

Contract 40

Micro-plastics water column and sediment residence times: quantifying the cycling and flux between bay waters and sediment, and the burial history of micro-plastics within the Matagorda and San Antonio Bay Systems

Third Interim Performance Report

September 15, 2025

Submitted To:

Matagorda Bay Mitigation Trust

Performing Laboratory:

Texas A&M University on behalf of Texas A&M University at Galveston

Authors:

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Personnel

Principal Investigator(s):

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Consulting MBMT Project Coordinator:

Mr. Steven J. Raabe

Location(s):

Texas A&M University at Galveston

Project Duration:

01 2023 – 31 August 2026

Scope of work:

Sampling and research approaches designed for task:

Task 1: Sampling of suspended sediments and sediment cores:

Suspended sediment samples and analyses will be conducted during the Fall 2025-Spring 2026 field seasons.

In November 2023 a total of 33 submersible vibracores were collected from throughout the Matagorda Bay system (Table 1).

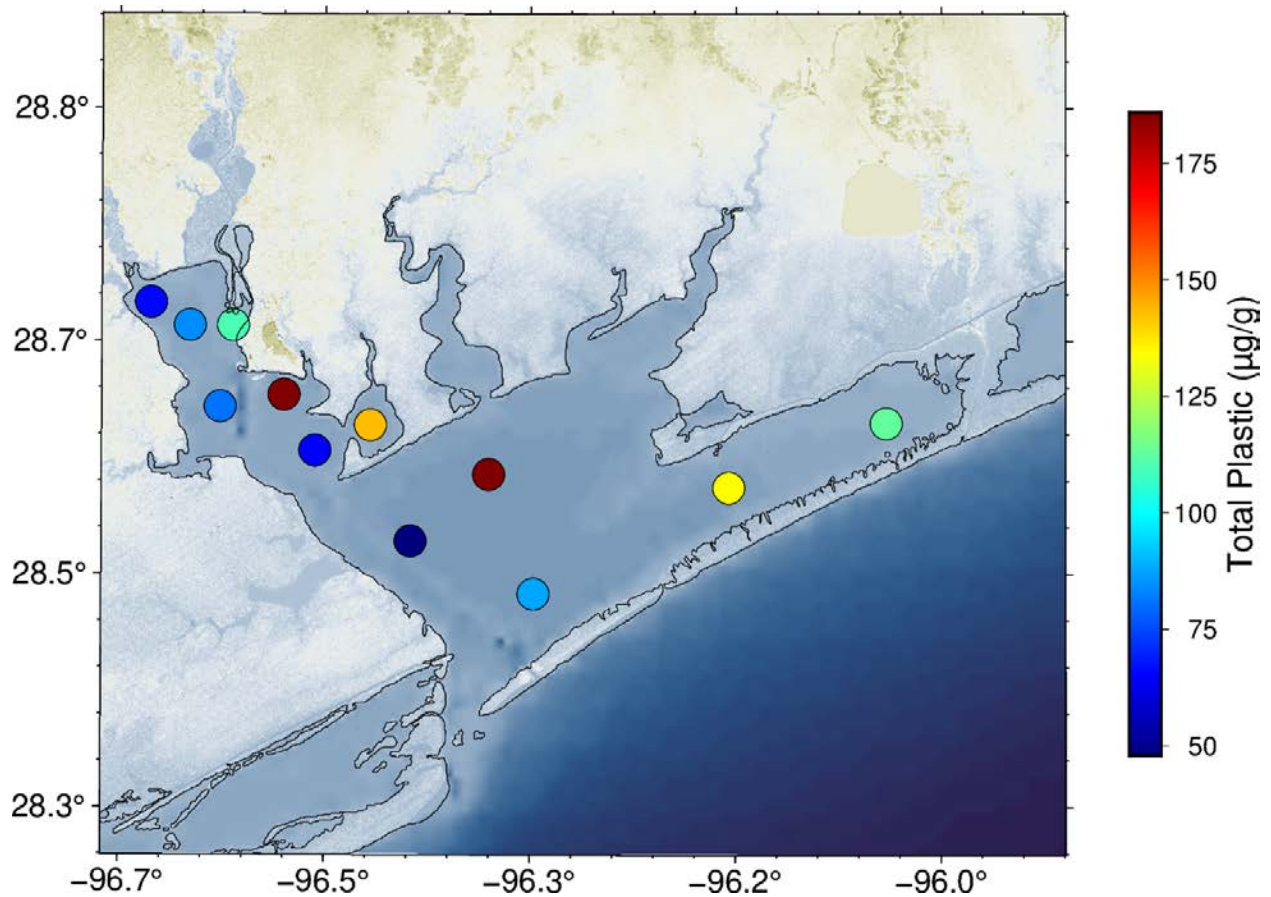
Task 2: Estimation of the water column residence times of micro-plastics-bearing suspended sediments:

