

Quarterly Progress Report

December 2023

Project Title

**Sediment Mercury Concentrations in the Closed Area of Lavaca Bay and the Risk to
Wildlife from Mercury Remobilization During Dredging**

Contract # 041

Submitted to

Matagorda Bay Mitigation Trust

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Project Summary

The Closed Area of Lavaca Bay is a mercury (Hg) Superfund site that is undergoing long-term environmental monitoring. The proposed Matagorda ship channel expansion project will dredge in the Closed Area and could remobilize Hg stored in sediment back into the bay. This study will investigate how sediment Hg concentrations vary with depth throughout the proposed dredging area and undertake lab-based toxicity and bioaccumulation experiments to determine whether the Hg-rich sediment is toxic to benthic organisms. Agencies can use the data to make informed decisions about how to dredge and dispose of the Hg-rich sediment to minimize its environmental impact.

Project Goals and Objectives

The goal of this project is to investigate sediment Hg concentrations in the Closed Area of Lavaca Bay (with a focus on the area that will be dredged) and determine whether sediment Hg concentrations are high enough to pose a threat to the health of benthic organisms if Hg is remobilized during the proposed dredging activities. This study can be broken down into six objectives:

Objective 1: Investigate how THg concentrations change with sediment depth to determine 1) at what depth the greatest THg concentrations are found; 2) how thick the Hg layer is; and 3) how THg concentrations vary spatially throughout the Closed Area.

Objective 2: Map the bay floor and investigate the relationship between sediment THg concentrations and sediment characteristics (grain size and organic carbon content).

Objective 3: Use radioisotopes (^{210}Pb and ^{137}Cs) to create sediment age-depth profiles and determine sedimentation rates.

Objective 4: Speciate THg in the surface and Hg layer sediment to determine the MeHg concentration and percent MeHg and determine the bacterial composition of the sediment.

Objective 5: Calculate how much Hg could potentially be released into Lavaca Bay from the proposed dredging activities.

Objective 6: Determine whether sediment Hg concentrations are high enough to cause toxicity to benthic organisms (polychaete worms, amphipods, bivalves, gastropods) using laboratory-based toxicity tests and bioaccumulation experiments.

Project Update

The following was completed this quarter:

1. Each interval (1 or 2 cm depending on the location) from every core has been subsampled for the various analyses (Hg concentrations, grain size analysis, organic carbon content, aging). There is a total of 1,853 samples from all cores collected in June 2023 (Table 1).

2. 11 cores have been freeze dried. Twenty samples can be freeze dried every 48-72 hours. This step takes the longest time due to the time needed to dry the samples.
3. The mercury (Hg) concentration has been measured in five cores collected from the area next to the ship channel that will be dredged as part of the proposed Matagorda Ship Channel expansion project (Objective 1). Key findings to date:
 - One core (25) had a peak Hg concentration of 1.48 $\mu\text{g/g}$ dry weight at 38-40 cm depth. This concentration is 2.96-times greater than the U.S. Environmental Protection Agency (EPA) open water sediment cleanup goal of 0.5 $\mu\text{g/g}$ dry weight.
 - Background Hg concentrations in non-contaminated sediment (e.g., sediment deposited prior to the introduction of Hg into the bay) are $< 0.0090 \mu\text{g/g}$ dry weight. The lowest reported concentration is 0.0005 $\mu\text{g/g}$ dry weight.
 - Three cores (10, 21, 25) had a surface sediment (up to 26 cm depth depending on the core) Hg concentration ranging between 0.1049 $\mu\text{g/g}$ and 0.2591 $\mu\text{g/g}$ dry weight. These concentrations are below the EPA open water sediment cleanup goal; however, they are elevated compared to the background concentration. Surface sediment has been the most recently deposited, suggesting that Hg is still entering the bay or is being resuspended.
4. The muffle furnace needed for the organic carbon content analysis has been purchased and delivered.
5. PI Dutton attended a community meeting organized by the EPA in Port Lavaca on October 24, 2023, which provided an update on long-term Hg monitoring activities at the Point Comfort/Alcoa Superfund site.

