Winter 12-27-2022

2022 Draft Final Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site Organic Pollutant Surface Water Sampling Quality Assurance Project Plan (QAPP)

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December 27, 2022

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RE: Draft Final Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site Organic Pollutant Surface Water Sampling Quality Assurance Project Plan (QAPP)

Agency Representatives:

I am writing you on behalf of Atlantic Richfield Company (Atlantic Richfield) to submit the *Draft Final Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site Organic Pollutant Surface Water Quality Assurance Project Plan (QAPP)* (BRW Organic Pollutant SW QAPP) for your review and approval. The BRW Organic Pollutant SW QAPP provides the sampling and analytical procedures and protocols necessary to estimate existing concentrations of organic pollutants within Blacktail Creek (BTC) and Silver Bow Creek (SBC) during normal flow conditions prior to commencement of RA activities at the Site. Pioneer Technical Services, Inc. (Pioneer) is the contractor responsible for conducting and coordinating the elements of the BRW Organic Pollutant Surface Water Sampling QAPP and will receive sampling support from Woodard & Curran under the direction of Atlantic Richfield. Pioneer is responsible for sample shipping, data validation, and reporting, whereas Woodard & Curran will be responsible for monthly sample collection of organic pollutants in conjunction with monthly sampling completed under the 2023 Final Butte Priority Soils Operable Unit Interim Site-Wide Surface Water Monitoring Quality Assurance Project Plan. Fieldwork will begin once Agency approval has been received. A proposed schedule is discussed in the BRW Organic Pollutant SW QAPP.

The documents may be downloaded at the following link:

https://pioneertechnicalservices.sharepoint.com/:f:/s/submitted/Ekx4DTKecdlBuBL4xS1p85kBSE4XDmCAm4pNcjDt4un76w

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SILVER BOW CREEK/BUTTE AREA NPL SITE
BUTTE PRIORITY SOILS OPERABLE UNIT

2022

Draft Final

Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site Organic Pollutant Surface Water Sampling Quality Assurance Project Plan (QAPP)

Atlantic Richfield Company

December 2022

SILVER BOW CREEK/BUTTE AREA NPL SITE
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Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site
Organic Pollutant Surface Water Sampling Quality Assurance Project Plan (QAPP)

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December 2022

APPROVAL PAGE

Silver Bow Creek/Butte Area NPL Site
Butte Reduction Works Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site
Organic Pollutant Surface Water Sampling Quality Assurance Project Plan

Approved: ______________________________ Date: ____________
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Approved: ______________________________ Date: ____________
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Plan is effective on date of approval.

DOCUMENT REVISION TRACKING TABLE

Revision No.	Author	Version	Description	Date

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Silver Bow Creek/Butte Area NPL Site
Butte Reduction Works Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site
Quality Assurance Project Plan for Microbial Analysis and Biotreatability Study

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ACRONYMS

Acronym	Definition	Acronym	Definition
%R	Percent Recovery	**MS**	Matrix Spike
%D	Percent Difference	**MSD**	Matrix Spike Duplicate
		NWE	NorthWestern Energy
Atlantic Richfield	Atlantic Richfield Company	**Pace**	Pace Analytical Services, LLC
BNSF	Burlington Northern Santa Fe	**PAH**	Polycyclic Aromatic Hydrocarbons
BPSOU	Butte Priority Soils Operable Unit	**PARCCS**	Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity
BRW	Butte Reduction Works	**PCB**	Polychlorinated Biphenyl
BSB	Butte-Silver Bow	**PCP**	Pentachlorophenol
BTC	Blacktail Creek	**PDI**	Pre-Design Investigation
CAR	Corrective Action Report	**Pioneer**	Pioneer Technical Services, Inc.
CD	Consent Decree	**QA**	Quality Assurance
CECRA	Comprehensive Environmental Cleanup and Responsibility Act		
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act		
CFRSSI	Clark Fork River Superfund Site Investigation	**QAM**	Quality Assurance Manager
COC	Contaminant of Concern	**QAO**	Quality Assurance Officer
CPM	Contractor Project Manager	**QAPP**	Quality Assurance Project Plan
DEQ	Department of Environmental Quality	**QC**	Quality Control
DI	Deionized Water	**R**	Equipment Blanks
DM/DV	Data Management/Data Validation	**RA**	Remedial Action
DQA	Data Quality Assessment	**RD**	Remedial Design
DQO	Data Quality Objective	**RFC**	Request for Change
EDD	Electronic Data Deliverable	**RL**	Reporting Limit
		ROD	Record of Decision
EPA	Environmental Protection Agency	**RPD**	Relative Percent Difference
EPH	Extractable Petroleum Hydrocarbons	**SBC**	Silver Bow Creek
F	Field Blanks	**SOP**	Standard Operating Procedure
GTI	Groundwater Technology Inc.		
LCS	Laboratory Control Sample	**SQL**	Structured Query Language
LCSD	Laboratory Control Sample Duplicate	**T**	Duplicate Identification for Field Samples
LDS	Laboratory Duplicate Sample	**TB**	Trip Blanks
		UST	Underground Storage Tank
LMS	Laboratory Matrix Spike	**VOC**	Volatile Organic Compounds
MB	Method Blank	**VPH**	Volatile Petroleum Hydrocarbon
MBMG	Montana Bureau of Mines and Geology		
MDHES	Montana Department of Health and Environmental Services		
MPTP	Montana Pole Treatment Plant		

1.0 INTRODUCTION

This Butte Reduction Works (BRW) Organic Pollutant Surface Water Sampling Quality Assurance Project Plan (QAPP) provides the sampling and analytical procedures and protocols necessary to complete organic pollutant surface water sampling prior to the Remedial Action (RA) effort for the BRW Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site (BRW Site).

This QAPP addresses surface water sampling upstream and downstream of the BRW Site to estimate existing concentrations of organic pollutants within Blacktail Creek (BTC) and Silver Bow Creek (SBC) during normal flow conditions prior to commencement of RA activities at the BRW Site. The area of investigation described in this QAPP is the length of SBC and BTC between the western- and eastern-most sampling locations shown on Figure 1 (referred to as the Investigation Area). Surface water samples will be analyzed for volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons ([EPH] fractionation with polycyclic aromatic hydrocarbons [PAH], and lead scavengers (referred to collectively as hydrocarbon compounds), polychlorinated biphenyls (PCBs), pentachlorophenol (PCP), and dioxins. Samples will be collected monthly from March 2023 to October 2023 at the locations listed in Table 1, and Table 2 lists the applicable analyses and holding times.

To detail the sampling and analytical procedures and methodologies for this work, this document includes the following information, as generally required in the U.S. Environmental Protection Agency (EPA) Remedial Design (RD)/RA Handbook, EPA 540/R- 95/059 (EPA, 1995):

1. Background (Section 2.0).
2. Data Quality Objectives (DQOs) (Section 3.0).
3. Sample Process and Design (Section 4.0).
    - Preparation for Field Work (Section 4.1)
    - Sample Location and Frequency (Section 4.2).
    - Sample Designation (Section 4.3).
    - Sampling Equipment and Procedures (Section 4.4).
    - Sample Handling and Analysis (Section 4.5).
4. Quality Assurance (QA)/Quality Control (QC) (Section 5.0).
5. Assessment and Oversight (Section 6.0).
6. Health and Safety (Section 7.0).
7. Project Organization and Responsibilities (Section 8.0).
8. Data Validation and Usability (Section 9.0).

Supplemental information mentioned throughout the text is included in Appendix A through Appendix C and includes operating procedures, corrective action report form, and data validation checklists, respectively.

1.1 Objectives

The specific objectives of this QAPP have been identified through the DQO process (Section 3.0). The primary objective is to collect surface water samples to estimate existing concentrations of certain organic pollutants within BTC and SBC during normal flow conditions prior to commencement of RA activities at the BRW Site. Sampling will need to occur during the time of year when construction is most-likely anticipated for the RA (i.e., March through October). Monthly sampling is anticipated to begin in March 2023 and will continue through October 2023 (8 months).

This information will then be used to potentially inform RA monitoring for SBC. Samples will be sent to Pace Analytical Services, LLC (Pace) to determine surface water concentrations of organic pollutants in SBC and BTC. Additional information relevant to operating procedures and data validation equations is listed in Table 3 and Table 4, respectively.

2.0 BACKGROUND

Details of the BRW Site, its history, and previous investigations are included in the *Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site Remedial Design Work Plan* (Atlantic Richfield Company, 2021) and the corresponding Pre-Design Investigation (PDI) Work Plan included as an attachment to the RD work plan. These documents are working documents and will be updated as needed. Summaries relevant to the BRW Organic Pollutant Surface Water Sampling QAPP are included in the sections below along with summaries of other investigations conducted near the Investigation Area.

