Tesoro Alaska Company LLC

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November 15, 2023

Pete Campbell
Environmental Specialist.
Alaska Department of Environmental Conservation
43335 K-Beach Road, Suite 11
Soldotna, Alaska 99669

Submitted via email:
Peter.Campbell@alaska.gov

Re: Swamp Surface Water and Sediment Sampling Work Plan

Dear Mr. Campbell:

Enclosed is surface water and sediment sampling work plan (Work Plan) in response to a letter request dated September 12, 2023.

The objective of this Work Plan is to assess the surface water quality and evaluate whether the Swamp is currently in compliance with Technical Memorandum 01-005 for total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH). Surface water and sediment samples will be collected from SW-1, SW-2, SW-3, SW-6, SW-9, SW-11, SW-12, SW-13, and SW-14.

If you have any questions, please contact me at (907) 776-4225.

Sincerely,

Maya Lehl
Environmental Specialist

Enclosure (1)

SWAMP SURFACE WATER AND SEDIMENT SAMPLING WORK PLAN

TESORO ALASKA COMPANY, LLC

MARATHON KENAI REFINERY

KENAI, ALASKA

November 15, 2023

Project #: 0039B-003-0090

PREPARED BY: Trihydro Corporation

312 Tyee Street, Soldotna, AK 99669

SUBMITTED BY: Tesoro Alaska Company, LLC

54741 Energy Way, Kenai, AK 99611

SOLUTIONS YOU CAN COUNT ON.
PEOPLE YOU CAN TRUST.

CERTIFICATION STATEMENT

SWAMP SURFACE WATER AND SEDIMENT SAMPLING WORK PLAN

MARATHON KENAI REFINERY - SWAMP

PREPARED FOR TESORO ALASKA COMPANY, LLC

I certify that the work presented in this report was performed under my supervision. To the best of my knowledge, the data contained herein are true and accurate and the work was performed in accordance with professional standards.

11/15/2023

Joe McElroy, P.E. Date

Project Engineer

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List of Abbreviations and Acronyms

ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
COC	chain of custody
DI	deionized
EPA	Environmental Protection Agency
LCS	laboratory control samples
LCSD	laboratory control sample duplicates
MB	method blank
µg/L	micrograms per liter
µg/g	micrograms per gram
MS	matrix spike
MSD	matrix spike duplicate
QA	quality assurance
QC	quality control
ppm	parts per million
RPD	relative percent differences
SGS	SGS North America Inc.
SOP-SD.	Standard Operating Procedures – Sediment Sampling using Dredge Samples
SOP-SW	Standard Operating Procedures – Surface-Water Sampling

1.0 INTRODUCTION

This work plan (Work Plan) was prepared by Trihydro Corporation (Trihydro) on behalf of Marathon Petroleum Company (Marathon) in response to the Alaska Department of Environmental Conservation (ADEC) letter "Tesoro Alaska Refinery, ADEC Hazard ID# 312 September 6th EPA RCRA Inspection – DEC Comments" dated September 12, 2023. In that letter, ADEC requested that Marathon monitor the surface water and sediment in the swamp area (Swamp) directly west of the Marathon Kenai Refinery (Refinery).

1.1 OBJECTIVES

Marathon proposes a one-time surface water and sediment sampling event inside the Swamp to assess the surface water quality and evaluate whether the Swamp is currently in compliance with Technical Memorandum 01-005 for total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH). TAH parameters are currently collected semiannually in the Swamp as part of a Resource Conservation and Recovery Act (RCRA) permit regulated by the Environmental Protection Agency (EPA). As part of the RCRA permit sampling, episodic events of elevated benzene concentrations in the Swamp waters, particularly when groundwater levels are high, have been noted. Surface water sampling efforts, in conjunction with correlated sediment samples, will be used to characterize the overall surface water quality in the Swamp.

2.0 SITE HISTORY

2.1 SITE HYDROGEOLOGY

The Refinery borders Cook Inlet in the Kenai Lowland physiographical province. According to Karlsotrm (1964), Pleistocene glaciers occurred in the Kenai Lowland and shaped both her modern topography and shallow subsurface sedimentary sequences. A persistent glacial lake is believed by the same source to received sediments from both the Alaska Range (west) and Kenai Range (east). Stratified layers of sand and gravel were deposited in the proglacial fluvial and fluvial delta environments during periods of low lake water. In periods of high lake water, silt and clay were deposited. This sequence of gravel and clay covers most of the Refinery area and was proposed by Nelson (1981) to be at least 500 feet thick. On the western half of the Refinery, the ground water system consists of two unconfined aquifers (A-aquifer and B-aquifer) along with both upper and lower confined aquifers. A- and B- aquifers are separated by an intermediate layer of clay, approximately 60 feet below ground surface. These clay layers merge in the east, where it is proper to speak of only one unconfined aquifer.

Through most of the refinery, water in the A-aquifer moves west towards Cook Inlet, including beneath or through the Swamp (Figure 1). It is suspected that during times of high surface water, the Swamp and the A-aquifer are hydraulicly connected, allowing migration of the groundwater plume into and through the Swamp.

2.2 RCRA PERMIT SAMPLING

Under the RCRA permit, surface water in the Swamp is currently monitored semiannually at a minimum, and as often as quarterly depending on benzene concentrations, for benzene, toluene, ethylbenzene, and xylenes (BTEX). Numerous monitoring wells adjacent to the Swamp, including E-227, E-065, E-247A, E-247B, E-248A, E-248B, MW-93A and MW-93B, are also monitored for BETX either quarterly or semiannually under the RCRA permit (Figure 1). Groundwater and surface water elevations are measured semiannually.

3.0 SURFACE WATER AND SEDIMENT SAMPLING

Marathon proposes to analyze surface water and sediment at the following locations for TAH and TAqH: SW-1, SW-2, SW-3, SW-6, SW-9, SW-11, SW-12, SW-13, and SW-14.

As part of the sampling effort, Marathon will reestablish the basis of Swamp elevations measurements to verify that swamp elevations are accurate in relation to groundwater elevations. Swamp elevations will be recorded each day during surface water and sediment sampling events.

TAH and TAqH analyses will be conducted by SGS North America Inc. (SGS), in Anchorage, AK.

3.1 SURFACE WATER SAMPLING

Surface water samples will be collected from the following locations: SW-1, SW-2, SW-3, SW-6, SW-9, SW-11, SW-12, SW-13, and SW-14. If sample locations are dry, they will not be sampled. Surface water will be collected using simple handheld containers and will not be field filtered. Water quality parameters will be recorded using a multi-probe water quality meter and will include pH, specific conductance, turbidity, temperature, oxygen-reduction potential (ORP), and dissolved oxygen (DO). They will be collected during purging and recorded on field forms (Appendix C). Surface water sampling will be completed in accordance with Standard Operating Procedure – Surface-Water Sampling (SOP-SW) found in Appendix A.

3.2 SEDIMENT SAMPLING

Sediment samples will be collected at each surface water sample location. Collecting sediments at known monitoring points eliminates the need to survey new points and allows the relationship between sediment and surface water analytes to be better understood. Sediment samples will be collected after surface water samples so as not to disturb the water prior to sampling. Only small, handheld tools will be needed to collect sediment samples (Appendix D). Sediment sampling will be done in accordance with Standard Operating Procedure – Sediment Sampling Using Dredge Samplers (SOP-SD.) found in Appendix B.