Goals for the Next Quarter

- Freeze dry the remaining cores.
- Continue the Hg analysis (Objective 1) and start the organic content analysis and grain size analysis (Objective 2). The Hg analysis must be completed first so the PIs know if they are handling sediment that is elevated in Hg and can take appropriate precautions to minimize exposure (e.g., wear face masks to avoid breathing in fine sediment particles).
- Complete the CHIRP profiling in the Closed Area (weather permitting) (Objective 2).
- Select sampling locations for the 2024 core collection (planning to collect the cores in May 2024).

Table 1. Collection date, location, water depth, and core length for the 32 sediment cores collected during June 2023.

Core ID	Collection date	Latitude	Longitude	Water depth (cm)	Core depth (cm)
LB23-01	6/12/2023	28°39'42.31085"N	96°34'05.90487"W	172.7	102
LB23-02A	6/12/2023	28°39'25.90933"N	96°34'23.10856"W	96.5	40
LB23-02B	6/12/2023	28°39'25.85028"N	96°34'23.26292"W	96.5	141
LB23-03	6/12/2023	28°39'06.18588"N	96°34'31.49129"W	106.7	119
LB23-04	6/12/2023	28°39'13.67991"N	96°34'05.19001"W	40.6	66
LB23-05	6/12/2023	28°39'37.12456"N	96°34'22.07283"W	127.0	158
LB23-06	6/14/2023	28°38'39.94144"N	96°33'26.05159"W	477.5	43
LB23-07	6/13/2023	28°38'37.61193"N	96°33'30.49775"W	104.1	94
LB23-08	6/14/2023	28°38'36.43114"N	96°33'28.88230"W	269.2	32
LB23-09	6/13/2023	28°38'34.51271"N	96°33'35.96964"W	121.9	139
LB23-10	6/14/2023	28°38'33.45216"N	96°33'33.12059"W	281.9	31
LB23-11	6/13/2023	28°38'31.41176"N	96°33'40.73990"W	134.6	120
LB23-12	6/14/2023	28°38'30.34704"N	96°33'38.92905"W	170.2	152
LB23-13	6/12/2023	28°38'29.43531"N	96°33'49.72564"W	190.5	105.5
LB23-14A	6/13/2023	28°38'27.92569"N	96°33'45.15590"W	195.6	43.5
LB23-14B	6/13/2023	28°38'27.92569"N	96°33'45.15590"W	195.6	119.5
LB23-15	6/14/2023	28°38'27.50750"N	96°33'43.82768"W	264.2	90
LB23-16	6/13/2023	28°38'27.19897"N	96°33'51.87453"W	91.4	91
LB23-17	6/13/2023	28°38'24.64368"N	96°33'49.03493"W	152.4	128
LB23-18	6/14/2023	28°38'24.89089"N	96°33'47.31254"W	274.3	73
LB23-19	6/13/2023	28°38'21.28173"N	96°33'53.01940"W	144.8	99
LB23-20	6/14/2023	28°38'20.02780"N	96°33'50.73311"W	274.3	61
LB23-21	6/14/2023	28°38'15.65252"N	96°33'55.40691"W	254.0	67
LB23-22	6/14/2023	28°38'15.41006"N	96°33'53.90006"W	266.7	46
LB23-23	6/14/2023	28°38'11.97553"N	96°33'58.53639"W	657.9	74
LB23-24	6/15/2023	28°38'08.72761"N	96°33'55.94438"W	538.5	10
LB23-25	6/15/2023	28°38'04.26207"N	96°34'01.40136"W	274.3	49.5
LB23-26	6/15/2023	28°37'58.26566"N	96°34'03.05826"W	236.2	110
LB23-27	6/15/2023	28°37'50.42967"N	96°34'02.67699"W	254.0	128
LB23-28	6/15/2023	28°37'43.49040"N	96°34'04.38390"W	259.1	130.5
LB23-29	6/15/2023	28°37'35.84904"N	96°34'03.72827"W	226.1	158
LB23-30	6/15/2023	28°37'27.08942"N	96°34'03.64905"W	231.1	85