April 4, 2023

Mrs. Lisa M. Finn
U.S. Army Corps of Engineers
2000 Fort Point Rd
Galveston, TX 77550

Subject: Sampling and Analysis Plan for Sediment and Water Sample Collection, Testing, and Analysis for Maintenance Dredging
TXIT Berths 2 and 3 2023 Maintenance Dredging Project
Texas International Terminals (TXIT)
USACE Permit No. SWG-2012-00602
Harris County, Texas

Dear Mrs. Finn,

Please find the attached sampling and analysis plan for sediment and water sample collection, testing, and analysis in conjunction with maintenance dredging required as part the TXIT Berths 2 & 3 Maintenance Dredging Project, U.S. Army Corps of Engineers (USACE) Permit No. SWG-2012-00602 located in Galveston, Texas adjacent to the Galveston Ship Channel.

Please reply with your approval so that we may initiate field work. Should you have any questions or concerns, please contact me at marisa@lloydeng.com.

Sincerely,
Lloyd Engineering, Inc.
TXBPE # 2846

Marisa Weber
Vice President of Environmental Services

# SAMPLING AND ANALYSIS PLAN
# SAMPLING AND CHEMICAL ANALYSIS OF MARINE SEDIMENTS
# TXIT BERTHS 2 AND 3 2023 MAINTENANCE DREDGING PROJECT
# TEXAS INTERNATIONAL TERMINALS
# GALVESTON SHIP CHANNEL
# GALVESTON COUNTY, TEXAS

## Objectives

The objective of this sampling and analysis plan (SAP) is to detail the methods for conducting testing and characterization of maintenance dredge material as a part of the Texas International Terminals (TXIT) Berths 2 and 3 2023 Maintenance Dredging Project (Project). Lloyd Engineering, Inc. (LEI) will collect sediment and water samples from the dredge footprint of the Project located at TXIT's existing facilities adjacent to the Galveston Ship Channel (GSC) near Station Number 22+569 in Galveston, Galveston County, Texas. Refer to Figure 1 in Attachment A for a map depicting the precise location of the site.

## Overview

The dredge material characterization will be comprised of chemical analyses of sediment, water, and elutriate samples, and grain size analysis of sediment samples. The proposed Project will require the excavation of up to 200,000 cubic yards (CY) of material to authorized depths of -45' mean lower low water (MLLW), plus 2' of allowable overdredge for a total maximum dredge depth of -47' MLLW. Refer to Figure 2 in Attachment A for a map depicting the current bathymetric conditions at the Project site. TXIT is requesting authorization from USACE for the dredging and placement of up to 200,000 CY of maintenance dredge material within open water placement area PA 50.

Sediment and elutriate samples will be collected from three sample locations and a site water sample will be collected from one location within the proposed dredge footprint (Table 1). By following this SAP, all regulatory requirements for the U.S. Army Corps of Engineers (USACE) for the placement of material within an open water placement area will be met. Samples will be collected and tested to determine whether adverse impacts would result from the dredging and dredged material placement operations performed during the Project. Field sampling protocol and laboratory analyses will be conducted according to the USACE document, "Sampling and Analysis Plan-Private Dredging, USACE Galveston District, Galveston TX" (2019)[1].

Prior to sample collection, all containers and sampling equipment will be cleaned according to protocols described in Plumb (1981)[2], or other appropriate guidance

[1] U.S. Army Corps of Engineers. 2019. Sampling and Analysis Plan-Private Dredging, USACE Galveston District, Galveston TX.

[2] Plumb, R. H., Jr. 1981. Procedure for Handling and Chemical Analysis of Sediment and Water Samples. EPA/CE-81-1. Prepared by State University College at Buffalo, Great Lakes Laboratory, Buffalo, N.Y. U.S. Environmental Protection Agency and U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

manuals. Care will be taken to avoid contamination of sampling devices from the boat deck or other surfaces. Powderless nitrile gloves will be worn during sample collection. Navigation to and documentation of all sample sites will be accomplished via a handheld global positioning system (GPS) unit.