4.0 REPORTING AND SCHEDULE

Field work is planned for the spring of 2024, after the ice is off the Swamp and surface water is safely assessable. Field work may coincide with RCRA quarterly sampling events if timeframe aligns. Field work outlined in this Work Plan is proposed to be conducted one time.

Marathon will prepare and submit a report to ADEC summarizing the findings of surface water and sediment sampling, including recommendations based on results, within 90 days of receiving data from the lab.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

This section addresses the qualitative and quantitative criteria that will be used to evaluate the quality of the field and analytical data collected during the field activities.

5.1 FIELD QUALITY ASSURANCE AND QUALITY CONTROL SAMPLES

Four different kinds of field quality assurance and quality control samples (QA/QC) will be collected during the sampling event as described below.

1. Field Duplicate Samples. Duplicate samples will be collected to evaluate precision associated with the reproducibility of sampling techniques and the homogeneity of sample matrices. Duplicate samples will be collected at a minimum frequency of 10%, or one for every 10 samples. The duplicate sample will be "blind" to the laboratory; therefore, it will have a coded identity on its label and on the Chain of Custody (COC). The actual sampling location and identification will be recorded on the sampling log.
2. Trip Blanks. One trip blank will accompany each sample cooler. Experience has shown that cross-contamination at analytical laboratories can lead to spurious detections. The trip blanks prepared by the laboratory can point to the reagent water used by the laboratory as a source of contamination not related to field sampling procedures.
3. Field Blanks. Field blanks will be collected in the vicinity of the project area. Field blanks will be collected by pouring laboratory provided deionized water (DI) water into the appropriate containers and submitted for analysis. A minimum of one field blank will be collected per set of 20 tests.
4. Equipment Blanks. Equipment blanks will be prepared and submitted for laboratory analysis to assess sampling equipment decontamination procedures. Following ADEC guidance, Trihydro will take a minimum of one blank per set of 20 tests.

All QA/QC samples will be analyzed by SGS. The laboratory will follow proper QA/QC procedures, including laboratory blanks and duplicates. Data from the QC samples are used as a measure of performance and as an indicator of potential sources of cross-contamination. All QC data generated by the laboratory will be submitted with the report.

5.2 LABORATORY ASSURANCE AND QUALITY CONTROL SAMPLES

SGS will follow proper QA/QC procedures, including laboratory blanks, duplicates, and spiked samples for calibration and identification of potential matrix effects. Data from the QC samples are used as a measure of performance and as an indicator of potential sources of cross-contamination. These data are submitted in the data packages provided by SGS.

1. MS/MSD. MS/MSD are not planned to be collected during this sampling event. The lab will perform laboratory control samples (LCS) and laboratory control sample duplicates (LCSD).

2. Surrogate Spiking. Surrogate compounds are added before sample preparation for organics to all samples prior to extraction and analysis. The review for surrogate compounds can be used to assess method accuracy for each sample matrix.

5.3 DATA VALIDATION

All analytical data received from the laboratory will undergo Trihydro's data validation process. Minimally, data will be evaluated by the Tier I data validation process and the *ADEC Contaminated Sites Program Laboratory Data Review Checklist* data checklist and summary will be completed and attached to the report.

Precision, accuracy, method compliance, and completeness of the data packages will be assessed during the data validation process. Precision is determined by evaluating the calculated relative percent difference (RPD) values from: laboratory duplicate pairs and LCS/LCSD pairs. Laboratory accuracy is established by reviewing the demonstrated percent recoveries of the following items to identify potential biases in the analytical data: LCS/LCSD samples and organic system monitoring compounds (surrogates). Field accuracy is established by collecting and analyzing field QA/QC samples to monitor for possible ambient or cross-contamination during sampling and transportation. Method compliance is established by reviewing sample integrity, holding times, detection limits, surrogate recoveries, laboratory blanks, initial and continuing calibrations (where applicable), and the LCS/LCSD percent recoveries against method-specific requirements. Completeness is evaluated by determining the overall ratio of the number of samples and analyses planned versus the number of samples with valid analyses. Determination of completeness includes a review of the COC, laboratory analytical methods, and other laboratory and field documents associated with the analytical data set.

202311_Final_SwampSW-Sed_WP.docx

6.0 REFERENCES

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TABLES

TABLE 1. SURFACE WATER ANALYTE TABLE

Chemical Name	CAS NO.	Surface Water Test Method	ADEC Surface Water Quality Standard[1] (µg/L)
Total Aromatic Hydrocarbons (TAHs)			**10**
Benzene	71-43-2	SW 8021B / 8260B	4.6
Toluene	108-88-3	SW 8021B / 8260B	1100
Ethylbenzene	100-41-4	SW 8021B / 8260B	15
Xylenes	1330-20-7	SW 8021B / 8260B	190
Polynuclear Aromatic Hydrocarbons (PAHs)			
Acenaphthene	208–96–8	SW 8270B / 8310	530
Acenaphthylene3	201–06–9	SW 8270B / 8310	260
Anthracene	120–12–7	SW 8270B / 8310	434
Benz[a]anthracene	56–55–3	SW 8270B / 8310	0.12
Benzo[a]pyrene	50–32–8	SW 8270B / 8310	0.034
Benzo[b]fluoranthene	205-99-2	SW 8270B / 8310	0.34
Benzo[g,h,i]perylene3	191–24–2	SW 8270B / 8310	0.264
Benzo[k]fluoranthene	207–08–9	SW 8270B / 8310	0.804
Chrysene	218–01–9	SW 8270B / 8310	2.04
Dibenz[a,h]anthracene	53–07–3	SW 8270B / 8310	0.034
Fluoranthene	206–44–0	SW 8270B / 8310	2604
Fluorene	86–73–7	SW 8270B / 8310	290
Indeno[1,2,3-cd]pyrene	193–39–5	SW 8270B / 8310	0.194
Naphthalene	91–20–3	SW 8270B / 8310	1.7
Phenanthrene3	85–01–8	SW 8270B / 8310	170
Pyrene	129–00–0	SW 8270B / 8310	120
Total Aqueous Hydrocarbons (TAqH)			**15**
Test Containment & Shipping:			
Hold Time:	14 days		
Arrival Temperature Range:	0-6 °C		
Sampling Container:	2x 250 mL Amber Glass		

Notes:

[1] -- TAH and TAqH criteria are taken from 18 AAC 70 Standards Table 5(A)(iii). BTEX and PAH compounds do not have surface water action criteria, and are thus regulated under 18 AAC 75 Table C. Action criteria is the stricter of the two values.

CAS No. - Chemical Abstracts Service Number

µg/L - micrograms per liter

mL - mililiter, 1/1000th of a liter

ADEC - Alaska Department of Enviornmental Conservation

SGS - SGS North America Inc.