2.1 Site Description

The BRW Site and Investigation Area are in Butte, Montana. The BRW Site covers approximately 24 acres, and is located immediately west of Montana Street between SBC and the Burlington Northern Santa Fe (BNSF) Railway line (Figure 1). The SBC runs east to west along the BRW Site, outlining the Site's northern boundary. The Investigation Area follows SBC and BTC starting west of the BRW Site at SS-06A and continues east and south of the BRW Site along BTC to SS-01.35 (Figure 1).

The BRW Site and Investigation Area are located within an urban area with multiple current and past industrial and commercial properties in the vicinity. To the south and west of the BRW Site, the Montana Pole and Treating Plant (MPTP) Water Treatment Plant treats groundwater impacted by a solution of approximately 5% PCP mixed with a petroleum carrier oil that was used to preserve poles, posts, and bridge timbers from 1946 to 1984 (EPA, 2017a). NorthWestern Energy (NWE) has a storage yard and operating center immediately south of the Site. The storage yard has existed since 1899 and is a Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Site. Underground storage tanks and on-site use or disposal of various substances such as paints, solvents, mercury, Fuller's earth, wood-treating compounds, and transformer oil containing PCBs have resulted in on-site soil contamination and possibly localized groundwater contamination (DEQ, 2002).

Beginning in 1885 and to the time of this writing, the BRW Site has been the location of multiple industrial operations including a copper smelter and a zinc concentrator, and it was also used by the Domestic Manganese and Development Company (Sanborn, 1943) and Rocky Mountain Phosphates, Inc. (GCM Services, Inc., 1991). Additionally, Butte-Silver Bow (BSB) operated an asphalt plant and aggregate crushing plant at the BRW Site from the mid-1990s to late 2020. Currently, BSB uses the BRW Site to store construction and aggregate materials.

2.2 Relevant Previous Investigations

2.2.1 BRW Site

Several field investigations have been completed at the BRW Site (1991 to present day). These investigations include monitoring well construction and groundwater data collection as well as impacted soil and solid materials characterization. Most recently the BRW Phase I and II Site Investigations were completed, beginning in 2018 as part of the RD.

Additional detail on the BRW Phase I and II Site Investigations can be found in the *Draft Final Revised Butte Reduction Works (BRW) Smelter Area Mine Waste Remediation and Contaminated Groundwater Hydraulic Control Site Pre-Design Investigation (PDI) Evaluation Report* (BRW PDI Evaluation Report) (Atlantic Richfield Company, 2022a) as well as the associated QAPPs (referenced in the BRW PDI Evaluation Report).

2.2.2 Investigation Area

Relevant investigations conducted near the Investigation Area outside of the BRW Site include those conducted at the MPTP Water Treatment Plant (MPTP Site) and the NWE storage yard and operating center (NWE property).

MPTP Site
The MPTP Site is a documented Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site and is geographically located within the Butte Priority Soils Operable Unit (BPSOU), but is a separate site operated/managed according to a separate Record of Decision (ROD) (EPA, 1993). The MPTP Site investigations have shown impacts to soil, sediment, debris, sludge, groundwater, and surface water. The key contaminants at the MPTP Site are organic pollutants including dioxins, oils, PAHs, and phenols and heavy metals primarily including arsenic, lead, and chromium. A groundwater extraction and treatment plant currently operates at the MPTP Site as a component of the CERCLA remedy. Currently, contaminated soil in the land treatment unit is being removed and placed in a corrective action management unit located south of Interstate 90. The corrective action management unit will serve as a permanent repository for the contaminated soil. After construction is complete, the area around the corrective action management unit will be ready for recreational or industrial/commercial redevelopment (DEQ, 2021). Groundwater concentrations of dioxins and PCP continue to be present above the ROD cleanup standards; however, the effluent standards from the water treatment plant for dioxins and PCP are routinely met. It is anticipated that water treatment will be necessary for the MPTP Site for at least an additional 56 to 123 years (EPA, 2017).

NWE property

The NWE property, located south of the BRW Site, is an active 50-acre power substation and operating center that has been in use commercially since 1899. The NWE property is a medium priority Montana CECRA site with potential risks to human health and the environment (DEQ, 1995a). The following is a summary of some of the investigation and remediation activities that have occurred at the site based on records obtained from the Montana Department of Environmental Quality (DEQ):

- In 1989 a site history and characterization investigation was conducted by Groundwater Technology, Inc. (GTI). GTI conducted screen site investigation and groundwater monitoring well sampling, monitoring well soil analysis, soil boring analysis, and concrete dust sample analysis (Montana Power Company [MPC], 1989).
- In 1990, the Montana Bureau of Mines and Geology (MBMG) completed groundwater monitoring and hydrogeologic characterization of the NWE property on behalf of the Montana Department of Health and Environmental Services (MDHES) (MDHES, 1991).
- In November 1990, petroleum-impacted material (imported fill) was hauled from the historical Interstate Exxon Station located just south of Oxford Street during a storage tank installation and placed in the Apprentice Pole Yard (MBMG, 1991a).
- In 1991 MBMG and MPC sampled impacted fill material stockpiled within the Apprentice Pole Yard area of NWE property. MDHES approves recycling of the tar-like substance as asphalt. Impacted fill material and tar-like substance was excavated and removed from the Apprentice Pole Yard and hauled off-site and disposed of at the landfill (MBMG, 1991b).
- The MBMG conducted groundwater monitoring activities from April 1990 to June 1994 and documented activities in summary letters dated August 17, 1993 (MDHES, 1993); March 8, 1994 (MDHES, 1994a), and July 3, 1994 (MDHES, 1994b).
- In 1995, a gasoline and diesel Underground Storage Tank (UST) release (DEQ, 1995a) prompted the removal of pumps, pump island and piping associated with the historical UST and pump island on the NWE property (DEQ, 1995b). A No Further Corrective Action Letter was filed after the tank removal was complete (DEQ, 1995c).

Based on a review of the available records, the NWE property contained underground storage tanks and various substances that were either used on-site or disposed of including paints, solvents, mercury, Fuller's earth (i.e., bentonite), wood-treating compounds, and transformer oils containing PCBs (DEQ, 1995d). This historical use has resulted in on-site contamination of soil and potentially localized groundwater (DEQ, 1995d). Additionally, the western portion of the NWE property reportedly contains a closed and covered pre-World War II municipal landfill with unknown substances (MPC, 1989).

2.3 BRW Remedial Action

The BRW RA includes removing tailings, waste, contaminant of concern (COC)-impacted soil, and slag within the SBC 100-year floodplain reconstruction area to a depth to be determined during the RD activities. The conceptual RD will include the following additional elements:

- Removing waste (as defined by the BPSOU Consent Decree [CD] Waste Identification Screening Criteria [EPA, 2020a]) from the designated and approved 275-foot average width removal corridor (referred to herein as the waste removal corridor).
- Managing soil and groundwater within the BRW Site impacted by organic pollutants as appropriate and in a manner that is complementary with the remedy. Organic pollutants (hydrocarbon compounds, PCB, PCP, and dioxins) are secondary concerns for the BRW Site. Soil and groundwater within the BRW Site that have been impacted by these pollutants to concentrations above site-specific action levels will be properly addressed/managed as part of the RA (e.g., soils excavated within the waste removal corridor will be disposed of properly and groundwater collected as part of construction dewatering and/or hydraulic control will be treated for organic pollutants to meet applicable standards). However, additional remediation of the soil and groundwater impacted with organic pollutants (e.g., treatment of organic pollutant sources, removal and disposal of impacted soil outside the waste removal corridor, etc.) is not required by the BPSOU CD (EPA, 2020a).
- Realigning SBC and constructing the bank-full channel and 100-year floodplain within the 275-foot average width waste removal corridor.
- Regrading and constructing caps over the waste left in place (e.g., tailings, slag, and COC-impacted soil). Some slag walls will remain exposed on-site for cultural and historic preservation.
- Hydraulically managing COC-impacted groundwater from the BRW Site to control discharge of COC-impacted groundwater to surface water and stream sediment in SBC within BPSOU generally and the BRW Site specifically.

To implement the remedy, construction dewatering is required to excavate the waste materials from the waste removal corridor. Additionally, the remedy requires the collection and treatment of COC-impacted groundwater to hydraulically manage COC-impacted groundwater from the BRW Site. The COC-impacted groundwater collected during construction dewatering and the future hydraulic control will ultimately be discharged to SBC following any water treatment that is necessary.

