ESTCP

FINAL REPORT

Standardizing Sediment Porewater Passive Samplers for Inorganic Constituents of Concern

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14. ABSTRACT

The overall objective of this project is to enhance the standardization of, and confidence in, the use of peepers for passive sampling of inorganic constituents such as metals, metalloids and anions in sediment porewater. This document details the results of a field demonstration in which peepers were deployed in surface sediment and surface water at Naval Base San Diego, San Diego, California, in October 2022.

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ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
Br	Bromide
cc	Cubic Centimeters
CCC	Criterion Continuous Concentration
Cd	Cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter
Cr	Chromium
Cu	Copper
DGT	Diffusive Gradients in Thin-Films
DOC	Dissolved Organic Carbon
DoD	Department of Defense
ESTCP	Environmental Security Technology Certification Program
Fe	Iron
FY	Fiscal Year
HDPE	High Density Polyethylene
Hg	Mercury
km	Kilometer
Li	Lithium
mg	Milligram
mg/L	Milligrams per liter
mL	Milliliter
Mn	Manganese
NBSD	Naval Base San Diego
Ni	Nickel
NIWC	Naval Information Warfare Center
P	P-value associated with statistical test
Pb	Lead
PP	Polypropylene
QA/QC	Quality Assurance / Quality Control
SD	Standard Deviation

SERDP	Strategic Environmental Research and Development Program
SCCWRP	Southern California Coastal Water Research Project
SCUBA	Self-Contained Underwater Breathing Apparatus
SWRCB	State Water Resources Control Board
USA	United States of America
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
Zn	Zinc
µg/L	Micrograms per liter

EXECUTIVE SUMMARY

The overall objective of SERDP Project ER20-5261 (https://serdp-estcp.org/projects/details/db871313-fbc0-4432-b536-40c64af3627f) is to enhance the standardization of, and confidence in, the use of peepers for passive sampling of inorganic constituents such as metals, metalloids and anions in sediment porewater. This document details the results of a field demonstration in which peepers were deployed in surface sediment and surface water at Naval Base San Diego, San Diego, California, in October 2022. Over the course of 2 days, commercially available peepers were deployed at 10 stations, left to equilibrate for approximately 10 days, then retrieved over a course of 2 days, after which they were processed and shipped to a commercial analytical laboratory. Ninety percent of peeper samples were successfully analyzed (peepers at 1 station were not able to be retrieved) for target metal analytes cadmium, chromium, copper, iron, lead, manganese, mercury, and zinc. Lithium and bromide tracers spiked into the peepers indicated that greater than 70% equilibration was reached for all target metals during the 10-day exposure. Both tracers performed similarly. In the future, use of the lithium tracer (rather than bromide) is recommended, as the use of a lithium tracer is most efficient in terms of method simplicity and analytical cost savings. Method detection limits for peepers were sufficiently sensitive to detect concentrations lower than USEPA's saltwater Criterion Continuous Concentration (CCC) for aquatic life. All metals except for mercury (detection limit of approximately 0.1 to 0.4 µg/L) were detected in at least one peeper sample. Differences in concentrations in sediment porewater and surface water were noted for some, but not all, metals. Detailed methods are presented, as well as logistical details and recommendations for planning and executing successful peeper investigations.

1.0 INTRODUCTION

The overall objective of SERDP Project ER20-5261 (https://serdp-estcp.org/projects/details/db871313-fbc0-4432-b536-40c64af3627f) is to enhance the standardization of and confidence in the use of peepers for passive sampling of inorganic constituents such as metals, metalloids and anions in sediment porewater. This work would support the critical priorities highlighted by the Workshop on Research and Development for Long-Term Management of Contaminated Sediments (SERDP, 2016) as well as the FY2020 Broad Agency Announcement (ESTCP, 2019) which re-iterates interest in facilitating the application/ commercialization of passive samplers.

The technical objectives of this project are intended to enhance the commercial application of sediment porewater passive sampler and capture the latest technological advances that have been made in the field of passive sampling, following the successful approaches for passive samplers for organic chemicals pioneered by SERDP and ESTCP research.

The primary objective of the work described in this Field Report was to demonstrate best practices for the field deployment of sediment porewater passive samplers ("peepers") for inorganic contaminants at an active Department of Defense (DoD) sediment site. This field deployment was a culmination of the laboratory work conducted as part of ER20-5261, and served to implement, in the field, the methods developed and optimized in the laboratory experiments. The field deployment focused on quantifying the logistical aspect of a field mobilization and highlight the required effort to successfully ship, deploy, retrieve and process peepers in the field. The intended audience for this information is project managers and consultants that wish to plan and conduct field projects using peepers to measure metals in sediment and/or surface water at a freshwater or marine sediment site.

This remainder of this report describes the work and results of the Field Campaign that was conducted in October 2022 in San Diego, consisting of the following sections:

- **Section 2 Site Description:** Describes the site at which the peepers were deployed.
- **Section 3 Field Methods:** Describes the methods and materials used for the field work, including the peeper deployment, retrieval, processing, analysis, and data procedures.
- **Section 4 Results:** Provides the concentrations of metals in sediment porewater and surface water, as measured by the peepers, and metals in surface water, as measured by the DGTs, as well as other ancillary results associated with the measurements.
- **Section 5 Results:** Provides logistical information associated with the field work, with a focus on recommendations for conducting peeper investigations.
- **Section 6 References:** Provides a list of the references cited.

The following appendices are also provided:

- **Appendix A:** Detailed peeper calculation sheets, which are also provided attached to this PDF as Microsoft Excel™ files.

- **Appendix B:** Detailed Diffusive Gradient in Thin Film (DGT) calculation sheets, which are also provided, which are also provided attached to this PDF as Microsoft Excel™ files.
- **Appendix C:** Field notes and forms used during the field work.
- **Appendix D:** Chain of custody produced for the peeper and DGT samples.
- **Appendix E:** Analytical laboratory reports for the analyses of the peeper water and DGTs.
- **Appendix F:** Step-by-step methods for peeper deployment, retrieval, and processing.

2.0 SITE DESCRIPTION

The site selected for the demonstration of the inorganic passive samplers was the mouth of Paleta Creek (hereinafter referred to as "Paleta Creek"), located in the Naval Base San Diego (NBSD), San Diego Bay, San Diego, California, USA. Access to the site was facilitated though a collaboration with Mr. Gunther Rosen from US Navy NIWC Pacific (San Diego), who had agreement with NBSD to access the proposed demonstration site. The following section describes the selected site.

2.1 SITE LOCATION AND HISTORY

Paleta Creek is a man-made urban creek located on the eastern shoreline of the Naval Base of San Diego, California, USA (32°40' 21.49"N, 117° 7'1.93"W) (Figure 1). At this location, Paleta Creek joins with San Diego Bay, and the Paleta Creek site location can be considered a cove area of San Diego Bay. San Diego Bay is relatively long and narrow, 25 km length and 1–3 km wide, and tides and currents within the bay can move sediment around, and in and out, of the bay, as can storm events and resuspension from propeller wash (Wang et al., 2000; ESTCP, 2016). The California State Water Resources Control Board has characterized Paleta Creek as a high priority toxic hot spot due to amphipod sediment toxicity findings in the Consolidated Toxic Hotspots Cleanup Plan (SWRCB, 1999), and added Paleta Creek to the Federal list of impaired waters for impaired benthic communities, sediment toxicity, sediment contamination, or a combination of these three (SCCWRP, 2007).

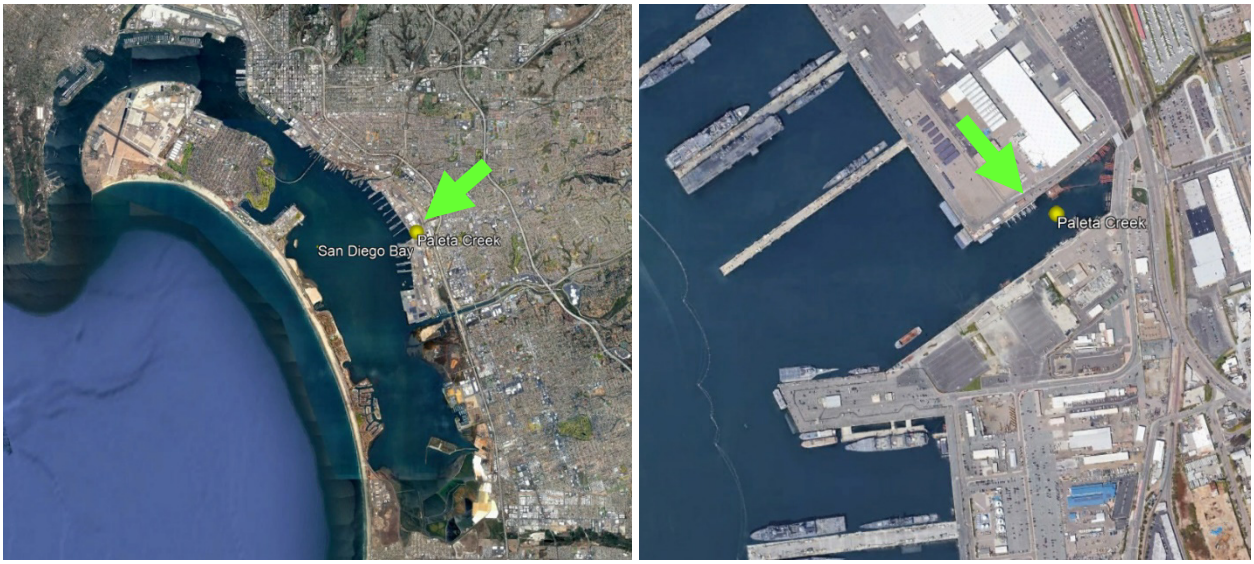


Figure 1. Paleta Creek Site Location

(Naval Base San Diego, San Diego Bay, San Diego, California)

2.2 SITE GEOLOGY/HYDROGEOLOGY

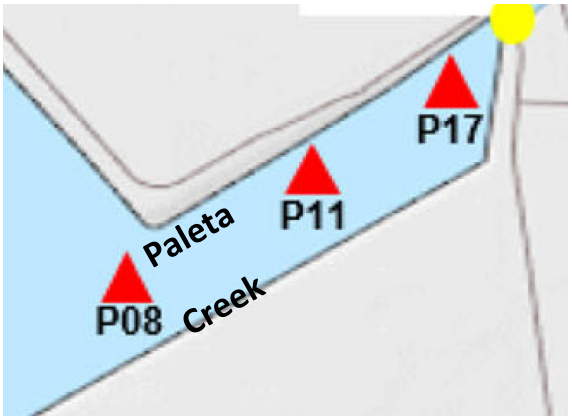
Paleta Creek receives high water flow from winter storms as well as low flow during dry periods for the rest of the year from Seventh Street Channel. It receives stormwater from an urbanized (San Diego) watershed and is tidally influenced by San Diego Bay. Water depths in Paleta Creek are between approximately 15 to 26 feet (USACE, 2020), which is shallow enough to allow the use of

the diver-less push-pole deployment system for peepers, even during the highest tides (+4 to +5 feet) that occurred during our field work (October 2022). Creek flow is minimal (unless during storms), so water salinity is consistent with the saline nature of the remainder of San Diego Bay.

2.3 CONTAMINANT DISTRIBUTION

Recent studies (Drygiannaki et al., 2020; Hayman et al., 2019; Rosen et al. 2017) identified Paleta Creek as a site of sediment contamination due to stormwater and observed sediment toxicity resulting in impacts on the benthic community. Other studies have been conducted to characterize sediments at the mouth of Paleta Creek, and metals like copper, lead, and zinc are contaminants of concern (City of San Diego, 2009; SCCWRP, 2007). Spatial and temporal impacts of metals in sediment were investigated near the mouth of Paleta Creek using a 95% prediction limit based on a pool of stations representing baseline conditions in San Diego Bay. Sediment samples from monitored stations at Paleta Creek presented Cd, Cr, Cu, Pb, Ni, and Zn concentrations that exceeded the baseline threshold values and/or the 95% prediction limit. Concentrations of silver (Ag), arsenic (As), and Cr were within a factor of two of concentrations from reference sites, and concentrations of Cu, Hg, Pb, and Zn were approximately three times higher than concentrations at reference sites (SCCWRP, 2011).

A SERDP-funded research effort by Drygiannaki et al. (2020) provides some of the most relevant recent data on metals in surface sediments in Paleta Creek. In general, data indicate the presence of metals in sediment, with detectable levels of metals in porewater (as measured by DGT) that exceed the approximate method detection limits for target metals. Consistent with other studies in this area, Drygiannaki et al. (2020) results indicated that surface sediments at this location were fine grained (60 to 85% fines (clay plus silt)), indicating an ideal sediment substrate for the insertion of peepers.



Metal	Drygiannaki et al. (2020a) Stations P08, P11, and P17		Approximate method detection limit in porewater for peepers (this study, (µg/L)
	Concentrations in surface sediment (mg/kg)	Concentrations in surface sediment porewater, measured by DGT (µg/L)	
Ni	17 - 23	0.7 - 3.6	0.5
Cu	210 - 260	1.7 - 16	0.6
Zn	290 - 620	6.2 - 68	3
Cd	0.09 - 2.3	non-detect - 0.34	0.2
Hg	0.35 - 1.1	non-detect - 0.18	0.1
Pb	78 - 260	0.18 - 1.3	0.1

Figure 2. Ranges of Recent Concentrations of Metals in Sediment and Porewater (Table, Right) Collected at Three Stations (map, left) in Paleta Creek (Drygiannaki et al., 2020a) Compared to Approximate Method Detection Limits for Peepers to Be Used in the Field Study.

Dredging was conducted in 2020 (USACE, 2020) to remove a portion of sediment along the north-west edge of Paleta Creek (Figure 3). This area was not sampled by Drygiannaki et al. (2020), as shown in Figure 3. This study was not conducted in this dredged area since it is possible that the area may now be relatively uncontaminated and may not yield samples containing elevated or detectable levels of metals in porewater.

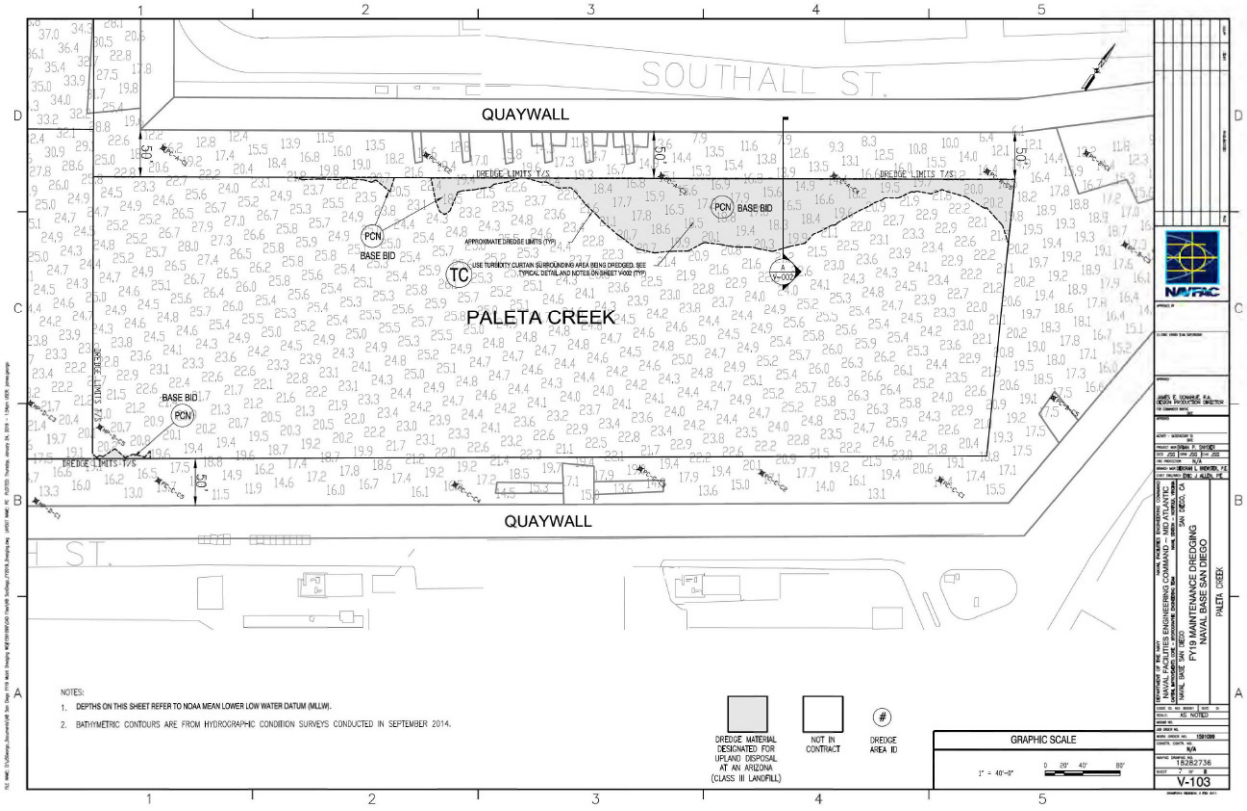


Figure 3. Dredging Footprint (Shown in Grey Shading) at Paleta Creek (USACE, 2020)

3.0 FIELD METHODS

This section provides a description of the field experimental design, sampling methods, and analytical methods that were used in the field demonstration. Peeper passive samplers were deployed at eight sampling locations (Figure 4). Two passive samplers consisting of four peepers samplers each were deployed at each sampling location, one for porewater and one for surface water analysis. Two surface water diffusive gradients in thin films (DGTs) were also deployed at each sampling location (Table 2). Field Notes can be found in Appendix C. A general step-by-step guide for deployment, retrieval, and processing of peeper samplers is provided in Appendix F.

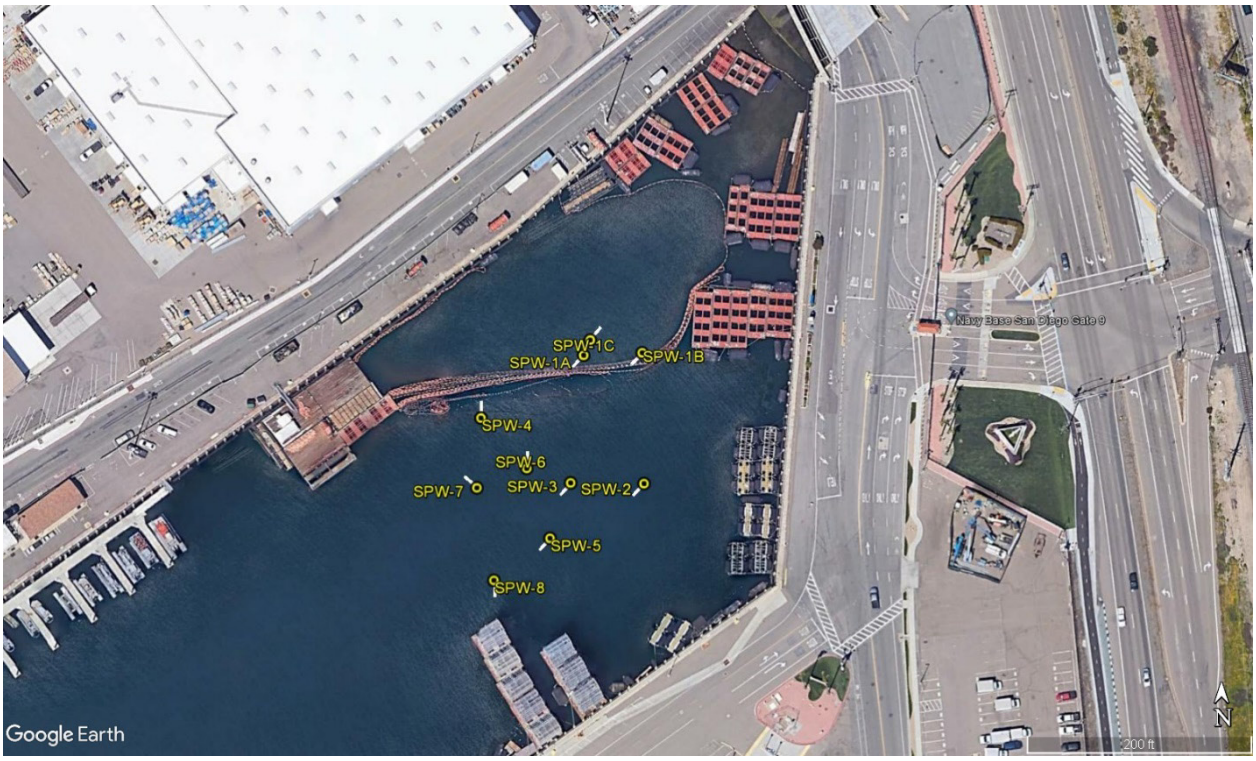


Figure 4. Field Sampling Sediment Stations.

The dots are the sampling stations and the lines represent the direction of the deployed anchor line.

3.1 FIELD MOBILIZATION

The field mobilization effort started four months ahead of the field event by scheduling the final field dates and reserving the services of a vessel and its crew. Field personnel that would be involved were also notified to ensure availability of key staff. In total, six people were selected, each with a defined role (Table 1).

Table 1. Field Personnel and Responsibilities for this Field Study

Field Personnel	Responsibilities
Field Coordinator	Coordinate field deployment. Organize material shipping and receiving. Direct staff during field event.
Principal Investigator	Overseeing of field event. Taking detailed notes during field event.
Site Access Contact	Direct contact with site owner for access and onsite scheduling.
Boat Captain	Vessel support.
Deck Hand	Vessel support.
Staff Support	Support for field event.

Material orders for the peepers, peeper frames, and DGT were placed 3 months ahead of the field event to allow for any delays due to potential supply chain issues. Peepers and frames were prepared by SiREM laboratories (https://www.siremlab.com/) and DGT were ordered from DGT Research (https://www.dgtresearch.com/). The diverless push-pole system that was used for this deployment was reserved from SiREM alongside the peeper order. S.ampling bottles were ordered from Eurofins Environment Testing America (Eurofins). All materials were shipped to the local Geosyntec office to be picked up by staff ahead of deployment. Peepers and DGTs were both shipped in a cooler, on ice, and were stored in the fridge until the first field deployment day.

3.2 PASSIVE SAMPLER DEPLOYMENT

Peeper passive samplers were deployed from a boat using the push-pole and camera system to ensure proper deployment and placement. Deployment took place from October 3 and 4, 2022. Prior to deployment, the peeper frames (each frame holding 4 peepers) were assembled by attaching plastic wings to support frames using supports and screws. The wings were attached to the frames to prevent the frame from over-penetrating the sediment. Two frames were attached together as to have one embedded in the sediment and one (above the wings) in the surface water. A laminated sample ID card was secured to one side of the frame, using a zip-tie and a sinking anchor line approximately 35 feet in length was attached to the other (Figure 5).

Peepers were removed from the Mylar® peeper bags, visually inspected for bubbles and damage during shipment, and secured into the peeper frame. Damaged peepers were discarded and not used for sampling purposes (Figure 6). Four peepers were inserted into the frame for porewater and four inserted for surface water sampling. One Agarose DGT, for mercury and one Chelex DGT, for other metals (i.e., cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc) were attached to the peeper frame using a loop of monofilament fishing line (Figure 7), with the following exceptions: Two Agarose DGTs for mercury and no Chelex DGTs for metals were deployed at stations SPW-1A, SPW-1B and SPW-1C. Two Chelex DGTs for metals and no agarose DGTs for mercury were deployed at SPW-6. This modification in the sampling approach for DGT served as a "duplicate" to compare the precision of surface water results.

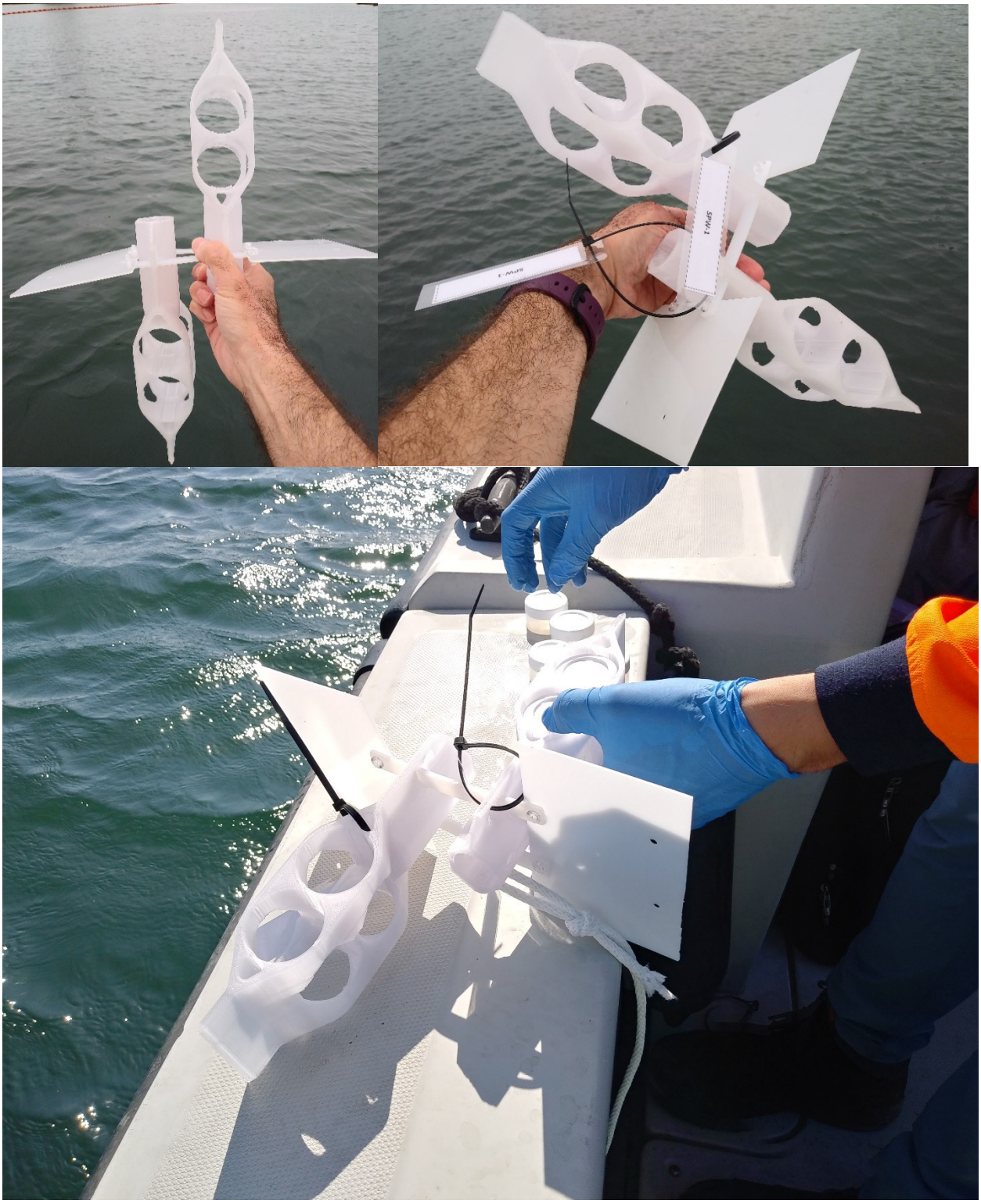


Figure 5. Peeper Frame (Top) and Frame with Peepers Being Inserted (Bottom).

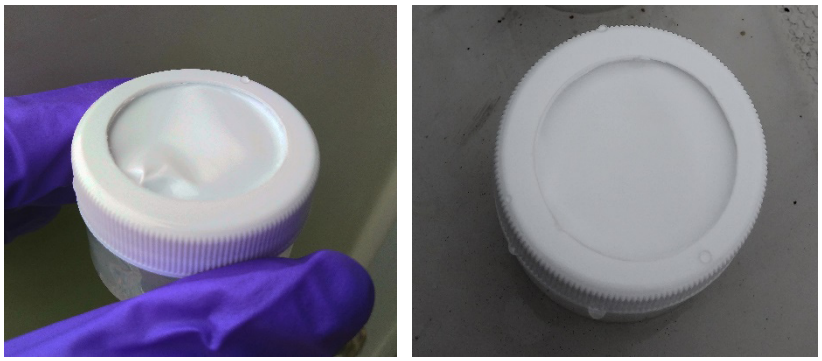


Figure 6. Peeper with Membrane Damage (Left) and Peeper with No Damage (right).

Figure 7. Fully Assembled Frame (Left) with Detail Showing Portion of Frame that Will Be Exposed to the Surface Water (Right).

After positioning the vessel at each station, the vessel anchored to secure position. The water depth was confirmed at each sampling location using GPS and sonar. Two aluminum push poles were attached together and the deployment head containing the release mechanism was attached. The camera system (SondeCAM HD) was secured to the bottom of the push poles. The fully assembled and loaded peeper frame was inserted into the deployment head slot on the push-pole deployment device (Figure 8) and a spring-loaded pin was inserted into the pole. The anchor, camera, and spring-loaded pin lines were all held above the water and managed on board the boat to ensure no tangling occurred during deployment. To deploy, the attached peeper frames were slowly lowered into the water and poles were added to the top of the push-pole system until the length was enough to reach the sediment. The peeper frame was then inserted into the sediment until the frame wings were flush with the sediment. This was visually confirmed using the camera system, which was

viewed on cell phone wirelessly. After confirmation, the anchor line was tossed into the water, and the line direction was recorded as a cardinal direction. The spring-loaded pin was released, and the push poles were slowly removed from the frame and back onto the boat.

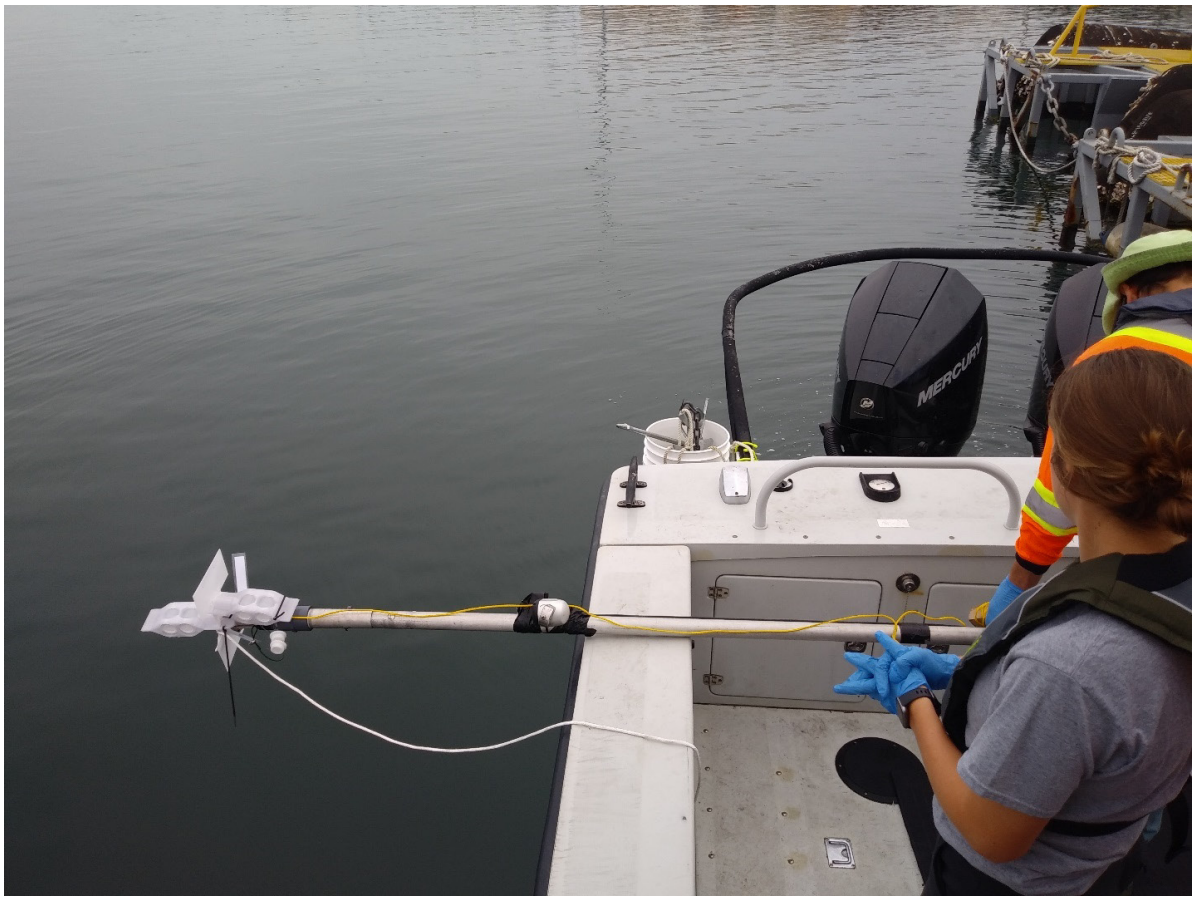


Figure 8. Fully Assembled Frame (Left) with Detail Showing Portion of Frame that Will Be Exposed to the Surface Water (Right).

GPS coordinates were collected and recorded immediately upon deployment of the peeper frame. The coordinates for SPW-8 were recorded after the frame had been deployed and the boat position had shifted. Therefore, the coordinates for SPW-8 are considered approximate and may not reflect the actual location of the deployed frame. In total 10 frames were deployed at all the planned locations (Table 2).

Table 2. Sampling Locations and Associated Sample Collection

Sampling Station	Passive Sampling Platforms	Coordinates as Deployed	Water depth (feet)	Samplers Deployed
SPW-1A	1	32°40'25.039"N 117° 6'58.693"W	24.4	1 porewater metal (peeper) 1 surface water metal (peeper) 2 surface water mercury (DGT)
SPW-1B	1	32°40'25.060"N 117° 6'58.079"W	24.4	1 porewater metal (peeper) 1 surface water metal (peeper) 2 surface water mercury (DGT)
SPW-1C	1	32°40'25.174"N 117° 6'58.623"W	25.2	1 porewater metal (peeper) 1 surface water metal (peeper) 2 surface water mercury (DGT)
SPW-2	1	32°40'23.907"N 117° 6'58.064"W	25.0	1 porewater metal (peeper) 1 surface water metal (peeper) 1 surface water mercury (DGT) 1 surface water metal (DGT)
SPW-3	1	32°40'23.915"N 117° 6'58.833"W	28.0	1 porewater metal (peeper) 1 surface water metal (peeper) 1 surface water mercury (DGT) 1 surface water metal (DGT)
SPW-4	1	32°40'24.489"N 117° 6'59.771"W	25.1	1 porewater metal (peeper) 1 surface water metal (peeper) 1 surface water mercury (DGT) 1 surface water metal (DGT)
SPW-5	1	32°40'23.427"N 117° 6'59.051"W	28.0	1 porewater metal (peeper) 1 surface water metal (peeper) 1 surface water mercury (DGT) 1 surface water metal (DGT)
SPW-6	1	32°40'24.044"N 117° 6'59.293"W	25.8	1 porewater metal (peeper) 1 surface water metal (peeper) 2 surface water metal (DGT)
SPW-7	1	32°40'23.874"N 117° 6'59.816"W	26.3	1 porewater metal (peeper) 1 surface water metal (peeper) 1 surface water mercury (DGT) 1 surface water metal (DGT)
SPW-8[1]	1	32°40'23.058"N 117° 6'59.640"W	27.9	1 porewater metal (peeper) 1 surface water metal (peeper) 1 surface water mercury (DGT) 1 surface water metal (DGT)
FB	-	-	-	1 Trip Blank (peeper)
Total Samples Deployed				**21 Peeper, 19 DGT**

[1]Peeper array and samples were deployed, but not retrieved from SPW-8. Samples were not collected or processed from this location.