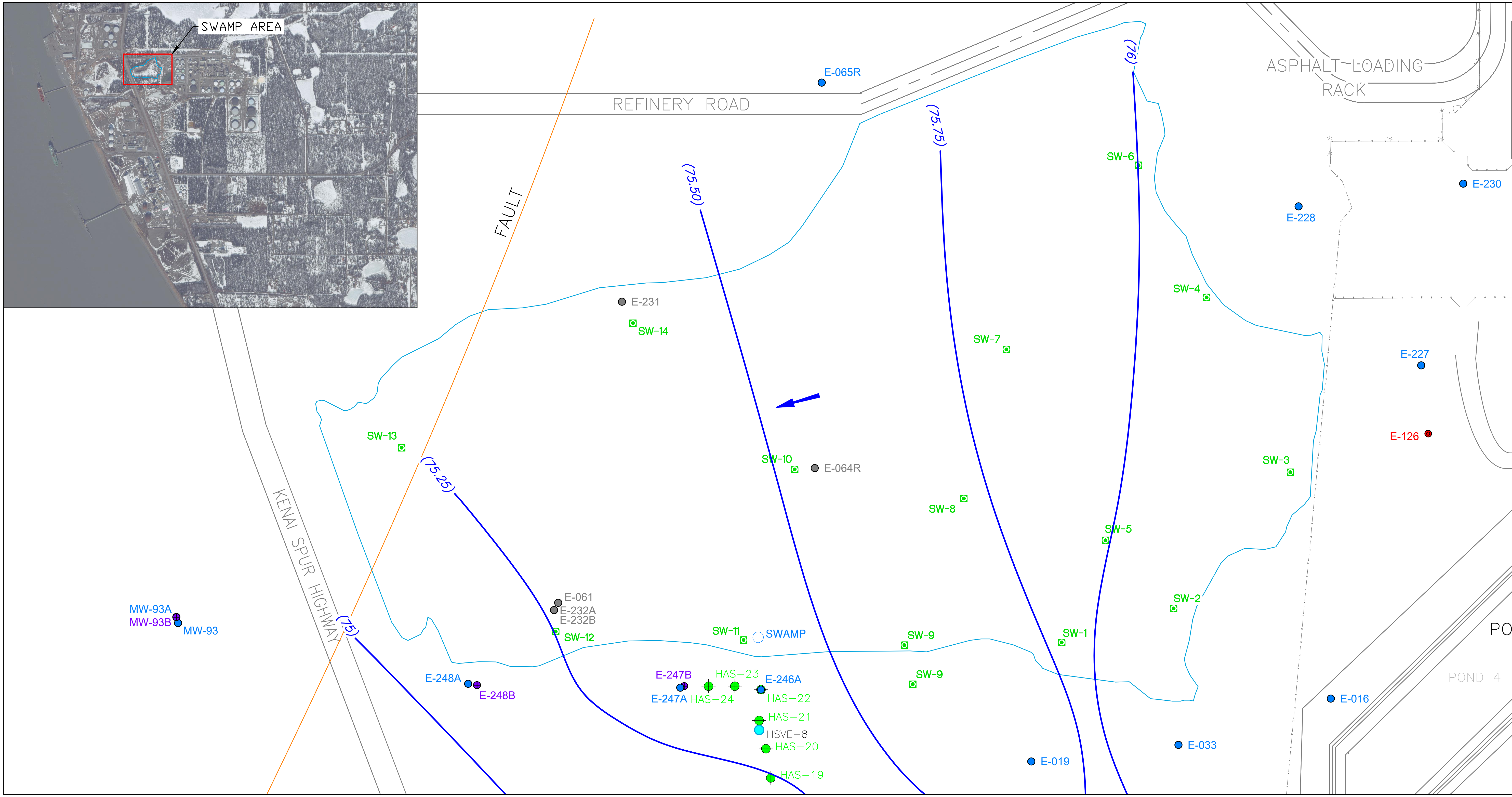
$$TAqH = TAH + \sum PAHs$$

TABLE 2. SEDIMENT ANALYTE TABLE

Chemical Name	CAS NO.	Sediment Test Method	NOAA SQuiRT Sediment Quality Guidance[1] (ppb)
Total Aromatic Hydrocarbons (TAHs)			
Benzene	71-43-2	8021B / 8260D	1,000
Toluene	108-88-3	8021B / 8260D	47,000
Ethylbenzene	100-41-4	8021B / 8260D	50,000
Xylenes	1330-20-7	8021B / 8260D	17,000
Polynuclear Aromatic Hydrocarbons (PAHs)			
Acenaphthene	208–96–8	8270E / 8310	NG
Acenaphthylene3	201–06–9	8270E / 8310	NG
Anthracene	120–12–7	8270E / 8310	1600
Benz[a]anthracene	56–55–3	8270E / 8310	2,500
Benzo[a]pyrene	50–32–8	8270E / 8310	7,000
Benzo[b]fluoranthene	205-99-2	8270E / 8310	NG
Benzo[g,h,i]perylene3	191–24–2	8270E / 8310	33,000
Benzo[k]fluoranthene	207–08–9	8270E / 8310	38,000
Chrysene	218–01–9	8270E / 8310	35,000
Dibenz[a,h]anthracene	53–07–3	8270E / 8310	NG
Fluoranthene	206–44–0	8270E / 8310	260,000
Fluorene	86–73–7	8270E / 8310	NG
Indeno[1,2,3-cd]pyrene	193–39–5	8270E / 8310	1,900
Naphthalene	91–20–3	8270E / 8310	17,000
Phenanthrene3	85–01–8	8270E / 8310	31,000
Pyrene	129–00–0	8270E / 8310	NG
Test Containment & Shipping:			
Hold Time:	14 days		
Arrival Temperature Range:	0-6 °C		
Sampling Container:	4oz 4mber Glass		

Notes:
NOAA -- National Oceanic and Atmospheric Agency
SQuiRT -- Screening Quick Reference Tables
[1] -- Guidance follows the Dutch Sediment Intervention criteria. This criteria provides a baseline for clean up levels.
CAS No. - Chemical Abstracts Service Number
ppb -- parts per billion
mL - milliliter
oz -- Ounce, Fluid
°C -- Degrees Centigrade
NG -- No Guidance

FIGURE



Source Drawing From: Kent & Sullivan Inc., Circa 2007

EXPLANATION

- A-AQUIFER MONITORING WELL
- B-AQUIFER MONITORING WELL
- UCA MONITORING WELL
- SURFACE WATER SAMPLE LOCATION
- AIR SPARGE WELL
- REMOVED OR DESTROYED WELL
- SURFACE WATER LEVEL MEASURING POINT
- FAULT
- SWAMP BOUNDARY
- (75) FALL 2023 A/B WATER LEVEL CONTOUR (FT AMSL, DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION
- FT AMSL FEET ABOVE MEAN SEAL LEVEL

N

0 100'

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FIGURE 1

SITE MAP AND POTENTIOMETRIC SURFACE

TESORO ALASKA COMPANY, LLC
NIKISKI, ALASKA

Drawn By: JLP	Checked By: JM	Scale: 1" = 100'	Date: 11/3/2023	File: 390_S&SW-SITEMAP-202311

APPENDIX A

STANDARD OPERATING PROCEDURE – SURFACE-WATER SAMPLING

memorandum

To:	Trihydro Employees
From:	OSE
Date:	August 1, 2019
Re:	Standard Operating Procedure – Surface-Water Sampling

1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to provide methods, procedures, and guidance for sampling surface waters or liquids in lakes, streams, pits, sumps, lagoons, and similar reservoirs for environmental analysis. The SOP presents two methods of sampling: direct immersion of sampling containers and use of a pond sampler.

This SOP applies to Trihydro Corporation (Trihydro) projects where surface-water sampling will be performed and no program- or client-specific procedure is in use.