As a result of multiple industrial operations within and adjacent to the BRW Site, groundwater within the BRW Site has been impacted with hydrocarbon compounds and there is a potential that groundwater within the BRW Site is impacted with other organic pollutants (i.e., PCP, PCBs, and dioxins). However, it is anticipated that the concentrations of these organic pollutants are minimal based on current data (Section 2.2).

As required by the BPSOU CD (EPA, 2020a), groundwater impacted with organic pollutants must be properly managed in a manner that is consistent with the remedy. Sampling of organic pollutants prior to RA will help determine the pre-existing concentrations of organic pollutants within SBC to help develop a monitoring plan to verify that surface water standards for organic pollutants are met during the RA.

3.0 DATA QUALITY OBJECTIVES

The DQO process is used to define the type of quality, quantity, purpose, and use of the data to be collected. EPA developed a seven-step process to ensure the data collected during field activities are adequate to support the site-specific remediation plan. The DQOs were developed for this BRW Organic Pollutant Surface Water Sampling QAPP according to the EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006). The seven-step process is outlined below.

Step 1: State the Problem
The purpose of this step is to describe the problem to be studied and so that the focus of the investigation will not be ambiguous.

Problem: The BRW Site is situated in an environment with significant infrastructure, historical industrial activity, and potential unknown sources of organic pollutants that may contribute to surface water. It is necessary to determine if SBC and BTC are impacted with potential organic pollutants.

In addition, with multiple industrial operations within and adjacent to the BRW Site, there is a potential that groundwater within the BRW Site is impacted with organic pollutants (i.e., hydrocarbon compounds, PCP, PCBs, and dioxins). As required by the BPSOU CD (EPA, 2020a), groundwater impacted with organic pollutants must be properly addressed/managed as part of the RA (e.g., groundwater collected as part of construction dewatering and/or hydraulic control will be treated for organic pollutants to meet applicable standards). The RA will require discharge of groundwater from the BRW Site to SBC. Currently, there is a lack of organic pollutant surface water quality data in SBC to determine the pre-existing concentrations of organic pollutants within SBC and BTC in the Investigation Area. This information will be used to help develop a monitoring plan to verify that surface water standards for organic pollutants are met during the RA.

Available Resources and Schedule: Pioneer Technical Services, Inc. (Pioneer) is the contractor responsible for conducting and coordinating the elements of the BRW Organic Pollutant Surface Water Sampling QAPP and will receive sampling support from Woodard & Curran under the direction of Atlantic Richfield Company (Atlantic Richfield). Pioneer is responsible for sample shipping, data validation, and reporting, whereas Woodard & Curran will be responsible for monthly sample collection of organic pollutants in conjunction with monthly sampling completed under the 2023 Final Butte Priority Soils Operable Unit Interim Site-Wide Surface Water Monitoring Quality Assurance Project Plan (referred to herein as the BPSOU Surface Water QAPP; Atlantic Richfield Company, 2022b). Section 8.0 includes a detailed description on the project organization and responsibilities.

All personnel completing field work will be properly trained in how to perform their tasks. The laboratory(s) selected to analyze the surface water samples will be an Atlantic Richfield-approved laboratory(s).

The BRW Organic Pollutant Surface Water Sampling QAPP work must commence by March 2023 to generate at least 8 months of data indicative of existing concentrations within BTC and SBC during normal flow conditions. The data must be collected prior to submittal of the proposed monitoring plan which will be submitted with the Pre-Final (95%) RD Report. However, potential constraints could delay field work and/or the RD (Step 5) and will need to be addressed by Atlantic Richfield and Agencies if they occur.

Conceptual Model of Environmental Problem: The BRW Site and Investigation Area are situated in an environment with significant infrastructure, historical industrial activity, and potential unknown sources of organic pollutants that contribute to surface water. A description of the background and required RA is included in Section 2.0.

Step 2: Identify Goals of the Study

This step identifies the principal questions that the study will attempt to resolve and what actions may result.

Principal Study Question: What are the existing concentrations of organic pollutants within SBC and BTC during normal flow conditions[1]?

Estimation Statement: The principal study questions will be answered by collecting monthly surface water samples for at least 8 months to determine existing concentrations exist SBC and BTC during normal flow conditions. The data collected will be used to help develop an appropriate monitoring plan for organic pollutants during RA.

Step 3: Identify Information Inputs

The purpose of this step is to identify the informational variables that will be required to answer the principal study questions and determine which variables require environmental measures.

Types of Information Needed:

- Survey-grade GPS location coordinates and measuring point elevation for each staff gage location listed in Table 1.
- Stage measurements from staff gages.

[1] Normal flow conditions, as defined in the BPSOU Surface Water Compliance Determination Plan (Attachment A to Appendix D of the BPSOU CD), are "*flows outside of a 96-hour time period following a hydrologic change caused by a precipitation or snowmelt event or when one or more of the basins discharges, to allow for streams to return to normal flow conditions*" (EPA, 2020a).

- Surface water samples analyzed for PCBs, PCP, dioxin, and hydrocarbon-compounds (Table 2).

Applicable Limits/Thresholds:
- DEQ Circular DEQ-7 Standards (DEQ, 2019)

Appropriate Sampling and Analysis Methods:
- Sampling methods are discussed in Section 4.0.
- Analysis methods are detailed in Table 2.
- All laboratory results will go through a Stage 2A Verification and Validation as defined in EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009).

Step 4: Define the Boundaries
The purpose of this step is to define the spatial and temporal boundaries of this study.

Target Population: Surface water samples to be collected are listed in Table 1 and shown on Figure 1.

Spatial Boundaries, Temporal Boundaries, and Other Practical Constraints: The projected boundary of this study is the Investigation Area which includes SBC and BTC to the extent shown on Figure 1. Sampling locations were selected upstream and downstream of the BRW Site.

Sampling will need to occur during the time of year when construction is most likely anticipated for the RA (i.e., March through October). Monthly sampling is anticipated to begin in March 2023 and will continue through October 2023 (8 months). Work will be performed as weather conditions permit. Potential constraints that could delay fieldwork include adverse weather conditions, unforeseen challenges with the Covid-19 pandemic, or other unforeseen issues. Major project delays resulting from these constraints will be recorded in the field logbooks and reported to the Agencies.

Scale of Estimates to be Made: The sample results will be used to estimate existing concentrations of organic pollutants in SBC and BTC during normal flow conditions.

Step 5: Develop the Analytical Approach
The purpose of this step is to specify the appropriate population parameters for making estimates.

Population Parameters:
- Staff gage water level, general parameters (temperature, specific conductance, dissolved oxygen, and pH), and concentration of hydrocarbon-compounds, lead scavengers, PCP, PCBs, and dioxins.

- Basic descriptive statistics of the above parameters and concentrations such as mean, median, mode, range, maximum, and minimum as well as plots of the parameters and concentrations over time.
- Collection of the above parameters and concentrations to occur during the time of year when construction is most likely anticipated for the RA (i.e., March through October).
- The above parameters and concentrations are to be collected from locations upstream, downstream, and adjacent to the anticipated remedial action at the BRW Site.
- Date the sample was collected.
- Sample collection location.

Specification of Estimator:

- The staff gage water level and general parameters will characterize water quality conditions. Recording the staff gage water level and general parameters is common practice when sampling for target analytes.
- Concentrations of hydrocarbon compounds, PCP, PCBs, and dioxins will help estimate the existing concentrations of these organic pollutants within BTC and SBC during normal flow conditions.
- A comparison between the concentrations of the hydrocarbon compounds, PCP, PCBs, and dioxins from each sampling event will be compared to the DEQ Circular DEQ-7 Standards (shown in Table 2) to evaluate how the individual concentrations compare to these thresholds.
- Descriptive statistics may be used to illustrate the typical conditions in BTC and SBC as well as the occurrence and timing of high and low magnitude values.
- Collecting the samples during the time of year when construction is most likely anticipated for the RA, during normal flow conditions, and from locations located upstream, downstream, and adjacent to the anticipated remedial action at the BRW Site will provide the necessary data to answer the principal study question so that the data can potentially be used to inform RA monitoring in SBC.
- The time of year the sample was collected may determine whether organic pollutant concentrations vary throughout the year during normal flow conditions.
- The location of the samples may indicate a source area or whether analyte concentrations are conserved moving from upstream to downstream.

There are no **Specific Action Levels** for this work.

Step 6: Specific Performance or Acceptance Criteria

The purpose of this step is to define performance or acceptance criteria that the data collected will need to include.