3.3 PASSIVE SAMPLER RETRIEVAL

Prior to retrieval, the peeper passive samplers and DGTs were allowed to equilibrate for ten days after deployment. Retrieval took place on October 13-14, 2022. Retrieval of the passive samplers was initially attempted using a grappling hook attached to a retrieval rope (Figure 9). Using this method for ~ 1 day, only one of the peeper frames was able to be retrieved. This low recovery rate was due to a combination of debris found in Paleta Creek (old oil booms, ladders) and the short length of the anchor lines. Anchor lines were cut at 36 feet long. Since the water depth was between 25 to 28 feet at the stations, this resulted in only 6 to 10 feet of line extending laterally on the seabed. This small amount of lateral length was not sufficiently long to be efficiently targeted using the grappling hook. After multiple unsuccessful attempts using the grappling hook, a diver was employed to retrieve the sampler frames. The diver conducted a circle search around a dropped buoy deployed at the GPS coordinates to locate and retrieve the passive samplers (Figure 10).

Figure 9. Grappling Hook and Retrieval Rope.

Figure 10. Diver Retrieval and Marker Buoy.

Upon retrieval of the samplers from the diver, the peepers were immediately removed from the frame and placed flat in a Mylar® bag with 3-4 500-cc oxygen absorbing packets (Figure 11). Three of the 80 peepers exhibited broken membranes, and these were discarded (Figure 12); the damage may have occurred due to mishandling during retrieval (finger pokes were noted on the membrane). The outside of the storage bag was labeled with the sample nomenclature and stored in a cooler with wet ice until processing. DGTs were also removed from the frames, placed flat inside a labeled Mylar® bag and stored on wet ice until shipped.

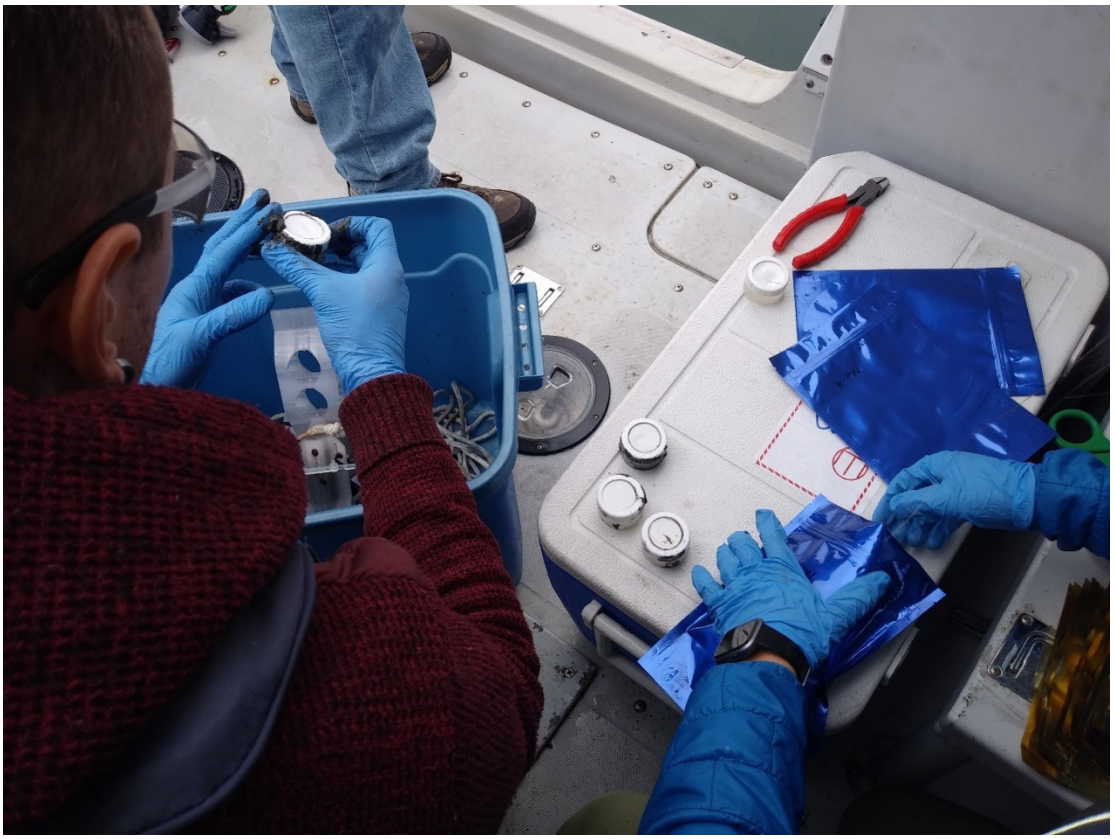


Figure 11. Peeper and DGT Storing After Retrieval.

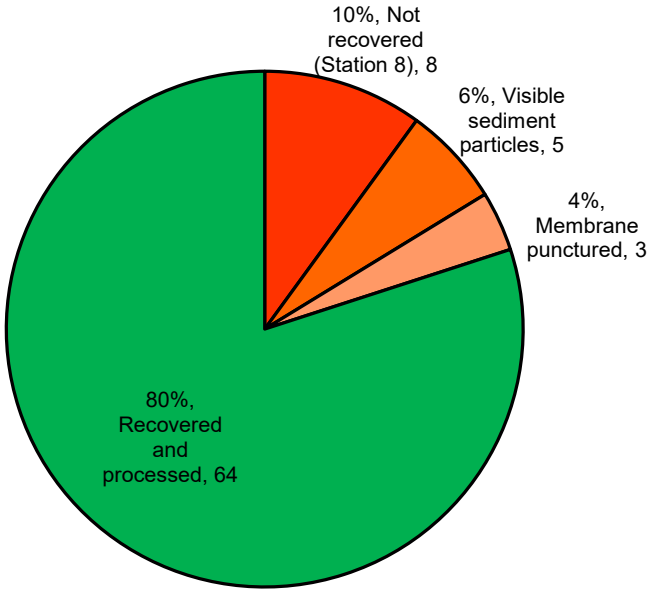


Figure 12. Recovery Summary of the 80 Peepers that Were Deployed in Surface Water and Sediment at the 10 Stations.

3.4 PASSIVE SAMPLER PROCESSING

At the end of each field day, the passive samplers were processed at a secure location onshore. Each peeper was removed from the storage bag and the membrane was washed with distilled water dispensed from a spray bottle (Figure 13). Each peeper was inspected for contamination by sediments (Figure 14). If particles were seen inside the peeper (5 of the 80 peepers, Figure 12), the peeper was not processed, as this can affect the metal concentration results (i.e., particle bound metals inside the peeper would cause an overestimation of the freely dissolved concentration of metals). Particles inside peepers were likely a result of inadvertently pressing upon the membranes by the diver and field crew. Peepers were also inspected for any biofilm or other biological growth on the membrane that could have impacted the performance of the device. No biofilm or any biological growth was noted on the membranes, the sampler or the frames. In total, 80% of the peepers (64 of 80) were recovered for processing (Figure 12). As peeper samples for the metals analysis can be comprised of 1, 2, or 3 peepers, however, 90% of the peeper samplers were able to be submitted for analysis. Only the sediment peeper sample and surface water peeper sample from station 8 was unable to be analyzed, as the peepers from this station were not able to be recovered. Thus, overall, the sampling effort achieved a 90% success rate.

Figure 13. Washing Peepers to Remove Sediments from the Membrane.

Figure 14. Contaminated Peeper with Particles (Left) vs Peeper without Any Contamination (Right).

To process and sample the peeper water, a 25-mL serological pipette was inserted into the bottom of the peeper by puncturing the membrane, and the water inside the peeper was drawn up (Figure 15). The water from one peeper (~20 mL) was dispensed into a sample container for bromide analysis (100-mL polypropylene bottle, supplied by the analytical laboratory). The remaining three peepers (~60 mL) were dispensed into the sample container for metal analysis (100-mL HDPE bottle containing 2.5 mL 1:4 concentrated nitric acid:water, supplied by the analytical laboratory)[1]. The following exceptions are noted:

- One of the peepers retrieved from SPW-1A for surface water was punctured and not useable for sampling purposes while another peeper was contaminated by sediment particles Therefore, only one peepers was used for metals analysis, instead of three.
- One of the peepers retrieved from SPW-1A for sediment porewater was contaminated by sediment particles. Therefore, only 2 peepers were used for metals analysis, instead of three.
- One of the peepers retrieved from SPW-3 for sediment porewater was punctured and not useable for sampling purposes. One of the peepers was contaminated by sediment particles. Therefore, only one peeper was used for metals analysis, instead of three.
- Two of the peepers retrieved from SPW-4, one for surface water, and one for porewater were contaminated with sediments. Therefore, only two peepers were used for metals analysis for surface water and porewater at this location.

[1] It is recommended that a small volume from each peeper (e.g., 5 mL) should be used for the bromide analysis, rather than the entire 20-mL originating from a single peeper (as reflected in the recommended standard operating procedures attached to this document). For this experiment, using 20 mL from a single peeper did not affect the results; however, in sediments that are very heterogenous in texture in the top 5 to 10 cm, differences in diffusion among the four peepers could be significant.

- One of the peepers retrieved from SPW-6 for surface water was punctured and not useable for sampling purposes. Therefore, only two peepers were used for metals analysis, instead of three.

In cases in which only one peeper (i.e., 20 mL) was available for analysis, this resulted in an approximate increase in detection limit by a factor of 2 to 3. As long as 40 to 60 mL were available, detection limit was not affected.

One field blank was prepared using four unexposed peepers which was brought to the field during deployment and retrieval. All sample bottles were capped and labeled with their sample IDs.

No further processing was required for the DGTs.

Figure 15. Peeper processing.

3.5 SAMPLE STORAGE AND SHIPMENT

Sample bottles and Mylar® bags containing the DGTs were stored on wet ice immediately after processing, until sample shipment. Samples were shipped on ice via Fedex, under Chain of Custody procedures (Appendix D), to Eurofins Environment Testing America of Seattle and Pittsburgh.

3.6 SAMPLE ANALYSIS

Peeper samples were analyzed for metals and bromide by Eurofins Pittsburgh, Pennsylvania laboratory using the analytical specifications outlined in Table 3. All method detection limits were below the USEPA's saltwater Criterion Continuous Concentration (CCC) for aquatic life (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table). The analytical report is available in Appendix E.

Table 3. Analytical Specifications for Inorganic Analytes in Peeper Water

Analyte	Analytical Method	Sample Type	Container	Preser-vative	Holding Time (days)	Average Method Detection Limit (µg/L)	USEPA Saltwater Criterion Continuous Concentration (µg/L)
Cadmium (Cd)	EPA Method 6020B	60 mL of peeper water from three peepers	100-mL HDPE bottle	Nitric Acid	180	0.22	7.9
Chromium (Cr)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	1.5	NA
Copper (Cu)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	1.1	3.1
Iron (Fe)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	28	NA
Lead (Pb)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	0.17	8.1
Total Mercury (Hg)	EPA Method 7470A		100-mL HDPE bottle	Nitric Acid	180	0.13	0.94
Manganese (Mn)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	1.3	NA
Nickel (Ni)	EPA Method 7470B		100-mL HDPE bottle	Nitric Acid	180	0.52	8.2
Zinc (Zn)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	2.9	81
Lithium (Li)	EPA Method 6020B		100-mL HDPE bottle	Nitric Acid	180	0.83	NA
Bromide (Br)	EPA Method 9056A	20 mL of peeper water from one peeper	100-mL HDPE bottle	None	180	2,700	NA

Note: NA: Not Available

DGTs were analyzed for metals and mercury by Eurofins Tacoma, Washington laboratory using the analytical specifications outlined in Table 4. Results are reported as the total µg of analyte detected from the gel portion of the DGT. The analytical report is available in Appendix E.

Table 4. Analytical Specifications for Inorganic Analytes in DGT.

Analyte	Analytical Method	Sample Type	Container	Preserv-ative	Holding Time (d)	Method Detection Limit (µg/sample)
Cadmium (Cd)	EPA Method 1638	DGT resin obtained from one general metals DGT	Plastic zipseal bag containing DGT	None	180	0.00075
Chromium (Cr)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.0053
Copper (Cu)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.01
Iron (Fe)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.075
Lead (Pb)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.00068
Manganese (Mn)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.0045
Nickel (Ni)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.0058
Zinc (Zn)	EPA Method 1638		Plastic zipseal bag containing DGT	None	180	0.021
Total Mercury (Hg)	EPA Method 1631B	DGT resin obtained from one mercury-specific DGT	Plastic zipseal bag containing DGT	None	180	0.00001

3.7 PEEPER EQUILIBRIUM CALCULATIONS

For all peepers deployed in the sediments and in the surface water, the bromide and lithium tracer data was used to estimate the equilibrium freely-dissolved concentration of the target metals using the modeling techniques of Thomas and Arthur (2010). Thomas and Arthur (2010) studied the use of the bromide reverse tracer to estimate percent equilibrium in lab experiments and a field application. They concluded that bromide can be used to estimate concentrations in porewater using measurements obtained before equilibrium is reached. The study included a mathematical model for estimating concentrations of ions in external media ($C_{e,i}$) based on measured concentrations in the peeper chamber ($C_{p,i}$), the elimination rate of the target analyte (K_i) and the deployment time (t):

$$C_{e,i} = \frac{C_{p,i}}{1 - e^{-K_i t}}$$

Where K_i is the elimination rate of the target analyte, calculated using the ratio of the free-water diffusion coefficient of the tracer (D_t) and the target analyte (D_i) (Thomas and Arthur, 2010):

$$K_i = K_t \left(\frac{D_i}{D_t}\right)$$

D values for the 7 target analytes and 2 tracers are provided in Table 5.

Table 5. Free-water Diffusion Coefficient (D) for Inorganics.

Analyte	D ($x10^{-5}$ cm^2/s)	Reference
Cadmium (Cd)	0.63	Buffle et al. (2007)
Chromium (Cr)	0.52	
Copper (Cu)	0.62	
Iron (Fe)	0.63	
Lead (Pb)	0.83	
Manganese (Mn)	0.62	
Mercury (Hg)	0.74	
Nickel (Ni)	0.62	
Zinc (Zn)	0.61	
Lithium (Li)	0.90	
Bromide (Br)	1.8	

The elimination rate of the tracer (K_t) is calculated using the following equation:

$$K_t = \frac{-ln\ (1 - \frac{Tr_{p,t} - Tr_{p,0}}{Tr_{e,t} - Tr_{p,0}})}{t}$$

Where:

- $Tr_{p,0}$ is the measured concentrations of the tracer in the peeper prior to deployment (mg/L or µg/L),
- $Tr_{p,t}$ is the measured concentrations of the tracer in the peeper at time of retrieval (mg/L or µg/L),
- $Tr_{e,t}$ is the concentrations of the tracer in the external media (mg/L or µg/L) which for seawater is 65 mg/L for bromide and 100 µg/L for lithium, and
- t is the deployment time (days)
- K_t is the elimination rate of the tracer

Additional laboratory experiments conducted by our team indicated that for marine sediment, lithium can be used in conjunction with bromide as a tracer to provide more robust equilibrium calculations.

These calculations were conducted on every porewater and surface water sample obtain from each station. This resulted in a corrected "at equilibrium" metal concentrations that was used to assess the peepers and was compared to the DGT. Details of the calculations and Excel file attachments can be found in Appendix A.

3.8 DGT POREWATER CONCENTRATION CALCULATIONS

The data obtained from the analysis of metals in the gels obtained from the DGTs used in the surface water were processed to be converted to a concentration due to their non-equilibrium mechanism (i.e. binding layer adsorbs continuously for the deployment length) using the approach detailed by Zhang and Davison (1995). The calculation of the aqueous concentration of any metal species using DGT data is as follows:

$$C_{DGT} = \frac{M\Delta_g}{D^{mdl}A_p t}$$

Where:

- C_{DGT} (ng/L for Hg, µg/L for other metals) is the concentration of metal in water measured by the DGT.
- M (ng for Hg, µg for other metals) is the mass of analyte in the gel from the binding layer of the DGT. It is obtained from the laboratory analysis (Appendix E).
- Δg (cm) is the total thickness of the materials (diffusive gel and membrane) in the diffusion layer (0.094 cm, as indicated by the DGT manufacturer).
- D^{mdl} (cm^2/s) is the diffusion coefficient of the metal in the diffusion layer for the assumed deployment temperature (15°C, table of values provided by the DGT manufacturer, see Appendix B).
- A_p (cm^2) is the physical area of the exposed filter membrane (3.14 cm^2, as provided by the manufacturer).
- t (s) is the deployment time (as determined from the field notes, Appendix C).

The mass, M, of analyte in the binding layer, of volume V^{bl} (mL), is calculated from the measured concentration of analyte c_e in the acid eluent of the volume V_e (mL) of DGT gel, remembering to consider any subsequent dilution.

$$M = \frac{c_e(V^{bl} + V_e)}{f_e}$$

Each DGT deployed in the surface water at each station was processed using these formulas to obtain a dissolved metal concentration that can be compared to the concentration obtained using peepers deployed in surface water. Details of the DGT calculation can be found in Appendix B.

4.0 RESULTS

4.1 SEDIMENT POREWATER CONCENTRATION RESULTS MEASURED WITH PEEPERS

Bromide and lithium results for the sediment porewater peepers are presented in Table 6 for each station. Deployment time varied between 9 to 11 days. The percentage of the equilibrium reached was calculated using the equations presented in section 3.7 and the initial peeper concentrations (980 mg/L Br, 86,000 µg/L Li) measured in the trip blank peeper, the concentrations of bromide and lithium measured in each peeper, and assumed concentration of bromide and lithium in seawater (65 mg/L Br, 100 µg/L Li). Results from peeper bromide and lithium concentrations both indicated that 80% to 100% equilibrium for bromide and lithium had been reached in the peepers deployed in sediment. However, because the target metals diffuse more slowly than tracers (Table 5), the percentage of equilibration estimated for the target metals was less than this 80% to 100% range. For example, the least amount of equilibration was observed for chromium in sediment peepers. Based on calculations using the lithium tracer, the average (SD) percentage equilibration reached by chromium in sediment was 74% (16%) among the 10 sediment peepers. Assuming this corresponds to a site-specific K_i value of 0.12 (day^{-1}), approximately 20 days would be needed to achieve approximately 90% equilibration in sediment. However, 3 to 5 days of deployment time would be sufficient to allow an approximate 30% to 50% equilibration for chromium in sediment (this time period would allow a higher percentage of equilibration for other target metals); this deployment time could be used (with tracers) to estimate the equilibrium concentration of chromium.

Overall, these results indicate that the deployment duration was sufficient to reach equilibrium during the ~10-day deployment period, and little to no correction are needed to account for partial equilibrium between porewater and peepers. Pre-equilibrium corrections were applied to all measured concentrations of metal analytes using the equations provided above. It is acknowledged that peepers that indicate nearly 100% of the equilibrium for lithium or bromide cannot provide exact cues as to when near 100% of equilibrium will be reached for target metals, because the target metals analytes measured in this study diffuse more slowly than lithium and bromide. Conceptually, this could prevent accurate pre-equilibrium correction. For example, among the metal analytes measured in this experiment, chromium is the slowest to reach equilibrium (lowest D value, Table 5). Given the equilibrium equations, if results indicated lithium has reached 96% of equilibrium, chromium would be expected to be only at 82% of equilibration. For this example, the concentration of chromium measured in the peeper water would be corrected by a factor of 1.2 (i.e., 1 ÷ 82%) to estimate the concentration of chromium at equilibrium. This pre-equilibration correction is relatively minor such that if no multiplication of chromium results were applied, the uncorrected (pre-equilibrated result) would be a factor of 1.2 or less than the true equilibrated concentration of chromium. This error rate is at most 20%, and would be lower for other metals diffusing at faster speeds. A ± 20% uncertainty or error rate is a reasonable level of uncertainty for measurements of metals in water (USEPA, 2014). Thus, overall, for samples that indicate a high degree of equilibration for lithium (e.g., approximately 95% or more), the amount of uncertainty in predicting the equilibration of the other analytes lies in a reasonable ± 20% range typical of analytical measurement uncertainty. In cases in which lithium has equilibrated 95% or more, the use of pre-equilibrium correction is not likely to indicate meaningfully different results from the uncorrected results for the metals measured in this study. Overall, despite the fact that lithium and bromide diffuse faster than the slowest analytes in this study (chromium), the difference is minor

such that, even when tracers are fairly well equilibrated, equilibrium estimated for the metals are likely to be within ± 20% of true equilibrated values, which is a reasonable level of uncertainty. Extending the deployment time would decrease this error rate even further.

Table 6. Peeper Porewater Equilibrium Results

Sample	Deployment Duration (d)	Bromide	Lithium	Br Equilibrium	Li Equilibrium
		mg/L	µg/L	%	%
1A-PW	11.10	220	16000	83	81
1B-PW	11.06	120	510	94	100
1C-PW	10.92	230	19000	82	78
2-PW	9.14	120	5100	94	94
3-PW	10.96	230	18000	82	79
4-PW	10.16	130	170	93	100
5-PW	10.27	170	15000	89	83
6-PW	10.08	220	17000	83	80
7-PW	10.23	140	9600	92	89

Equilibrium porewater concentrations were calculated from the measured peeper concentrations, as described in section 3.7. Two different tracers were used (bromide and lithium) and thus two different final porewater concentration were calculated for bromide (Table 7) and lithium (Table 8). Concentrations of cadmium, copper, lead, total mercury, and nickel that are highlighted yellow were in exceedance of USEPA's saltwater CCC (Table 3). Copper frequently exceeded the CCC value; this does not indicate that copper is resulting in aquatic toxicity, only that the CCC screening level is exceeded. Despite equilibrium being reached at many stations, the approach was used on all samples to confirm the accuracy of the method. Note that detection limits were also corrected to provide the "at equilibrium" minimum detection limit.

Table 7. Bromide Corrected Porewater Results

Station	Bromide corrected values (µg/L)								
	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-PW	< 0.59	< 4.8	**7.1**	**480**	**1.6**	**55**	< 0.25	< 1.4	**29**
1B-PW	< 0.35	< 2.7	**7.8**	**7100**	**0.54**	**370**	< 0.19	**1.6**	**33**
1C-PW	< 0.49	< 3.9	**5.9**	**510**	< 0.31	**81**	< 0.26	< 1.2	**13**
2-PW	< 0.35	< 2.7	**5.8**	**2300**	< 0.24	**120**	< 0.19	< 0.84	**5.1**
3-PW	< 0.8	< 6.7	< 4.3	**340**	< 0.52	**41**	< 0.66	**2.5**	**25**
4-PW	< 0.37	< 2.8	**10**	< 47	**0.29**	**8.8**	< 0.5	**1.9**	**27**
5-PW	< 0.42	< 3.3	**3.5**	**2800**	< 0.27	**210**	< 0.22	< 1	**5.8**
6-PW	< 0.48	< 3.8	< 2.4	**6800**	< 0.31	**330**	< 0.25	< 1.1	< 6.5
7-PW	< 0.38	< 2.9	< 1.9	**2100**	< 0.25	**170**	< 0.2	**1.3**	**11**
USEPA Saltwater CCC	*7.9*	*NA*	*3.1*	*NA*	*8.1*	*NA*	*0.94*	*8.2*	*81*

Table 8. Lithium Corrected Porewater Results

Station	Lithium corrected values (µg/L)								
	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-PW	< 0.39	< 3	**4.7**	**320**	**1.1**	**36**	< 0.17	< 0.95	**19**
1B-PW	< 0.23	< 1.6	**4.9**	**4500**	**0.39**	**240**	< 0.13	**1**	**21**
1C-PW	< 0.34	< 2.6	**4**	**350**	< 0.23	**56**	< 0.18	< 0.8	**8.7**
2-PW	< 0.25	< 1.9	**4.2**	**1600**	< 0.18	**90**	< 0.14	< 0.61	**3.6**
3-PW	< 0.54	< 4.4	< 2.9	**220**	< 0.37	**27**	< 0.46	**1.7**	**17**
4-PW	< 0.22	< 1.5	**6.2**	< 28	**0.2**	**5.2**	< 0.33	**1.1**	**16**
5-PW	< 0.31	< 2.4	**2.6**	**2100**	< 0.21	**160**	< 0.17	< 0.74	**4.3**
6-PW	< 0.32	< 2.5	< 1.6	**4600**	< 0.22	**220**	< 0.18	< 0.77	< 4.3
7-PW	< 0.28	< 2.1	< 1.4	**1500**	< 0.2	**130**	< 0.16	**0.99**	**8**
USEPA Saltwater CCC	*7.9*	*NA*	*3.1*	*NA*	*8.1*	*NA*	*0.94*	*8.2*	*81*

The range of porewater concentration results between lithium and bromide correction are overlapping showing that both tracers are equally appropriate. Copper in the porewater was measured between < 1.4 to 10 µg/L, iron between < 28 to 6800 µg/L, lead between < 0.18 and 1.6 µg/L, manganese between 5.2 and 370 µg/L, nickel between < 0.61 and 2.5, and zinc between < 4.3 and 33. Cadmium, chromium and mercury were not detected in any of the porewater samples.

4.2 SURFACE WATER CONCENTRATIONS MEASURED WITH PEEPERS

Equilibrium results of the surface water peepers are presented in Table 9 for each station. Deployment time varied between 9 to 11 days. The percentage of the equilibrium reached was calculated using the equations presented in section 3.7 and uses the initial peeper concentrations (980 mg/L Br, 86,000 µg/L Li) and the seawater concentration (65 mg/L Br, 100 µg/L Li). Results from peeper bromide and lithium concentrations both indicated that 92% to 100% equilibrium had been reached. As in sediment, the least amount of equilibration was observed for chromium in surface water peepers. Based on calculations using the lithium tracer, the average (SD) percentage equilibration reached by chromium in water was 98% (0.15%) among the 10 surface water peepers. Assuming this corresponds to a site-specific K_i value of 0.39 (day^{-1}), approximately 6 days would be needed to achieve approximately 90% equilibration in surface water. However, 1 to 2 days of deployment time would be sufficient to allow an approximate 30% to 50% equilibration for chromium in surface water (this time period would allow a higher percentage of equilibration for other target metals); this deployment time could be used (with tracers) to estimate the equilibrium concentration of chromium. These results indicate that the deployment duration was sufficient to reach equilibrium during the ~10-day deployment period, and little to no correction are needed to account for partial equilibrium between surface water and peepers. As for the treatment of peepers deployed in sediment porewater, corrections based on lithium and bromide tracer measurements were applied to all measured concentrations. Because the percentage of equilibration for lithium was approximately 99.9% and 92% or greater for bromide for all samples, little correction was needed.

Table 9. Peeper Surface Water Equilibrium Results

Sample	Deployment Time (d)	Br	Li	Br Equilibrium	Li Equilibrium
		mg/L	µg/L	%	%
1A-SW	11.10	120	150	94	100
1B-SW	11.06	120	180	94	100
1C-SW	10.92	120	180	94	100
2-SW	9.14	110	180	95	100
3-SW	10.96	140	170	92	100
4-SW	10.16	130	170	93	100
5-SW	10.27	130	170	93	100
6-SW	10.08	130	180	93	100
7-SW	10.23	130	190	93	100

Equilibrium porewater concentrations were calculated from the measured peeper concentration as described in section 3.7. Two different tracers were used (bromide and lithium) and thus two different final porewater concentration were calculated for bromide (Table 10) and lithium (Table 11). Concentrations of cadmium, copper, lead, total mercury, and nickel that are highlighted yellow were in exceedance of USEPA's CCC (Table 3). Copper frequently exceeded the CCC value and nickel exceeded its CCC at one station (1A-SW); this does not indicate that copper or nickel are resulting in aquatic toxicity, only that the CCC screening level is exceeded. Despite equilibrium being reached at many stations, the approach was used on all samples to confirm the accuracy of the method. Note that detection limits were also corrected to provide the "at equilibrium" minimum detection limit.

Table 10. Bromide Corrected Surface Water Results

Station	Bromide corrected values (µg/L)								
	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-SW	< 0.58	**36**	**21**	**180**	**0.5**	**19**	< 0.48	**47**	**38**
1B-SW	< 0.35	< 2.7	**16**	< 45	**0.62**	**8.4**	< 0.19	**1.6**	**54**
1C-SW	**0.58**	< 2.7	**12**	< 45	< 0.24	**11**	< 0.19	**1.3**	**25**
2-SW	< 0.34	< 2.6	**10**	< 43	**0.24**	**9.8**	< 0.18	**1.1**	**17**
3-SW	< 0.38	< 2.9	**11**	< 48	< 0.25	**11**	< 0.2	**1.4**	**18**
4-SW	< 0.4	< 3.2	**8.9**	**110**	< 0.26	**15**	< 0.2	**1.7**	**15**
5-SW	< 0.37	< 2.8	**9.4**	< 47	**0.33**	**13**	< 0.2	**1.6**	**20**
6-SW	< 0.37	< 2.8	**8.1**	< 47	**0.37**	**12**	< 0.5	**1.3**	**17**
7-SW	< 0.37	< 2.8	**9.3**	**48**	**0.37**	**13**	< 0.2	**1.6**	**22**
USEPA Saltwater CCC	*7.9*	*NA*	*3.1*	*NA*	*8.1*	*NA*	*0.94*	*8.2*	*81*

Table 11. Lithium Corrected Surface Water Results

Station	Lithium corrected values (µg/L)								
	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-SW	< 0.36	**20**	**13**	**110**	**0.36**	**12**	< 0.33	**29**	**23**
1B-SW	< 0.22	< 1.5	**10**	< 28	**0.45**	**5.2**	< 0.13	**1**	**33**
1C-SW	**0.36**	< 1.5	**7.5**	< 28	< 0.17	**6.7**	< 0.13	**0.8**	**15**
2-SW	< 0.22	< 1.5	**6.7**	< 28	**0.18**	**6.4**	< 0.13	**0.72**	**11**
3-SW	< 0.22	< 1.5	**6.2**	< 28	< 0.17	**6.5**	< 0.13	**0.8**	**10**
4-SW	< 0.24	< 1.7	**5.3**	**63**	< 0.18	**9**	< 0.13	**1**	**9**
5-SW	< 0.22	< 1.5	**5.6**	< 28	**0.23**	**7.8**	< 0.13	**0.98**	**12**
6-SW	< 0.22	< 1.5	**4.8**	< 28	**0.26**	**7**	< 0.33	**0.78**	**10**
7-SW	< 0.22	< 1.5	**5.5**	**29**	**0.26**	**7.6**	< 0.13	**0.97**	**13**
USEPA Saltwater CCC	*7.9*	*NA*	*3.1*	*NA*	*8.1*	*NA*	*0.94*	*8.2*	*81*

The range of peeper surface water concentration results between lithium and bromide correction are overlapping showing that both tracers are equally appropriate. Cadmium in the surface water was measured between < 0.22 to 0.58 µg/L, chromium between < 1.5 and 36 µg/L, copper between 4.8 and 21 µg/L, iron between < 28 to 180 µg/L, lead between < 0.17 and 0.62 µg/L, manganese between 5.2 and 19 µg/L, nickel between 0.72 and 47, and zinc between 9 and 54 µg/L. Mercury was not detected in any of the surface water samples.

4.3 COMPARISON OF PEEPER RESULTS ESTIMATED WITH LITHIUM TRACERS VERSUS BROMIDE TRACERS

Concentrations of metals in peepers, as calculated with the bromide (Table 7 and Table 8) and lithium (Table 10 and Table 11) were similar. This lack of difference was not unexpected given that the tracers indicated that the sediment and water peepers were near equilibrium (87% on average for all peepers). As shown in Figure 16, the percentage of equilibration was generally higher in the surface water peepers compared to the sediment peepers, which, is to be expected given that water flows around the peepers that were deployed in surface water which will agitate the boundary layer at the outside surface of the peeper membrane, facilitating a faster diffusive transfer. For the sediments, the amount of equilibration achieved by the lithium tracer was not statistically different than that achieved with the bromide tracer (average of 88% versus 87%), while for surface water the amount of equilibration achieved by the lithium tracer (average of 99.9%) was statistically significantly higher than that achieved with the bromide tracer (average of 93%).

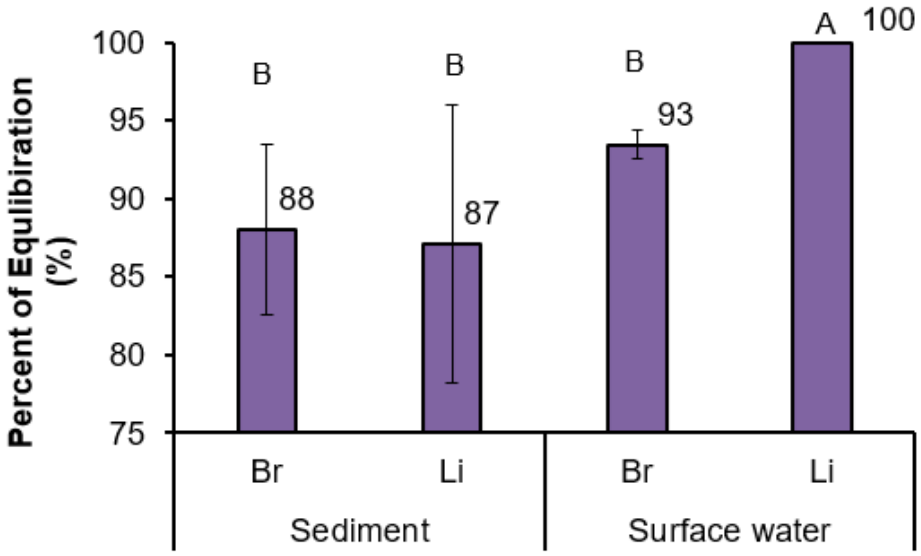


Figure 16. Percentage of Equilibration Achieved by the Bromide and Lithium Tracers for Peepers Deployed in Sediment and Surface Water.

Note: Columns are average (SD) values; numerical labels are averages; columns with the same letter are not statistically different (ANOVA with Tukey's Honestly Significant Difference).

Data were further evaluated by comparing the concentrations of copper, manganese, and zinc in sediment porewater and surface water as estimated by the bromide tracer to those estimated using the lithium tracer (Figure 17). These three metals were evaluated because they were the metals with the highest percentages of detected results in both sediment and water. Results indicated that in all cases, the concentrations for copper, zinc, and manganese estimated using the bromide tracer were an average of 37%, 24% and 31% higher, respectively, than the concentrations indicated using the lithium tracer. Specifically:

- The average (SD) concentration of copper estimated using the bromide tracer (8.3 (5.0) µg/L) was statistically different from that estimated using the lithium tracer (5.2 (3.0) µg/L)), based on a paired t-test ($P < 0.0001$).
- The average (SD) concentration of zinc estimated using the bromide tracer (17.3 (10.1) µg/L) was statistically different from that estimated using the lithium tracer (13.1 (7.6) ug/L)), based on a paired t-test ($P = 0.0001$).
- The average (SD) concentration of manganese estimated using the bromide tracer (83.2 (114.1) µg/L) was not statistically different from that estimated using the lithium tracer (57 (78) ug/L)), based on a paired t-test ($P < 0.0001$).