2.0 PLANNING AND PROCEDURES

Surface-water sampling involves removing water directly from a water body with minimal interferences from bank effects, sediment, or other disturbances. The sample is collected from a representative area of the water body and transferred to appropriate sample containers for transport to the laboratory. Monitoring of water-quality parameters (i.e., pH, specific conductivity, temperature, dissolved oxygen) is performed after a representative sample has been collected and the sample bottles have been filled and secured.

3.0 VARIABLES

The following variables should be considered in planning for surface-water sampling:

- **Current flow and direction:** Samples should be collected from a flowing stream moving into the sampling container. Sampling locations should be clear of stagnant water, eddies, backwater, reverse flows, and areas of faster than normal flows. In addition, identify confluences with other water bodies to select sampling locations that are either isolated from mixing or within the mixing zone, depending on the sampling and analysis plan.
- **Water-body width and depth:** The width and depth of the sampling body determine sampling location. The sample should be collected from a representative location near the center of the water body to avoid stagnant near-shore water and bank-material effects. The water-body depth should be determined to assess if it is safe to enter the water or if a pond sampler should instead be used.
- **Pond sampler (Attachment A, Photo 1):** This long-handled device allows a sample to be collected from a limited-access location. Compared to wading, pond samplers cause minimal bottom-sediment disturbance.

- **Water quality, including type and concentration of chemical compounds present:** Surface-water sampling methods can be used for aqueous-phase contamination, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, pesticides, polychlorinated biphenyls, radionuclides, and microbiological constituents. Sampling-equipment composition should be compatible with the constituents of concern.

4.0 EQUIPMENT

The following equipment is recommended for surface-water sampling:

- ☐ Required personal protective equipment (PPE), listed in the site-specific health and safety plan (HASP) (generally nitrile gloves, waders, and safety glasses)
- ☐ Water-quality meter (for pH, specific conductance, temperature, dissolved oxygen, or redox potential) calibrated daily per the manufacturer's specifications **(Attachment A, Photo 2)**
- ☐ Swabbing materials
- ☐ Pond (or dip) sampler
- ☐ Nephelometer (for turbidity measurements; calibrated if required by the manufacturer) **(Attachment A, Photo 3)**
- ☐ Plastic sheeting
- ☐ Sampling vessel
- ☐ Sample containers and preservatives
- ☐ Photoionization detector (PID) **(Attachment A, Photo 4)** (calibrated, if screening for VOCs is required)
- ☐ Ice and resealable plastic bags
- ☐ Field logbook
- ☐ Wrist watch (with digital display)

5.0 PRE-SAMPLING

To prevent cross contaminating other samples, upstream and background sites should be sampled first. The procedure for pre-sampling is as follows:

1. Don a pair of clean nitrile gloves, safety glasses, and other required PPE (as listed in the HASP).
2. Prepare an area on the bank by placing plastic sheeting on the ground surface to minimize the potential to cross contaminate the sampling equipment and materials.
3. If performing VOC screening, measure and record the background organic vapors in the ambient air using a PID (in accordance with manufacturer specifications and recommendations).
4. Record general weather conditions in the field logbook.

6.0 SAMPLE COLLECTION

The sample-collection procedure is listed below:

1. Don a pair of clean nitrile gloves, safety glasses, and other required PPE (listed in the HASP). Don waders, if necessary.
2. Prepare sample bottles and preservatives for sampling.
3. If wading, avoid disturbing the substrate as much as possible and allow any disturbed sediment to settle before sampling.
4. While keeping the sampling vessel upstream of the sampler and pointed upstream, collect the sample from just under the water surface (Attachment A, **Photo 5**).
5. Return to the prepared area and from the sampling vessel, fill volatile organic analysis (VOA) vials first, allowing the liquid to slowly fill the container without agitation. While filling the VOA vial, obtain a meniscus slightly above the top of the vial.
6. Place cap on VOA and check for entrained air by slowly tipping, tapping against the palm of one hand, and observing for bubbles. If bubbles are present, discard the sample and collect again, as described above.
7. Continue filling sample bottles (Attachment A, **Photo 6).**
8. Monitor and record the pH, conductivity, dissolved oxygen, and turbidity in the water remaining in the sampling vessel.
9. Add preservatives to the samples as needed, and place the sample bottles on ice. Note that most sample bottles come with preservatives already added. If such is the case, do not overfill the bottles. If a sample bottle containing preservatives is overfilled, discard the overfilled bottle and collect again, as described above.
10. Record the sampling information.

11. Secure the area by removing equipment and materials; properly dispose of plastic sheeting and other sampling materials.
12. Decontaminate the sampling equipment using Simple Green or similar cleaning solution.

7.0 BIBLIOGRAPHY

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QAQ-CSO-P00

ATTACHMENT A. PHOTOGRAPHS

Photo 1: Pond Sampler (2013)

Photo 2: Hanna Multi-parameter Portable Water-Quality Meter (2013)

Photo 3: Nephelometer (2013)

Photo 4: Photoionization Detector (PID) (2013)

Photo 5: Collecting samples upstream (Trihydro 2005)

Photo 6: Filling VOA vials (TriHydro 2003)

APPENDIX B

STANDARD OPERATING PROCEDURE – SEDIMENT SAMPLING USING DREDGE SAMPLERS memorandum

To: Trihydro Employees
From: OSE
Date: May 13, 2015
Re: Standard Operating Procedure – Sediment Sampling using Dredge Samplers (Author: Ron Halpern)

This standard operating procedure (SOP) is intended to provide a standardized method for collecting sediment samples using dredge samplers. The methods discussed in this SOP apply to sampling sediment in both flowing and standing water. They are generic in nature, and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, and the constraints presented by site-specific conditions and equipment limitations (USEPA 1999).

For the purposes of this document, "sediments" refer to mineral and organic materials situated below the water surface. The water may be standing (e.g., lakes, ponds, and impoundments) or flowing (e.g., rivers and streams) (USEPA 1999). The SOP applies to collecting representative sediment samples. The samples may be collected for chemical, biological, or physical analysis, or for visual purposes.

1.0 PRE-SAMPLE PLANNING

Sediment sampling, as described in this SOP, is the collection of saturated samples of sediment from beneath the water (aqueous or other liquid) surface. This section describes a brief summary of the method, potential variables that may affect sampling, equipment needed to complete the sampling, and health and safety aspects associated with equipment operation and sample collection.

1.1 Method Summary

Sediment samples may be collected using various methods and equipment, depending on the depth of the liquid layer overlying the sediment, the portion of the sediment profile required (surface versus subsurface), the type of sample required (disturbed versus undisturbed), contaminants present, and the sediment type (USEPA 1999).

Sediment samples can be collected from beneath a liquid layer either directly or indirectly. Direct sampling can be performed using a hand-held device (e.g., shovel, trowel, or auger). Indirect sampling can be performed using a remotely-activated sampling device (e.g., Ekman or PONAR dredge). Following collection, the sample is retrieved and transferred from the sampling device to a sample container of appropriate size and construction for the analyses to be performed (USEPA 1999).

1.2 Variables

The following variables should be considered when planning for sediment sampling using dredge samplers (USEPA 1999):

- *Liquid-layer composition:* Typically the liquid layer is water. However, in rare circumstances, it could be another liquid type. This is important to evaluate if the liquid is compatible with the composition of the sampler and/or cordage.