All analytical data collected as part of this BRW Organic Pollutant Surface Water Sampling QAPP will be validated to ensure that the data are suitable for the intended purpose. Specific data validation processes that will be followed to ensure that analytical results are within acceptable limits are detailed in Section 9.0. The data collected from Pace will undergo Stage 2A

Verification and Validation as defined in EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009). The data validation process will include evaluating analytical control limits and the precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) parameters. If significant issues with the data are found, results will be discussed with the EPA.

Step 7: Develop the Plan for Obtaining the Data
The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy the DQOs.

Section 4.0 describes the applicable data collection for this BRW Organic Pollutant Surface Water Sampling QAPP. Procedures outlined in Section 9.0 are designed to ensure that the data will be of sufficient quality and quantity to answer the principal study questions outlined in Step 2.

3.1 Measurement Performance Criteria for Data

Specific data validation processes determine if analytical results are within acceptable limits. For work completed under this BRW Organic Pollutant Surface Water Sampling QAPP, all data gathered will be checked to ensure they are usable for their intended purposes. Analytical control limits and the PARCCS parameters of the data will be analyzed. If significant issues with any data are found, results will be discussed with EPA and Montana DEQ project managers. EPA, in consultation with Montana DEQ, will then decide if the total study error could cause them to make an incorrect decision. Using this approach, the probability of making an incorrect decision (i.e., either a false negative or positive) based on the information collected is considered small.

The PARCCS definitions are provided below along with the acceptance criteria for data collected. Equations for calculating precision, accuracy, and completeness are provided in Table 4.

Precision
Precision is the amount of scatter or variance that occurs in repeated measurements of a particular analyte. Acceptance or rejection of precision measurements is based on the relative percent difference (RPD) of the laboratory and field duplicates. For example, perfect precision would be a 0% RPD between duplicate samples (both samples have the same analytical result). For surface water samples, the control limit of a RPD less than 20% will be used when sample results are greater than 5 times the laboratory Reporting Limit (RL). If either of the sample results are less than 5 times the RL, the control limit used will be a difference between sample results less than the RL. This precision requirement is derived from the *Clark Fork River Superfund Site Investigation* (CFRSSI), *Laboratory Analytical Protocol* (ARCO, 1992a), and the *CFRSSI QAPP* (ARCO, 1992b).

Accuracy
Accuracy is the ability of the analytical procedure to determine the actual or known quantity of a particular substance in a sample. Accuracy is assessed based on the percent recovery (%R) and percent difference (%D) of various laboratory QC samples. Perfect %R is 100% and perfect %D

is 0% (the analysis result is exactly the known concentration of the QC sample). The laboratory control sample (LCS) and laboratory matrix spike (LMS) are used to measure accuracy, based on the %R of the LMS and LCS. Additional laboratory QC samples may be used to assess accuracy as appropriate to the analytical method. Accuracy requirements for this project are derived from the CFRSSI QAPP (ARCO, 1992b).

Representativeness

Representativeness is a qualitative parameter that is addressed through proper design of the sampling program. The sampling program is designed to obtain a sufficient number of samples that adequately represents the range of conditions present in the medium being sampled and specify suitable sampling methods and procedures.

For this work, the Contractor Project Manager (CPM) will review the BRW Organic Pollutant Surface Water Sampling QAPP to ensure that it is designed to collect the data and information necessary to meet the purpose of the investigation. The review will consider the volume, variability, and intended use of the data to ensure proper sampling methods and adequate spatial distribution of samples.

After the data have been collected and analyzed, the Field Team Leader or CPM will review the data and qualitatively assess whether the data adequately represent the Investigation Area conditions and intended purpose of the investigation. Sample representativeness may also be evaluated using the RPDs for field duplicate sample results, if applicable.

Comparability

Comparability determines if one set of data can be compared to another set of data. Comparability will be assessed by determining if an EPA-approved analysis method was used, if values and units are sufficient for the database, if specific sampling points can be established and documented, and if field collection methods are similar. The Standard Operating Procedures (SOPs) applicable to the work are referenced in the appropriate sections throughout this report and are listed in Table 3. A copy of Pioneer SOPs related to the sample packaging and shipping are included in Appendix A, and a copy of Woodard & Curran's SOPs related to sampling procedures are included in the BPSOU Surface Water QAPP. Analytical methods are listed in Table 2.

Completeness

Completeness determines if enough valid data have been collected to meet the investigation needs. Completeness is assessed by comparing the number of valid sample results to the number of sample results planned for the investigation. Although not all the analytes measured in this sampling effort have completeness objectives outlined in the CFRSSI QAPP (ARCO, 1992b), the completeness target for this investigation is 95.0% or greater as designated in the CFRSSI QAPP.

Method Sensitivity

Method sensitivity is related to the method detection limits. The method sensitivity or lower limit of detection depends on several factors, including the analyte of interest, the method used, the type of detector used, matrix effects, etc. Appropriate methods must be selected with sufficient method sensitivity to accomplish the project's goals. The method sensitivity for laboratory analyses is determined as part of the laboratory's SOPs. The laboratory RL and anticipated method detection limit along with the required reporting values from the DEQ-7 Circular for each analyte are listed in Table 2. These detection limits will be reviewed as part of the data validation process (Section 9.0).

4.0 SAMPLING PROCESS AND DESIGN

The BRW Organic Pollutant Surface Water Sampling QAPP will address surface water sampling and laboratory analysis. Surface water samples will be collected at locations with an existing staff gage in SBC and BTC (Table 2). The samples will be collected according to the procedures detailed in the BPSOU Surface Water QAPP and the SOP for Surface Water Sampling for volatile organic compounds (VOCs) and Other Organics that is included in Appendix A (SOP-SW-25). Note that the BPSOU Surface Water QAPP is specific to sampling of inorganics and there are some additional requirements specific to sampling of organic pollutants that have been detailed below and are included in SOP-SW-25. The SOPs are listed in Table 3. Samples will be sent to Pace for hydrocarbon compounds, PCP, PCBs, and dioxins analyses. The following subsections provide the procedures and protocols necessary to complete these tasks.

4.1 Preparation for Fieldwork

The following tasks will be completed prior to conducting field activities.

4.1.1 Training

All field personnel will have a current certification for the 40-hour Occupational Safety and Health Administration Hazardous Waste Site and Emergency Response Training.

In a project meeting held prior to fieldwork, all field personnel will review this BRW Organic Pollutant Surface Water Sampling QAPP and well as the BPSOU Surface Water QAPP and receive any specified training. Field personnel will review sampling procedures and requirements prior to field activities to ensure collecting and handling methods are completed according to the BRW Organic Pollutant Surface Water Sampling QAPP and BPSOU Surface Water QAPP requirements. Field personnel will be trained in how to properly use field equipment and complete activities according to field data collection SOPs (Table 3).

The Field Team Leader will be experienced in the use of the equipment that will be used and responsible for training and overseeing the support staff. One hard copy of the current approved version of this BRW Organic Pollutant Surface Water Sampling QAPP and BPSOU Surface Water QAPP will be maintained for reference purposes in the field vehicle and/or field office. All field team personnel will have access to electronic PDF format files of all documents pertaining to fieldwork.

4.2 Sample Location and Frequency

Surface water samples will be collected at locations shown on Figure 1 and described in Table 1. These sample areas were selected to estimate the concentrations of hydrocarbon-compounds, PCBs, PCP, and dioxins upstream and downstream of the BRW Site (Investigation Area). The sample collection requirements and justification for each sample location are described in Table 2.

4.3 Sample Designation

A sample number system will be used to uniquely identify the project site, the specific sample location, and date sample was collected. For example, a sample designated BRW-SS06A-06012023 describes a sample collected for BRW from the surface water location SS06A on June 1, 2023. There will be no blank spaces permitted in the identification. The following is an example of the sample numbering system:

Sample Number: **BRW-SS06A-06012023**

Project Site: *"BRW"* - BRW project area.
Location/Number: *"SS06A"* - Sample Location.
Date: *"06012023"* - sample collected on June 1, 2023.

For field duplicates, the sample location will be followed by "(T)." For example, a duplicate of BRW-SS06A-06012023 would be BRW-SS06A(T)-06012023. Field duplicate samples will be recorded in the logbook, and the primary sample will be clearly indicated.

For field blanks, the sample location will be followed by "(F)." For example, a field blank would be BRW-SS06A(F)-06012023. For equipment blanks, the sample location will be followed by "(R)." For example, an equipment blank would be BRW-SS06A(R)-06012023. Field blanks and equipment blanks will be recorded in the logbook.

For trip blanks, the sample location will be TB. For example, a trip blank would be BRW-TB-06012023.

4.4 Sampling Equipment and Procedures

The samples will be collected according to the procedures detailed in SOP-SW-25. The sampling details are also listed below.