**Water Sampling**

One water sample will be collected using a suitable non-contaminating bilge pump with a food-grade hose or a peristaltic pump. Additionally, one duplicate sample will also be collected at the time of sampling. The depth of the water sample will be between mid-depth to one-third of the way to the bottom of the water column. Prior to filling the sample containers, the pump will be allowed to run to purge the existing hose with at least five times the volume of the hose and ensure water collected is representative of the sample location. The water sample will then be collected in polyethylene or glass bottles, pre-cleaned, and prepared with preservatives by the chemistry laboratory. Water samples to be analyzed for metals will be collected using a variable-speed non-contaminating peristaltic pump and Teflon tubing. Water samples to be analyzed for metals other than mercury and selenium are to be filtered through a clean 0.45-micrometer (µm) filter prior to dispensing into containers with acid preservatives, or they will be filtered in the lab. Pre-cleaned brown-glass bottles will be used for organic analyses. All bottles will be filled completely with no air bubbles or headspace.

During water collection, in situ standard water quality parameters will be recorded at each sample site using a multi-parameter sonde instrument. Water quality parameters include dissolved oxygen, recorded in milligrams per liter (mg/L); pH, recorded in standard units (SU); salinity, recorded in practical salinity units (psu); conductivity, recorded in millisiemens per centimeter (mS/cm); water temperature, recorded in degrees Celsius (°C); and water depth, recorded in feet (ft). In addition to water quality parameters, ambient water, and weather conditions, as well as the tidal stage at the time of sample collection, will be recorded on field data sheets.

**Sediment Sampling**

Three sample locations have been identified within the dredge footprint for sediment samples to be collected. The collection of sediment at each sample location will consist of surface grabs collected with a ponar sampling device to characterize the material proposed to be dredged. Additionally, one duplicate sample will be collected at one of the sample sites as determined at the time of sampling, for a total of four sediment samples. Prior to collection and between samples, the sampling device will be cleaned with Alconox soap, rinsed with deionized water, and rinsed with ambient water; water depth to the sediment surface will also be recorded. Each sample will be placed into pre-cleaned glass and HDPE jars. The jars will be filled completely to avoid any head space and to ensure

total sample volume. The lids will be tightly secured, and the sample bottles placed into an ice chest.

Field efforts would consist of sample collection within the proposed dredge footprint. Sampling efforts for the collection of surface samples at each location will be conducted from a bay boat. A GPS on the vessel would be used to determine the location of each sample site as designated in the SAP (Figure 1).

Refer to Figure 2 in Attachment A for a depiction of the sampling locations. Refer to Table 1 for latitude/longitude, analysis to be performed, existing depths, and previously authorized depth of dredge for each sampling location. Representative photos of the samples will be taken for documentation purposes. Any deviations from the pre-designated sample locations or other protocols would be noted and described in the report.

**Table 1**
**Sample Collection Sites and Analysis to be Performed at the TXIT Terminal for the Berths 2 and 3 2023 Maintenance Dredging Project**

| Sample ID | Latitude (NAD83) | Longitude (NAD 83) | Existing Depth (ft, MLLW) | Previously Authorized Dredge Depth (ft, MLLW) | Sample Matrix | Analyses |
|---|---|---|---|---|---|---|
| TXIT-23-01 | 29.306136 | -94.825231 | -46* | -47 | Sediment, Water | S, W, E, GS, PCDD, PCDF |
| TXIT-23-02 | 29.307681 | -94.822382 | -46.5* | -47 | Sediment | S, E, GS, PCDD, PCDF |
| TXIT-23-03 | 29.309668 | -94.823121 | -46.3* | -47 | Sediment | S, E, GS, PCDD, PCDF |

S = Chemical analysis of a sediment sample
W = Chemical analysis of water sample
E = Chemical analysis of elutriate sample
GS = Physical analysis of sediment grain-size sample
PCDD = Polychlorinated dibenzodioxins
PCDF = Polychlorinated dibenzofurans
* = Approximate Depth

## Sample Preservation and Storage

Collected samples will be stored at 2 to 4°C but never frozen after collection. Analyses are to be performed within the recommended holding times, as described in the referenced guidance documents.

## Chain of Custody

Chain of Custody forms will be completed according to appropriate guidance manuals and will accompany the samples until laboratory analysis.

