or laboratory staff. The Extension PM is responsible, in consultation with the Extension QAO, for ensuring that the corrective actions and resolutions to the problems are documented and records maintained in accordance with the QAPP. In addition, these actions and resolutions are reported to the CMP PM in writing in email, quarterly progress reports and by completion of CAP (Corrective Action Plan).

Table C1.1 Assessments and Response Requirements

Assessment Activity	Schedule	Responsible Party	Scope	Response Requirement
Status Monitoring	Continuous	Extension PM	Monitor project status and records to ensure requirements are being fulfilled.	Quarterly reports to CMP PM
Monitoring Systems Audit	Dates to be determined by CMP PM/ Extension QAO	CMP PM Extension QAO	To ensure field sampling, handling, and measurements are happening in accordance with the QAPP. Review data management as it relates to this project.	Quarterly Progress Reports and/or timely response to CMP PM. Complete any CAP provided by QAO or CMP PM.

C2. Reports to Management

All the reports in this section are contract deliverables for the AgriLife Extension and are transferred to the CMP PM in accordance with contract requirements.

The QAPP, associated appendices and amendments detail the sample handling and data reporting for this project.

Quarterly Progress Reports summarize activities for each task; reports monitoring status, problems, delays, corrective actions; and describes the status of each deliverable task.
Final Project Report summarizes the activities for the entire project period including a description and documentation of major project activities, evaluation of project results and environmental benefits and a conclusion drawn from the research.

D. Data Validation and Usability

D1. Data Review, Verification, and Validation

For this document's purpose, data verification is a systematic process for evaluating performance and compliance of a set of data to ascertain its completeness, correctness, and consistency using the methods and criteria defined in the QAPP. Validation means the processes taken independently of data generation to evaluate the technical usability of verified data with respect to the project's objectives or intention. All data obtained from the field and laboratory measurements will be reviewed and verified for conformance to project requirements and validated against the data quality criteria in section A4 of this QAPP. Data supported by these verification and validation controls will be considered acceptable and reported on the webpage.

D2. Verification and Validation Methods

All data will be verified by Extension PM to ensure they are representative of the samples analyzed and the locations where the measurements were made and that the data and quality control measures were made accurately in accordance with the project specifications.
The staff and management of the respective field, laboratory, and analysis and data management tasks are responsible for the integrity, verification, and validation of the data each task generates or handles throughout each project process.
The data to be verified (listed in Table D2.1) are evaluated for against performance specifications (section B4) and are checked for errors in transcription, calculations, and data input. If an error is found the person who entered the data will be notified to address the issue. Issues that can be corrected are corrected and documented electronically or by initialing and dating the appropriate paperwork. If the error cannot be corrected the data associated with the error will be rejected and not reported.

Table D2.1 Data Verification Procedures

Data to be Verified	Field Task	Laboratory Task	Extension Data Management Task
Sample documentation complete, sample labeled, site id	Y	Y	
Field samples collected	Y		
Standards and reagents traceable	Y	Y	
Sample preservation and handling acceptable	Y	Y	
COC Complete	Y	Y	
Hold times not exceeded	Y	Y	
Collection, Preparation, Analysis consistent with SOPs and QAPP	Y	Y	Y
Field Documentation	Y		Y
Instrument calibration	Y	Y	
QC samples analyzed at required frequency	Y	Y	Y
QC results meet performance specifications	Y	Y	Y

Analytical Sensitivity consistent with QAPP		Y	Y
Results, calculations, transcriptions checked	Y	Y	Y
Laboratory samples analyzed for all parameters		Y	
Nonconforming activities documented	Y	Y	Y
Outliers confirmed and documented; reasonableness checked			Y
Results reported in standard measures and formats			Y
Sampling and data gaps documented and checked	Y	Y	Y
10 % data manually reviewed			Y
Data, Analysis, Results reported on webpage quarterly			Y

D3. Reconciliation with User Requirements

Data collected from this project will be analyzed and reported on the dedicated webpage located on the TCWP website and in a final white paper to the CMP to show the performance of stormwater wetlands as a BMP. The purpose is to show the reduction in NPS loadings of water that has passed through the stormwater wetland. The paper will discuss the limitations of the data collected. The results will be used by local officials as they review ordinances and design standards for future stormwater retention in their communities. Data will also be used in AgriLife Extension outreach programs to provide unbiased, science- based, quality assured data on the effectiveness of stormwater wetlands for reducing NPS loadings on the Texas Gulf Coast.