4.4.1 Equipment

The sample equipment is listed in SOP-SW-25.

4.4.2 Procedures

The samples will be collected according to the procedures detailed in SOP-SW-25 and summarized below:

- Samples will be collected from a single point at the centroid of the stream via the unpreserved glass sample bottles provided by the analytical laboratory.
    - If necessary, the samples can be collected in a stainless-steel sample container that will be dedicated for the sample location and will not be used anywhere else for the duration of the investigation.
- For samples that require preservation (Analytical Groups 6, 7, and 9), the samples will be collected in a glass sample bottle that does not contain the preservative solution. The sample will then be poured from the glass sample bottle into the appropriate sampling containers making sure that the glass sample bottle does not come in contact with the sample containers.
- For samples that do not require preservation (Analytical Groups 3, 4, 5, and 8), the sample will be collected directly in the glass sample bottle.
- Sample containers for Analytical Groups 6 and 9 will be filled first to prevent the loss of volatiles during sampling. These samples will be collected with as little agitation or disturbance as possible. The vials will be filled so that there is a reverse or convex meniscus at the top of the vial and absolutely no bubbles or headspace should be present in the vial after it is capped.

4.4.3 Standard Operating Procedures

This document references SOPs for activities that outline specific procedures to safely complete tasks involved in this BRW Organic Pollutant Surface Water Sampling QAPP. The SOPs applicable to the work are referenced in the appropriate sections throughout this report and are listed in Table 3. A copy of Pioneer SOPs related to the sample packaging and shipping are included in Appendix A. The sampling procedure for collecting samples in the creek, SOP-SW-25, is also included in Appendix A. Additional SOPs related to sampling procedures to be used by the Woodard & Curran field team are included in the BPSOU Surface Water QAPP.

Depending on circumstances and needs, it may not be possible or appropriate to follow the SOPs exactly in all situations due to site conditions, equipment limitations, and SOP limitations. When necessary to perform an activity that does not have a specific SOP, or when the SOP cannot be followed, existing SOPs may be used as a general guidance or similar SOPs (not listed in this report) may be adopted if they meet the project DQO. All modifications or adoptions will be approved by the Field Team Leader, CPM, and Contractor Quality Assurance Officer (QAO) and documented in the field logbook and/or the final project report, as appropriate.

4.4.4 Field Documentation

Woodard & Curran will be responsible for completing all field documentation (including field logbook and photographs). Woodard & Curran field personnel will follow the procedures and protocols detailed in the BPSOU Surface Water QAPP. At the conclusion of the sampling event, Woodard & Curran will provide a copy of the field documentation to Pioneer.

4.5 Sample Handling and Analysis

4.5.1 Documentation and Shipping

Sample containers and holding times are listed in Table 2. Woodard & Curran field staff will collect all samples in the proper sample containers. Woodard & Curran will write the sample identification and date/time on each sample container with an indelible marker. Immediately following sample collection, Woodard & Curran will preserve the samples in appropriate sample containers as described in Table 2.

At the conclusion of the sampling event (i.e., conclusion of the day), the samples will be transferred to Pioneer staff's custody. This transition of custody will be documented on the chain of custody and in both Woodard & Curran's field logbook as well as Pioneer's field logbook. Pioneer will be responsible for preparing the samples for shipment and placing the custody seals on the sample storage containers (coolers).

Pioneer will be responsible for shipping the samples to Pace. Samples will be shipped via FedEx or UPS to Pace under strict EPA chain of custody procedures. Samples will be shipped in appropriate containers that will prevent detrimental effects to the sample. A copy of the chain of custody record will accompany the samples during shipment and will serve as the laboratory request form. The chain of custody form will specify the type of analysis requested for each individual sample. The original form will be maintained with the field notes in the project records.

4.5.2 Chain of Custody

The SOP for chain of custody (SOP-SA-04) is in Appendix A. Maintaining the integrity of the sample from collection through data reporting is critical to the sampling and analytical program. This process includes the ability to trace the possession and handling of samples from the time of collection through analysis and final disposition. This documentation of the sample's history is referred to as chain of custody. A sample is under an individual's custody if it is in that individual's physical possession, in view of the individual after taking possession, or secured by that individual so that no one can tamper with the sample. The components of the laboratory chain of custody (chain of custody form, custody seals, and laboratory custody) are described in this section.

Chain of Custody Form

A standard chain of custody form will be provided from Pace. The form will include the following information:

- Project code.
- Project name.
- Sampler's signature.
- Sample identification.
- Date sampled.
- Time sampled.
- Analysis requested.
- Remarks.
- Relinquishing signature, data, and time.
- Receiving signature, date, and time.

Pioneer staff will be responsible for completing the project code, project name, sample identification, and requested analyses prior to the sample event. Pioneer staff will then provide Woodard & Curran field staff the chain of custody form, and the field staff will be responsible for completing the field documentation for the samples collected and providing the date and time sampled as well as the sampler information on the chain of custody. At the conclusion of the sampling (i.e., conclusion of the day), the samples will be transferred to Pioneer staff's custody. This transition of custody will be documented on the chain of custody and in both Woodard & Curran's field logbook as well as Pioneer's field logbook.

The components of the laboratory chain of custody (chain of custody form, custody seals, and laboratory custody) are described in this section.

Custody Seals

Custody seals are used to detect unauthorized tampering with samples following sample collection up to the time of analysis. Pioneer staff will apply custody seals will be applied to the shipping containers when Pioneer ships the samples to the laboratory.

Laboratory Custody

Laboratory custody procedures will conform to procedures established for the EPA Contract Laboratory Program Statement of Work for Superfund Analytical Methods SFAM01.1 (EPA, 2020b). These procedures include the following:

- Designation of sample custodian.
- Correct completion of the chain of custody form, recording of sample identification numbers, and documentation of sample condition upon receipt.

- Laboratory sample tracking and documentation procedures.
- Secure sample storage.

The samples will be delivered to the laboratory for analysis in a timely manner to ensure the requested analyses can be performed within the specified allowable holding times. The sample will be hand delivered or addressed to a person in the laboratory who is authorized to receive samples (laboratory sample custodian).

4.5.3 Laboratory Analytical Methods

Laboratory analyses of samples collected will be performed by laboratories with established protocols and QA procedures that meet or exceed EPA guidelines. Instruments used by the laboratory will be maintained in accordance with the laboratory QA plan requirements and analytical method requirements. All analytical measurement instruments and equipment used by the laboratory will be controlled by a formal calibration and preventive maintenance program. The laboratory will keep maintenance records and make them available for review, if requested. Laboratory preventive maintenance will include routine equipment inspection and calibration at the beginning of each day or each analytical batch, per the laboratory internal SOPs and method requirements. Standard laboratory turnaround times will be requested.

The anticipated laboratory analytical methods and procedures are summarized in Table 2. Surface water samples will be sent to Pace for hydrocarbon-compounds [VPH, EPH fractionation with PAH, and lead scavengers], PCBs, PCP, dioxins. Dioxin analysis includes 16 dioxin and furan congeners.

The planned laboratory analysis approach may be altered by the CPM, in consultation with the Contractor QAO. Agencies will be notified of any significant changes to the laboratory analysis approach.

5.0 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

5.1.1 Field Quality Control Samples

Field QC samples are used to identify any biases from transportation, storage, and field handling processes during sample collection, and to determine sampling precision. All field QC samples will be shipped with field samples to the laboratories per G-6 included in BPSOU Surface Water QAPP. Brief descriptions of the field QC samples are below along with when and how many are to be collected.

Field Duplicate

A field duplicate is an identical, second sample collected from the same location, in immediate succession of the primary sample, using identical techniques. The duplicate sample will have its own sample number. Duplicate samples will be sealed, handled, stored, shipped, and analyzed in the same manner as the primary sample. Both the primary sample and duplicate sample will be analyzed for identical chemical parameters by the laboratory. The analytical results of the primary and duplicate sample will be compared to determine sampling precision. Field duplicates will be collected at a frequency of at least 1 field duplicate per 20 natural samples collected.

Field Blank
A field blank is a sample bottle containing deionized water (DI) or analyte-free water and appropriate preservatives and is prepared in the field. A sample bottle is randomly chosen from bottles received by the contract laboratory or supplier, and DI or analyte-free water is poured directly into the sample bottle while in the field and the bottle is preserved and shipped to the laboratory with the field samples. Field blanks must be prepared in the field and help evaluate the potential for possible contamination from the sampling environment. The field blank will have its own unique sample number and will be recorded in the project logbook as a field blank or bottle blank. Field blanks will be prepared at a frequency of at least 1 field blank per 20 natural samples collected.