Overall, the 24-37% difference between the approaches is within an acceptable level of uncertainty for the measurement approaches such that either the concentrations estimated using the lithium tracer or the concentrations estimated using the bromide tracer would be assumed to be accurate measurements. However, it is important to note that diffusion coefficient for bromide (1.8×10^{-5} cm^2/s, Table 5) is much higher compared to lithium (0.9×10^{-5} cm^2/s, Table 5) and thus bromide is expected to diffuse faster than lithium in sediments and in surface water.

Since the opposite is observed for surface water while no difference is observed for sediments, we can hypothesize that either the diffusion of lithium is faster that theorical values or that the diffusion of bromide is slower that theorical values. However, based on the diffusion coefficients, bromide should have reached equilibrium earlier in the given deployment time, thus using bromide correction may slightly overestimate porewater and surface water concentrations for this study. Indeed, corrections using lithium provided concentrations of copper, manganese and zinc that were only within a factor of 1.06 to 1.2 from the measured concentrations, which is expected based on the samplers having reached equilibrium. For this reasons, the lithium tracer results will be used for the remainder of the discussion in this study.

It is important to note that both lithium and bromide tracer indicate 80% or more of the equilibrium has been reach in both porewater and surface water peepers. Corrections are still applied in this study to provide the methods to other studies that may retrieve peepers before equilibrium is established.

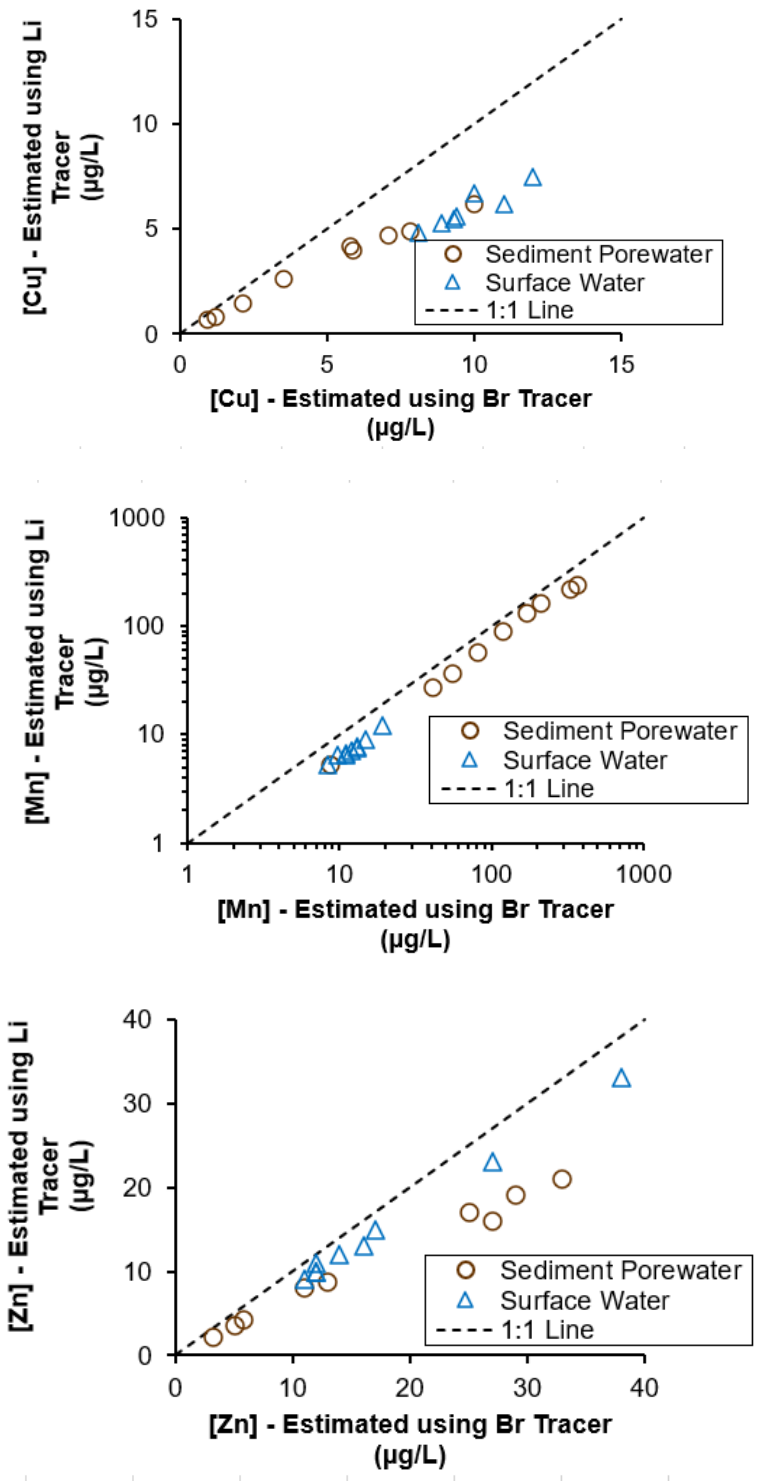


Figure 17. Concentrations of Copper, Manganese, and Zinc, as Estimated Using the Lithium Tracer (y-axis) Compared to Concentrations as Estimated Using the Bromide Tracer (x-axis) for Peepers Deployed in Sediment and Surface Water.

4.4 COMPARISON OF SEDIMENT POREWATER AND SURFACE WATER PEEPER RESULTS

Concentrations of copper, manganese, and zinc in peepers deployed in sediment were compared to concentrations in surface water (calculated using the lithium tracer, Figure 18). There was a lack of a clear correlation between concentrations of metals in sediment porewater and the corresponding concentration in surface water at each station. Differences in concentrations between sediment porewater and surface water were noted for copper and manganese, but not zinc:

- The average (SD) concentrations of copper in sediment porewater (3.3 (2.0) ug/L) were statistically lower (by a factor of ~2) than that of surface water (7.2 (2.7) ug/L), based on paired t-test (P = 0.0014).
- The average (SD) concentrations of manganese in sediment porewater (107 (86) ug/L) were statistically higher (by a factor of 14) than that of surface water (7.6 (2.0) ug/L), based on paired t-test (P = 0.0087).
- The average (SD) concentrations of zinc were not statistically different between sediment porewater (11.1 (7.2) ug/L) and surface water (15 (7.9) ug/L), based on paired t-test (P = 0.1061).

Overall, the differences between sediment porewater and surface water for copper and zinc were minor (factor of 2 or less difference), indicating some degree of potential equilibration between surface sediment and surface water. In contrast, concentrations of manganese in sediment porewater were much higher (factor of 14) than surface water. This is expected given that the sediment was likely anoxic or partly anoxic, which would facilitate the presence of freely available manganese compared to the more oxygenated surface water, where manganese availability would be limited.

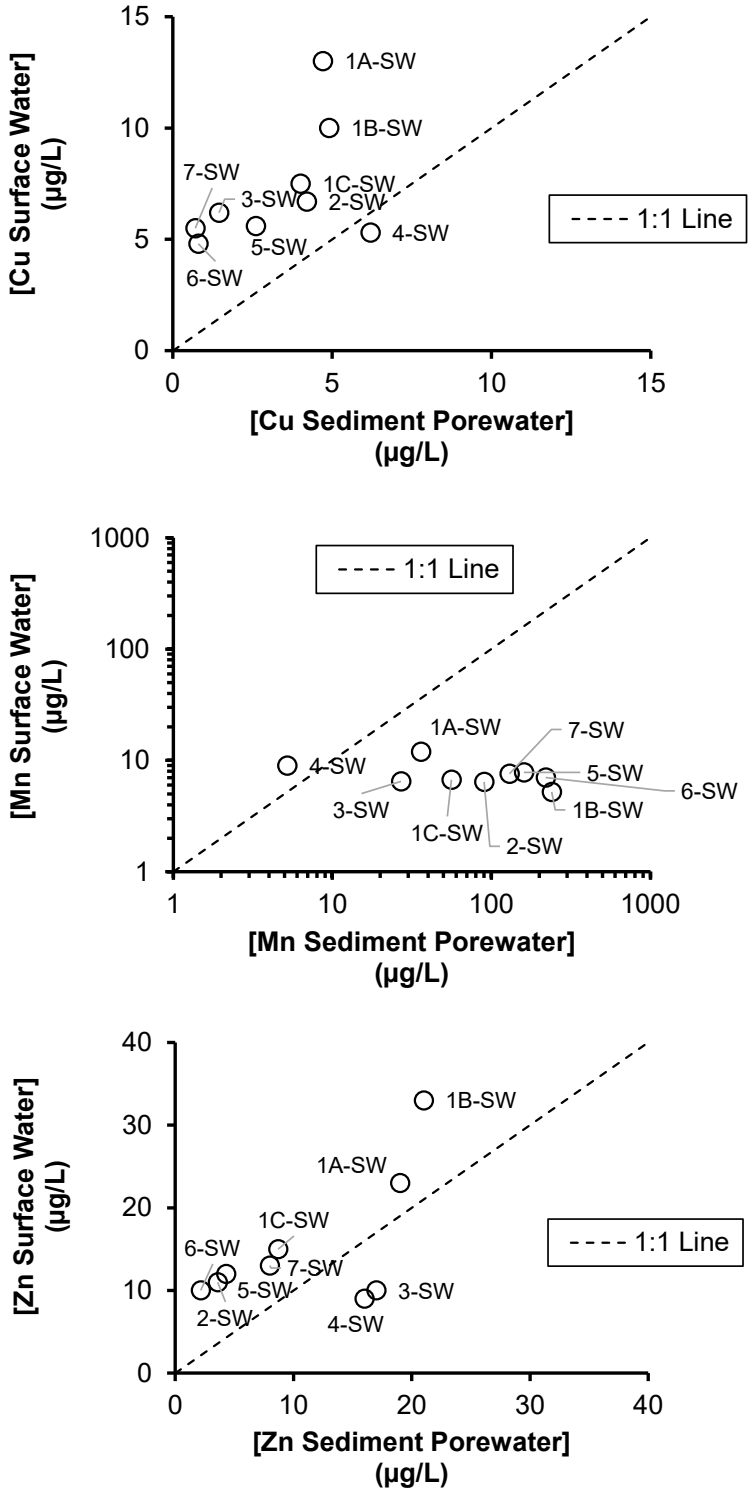


Figure 18. Concentrations of Copper, Manganese, and Zinc, as Estimated Using the Lithium Tracer (y-axis) Compared to Concentrations as Estimated Using the Bromide Tracer (x-axis) for Peepers Deployed in Sediment and Surface Water.

Note: Labels indicate stations.

4.5 SURFACE WATER CONCENTRATIONS MEASURED WITH DGTS

Concentrations of metals as measured by the DGTs is presented in Table 12. No concentrations of cadmium, copper, lead, total mercury, or nickel (measured by DGTs) were in exceedance of USEPA's saltwater CCC (Table 3).

Table 12. DGT Surface Water Results

Station	Hg	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
	ng/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1A-SW*	< 0.520	-	-	-	-	-	-	-	-
	< 0.520	-	-	-	-	-	-	-	-
1B-SW*	**1.409**	-	-	-	-	-	-	-	-
	< 0.522	-	-	-	-	-	-	-	-
1C-SW*	< 0.529	-	-	-	-	-	-	-	-
	< 0.529	-	-	-	-	-	-	-	-
2-SW	< 0.632	**0.024**	< 0.053	**1.054**	**1.74**	**0.088**	**1.99**	**0.37**	**4.91**
3-SW	< 0.527	**0.030**	< 0.044	**0.743**	< 0.52	**0.068**	**2.38**	**0.38**	**5.06**
4-SW	< 0.569	**0.032**	< 0.048	**0.875**	**1.04**	**0.079**	**2.18**	**0.39**	**5.84**
5-SW	< 0.562	**0.030**	< 0.047	**0.865**	**2.50**	**0.078**	**2.07**	**0.30**	**4.44**
6-SW*	-	**0.031**	< 0.048	**0.808**	< 0.56	**0.068**	**2.51**	**0.36**	**5.13**
	-	**0.029**	< 0.048	**0.808**	< 0.56	**0.068**	**1.88**	**0.34**	**4.82**
7-SW	< 0.564	**0.030**	< 0.047	**1.013**	< 0.55	**0.090**	**1.47**	**0.34**	**5.57**

- : Not analyzed

*: Represents stations at which duplicate DGTs for mercury (1A-SW, 1B-SW, and 1C-SW) or other metals (6-SW) were deployed.

DGTs indicated lower method detection limits than peepers, but detection limits for peepers were generally an order of magnitude lower than USEPA's saltwater CCC for aquatic life (Table 3), making them sufficient for most investigations of metals that consider potential risks to aquatic life. Cadmium in the surface water was measured between 0.024 to 0.032 µg/L, chromium between < 0.044 and < 0.053 µg/L, copper between 0.743 and 1.054 µg/L, iron between < 0.52 to 2.50 µg/L, lead between 0.068 and 0.090 µg/L, manganese between 1.47 and 2.51 µg/L, nickel between 0.030 and 0.38, and zinc between 4.44 and 5.57 µg/L. Mercury was only detected in one of the surface water samples at 1.409 ng/L.

It is notable that the surface water peepers identified copper as consistently exceeding the saltwater CCC, but the DGTs did not identify copper as an issue. Copper is a known contaminant of concern at Naval Base San Diego (Drygiannaki et al., 2020; Hayman et al., 2019; Rosen et al. 2017).

The DGT data in Table 12 indicated lower concentrations of metals in the surface water compared to peepers (Table 10 and Table 11). For example, as shown in Figure 19, concentrations at the stations at which both peepers and DGTs were used to measure copper, manganese, and zinc in surface water (stations 2 through 7) were statistically different, with average values differing by a factor of 2 to 6 between DGTs and peepers:

- The average (SD) concentration of copper in peepers (estimated using the lithium tracer, 5.7 (0.67) µg/L, was statistically higher (by a factor of 6) than that indicated by DGTs (0.89 (0.12) µg/L) based on paired t-test ($P < 0.0001$).
- The average (SD) concentration of manganese in peepers (estimated using the lithium tracer, 7.4 (0.97) µg/L, was statistically higher (by a factor of 4) than that indicated by DGTs (2.1 (0.31) µg/L) based on paired t-test ($P < 0.0001$).
- The average (SD) concentration of zinc in peepers (estimated using the lithium tracer, 11 (1.5) µg/L, was statistically higher (by a factor of 2) than that indicated by DGTs (5.1 (0.50) µg/L) based on paired t-test ($P = 0.0004$).

The lower concentrations obtained from DGT in comparison to peeper data may be in part due to differences in the mechanisms by which metals are sampled by the devices. Strivens et al. (2019) hypothesized that Dissolved Organic Carbon (DOC) bound copper may not freely diffuse and bind to the chelex binding layer of DGT, thus recording lower dissolved metals concentrations in DOC rich environment compared to other methods. In comparison, peeper membranes may not prevent DOC-metal complexes from diffusing inwards allowing the measurement of DOC-metal complexes. Additional study may be needed to refine the differences in DGT and peeper measurements, although the fact that these very different measurement techniques were within an approximately factor of 5 agreement is notable. Given this relative level of agreement, differences between DGT and peeper measurements may be within typical levels of variation and measurement error, but more research would be beneficial to evaluate the comparison.

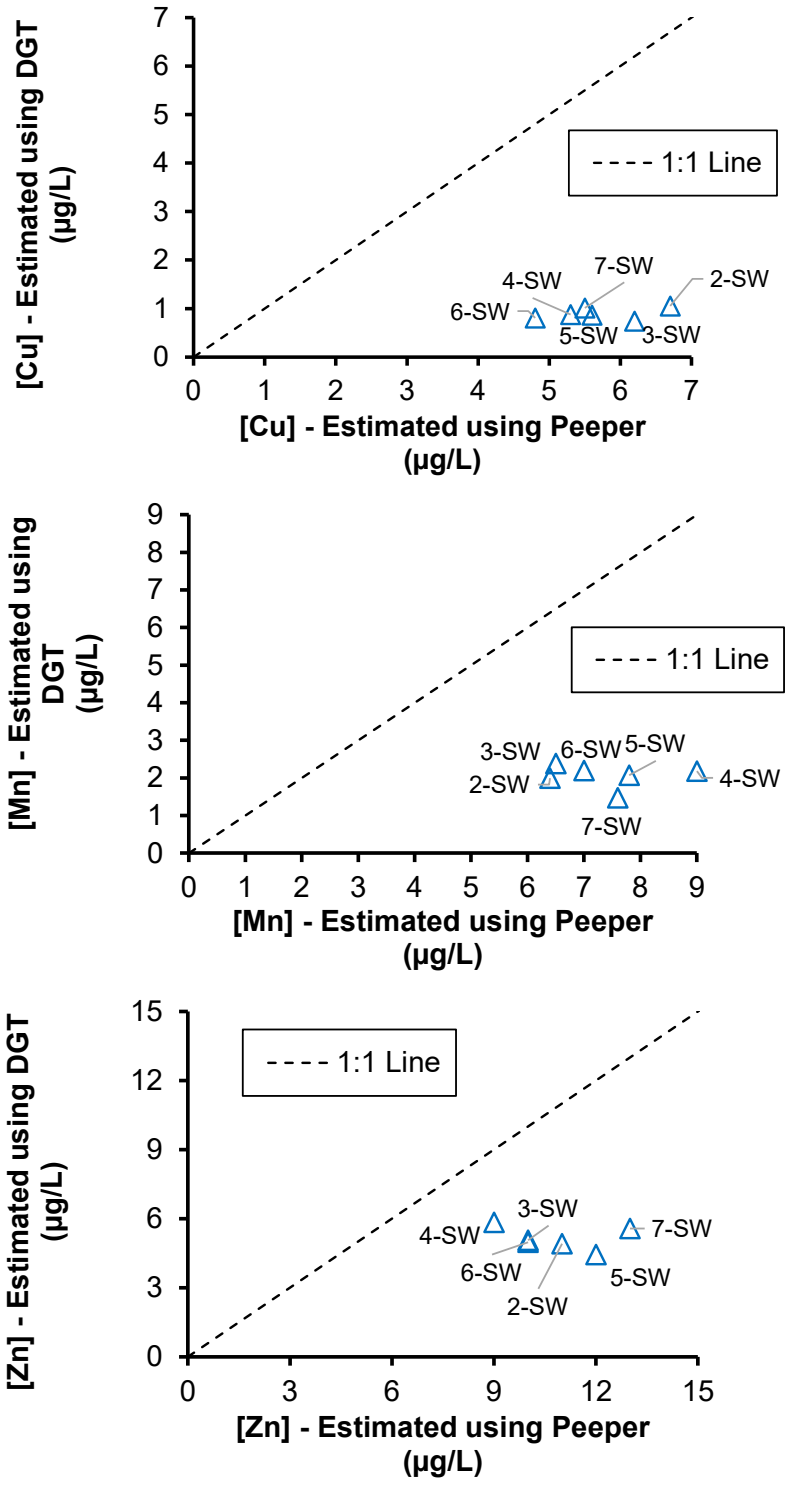


Figure 19. Concentrations of Copper, Manganese, and Zinc, as Estimated Using Peepers and the Lithium Tracer (x-axis) Compared to Concentrations as Estimated Using DGTs (x-axis) for Peepers and DGTs Deployed in Surface Water.

Note: Labels indicate stations.

Concentrations of metals in sediment porewater obtained from peepers were also compared to concentrations obtained in a previous SERDP-funded research effort by Drygiannaki et al. (2020) (Table 13). Ranges of concentrations of cadmium, copper, lead, total mercury, and nickel that are highlighted yellow included ranges that were in exceedance of USEPA's saltwater CCC (Table 3). Both studies were in agreement that copper exceeded the CCC value in sediment porewater. The Drygiannaki et al. (2020) study used DGT to measure availability of metals in the porewater at three locations in Paleta creek (Figure 2) that were in the vicinity of the locations sampled in this study (Figure 4).

Table 13. Comparison of Sediment Porewater Metal Concentration in Paleta Creek

Metal	Concentration Range Measured in DGT (µg/L) (Drygiannaki et al., 2020)	Concentration Range Measured in Peepers (µg/L) (this study)
Ni	0.7 – 3.6	< 0.6 – 1.7
Cu	1.7 – 16	< 1.3 – 7.4
Zn	6.2 – 68	< 4.2 – 23
Cd	ND – 0.34	< 0.22 – < 0.54
Hg	ND – 0.18	< 0.17 – < 0.46
Pb	0.18 – 1.3	< 0.17 – 1.1

Overall, the concentration ranges for metals in sediment porewater measured in this study overlaps with the range measured by Drygiannaki et al. (2020), indicating that the peeper method provides similar results as DGT in sediment. Additional comparisons between peepers and DGTs may be needed to resolve the differences observed between peepers and DGTs deployed in surface water.

5.0 ANALYSIS OF PEEPER FIELD SAMPLING LOGISTICS AND RECOMMENDATIONS FOR CONDUCTING PEEPER INVESTIGATIONS

The purpose of this section is to review the logistical details associated with the field efforts and provide recommendations for future peeper field investigations. This information is provided to aid in the planning and execution of future efforts. Details are organized according to the basic steps involved in the peeper field investigation:

1. Planning
2. Preparation and Shipment of Peepers
3. Mobilization for Deployment
4. Deployment Period
5. Mobilization for Retrieval
6. Retrieval
7. Processing and Shipment

Step 1: Planning. Planning the field work was typical of that at an aquatic sediment site, and was initiated 3 to 4 months ahead of the planned deployment date. Key activities included identifying optimal dates, ordering the peepers, arranging the vessel support, and working with local site personnel regarding access to the site.

- Key recommendations for planning:
  - Plan field work well in advance, ideally several months ahead of the planned deployment date, if possible.
  - Assume a less than 100% success rate for peeper sampling, as peepers may be lost or samples compromised; it is recommended to deploy at least 1.25X to 1.5X the number of stations required for the investigation.

Step 2: Preparation and Shipment of Peepers. Peeper preparation was conducted at SiREM approximately 2 weeks in advance of the field deployment. It is recommended to coordinate the peeper preparation well in advance to allow adequate time for preparation and shipping of peepers to the field.

In this experiment, peepers were prepared using bromide and lithium tracers. For the peepers deployed in sediment, the amount of equilibration indicated by bromide and lithium did not greatly differ. The bromide data and lithium data from each deployed peepers were then used independently to calculate the concentrations of metals at equilibrium. Among the metals that were frequently detected in both sediment and water (copper, manganese, and zinc), average results estimated using the lithium tracer data were within approximately 24-37% of the results indicated using the bromide tracer. This difference has been observed in laboratory experiments as well (conducted by this team – available in a subsequent report), even when peepers were deployed for time periods that only allowed partial (i.e., 20%, 50%, etc.) equilibration.

Given the minimal difference between results estimated with bromide tracer versus the lithium tracer, the fact that bromide concentrations in seawater are likely much higher than concentrations lithium (resulting in some uncertainty regarding tracer elimination rates for bromide), and that fact that the analysis of bromide requires a separate sample preservation and analysis, the use of lithium as a single tracer may be advantageous for future work. This would save analytical costs (i.e., not having a separate analysis for bromide), simplify the processing step, and allow more peeper water sample to be devoted to the analysis of the target metal analytes, which will improve analytical precision.

- Key recommendations for peeper preparation and shipment:
  - Begin peeper preparation (ideally) at least 2-3 weeks in advance.
  - Peepers can be prepared with either bromide or lithium tracers (or both), although it is recommended to use lithium only.
  - Order at least 5-10% more peepers than required for deployment; this will provide a buffer against damage to peeper that may occur during shipping and handling and will not greatly increase investigation costs.
  - Arrange shipping of peepers to a secure location where peepers can be stored at room temperature (or refrigerated) at least one week in advance of the field deployment.
  - Immediately upon arrival of peepers and frames, verify the number of peepers and support frames that were shipped.
  - Immediately upon arrival of peepers and frames, have a field staff construct at least one peeper frame so that it is clear to staff the manner in which the frames are assembled and that all pieces required for the frame construction are available and line up properly.

Step 3: Mobilization for Deployment. Mobilization for retrieval was typical of field work at an aquatic sediment site. Approximately 2 hours during the first morning of the first field day (deployment) was spent organizing the deployment equipment, preparing the frames for deployment, launching the vessel, and coordinating the field staff. Although some portion of this work may have been able to have been accomplished prior to the start time, projects should plan on at least 1 to 2 hours at the beginning of field events to conduct this mobilization and organization activity. This allows extra time for troubleshooting if any issues arise and gives times to safely travel to and from the deployment locations.

- Key recommendations for deployment mobilization:
  - Plan for a "slow start" on the first day of field work.

Step 4: Deployment. Overall, 1.5 days were spent to deploy peeper frames at 10 stations, all which included 1 peeper frame with 4 surface water peepers, 4 porewater peepers, and 2 surface water DGTs. This time includes the approximate 30- to 45-minute transit time to and from the vessel launch area to the Site.

At the site, positioning of the vessel at each station required 5 to 37 minutes (average of 13 minutes per station, Table 14), although this was dependent on the wind conditions, which affected the ability to anchor securely at certain stations. It is important to note that boating to the locations and anchoring could take up to 40-60 minutes depending on the weather and site conditions, which can extensively add to the field effort. Deployment locations at the field site were within 10 to 50 feet of the planned locations.

Once on station, peepers and DGTs were assembled into a single peeper frame device deployed using a driverless push-pole system. The assembly of the frames, insertion of peepers and DGTs into the frames, and attachment of the frame to the push pole required approximately 5 minutes per frame (data not shown); this primarily accomplished by 1 field staff. After the peepers were attached to the push pole, the pole and peepers were inserted into the water. This process required at least two field staff to handle the push pole and attach the additional lengths of pole required (i.e., approximately 30 feet of pole), while a third field staff viewed the video camera feed to note when the peeper frame approached the sediment, monitor the insertion, and confirm detachment of the push pole from the peeper frame. From the time the peeper frame entered the water, the first station (1A) required approximately 26 minutes to install the peeper frame (Table 14). This was largely a factor of field staff optimizing and becoming familiar with the equipment and process. The next two deployments (1B and 1C) required only 5 and 3 minutes, respectively. Not counting station 1A, the peeper frame insertion process required an average of 5 minutes per peeper frame. This gain in efficiency can be attributed to field personnel familiarization with the material and efficiencies found during deployment. Example of these efficiencies include pre-assembly of material during anchoring and attribution of defined roles to field crew members.

Table 14. Preparation and Deployment Time

Sampling station	Vessel Positioning Time (minutes)	Push Pole Deployment Time (minutes)
1A	16	26
1B	0 (same location as 1A)	5
1C	0 (same location as 1A)	3
2	14	5
3	37	8
4	9	6
5	9	4
6	5	3
7	7	6
8	13	8

The optimal rate of efficiency for the deployment was realized on the second day of deployment. During the 3 hours spent on site (not counting transit time from the vessel launch to the site), 6 peeper frames were deployed at 6 different locations, an approximate 2 stations per hour rate of deployment. This rate would afford typical projects being able to deploy approximately 10 to 20 peeper frames in a single field day using this push pole method.

Deployment of peepers using divers is likely to be closer to the 10 peeper frames per day rate rather than 20 peeper frames per day rate. In this case, only 1 field staff would be needed to construct and arrange peepers and frames, although many more field staff would be needed for diving (i.e., 1 to 2 divers, 1 to 2 dive support staff, etc.). With that approach, stations are usually marked with a buoy, then the diver is provided the peeper frame on the vessel. The diver then descends to the station, manually inserts the peeper frame, and returns to the surface. Multiple stations can be coordinated on a single dive depending on site conditions.

- Key recommendations for deployment:
  - Deployment of peepers requires 2 to 3 field staff if using push pole system, or 1 field staff plus divers and associated diver support personnel if divers are used for deployment.
  - Deployment of peeper frames can likely achieve rates of 10 to 20 stations per day; this rate is highly depending on field staff, site conditions, arrangement of stations, transit times, deployment approaches, and other factors.
  - Once at a site, it is recommended to conduct a practice run using a sacrificial peeper frame so that push pole operators or divers (and field staff) can familiarize themselves with the process.

Step 5: Deployment Period. The final day of retrieval was on October 4, 2022. During the period of October 5 to October 12 (8 days), no active field work occurred. This period allowed the peepers to be exposed to the site sediment or surface water for approximately 10 days. Since retrieval was completed in 2 days' time (October 13-14, 2022), the entire field work program was completed in two working weeks.

As discussed in the results, the tracer data indicated that peepers used in this investigation were 70% to 100% equilibrated for all target metals over a period of 10 days. Data suggested that approximately 3 weeks would be needed for all target metals to approach 90% of equilibrium in sediment (6 days for surface water). However, 30% to 50% levels of equilibration could be achieved for the slowest diffusing metal (chromium) in as little as 3 to 5 days in sediment and 1 to 3 days in surface water. Reducing the deployment periods to less than one week (using the lithium tracer to correct for equilibrium) could enable more efficient field programs, especially when overnight travel for field staff is a logistical component. Additional field deployment kinetic studies may be useful in refining the ability to reduce the deployment period.

Alternately, the peeper design used in this experiment has been successfully deployed in sediment for periods of 28 days. Increasing the deployment period provides more assurance that equilibrium is attained for all analytes, but the risk of sampler loss increases with time. Additionally, for very long deployments in surface water, biofilms that impede diffusion may affect the peeper membrane. This issue has not been observed for typical long-term deployments (e.g., 28 days) with this type of peeper, however.

- Key recommendations for deployment periods:
  - Deployment periods for peepers in sediment and surface water may be able to be reduced to less than one week, depending on the peeper design being used.
  - Deployment periods of 2, 3, or 4 weeks are also acceptable, as full equilibration or all metals is expected at approximately 3 weeks (in sediment); although risk of sampler loss increases with deployment time.

Step 6: Mobilization for Retrieval. Mobilization for retrieval was typical of field work at an aquatic sediment site. Mobilization for retrieval on the first day was efficient (approximately 45 minutes), but a change in the retrieval approach (see below), required approximately 3 hours for mobilization.

- Key recommendations for retrieval mobilization:
  - Plan for a "slow start" on the first day of field work.

Step 7: Retrieval. Day 1 of retrieval was largely unsuccessful. Retrieval methods featured throwing a grappling hook from the vessel and dragging bottom in an attempt to snag anchor lines attached to the peeper frames. Because the anchor lines were only 36 feet in length and the water depth was > 20 feet, only 5 to 10 feet of anchor line extended laterally on the sediment surface. This was not a sufficient target to snag using the grappling hook. This was compounded by the heavy debris at the location, as noted per the diver that noted that peepers at stations 1A and 1B were under debris (a sunken boom). Only one peeper frame (station 2) was recovered using the grappling hook method, and the peeper samples from this station were processed at the end of the field day.

Day 2 of retrieval featured the use of a scuba diver to retrieve the peeper frames. On average, the diver required approximately 20 minutes per station to enter the water, search for the peeper frame, and return the frame to the vessel. Additional time was needed to mark the approximate locations of the sites with marker buoys and transit between stations.

Table 15. Retrieval Times for Day 2

Sampling station	Diver Retrieval Time (minutes)
1A	40*
1B	
1C	5
2	Retrieved on Day 1
3	15
4	10
5	30
6	30
7	30
8	-

* Station 1A and 1 B were recovered together within 40 minutes.

- Station 8 was not retrieved.

Once the peeper frame was aboard the vessel, 2 field staff quickly removed the peepers and DGTs from the frame and recorded information on the retrieval forms. One "dirty hands" and one "clean hands" staff are recommended for this process. Packaging the peepers into storage bags required approximately 5 minutes or less (data not presented), and was conducted while the vessel was moving to the next station. Processing of the peeper (rather than packaging for storage) could be conducted at this stage of the field work, as discussed below.

Eight peeper frames were retrieved and packaged over a 5-hour period on day 2 using the diver. Assuming having access to a second diver and saving 1 to 2 hours of time in the field day to process peepers onshore, it may be possible to retrieve peepers from approximately 10 stations per day. Retrieval rates using the driverless grappling hook method (when a proper length of anchor line is used) are likely to be higher (i.e., 10 to 20 stations per day).

- Key recommendations for retrieval:
  - Retrieval of peepers is most optimal with 2 field staff; additional staff may be needed if processing occurs on the vessel.
  - Time on the water should be limited to allow 1 to 2 hours onshore work at the end of the field day for processing the retrieved peepers.
  - Retrieval of peeper frames can likely achieve rates of 10 stations per day when divers are used, or higher rates (10 to 20 stations per day) when diverless techniques are optimally employed; these rates is highly depending on field staff, site conditions, arrangement of stations, transit times, deployment approaches, and other factors.
  - If an anchor line is used to mark peeper stations, ensure it extends at least 30 feet from the peeper frame insertion point, as this will allow a longer target for snagging with a grappling hook or locating underwater via a diver.

Step 8: Processing and Shipment. In this field event, peepers were processed onshore at the end of the retrieval day. Processing time for the majority of the peepers (16 peeper samples on day 2), from the time at which the vessel arrived onshore to the time the processing equipment and samples were packed for shipment required approximately 2 hours, a rate of approximately 8 minutes per peeper sample. Two field staff are recommended for processing.

Processing of the peeper samples could be conducted on the vessel immediately after obtaining the peepers. This approach would delay the retrieval process unless 1 to 2 additional field staff are available to dedicate their focus to processing steps (while 2 other field staff focused on retrieval of the frames and coordination with the vessel captain and staff). This approach also requires sufficient space to process the samples, and this may interfere with space needed for retrieval activities. Processing also requires fairly sheltered conditions so that samples are not contaminated with precipitation. Precise pipetting and handling of peepers and sample bottles also requires a stable and ergonomic platform. The often unsheltered, uncontrolled, unstable, and cramped conditions on a vessel (wind, precipitation, vessel movement, etc.) may not be ideal for processing peeper samples.

- Key recommendations for processing and shipment:
  - In most cases, peeper samples should be processed at the end of the field day onshore (laboratory research is ongoing to confirm the timing of this recommendation).
  - Peeper processing is possible onboard the vessel immediately after the peepers are retrieved from the sediment or water, although this can be more complicated than onshore processing.
  - If peeper processing is conducted onshore, it is recommended to save at least 1 to 2 hours of time at the end of each field day to process 10 to 20 peeper samples.
  - Preserved peeper samplers should be preserved cold (ice replenished daily) and shipped to the analytical chemistry laboratory, where they should be analyzed before expiration of USEPA method hold times.

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APPENDIX A PEEPER CALCULATION SHEETS

Table A1. Calculation of Cfree values using the lithium tracer, San Diego peeper samples.