## Chemical Analyses

Each sample will be analyzed in a laboratory for the analyses shown in Table 2. All chemical

analyses will be performed by a laboratory accredited by an accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP) for the analytes/analyte groups and matrices to be analyzed. Parameters to be analyzed are listed in Table 2, along with the required detection limits. Sediment samples will be reported as dry weight.

Detected concentrations of contaminants of concern (COC) reported by the laboratory will be evaluated by comparing detected compound concentrations with standard benchmark values proved in the federal and state regulatory agencies' reference guidance documents. Should a detected compound exceed the recommended benchmark value in one or more samples, it shall be documented and discussed in the report.

**Table 2: Target Detection Levels (TDLs) for Analysis of Sediment, Water, Elutriate Samples**

| Chemical | Sediment | Water/Elutriate |
|---|---|---|
| **Metals**[d] | **mg/kg** | ***µg/l*** |
| Antimony | 2.5 | 3 (0.02)[c] |
| Arsenic | 0.3[b] | 1 (0.005)[c] |
| Beryllium | 1[b] | 0.2 |
| Cadmium | 0.1 | 1 (0.01)[c] |
| Chromium (total) | 1[b] | 1 |
| Chromium (3+) | 1 | 1 |
| Chromium (6+) | 1 | 1 |
| Copper | 1[b] | 1 (0.1)[c] |
| Lead | 0.3[b] | 1 (0.02)[c] |
| Mercury | 0.2 | 0.2 (0.0002)[c] |
| Nickel | 0.5[b] | 1 (0.1)[c] |
| Selenium | 0.5[b] | 2 |
| Silver | 0.2 | 1 (0.1)[c] |
| Thallium | 0.2 | 1 (0.02)[c] |
| Zinc | 2[b] | 1 (0.5)[c] |
| **Conventional/Ancillary Parameters** | **mg/kg** | **mg/l** |
| Ammonia | 0.1 | 0.03 |
| Cyanides | 2 | 0.1d |
| Total Organic Carbon | 0.1% | 0.1% |
| Total Petroleum Hydrocarbons | 5 | 0.1 |
| Grain Size | 1% | - |
| % Solids | 0.1% | - |
| **LPAH Compounds** | ***µg/kg*** | ***µg/l*** |
| Naphthalene | 20 | 0.8[b] |
| Acenaphthylene | 20 | 1.0[b] |
| Acenaphthene | 20 | 0.75[b] |

| Chemical | Sediment | Water/Elutriate |
|---|---|---|
| Fluorene | 20 | 0.6[b] |
| Phenanthrene | 20 | 0.5[b] |
| Anthracene | 20 | 0.6[b] |
| **HPAH Compounds** | **µg/kg** | **µg/l** |
| Fluoranthene | 20 | 0.9[b] |
| Pyrene | 20 | 1.5[b] |
| Benzo(a)anthracene | 20 | 0.4[b] |
| Chrysene | 20 | 0.3[b] |
| Benzo(b&k)fluoranthene | 20 | 0.6[b] |
| Benzo(a)pyrene | 20 | 0.3[b] |
| Indeno[1,2,3-c,d]pyrene | 20 | 1.2[b] |
| Dibenzo[a,h]anthracene | 20 | 1.3[b] |
| Benzo[g,h,i]perylene | 20 | 1.2[b] |
| **Organonitrogen Compounds** | **µg/kg** | **µg/l** |
| Benzidine | 5 | 1 |
| 3,3-Dichlorobenzidine | 300[b] | 3[b] |
| 2,4-Dinitrotoluene | 200[b] | 2[b] |
| 2,6-Dinitrotoluene | 200[b] | 2[b] |
| 1,2-Diphenylhydrazine | 10 | 1 |
| Nitrobenzene | 160[b] | 0.9[b] |
| N-Nitrosodimethyl amine | - | 3.1[b] |
| N-Nitrosodi-n-propylamine | 150[b] | 0.9[b] |
| N-Nitrosodiphenylamine | 20 | 2.1[b] |
| **Phthalate Esters** | **µg/kg** | **µg/l** |
| Dimethyl Phthalate | 50 | 1[b] |
| Diethyl Phthalate | 50 | 1[b] |
| Di-n-butyl Phthalate | 50 | 1[b] |
| Butyl Benzyl Phthalate | 50 | 4[b] |
| Bis[2-ethylhexyl] Phthalate | 50 | 2[b] |
| Di-n-octyl Phthalate | 50 | 3[b] |
| **Phenols/Substituted Phenols** | **µg/kg** | **µg/l** |
| Phenol | 100 | 10 |
| 2,4-Dimethylphenol | 20 | 10 |
| Pentachlorophenol | 100 | 50 |
| 2,4,6-Trichlorophenol | 140[b] | 0.9[b] |
| 4-Chloro-3-methylphenol | 140[b] | 0.7[b] |
| 2-Nitrophenol | 200[b] | 2[b] |
| 4-Nitrophenol | 500[b] | 5[b] |
| 2,4-Dinitrophenol | 500[b] | 5[b] |
| 2-Chlorophenol | 110[b] | 0.9[b] |