Equipment, Cross Contamination, or Rinsate Blank
Equipment contamination blanks will be collected after reusable sampling equipment is decontaminated or prior to sampling activities, if necessary. If no reusable sampling equipment is used, an equipment blank is not necessary and should be noted when submitting the samples. An equipment blank is prepared by running distilled, DI, or analyte-free water through or over the cleaned, decontaminated sampling equipment; gathering the water in a sample collection bottle; and adding the appropriate chemical preservatives. Analysis on the equipment blanks will assess the adequacy of the decontamination process as well as the potential contamination of samples by the containers, preservatives, and filters. The appropriate sample number will be placed on the collection bottle and recorded in the project logbook as an equipment blank. The equipment blank will be analyzed for identical chemical parameters by the laboratory as a natural sample collected from the equipment. A minimum of 1 equipment blank is required for every 20 natural samples collected.

Temperature Blank
A temperature blank is a vial of water that accompanies the samples that will be opened and tested upon arrival at the laboratory to ensure that the temperature of the shipping container was less than 6 °C. One temperature blank is required for each cooler shipped to the laboratory.

Trip Blank
One trip blank is required per sampling event when VOC samples are collected. Trip blanks are used to determine if samples were contaminated during storage and/or transportation back to the laboratory. A trip blank is only required for VOC sampling. A trip blank is prepared for field personnel by the contract laboratory staff prior to the sampling event and is shipped and stored in the same cooler with the investigative VOC samples throughout the sampling event. At no time after their preparation are trip blanks to be opened before they reach the laboratory. Trip blanks should be kept on ice in the cooler, along with the VOC samples, during the entire sampling run. They must be stored in an iced cooler from the time of collection, while they are in the sampling vehicle, until they arrive at the laboratory.

5.1.2 Laboratory Quality Control Samples

Laboratory QC samples are introduced into the measurement process to evaluate laboratory performance and sample measurement bias. Laboratory QC samples can be prepared from environmental samples or generated from standard materials in the laboratory per the internal laboratory SOPs.

Method Blank
One method blank (MB) sample will be prepared for each laboratory QC batch. The MB is laboratory DI that has gone through the applicable sample preparation and analysis procedure. Control limits vary based on the laboratory method performed and are contained in the applicable laboratory method and SOP. Failure will trigger corrective action and the blank will be reanalyzed. All samples will be footnoted with the appropriate flag to document contamination in the blank.

Laboratory Control Sample
A LCS will be prepared and analyzed for the applicable methods following the method required frequency with at least one for each laboratory QC batch for each applicable method. Control limits vary based on the laboratory method performed and are contained in the applicable laboratory method and SOP. Failure will trigger corrective action and the analysis will be terminated, the problem corrected, and the samples reanalyzed. If reanalysis of the samples fails, the samples will need to be re-digested and reanalyzed.

Matrix Spike/Matrix Spike Duplicate
Project-specific matrix spike (MS) and matrix spike duplicate (MSD) samples will be requested on the chain of custody at a rate of one MS and MSD per 20 natural samples and per similar sample matrices. Each project specific MS and MSD samples will be prepared and analyzed with the applicable methods. There are two sample matrices: one located upstream of the polishing facility discharge structure (sample locations SS-04 or SS-01.35 [Figure 1]) and one located downstream of the polishing facility discharge structure (sample locations BRW-SS01 or SS-06A [Figure 1]). Sufficient material will be supplied to the laboratory to perform the requested MS and MSD analyses. The control limits also depend on the method used and are contained in the applicable laboratory method and SOP. If the %R for the MS and MSD falls outside the control limits, the results are flagged as outside acceptance criteria along with the parent sample. If the RPD exceeds the acceptance criteria, the MSD sample and associated parent sample will be flagged.

Laboratory Duplicate Sample
A laboratory duplicate sample (LDS) will be prepared and analyzed for each laboratory QC batch for the applicable methods. A LCS and LCS duplicate (LCSD) pair or an MS and MSD sample pair may be used as the LDS. Control limits will vary based on the QC sample used. Failure will trigger corrective action and a single reanalysis of the respective failing QC sample is allowed. If the reanalysis is outside the acceptance criteria, the analysis must be terminated, the problem corrected, the instrument recalibrated, and the calibration re-verified.

5.2 Instrument/Equipment Testing, Inspection, Maintenance and Calibration

The Instrument/Equipment Testing, Inspection, Maintenance and Calibration procedures detailed in the BPSOU Surface Water QAPP.

5.3 Inspection/Acceptance of Supplies and Consumables

All supplies and consumables received for the project (e.g., sampling equipment, calibration standards, etc.) will be checked to ensure their condition is satisfactory, such as free of defects that would affect performance. The types of equipment needed to complete sampling activities are described in the relevant field SOPs (Table 3). Inspections of field supplies will be performed by the Field Team Leader or field team members. The personnel at the laboratory (Section 8.0) will be responsible for inspecting laboratory supplies in accordance with the laboratory QA program.

5.4 Data Management Procedures

This section describes how the data for the project will be managed, including field and laboratory data. Data will be managed in accordance with the BPSOU Data Management Plan (Atlantic Richfield Company, 2022c). The BRW Organic Pollutant Surface Water Sampling QAPP quality records will be maintained by Atlantic Richfield. These records, in either electronic or hard copy form, may include the following:

- Project work plans with any approved modifications, updates, and addenda.
- BRW Organic Pollutant Surface Water Sampling QAPP with any approved modifications, updates, addenda, and any approved corrective or preventive actions.
- Field documentation (including logbooks, data sheets, and photographs) in accordance with G-4 in BPSOU Surface Water QAPP.
- Chain of custody records in accordance with SOP-SA-04 in Appendix A.
- Laboratory documentation (results received from the laboratory will be documented in hard copy and in an electronic format).
- PDI Evaluation Report.

Hard copy field and laboratory records will be maintained in the project's central data file, where original field and laboratory documents are filed chronologically for future reference. These records will also be scanned to produce electronic versions. The electronic versions of these records will be maintained on a central Microsoft structured query language (SQL) server system that is backed up regularly. The data will be stored on the SQL server and a Microsoft Access database will be set up to access the data, which can then be exported to Excel, if necessary, for further graphing and interpretive analysis. Using a Microsoft-based software configuration is widely accepted with support from Microsoft and allows for easy data sharing with most hardware configurations.

All field and laboratory data and supporting documentation will be subject to appropriate review to ensure the accuracy and completeness of original data records prior to uploading into the project database. Field data that have been reviewed and approved in a hard copy format will be entered into an electronic system to be uploaded to the project database. Laboratory electronic data deliverables (EDDs), provided in Microsoft Excel format and correlating PDF standard data packages (simplified format), will be reviewed as part of the internal data review process. Following these review steps, field and laboratory electronic data files will be imported to the project database.

Standardized data import formats and procedures will be used to upload both field and laboratory data into the electronic database. Standardized parameter names, numerical formats, and units of measure will be applied to the original information to facilitate comparability across all data sets and within the database. Using these standardized formats will allow for quick and easy querying to retrieve data. Data can be retrieved by exporting into an Excel file and, because the data will be formatted with parameter names, easily made into a pivot table for data processing.

6.0 ASSESSMENT AND OVERSIGHT

Assessment and oversight of data collection and reporting activities are designed to verify that sampling and analyses are performed in accordance with the procedures established in this BRW Organic Pollutant Surface Water Sampling QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits. Internal audits will be performed by Atlantic Richfield, their contractor, or a contracted laboratory consultant as necessary. External audits will be performed by EPA as necessary. Performance and system audits of field and laboratory data collection and reporting procedures are described in this section.

6.1 Field Activities Oversight

Oversight personnel will have the ability to inspect each surface water sample and ensure that the appropriate samples are collected. Copies of field logbook pages will be provided to oversight personnel as part of the PDI Evaluation Report.

Any deviations from this BRW Organic Pollutant Surface Water Sampling QAPP will be brought to the attention of oversight personnel. If the deviation is first determined by oversight personnel, Atlantic Richfield and/or field representatives will be immediately notified. Reasons for such deviations will be recorded in the field logbook along with corrective actions to be implemented, if required. If oversight personnel request a deviation from the BRW Organic Pollutant Surface Water Sampling QAPP, the deviation and the reasons for the deviation will be noted and then signed by the agency personnel.

6.2 Corrective Action Procedures

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC performance, which can affect data quality. Corrective action can occur during field activities, laboratory analyses, and data assessment.