Equilibrium Correction of Porewater Concentration using Lithium Tracer

Sample ID	Sample Deployment Date	Sample Collection Date	Chemical Name	Chemical Abreviation	Report Result Text	Measured Concentration in Peeper	MDL in Peeper	Report Result Unit	Lab Qualifiers	Initial Li Concentration (µg/L)	Deployment Time (days)	Assumed Li Concentration External to Peeper (µg/L)	Sample-Specific Elimination Rate for Li (K_{Li}) (day^{-1})	Diffusion Coefficient for Analytes (Di) (* 10^{-5} cm^2/s)	Di ÷ D_{Li}	Sample-specific Elimination Rate for Analytes (K_i) (day-1)	Percent Equilibrium Reached (%)	Equilibrium Corrected Concentration (µg/L)	Equilibrium Corrected MDL (µg/L)	Equilibrium Corrected Result (µg/L) 2-sig figs
1A-PW	10-3-22 12:30	10-14-22 14:58	Lithium	Li	16000	16000	26	µg/L		86000	11.10	100	0.152	0.90	1.00	0.152	81	--	--	--
1A-PW			Cadmium	Cd	ND	0	0.27	µg/L			11.10			0.63	0.70	0.107	69	0.00	0.39	**< 0.39**
1A-PW			Chromium	Cr	ND	0	1.9	µg/L			11.10			0.52	0.58	0.088	62	0.00	3.05	**< 3**
1A-PW			Copper	Cu	3.2	3.2	1.4	µg/L			11.10			0.62	0.69	0.105	69	4.65	2.04	**4.7**
1A-PW			Iron	Fe	220	220	35	µg/L			11.10			0.63	0.70	0.107	69	317.23	50.47	**320**
1A-PW			Lead	Pb	0.88	0.88	0.21	µg/L	J		11.10			0.83	0.92	0.140	79	1.11	0.27	**1.1**
1A-PW			Manganese	Mn	25	25	1.7	µg/L			11.10			0.62	0.69	0.105	69	36.35	2.47	**36**
1A-PW			Mercury	Hg	ND	0	0.13	µg/L			11.10			0.74	0.82	0.125	75	0.00	0.17	**< 0.17**
1A-PW			Nickel	Ni	ND	0	0.65	µg/L			11.10			0.62	0.69	0.105	69	0.00	0.95	**< 0.95**
1A-PW			Zinc	Zn	13	13	3.6	µg/L			11.10			0.61	0.68	0.103	68	19.07	5.28	**19**
1A-SW	10-3-22 12:30	10-14-22 14:58	Lithium	Li	150	150	1.4	µg/L		86000	11.10	100	0.671	0.90	1.00	0.671	100	--	--	--
1A-SW			Cadmium	Cd	ND	0	0.36	µg/L			11.10			0.63	0.70	0.470	99	0.00	0.36	**< 0.36**
1A-SW			Chromium	Cr	20	20	2.6	µg/L			11.10			0.52	0.58	0.388	99	20.27	2.64	**20**
1A-SW			Copper	Cu	13	13	1.9	µg/L			11.10			0.62	0.69	0.463	99	13.08	1.91	**13**
1A-SW			Iron	Fe	110	110	46	µg/L			11.10			0.63	0.70	0.470	99	110.60	46.25	**110**
1A-SW			Lead	Pb	0.36	0.36	0.28	µg/L	J		11.10			0.83	0.92	0.620	100	0.36	0.28	**0.36**
1A-SW			Manganese	Mn	12	12	2.2	µg/L			11.10			0.62	0.69	0.463	99	12.07	2.21	**12**
1A-SW			Mercury	Hg	ND	0	0.33	µg/L			11.10			0.74	0.82	0.552	100	0.00	0.33	**< 0.33**
1A-SW			Nickel	Ni	29	29	0.86	µg/L			11.10			0.62	0.69	0.463	99	29.17	0.87	**29**
1A-SW			Zinc	Zn	23	23	4.8	µg/L			11.10			0.61	0.68	0.455	99	23.15	4.83	**23**
1B-PW	10-3-22 13:25	10-14-22 14:56	Lithium	Li	510	510	0.83	µg/L		86000	11.06	100	0.483	0.90	1.00	0.483	100	--	--	--
1B-PW			Cadmium	Cd	ND	0	0.22	µg/L			11.06			0.63	0.70	0.339	98	0.00	0.23	**< 0.23**
1B-PW			Chromium	Cr	ND	0	1.5	µg/L			11.06			0.52	0.58	0.280	95	0.00	1.57	**< 1.6**
1B-PW			Copper	Cu	4.8	4.8	1.1	µg/L			11.06			0.62	0.69	0.333	97	4.92	1.13	**4.9**
1B-PW			Iron	Fe	4400	4400	28	µg/L			11.06			0.63	0.70	0.339	98	4506.30	28.68	**4500**
1B-PW			Lead	Pb	0.39	0.39	0.17	µg/L	J		11.06			0.83	0.92	0.446	99	0.39	0.17	**0.39**
1B-PW			Manganese	Mn	230	230	1.3	µg/L			11.06			0.62	0.69	0.333	97	235.91	1.33	**240**
1B-PW			Mercury	Hg	ND	0	0.13	µg/L			11.06			0.74	0.82	0.398	99	0.00	0.13	**< 0.13**
1B-PW			Nickel	Ni	1	1	0.52	µg/L			11.06			0.62	0.69	0.333	97	1.03	0.53	**1**
1B-PW			Zinc	Zn	20	20	2.9	µg/L			11.06			0.61	0.68	0.328	97	20.55	2.98	**21**
1B-SW	10-3-22 13:25	10-14-22 14:56	Lithium	Li	180	180	0.83	µg/L		86000	11.06	100	0.631	0.90	1.00	0.631	100	--	--	--
1B-SW			Cadmium	Cd	ND	0	0.22	µg/L			11.06			0.63	0.70	0.442	99	0.00	0.22	**< 0.22**
1B-SW			Chromium	Cr	ND	0	1.5	µg/L			11.06			0.52	0.58	0.365	98	0.00	1.53	**< 1.5**
1B-SW			Copper	Cu	10	10	1.1	µg/L			11.06			0.62	0.69	0.435	99	10.08	1.11	**10**
1B-SW			Iron	Fe	ND	0	28	µg/L			11.06			0.63	0.70	0.442	99	0.00	28.21	**< 28**
1B-SW			Lead	Pb	0.45	0.45	0.17	µg/L	J		11.06			0.83	0.92	0.583	100	0.45	0.17	**0.45**
1B-SW			Manganese	Mn	5.2	5.2	1.3	µg/L			11.06			0.62	0.69	0.435	99	5.24	1.31	**5.2**
1B-SW			Mercury	Hg	ND	0	0.13	µg/L			11.06			0.74	0.82	0.519	100	0.00	0.13	**< 0.13**
1B-SW			Nickel	Ni	1	1	0.52	µg/L			11.06			0.62	0.69	0.435	99	1.01	0.52	**1**
1B-SW			Zinc	Zn	33	33	2.9	µg/L			11.06			0.61	0.68	0.428	99	33.29	2.93	**33**
1C-PW	10-3-22 13:50	10-14-22 11:51	Lithium	Li	19000	19000	42	µg/L		86000	10.92	100	0.139	0.90	1.00	0.139	78	--	--	--
1C-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.92			0.63	0.70	0.097	65	0.00	0.34	**< 0.34**
1C-PW			Chromium	Cr	ND	0	1.5	µg/L			10.92			0.52	0.58	0.080	58	0.00	2.57	**< 2.6**
1C-PW			Copper	Cu	2.6	2.6	1.1	µg/L			10.92			0.62	0.69	0.096	65	4.01	1.70	**4**
1C-PW			Iron	Fe	230	230	28	µg/L			10.92			0.63	0.70	0.097	65	351.67	42.81	**350**
1C-PW			Lead	Pb	ND	0	0.17	µg/L			10.92			0.83	0.92	0.128	75	0.00	0.23	**< 0.23**
1C-PW			Manganese	Mn	36	36	1.3	µg/L			10.92			0.62	0.69	0.096	65	55.54	2.01	**56**
1C-PW			Mercury	Hg	ND	0	0.13	µg/L			10.92			0.74	0.82	0.114	71	0.00	0.18	**< 0.18**
1C-PW			Nickel	Ni	ND	0	0.52	µg/L			10.92			0.62	0.69	0.096	65	0.00	0.80	**< 0.8**
1C-PW			Zinc	Zn	5.6	5.6	2.9	µg/L			10.92			0.61	0.68	0.094	64	8.72	4.52	**8.7**
1C-SW	10-3-22 13:50	10-14-22 11:51	Lithium	Li	180	180	0.83	µg/L		86000	10.92	100	0.639	0.90	1.00	0.639	100	--	--	--
1C-SW			Cadmium	Cd	0.36	0.36	0.22	µg/L	J		10.92			0.63	0.70	0.448	99	0.36	0.22	**0.36**
1C-SW			Chromium	Cr	ND	0	1.5	µg/L			10.92			0.52	0.58	0.370	98	0.00	1.53	**< 1.5**
1C-SW			Copper	Cu	7.4	7.4	1.1	µg/L			10.92			0.62	0.69	0.441	99	7.46	1.11	**7.5**
1C-SW			Iron	Fe	ND	0	28	µg/L			10.92			0.63	0.70	0.448	99	0.00	28.21	**< 28**
1C-SW			Lead	Pb	0.17	0.17	0.17	µg/L	J		10.92			0.83	0.92	0.590	100	0.17	0.17	**< 0.17**
1C-SW			Manganese	Mn	6.6	6.6	1.3	µg/L			10.92			0.62	0.69	0.441	99	6.65	1.31	**6.7**
1C-SW			Mercury	Hg	ND	0	0.13	µg/L			10.92			0.74	0.82	0.526	100	0.00	0.13	**< 0.13**
1C-SW			Nickel	Ni	0.79	0.79	0.52	µg/L	J		10.92			0.62	0.69	0.441	99	0.80	0.52	**0.8**
1C-SW			Zinc	Zn	15	15	2.9	µg/L			10.92			0.61	0.68	0.434	99	15.13	2.93	**15**
2-PW	10-4-22 8:50	10-13-22 12:07	Lithium	Li	5100	5100	8.3	µg/L		86000	9.14	100	0.311	0.90	1.00	0.311	94	--	--	--
2-PW			Cadmium	Cd	ND	0	0.22	µg/L			9.14			0.63	0.70	0.218	86	0.00	0.25	**< 0.25**
2-PW			Chromium	Cr	ND	0	1.5	µg/L			9.14			0.52	0.58	0.180	81	0.00	1.86	**< 1.9**
2-PW			Copper	Cu	3.6	3.6	1.1	µg/L			9.14			0.62	0.69	0.215	86	4.19	1.28	**4.2**
2-PW			Iron	Fe	1400	1400	28	µg/L			9.14			0.63	0.70	0.218	86	1620.75	32.42	**1600**
2-PW			Lead	Pb	ND	0	0.17	µg/L			9.14			0.83	0.92	0.287	93	0.00	0.18	**< 0.18**
2-PW			Manganese	Mn	77	77	1.3	µg/L			9.14			0.62	0.69	0.215	86	89.60	1.51	**90**
2-PW			Mercury	Hg	ND	0	0.13	µg/L			9.14			0.74	0.82	0.256	90	0.00	0.14	**< 0.14**
2-PW			Nickel	Ni	ND	0	0.52	µg/L			9.14			0.62	0.69	0.215	86	0.00	0.61	**< 0.61**
2-PW			Zinc	Zn	3.1	3.1	2.9	µg/L	J		9.14			0.61	0.68	0.211	85	3.63	3.39	**3.6**

Table A1. Calculation of Cfree values using the lithium tracer, San Diego peeper samples.

Equilibrium Correction of Porewater Concentration using Lithium Tracer

Sample ID	Sample Deployment Date	Sample Collection Date	Chemical Name	Chemical Abreviation	Report Result Text	Measured Concentration in Peeper	MDL in Peeper	Report Result Unit	Lab Qualifiers	Initial Li Concentration (µg/L)	Deployment Time (days)	Assumed Li Concentration External to Peeper (µg/L)	Sample-Specific Elimination Rate for Li (K_{Li}) (day^{-1})	Diffusion Coefficient for Analytes (Di) (* 10^{-5} cm^2/s)	Di ÷ D_{Li}	Sample-specific Elimination Rate for Analytes (K_i) (day-1)	Percent Equilibrium Reached (%)	Equilibrium Corrected Concentration (µg/L)	Equilibrium Corrected MDL (µg/L)	Equilibrium Corrected Result (µg/L) 2-sig figs
2-SW	10-4-22 8:50	10-13-22 12:06	Lithium	Li	180	180	0.83	µg/L		86000	9.14	100	0.764	0.90	1.00	0.764	100	--	--	--
2-SW			Cadmium	Cd	ND	0	0.22	µg/L			9.14			0.63	0.70	0.536	99	0.00	0.22	**< 0.22**
2-SW			Chromium	Cr	ND	0	1.5	µg/L			9.14			0.52	0.58	0.442	98	0.00	1.53	**< 1.5**
2-SW			Copper	Cu	6.6	6.6	1.1	µg/L			9.14			0.62	0.69	0.527	99	6.65	1.11	**6.7**
2-SW			Iron	Fe	ND	0	28	µg/L			9.14			0.63	0.70	0.536	99	0.00	28.21	**< 28**
2-SW			Lead	Pb	0.18	0.18	0.17	µg/L	J		9.14			0.83	0.92	0.706	100	0.18	0.17	**0.18**
2-SW			Manganese	Mn	6.3	6.3	1.3	µg/L			9.14			0.62	0.69	0.527	99	6.35	1.31	**6.4**
2-SW			Mercury	Hg	ND	0	0.13	µg/L			9.14			0.74	0.82	0.629	100	0.00	0.13	**< 0.13**
2-SW			Nickel	Ni	0.71	0.71	0.52	µg/L	J		9.14			0.62	0.69	0.527	99	0.72	0.52	**0.72**
2-SW			Zinc	Zn	11	11	2.9	µg/L			9.14			0.61	0.68	0.519	99	11.10	2.93	**11**
3-PW	10-3-22 15:00	10-14-22 14:02	Lithium	Li	18000	18000	28	µg/L		86000	10.96	100	0.143	0.90	1.00	0.143	79	--	--	--
3-PW			Cadmium	Cd	ND	0	0.36	µg/L			10.96			0.63	0.70	0.100	67	0.00	0.54	**< 0.54**
3-PW			Chromium	Cr	ND	0	2.6	µg/L			10.96			0.52	0.58	0.083	60	0.00	4.36	**< 4.4**
3-PW			Copper	Cu	ND	0	1.9	µg/L			10.96			0.62	0.69	0.099	66	0.00	2.87	**< 2.9**
3-PW			Iron	Fe	150	150	46	µg/L			10.96			0.63	0.70	0.100	67	224.90	68.97	**220**
3-PW			Lead	Pb	ND	0	0.28	µg/L			10.96			0.83	0.92	0.132	77	0.00	0.37	**< 0.37**
3-PW			Manganese	Mn	18	18	2.2	µg/L			10.96			0.62	0.69	0.099	66	27.23	3.33	**27**
3-PW			Mercury	Hg	ND	0	0.33	µg/L			10.96			0.74	0.82	0.118	73	0.00	0.46	**< 0.46**
3-PW			Nickel	Ni	1.1	1.1	0.86	µg/L	J		10.96			0.62	0.69	0.099	66	1.66	1.30	**1.7**
3-PW			Zinc	Zn	11	11	4.8	µg/L			10.96			0.61	0.68	0.097	66	16.79	7.33	**17**
3-SW	10-3-22 15:00	10-14-22 14:02	Lithium	Li	170	170	0.83	µg/L		86000	10.96	100	0.649	0.90	1.00	0.649	100	--	--	--
3-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.96			0.63	0.70	0.455	99	0.00	0.22	**< 0.22**
3-SW			Chromium	Cr	ND	0	1.5	µg/L			10.96			0.52	0.58	0.376	98	0.00	1.52	**< 1.5**
3-SW			Copper	Cu	6.2	6.2	1.1	µg/L			10.96			0.62	0.69	0.448	99	6.25	1.11	**6.2**
3-SW			Iron	Fe	ND	0	28	µg/L			10.96			0.63	0.70	0.455	99	0.00	28.19	**< 28**
3-SW			Lead	Pb	ND	0	0.17	µg/L			10.96			0.83	0.92	0.599	100	0.00	0.17	**< 0.17**
3-SW			Manganese	Mn	6.5	6.5	1.3	µg/L			10.96			0.62	0.69	0.448	99	6.55	1.31	**6.5**
3-SW			Mercury	Hg	ND	0	0.13	µg/L			10.96			0.74	0.82	0.534	100	0.00	0.13	**< 0.13**
3-SW			Nickel	Ni	0.79	0.79	0.52	µg/L	J		10.96			0.62	0.69	0.448	99	0.80	0.52	**0.8**
3-SW			Zinc	Zn	10	10	2.9	µg/L			10.96			0.61	0.68	0.441	99	10.08	2.92	**10**
4-PW	10-4-22 10:34	10-14-22 14:20	Lithium	Li	170	170	0.83	µg/L		86000	10.16	100	0.700	0.90	1.00	0.700	100	--	--	--
4-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.16			0.63	0.70	0.491	99	0.00	0.22	**< 0.22**
4-PW			Chromium	Cr	ND	0	1.5	µg/L			10.16			0.52	0.58	0.405	98	0.00	1.52	**< 1.5**
4-PW			Copper	Cu	6.2	6.2	1.1	µg/L			10.16			0.62	0.69	0.483	99	6.25	1.11	**6.2**
4-PW			Iron	Fe	ND	0	28	µg/L			10.16			0.63	0.70	0.491	99	0.00	28.19	**< 28**
4-PW			Lead	Pb	0.2	0.2	0.17	µg/L	J		10.16			0.83	0.92	0.647	100	0.20	0.17	**0.2**
4-PW			Manganese	Mn	5.2	5.2	1.3	µg/L			10.16			0.62	0.69	0.483	99	5.24	1.31	**5.2**
4-PW			Mercury	Hg	ND	0	0.33	µg/L			10.16			0.74	0.82	0.577	100	0.00	0.33	**< 0.33**
4-PW			Nickel	Ni	1.1	1.1	0.52	µg/L			10.16			0.62	0.69	0.483	99	1.11	0.52	**1.1**
4-PW			Zinc	Zn	16	16	2.9	µg/L			10.16			0.61	0.68	0.475	99	16.13	2.92	**16**
4-SW	10-4-22 10:34	10-14-22 14:20	Lithium	Li	170	170	0.9	µg/L		86000	10.16	100	0.700	0.90	1.00	0.700	100	--	--	--
4-SW			Cadmium	Cd	ND	0	0.24	µg/L			10.16			0.63	0.70	0.491	99	0.00	0.24	**< 0.24**
4-SW			Chromium	Cr	ND	0	1.7	µg/L			10.16			0.52	0.58	0.405	98	0.00	1.73	**< 1.7**
4-SW			Copper	Cu	5.3	5.3	1.2	µg/L			10.16			0.62	0.69	0.483	99	5.34	1.21	**5.3**
4-SW			Iron	Fe	63	63	30	µg/L			10.16			0.63	0.70	0.491	99	63.43	30.21	**63**
4-SW			Lead	Pb	ND	0	0.18	µg/L			10.16			0.83	0.92	0.647	100	0.00	0.18	**< 0.18**
4-SW			Manganese	Mn	8.9	8.9	1.5	µg/L			10.16			0.62	0.69	0.483	99	8.97	1.51	**9**
4-SW			Mercury	Hg	ND	0	0.13	µg/L			10.16			0.74	0.82	0.577	100	0.00	0.13	**< 0.13**
4-SW			Nickel	Ni	1	1	0.56	µg/L	J		10.16			0.62	0.69	0.483	99	1.01	0.56	**1**
4-SW			Zinc	Zn	8.9	8.9	3.1	µg/L			10.16			0.61	0.68	0.475	99	8.97	3.13	**9**
5-PW	10-4-22 9:17	10-14-22 15:52	Lithium	Li	15000	15000	42	µg/L		86000	10.27	100	0.171	0.90	1.00	0.171	83	--	--	--
5-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.27			0.63	0.70	0.120	71	0.00	0.31	**< 0.31**
5-PW			Chromium	Cr	ND	0	1.5	µg/L			10.27			0.52	0.58	0.099	64	0.00	2.35	**< 2.4**
5-PW			Copper	Cu	1.8	1.8	1.1	µg/L	J		10.27			0.62	0.69	0.118	70	2.57	1.57	**2.6**
5-PW			Iron	Fe	1500	1500	28	µg/L			10.27			0.63	0.70	0.120	71	2121.18	39.60	**2100**
5-PW			Lead	Pb	ND	0	0.17	µg/L			10.27			0.83	0.92	0.157	80	0.00	0.21	**< 0.21**
5-PW			Manganese	Mn	110	110	1.3	µg/L			10.27			0.62	0.69	0.118	70	156.83	1.85	**160**
5-PW			Mercury	Hg	ND	0	0.13	µg/L			10.27			0.74	0.82	0.140	76	0.00	0.17	**< 0.17**
5-PW			Nickel	Ni	ND	0	0.52	µg/L			10.27			0.62	0.69	0.118	70	0.00	0.74	**< 0.74**
5-PW			Zinc	Zn	3	3	2.9	µg/L	J		10.27			0.61	0.68	0.116	70	4.31	4.17	**4.3**
5-SW	10-4-22 9:17	10-14-22 15:52	Lithium	Li	170	170	0.83	µg/L		86000	10.27	100	0.692	0.90	1.00	0.692	100	--	--	--
5-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.27			0.63	0.70	0.485	99	0.00	0.22	**< 0.22**
5-SW			Chromium	Cr	ND	0	1.5	µg/L			10.27			0.52	0.58	0.401	98	0.00	1.52	**< 1.5**
5-SW			Copper	Cu	5.6	5.6	1.1	µg/L			10.27			0.62	0.69	0.478	99	5.64	1.11	**5.6**
5-SW			Iron	Fe	ND	0	28	µg/L			10.27			0.63	0.70	0.485	99	0.00	28.19	**< 28**
5-SW			Lead	Pb	0.23	0.23	0.17	µg/L	J		10.27			0.83	0.92	0.639	100	0.23	0.17	**0.23**
5-SW			Manganese	Mn	7.7	7.7	1.3	µg/L			10.27			0.62	0.69	0.478	99	7.76	1.31	**7.8**
5-SW			Mercury	Hg	ND	0	0.13	µg/L			10.27			0.74	0.82	0.570	100	0.00	0.13	**< 0.13**
5-SW			Nickel	Ni	0.97	0.97	0.52	µg/L	J		10.27			0.62	0.69	0.478	99	0.98	0.52	**0.98**
5-SW			Zinc	Zn	12	12	2.9	µg/L			10.27			0.61	0.68	0.470	99	12.10	2.92	**12**

Table A1. Calculation of Cfree values using the lithium tracer, San Diego peeper samples.

Equilibrium Correction of Porewater Concentration using Lithium Tracer

Sample ID	Sample Deployment Date	Sample Collection Date	Chemical Name	Chemical Abreviation	Report Result Text	Measured Concentration in Peeper	MDL in Peeper	Report Result Unit	Lab Qualifiers	Initial Li Concentration (µg/L)	Deployment Time (days)	Assumed Li Concentration External to Peeper (µg/L)	Sample-Specific Elimination Rate for Li (K_{Li}) (day^{-1})	Diffusion Coefficient for Analytes (Di) (* 10^{-5} cm^2/s)	$Di \div D_{Li}$	Sample-specific Elimination Rate for Analytes (K_i) (day-1)	Percent Equilibrium Reached (%)	Equilibrium Corrected Concentration (µg/L)	Equilibrium Corrected MDL (µg/L)	Equilibrium Corrected Result (µg/L) 2-sig figs
6-PW	10-4-22 10:54	10-14-22 12:49	Lithium	Li	17000	17000	42	µg/L		86000	10.08	100	0.161	0.90	1.00	0.161	80	--	--	--
6-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.08			0.63	0.70	0.113	68	0.00	0.32	**< 0.32**
6-PW			Chromium	Cr	ND	0	1.5	µg/L			10.08			0.52	0.58	0.093	61	0.00	2.46	**< 2.5**
6-PW			Copper	Cu	ND	0	1.1	µg/L			10.08			0.62	0.69	0.111	67	0.00	1.63	**< 1.6**
6-PW			Iron	Fe	3100	3100	28	µg/L			10.08			0.63	0.70	0.113	68	4558.01	41.17	**4600**
6-PW			Lead	Pb	ND	0	0.17	µg/L			10.08			0.83	0.92	0.149	78	0.00	0.22	**< 0.22**
6-PW			Manganese	Mn	150	150	1.3	µg/L			10.08			0.62	0.69	0.111	67	222.46	1.93	**220**
6-PW			Mercury	Hg	ND	0	0.13	µg/L			10.08			0.74	0.82	0.133	74	0.00	0.18	**< 0.18**
6-PW			Nickel	Ni	ND	0	0.52	µg/L			10.08			0.62	0.69	0.111	67	0.00	0.77	**< 0.77**
6-PW			Zinc	Zn	ND	0	2.9	µg/L			10.08			0.61	0.68	0.109	67	0.00	4.34	**< 4.3**
6-SW	10-4-22 10:54	10-14-22 12:49	Lithium	Li	180	180	0.83	µg/L		86000	10.08	100	0.692	0.90	1.00	0.692	100	--	--	--
6-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.08			0.63	0.70	0.485	99	0.00	0.22	**< 0.22**
6-SW			Chromium	Cr	ND	0	1.5	µg/L			10.08			0.52	0.58	0.401	98	0.00	1.53	**< 1.5**
6-SW			Copper	Cu	4.8	4.8	1.1	µg/L			10.08			0.62	0.69	0.478	99	4.84	1.11	**4.8**
6-SW			Iron	Fe	ND	0	28	µg/L			10.08			0.63	0.70	0.485	99	0.00	28.21	**< 28**
6-SW			Lead	Pb	0.26	0.26	0.17	µg/L	J		10.08			0.83	0.92	0.639	100	0.26	0.17	**0.26**
6-SW			Manganese	Mn	6.9	6.9	1.3	µg/L			10.08			0.62	0.69	0.478	99	6.96	1.31	**7**
6-SW			Mercury	Hg	ND	0	0.33	µg/L			10.08			0.74	0.82	0.570	100	0.00	0.33	**< 0.33**
6-SW			Nickel	Ni	0.77	0.77	0.52	µg/L	J		10.08			0.62	0.69	0.478	99	0.78	0.52	**0.78**
6-SW			Zinc	Zn	10	10	2.9	µg/L			10.08			0.61	0.68	0.470	99	10.09	2.93	**10**
7-PW	10-4-22 9:59	10-14-22 15:33	Lithium	Li	9600	9600	21	µg/L		86000	10.23	100	0.215	0.90	1.00	0.215	89	--	--	--
7-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.23			0.63	0.70	0.151	79	0.00	0.28	**< 0.28**
7-PW			Chromium	Cr	ND	0	1.5	µg/L			10.23			0.52	0.58	0.125	72	0.00	2.08	**< 2.1**
7-PW			Copper	Cu	1.1	1.1	1.1	µg/L	J		10.23			0.62	0.69	0.148	78	1.41	1.41	**< 1.4**
7-PW			Iron	Fe	1200	1200	28	µg/L			10.23			0.63	0.70	0.151	79	1525.95	35.61	**1500**
7-PW			Lead	Pb	ND	0	0.17	µg/L			10.23			0.83	0.92	0.199	87	0.00	0.20	**< 0.2**
7-PW			Manganese	Mn	98	98	1.3	µg/L			10.23			0.62	0.69	0.148	78	125.46	1.66	**130**
7-PW			Mercury	Hg	ND	0	0.13	µg/L			10.23			0.74	0.82	0.177	84	0.00	0.16	**< 0.16**
7-PW			Nickel	Ni	0.77	0.77	0.52	µg/L	J		10.23			0.62	0.69	0.148	78	0.99	0.67	**0.99**
7-PW			Zinc	Zn	6.2	6.2	2.9	µg/L			10.23			0.61	0.68	0.146	78	7.99	3.74	**8**
7-SW	10-4-22 9:59	10-14-22 15:33	Lithium	Li	190	190	0.83	µg/L		86000	10.23	100	0.671	0.90	1.00	0.671	100	--	--	--
7-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.23			0.63	0.70	0.470	99	0.00	0.22	**< 0.22**
7-SW			Chromium	Cr	ND	0	1.5	µg/L			10.23			0.52	0.58	0.388	98	0.00	1.53	**< 1.5**
7-SW			Copper	Cu	5.5	5.5	1.1	µg/L			10.23			0.62	0.69	0.463	99	5.55	1.11	**5.5**
7-SW			Iron	Fe	29	29	28	µg/L	J		10.23			0.63	0.70	0.470	99	29.24	28.23	**29**
7-SW			Lead	Pb	0.26	0.26	0.17	µg/L	J		10.23			0.83	0.92	0.619	100	0.26	0.17	**0.26**
7-SW			Manganese	Mn	7.5	7.5	1.3	µg/L			10.23			0.62	0.69	0.463	99	7.57	1.31	**7.6**
7-SW			Mercury	Hg	ND	0	0.13	µg/L			10.23			0.74	0.82	0.552	100	0.00	0.13	**< 0.13**
7-SW			Nickel	Ni	0.96	0.96	0.52	µg/L	J		10.23			0.62	0.69	0.463	99	0.97	0.52	**0.97**
7-SW			Zinc	Zn	13	13	2.9	µg/L			10.23			0.61	0.68	0.455	99	13.12	2.93	**13**

Table A2. Calculation of Cfree values using the bromide tracer, San Diego peeper samples.
Equilibrium Correction of Porewater Concentration using Bromide Tracer