- *Liquid-layer thickness and sample depth:* This information, combined with total sample depth, is important in evaluating the sampling method and tools required.
- *Disturbed versus undisturbed sample:* This will help determine the type of sampling equipment needed.

1.3 Equipment

Depending on the type of sampling performed, some or all of the following equipment is recommended for sediment sampling (USEPA 1999):

- ☐ Required personal protective equipment (PPE), listed in the site-specific health and safety plan (HASP) (generally nitrile gloves and safety glasses).
- ☐ Spade, shovel, trowel, or scoop – used to collect disturbed (grab) sediment samples from shallow (wadable) locations.
- ☐ Bucket (hand) auger or tube auger – used to collect undisturbed sediment samples from shallow (wadable) locations. Bring additional extension rods, "T" handle, and pipe wrenches as appropriate. When using a tube auger, bring acetate tubes.
- ☐ Ekman or PONAR dredge samplers – used to collect sediment samples from deeper locations (e.g., lakes and ponds).
- ☐ Nylon rope or steel cable – for raising and lowering the dredge. Choose a 3/16-inch wire line (e.g., Wildco No. 62-C15).
- ☐ Sieve or screen if sampling for biological sampling – a 500-micron mesh screen is recommended for benthic invertebrate sampling).
- ☐ Large-size tub, bucket, or other container – to place the dredge sampler after retrieval. This allows the residual water and fine sediment to be caught and provides a surface to rest the dredge while transfering sediment to the sample containers.
- ☐ Light-duty crane or winch – the large Ekman dredge can weigh over 80 pounds when full. The standard Ekman dredge can weigh over 30 pounds. The standard PONAR dredge weighs 45 pounds when empty.
- ☐ Sample containers and preservatives – 4-ounce, 8-ounce, and/or 1-quart wide-mouth glass jars (as appropriate for analyses required) with Teflon-lined lids.

Winch/Depth Meter No. 85-E20
(Wildco 2007a)

- ☐ Zip-lock® plastic bags.
- ☐ Coolers - depending on the sediment sample number and volume (i.e., total final cooler weight, samples, and ice), a dolly may be needed to transport the cooler from sample location to truck. Alternatively, bring a cooler equipped with wheels.
- ☐ Ice and resealable plastic bags.
- ☐ Stainless steel lab spoon and buckets (or equivalent) – used for homogenizing sediment samples (if compositing samples) not being submitted for volatile organic compound (VOC) analysis.
- ☐ Gloves – for personal protection and to prevent sample cross-contamination.
- ☐ Other appropriate PPE as specified in the HASP.
- ☐ Sampling flags or buoys – to identify sampling locations.
- ☐ Trimble® global-positioning system (GPS) (or similar) to log sample latitude/longitude.
- ☐ Field notebook – to record sampling procedures and observations.
- ☐ Permanent-ink marker and sample labels to mark samples.
- ☐ Plastic sheeting.
- ☐ Decontamination buckets, solutions, brushes, and containment drums.
- ☐ Clean water for rinsing.
- ☐ Field logbook.
- ☐ Calculator.
- ☐ Wristwatch.

1.4 Health and Safety Concerns

Besides site-specific hazards, several potential hazards are associated with the sampling process and equipment. Some of these hazards are listed below.

- ☐ Pinch points – both the PONAR and Ekman dredge samplers have clam-shell style openings. The PONAR dredge is spring-activated. ANSI Level II laceration-resistant gloves should be worn when setting the spring-activation system, and jaws should be placed facing down on a flat surface (e.g., ground, floor, or bench). Hands should not be placed within the clam-shell opening once springs are set.
- ☐ Back injury – when using a shovel, do not collect too large a sample that it puts excessive stress on your back when lifting. When using an auger, proper body placement and use of arms and weight will minimize the potential for lower-back twisting and injuries. Ekman and PONAR samplers can be heavy, especially when full of sediment. Using a winch will alleviate back strain. Use appropriate lifting techniques when samplers are not connected to a winch.
- ☐ Injury or damage due to dropping from height –hand auger (bucket or tubular) “T” handle bars can impact the head or body when lowered to the sampling height. The Ekman and PONAR dredge samplers are heavy and can cause injury (or damage to equipment) when dropped. Wear appropriate head protection and steel-toed boots. When using an auger, lower equipment in a controlled manner – do not allow free fall.
- ☐ Slip/fall hazards – when wading into a lake, pond, or lagoon, move slowly. Transfer weight only after carefully testing whether it is safe to do so. When using a spade or shovel, do not jump on the shovel to drive it into sediment – place one foot on top of the shovel blade, lean forward, and use your foot combined with body weight to push the shovel into sediment. Ensure the sample is loose enough from the surrounding material before lifting.
- ☐ Biological hazards – depending on location and sampling method, there may be biological hazards that may directly affect employees/technicians. Review the HASP and employ appropriate action.
- ☐ Tipping hazard – deploying and retrieving the Ekman or PONAR samplers from a boat may require leaning over the side, which may destabilize the boat. If possible, use a boom winch with a swinging arm.
- ☐ Hand injury – wear laceration-resistant gloves when using a trowel to retrieve samples. Sharp objects may be present near the sampling location.

1.5 Pre-sampling Preparation

Pre-sampling preparation should include the following steps (USACE 2001):

1. Determine the objective(s) and extent of the sampling effort. Based on the site characteristics and objectives, determine the appropriate sampling methods (e.g., disturbed, undisturbed, deep sediment or shallow sediment) to be employed and the equipment and supply types and amounts required.
2. Obtain the necessary sampling and monitoring equipment.
3. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
4. Decontaminate or preclean equipment, and ensure that it is in working order.
5. Perform a general site survey before site entry in accordance with the site-specific HASP. Identify potential biological, chemical, mechanical, and physical hazards.
6. Mark sampling locations using stakes, flags, or buoys. Site-specific factors, including flow regime, basin morphology, sediment characteristics, depth of overlying liquid/water, contaminant source, and extent and nature of contamination should be considered when selecting the sample locations. Sample locations may be adjusted based on site access, property boundaries, and surface obstruction. Criteria for choosing sample locations will depend on the objectives. For evaluating contaminants, consider the following:
   - Substrate particle size and organic matter content – contaminants are more likely to be concentrated in sediment typified by fine particle size and high organic matter. These are deposited in lower-energy eddies (or depositional zones).
   - Coarser materials do not typically contain much organic material, and do not typically concentrate contaminants.

2.0 SAMPLE COLLECTION PROCEDURES

Selecting a sampling device is most often contingent upon (USEPA 1999):

- Water depth at the sampling location.
- The physical characteristics of the sediment to be sampled.
- The type of sample required.
- The parameters being analyzed.

Procedures for various site conditions are presented in the following subsections.

2.1 Sampling Surface Sediment with a Trowel or Scoop from Beneath a Shallow Aqueous Layer

For this procedure, surface sediment is considered to range from 0 to 6 inches in depth, and a shallow aqueous layer is considered to range from 0 to 12 inches in depth. Collecting surface sediment from beneath a shallow aqueous layer can be accomplished with tools such as spades, shovels, trowels, and scoops. Although this method can be used to collect both unconsolidated and/or consolidated sediment, it is limited by the depth and movement of the liquid/aqueous layer. Deep and rapidly flowing water render this method less accurate than others discussed below. However, representative samples can be collected with this procedure in shallow sluggish water provided care is demonstrated by the sampler. A stainless steel or plastic sampling implement will suffice in most applications. Care should be exercised to avoid the use of devices plated with chrome or other materials: plating is particularly common with garden trowels (USEPA 1999).