Non-conforming equipment, items, activities, conditions, and unusual incidents that could affect data quality and attainment of the project's quality objectives will be identified, controlled, and reported in a timely manner. For this BRW Organic Pollutant Surface Water Sampling QAPP, a non-conformance is defined as a malfunction, failure, deficiency, or deviation that renders the quality of an item unacceptable or indeterminate in meeting the project's quality objectives. Corrective actions implemented by field personnel will follow appropriate field SOPs (Table 3), as necessary.

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, preservation or holding-time issues, and potentially high-concentration samples may be identified during sample log in or just prior to analyses. Corrective actions to address these conditions will be taken in consultation with the CPM (Section 8.0) and reported on a Corrective Action Report (CAR) form included in Appendix B, as necessary. In the event that corrective action requests are not in complete accordance with approved project planning documents, EPA will be consulted and concurrence will be obtained before the change is implemented.

If during sample analyses, the associated laboratory QC results fall outside of the project's performance criteria, the laboratory should initiate corrective actions immediately. If laboratory QC results are outside of the project specifications, the laboratory should take the appropriate corrective actions for the specific analytical method. Following consultation with laboratory analysts and section leaders, it may be necessary for the CPM to approve implementing a corrective action. These conditions may include dilution of samples, additional sample extract cleanup, or automatic reanalysis when certain QC criteria are not met. If the laboratory cannot correct the situation that caused the non-conformance and an out-of-control situation continues to occur or is expected to occur, then the laboratory will immediately contact the CPM and request instructions regarding how to proceed with sample analyses.

Completion of any corrective action should be evidenced by data once again falling within the project's performance criteria. If this is not the case, and an error in laboratory procedures or sample collection and handling procedures cannot be found, the results will be reviewed by the CPM and Field Team Leader in consultation with the Contractor QAO to assess whether reanalysis or re-sampling is required.

All corrective actions taken by the laboratory will be documented in writing by the Laboratory Project Manager and reported to the Field Team Leader and CPM. In the event that corrective action requests are not in complete accordance with approved project planning documents, EPA will be consulted and concurrence will be obtained before the change is implemented. All corrective action records will be included with the QAPP records.

6.3 Corrective Action During Data Assessment

During data assessment, the Contractor QAO could identify the need for corrective action. Potential types of corrective action include re-sampling by the field team, reanalyzing samples by the laboratory, or re-submitting standard data packages with corrected clerical errors. The appropriate and feasible corrective actions will depend on the ability to mobilize the field team and whether the data to be collected are necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded, etc.). If corrective action requests are not in complete accordance with approved project planning documents, EPA will be consulted and concurrence will be obtained before the change is implemented. Corrective actions of this type will be documented by the Contractor QAO on a CAR and will be included in any subsequent reports.

6.4 Quality Assurance Reports to Management

After the study is complete, the Atlantic Richfield contractor will incorporate the results into the BRW PDI Evaluation Report summarizing and interpreting the sampling activities. The report will include the following:

- Summary of the work performed.
- Summary of the results.
- Summary of validated data (i.e., tables and graphics).
- Data validation reports and laboratory data reports.
- Narrative interpretation of data and results.
- Results of statistical and modeling analyses.
- Photographs documenting the work conducted, if collected.
- Conclusions and recommendations for RD, including design parameters and criteria.
- Recommendations for an additional phase(s) (if necessary).

The CPM and Contractor QAO are responsible for preparing the PDI Evaluation Report.

7.0 HEALTH AND SAFETY

All work completed by Woodard & Curran during execution of this BRW Organic Pollutant Surface Water Sampling QAPP will be performed in accordance with Woodard & Curran's BPSOU Site-Specific Health and Safety Plan. Planned field activity for the BRW Organic Pollutant Surface Water Sampling QAPP maintains the same types of activity detailed in the BPSOU Surface Water QAPP; therefore, the Health and Safety Plan currently contains applicable hazards for this BRW Organic Pollutant Surface Water Sampling QAPP. The Health and Safety Plan may be updated to include unique hazards that materialize during field activities for work.

8.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The roles, duties, and responsibilities of personnel assigned to the BRW Organic Pollutant Surface Water Sampling QAPP are provided below. An organizational chart showing the overall organization of the project team is detailed on Figure 2.

Atlantic Richfield Liability/Project Manager – Josh Bryson
The Atlantic Richfield Liability/Project Manager communicates directly to the Agencies on project matters, monitors the performance of the contractor(s), consults with the CPM and Contractor QAO on deficiencies and helps finalize resolution actions.

Atlantic Richfield Quality Assurance Manager (QAM) – David Gratson
The Atlantic Richfield QAM interfaces with the Atlantic Richfield Operations Project Manager on company policies regarding quality and has the authority and responsibility to approve specific QA documents including this BRW Organic Pollutant Surface Water Sampling QAPP. Mr. Gratson is employed by Environmental Standards, Inc.

Contractor
Pioneer is the contractor responsible for coordinating the elements of the BRW Organic Pollutant Surface Water Sampling QAPP with sampling support from Woodard & Curran. Both Pioneer and Woodard & Curran are under the direction of Atlantic Richfield.

Pioneer Contractor Project Manager (CPM) – Karen Helfrich (Pioneer)
The CPM is responsible for scheduling all testing and sampling work to be completed and ensuring that the work is performed in accordance with the requirements contained herein. The CPM, or designated alternate, is also responsible for consulting with the specific project QA personnel regarding any deficiencies and finalizing resolution actions, maintaining the BRW Organic Pollutant Surface Water Sampling QAPP, and verifying effective implementation of BRW Organic Pollutant Surface Water Sampling QAPP requirements and procedures, including request for changes (RFCs). This includes reviewing field and laboratory data and evaluating data quality.

Contractor Quality Assurance Officer (QAO) – Jackie Janosko (Pioneer)
The Contractor QAO is responsible for verifying effective implementation of BRW Organic Pollutant Surface Water Sampling QAPP requirements and procedures, including reviewing field and laboratory data, and evaluating data quality. The Contractor QAO may conduct site reviews and prepare site review reports for the QAM. The Contractor QAO will have a direct line of communication to the QAM to ensure issues related to project QA are resolved. The Contractor QAO is also authorized to stop work if, in the judgment of that individual, the work is performed contrary to or in the absence of prescribed QCs or approved methods and further work would make it difficult or impossible to obtain acceptable results.

Pioneer Field Team Leader – Alice Drew-Davies (Woodard & Curran)
The Field Team Leader ensures that the BRW Organic Pollutant Surface Water Sampling QAPP and associated RFCs have been reviewed by all members of the field team and the BRW Organic Pollutant Surface Water Sampling QAPP procedures are properly followed during field

activities. The Field Team Leader will conduct daily safety meetings, assist in field activities, and document activities in the field logbook. The Field Team Leader is responsible for facilitating field activities and managing equipment and is responsible for coordinating with the CPM and Contractor QAO regarding problem solving and decision making in the field. The Field Team Leader is responsible for technical aspects of the project and providing "on-the-ground" overviews of project implementation by observing site activities to ensure compliance with technical project requirements and the Health and Safety Plan. The Field Team Leader is responsible for identifying potential Integrity Management issues during field activities and reporting any issues to the Contractor QAO.

Safety and Health Manager – Nicole Santifer (Woodard & Curran)
The Safety and Health Manager is responsible for reviewing the Health and Safety Plan with all members of the field team and updating it if necessary. The Safety and Health Manager will lead BRW Organic Pollutant Surface Water Sampling QAPP applicable Task Risk Assessments and conduct the initial safety meeting prior to starting fieldwork. The Safety and Health Manager will monitor work crews' compliance with all safety and health requirements.

Laboratory - Pace
Pace has been selected to provide analytical services. This laboratory is required to generate and report high quality data that identify and define the physical and chemical characteristics of water for environmental investigations, remediation activities, long-term monitoring programs, discharge compliance monitoring, and/or waste characterization under the purview of Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation & Liability Act, referred to as Superfund. As such, analytical data must be accurately and precisely generated and reported in conformance with the applicable method "best industry standards." Pace will have QA personnel familiar with the approved QAPP and be responsible for reviewing final analytical reports, scheduling analyses, and supervising in-house custody procedures.

9.0 DATA VALIDATION AND USABILITY

This section addresses the final project checks conducted after the data collection phase of the project is completed to confirm that the data obtained meet the project objectives and to estimate the effect of any deviations on data usability for the express purposes of achieving the stated DQOs (Section 3.0). Based on a review of EPA guidance, the analytical data (not including any geotechnical data) collected will undergo Stage 2A Verification and Validation as defined in EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009).