Sample ID	Sample Deployment Date	Sample Collection Date	Chemical Name	Chemical Abreviation	Report Result Text	Measured Concentration in Peeper	MDL in Peeper	Report Result Unit	Lab Qualifiers	Initial Br Concentration (mg/L)	Deployment Time (days)	Assumed Br Concentration External to Peeper (mg/L)	Sample-Specific Elimintation Rate for Br (K_{Br}) (day^{-1})	Diffusion Coefficient for Analytes (Di) (* 10^{-5} cm^2/s)	Di ÷ D_{Br}	Sample-specific Elimination Rate for Analytes (K_i) (day-1)	Percent Equilibrium Reached (%)	Equilibrium Corrected Concentration (µg/L)	Equilibrium Corrected MDL (µg/L)	Equilibrium Corrected Result (µg/L) 2-sig figs
1A-PW	10-3-22 12:30	10-14-22 14:58	Bromide	Br	220	220	2.7	mg/L		980	11.10	65	0.160	1.82	1.00	0.160	83	--	--	--
1A-PW			Cadmium	Cd	ND	0	0.27	µg/L			11.10			0.63	0.35	0.055	46	0.00	0.59	**< 0.59**
1A-PW			Chromium	Cr	ND	0	1.9	µg/L			11.10			0.52	0.29	0.046	40	0.00	4.78	**< 4.8**
1A-PW			Copper	Cu	3.2	3.2	1.4	µg/L			11.10			0.62	0.34	0.054	45	7.05	3.08	**7.1**
1A-PW			Iron	Fe	220	220	35	µg/L			11.10			0.63	0.35	0.055	46	479.16	76.23	**480**
1A-PW			Lead	Pb	0.88	0.88	0.21	µg/L	J		11.10			0.83	0.46	0.073	56	1.59	0.38	**1.6**
1A-PW			Manganese	Mn	25	25	1.7	µg/L			11.10			0.62	0.34	0.054	45	55.09	3.75	**55**
1A-PW			Mercury	Hg	ND	0	0.13	µg/L			11.10			0.74	0.41	0.065	51	0.00	0.25	**< 0.25**
1A-PW			Nickel	Ni	ND	0	0.65	µg/L			11.10			0.62	0.34	0.054	45	0.00	1.43	**< 1.4**
1A-PW			Zinc	Zn	13	13	3.6	µg/L			11.10			0.61	0.34	0.054	45	28.99	8.03	**29**
1A-SW	10-3-22 12:30	10-14-22 14:58	Bromide	Br	120	120	2.7	mg/L		980	11.10	65	0.253	1.82	1.00	0.253	94	--	--	--
1A-SW			Cadmium	Cd	ND	0	0.36	µg/L			11.10			0.63	0.35	0.088	62	0.00	0.58	**< 0.58**
1A-SW			Chromium	Cr	20	20	2.6	µg/L			11.10			0.52	0.29	0.072	55	36.22	4.71	**36**
1A-SW			Copper	Cu	13	13	1.9	µg/L			11.10			0.62	0.34	0.086	62	21.09	3.08	**21**
1A-SW			Iron	Fe	110	110	46	µg/L			11.10			0.63	0.35	0.088	62	176.81	73.94	**180**
1A-SW			Lead	Pb	0.36	0.36	0.28	µg/L	J		11.10			0.83	0.46	0.115	72	0.50	0.39	**0.5**
1A-SW			Manganese	Mn	12	12	2.2	µg/L			11.10			0.62	0.34	0.086	62	19.47	3.57	**19**
1A-SW			Mercury	Hg	ND	0	0.33	µg/L			11.10			0.74	0.41	0.103	68	0.00	0.48	**< 0.48**
1A-SW			Nickel	Ni	29	29	0.86	µg/L			11.10			0.62	0.34	0.086	62	47.06	1.40	**47**
1A-SW			Zinc	Zn	23	23	4.8	µg/L			11.10			0.61	0.34	0.085	61	37.69	7.87	**38**
1B-PW	10-3-22 13:25	10-14-22 14:56	Bromide	Br	120	120	2.7	mg/L		980	11.06	65	0.254	1.82	1.00	0.254	94	--	--	--
1B-PW			Cadmium	Cd	ND	0	0.22	µg/L			11.06			0.63	0.35	0.088	62	0.00	0.35	**< 0.35**
1B-PW			Chromium	Cr	ND	0	1.5	µg/L			11.06			0.52	0.29	0.073	55	0.00	2.72	**< 2.7**
1B-PW			Copper	Cu	4.8	4.8	1.1	µg/L			11.06			0.62	0.34	0.087	62	7.79	1.78	**7.8**
1B-PW			Iron	Fe	4400	4400	28	µg/L			11.06			0.63	0.35	0.088	62	7072.31	45.01	**7100**
1B-PW			Lead	Pb	0.39	0.39	0.17	µg/L	J		11.06			0.83	0.46	0.116	72	0.54	0.24	**0.54**
1B-PW			Manganese	Mn	230	230	1.3	µg/L			11.06			0.62	0.34	0.087	62	373.22	2.11	**370**
1B-PW			Mercury	Hg	ND	0	0.13	µg/L			11.06			0.74	0.41	0.103	68	0.00	0.19	**< 0.19**
1B-PW			Nickel	Ni	1	1	0.52	µg/L			11.06			0.62	0.34	0.087	62	1.62	0.84	**1.6**
1B-PW			Zinc	Zn	20	20	2.9	µg/L			11.06			0.61	0.34	0.085	61	32.77	4.75	**33**
1B-SW	10-3-22 13:25	10-14-22 14:56	Bromide	Br	120	120	2.7	mg/L		980	11.06	65	0.254	1.82	1.00	0.254	94	--	--	--
1B-SW			Cadmium	Cd	ND	0	0.22	µg/L			11.06			0.63	0.35	0.088	62	0.00	0.35	**< 0.35**
1B-SW			Chromium	Cr	ND	0	1.5	µg/L			11.06			0.52	0.29	0.073	55	0.00	2.72	**< 2.7**
1B-SW			Copper	Cu	10	10	1.1	µg/L			11.06			0.62	0.34	0.087	62	16.23	1.78	**16**
1B-SW			Iron	Fe	ND	0	28	µg/L			11.06			0.63	0.35	0.088	62	0.00	45.01	**< 45**
1B-SW			Lead	Pb	0.45	0.45	0.17	µg/L	J		11.06			0.83	0.46	0.116	72	0.62	0.24	**0.62**
1B-SW			Manganese	Mn	5.2	5.2	1.3	µg/L			11.06			0.62	0.34	0.087	62	8.44	2.11	**8.4**
1B-SW			Mercury	Hg	ND	0	0.13	µg/L			11.06			0.74	0.41	0.103	68	0.00	0.19	**< 0.19**
1B-SW			Nickel	Ni	1	1	0.52	µg/L			11.06			0.62	0.34	0.087	62	1.62	0.84	**1.6**
1B-SW			Zinc	Zn	33	33	2.9	µg/L			11.06			0.61	0.34	0.085	61	54.07	4.75	**54**
1C-PW	10-3-22 13:50	10-14-22 11:51	Bromide	Br	230	230	2.7	mg/L		980	10.92	65	0.157	1.82	1.00	0.157	82	--	--	--
1C-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.92			0.63	0.35	0.054	45	0.00	0.49	**< 0.49**
1C-PW			Chromium	Cr	ND	0	1.5	µg/L			10.92			0.52	0.29	0.045	39	0.00	3.88	**< 3.9**
1C-PW			Copper	Cu	2.6	2.6	1.1	µg/L			10.92			0.62	0.34	0.053	44	5.88	2.49	**5.9**
1C-PW			Iron	Fe	230	230	28	µg/L			10.92			0.63	0.35	0.054	45	514.19	62.60	**510**
1C-PW			Lead	Pb	ND	0	0.17	µg/L			10.92			0.83	0.46	0.072	54	0.00	0.31	**< 0.31**
1C-PW			Manganese	Mn	36	36	1.3	µg/L			10.92			0.62	0.34	0.053	44	81.43	2.94	**81**
1C-PW			Mercury	Hg	ND	0	0.13	µg/L			10.92			0.74	0.41	0.064	50	0.00	0.26	**< 0.26**
1C-PW			Nickel	Ni	ND	0	0.52	µg/L			10.92			0.62	0.34	0.053	44	0.00	1.18	**< 1.2**
1C-PW			Zinc	Zn	5.6	5.6	2.9	µg/L			10.92			0.61	0.34	0.053	44	12.82	6.64	**13**
1C-SW	10-3-22 13:50	10-14-22 11:51	Bromide	Br	120	120	2.7	mg/L	^2	980	10.92	65	0.258	1.82	1.00	0.258	94	--	--	--
1C-SW			Cadmium	Cd	0.36	0.36	0.22	µg/L	J		10.92			0.63	0.35	0.089	62	0.58	0.35	**0.58**
1C-SW			Chromium	Cr	ND	0	1.5	µg/L			10.92			0.52	0.29	0.074	55	0.00	2.72	**< 2.7**
1C-SW			Copper	Cu	7.4	7.4	1.1	µg/L			10.92			0.62	0.34	0.088	62	12.01	1.78	**12**
1C-SW			Iron	Fe	ND	0	28	µg/L			10.92			0.63	0.35	0.089	62	0.00	45.01	**< 45**
1C-SW			Lead	Pb	0.17	0.17	0.17	µg/L	J		10.92			0.83	0.46	0.117	72	0.24	0.24	**< 0.24**
1C-SW			Manganese	Mn	6.6	6.6	1.3	µg/L			10.92			0.62	0.34	0.088	62	10.71	2.11	**11**
1C-SW			Mercury	Hg	ND	0	0.13	µg/L			10.92			0.74	0.41	0.105	68	0.00	0.19	**< 0.19**
1C-SW			Nickel	Ni	0.79	0.79	0.52	µg/L	J		10.92			0.62	0.34	0.088	62	1.28	0.84	**1.3**
1C-SW			Zinc	Zn	15	15	2.9	µg/L			10.92			0.61	0.34	0.086	61	24.58	4.75	**25**
2-PW	10-4-22 8:50	10-13-22 12:07	Bromide	Br	120	120	2.7	mg/L	^2	980	9.14	65	0.308	1.82	1.00	0.308	94	--	--	--
2-PW			Cadmium	Cd	ND	0	0.22	µg/L			9.14			0.63	0.35	0.107	62	0.00	0.35	**< 0.35**
2-PW			Chromium	Cr	ND	0	1.5	µg/L			9.14			0.52	0.29	0.088	55	0.00	2.72	**< 2.7**
2-PW			Copper	Cu	3.6	3.6	1.1	µg/L			9.14			0.62	0.34	0.105	62	5.84	1.78	**5.8**
2-PW			Iron	Fe	1400	1400	28	µg/L			9.14			0.63	0.35	0.107	62	2250.28	45.01	**2300**
2-PW			Lead	Pb	ND	0	0.17	µg/L			9.14			0.83	0.46	0.140	72	0.00	0.24	**< 0.24**
2-PW			Manganese	Mn	77	77	1.3	µg/L			9.14			0.62	0.34	0.105	62	124.95	2.11	**120**
2-PW			Mercury	Hg	ND	0	0.13	µg/L			9.14			0.74	0.41	0.125	68	0.00	0.19	**< 0.19**
2-PW			Nickel	Ni	ND	0	0.52	µg/L			9.14			0.62	0.34	0.105	62	0.00	0.84	**< 0.84**
2-PW			Zinc	Zn	3.1	3.1	2.9	µg/L	J		9.14			0.61	0.34	0.103	61	5.08	4.75	**5.1**

Table A2. Calculation of Cfree values using the bromide tracer, San Diego peeper samples.
Equilibrium Correction of Porewater Concentration using Bromide Tracer

Sample ID	Sample Deployment Date	Sample Collection Date	Chemical Name	Chemical Abreviation	Report Result Text	Measured Concentration in Peeper	MDL in Peeper	Report Result Unit	Lab Qualifiers	Initial Br Concentration (mg/L)	Deployment Time (days)	Assumed Br Concentration External to Peeper (mg/L)	Sample-Specific Elimintation Rate for Br (K_{Br}) (day^{-1})	Diffusion Coefficient for Analytes (Di) (* 10^{-5} cm^2/s)	Di ÷ D_{Br}	Sample-specific Elimination Rate for Analytes (K_i) (day-1)	Percent Equilibrium Reached (%)	Equilibrium Corrected Concentration (µg/L)	Equilibrium Corrected MDL (µg/L)	Equilibrium Corrected Result (µg/L) 2-sig figs
2-SW	10-4-22 8:50	10-13-22 12:06	Bromide	Br	110	110	2.7	mg/L	^2	980	9.14	65	0.330	1.82	1.00	0.330	95	--	--	--
2-SW			Cadmium	Cd	ND	0	0.22	µg/L			9.14			0.63	0.35	0.114	65	0.00	0.34	**< 0.34**
2-SW			Chromium	Cr	ND	0	1.5	µg/L			9.14			0.52	0.29	0.094	58	0.00	2.60	**< 2.6**
2-SW			Copper	Cu	6.6	6.6	1.1	µg/L			9.14			0.62	0.34	0.112	64	10.29	1.71	**10**
2-SW			Iron	Fe	ND	0	28	µg/L			9.14			0.63	0.35	0.114	65	0.00	43.24	**< 43**
2-SW			Lead	Pb	0.18	0.18	0.17	µg/L	J		9.14			0.83	0.46	0.150	75	0.24	0.23	**0.24**
2-SW			Manganese	Mn	6.3	6.3	1.3	µg/L			9.14			0.62	0.34	0.112	64	9.82	2.03	**9.8**
2-SW			Mercury	Hg	ND	0	0.13	µg/L			9.14			0.74	0.41	0.134	71	0.00	0.18	**< 0.18**
2-SW			Nickel	Ni	0.71	0.71	0.52	µg/L	J		9.14			0.62	0.34	0.112	64	1.11	0.81	**1.1**
2-SW			Zinc	Zn	11	11	2.9	µg/L			9.14			0.61	0.34	0.111	64	17.31	4.56	**17**
3-PW	10-3-22 15:00	10-14-22 14:02	Bromide	Br	230	230	2.7	mg/L	^2	980	10.96	65	0.156	1.82	1.00	0.156	82	--	--	--
3-PW			Cadmium	Cd	ND	0	0.36	µg/L			10.96			0.63	0.35	0.054	45	0.00	0.80	**< 0.8**
3-PW			Chromium	Cr	ND	0	2.6	µg/L			10.96			0.52	0.29	0.045	39	0.00	6.72	**< 6.7**
3-PW			Copper	Cu	ND	0	1.9	µg/L			10.96			0.62	0.34	0.053	44	0.00	4.30	**< 4.3**
3-PW			Iron	Fe	150	150	46	µg/L			10.96			0.63	0.35	0.054	45	335.34	102.84	**340**
3-PW			Lead	Pb	ND	0	0.28	µg/L			10.96			0.83	0.46	0.071	54	0.00	0.52	**< 0.52**
3-PW			Manganese	Mn	18	18	2.2	µg/L			10.96			0.62	0.34	0.053	44	40.72	4.98	**41**
3-PW			Mercury	Hg	ND	0	0.33	µg/L			10.96			0.74	0.41	0.064	50	0.00	0.66	**< 0.66**
3-PW			Nickel	Ni	1.1	1.1	0.86	µg/L	J		10.96			0.62	0.34	0.053	44	2.49	1.95	**2.5**
3-PW			Zinc	Zn	11	11	4.8	µg/L			10.96			0.61	0.34	0.052	44	25.18	10.99	**25**
3-SW	10-3-22 15:00	10-14-22 14:02	Bromide	Br	140	140	2.7	mg/L	^2	980	10.96	65	0.228	1.82	1.00	0.228	92	--	--	--
3-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.96			0.63	0.35	0.079	58	0.00	0.38	**< 0.38**
3-SW			Chromium	Cr	ND	0	1.5	µg/L			10.96			0.52	0.29	0.065	51	0.00	2.94	**< 2.9**
3-SW			Copper	Cu	6.2	6.2	1.1	µg/L			10.96			0.62	0.34	0.078	57	10.81	1.92	**11**
3-SW			Iron	Fe	ND	0	28	µg/L			10.96			0.63	0.35	0.079	58	0.00	48.33	**< 48**
3-SW			Lead	Pb	ND	0	0.17	µg/L			10.96			0.83	0.46	0.104	68	0.00	0.25	**< 0.25**
3-SW			Manganese	Mn	6.5	6.5	1.3	µg/L			10.96			0.62	0.34	0.078	57	11.33	2.27	**11**
3-SW			Mercury	Hg	ND	0	0.13	µg/L			10.96			0.74	0.41	0.093	64	0.00	0.20	**< 0.2**
3-SW			Nickel	Ni	0.79	0.79	0.52	µg/L	J		10.96			0.62	0.34	0.078	57	1.38	0.91	**1.4**
3-SW			Zinc	Zn	10	10	2.9	µg/L			10.96			0.61	0.34	0.076	57	17.62	5.11	**18**
4-PW	10-4-22 10:34	10-14-22 14:20	Bromide	Br	130	130	2.7	mg/L	^2	980	10.16	65	0.260	1.82	1.00	0.260	93	--	--	--
4-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.16			0.63	0.35	0.090	60	0.00	0.37	**< 0.37**
4-PW			Chromium	Cr	ND	0	1.5	µg/L			10.16			0.52	0.29	0.074	53	0.00	2.83	**< 2.8**
4-PW			Copper	Cu	6.2	6.2	1.1	µg/L			10.16			0.62	0.34	0.089	59	10.44	1.85	**10**
4-PW			Iron	Fe	ND	0	28	µg/L			10.16			0.63	0.35	0.090	60	0.00	46.69	**< 47**
4-PW			Lead	Pb	0.2	0.2	0.17	µg/L	J		10.16			0.83	0.46	0.119	70	0.29	0.24	**0.29**
4-PW			Manganese	Mn	5.2	5.2	1.3	µg/L			10.16			0.62	0.34	0.089	59	8.76	2.19	**8.8**
4-PW			Mercury	Hg	ND	0	0.33	µg/L			10.16			0.74	0.41	0.106	66	0.00	0.50	**< 0.5**
4-PW			Nickel	Ni	1.1	1.1	0.52	µg/L			10.16			0.62	0.34	0.089	59	1.85	0.88	**1.9**
4-PW			Zinc	Zn	16	16	2.9	µg/L			10.16			0.61	0.34	0.087	59	27.22	4.93	**27**
4-SW	10-4-22 10:34	10-14-22 14:20	Bromide	Br	130	130	2.7	µg/L	^2	980	10.16	65	0.260	1.82	1.00	0.260	93	--	--	--
4-SW			Cadmium	Cd	ND	0	0.24	µg/L			10.16			0.63	0.35	0.090	60	0.00	0.40	**< 0.4**
4-SW			Chromium	Cr	ND	0	1.7	µg/L			10.16			0.52	0.29	0.074	53	0.00	3.21	**< 3.2**
4-SW			Copper	Cu	5.3	5.3	1.2	µg/L			10.16			0.62	0.34	0.089	59	8.93	2.02	**8.9**
4-SW			Iron	Fe	63	63	30	µg/L			10.16			0.63	0.35	0.090	60	105.06	50.03	**110**
4-SW			Lead	Pb	ND	0	0.18	µg/L			10.16			0.83	0.46	0.119	70	0.00	0.26	**< 0.26**
4-SW			Manganese	Mn	8.9	8.9	1.5	µg/L			10.16			0.62	0.34	0.089	59	14.99	2.53	**15**
4-SW			Mercury	Hg	ND	0	0.13	µg/L			10.16			0.74	0.41	0.106	66	0.00	0.20	**< 0.2**
4-SW			Nickel	Ni	1	1	0.56	µg/L	J		10.16			0.62	0.34	0.089	59	1.68	0.94	**1.7**
4-SW			Zinc	Zn	8.9	8.9	3.1	µg/L			10.16			0.61	0.34	0.087	59	15.14	5.27	**15**
5-PW	10-4-22 9:17	10-14-22 15:52	Bromide	Br	170	170	2.7	mg/L	^2	980	10.27	65	0.211	1.82	1.00	0.211	89	--	--	--
5-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.27			0.63	0.35	0.073	53	0.00	0.42	**< 0.42**
5-PW			Chromium	Cr	ND	0	1.5	µg/L			10.27			0.52	0.29	0.060	46	0.00	3.25	**< 3.3**
5-PW			Copper	Cu	1.8	1.8	1.1	µg/L	J		10.27			0.62	0.34	0.072	52	3.45	2.11	**3.5**
5-PW			Iron	Fe	1500	1500	28	µg/L			10.27			0.63	0.35	0.073	53	2844.38	53.10	**2800**
5-PW			Lead	Pb	ND	0	0.17	µg/L			10.27			0.83	0.46	0.096	63	0.00	0.27	**< 0.27**
5-PW			Manganese	Mn	110	110	1.3	µg/L			10.27			0.62	0.34	0.072	52	210.85	2.49	**210**
5-PW			Mercury	Hg	ND	0	0.13	µg/L			10.27			0.74	0.41	0.086	59	0.00	0.22	**< 0.22**
5-PW			Nickel	Ni	ND	0	0.52	µg/L			10.27			0.62	0.34	0.072	52	0.00	1.00	**< 1**
5-PW			Zinc	Zn	3	3	2.9	µg/L	J		10.27			0.61	0.34	0.071	52	5.81	5.62	**5.8**
5-SW	10-4-22 9:17	10-14-22 15:52	Bromide	Br	130	130	2.7	mg/L	^2	980	10.27	65	0.257	1.82	1.00	0.257	93	--	--	--
5-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.27			0.63	0.35	0.089	60	0.00	0.37	**< 0.37**
5-SW			Chromium	Cr	ND	0	1.5	µg/L			10.27			0.52	0.29	0.074	53	0.00	2.83	**< 2.8**
5-SW			Copper	Cu	5.6	5.6	1.1	µg/L			10.27			0.62	0.34	0.088	59	9.43	1.85	**9.4**
5-SW			Iron	Fe	ND	0	28	µg/L			10.27			0.63	0.35	0.089	60	0.00	46.69	**< 47**
5-SW			Lead	Pb	0.23	0.23	0.17	µg/L	J		10.27			0.83	0.46	0.117	70	0.33	0.24	**0.33**
5-SW			Manganese	Mn	7.7	7.7	1.3	µg/L			10.27			0.62	0.34	0.088	59	12.97	2.19	**13**
5-SW			Mercury	Hg	ND	0	0.13	µg/L			10.27			0.74	0.41	0.105	66	0.00	0.20	**< 0.2**
5-SW			Nickel	Ni	0.97	0.97	0.52	µg/L	J		10.27			0.62	0.34	0.088	59	1.63	0.88	**1.6**
5-SW			Zinc	Zn	12	12	2.9	µg/L			10.27			0.61	0.34	0.086	59	20.41	4.93	**20**

Table A2. Calculation of Cfree values using the bromide tracer, San Diego peeper samples.
Equilibrium Correction of Porewater Concentration using Bromide Tracer

Sample ID	Sample Deployment Date	Sample Collection Date	Chemical Name	Chemical Abreviation	Report Result Text	Measured Concentration in Peeper	MDL in Peeper	Report Result Unit	Lab Qualifiers	Initial Br Concentration (mg/L)	Deployment Time (days)	Assumed Br Concentration External to Peeper (mg/L)	Sample-Specific Elimintation Rate for Br (K_{Br}) (day^{-1})	Diffusion Coefficient for Analytes (Di) (* 10^{-5} cm^2/s)	Di ÷ D_{Br}	Sample-specific Elimination Rate for Analytes (K_i) (day-1)	Percent Equilibrium Reached (%)	Equilibrium Corrected Concentration (µg/L)	Equilibrium Corrected MDL (µg/L)	Equilibrium Corrected Result (µg/L) 2-sig figs
6-PW	10-4-22 10:54	10-14-22 12:49	Bromide	Br	220	220	2.7	mg/L	^2	980	10.08	65	0.176	1.82	1.00	0.176	83	--	--	--
6-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.08			0.63	0.35	0.061	46	0.00	0.48	**< 0.48**
6-PW			Chromium	Cr	ND	0	1.5	µg/L			10.08			0.52	0.29	0.050	40	0.00	3.77	**< 3.8**
6-PW			Copper	Cu	ND	0	1.1	µg/L			10.08			0.62	0.34	0.060	45	0.00	2.42	**< 2.4**
6-PW			Iron	Fe	3100	3100	28	µg/L			10.08			0.63	0.35	0.061	46	6751.75	60.98	**6800**
6-PW			Lead	Pb	ND	0	0.17	µg/L			10.08			0.83	0.46	0.080	56	0.00	0.31	**< 0.31**
6-PW			Manganese	Mn	150	150	1.3	µg/L			10.08			0.62	0.34	0.060	45	330.51	2.86	**330**
6-PW			Mercury	Hg	ND	0	0.13	µg/L			10.08			0.74	0.41	0.072	51	0.00	0.25	**< 0.25**
6-PW			Nickel	Ni	ND	0	0.52	µg/L			10.08			0.62	0.34	0.060	45	0.00	1.15	**< 1.1**
6-PW			Zinc	Zn	ND	0	2.9	µg/L			10.08			0.61	0.34	0.059	45	0.00	6.47	**< 6.5**
6-SW	10-4-22 10:54	10-14-22 12:49	Bromide	Br	130	130	2.7	mg/L	^2	980	10.08	65	0.262	1.82	1.00	0.262	93	--	--	--
6-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.08			0.63	0.35	0.091	60	0.00	0.37	**< 0.37**
6-SW			Chromium	Cr	ND	0	1.5	µg/L			10.08			0.52	0.29	0.075	53	0.00	2.83	**< 2.8**
6-SW			Copper	Cu	4.8	4.8	1.1	µg/L			10.08			0.62	0.34	0.089	59	8.08	1.85	**8.1**
6-SW			Iron	Fe	ND	0	28	µg/L			10.08			0.63	0.35	0.091	60	0.00	46.69	**< 47**
6-SW			Lead	Pb	0.26	0.26	0.17	µg/L	J		10.08			0.83	0.46	0.120	70	0.37	0.24	**0.37**
6-SW			Manganese	Mn	6.9	6.9	1.3	µg/L			10.08			0.62	0.34	0.089	59	11.62	2.19	**12**
6-SW			Mercury	Hg	ND	0	0.33	µg/L			10.08			0.74	0.41	0.107	66	0.00	0.50	**< 0.5**
6-SW			Nickel	Ni	0.77	0.77	0.52	µg/L	J		10.08			0.62	0.34	0.089	59	1.30	0.88	**1.3**
6-SW			Zinc	Zn	10	10	2.9	µg/L			10.08			0.61	0.34	0.088	59	17.01	4.93	**17**
7-PW	10-4-22 9:59	10-14-22 15:33	Bromide	Br	140	140	2.7	mg/L	^2	980	10.23	65	0.244	1.82	1.00	0.244	92	--	--	--
7-PW			Cadmium	Cd	ND	0	0.22	µg/L			10.23			0.63	0.35	0.085	58	0.00	0.38	**< 0.38**
7-PW			Chromium	Cr	ND	0	1.5	µg/L			10.23			0.52	0.29	0.070	51	0.00	2.94	**< 2.9**
7-PW			Copper	Cu	1.1	1.1	1.1	µg/L	J		10.23			0.62	0.34	0.083	57	1.92	1.92	**< 1.9**
7-PW			Iron	Fe	1200	1200	28	µg/L			10.23			0.63	0.35	0.085	58	2071.40	48.33	**2100**
7-PW			Lead	Pb	ND	0	0.17	µg/L			10.23			0.83	0.46	0.111	68	0.00	0.25	**< 0.25**
7-PW			Manganese	Mn	98	98	1.3	µg/L			10.23			0.62	0.34	0.083	57	170.88	2.27	**170**
7-PW			Mercury	Hg	ND	0	0.13	µg/L			10.23			0.74	0.41	0.099	64	0.00	0.20	**< 0.2**
7-PW			Nickel	Ni	0.77	0.77	0.52	µg/L	J		10.23			0.62	0.34	0.083	57	1.34	0.91	**1.3**
7-PW			Zinc	Zn	6.2	6.2	2.9	µg/L			10.23			0.61	0.34	0.082	57	10.92	5.11	**11**
7-SW	10-4-22 9:59	10-14-22 15:33	Bromide	Br	130	130	2.7	mg/L	^2	980	10.23	65	0.258	1.82	1.00	0.258	93	--	--	--
7-SW			Cadmium	Cd	ND	0	0.22	µg/L			10.23			0.63	0.35	0.089	60	0.00	0.37	**< 0.37**
7-SW			Chromium	Cr	ND	0	1.5	µg/L			10.23			0.52	0.29	0.074	53	0.00	2.83	**< 2.8**
7-SW			Copper	Cu	5.5	5.5	1.1	µg/L			10.23			0.62	0.34	0.088	59	9.26	1.85	**9.3**
7-SW			Iron	Fe	29	29	28	µg/L	J		10.23			0.63	0.35	0.089	60	48.36	46.69	**48**
7-SW			Lead	Pb	0.26	0.26	0.17	µg/L	J		10.23			0.83	0.46	0.118	70	0.37	0.24	**0.37**
7-SW			Manganese	Mn	7.5	7.5	1.3	µg/L			10.23			0.62	0.34	0.088	59	12.63	2.19	**13**
7-SW			Mercury	Hg	ND	0	0.13	µg/L			10.23			0.74	0.41	0.105	66	0.00	0.20	**< 0.2**
7-SW			Nickel	Ni	0.96	0.96	0.52	µg/L	J		10.23			0.62	0.34	0.088	59	1.62	0.88	**1.6**
7-SW			Zinc	Zn	13	13	2.9	µg/L			10.23			0.61	0.34	0.087	59	22.11	4.93	**22**

Table A3. Cfree of metals in sediment porewater and surface water from the San Diego field deployment, as determined with the lithium tracer (top) and bromide tracer (bottom).

			Lithium corrected porewater concentration (µg/L)								
Sample ID	Station	Description	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-PW	1A	Sed porewater	< 0.39	< 3	**4.7**	**320**	**1.1**	**36**	< 0.17	< 0.95	**19**
1B-PW	1B	Sed porewater	< 0.23	< 1.6	**4.9**	**4500**	**0.39**	**240**	< 0.13	**1**	**21**
1C-PW	1C	Sed porewater	< 0.34	< 2.6	**4**	**350**	< 0.23	**56**	< 0.18	< 0.8	**8.7**
2-PW	2	Sed porewater	< 0.25	< 1.9	**4.2**	**1600**	< 0.18	**90**	< 0.14	< 0.61	**3.6**
3-PW	3	Sed porewater	< 0.54	< 4.4	< 2.9	**220**	< 0.37	**27**	< 0.46	**1.7**	**17**
4-PW	4	Sed porewater	< 0.22	< 1.5	**6.2**	< 28	**0.2**	**5.2**	< 0.33	**1.1**	**16**
5-PW	5	Sed porewater	< 0.31	< 2.4	**2.6**	**2100**	< 0.21	**160**	< 0.17	< 0.74	**4.3**
6-PW	6	Sed porewater	< 0.32	< 2.5	< 1.6	**4600**	< 0.22	**220**	< 0.18	< 0.77	< 4.3
7-PW	7	Sed porewater	< 0.28	< 2.1	< 1.4	**1500**	< 0.2	**130**	< 0.16	**0.99**	**8**
			Lithium corrected sureface water concentration (µg/L)								
Sample ID	Station	Description	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-SW	1A	Surface water	< 0.36	**20**	**13**	**110**	**0.36**	**12**	< 0.33	**29**	**23**
1B-SW	1B	Surface water	< 0.22	< 1.5	**10**	< 28	**0.45**	**5.2**	< 0.13	**1**	**33**
1C-SW	1C	Surface water	**0.36**	< 1.5	**7.5**	< 28	< 0.17	**6.7**	< 0.13	**0.8**	**15**
2-SW	2	Surface water	< 0.22	< 1.5	**6.7**	< 28	**0.18**	**6.4**	< 0.13	**0.72**	**11**
3-SW	3	Surface water	< 0.22	< 1.5	**6.2**	< 28	< 0.17	**6.5**	< 0.13	**0.8**	**10**
4-SW	4	Surface water	< 0.24	< 1.7	**5.3**	**63**	< 0.18	**9**	< 0.13	**1**	**9**
5-SW	5	Surface water	< 0.22	< 1.5	**5.6**	< 28	**0.23**	**7.8**	< 0.13	**0.98**	**12**
6-SW	6	Surface water	< 0.22	< 1.5	**4.8**	< 28	**0.26**	**7**	< 0.33	**0.78**	**10**
7-SW	7	Surface water	< 0.22	< 1.5	**5.5**	**29**	**0.26**	**7.6**	< 0.13	**0.97**	**13**

			Bromide corrected porewater concentration (µg/L)								
Sample ID	Station	Description	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-PW	1A	Sed porewater	< 0.59	< 4.8	**7.1**	**480**	**1.6**	**55**	< 0.25	< 1.4	**29**
1B-PW	1B	Sed porewater	< 0.35	< 2.7	**7.8**	**7100**	**0.54**	**370**	< 0.19	**1.6**	**33**
1C-PW	1C	Sed porewater	< 0.49	< 3.9	**5.9**	**510**	< 0.31	**81**	< 0.26	< 1.2	**13**
2-PW	2	Sed porewater	< 0.35	< 2.7	**5.8**	**2300**	< 0.24	**120**	< 0.19	< 0.84	**5.1**
3-PW	3	Sed porewater	< 0.8	< 6.7	< 4.3	**340**	< 0.52	**41**	< 0.66	**2.5**	**25**
4-PW	4	Sed porewater	< 0.37	< 2.8	**10**	< 47	**0.29**	**8.8**	< 0.5	**1.9**	**27**
5-PW	5	Sed porewater	< 0.42	< 3.3	**3.5**	**2800**	< 0.27	**210**	< 0.22	< 1	**5.8**
6-PW	6	Sed porewater	< 0.48	< 3.8	< 2.4	**6800**	< 0.31	**330**	< 0.25	< 1.1	< 6.5
7-PW	7	Sed porewater	< 0.38	< 2.9	< 1.9	**2100**	< 0.25	**170**	< 0.2	**1.3**	**11**
			Bromide corrected surface water concentration (µg/L)								
Sample ID	Station	Description	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
1A-SW	1A	Surface water	< 0.58	**36**	**21**	**180**	**0.5**	**19**	< 0.48	**47**	**38**
1B-SW	1B	Surface water	< 0.35	< 2.7	**16**	< 45	**0.62**	**8.4**	< 0.19	**1.6**	**54**
1C-SW	1C	Surface water	**0.58**	< 2.7	**12**	< 45	< 0.24	**11**	< 0.19	**1.3**	**25**
2-SW	2	Surface water	< 0.34	< 2.6	**10**	< 43	**0.24**	**9.8**	< 0.18	**1.1**	**17**
3-SW	3	Surface water	< 0.38	< 2.9	**11**	< 48	< 0.25	**11**	< 0.2	**1.4**	**18**
4-SW	4	Surface water	< 0.4	< 3.2	**8.9**	**110**	< 0.26	**15**	< 0.2	**1.7**	**15**
5-SW	5	Surface water	< 0.37	< 2.8	**9.4**	< 47	**0.33**	**13**	< 0.2	**1.6**	**20**
6-SW	6	Surface water	< 0.37	< 2.8	**8.1**	< 47	**0.37**	**12**	< 0.5	**1.3**	**17**
7-SW	7	Surface water	< 0.37	< 2.8	**9.3**	**48**	**0.37**	**13**	< 0.2	**1.6**	**22**

APPENDIX B DGT CALCULATION SHEETS

Table B1. Cfree calculation of metals in surface water from the San Diego field deployment, as determined in DGT.

Sample ID	1. Deployment Date/Time	1. Collection Date/Time	Exposure Duration (Days)	Exposure Duration (s)	3. M - Mass of metal in the resin gel (from Laboratory)								
					Hg (ng)	Cd (µg)	Cr (µg)	Cu (µg)	Fe (µg)	Mn (µg)	Ni (µg)	Pb (µg)	Zn (µg)
2-ME	10-4-22 8:50	10-13-22 12:05	9.14	789300	-	0.0029	0.0053	0.13	0.21	0.23	0.042	0.014	0.59
3-ME	10-3-22 15:00	10-14-22 14:01	10.96	946860	-	0.0044	0.0053	0.11	0.075	0.33	0.052	0.013	0.73
4-ME	10-4-22 10:34	10-14-22 14:18	10.16	877440	-	0.0043	0.0053	0.12	0.14	0.28	0.049	0.014	0.78
5-ME	10-4-22 9:17	10-14-22 15:50	10.27	887580	-	0.004	0.0053	0.12	0.34	0.27	0.038	0.014	0.6
6-ME1	10-4-22 10:54	10-14-22 12:49	10.08	870900	-	0.0041	0.0053	0.11	0.075	0.32	0.045	0.012	0.68
6-ME2	10-4-22 10:54	10-14-22 12:49	10.08	870900	-	0.0038	0.0053	0.11	0.075	0.24	0.043	0.012	0.64
7-ME	10-4-22 9:59	10-14-22 15:32	10.23	883980	-	0.004	0.0053	0.14	0.075	0.19	0.044	0.016	0.75
1A-HG1	10-3-22 12:30	10-14-22 14:58	11.10	959280	0.1	-	-	-	-	-	-	-	-
1A-HG2	10-3-22 12:30	10-14-22 14:58	11.10	959280	0.1	-	-	-	-	-	-	-	-
1B-HG1	10-3-22 13:25	10-14-22 14:57	11.06	955920	0.27	-	-	-	-	-	-	-	-
1B-HG2	10-3-22 13:25	10-14-22 14:57	11.06	955920	0.1	-	-	-	-	-	-	-	-
1C-HG1	10-3-22 13:50	10-14-22 11:51	10.92	943260	0.1	-	-	-	-	-	-	-	-
1C-HG2	10-3-22 13:50	10-14-22 11:51	10.92	943260	0.1	-	-	-	-	-	-	-	-
2-HG	10-4-22 8:50	10-13-22 12:06	9.14	789360	0.1	-	-	-	-	-	-	-	-
3-HG	10-3-22 15:00	10-14-22 14:02	10.96	946920	0.1	-	-	-	-	-	-	-	-
4-HG	10-4-22 10:34	10-14-22 14:20	10.16	877560	0.1	-	-	-	-	-	-	-	-
5-HG	10-4-22 9:17	10-14-22 15:52	10.27	887700	0.1	-	-	-	-	-	-	-	-
7-HG	10-4-22 9:59	10-14-22 15:33	10.23	884040	0.1	-	-	-	-	-	-	-	-

Red values are method detection limits.

Table B1. Cfree calculation of metals in surface water from the San Diego field deployment, as determined in DGT.

2. Average Temperature of Deployment (°C)	15

4. Thickness of the diffusive gel (mm)	4. Thickness of the Membrane (mm)	Δg (cm):	A - exposure area (cm2):	D - Diffusion coefficient of metal in the resin gel (temperature and metal specific)								
				Hg	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
				6	4.57	3.79	4.68	4.59	4.39	4.33	6.03	4.56
				Final Porewater Concentration								
				[Hg] ng/L	[Cd] µg/L	[Cr] µg/L	[Cu] µg/L	[Fe] µg/L	[Mn] µg/L	[Ni] µg/L	[Pb] µg/L	[Zn] µg/L
0.8	0.14	0.094	3.14	-	0.024	0.053	1.054	1.74	1.99	0.37	0.088	4.91
0.8	0.14	0.094	3.14	-	0.030	0.044	0.743	0.52	2.38	0.38	0.068	5.06
0.8	0.14	0.094	3.14	-	0.032	0.048	0.875	1.04	2.18	0.39	0.079	5.84
0.8	0.14	0.094	3.14	-	0.030	0.047	0.865	2.50	2.07	0.30	0.078	4.44
0.8	0.14	0.094	3.14	-	0.031	0.048	0.808	0.56	2.51	0.36	0.068	5.13
0.8	0.14	0.094	3.14	-	0.029	0.048	0.808	0.56	1.88	0.34	0.068	4.82
0.8	0.14	0.094	3.14	-	0.030	0.047	1.013	0.55	1.47	0.34	0.090	5.57
0.8	0.14	0.094	3.14	0.520	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.520	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	1.409	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.522	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.529	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.529	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.632	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.527	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.569	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.562	-	-	-	-	-	-	-	-
0.8	0.14	0.094	3.14	0.564	-	-	-	-	-	-	-	-

Red values are concentrations associated with the method detection limits.