Appendix A: Contract Scope of Work

Contract Number: 23-020-005-D599

Project Name: Exploration Green Stormwater Wetland Water Quality Baseline Study.

Subrecipient: Texas A&M AgriLife Extension Service.

Reporting Frequency: Quarterly.

Contact: Christie Taylor, Texas A&M AgriLife Extension Program Specialist.

Project Description:

Basins that incorporate stormwater wetlands can provide ecological benefits to water quality, habitat, and recreation. Currently, water quality data to assess the effectiveness of this type of stormwater treatment wetland is limited in the lower Galveston Bay watershed. Texas A&M AgriLife Extension Service has recently completed a study to test water quality treatment of storm events in three demonstration projects; however, there has not been a long-term or baseline study of water quality post-installation of stormwater wetlands in the area.

Texas A&M AgriLife Extension Service ("AgriLife" or "Subrecipient") will use Coastal Management Program ("CMP") Grant Cycle 27 funds to develop a water sampling plan and collect 50-60 weekly (or biweekly as determined in the QAPP) water samples from three outfall locations of Exploration Green Stormwater Wetland (the "Project"). As part of the Project, AgriLife will collect the samples through automated samplers installed by AgriLife onsite. AgriLife staff will retrieve the samples weekly and measure additional water quality parameters onsite using a handheld multiparameter sampling device. AgriLife will detail the parameters sampled in the sampling plan. AgriLife will send the water samples to a laboratory to test for nutrient levels and bacteria indicator species. Each water sample location is in a different phase of wetland establishment, allowing AgriLife to explore how the larger Exploration Green Stormwater Wetland is contributing to the reduction of nonpoint source ("NPS") pollution in the watershed. AgriLife will analyze the project results and report their findings to stakeholders.

This Project will provide more water quality data to assess the effectiveness of stormwater wetlands at reducing NPS pollution in associated waterbodies. Routine sampling over all seasons will allow AgriLife to track seasonal fluctuations, changes due to storm or drought events, and to gauge needs for future stormwater wetlands. Additionally, the Project will provide scientific data for decision makers at Exploration Green Conservancy and Clear Lake City Water Authority on how the stormwater treatment wetlands being created at Exploration Green in the Clear Creek watershed are impacting long-term water quality.

Project Budget:

	CMP	Subrecipient	Third Party	Project Totals
Salaries	$44,641.00	$3,926.00	$0.00	$48,567.00
Fringe	$11,305.00	$1,159.00	$0.00	$12,464.00
Travel	$1,334.00	$0.00	$0.00	$1,334.00
Supplies	$7,783.00	$0.00	$0.00	$7,783.00
Equipment	$0.00	$0.00	$0.00	$0.00
Contractual	$5,400.00	$0.00	$0.00	$5,400.00
Other	$620.00	$22,500.00	$0.00	$23,120.00
Subtotal	**$71,083.00**	**$27,585.00**	**$0.00**	**$98,668.00**
Indirect	$0.00	$19,805.00	$0.00	$19,805.00
Total	**$71,083.00**	**$47,390.00**	**$0.00**	**$118,473.00**

Special Award Conditions ("SAC"):

1. Subrecipient must complete Project as described in this Work Plan.
2. The GLO and/or NOAA must approve any changes to the scope of work or budget requests that change the total Project cost.
3. Subrecipient must print CMP and NOAA logos, including appropriate acknowledgment statement, on education/outreach materials, signs, final reports and/or publications.
4. Subrecipient must share data in the appropriate manner as specified in the Contract.
5. Subrecipient must coordinate with the GLO prior to issuing press releases, conducting media events, or otherwise engaging in media related communications for Project.

Task 1: Methodology and Quality Assurance Protocols

AgriLife will develop a Quality Assurance Project Plan ("QAPP") that includes detailed methodology for sample collection, recording, laboratory transfer, hold times and analysis. AgriLife will develop the QAPP in accordance with National Environmental Laboratory Accreditation Program ("NELAP") procedures, Environmental Protection Agency ("EPA") standards, and Texas Commission on Environmental Quality ("TCEQ") guidelines. AgriLife will train and hire a graduate student, or student workers, to collect the water samples and the onsite measurements.