| Chemical | Sediment | Water/Elutriate |
|---|---|---|
| 2,4-Dichlorophenol | 120[b] | 0.8[b] |
| 4,6-Dinitro-o-cresol | 600 | 10 |
| **Polychlorinated Biphenyls** | **µg/kg** | **µg/l** |
| Total PCB | 1 | 0.01 |
| **Pesticides** | **µg/kg** | **µg/l** |
| Aldrin | 3[b] | 0.03[b] |
| Chlordane and Derivatives | 3[b] | 0.03[b] |
| Dieldrin | 5[b] | 0.02 |
| 4,4'-DDD | 5[b] | 0.1 |
| 4,4'-DDE | 5[b] | 0.1 |
| 4,4'-DDT | 5[b] | 0.1 |
| Endosulfan and Derivatives | 5[b] | 0.1 |
| Endrin and Derivatives | 5[b] | 0.1 |
| Heptachlor and Derivatives | 3[b] | 0.1 |
| Alpha-BHC | 3[b] | 0.03 |
| Beta-BHC | 3[b] | 0.03 |
| Delta-BHC | 3[b] | 0.03 |
| Gamma-BHC (Lindane) | 3[b] | 0.1 |
| Toxaphene | 50 | 0.5 |
| **Chlorinated Hydrocarbons** | **µg/kg** | **µg/l** |
| 1,3-Dichlorobenzene | 20 | 0.9[b] |
| 1,4-Dichlorobenzene | 20 | 1b |
| 1,2-Dichlorobenzene | 20 | 0.8[b] |
| 1,2,4-Trichlorobenzene | 10 | 0.9[b] |
| Hexachlorobenzene | 10 | 0.4[b] |
| 2-Chloronapthalene | 160[b] | 0.8[b] |
| Hexachlorocyclopentadiene | 300[b] | 3.0[b] |
| Hexachloroethane | 100 | 0.9[b] |
| Hexachlorobutadiene | 20 | 0.9[b] |
| **Halogenated Ethers** | **µg/kg** | **µg/l** |
| Bis(2-chloroethyl) ether | 130[b] | 0.9[b] |
| 4-chlorophenyl phenyl ether | 170[b] | 0.6[b] |
| 4-Bromophenyl phenyl ether | 160[b] | 0.4[b] |
| Bis(2-chloroisopropyl) ether | 140[b] | 0.7[b] |
| Bis(2-chloroethoxy) methane | 130[b] | 1[b] |
| **Dioxins and Furans** | **pg/g** | - |
| 2,3,7,8 - TCDD | 0.1 | - |
| 1,2,3,7,8 - PeCDD | 0.1 | - |
| 1,2,3,4,7,8 - HxCDD | 0.1 | - |
| 1,2,3,6,7,8 - HxCDD | 0.1 | - |
| 1,2,3,7,8,9 - HxCDD | 0.1 | - |