The following procedure will be used to collect sediment with a scoop, shovel, or trowel (USEPA 1999):


Pointed Trowel Hand Spade

1. Using a decontaminated sampling implement, carefully remove the desired thickness and volume of sediment from the sampling area.
2. Tranfer the sample into an appropriate sample or homogenization container. Ensure that non-dedicated containers have been adequately decontaminated. (For high-quality assurance, collect an equipment blank before sampling.)
3. Surface water should be decanted from the sample or homogenization container before sealing or transfer; care should be taken to retain the fine-sediment fraction during this procedure.

2.2 Sampling Surface Sediment with a Bucket Auger or Tube Auger from Beneath a Shallow Aqueous Layer

For this procedure, surface sediment is considered to range from 0 to 6 inches in depth, and a shallow aqueous layer is considered to range from 0 to 24 inches in depth. Collecting surface sediment from beneath a shallow aqueous layer can be accomplished with a bucket or tube auger. These augers typically are equipped with a "T" handle to rotate the auger and extension rods. These sampling implements are also collectively called core samplers. Core samplers are used to sample vertical sediment columns. They are particularly useful when a historical picture of sediment deposition is desired because they preserve the sequential deposit layering, and when it is desirable to minimize the material loss at the sediment-water interface. Many coring-device types have been developed depending on the water depth from which the sample is to be obtained, the nature of the bottom material, and the core length to be collected. They vary from hand-push tubes to weight or gravity-driven devices (USEPA 1999).

Coring devices are particularly useful in pollutant monitoring because turbulence created by descent through the water is minimal. Therefore, the fines of the sediment-water interface are only minimally disturbed and the sample is withdrawn intact permitting the removal of only those layers of interest. Also, core liners manufactured of glass or Teflon® can be purchased, thus reducing possible sample contamination, and the samples are easily delivered to the lab for analysis in the tube in which they were collected (USEPA 1999).

Follow these procedures when using a **<u>hand tube sampler</u>** device to collect subsurface sediments. The hand tube sampler consists of a coring device, handle, and acetate core, and is used as follows (USEPA 1999):

Hand Bucket Auger Hand Tube Sampler

1. Assemble the coring device by inserting the acetate core into the sampling tube.
2. Insert the “eggshell” check valve (i.e., sand trap) mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.
3. Screw the coring point onto the tip of the sampling tube.
4. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
5. Place the sampler in a 0 to 20 degree from vertical position on the material to be sampled.
6. This sampler may be used with either a drive hammer for firm consolidated sediments, or a“T” handle for soft sediments. If the “T” handle is used, place downward pressure on the device until the desired depth is reached. Rotate the sample to shear off the core of the bottom, making sure the open slot is facing upward, retrieve the device, and proceed to Step 15.
7. If the drive hammer is selected, insert the tapered handle (drive head) of the drive hammer through the drive head.
8. With the left hand holding the tube, drive the sampler into the material to the desired depth; do not drive the tube farther than the tip of the hammer’s guide.
9. Record the length of the tube that penetrated the sample material, and the number of blows required to obtain this depth.
10. Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head. In this position, the hammer serves as a handle for the sampler.
11. Rotate the sampler at least two revolutions to shear off the sample at the bottom.
12. Lower the sampler handle (hammer) until it just clears the two ear-like protrusions on the drive head and rotate about 90 degrees.
13. Withdraw the sampler by pulling the handle (hammer) upwards and dislodging the hammer from the sampler.
14. Unscrew the coring point and remove the “eggshell” check valve.
15. Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. The sample may be used in this fashion, or the contents transferred to a stainless steel or plastic bucket and mixed thoroughly to obtain a homogeneous sample representative of the entire sampling interval.

Samples for volatile organic analysis must be subsampled and collected directly from the core before mixing the sample to minimize contaminant volatilization.

Follow these procedures when using a **<u>hand bucket auger</u>** device to collect subsurface sediments. It consists of a bucket-auger coring device, handle, and extension rods. Some kits include a coring device equipped with sample-sleeve insert. This device is recommended, if available (USEPA 1999).

1. Assemble the coring device by inserting the acetate core into the sampling tube.
2. Attach the bucket auger to the extension rods and attach the “T” handle.
3. If possible, clear the area to be sampled of any rocks or surface debris.
4. Place the sampler in a 0 to 20 degree (from vertical) position on the material to be sampled. This orientation minimizes sample spills from the sampler upon extraction from the sediment and water.
5. Place downward pressure on the device while turning the “T” handle clockwise until the desired depth is reached. The bucket auger breaks the native sediment, pushing it into the lined core. Rotate the sample an additional one or two times and then slowly lift the sampler to the surface.

6. Remove the auger/core and retrieve the sample. If an acetate core was not installed in the bucket auger or a lined core sampler was not used, transfer the sample from the bucket to an appropriate container.
7. Cap the acetate core at both ends, or seal the sample container (as described in Step 6). Alternatively, the contents can be transferred to a stainless steel or plastic bucket and mixed thoroughly to obtain a homogeneous sample representative of the entire sampling interval.

Samples for volatile organic analysis must be subsampled and collected directly from the core before mixing the sample to minimize contaminant volatilization.

2.3 Sampling Deep Sediment with a Bucket Auger or Tube Auger from Beneath a Shallow Aqueous Layer

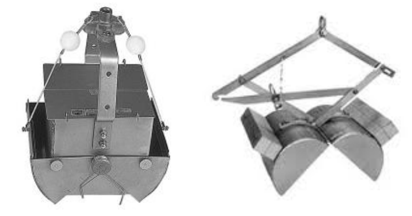
For this procedure, deep sediment is considered to range from 6 to greater than 18 inches in depth and a shallow aqueous layer from 0 to 24 inches. Collecting deep sediment from beneath a shallow aqueous layer can be accomplished with either a bucket auger or a tube auger in a manner similar to that previously described. Using additional extensions can increase the depth from which sediment can be collected from 24 inches to 5 feet or more. However, water clarity must be high enough to permit the sampler to directly observe the sampling operation. In addition, sample handling and manipulation increases in difficulty with increasing water depth. The bucket auger is used to bore a hole to the upper range of the desired sampling depth and then withdrawn. The tube auger is then lowered down the borehole and driven into the sediment to the lower range of the desired sampling depth. The tube is then withdrawn and the sample recovered from the tube. This method can be used to collect firmly consolidated sediments, but is somewhat limited by the depth of the aqueous layer and the initial borehole integrity (USEPA 1999).