Task 1 Deliverables:

1. Draft Quality Assurance Project Plan (QAPP)
   Due Date: 3/31/2023
2. Final Quality Assurance Project Plan (QAPP)
   Due Date: 4/10/2023
3. CV of Graduate Student or Student Worker(s)
   Due Date: 3/31/2023

Travel: No travel funds requested for this task.

Task 2: Water Sampling
AgriLife will collect water samples for 50-60 weeks from three outfall locations of Exploration Green Stormwater Wetland. AgriLife will install automated samplers and signage at each location. AgriLife shall program the automated samplers to collect the water samples at timed intervals as established by the QAPP. AgriLife will submit draft signage to the GLO for review and approval before installation. AgriLife will retrieve the water samples from all three solar-powered automated samplers and record the rainfall amount measured by the rain gauge attached to the samplers.

While onsite retrieving the samples, AgriLife will measure water quality parameters using handheld multiparameter sampling devices and measure light intensity using a photometer. AgriLife will send the water samples to a certified lab to test for bacteria and nutrient levels.

Task 2 Deliverables:
1. Map of sample locations
   Due Date: 4/10/2023
2. Draft signage
   Due Date: 2/10/2023
3. Executed contract with lab
   Due Date: 3/15/2023
4. Final signage
   Due Date: 3/25/2023
5. Photos of automated samplers and signage at all locations
   Due Date: 3/25/2023
6. Photos of water sampling efforts
   Due Date: Quarterly until 3/31/2024

Travel: Travel to sites for set up and sample collection using both personal and AgriLife fleet vehicles.

Task 3: Data Sharing and Outreach
AgriLife will share the Project results on a dedicated water quality webpage linked to one of the AgriLife Texas Community Watershed Partners ("TCWP") websites, most likely the Green Infrastructure for Texas ("GIFT") webpage. AgriLife will include a QR code to the webpage on all signage and printed materials. AgriLife will develop figures that summarize the project results and share them with partners at Clear Lake City Water Authority, Exploration Green Conservancy, Galveston Bay Foundation, Galveston Bay Estuary Program ("GBEP") Water and Sediment Quality subcommittee, and Harris County Flood Control District. AgriLife will publish a white paper describing the Project results. AgriLife will present the white paper at a local or state conference such as GBEP State of the Bay or the State Stormwater Conference.

Task 3 Deliverables:
1. Project webpage link
   Due Date: 2/10/2023
2. QR code linking to webpage
   Due Date: 2/10/2023

3. Quarterly data reports posted to a TCWP or GIFT website and links provided to GLO and project partners
   Due Date: 3/31/2024
4. Presentation agendas, power point slides, or poster presentation and photos
   Due Date: 2/16/2024
5. White paper
   Due Date: 3/15/2024

Travel: Two people to attend a local or state conference.

Task 4: Project Monitoring & Reporting

AgriLife will prepare and submit all reports, deliverables, and requests for reimbursement as required in the Contract, to CMPReceipts@GLO.TEXAS.GOV. Quarterly progress reports and requests for reimbursement are due to CMPReceipts@GLO.TEXAS.GOV on the 10th day of every quarter of the year starting with January 10, 2023. AgriLife will summarize the methods and results of the Project, as well as provide a discussion of the Project's findings and future recommendations in the final report. AgriLife will include photos of water sampling efforts in the report.

Task 4 Deliverables:

1. Quarterly progress reports and requests for reimbursement
   Due Date: Ongoing until 3/31/2024
2. Draft final report
   Due Date: 3/15/2024
3. Final report
   Due Date: 3/31/2024
4. Project closeout form
   Due Date: 3/31/2024

Travel: No travel funds requested for this task

Performance Evaluations

CMP staff will conduct quarterly performance evaluations of subrecipients to examine project progress and adherence to the 18-month completion timeline. Evaluations will be conducted under the following terms.