Nothing to report- will be conducted during the Fall 2025-Spring 2026 season

Task 3: Characterization and quantification of micro-plastics in sediments:

Graduate student Bryan Gahn has analyzed micro-plastics for the cores. So far, he has completed MB Cores 1, 2, 3, 4, 5, 7, 11, 14, 19, 21, and 22, referenced to Table 1. Work will continue to complete the remainder of the samples by end of Spring 2026.

A map showing the distribution of microplastics in surface sediments is provided below:



Task 4: Reconstruct the historical accumulation and record of micro-plastics in the Matagorda Bay systems:

To date, geochronology has been performed on MB Cores 11, 12, 13, 14 and 21. The remaining cores are still being processed and analyzed. There were equipment issues that delayed the processing and analyses, but these have been resolved.

Example radioisotope profiles for MBMT (MT) and preliminary estimations of accumulations rates for cores 1-7 are presented below:

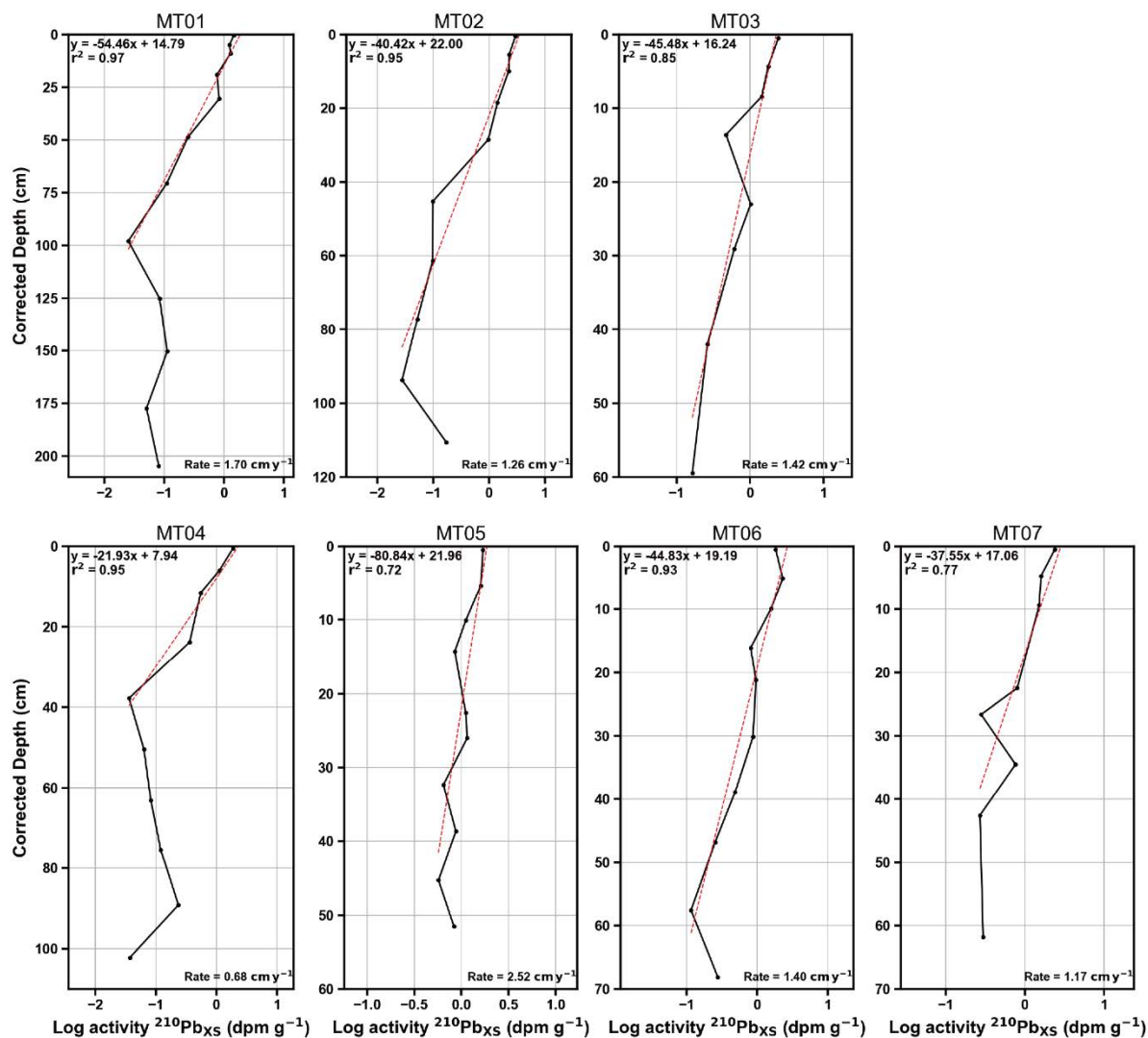


Figure 2. $^{210}\text{Pb}_{\text{xs}}$ profiles for all the MT cores. The corrected depth is calculated following Dellapenna et al. (1998). The mean accumulation rate of all the cores is 1.23 cm y^{-1} . The minimum and maximum accumulation rates are 0.54 and 2.50 cm y^{-1} , respectively.

Additionally, water content analyses has been performed on MB Cores 1, 2, 3, 4, 5, 7, 11, 14, 19, 21, and 22, referenced to Table 1.

Grain size data has been analyzed for the following cores shown in the figure below:

Table 1. Overview of individual analyses for each collected vibra-core. o indicates analysis completed, ^ indicates partially completed, x indicates not available, and blank indicates to be done.

Core Code	Region	Xray XRF Grain Size			Water Content	T-Hg ^{210}Pb	
MT01	Cox Bay	o	x	o	o	o	o
MT02	Carancahua Bay	o	x	o	o	o	o
MT03	Carancahua Bay	o	x	o	o	o	o

MT04	Tres Palacios Bay	0	x	0	0	0	0
MT05	Colorado River Delta	0	x	0	0	0	0
MT06	East Matagorda Bay	0	x	0	0	0	0
MT07	East Matagorda Bay	0	x	0	0	0	0
MA01	Matagorda Ship Channel	0	0	0	0	0	x
MA02	Matagorda Ship Channel	0	0	0	0	0	x
MA03	Matagorda Ship Channel	0	0	0	0	0	x
MA04	Matagorda Ship Channel	0	0	0	0	0	x
MA05	Matagorda Ship Channel	0	0	0	0	0	x
MA06	Matagorda Ship Channel	0	0	0	0	0	x
MA07	Matagorda Ship Channel	0	0	0	0	0	x
MA08	Matagorda Ship Channel	0	0	0	0	0	x
MA09	Matagorda Ship Channel	0	0	0	0	0	x
MA10	Matagorda Ship Channel	0	0	0	0	0	x
MA12	Matagorda Ship Channel	0	0	0	0	0	x
MA13	Matagorda Ship Channel	0	0	0	0	0	x
MA14	Matagorda Ship Channel	0	0	0	0	0	x
MA15	Matagorda Ship Channel	0	0	0	0	0	x
MA16	Matagorda Ship Channel	0	0	0	0	0	x
MA17	Matagorda Ship Channel	0	0	0	0	0	x
MA18	Matagorda Ship Channel	0	0	0	0	0	x
MA19	Matagorda Ship Channel	0	0	0	0	0	x
MM01	Lavaca Bay	0	0	0	0	0	x
MM02	Lavaca Bay	0	0	0	0	0	x
MM03	Lavaca Bay	0	0	0	0	0	
MM04	Lavaca Bay	0	0	0	0	0	
MM05	Cox Bay	0	0	0	0	0	x
MM06	Cox Bay	0	0	0	0	0	x

MM07	Keller Bay	0	0	0	0	0	
MM08	Keller Bay	0	0		0	0	X
MM09	Carancahua Bay	0	0	0	0		X
MM10	Carancahua Bay	0	0	0	0		X
MM11	Tres Palacios Bay	0	0	0	0	0	X
MM13	Tres Palacios Bay	0	0	0	0	0	
MM14	Matagorda Bay	0	0	0	0	0	X
MM15	Matagorda Bay	0	0	0	0	0	X
MM16	Matagorda Bay	0	0	0	0	0	
MM17	Matagorda Bay	0	0		0	0	X
MM18	Matagorda Bay	0	0	0	0	0	X
MM19	Matagorda Bay	0	0	0	0	0	X
MM20	Matagorda Bay	0	0	0	0	0	
MM21	Matagorda Bay	0	0		0	0	
MM22	East Matagorda Bay	0	0	0	0	0	
MM23	East Matagorda Bay	0	0	0	0	0	X
MM24	East Matagorda Bay	0	0	0	0	0	X
MM25	East Matagorda Bay	0	0	0	0	0	

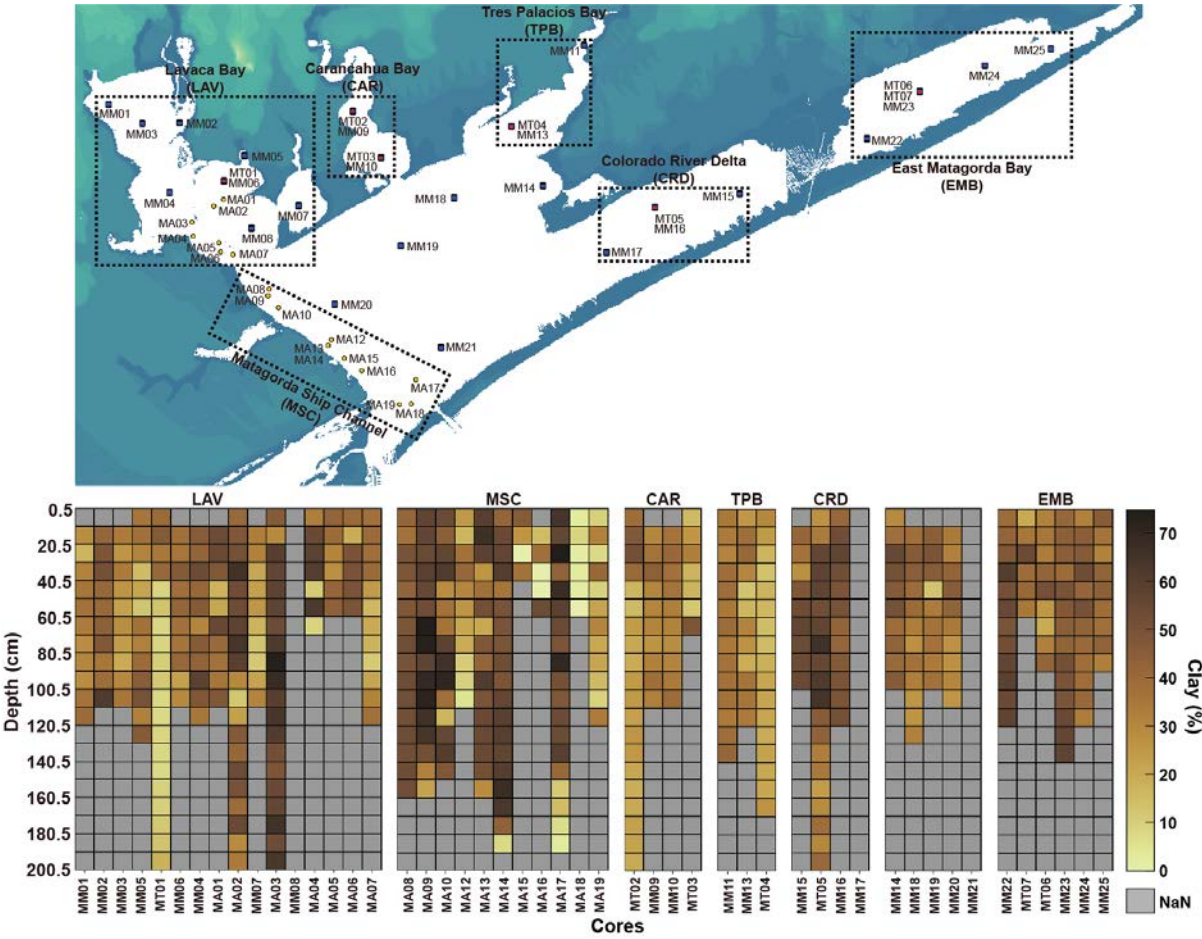
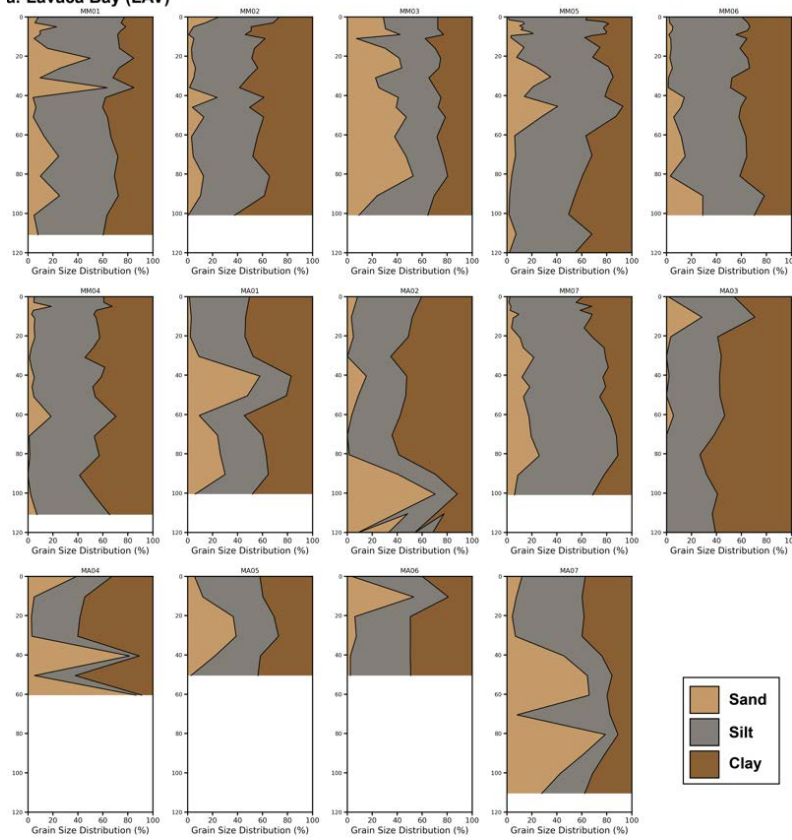
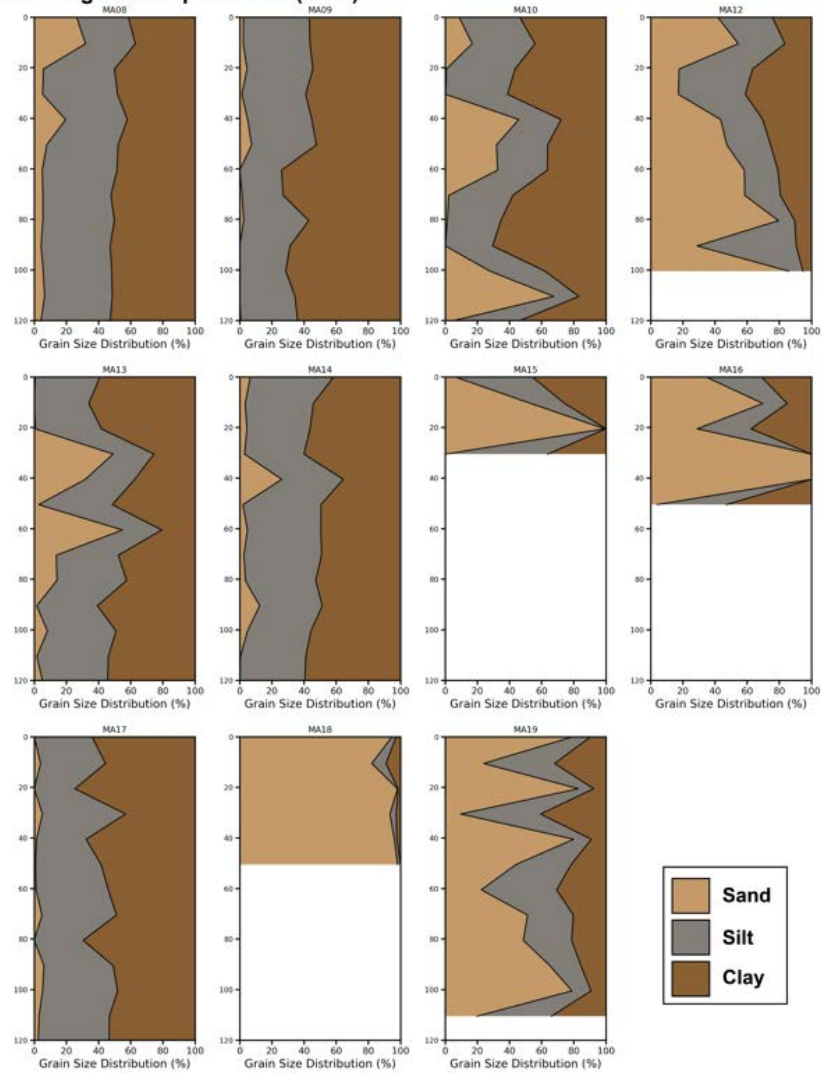


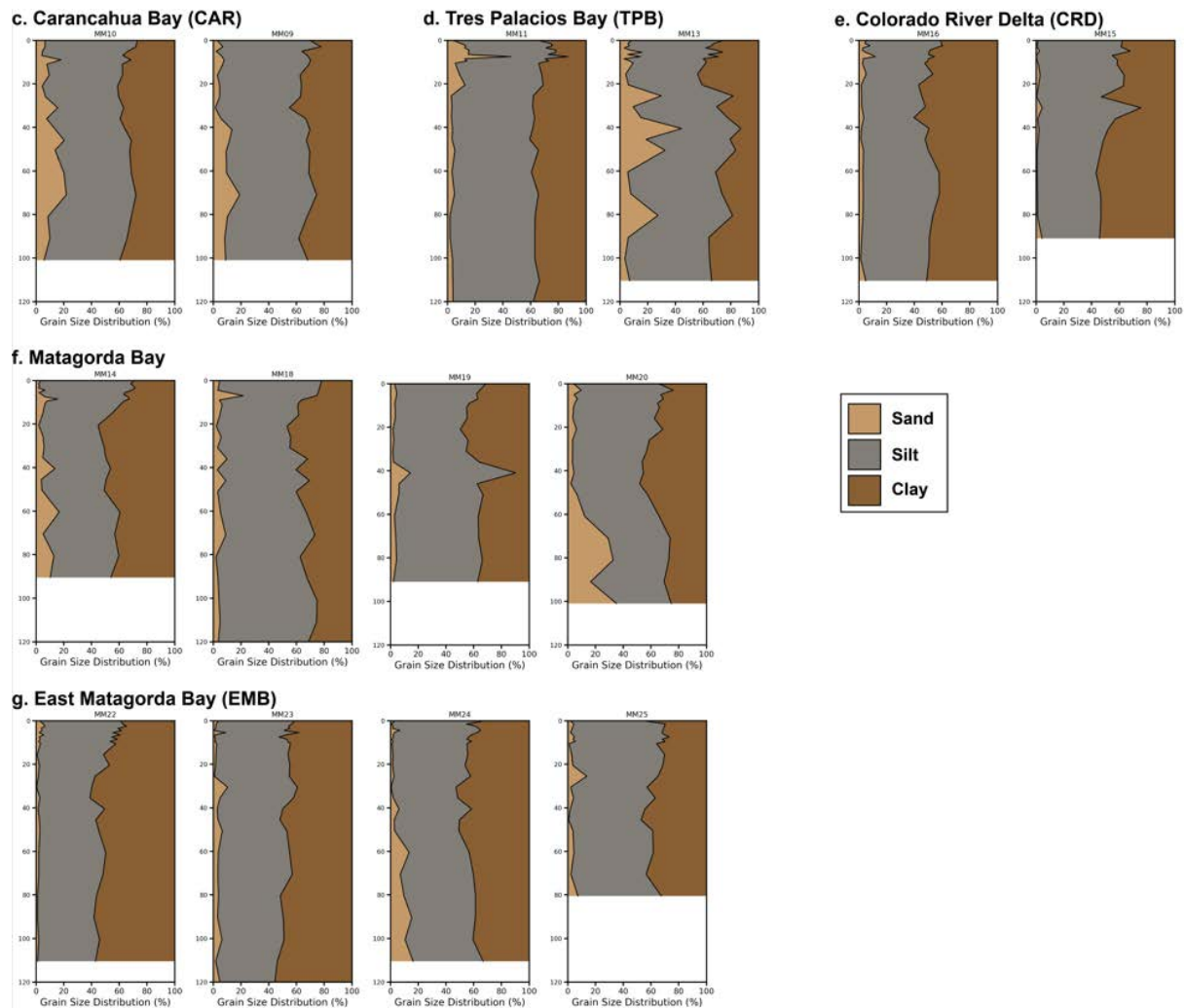
Figure 3. Clay content profiles for all cores. Darker colors suggest increasing clay content. More detailed grain size profiles can be found in Suppl. Fig. 1.

a. Lavaca Bay (LAV)



b. Matagorda Ship Channel (MSC)





Suppl. Fig. 1. Grain size profiles of MM and MA cores **a**, Grain size profiles of Lavaca Bay. **b**, Grain size profiles of Matagorda Ship Channel. **c**, Grain size profiles of Carancahua Bay. **d**, Grain size profiles of Tres Palacios Bay. **e**, Grain size profiles of Colorado River Delta **f**, Grain size profiles of main body of Matagorda Bay **g**, Grain size profiles of East Matagorda Bay

Task 5A: Acquisition of the seabed mixing depth associated with micro-plastics mobilization:

This analysis is still underway. In general, so far, we have found surface mixing in most cores to be minimal, but further details will be provided in the Spring 2026 report.

Task 5B: Develop a quantified conceptual model of processes controlling occurrences of MPs within the bay sediment, fluxes of MPs between bay sediment and the water column and the residence times of MPs in the water column:

This will be the final portion of our project and will be addressed towards the end of the project when all of the data has been analyzed.

Task 6: Report and Manuscript Writing and Presentations:

The two Ph.D. students who have been working on the project are now starting to prepare the first set of manuscripts. More details will be provided in following quarterly reports.

Reviewed by:



Dr. Timothy Dellapenna, TAMUG,
P.I.

9/15/2025

Date: _____

Accepted by:



Mr. Steven J. Raabe, Trustee

Date: 11/7/2025