The following procedure will be used to collect deep-sediment samples with a bucket auger and a tube auger (USEPA 1999):

1. Attach the bucket auger to the required extension length, and attach the “T” handle to the upper extension.
2. If possible, clear the area to be sampled of any rocks or surface debris.
3. Begin augering, periodically removing any accumulated sediment (i.e., cuttings) from the auger bucket. Cuttings should be disposed of far enough from the sampling area to minimize cross-contamination of various depths. Should the borehole continuously collapse after retrieving the bucket auger, try inserting a section of PVC pipe with a diameter slightly larger than the width of the auger blades. Advance the pipe with the augers and hold in place when removing the auger. This will maintain the borehole integrity.
4. After reaching the upper range of the desired sampling depth, slowly and carefully remove the bucket auger from the boring.
5. Attach the tube auger to the required extension length and attach the “T” handle to the upper extension.
6. Carfully lower the tube auger down the borehole using care to avoid making contact with the borehole sides and cross-contaminating the sample. Gradually force the tube auger into the sediment to the desired sampling depth. Hammering of the tube auger to facilitate coring should be avoided as the vibrations may cause the borehole walls to collapse (in an uncased hole).
7. Remove the tube auger from the borehole, again taking care to avoid making contact with the borehole sides and cross-contaminating the sample.
8. Remove the cutting tip from the tube auger and remove the core from the device.
9. Discard top of core (approximately 1 inch), as this represents material collected by the tube sampler before penetration of the layer of concern.
10. Transfer the sample into an appropriate sample or homogenization container.

2.4 Sampling Surface Sediment with an Ekman or Ponar Dredge from Beneath a Shallow Aqueous Layer

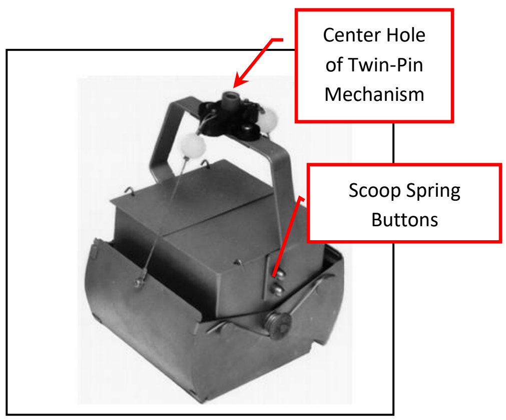
For this procedure, surface sediment is considered to range from 0 to 6 inches in depth. Collecting surface sediment can be accomplished with a system consisting of a remotely activated device (the dredge) and a deployment system. This technique consists of lowering the sampling device to the sediment surface using a rope, cable, or extended handle. The mechanism is activated, and the device entraps sediment in spring-loaded or lever-operated jaws (USEPA 1999).



Ekman Dredge Sampler PONAR Dredge Sampler

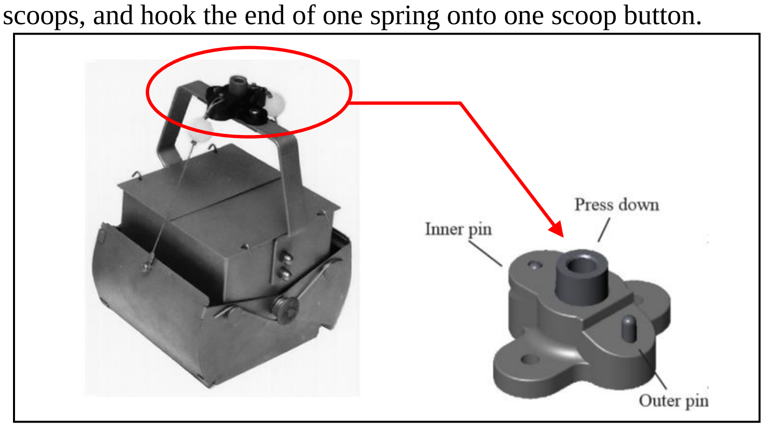
An Ekman dredge is a *lightweight* sediment-sampling device with spring-activated jaws. It is used to collect moderately consolidated, fine-textured sediment. The Ekman dredge performs best where the bottom material is unusually soft, as when covered with organic sludge, light mud, ooze, submerged marl, or fine peaty materials. It is unsuitable, however, for sandy, rocky, and hard bottoms or where there is vegetation, and is too light for use in streams with high velocities. This dredge should not be used from a bridge that is more than a few feet above the water, because the spring mechanism which activates the sampler can be damaged by the messenger if dropped from too great a height (Wildco 1997a).

The PONAR dredge is a *heavyweight* sediment-sampling device with weighted jaws that are lever activated. It is used to collect consolidated fine- to coarse-textured sediment.



The following procedure will be used for collecting sediment with an **Ekman dredge** (Wildco 1997a):

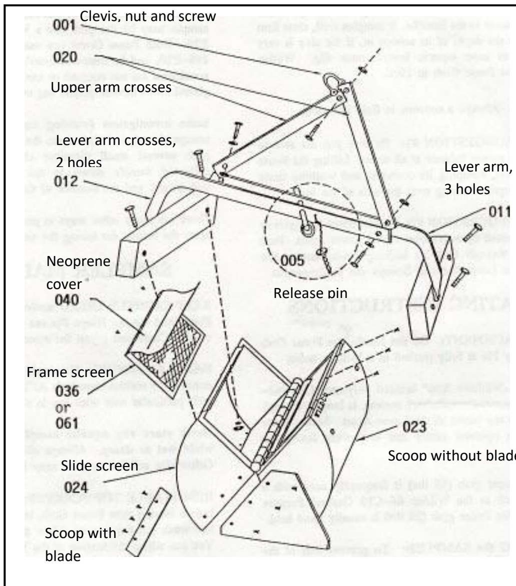
1. Attach a sturdy nylon rope or stainless-steel cable (minimum 3/16-inch) through the center (button) hole of the stainless steel strike pad of the Ekman Twin-Pin release mechanism. Tie a large knot or fasten a knot to a suitable washer to keep the line from pulling back through the center hole. Secure the free end of the line to the crane/winch or boat. After fastening and securing the line, ensure that the scoops open and close freely. Thread the messenger on the line. Alternately, secure an extension handle to the bracket with machine bolts. (See instructional video: http://youtu.be/hwQEjRcQQtI for instructions on attaching the extension handle).
2. Set the springs on the scoops, close the scoops, and hook the end of one spring onto one scoop button. Carefully stretch the spring to reach the second scoop button and repeat with the second spring on the other side.



3. Arm the scoops – place the sampler with the scoops facing down against a hard surface (e.g., ground, bottom of boat, or bench). Attach one side of the cable loops to the hook on one of the scoops. Pull the cable up using the white ball on the cable for a hand grip – this opens the scoop. Press the center release button (which pushes

the pins down) exposing the inner pin. Attach the cable loop to the inner pin. Carefully release the button (capturing the cable loop). Hook the second cable to the button on the second scoop. Using the white ball as a handle, pull the cable (opening the second scoop) and hook the cable loop over the outer pin. (See instructional video: http://youtu.be/L5cpq_wT9Dw). Wear gloves during this procedure to prevent pinch points/hand injuries.

4. Lower the sampler slowly to a point 4 to 6 inches above the sediment surface. If dropped rapidly, the sampler may descend in a more diagonal direction.
5. Drop the sampler the rest of the way to the sediment. Allow the sampler to settle before tripping the release mechanism.
6. Trigger the release mechanism by either lowering the messenger weight down the line, or by depressing the button on the upper end of the extension handle. This will allow the springs to close the scoops, collecting the sample.
7. Raise the sampler and slowly decant any free liquid through the top of the sampler. Care should be taken to retain the fine-sediment fraction during this procedure.
8. Place the sampler into a container or large tub.
9. Open the dredge scoops one at a time and transfer the sediment into an appropriate container. Ensure that non-dedicated containers have been property decontaminated before use. When collecting biological samples, place the sample onto a sieve and rinse with fresh water before storing. Subsampling can be performed by keeping the scoops closed and opening the top lids.
10. Thoroughly clean and decon the sampler between uses. After completing the sampling session, unhook the springs for safety.