- **3-Month Evaluation (January 15, 2023)**
  - Subrecipients that did not submit the initial progress report and reimbursement request and do not show progress toward establishing the framework of their project will be identified by the CMP project manager ("PM").
- **6-Month Evaluation (April 15, 2023)**
  - If the CMP PM determines the Project is behind schedule or is making insufficient progress, i.e. Deliverables and reporting are late, the CMP PM will contact

Subrecipient via phone or email to revise Deliverable due dates and determine a method for getting the Project completed within the remaining Contract period.
    - Subrecipients working on 306A projects with NOAA SAC requirements must provide the required SAC documentation at this time.
        - If the SAC documentation is not available, CMP staff may request a one- time SAC extension from NOAA. This extension is for a maximum of three (1) additional months.
- **9-Month Evaluation (July 15, 2023)**
    - If the Project had late reporting or Deliverables at the previous two (2) evaluations, the Project will be placed on a Performance Improvement Plan (PIP).
        - This will include more frequent check-ins with the CMP PM and a revised Deliverable schedule with Deliverables broken down into smaller pieces.
    - Reimbursement request will be held for payment until the PIP is in place.
    - **Subrecipients performing 306A projects with SACs must provide all required SAC documentation at this time. If the SAC documentation is unavailable, the Project may be terminated.**
- **12-Month Evaluation (October 15, 2023)**
    - If the Project is not adhering to the PIP and not demonstrating significant efforts to correct compliance issues, the GLO will consider the Project for termination and will issue a Notice of Deficiency to the project's Authorizing Official.
    - **Subrecipients can request a one (1) time extension.**
    - GLO will withhold payment on Subrecipient's reimbursement requests until GLO receives all outstanding documents and Deliverables.
- **15-Month Evaluation (January 15, 2024)**
    - GLO will closely examine projects with PIPs to ensure the PIP is being adhered to and the project is on track.
    - GLO may terminate the Project if the Project has significantly failed to adhere to the PIP.
    - GLO will withhold payment on Subrecipient's reimbursement requests until GLO receives all outstanding documents and Deliverables.
- **18-Month Evaluation (March 31, 2024)**
    - The Project must be complete. Incomplete projects may be terminated.

Appendix B: Field Data Recording Sheet

Field Data Recording Sheet

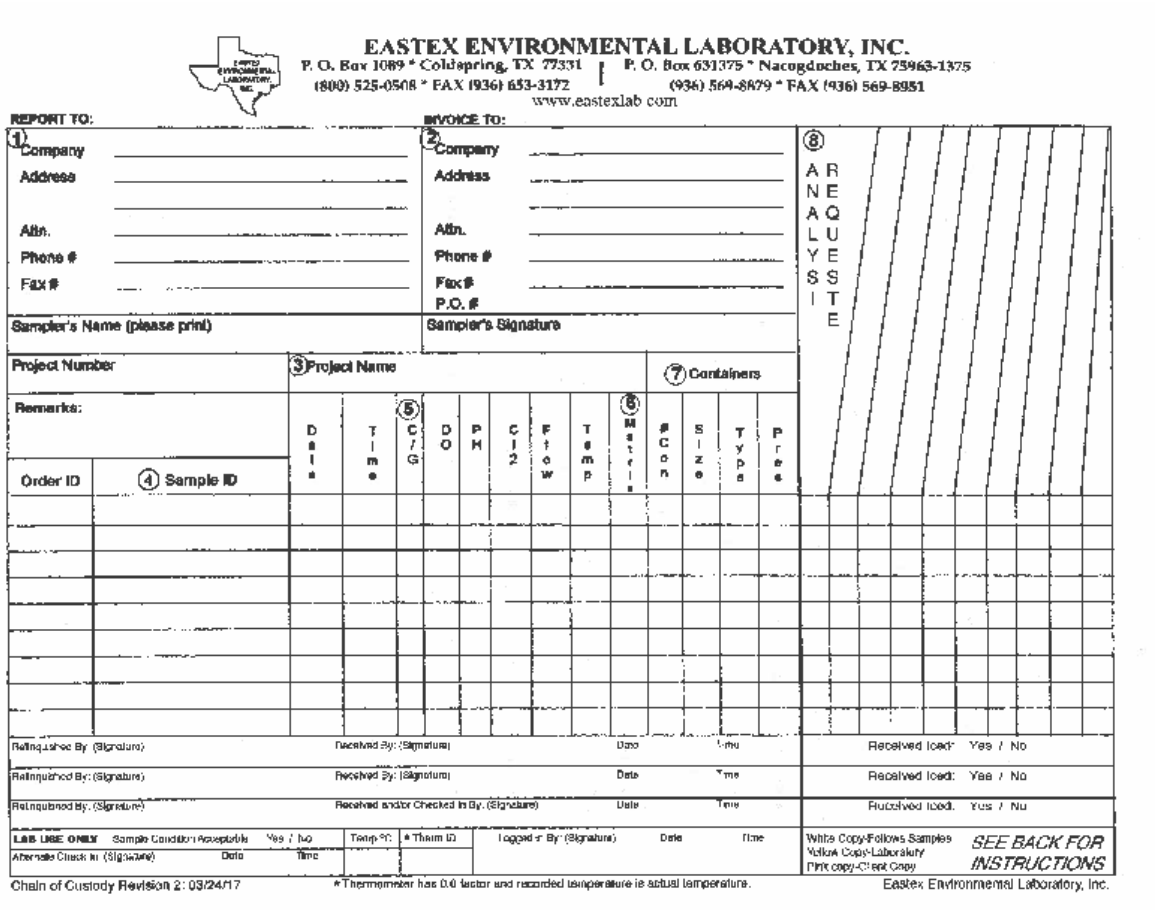
Date: _____ Collected By: _____

Location: _____ Event #: _____

Site ID:	Rainfall Amount	Flow level (ft.)	Water Temp.	DO	Specific Conductance	pH	Nitrogen (ammonium)		Bottle Collected #:

Field Observations:

Appendix C: Chain of Custody



EASTEX ENVIRONMENTAL LABORATORY, INC.

P. O. Box 1089 * Coldspring, TX 77331 | P. O. Box 631375 * Nacogdoches, TX 75963-1375

(800) 525-0508 * FAX (936) 653-3172 | (936) 569-8879 * FAX (936) 569-8951

www.eastexlab.com

REPORT TO: | **INVOICE TO:**

(1) Company / Address / Attn. / Phone # / Fax #

(2) Company / Address / Attn. / Phone # / Fax # / P.O. #

(8) ANALYSIS REQUESTED

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

Project Number | (3) Project Name | (7) Containers

Remarks:

Order ID	(4) Sample ID	Date	Time	(5) C/G	DO	PH	Cl2	Flow	Temp	(5) Matrix	# Con	Size	Type	Pres

Relinquished By: (Signature) | Received By: (Signature) | Date | Time | Received Iced: Yes / No

Relinquished By: (Signature) | Received By: (Signature) | Date | Time | Received Iced: Yes / No

Relinquished By: (Signature) | Received and/or Checked In By: (Signature) | Date | Time | Received Iced: Yes / No

LAB USE ONLY Sample Condition Acceptable Yes / No | Temp °C: | * Therm ID | Logged In By (Signature) | Date | Time

Alternate Check In (Signature) | Date | Time

White Copy-Follows Samples
Yellow Copy-Laboratory
Pink copy-Client Copy

SEE BACK FOR INSTRUCTIONS

Chain of Custody Revision 2: 03/24/17 | *Thermometer has 0.0 factor and recorded temperature is actual temperature. | Eastex Environmental Laboratory, Inc.

INSTRUCTIONS

Please be complete and accurate when filling out the Chain-of-Custody sheet, as all information will be printed on the final lab report.

1 REPORT TO: Name of company, address, #'s, and where you want the report sent.

2 INVOICE TO: Name of company, address, #'s, and where you want the report sent.

3 PROJECT NAME: What you will call this sample.

4 SAMPLE ID: How you will refer to this sample.

5 SAMPLE TYPE: C3=3pt Comp. C6=6pt Comp. C12=12hr Comp. C24=24hr Comp. G=Grab

6 MATRIX: DW=Drinking Water WW=Wastewater SO=Soil/Sludge OL=Oils
FL=Filter LE=Leachate SD=Solid RE=Resin OT=Other

7 CONTAINER(S)

SIZE: 1=Gallon 2=1/2 Gallon 3=Quart/Liter 4=Pint 5=1/2 pt (250 ml)
6=125 ml/4 oz. 7=60 mls/2 oz 8-Vial 9=Other

TYPE: P=Plastic G=Glass T=Teflon S=Sterile

PRESERVATIVE: C=Chilled S=Sulfuric Acid N=Nitric Acid B=Base/Caustic Z=Zn Acetate
H=Hydrochloric Acid ST=Sodium Thiosulfate O=Other

8 ANALYSIS REQUESTED Please be as specific as possible when listing which samples get what results.