APPENDIX C FIELD NOTES AND FORMS

Geosyntec consultants

Deployment Field Form

Project Number: PNG7584 - ER20-5261 **Project Name:** ESTCP Peeper

Site: Paleta Creek – San Diego

Date	Station ID	Sample ID	Pole Deployment		Water depth (ft)	Anchor Direction	Lat	Lon	Notes
			Times	Duration (min)					
10-3-22	1	SPW-1A	12:52 – 13:18	26	24.0	SW	32.40 25.039	117.06 58.693	2 agarose DGTs (for H_g)
10-3-22	1	SPW-1B	13:28 – 13:33	5	24.4	SW	32.40 25.060	117.06 58.079	2 agarose DGTs. Station 1B 5ft S of 1A
10-3-22	1	SPW-1C	13:55 – 13:58	3	25.2	NE	32.40 25.174	117.06 58.623	2 agarose DGTs.
10-3-22	3	SPW-3	14:58 – 15:06	8	28.0	SW	32.40 23.915	117.06 58.833	1 agarose, 1 Chelex DGT. 5 poles
10-4-22	2	SPW-2	08:50 – 08:55	5	25.0	SW	32.40 23.907	117.06 58.064	1 agarose, 1 CHELEX DGT 5 poles
10-4-22	5	SPW-5	09:13 – 09:17	4	28.0	SW	32.40 23.427	117.06 59.051	1 agarose, 1 Chelex DGT 5 poles
10-4-22	8	SPW-8	09:32 – 09:40	8	27.9	S	32.40 23.058	117.06 59.640	1 agarose, 1 Chelex DGT ✡ 5 poles
10-4-22	7	SPW-7	09:59 – 10:05	6	26.3	NW	32.40 23.874	117.06 59.816	1 agarose, 1 Chelex DGT 5 poles
10-4-22	4	SPW-4	10:28 – 10:34	6	25.1	N	32.40 24.489	117.06 59.771	1 agarose, 1 Chelex 5 poles
10-4-22	6	SPW-6	10:51 – 10:54	3	25.8	N	32.40 24.044	117.06 59.293	2 Chelex DGTs

Notes & Observations

✡ Station 8- Took GPS reading after leaving station, so GPS coordinates are uncertain at this station.

Peeper Deployment Notes
Jason Conder

10-3-22
ESTCP Peeper Project
Navy Base San Diego, San Diego, CA
Deployment Day 1

0745: Met at Pepper Park boat ramp; unload vehicle and load boat (Pi Environmental). Onboard health and safety meeting. Organize gear, peeper materials, equipment. Personnel present: Jason Conder, Flo Risacher, and Michaela Lawrence (Geosyntec); Brent Mardian and Mason (Pi Environmental); Gunther Rosen (US Navy NIWC). Weather – calm wind, cloudy, low 70°F. Unpack, prepare, and organize field gear and plan for the day with team.

1025: Left Pepper Park for Site – mouth of Paleta Creek in Navy Base San Diego.

1100: At Site in Paleta Creek. Had a little trouble getting through security barrier into the Base (clearing up and communicating access agreement and etc.). When on Site, had to wait for maintenance vessel (Port) to move some things around (booms) near Site. We used this time to prep the sandwich bag sand anchors and anchor lines.

1132: Position/anchor on Station 1.

1148: On Station 1; break for lunch.

1230: Station 1 – load up peeper frame with peepers and DGTs (2 Agarose DGTs for Hg), and then deployed frame into sediment for sample frame 1A. Had a few minor challenges with the pole and peeper frame disconnecting – the top of the frame kept getting hung on the bottom of the pole. This was because the frame was pushed too deeply into the sediment. Took 4 tries to insert the frame. Used 4 pole sections.

1325: Station 1 – sample frame 1B setup and load with peepers and DGTs (2 Agarose DGTs for Hg). Only took 1 try for insertion of frame into sediment (only took 5 minutes). The 1B location was approximately 5 feet to the southeast of where 1A was inserted. The Go Pro camera was having a bad connection and could not be used, so we used Pi Environmental's "Fishsens" (SondeCAM HD) underwater camera, which was superior and rugged and was able to connect to everyone's cell phone after installing the App.

1350: Station 1 – sample frame 1C setup and load with peepers and DGTs (2 Agarose DGTs for Hg). Only took 3 minutes to insert peeper. The 1C location was on the opposite side of the boat from 1A and 1B, approximately 12 feet northeast of 1A insertion point.

1405: Moved off of Station 1 to Station 3; applied 3-point anchor to secure in place.

1442: On Station 3. Anchoring was difficult due to light afternoon west wind an very soft sediment in the area. Important to plan sequence of stations and anchoring to avoid entangling anchor lines from the vessel and anchor lines from the peeper frames that had already been deployed.

1444: Assembling peepers and DGTs into frame for Station 3. Note – on 1A, 1B, and 1C, only the agarose DGTs (for Hg) were used in these frames. So we will get 6 Hg DGT samples from these 3 sample locations, but no regular metals (i.e., Chelex DGTs). Note that the Agarose and Chelex DGTs look identical, so all Chelex DGTs were notched on the edge with snips to we can differentiate them from the Agarose DGTs.

Peeper Deployment Notes
Jason Conder

1458: Started on Station 3. Had to use 5 poles since the water depth was 28 feet (tide was rising, and tides during the day were all positive). 30 feet deep is about the maximum depth for working with push poles since deeper water would require 6 poles, which would not be feasible for 1-2 people to operate safely. Got peeper frame for 3 deployed in 1 try.

1510: Moving to Station 2. Could not get Navy Base on radio to inform them of our plans to work more in the day, so we decided to stop work.

1515: Left Site for Pepper Park. After arriving at Pepper Park, left gear in the boat.

1535: Left Pepper Park; end of day.

10-4-22
ESTCP Peeper Project
Navy Base San Diego, San Diego, CA
Deployment Day 2

0731: At Pepper Park to ready boat. Onboard health and safety meeting. Organize gear, peeper materials, equipment. Personnel present: Jason Conder, Flo Risacher, and Michaela Lawrence (Geosyntec); Brent Mardian and Mason (Pi Environmental); Gunther Rosen (US Navy NIWC). Weather – calm wind, cloudy, low 70°F.

0745: Left Pepper Park for Site.

0758: Arrived at Base barrier gate to wait on tug to open gate to base.

0820: Gate finally open; accessing Navy Base San Diego.

0826: At Site. Navigate to Station 2. Floating dock was partly in the way, so we got as close as possible.

0840: At Station 2; build peeper frame- load up peeper frame with peepers and DGTs (1 Agarose DGT for Hg and 1 Chelex DGT for metals).

0850: Frame and pole ready; begin pole assembly and insertion. Had to use 5 poles.

0855: Complete insertion. Got good video.

0859: Navigate and anchor at Station 5. Marked the station location with a marker buoy.

0908: Anchored at Station 5; build peeper frame- load up peeper frame with peepers and DGTs (1 Agarose DGT for Hg and 1 Chelex DGT for metals).

0917: Station 5 complete. Navigated to Station 8. Dropped buoy marker.

0930: On Station 8; build peeper frame- load up peeper frame with peepers and DGTs (1 Agarose DGT for Hg and 1 Chelex DGT for metals).

0932: Started insertion at Station 8. Took 8 minutes. When pulling up pole, anchor line got hung on pole, so we re-threw sand bag anchor. We do not think the frame was dislodged from the sediment.

0942: Moving to Station 7, but then went back to Station 8 to record GPS location. Reported GPS coordinates may be a little off from where frame was inserted.

0949: Dropped marker buoy at Station 7; build peeper frame- load up peeper frame with peepers and DGTs (1 Agarose DGT for Hg and 1 Chelex DGT for metals).

0956: On Station 7. Three-point anchoring (as at all stations today). Wind was calm, so that helped a lot in anchoring.

0959: Inserted peeper frame at Station 7. Boat swung off station a bit, so we might be 15-20 feet from the actual planned station.

1009: Moved from Station 7. Took a break to drill out the holes (for the cotter pin) on the push poles a little more so they would accommodate the pin more easily. Headed to Station 4.

1018: On Station 4; build peeper frame- load up peeper frame with peepers and DGTs (1 Agarose DGT for Hg and 1 Chelex DGT for metals).

1028: Started deployment of frame at Station 4.

1034: Finished Station 4 frame insertion. Moving to Station 6. Start build peeper frame- load up peeper frame with peepers and DGTs (2 Chelex DGT for metals – NO AGAROSE DGT here). Saved 4 Chelex DGTs for use in blank analysis, as needed. No more agarose DGTs are available (they were all deployed).

1039: On Station 6. Saved 8 peepers for blanks and 4 Chelex DGTs for blanks.

1048: Re-positioning boat and re-anchor for Station 6.

1051: On Station 6. Start deployment. Always check to make sure anchor line not caught on pole before/as pulling pole away from inserted peeper frame.

1054: Finished Station 6. Deployed ROV, but not well configured today to view peeper frames or bottom.

1116: Started breaking down poles and equipment and pulling anchors.

1128: Left Site.

1140: Exited gate at Base. Visited areas nearby Coronado Bridge.

1154: Headed back to Pepper Park.

1205: At Pepper Park to unload and de-mobe from the boat.

1216: Finished de-mobe. End of day.

Geosyntec consultants

DGT Retrieval Field Form

Project Number: PNG7584 - ER20-5261 **Project Name:** ESTCP Peeper

Site: Paleta Creek – San Diego

Recorded by: Jason Conde

Station ID	Sample ID	Retrieval		Notes
		Date	Time	
1A	1A-HG1	10-14-22	14:55	
1A	1A-HG2	10-14-22	14:55	
1B	1B-HG1	10-14-22	14:57	
1B	1B-HG2	~~10-14-22~~ 10-14-22	~~14:57~~ 11:50	
1C	1C-HG1	10-14-22	11:50	
1C	1C-HG2	10-14-22	11:50	
2	2-HG	10-13-22	12:05	Snagged with hook.
2	2-ME	10-13-22	12:05	Snagged with hook.
3	3-HG	10-~~13~~14-22	14:01	
3	3-ME	10-~~13~~14-22	14:01	
4	4-HG	10-14-22	14:18	
4	4-ME	10-14-22	14:18	
5	5-HG	10-14-22	15:50	
5	5-ME	10-14-22	15:50	
6	6-ME1	10-~~13~~14-22	12:49	
6	6-ME2	10-~~13~~14-22	12:49	
7	7-HG	10-14-22	15:32	
7	7-ME	10-14-22	15:32	
8	8-HG	—	—	Did not locate Station 8 array
8	8-ME	—	—	Did not locate Station 8 array

Notes and Observations:

Geosyntec consultants

Peeper Retrieval and Processing Field Form

Project Number: PNG7584 - ER20-5261 **Project Name:** ESTCP Peeper

Site: Paleta Creek – San Diego

Recorded by: Jason Conder

Station ID	Sample ID	Retrieval ★		Processing ★★		Mtls (mL)	Br (mL)	Notes
		Date	Time	Date	Time			
1A	1A-PW	10-14-22	14:58	10-14-22	17:39	40	20	1 paper had sediment particles
1A	1A-SW	10-14-22	14:58	10-14-22	17:43	20	20	1 peeper was punctured 1 peeper had a 0.5-cm diameter orange/brown blob
1B	1B-PW	10-14-22	14:56	10-14-22	17:18	60	20	
1B	1B-SW	10-14-22	14:56	10-14-22	17:13	60	20	
1C	1C-PW	10-~~13~~ 14-22	11:51	10-14-22	18:16	60	20	
1C	1C-SW	10-~~13~~ 14-22	11:51	10-14-22	18:10	60	20	
2	2-PW	10-~~13~~ 13-22	12:07	10-13-22	16:18	60	20	snagged with grapple hook
2	2-SW	10-13-22	12:06	10-13-22	16:11	60	20	Snagged with grapple hook
3	3-PW	10-14-22	14:02	10-~~13~~ 14-22	17:32	20 ~~40~~	20	Only got 3, 1 was punctured, 1 had particles in the peeper
3	3-SW	10-14-22	14:02	10-14-22	17:48	60	20	

★ time noted is when peepers placed in storage bags with oxy munchers.

★★ time note is when sample bottles closed.

Geosyntec consultants

Peeper Retrieval and Processing Field Form

Station ID	Sample ID	Retrieval		Processing		Mtls (mL)	Br (mL)	Notes
		Date	Time	Date	Time			
4	4-PW	10-14-22	14:20	10-14-22	17:52	40	20	I ~~may have~~ had sed in it.
4	4-SW	10-14-22	14:20	10-14-22	17:56	40	20	I had particles
5	5-PW	10-14-22	15:52	10-14-22	17:07	60	20	
5	~~5-PW~~ 5-SW	10-14-22	15:52	10-14-22	17:02	60	20	
6	6-SW	10-14-22	12:49	10-14-22	18:07	40 ~~60~~	20 ~~20~~	Only got 3 peepers, 1 was punctured
6	6-PW	10-14-22	12:49	10-14-22	18:04	60	20	
7	7-PW	10-14-22	15:33	10-14-22	18:00	60	20	I had 0.5-cm orange blob in it, but was included in the Br sample (20 mL)
7	7-SW	10-14-22	15:33	10-14-22	17:27	60	20	
8	8-PW	—	—	—	—	0	0	Did not locate station 8 array
8	8-SW	—	—	—	—	0	0	Did not locate Station 8 array
Notes & Observations								
X	FB	NA (Field Blank)		10-13-22	16:02	60	20	

Peeper Retrieval Notes
Jason Conder

10-13-22
ESTCP Peeper Project
Navy Base San Diego, San Diego, CA
Retrieval Day 1

0744: Arrived at Pepper Park boat ramp; unload vehicle and load boat (Pi Environmental). Onboard health and safety meeting. Organize gear, peeper materials, equipment. Personnel present: Jason Conder, Flo Risacher, and Michaela Lawrence (Geosyntec); Brent Mardian and Mason (Pi Environmental); Gunther Rosen (US Navy NIWC). Weather – calm wind, cloudy, high 60s°F.

0817: Left Pepper Park for Site – mouth of Paleta Creek in Navy Base San Diego, San Diego, CA.

0824: At security barrier gate to Navy Base San Diego to request access.

0838: Accessed Base.

0848: At Site, cruised to Station 1A/1B/1C area; looked at sonar.

0858: At Station 1 area. Booms were in the way, partly.

0902: First throw of grappling hook to snag station 1 peeper arrays. Various techniques tried, but overall, no success. Even tried 2 grappling hooks at the same time. Added weight (2 pound or so) to top of hook to make sure it sinks well and scrapes bottom, but that did not seem to help much. The issue was that the anchor lines were too short – the lines were only about 5 to 10 feet out from the peeper arrays, which does not make a large target to snag with the hooks given the uncertainty around GPS locations and vessel positioning. Need to have at least 30 to 40 feet of rope for the anchor line, so if the water depth is 30 feet, plan on an anchor line of 60-70 feet so that the anchor weight (sand bag) can be thrown 30 feet or so from the vessel.

1204: After tying up to floating bumpers/infrastructure at Station 2, was able to snag the Station 2 peeper array. Packaged up peepers and DGTs for Station 2. No fouling on peepers or DGTs at Station 2 (and this was consistent for the remainder of the peeper and DGTs recovered).

1212: Break for lunch. Spent some time working with the underwater drop camera and ROV, but was not able to see anything at any of the stations.

1235: Moved back to Station 1 area and tried to retrieve. Also tried a few more Stations (1, 3, 5, etc.). Could not snag any arrays with the grappling hooks.

1415: Gave up grappling and left the Site. Will return tomorrow with scuba diver.

1422: Exited Base; headed to Pepper Park boat launch.

1434: Back at Pepper Park to unload.

1503: Went to San Diego Geosyntec office (2355 Northside Dr Suite 250, San Diego, CA) to obtain bottles.

1537: Set up processing station in parking lot at Geosyntec San Diego so we could process Station 2 samples and Field Blank samples.

Peeper Retrieval Notes
Jason Conder

1620: Finished processing. All samples (2-PW for sediment porewater, 2-SW for surface water, and FB field blank) were obtained; each sample had 1 sample for bromide and 1 sample for target metals (including lithium). Samples placed in cooler. Packed up processing materials and table.

1628: End of day.

10-14-22
ESTCP Peeper Project
Navy Base San Diego, San Diego, CA
Retrieval Day 2

0740: Arrived at Pepper Park boat ramp. Pi Environmental put boat in water. Unload vehicle and load boat (Pi Environmental). Organize gear, peeper materials, equipment. Personnel present: Jason Conder, Flo Risacher, and Michaela Lawrence (Geosyntec); Brent Mardian and Mason (Pi Environmental); Gunther Rosen (US Navy NIWC).

0835: Left Pepper Park to get 3 scuba tanks from a local dive shop. Rest of crew went to the Site to try to locate and retrieve peeper arrays using grappling hook and the side scan sonar to help better visualize. Was not successful.

1103: Back at Pepper Park with scuba tanks. Boat returned shortly thereafter and we loaded tanks on boat. Took a brief break for lunch at Pepper Park.

1120: Left Pepper Park for Site.

1142: On Site. Navigated to Station 1 to mark it with a marker buoy.

1147: Diver entered the water from the boat, swam to the marker buoy, and descended along the marker buoy line.

1149: Diver returned to the surface with the peeper array for Station 1C. Pulled anchor and moved to Station B location.

1154: Dropped buoy at Station 1B.

1156: Diver down at Station 1B.

1158: Diver up at 1B. Did not find array. Station 1B coordinates (from deployment) are suspect. 1B should be 5 to 10 feet away from 1A and 1C, but GPS coordinates indicate it is 50 feet away. Most likely this was an error in GPS or recording the coordinates.

1206: Dropped marker buoy at Station 7, but re-pulled buoy since it did not appear to be on target.

1212: Dropped marker buoy at Station 7, 2nd attempt.

1213: Diver down at Station 7. Spent 6 minutes looking for array.

1222: Moved buoy to Station 6.

1225: Diver down at Station 6.

1241: Re-dropped anchor at Station 6. Diver down Station 6.

1250: Diver up with Station 6 array. Packaged peepers and DGTs from Station 6 and headed to 5. The key to retrieval is having accurate GPS with good refresh rates and dropping the marker buoy accurately.

1255: Dropped buoy at Station 5. Took a short (~25 minute) break. During this break, we rigged up a 60-foot line with a sand bag anchor weight at each end. One bag was dropped adjacent to the boat (about 25-30 feet water depth). Once that bag was on the bottom, the other bag was thrown from the boat, and it landed in the water approximately 30 feet away – much farther than we had been able to throw the sand bag during last week's deployment. After this, a grappling hook was thrown in the water about 20 feet from the boat in the approximate area of the line. The hook snagged the anchor line on the first try and the 60-ft line was easily retrieved. The key to this method is to have a very long line that can be thrown as far as possible from the boat (at least 30 feet), such that there is a very long linear (horizontal) length of line extending from the array insertion point to the sand bag. Recording the direction of the throw is also critical. Ideally one can record basic cardinal direction for the throw (like NW, SE, etc.), but having a handheld GPS or compass to record the direction in degrees might be even more helpful.

1309: Diver in the water for surface swim to Station 5.

1311: Diver down at Station 5.

1320: Diver back at surface; array not located.

1322: Diver back on board. Took a break for about 10 minutes.

1330: Diver back in water to try Station 5 again.

1332: Diver down at Station 5.

1342: Diver back at surface; array not located.

1344: Diver back on board; head to Station 3.

1348: Dropped marker buoy at Station 3.

1351: Diver down at Station 3.

1400: Diver back with peeper array from Station 3.

1405: Moved to Station 4 to drop buoy.

1411: Marked buoy at Station 4.

1413: Diver in the water at Station 4. Diver down at Station 4.

1417: Diver back with peeper array from Station 4.

1420: Pulled anchor buoy. Moved boat back to Station 1A. Dropped anchor buoy.

1425: Diver down at Station 1A.

1435: Diver back at surface; array not located. Re-positioned buoy, as we believed it may be off target.

1442: Dropped buoy for 2nd time at Station 1A. Diver down at Station 1A.

1453: Diver back with peeper arrays from Station 1A and 1B. Peeper arrays were entangled in/blocked by underwater debris (a sunken oil boom/barrier). Packed up peepers and DGTs, pulled buoy marker, and moved to Station 8.

1507: Dropped marker buoy at Station 8. Diver in the water.

1509: Diver down at Station 8.

1519: Diver back at surface; array not located. Pulled buoy and moved to Station 7.

1523: Dropped buoy at Station 7.

1524: Diver down at Station 7.

1530: Diver back with peeper array from Station 7.

1540: Dropped buoy at Station 5 again. Diver down at Station 5.

1548: Diver back with peeper array from Station 5. Packed DGTs and peepers for Station 5. GPS coordinates for Station 8 (which was tried) are believed to be suspect because we did not get coordinates on the push pole at time of deployment (went back to location after moving boat and took a reading, as this was best we could do).

1555: Left Site.

1617: Back at Pepper Park to unload boat.

1632: Set up processing station at Pepper Park parking lot. Prepared bottle labels and organized processing materials, then filled out chain or custody forms.

1700: Start processing of peeper samples. Have 8 sediment porewater (PW) and 8 surface water (SW) samples to do.

1814: Finished processing of last sample. Begin packing up field table and materials.

1829: Finished packing and de-mobe. Left Pepper Park. End of day.

APPENDIX D CHAIN OF CUSTODY

Chain of Custody Record

eurofins | Environment Testing America

Eurofins Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Patrick Garcia-Strickl	Carrier: FedEx
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455		
San Diego, CA 92108	**Analysis Turnaround Time**		
437.347.3455 Phone	☐ CALENDAR DAYS ☑ WORKING DAYS		
(xxx) xxx-xxxx FAX	TAT if different from Below _____		
Project Name: PNG7584	☐ 2 weeks		
Site: Paleta Creek	☐ 1 week		
P O # 100034641	☐ 2 days		
	☐ 1 day		

Eurofins Environment Testing America 1

COC No: 1 of 2 COCs

TALS Project #:

Sampler: F Risacher

For Lab Use Only:
Walk-in Client:
Lab Sampling:

Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	EPA 7470A (mercury	Sample Specific Notes:
1A-HG1	10/14/22	1455	C	DGT	1	Y	N	X	
1A-HG2	10/14/22	1455	C	DGT	1	Y	N	X	
1B-HG1	10/14/22	1457	C	DGT	1	Y	N	X	
1B-HG2	10/14/22	1457	C	DGT	1	Y	N	X	
1C-HG1	10/14/22	1150	C	DGT	1	Y	N	X	
1C-HG2	10/14/22	1150	C	DGT	1	Y	N	X	
2-HG	10/14/22	1205	C	DGT	1	Y	N	X	
3-HG	10/14/22	1401	C	DGT	1	Y	N	X	
4-HG	10/14/22	1418	C	DGT	1	Y	N	X	
5-HG	10/14/22	1550	C	DGT	1	Y	N	X	
7-HG	10/14/22	1532	C	DGT	1	Y	N	X	
~~8-HG~~			C	DGT	1	Y	N	(MD) 10/17/22	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____ Corr'd: _____		Therm ID No.: _____
Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10.15.22 09:30	Received by: Jason Conder	Company: Geosyntec	Date/Time: 10-15-22 09:30
Relinquished by: Jason Conder	Company: Geosyntec	Date/Time: 10.17.22 14:34	Received by: Fed Ex	Company: Fed Ex	Date/Time: 10-17-22 14:34
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Chain of Custody Record

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238-2907
phone 412.963.7058 fax 412.963.2468

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22	COC No: 1
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Carrie Gamber	Carrier: FedEx	2 of 2 COCs
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455			TALS Project #:
San Diego, CA 92108	**Analysis Turnaround Time**			Sampler: F. Risacher
437.347.3455 Phone	☐ CALENDAR DAYS ☑ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx FAX	TAT if different from Below _____			Walk-in Client:
Project Name: PNG7584	☐ 2 weeks			Lab Sampling:
Site: Paleta Creek	☐ 1 week			Job / SDG No.:
P O # 100034641	☐ 2 days ☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS/MSD (Y/N)	EPA 6020 (Cd,Cr,Cu,Ni,Pb,Zn,Fe,Mn,Li)	EPA 7470A (mercury	EPA 300 (bromide)	Sample Specific Notes:
5-PW	10/14/22	1552	C	Water	2	Y	N	X	X	X	
5-SW	10/14/22	1552	C	Water	2	Y	N	X	X	X	
6-PW	10/14/22	1249	C	Water	2	Y	N	X	X	X	
6-SW	10/14/22	1249	C	Water	2	Y	N	X	X	X	
7-PW	10/14/22	1533	C	Water	2	Y	N	X	X	X	
7-SW	10/14/22	1533	C	Water	2	Y	N	X	X	X	
~~8-PW~~			C	Water	2	Y	N	X	X	X	
~~8-SW~~			C	Water	2	Y	N				

10/14/22 10/14/22

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____	Corr'd: _____	Therm ID No.: _____	
Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10-15-22 09:30	Received by: Jason Corder	Company: Geosyntec	Date/Time: 10-15-22 09:30	
Relinquished by: Jason Corder	Company: Geosyntec	Date/Time: 10-17-22 14:34	Received by: Fed Ex	Company: Fed Ex	Date/Time: 10-17-22 14:34	
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:	

Chain of Custody Record

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238-2907
phone 412.963.7058 fax 412.963.2468

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22	COC No: 1
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Carrie Gamber	Carrier: FedEx	___1___ of ___2___ COCs
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455			TALS Project #:
San Diego, CA 92108	Analysis Turnaround Time			Sampler: F. Risacher
437.347.3455 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below _____			Walk-in Client:
Project Name: PNG7584	☐ 2 weeks			Lab Sampling:
Site: Paleta Creek	☐ 1 week			
P O # 100034641	☐ 2 days			Job / SDG No.:
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	EPA 6020 (Cd,Cr,Cu,Ni,Pb,Zn,Fe,Mn,Li)	EPA 7470A (mercury	EPA 300 (bromide)	Sample Specific Notes:
1A-PW	10/14/22	1458	C	Water	2	Y	N	X	X	X	
1A-SW	10/14/22	1458	C	Water	2	Y	N	X	X	X	
1B-PW	10/14/22	1456	C	Water	2	Y	N	X	X	X	
1B-SW	10/14/22	1456	C	Water	2	Y	N	X	X	X	
1C-PW	10/14/22	1151	C	Water	2	Y	N	X	X	X	
1C-SW	10/14/22	1151	C	Water	2	Y	N	X	X	X	
2-PW	10/13/22	1207	C	Water	2	Y	N	X	X	X	
2-SW	10/13/22	1206	C	Water	2	Y	N	X	X	X	
3-PW	10/14/22	1402	C	Water	2	Y	N	X	X	X	
3-SW	10/14/22	1402	C	Water	2	Y	N	X	X	X	
4-PW	10/14/22	1420	C	Water	2	Y	N	X	X	X	
4-SW	10/14/22	1420	C	Water	2	Y	N	X	X	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.:

Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10.14.22 09:30	Received by: Jason Conder	Company: Geosyntec	Date/Time: 10-14-22 09:30
Relinquished by: Jason Conder	Company: Geosyntec	Date/Time: 10.17.22 14:34	Received by: Fed Ex	Company: Fed Ex	Date/Time: 10.17.22 14:34
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Chain of Custody Record

eurofins | Environment Testing America

Eurofins Seattle
5755 8th Street East
Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22	COC No: 2
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Patrick Garcia-Strick	Carrier: FedEx	2 of 2 COCs
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455			TALS Project #:
San Diego, CA 92108	Analysis Turnaround Time			Sampler: F Risacher
437.347.3455 Phone	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below _____			Walk-in Client:
Project Name: PNG7584	☐ 2 weeks			Lab Sampling:
Site: Paleta Creek	☐ 1 week			Job / SDG No.:
P O # 100034641	☐ 2 days			
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	EPA 6020 (Cd,Cr,Cu,Ni,Pb,Zn,Fe,Mn,Li)	Sample Specific Notes:
2-ME	10/13/22	1205	C	DGT	1	Y	N	X	
3-ME	10/14/22	1401	C	DGT	1	Y	N	X	
4-ME	10/14/22	1418	C	DGT	1	Y	N	X	
5-ME	10/14/22	1550	C	DGT	1	Y	N	X	
6-ME1	10/14/22	1249	C	DGT	1	Y	N	X	
6-ME2	10/14/22	1249	C	DGT	1	Y	N	X	
7-ME	10/14/22	1532	C	DGT	1	Y	N	X	
~~8-ME~~			C	DGT	1	Y	N	(MS) 10/14/22	
								(MSD) 10/14/22	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd:_____ Corr'd:_____		Therm ID No.:_____
Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10.15.22 09:30	Received by: Jason Conder	Company: Geosyntec	Date/Time: 10-15-22 09:30
Relinquished by: Jason Conder	Company: Geosyntec	Date/Time: 14:34 10-17-22	Received by: FedEx	Company: FedEx	Date/Time: 10-17-22 14:34
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

APPENDIX E ANALYTICAL LABORATORY REPORTS

eurofins | Environment Testing

ANALYTICAL REPORT

Eurofins Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

Laboratory Job ID: 580-118944-1
Client Project/Site: Trace Metals and Mercury Analysis

For:
Geosyntec Consultants, Inc.
1173 Cyrville Road
Suite 210
Ottawa, Ontario K1J 7S6

Attn: Florent Risacher

Authorized for release by:
11/14/2022 3:36:39 PM

Lilly-Anna LaCount, Project Manager
(253)922-2310
Lilly-Anna.Lacount@et.eurofinsus.com

Table of Contents

Case Narrative

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Job ID: 580-118944-1

Laboratory: Eurofins Seattle

Narrative

Job Narrative
580-118944-1

Comments
No additional comments.

Receipt
The samples were received on 10/18/2022 9:30 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was -0.1º C.

Metals
Method HNO3 Prep: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) for preparation batch 580-408820. A laboratory control sample/laboratory control sample duplicate was used in lieu of this to assess precision and accuracy.

Method HNO3 Prep: The following samples were placed in the same sampling bag with no way to identify which samples were which: 1C-HG1 (580-118944-5) and 1C-HG2 (580-118944-6). Per client request, the laboratory assigned the samples at random and documented said assignment.