Schematic of PONAR Dredge (2007)

The following procedure will be used for collecting sediment with an **PONAR** dredge (Wildco 2007b):

1. Warning – do not handle or move the PONAR grab unless the safety pin is fully pushed in the locking holes. To insert the safety-pin lock, keep clear of the scoops and other working edges of the sampler. Move the scoops to the open position. Bring the free end of the horizontal locking bar into position in the locking notch on the upper bar to insert the safety-pin lock.
2. Attach the line – use a stainless steel cable (e.g., Wildco 61-B). Loop the line through the clevis at the top center of the lever arms, and clamp securely (this is essential for operator safety and to prevent losing the sampler). Clamp the other end of the line to the boat (or other solid/secure location).
3. Use the winch to lift the dredge off the deck (the standard PONAR weighs 45 pounds; the petite PONAR weighs 24 pounds). Before moving the dredge over the water (or before lowering it) – insert the pinch pin as described in Step 4.
4. Arrange the PONAR dredge with the scoops in the open position, setting the trip bar so the sampler remains open when lifted from the top. If the dredge is so equipped, place the spring-loaded pinch pin into the aligned holes in the trip bar. Firmly push the pin in place. As long as the line is taut, the pinch pin will stay in place. When the line starts to become slack, the pinch-pin spring will pop out of the lever arm holes, allowing the scoops to close.
5. Lower the dredge slowly. The top surface of the dredge is covered with a 500-micron mesh screen. Lowering the dredge slowly will reduce the shock wave and drift and prevent bottom sediment and organisms from escaping. Lower the dredge to a few inches above the sediment.

6. Drop the sampler to the sediment below. When the line slackens, the pinch pin will pop out. Allow a moment for the dredge sampler to sink into the sediments (make sure the line is allowed to slacken). Reel in the cable to increase tension on the cable, which will exert a closing motion to the dredge jaws. Raise the dredge slowly at first, allowing the sampler to dig into the sediment underneath.
7. Maintain tension on the cable when raising the dredge sampler to the surface. Raising the dredge sampler should be done using a steady, relatively slow lift (closing should occur over 90% of the time). Decant any free liquid through the screens on the top of the dredge. Care should be taken to retain the fine-sediment fractions during this operation.
8. When the dredge reaches the surface, lift it clear and swing it inboard to a position over a tub placed to receive the sample. Stay clear of the scoop edges, open the dredge, and transfer the sediment to appropriate containers.
9. At the end of the sampling procedure, replace the safety pin (not the spring-loaded pin) to prevent accidental closing of the scoops while handling or shipping. Wash and decontaminate the dredge between use.

3.0 REFERENCES

U.S. Army Corps of Engineers (USACE). 2001. Requirements for the Preparation of Sampling and Analysis Plans, Appendix C, Section C.2, EM200-1-3. Washington, DC.

U.S. Environmental Protection Agency (USEPA). 1999. Field Sampling Guidance Document #1215 – Sediment Sampling. Prepared by the USEPA Region 9 Laboratory, Richmond, California. 10pp. Available from: http://www.epa.gov/region6/qa/qadevtools/mod5_sops/sediment_sampling/r9-sedimentsample_gui.pdf

Wildlife Supply Company (Wildco). 2007a. 197-C15 Large, 106-F65 Tall, & 196-B15 Standard Ekman Bottom Grabs, Instructions and Maintenance. Prepared by Wildco. Available from: http://www.benmeadows.com/store/assets/support_documents/223570Manual.pdf

Wildco. 2007b. 1725-F10 / 1725-F50 Standard Ponar Grab Instructions and Maintenance. Prepared by Wildco. Available from: http://www.benmeadows.com/store/assets/support_documents/223576Manual.pdf

APPENDIX C

SURFACE WATER SAMPLING FIELD FORM TEMPLATE

Surface Water Sampling Form

Sample ID: ______________________

Date: ______________________

Client: ______________________

Project: ______________________

Project No.: ______________________

Site Condition/Weather: ______________________

Sample Collection Method: ______________________

Field Personnel: (print) ______________________ (sign) ______________________

Time	Temperature (deg C)	Dissolved Oxygen (DO)	Specific Conductivity (mS/cm)	pH	Oxygen Reduction Potential (ORP)	Turbidity (NTU)

Sampling Information

Sample Collection Time: ______________________

Analytical Suite Collected: ______________________

Duplicate Sample Yes No

If Yes, Duplicate ID: ______________________ **Duplicate Time:** ______________________

Notes/Comments (odor, color, sheen, etc.): ______________________

____

____

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APPENDIX D

SEDIMENT SAMPLING FIELD FORM TEMPLATE

Trihydro CORPORATION

Sediment Sampling Form

Sample ID: ______________________

Date: ______________________

Client: Marathon Petroleum Company

Project: Sediment & Surface Water Sampling in Kenai Refinery wetlands

Project No.: 0039B-003-0090/0600

Site Condition/Weather: ______________________

Sample Collection Method: ______________________

Location: ______________________

Field Personnel: (print) ______________________ (sign) ______________________

Sampling Information

Sample Collection Time: ______________________

Analytical Suite Collected: ______________________

Duplicate Sample Yes No

If Yes, Duplicate ID: ______________________ **Duplicate Time:** ______________________

Notes/Comments (odor, color, sheen, etc.): ______________________

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APPENDIX E

GROUNDWATER MONITORING PLAN

TETRA TECH
5383 Hollister Avenue, Suite 130
Santa Barbara, CA 93111
Telephone (805) 681-3100
Telefax (805) 681-3108

SURFACE WATER & SEDIMENT
FIELD DATA LOG SHEET - SAMPLING

DATE ______________________

PROGRAM NAME **Program Name**
SITE NAME / NUMBER **Select Site**
SAMPLE MATRIX **Select Sample Matrix**
SAMPLER'S SIGNATURE ______________________

SURFACE WATER DATA

LOCATION I.D. ______________________
SAMPLE I.D. **EAS--010000**
DUPLICATE I.D. -
SAMPLE TIME ______________________
DUP TIME -

SAMPLING METHOD **Select SW Sampling Method**
SURFACE WATER BODY **Select Surface Water Body**
SAMPLE DEPTH (cm) ______________________
MS/MSD (Y/N) ______________________

Time (hhmm)	**Activity**	**Turbidity (NTU)**	**Temp (°C)**	**EC (ms/cm)**	**Dissolved Oxygen (mg/L)**	**pH**	**ORP (mV)**	**Color**
	Arrived	-	-	-	-	-	-	-
	Measure Parameters							
	Sample							

SEDIMENT DATA

LOCATION I.D. ______________________
SAMPLE I.D. **EAS--010000**
DUPLICATE I.D. -
SAMPLE TIME ______________________
DUP TIME -

SAMPLING METHOD **Select SD Sampling Method**
SURFACE WATER BODY **Select Surface Water Body**
MS/MSD (Y/N) ______________________

Time (hhmm)	**Activity**	**Depth (in)**	**Color**	**Description (Sand, Silt, Clay, Moisture, etc.)**
	Arrived	-	-	-
	Observe			
	Sample			

Comments: