

Attachment 1 to River Mile 11E Sediment Sampling and Analysis Plan

Standard Operation Procedures for Diver-Collected Sediment Sampling

December 2013 (Revised April 2014)

Purpose

This sediment sampling standard operating procedures (SOP) document presents detailed descriptions of methodologies for divers to follow during collection of surface sediment samples for the River Mile 11E (RM11E) supplemental remedial investigation/feasibility study (RI/FS). The purpose of this document is to provide a clear set of protocols for the dive team to review and follow in order to ensure data of sufficient quality and consistency are collected to meet project objectives.

Pre-dive Briefing

- Review the Ballard Marine Construction (BMC) Dive, and Health and Safety Plans (HSP).
- Review this RM11E sediment sampling SOP with the dive team.
- Inspect the sampling equipment to ensure it will function properly.
- Verify that the diver has the required gear.
- Review the method to establish the sample location (below) and water depth on the river bed.

Sample Location

- Diver moves to the general sample location with care not to disturb the river bottom.
- GSI staff members onboard the research vessel, view the general sample location on video, looking for areas of soft sediment and minimal debris.
- GSI coordinates with the diver via com and video to direct the diver to a specific sample location.
- The sample location will be established by global positioning system (GPS). If GPS use is restricted due to over-water structures, the locations will be established by measurement off of fixed points (pilings).
- Sample locations will be maintained within 10 meters (approximately 30 feet) of the location identified in the Sediment Sampling and Analysis Plan (Sediment SAP).

Selection of Sampling Methods

GSI selects the sampling method for collecting the 30-centimeter (cm)-deep surface sediment sample based on the conditions encountered at the sample location. The sampling methods are:

- **Method A** (primary): Hand-pushed 4-inch- diameter aluminum tubing with welded T-bar handle equipped with a 4-inch polycarbonate sleeve and a core catcher (see photo below).

- **Method B** (secondary): The same type of sampling equipment as Method A but without the T-bar handle such that a fence post type driver can be used advance the sampler into the sediment with greater force.
- **Method C** (tertiary): Manual collection using trowels to hand-dig sediment and transfer into sample jar.



Photo of 4-inch diameter aluminum tubing with welded T-bar handle and core catcher (Method A).

Surface Sediment Sampling Protocol

- After sample location is identified, GSI coordinates with the diver on the extent of removal of surface debris before sample collection, if required.
- GSI coordinates with the diver and talks through the sampling protocol during sample collection.
- Diver communicates measurements to establish the actual sample location; water depth at the sample location will be obtained using a pneumofathometer; and GSI staff on-board the vessel will record the location/depth of both successful sample locations and unsuccessful sample locations.
- In the case of sampling refusal with the selected sampling method, GSI will coordinate with the diver to determine:
 - If there is an alternate sample location to attempt with the same sampling method
 - If removal of surface debris will facilitate sample collection
 - If the selected sampling method will not work at the location and if an alternate sampling method will be deployed
- The desired sample depth is 30 cm (12 inches) below the mudline, with a minimum acceptable penetration of 20 cm. If after three attempts of each technique (i.e. A, then B, then C) a 20-cm penetration cannot be attained because of refusal conditions, then the sample location may be adjusted through further consultation with the Project Manager (PM) or a sample as shallow as 10 cm penetration will be accepted.

Sampling Methodology

Method A: Hand-Pushed Core

1. The diver will identify the sample location by GPS coordinates. Identifying appropriate locations under structures may be difficult to ensure proper location, but should be possible to obtain within 30 feet tolerance.
2. Diver will move to the general sample location with care not to disturb the river bottom.
3. Diver will hand-drive the aluminum tube with the polycarbonate liner into the sediment to the appropriate depth to recover a 30 cm sample. (*Should this method not be able to recover the sample with at least 20 cm of recovery, Method B or C will be used.*)
4. After the tube has reached full depth, the diver will extract the sampler taking care to keep it oriented in a vertical position as he surfaces with the recovered sampler.
5. Diver will bring the sample to the surface and hand over to the GSI person on board the vessel for processing.

Method B: Mechanically Driven Core

1. The diver will identify the sample location by GPS coordinates. Identifying appropriate locations under structures may be difficult to ensure proper location, but should be possible to obtain within 30 feet tolerance.
2. Diver will move to the general sample location with care not to disturb the river bottom.
3. Diver will use the fence post type driver to advance the aluminum tube with the polycarbonate liner into the sediment to recover the sample. (*Should this method not be able to recover the sample at the appropriate depths, Method C will be used.*)
4. The samplers are equipped with core catchers that retain the sediment in the tube and therefore do not require end capping prior to extraction.
5. Diver will pull the tube after it has reached the appropriate depth taking care to keep it oriented in a vertical position as he surfaces with the recovered sampler.
6. Diver will bring the sample to the surface and hand it to GSI staff on the research vessel.

Method C: Hand Trowel

1. The diver will identify the sample location by GPS coordinates (identifying appropriate locations under structures may be difficult to ensure proper location, but should be possible to obtain within 30 feet tolerance).
2. Diver will move to the general sample location with care not to disturb the river bottom.
3. After the diver is in position, the diver will use a pre-cleaned trowel to recover the sediment to a 30-cm depth over an area large enough to ensure minimal material sloughing and representative sample collection from 0 to 30 cm depth and place it into a sterile glass jar.
4. The jar will be capped by the diver to ensure sample integrity.
5. Diver will bring the sample to the surface and hand it to GSI staff on the research vessel.

Sample Processing on Research Vessel

Samples will be visually inspected, logged and processed by GSI staff members in accordance with the methodology in the Sediment SAP.