Method HNO3 Prep: Insufficient sample volume was available to perform a matrix spike/matrix spike duplicate (MS/MSD) associated with preparation batch 580-409072. A laboratory control sample/laboratory control sample duplicate was used in lieu of this to assess precision and accuracy.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Client Sample Results

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1A-HG1
Lab Sample ID: 580-118944-1
Date Collected: 10/14/22 14:55
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 18:57	20

Client Sample Results

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1A-HG2 **Lab Sample ID: 580-118944-2**
Date Collected: 10/14/22 14:55 **Matrix: Filter**
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:01	20

Client Sample Results

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1B-HG1
Lab Sample ID: 580-118944-3
Date Collected: 10/14/22 14:57
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.27		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:05	20

Client Sample Results

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1B-HG2
Lab Sample ID: 580-118944-4
Date Collected: 10/14/22 14:57
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:09	20

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1C-HG1
Lab Sample ID: 580-118944-5
Date Collected: 10/14/22 11:50
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:13	20

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1C-HG2
Lab Sample ID: 580-118944-6
Date Collected: 10/14/22 11:50
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:17	20

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 2-HG
Lab Sample ID: 580-118944-7
Date Collected: 10/13/22 12:05
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:30	20

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 3-HG
Lab Sample ID: 580-118944-8
Date Collected: 10/14/22 14:01
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:34	20

Client Sample Results

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 4-HG **Lab Sample ID: 580-118944-9**
Date Collected: 10/14/22 14:18 **Matrix: Filter**
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:38	20

Client Sample Results

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 5-HG
Lab Sample ID: 580-118944-10
Date Collected: 10/14/22 15:50
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:42	20

Client Sample Results

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 7-HG
Lab Sample ID: 580-118944-11
Date Collected: 10/14/22 15:32
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1631B - Mercury, Low Level (CVAFS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 19:47	20

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 2-ME
Lab Sample ID: 580-118944-12
Date Collected: 10/14/22 12:05
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0029**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Copper	**0.13**		0.013		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Iron	**0.21**		0.13		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Manganese	**0.23**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Nickel	**0.042**		0.013		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Lead	**0.014**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 21:55	1
Zinc	**0.59**		0.025		ug/Sample		11/07/22 12:40	11/08/22 21:55	1

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 3-ME
Lab Sample ID: 580-118944-13
Date Collected: 10/13/22 14:01
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0044**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Copper	**0.11**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Iron	ND		0.13		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Manganese	**0.33**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Nickel	**0.052**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Lead	**0.013**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 22:00	1
Zinc	**0.73**		0.025		ug/Sample		11/07/22 12:40	11/08/22 22:00	1

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 4-ME
Lab Sample ID: 580-118944-14
Date Collected: 10/14/22 14:18
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0043**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Copper	**0.12**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Iron	**0.14**		0.13		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Manganese	**0.28**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Nickel	**0.049**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Lead	**0.014**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 22:04	1
Zinc	**0.78**		0.025		ug/Sample		11/07/22 12:40	11/08/22 22:04	1

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 5-ME
Lab Sample ID: 580-118944-15
Date Collected: 10/14/22 15:50
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0040**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Copper	**0.12**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Iron	**0.34**		0.13		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Manganese	**0.27**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Nickel	**0.038**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Lead	**0.014**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 22:09	1
Zinc	**0.60**		0.025		ug/Sample		11/07/22 12:40	11/08/22 22:09	1

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 6-ME1
Lab Sample ID: 580-118944-16
Date Collected: 10/14/22 12:49
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0041**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Copper	**0.11**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Iron	ND		0.13		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Manganese	**0.32**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Nickel	**0.045**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Lead	**0.012**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 22:13	1
Zinc	**0.68**		0.025		ug/Sample		11/07/22 12:40	11/08/22 22:13	1

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 6-ME2
Lab Sample ID: 580-118944-17
Date Collected: 10/14/22 12:49
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0038**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Copper	**0.11**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Iron	ND		0.13		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Manganese	**0.24**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Nickel	**0.043**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Lead	**0.012**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 22:18	1
Zinc	**0.64**		0.025		ug/Sample		11/07/22 12:40	11/08/22 22:18	1

Client: Geosyntec Consultants, Inc.
Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 7-ME
Lab Sample ID: 580-118944-18
Date Collected: 10/14/22 15:32
Matrix: Filter
Date Received: 10/18/22 09:30

Method: EPA 1638 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.0040**		0.00075		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Copper	**0.14**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Iron	ND		0.13		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Manganese	**0.19**		0.0050		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Nickel	**0.044**		0.013		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Lead	**0.016**		0.0015		ug/Sample		11/07/22 12:40	11/08/22 22:22	1
Zinc	**0.75**		0.025		ug/Sample		11/07/22 12:40	11/08/22 22:22	1

Method: 1631B - Mercury, Low Level (CVAFS)

Lab Sample ID: MB 580-408820/1-A
Matrix: Filter
Analysis Batch: 409033

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 408820

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 18:27	20

Lab Sample ID: MB 580-408820/2-A
Matrix: Filter
Analysis Batch: 409033

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 408820

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 18:40	20

Lab Sample ID: MB 580-408820/3-A
Matrix: Filter
Analysis Batch: 409033

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 408820

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.25		ng/Sample		11/03/22 16:21	11/04/22 18:44	20

Lab Sample ID: LCS 580-408820/4-A
Matrix: Filter
Analysis Batch: 409033

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 408820

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			100	84.9		ng/Sample		85	75 - 125		

Lab Sample ID: LCSD 580-408820/5-A
Matrix: Filter
Analysis Batch: 409033

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 408820

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			100	85.5		ng/Sample		85	75 - 125	1	24

Method: 1638 - Metals (ICP/MS)

Lab Sample ID: MB 580-409072/1-A
Matrix: Filter
Analysis Batch: 409433

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 409072

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.00075		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Chromium	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Copper	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Iron	ND		0.13		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Manganese	ND		0.0050		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Nickel	ND		0.013		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Lead	ND		0.0015		ug/Sample		11/07/22 12:40	11/08/22 21:19	1
Zinc	ND		0.025		ug/Sample		11/07/22 12:40	11/08/22 21:19	1

Method: 1638 - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 580-409072/3-A
Matrix: Filter
Analysis Batch: 409433

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 409072

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Cadmium	1.00	0.940		ug/Sample		94	85 - 115
Chromium	1.25	1.17		ug/Sample		94	85 - 115
Copper	1.25	1.20		ug/Sample		96	85 - 115
Iron	31.3	29.4		ug/Sample		94	85 - 115
Manganese	1.25	1.18		ug/Sample		95	85 - 115
Nickel	1.25	1.21		ug/Sample		97	85 - 115
Lead	1.25	1.12		ug/Sample		90	85 - 115
Zinc	1.25	1.21		ug/Sample		97	85 - 115

Lab Sample ID: LCSD 580-409072/4-A
Matrix: Filter
Analysis Batch: 409433

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 409072

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Cadmium	1.00	0.941		ug/Sample		94	85 - 115	0	20
Chromium	1.25	1.17		ug/Sample		93	85 - 115	0	20
Copper	1.25	1.19		ug/Sample		96	85 - 115	0	20
Iron	31.3	27.2		ug/Sample		87	85 - 115	8	20
Manganese	1.25	1.17		ug/Sample		94	85 - 115	1	20
Nickel	1.25	1.21		ug/Sample		97	85 - 115	0	20
Lead	1.25	1.16		ug/Sample		92	85 - 115	3	20
Zinc	1.25	1.19		ug/Sample		95	85 - 115	1	20

Lab Chronicle

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 1A-HG1 — Lab Sample ID: 580-118944-1
Date Collected: 10/14/22 14:55 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 18:57

Client Sample ID: 1A-HG2 — Lab Sample ID: 580-118944-2
Date Collected: 10/14/22 14:55 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:01

Client Sample ID: 1B-HG1 — Lab Sample ID: 580-118944-3
Date Collected: 10/14/22 14:57 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:05

Client Sample ID: 1B-HG2 — Lab Sample ID: 580-118944-4
Date Collected: 10/14/22 14:57 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:09

Client Sample ID: 1C-HG1 — Lab Sample ID: 580-118944-5
Date Collected: 10/14/22 11:50 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:13

Client Sample ID: 1C-HG2 — Lab Sample ID: 580-118944-6
Date Collected: 10/14/22 11:50 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:17

Lab Chronicle

Client: Geosyntec Consultants, Inc.
Project/Site: Trace Metals and Mercury Analysis

Job ID: 580-118944-1

Client Sample ID: 2-HG
Date Collected: 10/13/22 12:05
Date Received: 10/18/22 09:30

Lab Sample ID: 580-118944-7
Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:30

Client Sample ID: 3-HG
Date Collected: 10/14/22 14:01
Date Received: 10/18/22 09:30

Lab Sample ID: 580-118944-8
Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:34

Client Sample ID: 4-HG
Date Collected: 10/14/22 14:18
Date Received: 10/18/22 09:30

Lab Sample ID: 580-118944-9
Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:38

Client Sample ID: 5-HG
Date Collected: 10/14/22 15:50
Date Received: 10/18/22 09:30

Lab Sample ID: 580-118944-10
Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:42

Client Sample ID: 7-HG
Date Collected: 10/14/22 15:32
Date Received: 10/18/22 09:30

Lab Sample ID: 580-118944-11
Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			408820	AJR	EET SEA	11/03/22 16:21
Total Recoverable	Analysis	1631B		20	409033	COW	EET SEA	11/04/22 19:47

Client Sample ID: 2-ME
Date Collected: 10/14/22 12:05
Date Received: 10/18/22 09:30

Lab Sample ID: 580-118944-12
Matrix: Filter

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 21:55

Lab Chronicle

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Client Sample ID: 3-ME — Lab Sample ID: 580-118944-13
Date Collected: 10/13/22 14:01 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 22:00

Client Sample ID: 4-ME — Lab Sample ID: 580-118944-14
Date Collected: 10/14/22 14:18 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 22:04

Client Sample ID: 5-ME — Lab Sample ID: 580-118944-15
Date Collected: 10/14/22 15:50 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 22:09

Client Sample ID: 6-ME1 — Lab Sample ID: 580-118944-16
Date Collected: 10/14/22 12:49 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 22:13

Client Sample ID: 6-ME2 — Lab Sample ID: 580-118944-17
Date Collected: 10/14/22 12:49 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 22:18

Client Sample ID: 7-ME — Lab Sample ID: 580-118944-18
Date Collected: 10/14/22 15:32 — **Matrix: Filter**
Date Received: 10/18/22 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total Recoverable	Prep	HNO3 Prep			409072	AJR	EET SEA	11/07/22 12:40
Total Recoverable	Analysis	1638		1	409433	AJR	EET SEA	11/08/22 22:22

Laboratory References:
EET SEA = Eurofins Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Laboratory: Eurofins Seattle

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Alaska (UST)	State	20-004	02-19-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

ANAB	Dept. of Defense ELAP	L2236	01-19-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

ANAB	Dept. of Energy	L2236	01-19-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

ANAB	ISO/IEC 17025	L2236	01-19-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Laboratory: Eurofins Seattle (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Arkansas DEQ	State	8801526	05-23-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

California	State	2954	07-07-22 *
Florida	NELAP	E87575	06-30-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Louisiana	NELAP	03073	06-30-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Maine	State	WA01273	05-02-24

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Laboratory: Eurofins Seattle (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Montana (UST)	State	NA	04-14-27

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

New Jersey	NELAP	WA014	06-30-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

New York	NELAP	11662	04-01-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead

Laboratory: Eurofins Seattle (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Authority	Program	Identification Number	Expiration Date
Oregon	NELAP	4167	07-08-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Authority	Program	Identification Number	Expiration Date
US Fish & Wildlife	US Federal Programs	A20571	06-30-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Authority	Program	Identification Number	Expiration Date
USDA	US Federal Programs	P330-20-00031	12-31-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Authority	Program	Identification Number	Expiration Date
Washington	State	C788	07-13-23

Accreditation/Certification Summary

Client: Geosyntec Consultants, Inc. Job ID: 580-118944-1
Project/Site: Trace Metals and Mercury Analysis

Laboratory: Eurofins Seattle (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Wisconsin	State	399133460	08-31-23

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
1631B	HNO3 Prep	Filter	Mercury
1638	HNO3 Prep	Filter	Cadmium
1638	HNO3 Prep	Filter	Chromium
1638	HNO3 Prep	Filter	Copper
1638	HNO3 Prep	Filter	Iron
1638	HNO3 Prep	Filter	Lead
1638	HNO3 Prep	Filter	Manganese
1638	HNO3 Prep	Filter	Nickel
1638	HNO3 Prep	Filter	Zinc

Sample Summary

Client: Geosyntec Consultants, Inc.
Project/Site: Trace Metals and Mercury Analysis

Job ID: 580-118944-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-118944-1	1A-HG1	Filter	10/14/22 14:55	10/18/22 09:30
580-118944-2	1A-HG2	Filter	10/14/22 14:55	10/18/22 09:30
580-118944-3	1B-HG1	Filter	10/14/22 14:57	10/18/22 09:30
580-118944-4	1B-HG2	Filter	10/14/22 14:57	10/18/22 09:30
580-118944-5	1C-HG1	Filter	10/14/22 11:50	10/18/22 09:30
580-118944-6	1C-HG2	Filter	10/14/22 11:50	10/18/22 09:30
580-118944-7	2-HG	Filter	10/13/22 12:05	10/18/22 09:30
580-118944-8	3-HG	Filter	10/14/22 14:01	10/18/22 09:30
580-118944-9	4-HG	Filter	10/14/22 14:18	10/18/22 09:30
580-118944-10	5-HG	Filter	10/14/22 15:50	10/18/22 09:30
580-118944-11	7-HG	Filter	10/14/22 15:32	10/18/22 09:30
580-118944-12	2-ME	Filter	10/14/22 12:05	10/18/22 09:30
580-118944-13	3-ME	Filter	10/13/22 14:01	10/18/22 09:30
580-118944-14	4-ME	Filter	10/14/22 14:18	10/18/22 09:30
580-118944-15	5-ME	Filter	10/14/22 15:50	10/18/22 09:30
580-118944-16	6-ME1	Filter	10/14/22 12:49	10/18/22 09:30
580-118944-17	6-ME2	Filter	10/14/22 12:49	10/18/22 09:30
580-118944-18	7-ME	Filter	10/14/22 15:32	10/18/22 09:30

Eurofins Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

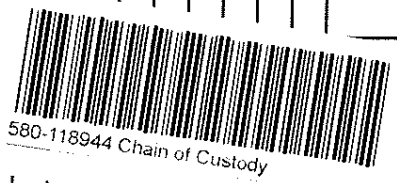
eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22	COC No: 1
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Patrick Garcia-Strick	Carrier: FedEx	1 of 2 COCs
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455			TALS Project #:
San Diego, CA 92108	Analysis Turnaround Time			Sampler: F Risacher
437.347.3455 Phone	☐ CALENDAR DAYS ☑ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below ____			Walk-in Client:
Project Name: PNG7584	☐ 2 weeks			Lab Sampling:
Site: Paleta Creek	☐ 1 week			
P O # 100034641	☐ 2 days			Job / SDG No.:
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	EPA 7470A (mercury	Sample Specific Notes:
1A-HG1	10/14/22	1455	C	DGT	1	Y	N	X	
1A-HG2	10/14/22	1455	C	DGT	1	Y	N	X	
1B-HG1	10/14/22	1457	C	DGT	1	Y	N	X	
1B-HG2	10/14/22	1457	C	DGT	1	Y	N	X	
1C-HG1	10/14/22	1150	C	DGT	1	Y	N	X	
1C-HG2	10/14/22	1150	C	DGT	1	Y	N	X	
2-HG	10/14/22	1205	C	DGT	1	Y	N	X	
3-HG	10/14/22	1401	C	DGT	1	Y	N	X	
4-HG	10/14/22	1418	C	DGT	1	Y	N	X	
5-HG	10/14/22	1550	C	DGT	1	Y	N	X	
7-HG	10/14/22	1532	C	DGT	1	Y	N	X	
~~8-HG~~			C	DGT	1	Y	N	MP 10/14/22	



Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments:

EFGSSC Dig3

0.5°C w/o CF
-0.1°C w/ CF
CF = -0.6°C

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:	Cooler Temp. (°C): Obs'd:	Corr'd:	Therm ID No.:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Florent Risacher	Geosyntec	10-15-22 09:30	Jason Conder	Geosyntec	10-15-22 09:30
Jason Conder	Geosyntec	10-17-22 14:34	Fed Ex	Fed Ex	10-17-22 14:34
			Received in Laboratory by: EFGS	FedEx	

11/14/2022

Eurofins Seattle
5755 8th Street East

Tacoma, WA 98424-1317
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

Client Contact	**Project Manager: Florent Risacher**		COC No: 2
Geosyntec Consultants	Email: frisacher@geosyntec.com	**Site Contact: Florent Risacher** Date: 10/14/22	2 of 2 COCs
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455	**Lab Contact: Patrick Garcia-Strick** Carrier: FedEx	TALS Project #:
San Diego, CA 92108	**Analysis Turnaround Time**		Sampler: F Risacher
437.347.3455 Phone	☐ CALENDAR DAYS ☑ WORKING DAYS		**For Lab Use Only:**
(xxx) xxx-xxxx FAX	TAT if different from Below _____		Walk-in Client:
Project Name: PNG7584	☐ 2 weeks		Lab Sampling:
Site: Paleta Creek	☐ 1 week		
P O # 100034641	☐ 2 days		Job / SDG No.:
	☐ 1 day		

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	EPA 6020 (Cd,Cr,Cu,Ni,Pb,Zn,Fe,Mn,Li)	Sample Specific Notes:
2-ME	10/13/22	1205	C	DGT	1	Y	N	X	
3-ME	10/14/22	1401	C	DGT	1	Y	N	X	
4-ME	10/14/22	1418	C	DGT	1	Y	N	X	
5-ME	10/14/22	1550	C	DGT	1	Y	N	X	
6-ME1	10/14/22	1249	C	DGT	1	Y	N	X	
6-ME2	10/14/22	1249	C	DGT	1	Y	N	X	
7-ME	10/14/22	1532	C	DGT	1	Y	N	X	
~~8-ME~~			C	DGT	1	Y	N	X (MW) 10/14/22	
								(MW) 10/14/22	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____ Corr'd: _____		Therm ID No.: _____
Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10.15.22 09:30	Received by: Jason Conder	Company: Geosyntec	Date/Time: 10-15-22 09:30
Relinquished by: Jason Conder	Company: Geosyntec	Date/Time: 10-17-22 14:34	Received by: FedEx	Company: FedEx	Date/Time: 10-17-22 14:34
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Geosyntec Consultants, Inc.

Job Number: 580-118944-1

Login Number: 118944
List Number: 1
Creator: Miller, Darren R

List Source: Eurofins Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	N/A	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	N/A	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	N/A	
Samples do not require splitting or compositing.	N/A	
Residual Chlorine Checked.	N/A	

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Dr. Brent Pautler
Sirem, div of Geosyntec Consultants
130 Stone Rd West
Guelph, Ontario N1G 3Z2

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JOB DESCRIPTION

Paleta Creek

JOB NUMBER

180-146342-1

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh PA 15238

See page two for job notes and contact information.

myEOL

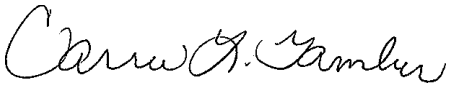
Job Notes

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to the NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory. This report is confidential and is intended for the sole use of Eurofins Environment Testing Northeast, LLC Pittsburgh and its client. All questions regarding this report should be directed to the Eurofins Environment Testing Northeast, LLC Pittsburgh Project Manager or designee who has signed this report.

PA Lab ID: 02-00416

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Pittsburgh Project Manager.

Authorization



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Authorized for release by
Carrie Gamber, Senior Project Manager
Carrie.Gamber@et.eurofinsus.com
(412)963-2428

Table of Contents

Job ID: 180-146342-1

Laboratory: Eurofins Pittsburgh

Narrative

CASE NARRATIVE

Client: Sirem, div of Geosyntec Consultants

Project: Paleta Creek

Report Number: 180-146342-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT

The samples were received on 10/18/2022; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 5.8 C.

The following sample was submitted for analysis; however, it was not listed on the Chain-of-Custody (COC): FB (180-146342-19)

Limited sample volume was received for several samples.

IC

All samples were diluted due to the nature of the sample matrix. Elevated reporting limits (RLs) are provided.

Due to the high concentration of Bromide, the matrix spike / matrix spike duplicate (MS/MSD) for analytical batch 180-415689 could not be evaluated for accuracy and precision. The associated laboratory control sample (LCS) met acceptance criteria.

The continuing calibration blank (CCB) for analytical batch 180-415689 contained Bromide above the reporting limit (RL). All reported samples associated with this CCB were either ND for this analyte or contained this analyte at a concentration greater than 10X the value found in the CCB; therefore, re-analysis of samples was not performed.

METALS

Elevated reporting limits are provided for the following samples due to the limited sample volume provided for preparation/analysis: 1A-PW (180-146342-1), 1A-SW (180-146342-2), 3-PW (180-146342-9) and 4-SW (180-146342-12).

Sample Field blank FB (180-146342-19) recovered above the reporting limit for Zinc and Lithium. There is insufficient sample for a re-scan or re-digestion; therefore the data has been reported with a narrative note.

The following samples were diluted to bring the concentration of target analytes within the calibration range: 1A-PW (180-146342-1), 1C-PW (180-146342-5), 2-PW (180-146342-7), 3-PW (180-146342-9), 5-PW (180-146342-13), 6-PW (180-146342-15), 7-PW (180-146342-17), FB (180-146342-19) and (180-146342-B-19-B SD ^1000). Elevated reporting limits (RLs) are provided.

Elevated reporting limits are provided for the following samples due to limited sample volume provided for Mercury prep: 1A-SW (180-146342-2), 3-PW (180-146342-9), 4-PW (180-146342-11) and 6-SW (180-146342-16).

Job ID: 180-146342-1 (Continued)

Laboratory: Eurofins Pittsburgh (Continued)

Definitions/Glossary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
^2	Calibration Blank (ICB and/or CCB) is outside acceptance limits.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Accreditation/Certification Summary

Client: Sirem, div of Geosyntec Consultants
Job ID: 180-146342-1
Project/Site: Paleta Creek

Laboratory: Eurofins Pittsburgh

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Arkansas DEQ	State	19-033-0	06-27-22 *
California	State	2891	04-30-23
Connecticut	State	PH-0688	09-30-22 *
Florida	NELAP	E871008	11-30-22
Georgia	State	PA 02-00416	11-30-22
Illinois	NELAP	004375	11-30-22
Kansas	NELAP	E-10350	11-30-22
Kentucky (UST)	State	162013	04-30-23
Kentucky (WW)	State	KY98043	12-31-22
Louisiana	NELAP	04041	06-30-22 *
Louisiana (All)	NELAP	04041	11-30-22
Maine	State	PA00164	03-06-24
Minnesota	NELAP	042-999-482	11-30-22
New Hampshire	NELAP	2030	11-30-22
New Jersey	NELAP	PA005	11-30-22
New York	NELAP	11182	11-30-22
North Carolina (WW/SW)	State	434	12-31-22
North Dakota	State	R-227	11-30-22
Oregon	NELAP	PA-2151	11-30-22
Pennsylvania	NELAP	02-00416	11-30-22
Rhode Island	State	LAO00362	12-31-22
South Carolina	State	89014	04-20-23
Texas	NELAP	T104704528	11-30-22
USDA	US Federal Programs	P330-16-00211	06-21-24
Utah	NELAP	PA001462019-8	05-31-23
Virginia	NELAP	10043	11-30-22
West Virginia DEP	State	142	11-30-22
Wisconsin	State	998027800	08-31-23

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Sample Summary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
180-146342-1	1A-PW	Water	10/14/22 14:58	10/18/22 10:35
180-146342-2	1A-SW	Water	10/14/22 14:58	10/18/22 10:35
180-146342-3	1B-PW	Water	10/14/22 14:56	10/18/22 10:35
180-146342-4	1B-SW	Water	10/14/22 14:56	10/18/22 10:35
180-146342-5	1C-PW	Water	10/14/22 11:51	10/18/22 10:35
180-146342-6	1C-SW	Water	10/14/22 11:51	10/18/22 10:35
180-146342-7	2-PW	Water	10/13/22 12:07	10/18/22 10:35
180-146342-8	2-SW	Water	10/13/22 12:06	10/18/22 10:35
180-146342-9	3-PW	Water	10/14/22 14:02	10/18/22 10:35
180-146342-10	3-SW	Water	10/14/22 14:02	10/18/22 10:35
180-146342-11	4-PW	Water	10/14/22 14:20	10/18/22 10:35
180-146342-12	4-SW	Water	10/14/22 14:20	10/18/22 10:35
180-146342-13	5-PW	Water	10/14/22 15:52	10/18/22 10:35
180-146342-14	5-SW	Water	10/14/22 15:52	10/18/22 10:35
180-146342-15	6-PW	Water	10/14/22 12:49	10/18/22 10:35
180-146342-16	6-SW	Water	10/14/22 12:49	10/18/22 10:35
180-146342-17	7-PW	Water	10/14/22 15:33	10/18/22 10:35
180-146342-18	7-SW	Water	10/14/22 15:33	10/18/22 10:35
180-146342-19	FB	Water	10/14/22 00:00	10/18/22 10:35

Method Summary

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Method	Method Description	Protocol	Laboratory
EPA 9056A	Anions, Ion Chromatography	SW846	EET PIT
EPA 6020B	Metals (ICP/MS)	SW846	EET PIT
EPA 7470A	Mercury (CVAA)	SW846	EET PIT
3005A	Preparation, Total Recoverable or Dissolved Metals	SW846	EET PIT
7470A	Preparation, Mercury	SW846	EET PIT

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PIT = Eurofins Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 1A-PW

Lab Sample ID: 180-146342-1
Matrix: Water
Date Collected: 10/14/22 14:58
Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 18:13	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			20 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		25			418005	11/10/22 13:08	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			20 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 15:07	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:24	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 1A-SW

Lab Sample ID: 180-146342-2
Matrix: Water
Date Collected: 10/14/22 14:58
Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 18:27	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			15 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 15:21	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			10 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:25	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 1B-PW

Lab Sample ID: 180-146342-3
Matrix: Water
Date Collected: 10/14/22 14:56
Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 18:42	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 15:35	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:26	RJR	EET PIT
	Instrument ID: HGY									

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 1B-SW

Date Collected: 10/14/22 14:56
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-4

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 18:57	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 15:49	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:27	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 1C-PW

Date Collected: 10/14/22 11:51
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-5

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 19:12	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		50			418005	11/10/22 13:12	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 16:03	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:28	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 1C-SW

Date Collected: 10/14/22 11:51
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-6

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 19:56	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 16:24	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:29	RJR	EET PIT
	Instrument ID: HGY									

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 2-PW

Lab Sample ID: 180-146342-7

Date Collected: 10/13/22 12:07

Matrix: Water

Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 20:11	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		10			418005	11/10/22 13:16	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 16:38	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:30	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 2-SW

Lab Sample ID: 180-146342-8

Date Collected: 10/13/22 12:06

Matrix: Water

Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 20:26	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 16:52	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:32	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 3-PW

Lab Sample ID: 180-146342-9

Date Collected: 10/14/22 14:02

Matrix: Water

Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 20:41	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			15 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		20			418005	11/10/22 13:23	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			15 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 17:06	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			10 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:33	RJR	EET PIT
	Instrument ID: HGY									

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 3-SW
Date Collected: 10/14/22 14:02
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-10
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 21:40	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 17:19	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:37	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 4-PW
Date Collected: 10/14/22 14:20
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-11
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 21:54	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 17:33	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			10 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:38	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 4-SW
Date Collected: 10/14/22 14:20
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-12
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 22:09	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			23 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 17:47	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:39	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 5-PW
Date Collected: 10/14/22 15:52
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-13
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 22:54	SNL	EET PIT
	Instrument ID: CHIC2100A									

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 5-PW

Date Collected: 10/14/22 15:52
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-13

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		50			418005	11/10/22 13:26	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 18:01	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:40	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 5-SW

Date Collected: 10/14/22 15:52
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-14

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 23:08	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 18:15	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:41	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 6-PW

Date Collected: 10/14/22 12:49
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-15

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 23:23	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		50			418005	11/10/22 13:30	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 18:36	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:42	RJR	EET PIT
	Instrument ID: HGY									

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 6-SW

Lab Sample ID: 180-146342-16

Date Collected: 10/14/22 12:49

Matrix: Water

Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 23:38	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 18:50	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			10 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:43	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 7-PW

Lab Sample ID: 180-146342-17

Date Collected: 10/14/22 15:33

Matrix: Water

Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/20/22 23:53	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		25			419389	11/29/22 12:25	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 19:04	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:44	RJR	EET PIT
	Instrument ID: HGY									

Client Sample ID: 7-SW

Lab Sample ID: 180-146342-18

Date Collected: 10/14/22 15:33

Matrix: Water

Date Received: 10/18/22 10:35

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		50			415689	10/21/22 00:08	SNL	EET PIT
	Instrument ID: CHIC2100A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 19:18	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:45	RJR	EET PIT
	Instrument ID: HGY									

Lab Chronicle

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: FB

Date Collected: 10/14/22 00:00
Date Received: 10/18/22 10:35

Lab Sample ID: 180-146342-19

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Analysis	EPA 9056A		10			415804	10/21/22 19:50	SNL	EET PIT
	Instrument ID: CHICS2100B									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		200			418173	11/12/22 14:54	RSK	EET PIT
	Instrument ID: A									
Dissolved	Prep	3005A			25 mL	25 mL	417288	11/04/22 14:30	HCY	EET PIT
Dissolved	Analysis	EPA 6020B		1			417507	11/05/22 19:32	RSK	EET PIT
	Instrument ID: DORY									
Dissolved	Prep	7470A			25 mL	25 mL	416905	11/01/22 14:11	RJR	EET PIT
Dissolved	Analysis	EPA 7470A		1			417201	11/03/22 13:46	RJR	EET PIT
	Instrument ID: HGY									

Laboratory References:

EET PIT = Eurofins Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Analyst References:

Lab: EET PIT

Batch Type: Prep

HCY = Harrison Yaeger

RJR = Ron Rosenbaum

Batch Type: Analysis

RJR = Ron Rosenbaum

RSK = Robert Kurtz

SNL = Sean Lordo

Client Sample ID: 1A-PW
Lab Sample ID: 180-146342-1
Date Collected: 10/14/22 14:58
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**220**		5.0	2.7	mg/L			10/20/22 18:13	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.3	0.27	ug/L		11/04/22 14:30	11/05/22 15:07	1
Chromium	ND		2.5	1.9	ug/L		11/04/22 14:30	11/05/22 15:07	1
Copper	**3.2**		2.5	1.4	ug/L		11/04/22 14:30	11/05/22 15:07	1
Manganese	**25**		6.3	1.7	ug/L		11/04/22 14:30	11/05/22 15:07	1
Iron	**220**		63	35	ug/L		11/04/22 14:30	11/05/22 15:07	1
Lead	**0.88**	**J**	1.3	0.21	ug/L		11/04/22 14:30	11/05/22 15:07	1
Nickel	ND		1.3	0.65	ug/L		11/04/22 14:30	11/05/22 15:07	1
Zinc	**13**		6.3	3.6	ug/L		11/04/22 14:30	11/05/22 15:07	1
Lithium	**16000**		160	26	ug/L		11/04/22 14:30	11/10/22 13:08	25

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:24	1

Client Sample ID: 1A-SW
Lab Sample ID: 180-146342-2
Date Collected: 10/14/22 14:58
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**120**		5.0	2.7	mg/L			10/20/22 18:27	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.7	0.36	ug/L		11/04/22 14:30	11/05/22 15:21	1
Chromium	**20**		3.3	2.6	ug/L		11/04/22 14:30	11/05/22 15:21	1
Copper	**13**		3.3	1.9	ug/L		11/04/22 14:30	11/05/22 15:21	1
Manganese	**12**		8.3	2.2	ug/L		11/04/22 14:30	11/05/22 15:21	1
Iron	**110**		83	46	ug/L		11/04/22 14:30	11/05/22 15:21	1
Lead	**0.36**	**J**	1.7	0.28	ug/L		11/04/22 14:30	11/05/22 15:21	1
Nickel	**29**		1.7	0.86	ug/L		11/04/22 14:30	11/05/22 15:21	1
Zinc	**23**		8.3	4.8	ug/L		11/04/22 14:30	11/05/22 15:21	1
Lithium	**150**		8.3	1.4	ug/L		11/04/22 14:30	11/05/22 15:21	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.50	0.33	ug/L		11/01/22 14:11	11/03/22 13:25	1

Client Sample ID: 1B-PW
Lab Sample ID: 180-146342-3
Date Collected: 10/14/22 14:56
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**120**		5.0	2.7	mg/L			10/20/22 18:42	50

Client Sample ID: 1B-PW

Lab Sample ID: 180-146342-3

Date Collected: 10/14/22 14:56

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 15:35	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 15:35	1
Copper	**4.8**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 15:35	1
Manganese	**230**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 15:35	1
Iron	**4400**		50	28	ug/L		11/04/22 14:30	11/05/22 15:35	1
Lead	**0.39**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 15:35	1
Nickel	**1.0**		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 15:35	1
Zinc	**20**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 15:35	1
Lithium	**510**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 15:35	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:26	1

Client Sample ID: 1B-SW

Lab Sample ID: 180-146342-4

Date Collected: 10/14/22 14:56

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**120**		5.0	2.7	mg/L			10/20/22 18:57	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 15:49	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 15:49	1
Copper	**10**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 15:49	1
Manganese	**5.2**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 15:49	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 15:49	1
Lead	**0.45**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 15:49	1
Nickel	**1.0**		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 15:49	1
Zinc	**33**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 15:49	1
Lithium	**180**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 15:49	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:27	1

Client Sample ID: 1C-PW

Lab Sample ID: 180-146342-5

Date Collected: 10/14/22 11:51

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**230**		5.0	2.7	mg/L			10/20/22 19:12	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 16:03	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 16:03	1
Copper	**2.6**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 16:03	1

Client Sample ID: 1C-PW
Lab Sample ID: 180-146342-5
Date Collected: 10/14/22 11:51
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Manganese	**36**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 16:03	1
Iron	**230**		50	28	ug/L		11/04/22 14:30	11/05/22 16:03	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 16:03	1
Nickel	ND		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 16:03	1
Zinc	**5.6**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 16:03	1
Lithium	**19000**		250	42	ug/L		11/04/22 14:30	11/10/22 13:12	50

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:28	1

Client Sample ID: 1C-SW
Lab Sample ID: 180-146342-6
Date Collected: 10/14/22 11:51
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**120**	**^2**	5.0	2.7	mg/L			10/20/22 19:56	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	**0.36**	**J**	1.0	0.22	ug/L		11/04/22 14:30	11/05/22 16:24	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 16:24	1
Copper	**7.4**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 16:24	1
Manganese	**6.6**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 16:24	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 16:24	1
Lead	**0.17**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 16:24	1
Nickel	**0.79**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 16:24	1
Zinc	**15**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 16:24	1
Lithium	**180**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 16:24	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:29	1

Client Sample ID: 2-PW
Lab Sample ID: 180-146342-7
Date Collected: 10/13/22 12:07
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**120**	**^2**	5.0	2.7	mg/L			10/20/22 20:11	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 16:38	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 16:38	1
Copper	**3.6**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 16:38	1
Manganese	**77**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 16:38	1
Iron	**1400**		50	28	ug/L		11/04/22 14:30	11/05/22 16:38	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 16:38	1

Client Sample ID: 2-PW
Lab Sample ID: 180-146342-7
Date Collected: 10/13/22 12:07
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nickel	ND		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 16:38	1
Zinc	**3.1**	**J**	5.0	2.9	ug/L		11/04/22 14:30	11/05/22 16:38	1
Lithium	**5100**		50	8.3	ug/L		11/04/22 14:30	11/10/22 13:16	10

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:30	1

Client Sample ID: 2-SW
Lab Sample ID: 180-146342-8
Date Collected: 10/13/22 12:06
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**110**	**^2**	5.0	2.7	mg/L			10/20/22 20:26	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 16:52	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 16:52	1
Copper	**6.6**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 16:52	1
Manganese	**6.3**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 16:52	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 16:52	1
Lead	**0.18**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 16:52	1
Nickel	**0.71**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 16:52	1
Zinc	**11**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 16:52	1
Lithium	**180**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 16:52	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:32	1

Client Sample ID: 3-PW
Lab Sample ID: 180-146342-9
Date Collected: 10/14/22 14:02
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**230**	**^2**	5.0	2.7	mg/L			10/20/22 20:41	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.7	0.36	ug/L		11/04/22 14:30	11/05/22 17:06	1
Chromium	ND		3.3	2.6	ug/L		11/04/22 14:30	11/05/22 17:06	1
Copper	ND		3.3	1.9	ug/L		11/04/22 14:30	11/05/22 17:06	1
Manganese	**18**		8.3	2.2	ug/L		11/04/22 14:30	11/05/22 17:06	1
Iron	**150**		83	46	ug/L		11/04/22 14:30	11/05/22 17:06	1
Lead	ND		1.7	0.28	ug/L		11/04/22 14:30	11/05/22 17:06	1
Nickel	**1.1**	**J**	1.7	0.86	ug/L		11/04/22 14:30	11/05/22 17:06	1
Zinc	**11**		8.3	4.8	ug/L		11/04/22 14:30	11/05/22 17:06	1
Lithium	**18000**		170	28	ug/L		11/04/22 14:30	11/10/22 13:23	20

Client Sample ID: 3-PW
Lab Sample ID: 180-146342-9
Date Collected: 10/14/22 14:02
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.50	0.33	ug/L		11/01/22 14:11	11/03/22 13:33	1

Client Sample ID: 3-SW
Lab Sample ID: 180-146342-10
Date Collected: 10/14/22 14:02
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**140**	**^2**	5.0	2.7	mg/L			10/20/22 21:40	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 17:19	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 17:19	1
Copper	**6.2**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 17:19	1
Manganese	**6.5**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 17:19	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 17:19	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 17:19	1
Nickel	**0.79**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 17:19	1
Zinc	**10**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 17:19	1
Lithium	**170**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 17:19	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:37	1

Client Sample ID: 4-PW
Lab Sample ID: 180-146342-11
Date Collected: 10/14/22 14:20
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**130**	**^2**	5.0	2.7	mg/L			10/20/22 21:54	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 17:33	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 17:33	1
Copper	**6.2**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 17:33	1
Manganese	**5.2**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 17:33	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 17:33	1
Lead	**0.20**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 17:33	1
Nickel	**1.1**		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 17:33	1
Zinc	**16**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 17:33	1
Lithium	**170**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 17:33	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.50	0.33	ug/L		11/01/22 14:11	11/03/22 13:38	1

Client: Sirem, div of Geosyntec Consultants
Project/Site: Paleta Creek

Job ID: 180-146342-1

Client Sample ID: 4-SW

Lab Sample ID: 180-146342-12

Date Collected: 10/14/22 14:20

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**130**	**^2**	5.0	2.7	mg/L			10/20/22 22:09	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.1	0.24	ug/L		11/04/22 14:30	11/05/22 17:47	1
Chromium	ND		2.2	1.7	ug/L		11/04/22 14:30	11/05/22 17:47	1
Copper	**5.3**		2.2	1.2	ug/L		11/04/22 14:30	11/05/22 17:47	1
Manganese	**8.9**		5.4	1.5	ug/L		11/04/22 14:30	11/05/22 17:47	1
Iron	**63**		54	30	ug/L		11/04/22 14:30	11/05/22 17:47	1
Lead	ND		1.1	0.18	ug/L		11/04/22 14:30	11/05/22 17:47	1
Nickel	**1.0**	**J**	1.1	0.56	ug/L		11/04/22 14:30	11/05/22 17:47	1
Zinc	**8.9**		5.4	3.1	ug/L		11/04/22 14:30	11/05/22 17:47	1
Lithium	**170**		5.4	0.90	ug/L		11/04/22 14:30	11/05/22 17:47	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:39	1