| Chemical | Sediment | Water/Elutriate |
|---|---|---|
| 1,2,3,4,6,7,8 - HpCDD | 0.1 | - |
| OCDD | 0.1 | - |
| 2,3,7,8 - TCDF | 0.1 | - |
| 1,2,3,7,8 - PeCDF | 0.1 | - |
| 2,3,4,7,8 - PeCDF | 0.1 | - |
| 1,2,3,4,7,8 - HxCDF | 0.1 | - |
| 1,2,3,6,7,8 - HxCDF | 0.1 | - |
| 2,3,4,6,7,8 - HxCDF | 0.1 | - |
| 1,2,3,7,8,9 - HxCDF | 0.1 | - |
| 1,2,3,4,6,7,8 - HpCDF | 0.1 | - |
| 1,2,3,4,7,8,9 - HpCDF | 0.1 | - |
| OCDF | 0.1 | - |
| Total Dioxin TEQ | 0.1 | - |
| **Miscellaneous** | ***µg/kg*** | ***µg/l*** |
| Isophorone | 10 | 1 |

[a]The primary source of these TDLs was U.S. EPA/USACE (1995), *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations*.

[b] These values are based on recommendations from the EPA Region 6 Laboratory in Houston; these values were based on data or other technical basis.

[c] The values in parentheses are based on EPA "clean techniques", (EPA 1600 series methods) which are applicable in instances where other TDLs are inadequate to assess EPA water quality criteria.

[d] Shall be expressed as dissolved values in water samples, except for mercury and selenium, which shall be reported as Total Recoverable Concentrations.

**Laboratory Quality Control**

The Laboratory Quality Control (QC) program will include, but will not be limited to:

a. **NELAC Accreditation** – The laboratory will have current accreditation status consistent with standards adopted by the National Environmental Laboratory Accreditation Conference (NELAC).
b. **Method Blanks** – Will be performed at a frequency of one per batch of samples, per matrix type, per sample extraction or preparation method.
c. **Laboratory Control Samples** – Will be analyzed at a minimum of 1 per batch of 20 or fewer samples per matrix type, per sample extraction or preparation method, except for analytes for which spiking solutions are not available.
d. **Matrix Spikes** – Will be performed at a frequency of 1 in 20 samples per matrix type, per sample extraction or preparation method, except for analytes for which spiking solutions are not available. The spike concentration will be no greater than 25 to 50 percent of the maximum concentration along the linear segment of the instrument calibration curve for any analyte.
e. **Matrix Spike Duplicates** – Will be analyzed at a minimum of 1 in 20 samples per matrix type, per sample extraction or preparation method.
f. **Surrogates** – Surrogate compounds must be added to all samples, standards, and blanks for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available.
g. **Field Equipment Blanks** – Analysis will be performed at a frequency of one per batch of samples collected.
h. Calibration of instrumentation and performance of periodic instrument checks according to manufacturer and EPA recommendations, and appropriate Standard Operating Procedures (SOP).
i. Participation in performance evaluation and method studies available from EPA, American Society for Testing and Materials (ASTM), or other agency. Performance evaluation under such a program is to be conducted at least on a semi-annual basis.
j. Each new shipment or lot of solvent, reagent, or adsorbent will be evaluated for purity in accordance with appropriate SOPs.
k. Standards will be prepared and verified in accordance with appropriate SOPs.
l. Calculation of QC limits and preparation of control charts will be performed in accordance with appropriate SOPs.
m. Out-of-control events or outlier data will be noted and corrective action will be taken in accordance with appropriate SOPs.

Documentation of all QC activities performed specifically in conjunction with this project will be furnished along with sample results. Copies of all raw data, lab notes,

chromatograms, standard curves, etc. will be available upon request.

**Report**

LEI will provide a brief letter report describing the sampling activities, along with lab result tables comparing the results to the corresponding screening benchmarks, the completed water quality data sheets, the raw chemical data, and QC data described above. The report should confirm to the format described in the guidance document (USACE, 2019)[3].

**Schedule**

The execution of this task will take approximately 65 days, depending on agency comments and review (Table 2).

**Table 2**
**Estimated Project Time**

| Task | No. Days After Agency Approval |
|---|---|
| Field Work (Sample Collection) | 5 |
| Laboratory-Chemical Analysis Completion | 60 |
| Submission of Data Report | 65 |

[3] U.S. Army Corps of Engineers. 2019. Sampling and Analysis Plan-Private Dredging, USACE Galveston District, Galveston TX.