Client Sample ID: 5-PW

Lab Sample ID: 180-146342-13

Date Collected: 10/14/22 15:52

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**170**	**^2**	5.0	2.7	mg/L			10/20/22 22:54	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 18:01	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 18:01	1
Copper	**1.8**	**J**	2.0	1.1	ug/L		11/04/22 14:30	11/05/22 18:01	1
Manganese	**110**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 18:01	1
Iron	**1500**		50	28	ug/L		11/04/22 14:30	11/05/22 18:01	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 18:01	1
Nickel	ND		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 18:01	1
Zinc	**3.0**	**J**	5.0	2.9	ug/L		11/04/22 14:30	11/05/22 18:01	1
Lithium	**15000**		250	42	ug/L		11/04/22 14:30	11/10/22 13:26	50

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:40	1

Client Sample ID: 5-SW

Lab Sample ID: 180-146342-14

Date Collected: 10/14/22 15:52

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**130**	**^2**	5.0	2.7	mg/L			10/20/22 23:08	50

Client Sample ID: 5-SW

Lab Sample ID: 180-146342-14

Date Collected: 10/14/22 15:52

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 18:15	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 18:15	1
Copper	**5.6**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 18:15	1
Manganese	**7.7**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 18:15	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 18:15	1
Lead	**0.23**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 18:15	1
Nickel	**0.97**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 18:15	1
Zinc	**12**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 18:15	1
Lithium	**170**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 18:15	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:41	1

Client Sample ID: 6-PW

Lab Sample ID: 180-146342-15

Date Collected: 10/14/22 12:49

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**220**	**^2**	5.0	2.7	mg/L			10/20/22 23:23	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 18:36	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 18:36	1
Copper	ND		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 18:36	1
Manganese	**150**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 18:36	1
Iron	**3100**		50	28	ug/L		11/04/22 14:30	11/05/22 18:36	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 18:36	1
Nickel	ND		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 18:36	1
Zinc	ND		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 18:36	1
Lithium	**17000**		250	42	ug/L		11/04/22 14:30	11/10/22 13:30	50

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:42	1

Client Sample ID: 6-SW

Lab Sample ID: 180-146342-16

Date Collected: 10/14/22 12:49

Matrix: Water

Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**130**	**^2**	5.0	2.7	mg/L			10/20/22 23:38	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 18:50	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 18:50	1
Copper	**4.8**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 18:50	1

Client Sample ID: 6-SW
Lab Sample ID: 180-146342-16
Date Collected: 10/14/22 12:49
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Manganese	**6.9**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 18:50	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 18:50	1
Lead	**0.26**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 18:50	1
Nickel	**0.77**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 18:50	1
Zinc	**10**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 18:50	1
Lithium	**180**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 18:50	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.50	0.33	ug/L		11/01/22 14:11	11/03/22 13:43	1

Client Sample ID: 7-PW
Lab Sample ID: 180-146342-17
Date Collected: 10/14/22 15:33
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**140**	**^2**	5.0	2.7	mg/L			10/20/22 23:53	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 19:04	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 19:04	1
Copper	**1.1**	**J**	2.0	1.1	ug/L		11/04/22 14:30	11/05/22 19:04	1
Manganese	**98**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 19:04	1
Iron	**1200**		50	28	ug/L		11/04/22 14:30	11/05/22 19:04	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 19:04	1
Nickel	**0.77**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 19:04	1
Zinc	**6.2**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 19:04	1
Lithium	**9600**		130	21	ug/L		11/04/22 14:30	11/29/22 12:25	25

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:44	1

Client Sample ID: 7-SW
Lab Sample ID: 180-146342-18
Date Collected: 10/14/22 15:33
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**130**	**^2**	5.0	2.7	mg/L			10/21/22 00:08	50

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 19:18	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 19:18	1
Copper	**5.5**		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 19:18	1
Manganese	**7.5**		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 19:18	1
Iron	**29**	**J**	50	28	ug/L		11/04/22 14:30	11/05/22 19:18	1
Lead	**0.26**	**J**	1.0	0.17	ug/L		11/04/22 14:30	11/05/22 19:18	1

Client Sample ID: 7-SW
Lab Sample ID: 180-146342-18

Date Collected: 10/14/22 15:33
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nickel	**0.96**	**J**	1.0	0.52	ug/L		11/04/22 14:30	11/05/22 19:18	1
Zinc	**13**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 19:18	1
Lithium	**190**		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 19:18	1

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:45	1

Client Sample ID: FB
Lab Sample ID: 180-146342-19

Date Collected: 10/14/22 00:00
Matrix: Water
Date Received: 10/18/22 10:35

Method: SW846 EPA 9056A - Anions, Ion Chromatography - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**980**		1.0	0.53	mg/L			10/21/22 19:50	10

Method: SW846 EPA 6020B - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 19:32	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 19:32	1
Copper	ND		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 19:32	1
Manganese	ND		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 19:32	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 19:32	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 19:32	1
Nickel	ND		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 19:32	1
Zinc	**78**		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 19:32	1
Lithium	**86000**		1000	170	ug/L		11/04/22 14:30	11/12/22 14:54	200

Method: SW846 EPA 7470A - Mercury (CVAA) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:46	1

Method: EPA 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 180-415689/6
Matrix: Water
Analysis Batch: 415689

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			10/20/22 16:47	1

Lab Sample ID: LCS 180-415689/7
Matrix: Water
Analysis Batch: 415689

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Bromide	10.0	10.2		mg/L		102	80 - 120

Lab Sample ID: MB 180-415804/6
Matrix: Water
Analysis Batch: 415804

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	ND		0.10	0.053	mg/L			10/21/22 14:12	1

Lab Sample ID: LCS 180-415804/7
Matrix: Water
Analysis Batch: 415804

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Bromide	10.0	9.46		mg/L		95	80 - 120

Method: EPA 6020B - Metals (ICP/MS)

Lab Sample ID: MB 180-417288/1-A
Matrix: Water
Analysis Batch: 417507

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 417288

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		1.0	0.22	ug/L		11/04/22 14:30	11/05/22 14:57	1
Chromium	ND		2.0	1.5	ug/L		11/04/22 14:30	11/05/22 14:57	1
Copper	ND		2.0	1.1	ug/L		11/04/22 14:30	11/05/22 14:57	1
Manganese	ND		5.0	1.3	ug/L		11/04/22 14:30	11/05/22 14:57	1
Iron	ND		50	28	ug/L		11/04/22 14:30	11/05/22 14:57	1
Lead	ND		1.0	0.17	ug/L		11/04/22 14:30	11/05/22 14:57	1
Nickel	ND		1.0	0.52	ug/L		11/04/22 14:30	11/05/22 14:57	1
Zinc	ND		5.0	2.9	ug/L		11/04/22 14:30	11/05/22 14:57	1
Lithium	ND		5.0	0.83	ug/L		11/04/22 14:30	11/05/22 14:57	1

Lab Sample ID: LCS 180-417288/2-A
Matrix: Water
Analysis Batch: 417507

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 417288

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Cadmium	500	520		ug/L		104	80 - 120
Chromium	500	511		ug/L		102	80 - 120
Copper	500	491		ug/L		98	80 - 120
Manganese	500	504		ug/L		101	80 - 120
Iron	5000	5270		ug/L		105	80 - 120

Method: EPA 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 180-417288/2-A
Matrix: Water
Analysis Batch: 417507

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 417288

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lead	500	522		ug/L		104	80 - 120
Nickel	500	515		ug/L		103	80 - 120
Zinc	250	258		ug/L		103	80 - 120
Lithium	500	522		ug/L		104	80 - 120

Lab Sample ID: LCSD 180-417288/3-A
Matrix: Water
Analysis Batch: 417507

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 417288

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Cadmium	500	529		ug/L		106	80 - 120	2	20
Chromium	500	519		ug/L		104	80 - 120	2	20
Copper	500	495		ug/L		99	80 - 120	1	20
Manganese	500	517		ug/L		103	80 - 120	3	20
Iron	5000	5420		ug/L		108	80 - 120	3	20
Lead	500	528		ug/L		106	80 - 120	1	20
Nickel	500	514		ug/L		103	80 - 120	0	20
Zinc	250	261		ug/L		104	80 - 120	1	20
Lithium	500	521		ug/L		104	80 - 120	0	20

Method: EPA 7470A - Mercury (CVAA)

Lab Sample ID: MB 180-416905/1-A
Matrix: Water
Analysis Batch: 417201

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 416905

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.20	0.13	ug/L		11/01/22 14:11	11/03/22 13:18	1

Lab Sample ID: LCS 180-416905/2-A
Matrix: Water
Analysis Batch: 417201

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 416905

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	2.50	2.37		ug/L		95	80 - 120

Lab Sample ID: LCSD 180-416905/3-A
Matrix: Water
Analysis Batch: 417201

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 416905

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	2.50	2.41		ug/L		97	80 - 120	2	20

HPLC/IC

Analysis Batch: 415689

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-1	1A-PW	Dissolved	Water	EPA 9056A	
180-146342-2	1A-SW	Dissolved	Water	EPA 9056A	
180-146342-3	1B-PW	Dissolved	Water	EPA 9056A	
180-146342-4	1B-SW	Dissolved	Water	EPA 9056A	
180-146342-5	1C-PW	Dissolved	Water	EPA 9056A	
180-146342-6	1C-SW	Dissolved	Water	EPA 9056A	
180-146342-7	2-PW	Dissolved	Water	EPA 9056A	
180-146342-8	2-SW	Dissolved	Water	EPA 9056A	
180-146342-9	3-PW	Dissolved	Water	EPA 9056A	
180-146342-10	3-SW	Dissolved	Water	EPA 9056A	
180-146342-11	4-PW	Dissolved	Water	EPA 9056A	
180-146342-12	4-SW	Dissolved	Water	EPA 9056A	
180-146342-13	5-PW	Dissolved	Water	EPA 9056A	
180-146342-14	5-SW	Dissolved	Water	EPA 9056A	
180-146342-15	6-PW	Dissolved	Water	EPA 9056A	
180-146342-16	6-SW	Dissolved	Water	EPA 9056A	
180-146342-17	7-PW	Dissolved	Water	EPA 9056A	
180-146342-18	7-SW	Dissolved	Water	EPA 9056A	
MB 180-415689/6	Method Blank	Total/NA	Water	EPA 9056A	
LCS 180-415689/7	Lab Control Sample	Total/NA	Water	EPA 9056A	

Analysis Batch: 415804

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-19	FB	Dissolved	Water	EPA 9056A	
MB 180-415804/6	Method Blank	Total/NA	Water	EPA 9056A	
LCS 180-415804/7	Lab Control Sample	Total/NA	Water	EPA 9056A	

Metals

Prep Batch: 416905

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-1	1A-PW	Dissolved	Water	7470A	
180-146342-2	1A-SW	Dissolved	Water	7470A	
180-146342-3	1B-PW	Dissolved	Water	7470A	
180-146342-4	1B-SW	Dissolved	Water	7470A	
180-146342-5	1C-PW	Dissolved	Water	7470A	
180-146342-6	1C-SW	Dissolved	Water	7470A	
180-146342-7	2-PW	Dissolved	Water	7470A	
180-146342-8	2-SW	Dissolved	Water	7470A	
180-146342-9	3-PW	Dissolved	Water	7470A	
180-146342-10	3-SW	Dissolved	Water	7470A	
180-146342-11	4-PW	Dissolved	Water	7470A	
180-146342-12	4-SW	Dissolved	Water	7470A	
180-146342-13	5-PW	Dissolved	Water	7470A	
180-146342-14	5-SW	Dissolved	Water	7470A	
180-146342-15	6-PW	Dissolved	Water	7470A	
180-146342-16	6-SW	Dissolved	Water	7470A	
180-146342-17	7-PW	Dissolved	Water	7470A	
180-146342-18	7-SW	Dissolved	Water	7470A	
180-146342-19	FB	Dissolved	Water	7470A	
MB 180-416905/1-A	Method Blank	Total/NA	Water	7470A	

Metals (Continued)

Prep Batch: 416905 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 180-416905/2-A	Lab Control Sample	Total/NA	Water	7470A	
LCSD 180-416905/3-A	Lab Control Sample Dup	Total/NA	Water	7470A	

Analysis Batch: 417201

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-1	1A-PW	Dissolved	Water	EPA 7470A	416905
180-146342-2	1A-SW	Dissolved	Water	EPA 7470A	416905
180-146342-3	1B-PW	Dissolved	Water	EPA 7470A	416905
180-146342-4	1B-SW	Dissolved	Water	EPA 7470A	416905
180-146342-5	1C-PW	Dissolved	Water	EPA 7470A	416905
180-146342-6	1C-SW	Dissolved	Water	EPA 7470A	416905
180-146342-7	2-PW	Dissolved	Water	EPA 7470A	416905
180-146342-8	2-SW	Dissolved	Water	EPA 7470A	416905
180-146342-9	3-PW	Dissolved	Water	EPA 7470A	416905
180-146342-10	3-SW	Dissolved	Water	EPA 7470A	416905
180-146342-11	4-PW	Dissolved	Water	EPA 7470A	416905
180-146342-12	4-SW	Dissolved	Water	EPA 7470A	416905
180-146342-13	5-PW	Dissolved	Water	EPA 7470A	416905
180-146342-14	5-SW	Dissolved	Water	EPA 7470A	416905
180-146342-15	6-PW	Dissolved	Water	EPA 7470A	416905
180-146342-16	6-SW	Dissolved	Water	EPA 7470A	416905
180-146342-17	7-PW	Dissolved	Water	EPA 7470A	416905
180-146342-18	7-SW	Dissolved	Water	EPA 7470A	416905
180-146342-19	FB	Dissolved	Water	EPA 7470A	416905
MB 180-416905/1-A	Method Blank	Total/NA	Water	EPA 7470A	416905
LCS 180-416905/2-A	Lab Control Sample	Total/NA	Water	EPA 7470A	416905
LCSD 180-416905/3-A	Lab Control Sample Dup	Total/NA	Water	EPA 7470A	416905

Prep Batch: 417288

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-1	1A-PW	Dissolved	Water	3005A	
180-146342-2	1A-SW	Dissolved	Water	3005A	
180-146342-3	1B-PW	Dissolved	Water	3005A	
180-146342-4	1B-SW	Dissolved	Water	3005A	
180-146342-5	1C-PW	Dissolved	Water	3005A	
180-146342-6	1C-SW	Dissolved	Water	3005A	
180-146342-7	2-PW	Dissolved	Water	3005A	
180-146342-8	2-SW	Dissolved	Water	3005A	
180-146342-9	3-PW	Dissolved	Water	3005A	
180-146342-10	3-SW	Dissolved	Water	3005A	
180-146342-11	4-PW	Dissolved	Water	3005A	
180-146342-12	4-SW	Dissolved	Water	3005A	
180-146342-13	5-PW	Dissolved	Water	3005A	
180-146342-14	5-SW	Dissolved	Water	3005A	
180-146342-15	6-PW	Dissolved	Water	3005A	
180-146342-16	6-SW	Dissolved	Water	3005A	
180-146342-17	7-PW	Dissolved	Water	3005A	
180-146342-18	7-SW	Dissolved	Water	3005A	
180-146342-19	FB	Dissolved	Water	3005A	
MB 180-417288/1-A	Method Blank	Total Recoverable	Water	3005A	
LCS 180-417288/2-A	Lab Control Sample	Total Recoverable	Water	3005A	

Metals (Continued)

Prep Batch: 417288 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCSD 180-417288/3-A	Lab Control Sample Dup	Total Recoverable	Water	3005A	

Analysis Batch: 417507

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-1	1A-PW	Dissolved	Water	EPA 6020B	417288
180-146342-2	1A-SW	Dissolved	Water	EPA 6020B	417288
180-146342-3	1B-PW	Dissolved	Water	EPA 6020B	417288
180-146342-4	1B-SW	Dissolved	Water	EPA 6020B	417288
180-146342-5	1C-PW	Dissolved	Water	EPA 6020B	417288
180-146342-6	1C-SW	Dissolved	Water	EPA 6020B	417288
180-146342-7	2-PW	Dissolved	Water	EPA 6020B	417288
180-146342-8	2-SW	Dissolved	Water	EPA 6020B	417288
180-146342-9	3-PW	Dissolved	Water	EPA 6020B	417288
180-146342-10	3-SW	Dissolved	Water	EPA 6020B	417288
180-146342-11	4-PW	Dissolved	Water	EPA 6020B	417288
180-146342-12	4-SW	Dissolved	Water	EPA 6020B	417288
180-146342-13	5-PW	Dissolved	Water	EPA 6020B	417288
180-146342-14	5-SW	Dissolved	Water	EPA 6020B	417288
180-146342-15	6-PW	Dissolved	Water	EPA 6020B	417288
180-146342-16	6-SW	Dissolved	Water	EPA 6020B	417288
180-146342-17	7-PW	Dissolved	Water	EPA 6020B	417288
180-146342-18	7-SW	Dissolved	Water	EPA 6020B	417288
180-146342-19	FB	Dissolved	Water	EPA 6020B	417288
MB 180-417288/1-A	Method Blank	Total Recoverable	Water	EPA 6020B	417288
LCS 180-417288/2-A	Lab Control Sample	Total Recoverable	Water	EPA 6020B	417288
LCSD 180-417288/3-A	Lab Control Sample Dup	Total Recoverable	Water	EPA 6020B	417288

Analysis Batch: 418005

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-1	1A-PW	Dissolved	Water	EPA 6020B	417288
180-146342-5	1C-PW	Dissolved	Water	EPA 6020B	417288
180-146342-7	2-PW	Dissolved	Water	EPA 6020B	417288
180-146342-9	3-PW	Dissolved	Water	EPA 6020B	417288
180-146342-13	5-PW	Dissolved	Water	EPA 6020B	417288
180-146342-15	6-PW	Dissolved	Water	EPA 6020B	417288

Analysis Batch: 418173

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-19	FB	Dissolved	Water	EPA 6020B	417288

Analysis Batch: 419389

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
180-146342-17	7-PW	Dissolved	Water	EPA 6020B	417288

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238-2907
phone 412.963.7058 fax 412.963.2468

Chain of Custody Record

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

COC No: 1
1 of 2 COCs
TALS Project #:
Sampler: F. Risacher
For Lab Use Only:
Walk-in Client:
Lab Sampling:
Job / SDG No.:

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Carrie Gamber	Carrier: Fedex
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455		
San Diego, CA 92108	**Analysis Turnaround Time**		
437.347.3455 Phone	☐ CALENDAR DAYS ☑ WORKING DAYS		
(xxx) xxx-xxxx FAX	TAT if different from Below ____		
Project Name: PNG7584	☐ 2 weeks		
Site: Paleta Creek	☐ 1 week		
P O # 100034641	☐ 2 days		
	☐ 1 day		

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	EPA 6020 (Cd,Cr,Cu,Ni,Pb,Zn,Fe,Mn,Li)	EPA 7470A (mercury	EPA 300 (bromide)	Sample Specific Notes:
1A-PW	10/14/22	1458	C	Water	2	Y	N	X	X	X	
1A-SW	10/14/22	1458	C	Water	2	Y	N	X	X	X	
1B-PW	10/14/22	1456	C	Water	2	Y	N	X	X	X	
1B-SW	10/14/22	1456	C	Water	2	Y	N	X	X	X	
1C-PW	10/14/22	1151	C	Water	2	Y	N	X	X	X	
1C-SW	10/14/22	1151	C	Water	2	Y	N	X	X	X	
2-PW	10/13/22	1207	C	Water	2	Y	N	X	X	X	
2-SW	10/13/22	1206	C	Water	2	Y	N	X	X	X	
3-PW	10/14/22	1402	C	Water	2	Y	N	X	X	X	
3-SW	10/14/22	1402	C	Water	2	Y	N	X	X	X	
4-PW	10/14/22	1420	C	Water	2	Y	N	X	X	X	
4-SW	10/14/22	1420	C	Water	2	Y	N	X	X	X	

180-146342 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ | Therm ID No.: ____

Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10-15-22 09:30	Received by: Jason Conder	Company: Geosyntec	Date/Time: 10-15-22 09:30
Relinquished by: Jason Conder	Company: Geosyntec	Date/Time: 10-17-22 14:34	Received by: Fed Ex	Company: Fed Ex	Date/Time: 10.17.22 14:34
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company: EETRA	Date/Time: 10/18-22 10 21

12/1/2022

Chain of Custody Record

Eurofins Pittsburgh
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238-2907
phone 412.963.7058 fax 412.963.2468

eurofins | Environment Testing America

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Eurofins Environment Testing America

Client Contact	Project Manager: Florent Risacher	Site Contact: Florent Risacher	Date: 10/14/22	COC No: 1
Geosyntec Consultants	Email: frisacher@geosyntec.com	Lab Contact: Carrie Gamber	Carrier: FedEx	2 of 2 COCs
2355 Northside Drive, Suite 250	Tel/Fax: 437-347-3455			TALS Project #:
San Diego, CA 92108	Analysis Turnaround Time			Sampler: F. Risacher
437.347.3455 Phone	☐ CALENDAR DAYS ☑ WORKING DAYS			For Lab Use Only:
(xxx) xxx-xxxx FAX	TAT if different from Below _____			Walk-in Client:
Project Name: PNG7584	☐ 2 weeks			Lab Sampling:
Site: Paleta Creek	☐ 1 week			Job / SDG No.:
P O # 100034641	☐ 2 days ☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	EPA 6020 (Cd,Cr,Cu,Ni,Pb,Zn,Fe,Mn,Li)	EPA 7470A (mercury	EPA 300 (bromide)	Sample Specific Notes:
5-PW	10/14/22	1552	C	Water	2	Y	N	X	X	X	
5-SW	10/14/22	1552	C	Water	2	Y	N	X	X	X	
6-PW	10/14/22	1249	C	Water	2	Y	N	X	X	X	
6-SW	10/14/22	1249	C	Water	2	Y	N	X	X	X	
7-PW	10/14/22	1533	C	Water	2	Y	N	X	X	X	
7-SW	10/14/22	1533	C	Water	2	Y	N	X	X	X	
~~8-PW~~			C	Water	~~2~~	Y	N	X	X MW 10/14/22		
~~8-SW~~			C	Water	2	Y	N				
										MW 10/14/22	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:	Cooler Temp. (°C): Obs'd: _____ Corr'd: _____	Therm ID No.: _____

Relinquished by: Florent Risacher	Company: Geosyntec	Date/Time: 10-15-22 09:30	Received by: Jason Corder	Company: Geosyntec	Date/Time: 10-15-22 09:30
Relinquished by: Jason Corder	Company: Geosyntec	Date/Time: 10-17-22 14:34	Received by: Fed Ex	Company: FedEx	Date/Time: 10-17-22 14:34
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time: 10-18-22 10:35

12/1/2022

180-146342 Waybill

ORIGIN ID:INSA (714) 685-1226
PNG7584-02
GEOSYNTEC CONSULTANTS
SUITE 100
3530 HYLAND AVE STE 100
COSTA MESA, CA 92626
UNITED STATES US

SHIP DATE:
ACTWGT: 32
CAD: 675400[illegible]
DIMS: 23x14x13 IN

BILL THIRD PARTY

TO CARRIE GAMBER
EURO FINS PITTSBURG
301 ALPHA DR. RIDC PARK

PITTSBURGH PA 15238
(412) 963-7058 REF:
INV:
PO: DEPT:

Uncorrected temp 5.8 °C
Thermometer ID 20
CF 10 Initials MG
T-WI-SR-001 effective 7/26/13

FedEx Express

TUE - 18 OCT 10:30A
PRIORITY OVERNIGHT

TRK# 0201 2792 5509 5788

XN AGCA

15238
PA-US PIT

Login Sample Receipt Checklist

Client: Sirem, div of Geosyntec Consultants

Job Number: 180-146342-1

Login Number: 146342
List Number: 1
Creator: Abernathy, Eric L

List Source: Eurofins Pittsburgh

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	False	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX F PEEPER DEPLOYMENT, RETRIEVAL AND PROCESSING METHOD

Peeper Deployment, Retrieval, and Processing Method

OVERVIEW

- Peepers are a small chamber containing deionized water capped with a semi-permeable membrane. The water may be spiked with lithium and/or bromine tracer.
- Peepers should be shipped in a plastic or mylar zipseal bag. The bags may have a few milliliters of water in them to keep peepers moist. The bags should be kept after deployment to store peepers during retrieval
- Peeper (within their bags) should ship from the laboratory in a cooler for ultimate protection during shipping.
- Prior to deployment, the peepers do not need to be refrigerated; however, they should be kept (ideally within their protective cooler) at temperatures above freezing (i.e., 32°F or 0°C) and below excessively hot temperatures (i.e., 100 °F or 38°C).
- A portion of the peeper water (e.g., at least 20 mL) from the peepers may be used for bromine tracer analysis while the remainder (e.g., 20 to 60 mL) is used for metal analysis (including lithium tracer).
- After retrieval, peepers should be processed, limiting exposure of the peeper to air to 10 minutes or less.
- If rapid processing is not possible, peeper should be stored in a plastic or mylar zipseal bag with oxygen absorbing packets within approximately 10 minutes or less after removal from sediment or water.
- At least 1 sample for blank analysis of metals and tracer should be created using a set of peepers that have not been deployed at the site (store them in the cooler in a safe location during the field deployment).

DEPLOYMENT

Materials for Deployment:

- Peepers– please ensure that extra peepers (approximately 10% extra, plus additional for Trip Blanks) are shipped to the field, as peepers can be damaged during transport and handling
- Peeper frame (if deployed in array)
- Polyester rope
- Laminated sample ID card
- Zip-ties
- Electrical tape & duct tape
- Handheld GPS unit with 1 second (or less) refresh rate and accuracy of 1-2 m or better
- Plastic or mylar bags for peepers storage

Deployment

1. If deployment is made from a vessel using divers, the vessel should be anchored to maintain the location and stability if possible.
2. Confirm the water depth at the location where the peepers will be deployed using vessel instruments (i.e., sonar) or a marked anchor line.
3. If peepers are deployed in a frame, take out the frame and put it together.
4. Label each peeper by attaching a laminated sample ID card to the frame with a zip-tie. If peepers are not deployed in a frame, attach the laminated card later directly to the peeper.
5. Attach a polyester rope to an attachment point at the top corner of the peeper frame or to the peeper itself. This rope can be attached to a sand bag or weight and serve as an anchor line. The length of rope should be long enough to facilitate the retrieval of the peepers by divers or with a grappling hook; ideally the length of the rope should extend at least 30 feet from the insertion point. Alternatively, if the deployment is close to an accessible shoreline the rope can be tied to a tree or a stake. If tied to shore, make sure the location has limited public access.
6. Remove the peepers from the bag. Note, there may be ~0.5 L of water in the bag surrounding the peepers; this is not leakage from the peepers. The extra water is included in the bag to assure the peepers stay moist. **Keep the plastic or mylar bags, as they will be used for retrieval of the peepers.** Inspect the peepers to make sure the water inside does not contain bubbles, and inspect the membrane of each peepers to make sure it wasn't damaged during transport. A damaged membrane (below, left) will appear wrinkled or punctured; a secure membrane will appear smooth (below, right):

A **wrinkle** in the peeper membrane due to damage or mishandling; do not use the peeper for field deployment, although it can be used as a Trip Blank if needed

A smooth peeper membrane

If a peeper has a damaged membrane or contains bubbles in the peeper water, do not use it for field sampling as it may negatively impact sampling performance. It can be used to create a Trip Blank sample, however.

7. Secure the peeper into the frame, being sure to not touch the peeper membranes. If no frames are used, attached a label to the peeper.
8. Insert the peeper frame or peeper into the sediment with the membrane facing the side. This can be achieved using divers, or by wading if the location is shallow enough. A diverless push pole apparatus can also be used. If full insertion cannot be achieved pull up the frame or peepers and retry insertion a few feet away.
9. The anchor line should be extended from the insertion point and the direction of the extension should be noted. If using divers, the diver can swim from the insertion point and drop the anchor a few feet (10 to 30 feet) away. If the peeper is being deployed from the surface (from a vessel) using a push pole or other apparatus, the anchor line should be tossed so that it enters the water approximately 30 feet (or more) away. This methods requires a longer anchor line (length equal to 30 feet plus water depth at station).
10. Using a handheld GPS unit, note (and/or mark) GPS coordinates of deployed peepers.

RETRIEVAL

Materials for Retrieval:

- Bags for peeper storage (use peeper bags from deployment)
- Oxygen absorbing packets
- Coolers with wet ice

Note: Before retrieving the peepers, ensure that you are ready to process them right away or that you have the supplies to preserve them until processing. If working from a boat, preserving the peepers and processing them on shore may be the best approach. After removal from the sediment, peepers should be exposed to surface water and air for as little time as possible (ideally 10 minutes or less). This can be achieved by having the plastic/mylar bags and oxygen absorbing packets ready to be used as soon as the peeper is retrieved at the surface. Note that once the oxygen absorbing packets are removed from their vacuum packed bag, they need to be used on the same day or be discarded.

Retrieval

1. Position the vessel at or near the location of the deployed peepers using the GPS coordinates from the deployment. Use of a handheld GPS system with a graphical display and “navigate to point” is extremely helpful.
2. If divers are retrieving the peepers, drop a buoy with an anchor to mark the retrieval location for the diver, then send the diver down to do a search around the buoy, starting adjacent and circling further around until the peepers are found. Once found, return the peeper frame as quickly as possible to the surface via diver or a tender line to the vessel.

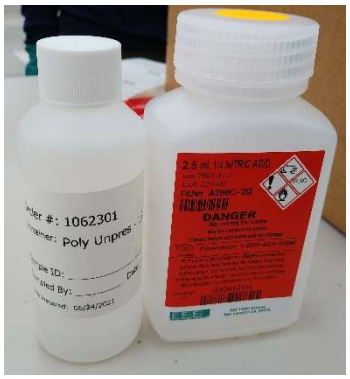
3. If retrieval is being attempted using grappling hooks from the surface of the boat, catch the weighted rope by tossing the hook in a direction perpendicular to that in which the anchor and anchor line were deployed. Drag the grappling hook on the bottom of the sediment until snagged on the rope. Pull the boat or platform above the hook and pull everything straight up.
4. If retrieval is being attempted via wading, safely wade into the water and remove the peeper frame from the sediment. Return the peepers to the shore or vessel.
5. Once retrieved, quickly remove the peepers from the frame and place in the plastic/mylar bag. Peepers do not need to be cleaned or rinsed. Be careful in positioning the peepers so that they do not bump against each other's membrane, this can be achieved by storing them flat in the bag, side by side, with the membrane up. Do not stack the peepers on top of each other. Add 2-3 oxygen absorbing packets in the bag before sealing it.
6. Label the outside of the storage bag according to the sample nomenclature.
7. Store the bags with the peepers in a cooler, on wet ice until they can be processed.
8. Processing should ideally occur on the same day after retreival (laboratory research is ongoing to confirm the timing of this recommendation).

Special Note: Once removed from the sediment, the peepers and peeper frames should be visually inspected to confirm they were fully inserted during the deployment duration. This can be seen from the different coloration of the frame between parts that were exposed to surface water and parts that were in the sediments.

PROCESSING

Peeper Processing in Field or Field Lab

1. Prepare a clean workstation (i.e. table), ideally in a sheltered area. Essential elements include:
    a. Serological pipettes tips
    b. Pipette pump compatible with serological pipettes tips
    c. Several gallons of DI or distilled water (e.g., approximately 1 gallon per 20 samples)
    d. Plastic spray bottle of DI or distilled water
    e. Laboratory supplied sample bottles to contain waters transferred from the peepers; two bottles are needed for each sample:
        i. An empty HPDE bottle for the bromine sample (if bromine is being used as a tracer)
        ii. An HDPE bottle for the metals sample, containing a small amount of nitric acid (i.e., 2.5 mL 1:4 concentrated nitric acid) for preservative



    f. Nitrile gloves
    g. Eye protection
    h. Roll of paper towels or box of Kimwipes
    i. Garbage bag or container to contain waste
    j. Cooler with peepers retrieved from the field and peepers for the Trip Blank
    k. Additional ice (as needed) to maintain cool temperatures
    l. Zipseal bags for packaging sample bottles
    m. Processing forms and chain of custody forms
    n. Tape for securing the cooler for shipment

    Special Note: Once removed from the protective bag, peepers should be processed within 10 minutes so that contact with the atmosphere is minimized (oxygen will diffuse into the water contained within the peepers and could compromise sample integrity)

2. Two people are recommended for processing. A designated person (“dirty hands”) should be responsible to clean peepers, while another person (“clean hands”) should be

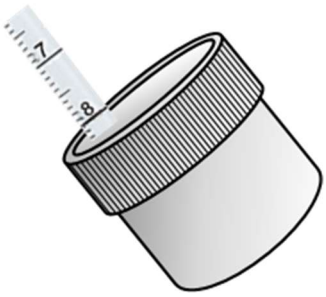
responsible for transferring water from the peepers into the sample bottles and recording processing information on the processing form. If this is not possible, it is recommended to change gloves between cleaning peepers and transferring the water to the sample bottles.

3. Attach the pipette pump to a fresh serological pipette tip. One pipette tip is needed to transfer the water from the multiple peepers used to create a sample (change out the pipette tip when processing peepers being combined for a separate sample).
4. Removal from storage, open the bag and remove one peeper; take note of the sampling location.
5. Rinse the top of the peeper membrane with DI water to clean off any sediment. Ensure to flush thoroughly around the membrane and cap. A paper towel or Kimwipe can be used to assist removal of sediment as needed, although care must be taken as the membrane is fragile. The membrane should be free of visible grains of sediment.
6. Inspect the peeper for contamination by sediments. To ensure sample integrity, peepers should be inspected for sediments by looking inside from the bottom of the vial. If sediment particles can be seen floating inside against the membrane of the peeper, the peeper should not be sampled, as it may have allowed solid particles into the sampler during sampling, and this may not represent freely-dissolved metal concentrations.

Sediment grains that have entered the peeper; they are observable by swirling the water and turning the peeper upside down

Peeper with no observable sediment grains

7. Once cleaned off, use the serological pipette tip to puncture the membrane, angle the serological pipette tip towards the bottom of the vial and drawn up all water from the peeper into the pipette.



8. Dispense at least 5 mL from the peeper in the sample container for the bromine analysis (if bromine is being used as a tracer).
9. Dispense the rest of the peeper water in the sample container for the metal analysis. The vial for metal analysis should already contain a small volume of nitric acid so that the sample will be acidified.
10. In total, ~20 mL or more should be collected for bromine analysis and ~60 mL or more for metal analysis (consult your analytical lab to confirm ideal and minimum sample volumes).
11. Cap all sample bottles, label, and store in a cooler on wet ice.
12. Note the processing date and time and approximate volume of peeper water used for the bromine sample (ideally ≥ 20 mL) and the metals sample (ideally ≥ 60 mL).
13. Remove the pipette tip from the pipette pump and attach a new pipette tip for use for the next set of peepers that will be used for the next sample.
14. Do not to forget to prepare blank samples using unexposed peepers. This will be used as the Trip Blank sample for bromine and metals.
15. Once all peeper samples have been processed, prepare the samples for laboratory submission (e.g. fill out chain of custody, initiate transfer of samples to receiving laboratory for analysis, etc.).