9.1 Data Review, Verification, and Validation

This section describes the review, verification, and validation process for field data and laboratory data. The section also details laboratory data reporting requirements, which describe how results are conveyed to data users.

9.1.1 Data Review Requirements

Data review is performed by the data producer to ensure that the data have been recorded, transmitted, and processed correctly.

Field Data Review

Raw field data will be entered in field logbooks and/or field data sheets per appropriate field SOPs (Table 3), and the data will be reviewed for accuracy and completeness by the Field Team Leader before the records are considered final. The overall quality of the field data from any given sampling round will be further evaluated during the process of data reduction and reporting.

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Field data review will include verification that any QC checks and calibrations, if necessary, are recorded properly in the field logbooks and/or data sheets and that any necessary and appropriate corrective actions were implemented and recorded. Such data will be written into the field logbook and/or data sheets immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, the Field Team Leader will proof the field logbooks and/or data sheets to determine whether any transcription errors have been made by the field crew. If transcription errors have been made, the Field Team Leader and field crew will address the errors to provide resolution.

If appropriate, field measurement data will be entered into electronic files for import to the project database. Data entries will be made from the reviewed field data sheets or logbooks, and all data entries will be reviewed for accuracy and completeness before the electronic file is provided to the database manager. Electronic files of field measurement data will be maintained as part of the project's quality records.

Laboratory Data Review

Internal laboratory data reduction procedures will be according to each laboratory's quality management plan. At a minimum, paper records will be maintained by the analysts to document sample identification number and the sample tag number with sample results and other details, such as the analytical method used (e.g., method SOP number), name of analyst, the date of analysis, matrix sampled, reagent concentrations, instrument settings, and the raw data. These records will be signed and dated by the analyst. Secondary review of these records by laboratory personnel will take place prior to final data reporting to Atlantic Richfield. The laboratory will appropriately flag unacceptable data in the data package.

9.1.2 Data Verification Requirements

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications.

Field Data Verification

The Level A/B review, as described in the CFRSSI Data Management/Data Validation (DM/DV) Plan (ARCO, 1992c) and the CFRSSI DM/DV Plan Addendum (AERL, 2000), will be used in the verification process for field documentation related to samples collected for laboratory analysis.

The Level A criteria are:

- Sampling date.
- Sample team and/or leader.
- Physical description of sample location.
- Sample collection technique.
- Field preservation technique.
- Sample preservation technique.
- Sample shipping records.

The Level B criteria are:

- Field instrumentation methods and standardization complete.
- Sample container preparations.
- Collection of field duplicates.
- Proper and decontaminated sampling equipment.
- Field custody documentation.
- Shipping custody documentation.
- Traceable sample designation number.
- Field notebook(s), custody records in secure repository.
- Complete field forms.

Laboratory Data Verification

The laboratory will prepare standard data packages for transmittal of results and associated QC information to Atlantic Richfield or its designee within a standard turnaround time, unless otherwise required.

Each data package from Pace will be accompanied by an EDD prepared by Pace. Additional laboratory QC data can be included in the EDD. The EDDs will be cross checked against corresponding data reports to confirm consistency in results reported in these two separate formats. This cross check will take place as part of the data verification process.

The data packages from the laboratory will contain the following minimum information as applicable:

- A narrative addressing any anomalies encountered during sample analysis, and a discussion of any exceedances in the laboratory QC sample results.
- Analytical method references.
- Definition of any data flags or qualifiers used.
- Chain of custody documentation signed and dated by the laboratory to indicate sample receipt.
- Method detection limits and reporting limits.
- Analytical results for each field sample.
- QC sample results (as applicable).

Resolution of Deficiencies

Any deficiencies found during the verification process will be discussed with the data producer and may be resolved with a revised data package.

9.1.3 Data Validation Requirements

Data validation is the process of ensuring data are correct and useful. Data validation will be performed by qualified, independent data validation personnel, who are not associated with data collection or sampling responsibilities, and that have applicable training. The QC criteria used during the data validation process will follow the National Functional Guidelines for Organic Superfund Methods Data Review (EPA, 2020c), the National Functional Guidelines for High Resolution Superfund Methods Data Review (EPA, 2020d), the CFRSSI QAPP (ARCO, 1992b), the CFRSSI DM/DV Plan (ARCO, 1992c), the CFRSSI DM/DV Plan Addendum (AERL, 2000), laboratory-specific QC criteria, and/or method-specific criteria where applicable.

9.2 Verification and Validation Methods

The Level A/B Assessment checklists included in Appendix C are based on the CFRSSI DM/DV Plan Addendum (AERL, 2000) guidance.

Stage 2A verification and validation checks include an evaluation of the following, as applicable for each analytical method:

- Completeness of laboratory data package.
- Requested analytical methods performed.
- Completeness of laboratory data package.
- Requested analytical methods performed.
- Holding times.
- Reported detection limits.

- Dilution factors.
- Method blanks.
- LCS and LCSD.
- MS samples and MSD samples.
- Post-digestion spikes (as required by the analytical method)
- Laboratory duplicate samples.
- Field blanks.
- Field duplicates.
- Trip Blanks.
- Serial Dilution (when provided in the laboratory report)
- Surrogates/Internal Standards (organic methods only).

Stage 2A data validation for each laboratory data package will be documented on the data validation checklists in Appendix C.

Data qualifiers will follow those used in the National Functional Guidelines for Organic Superfund Methods Data Review (EPA, 2020c) and the National Functional Guidelines for High Resolution Superfund Methods Data Review (EPA, 2020d).

The Data Validator will be responsible for reviewing field documentation associated with sample collection, conducting the verification and validation of laboratory-produced data, and completing a data validation report, which will be reviewed by the CPM.

9.3 Reconciliation and User Requirements

The Data Quality Assessment (DQA) process described in the CFRSSI DM/DV Plan Addendum (AERL, 2000) and the Guidance for Data Quality Assessment EPA QA/G-9 (EPA, 2000) will be performed to determine whether project-specific DQOs have been satisfied. The DQA process consists of five steps that relate the quality of the results to the intended use of the data:

Step 1: Review DQOs and sampling design.
Step 2: Conduct preliminary data review.
Step 3: Select statistical test(s), as appropriate, to evaluate data quality.
Step 4: Verify assumptions.
Step 5: Draw conclusions about the quality of the data (data report will not include interpterion of results but will state conclusions regarding the quality of the results).

If, as a result of the DQA process, it is determined that data do not satisfy all DQOs, then corrective action(s) should be recommended. Corrective actions include, but are not limited to, revision of the DQOs based on the results of the study or collection of more information or data. It may be determined that corrective actions are not required or the decision process may continue with the existing data with recognition of the limitations of the data.

The PARCCS data quality indicators (Section 3.1) will be used when conducting the DQA. If the PARCCS assessment satisfies the project DQOs, then usability of the data will follow the enforcement/screening/unusable data categories as described in the CFRSSI DM/DV Plan (ARCO, 1992c):

1. Enforcement Quality (Unrestricted Use) Data. Enforcement quality data may be used for all purposes under the Superfund program including the following: site characterization, health and safety, Environmental Evaluation/Cost Analysis, remedial investigation / feasibility study, alternatives evaluation, conformational purpose, risk assessment, and engineering design.
2. Screening Quality (Restricted Use) Data. Potential uses of screening quality data, depending on their quality, include site characterization, determining the presence or absence of contaminants, developing or refining sampling and analysis techniques, determining relative concentrations, scoping and planning for future studies, engineering studies and engineering design, and monitoring during implementation of the response action.
3. Unusable Data. These data are not usable for Superfund-related activities.

Data that meet the Level A and Level B criteria and are not qualified as estimated or rejected during the data validation process are assessed as enforcement quality data and can be used for all Superfund purposes and activities.

Data that meet only the Level A criteria and are not rejected during the data validation process can be assessed as screening quality data. Screening quality data can be used only for certain activities, which include engineering studies and design. Data that do not meet the Level A and/or B criteria and/or are rejected during the data validation process are designated as unusable. The data are assigned one of the following qualifiers:

E = Enforcement quality. No qualifiers or U qualifier and meets Level A and B criteria.
S = Screening quality. J or UJ qualifier and/or meets only Level A criteria.
R = Unusable. R qualifier and/or does not meet Level A or B requirements.

Data that are only qualified as a result of the reported value lying between the laboratory reporting limit and the detection limit are also considered enforcement quality.

Enforcement/Screening Designation

	Meets Level A and B	Meets Level A	Does not Meet Level A or B
No qualifier, A, or U	E	S	R
J, J+, J-, or UJ	S	S	R
R	R	R	R

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FIGURES

LEGEND

- Surface Sample Locations
- BRW Site Boundary

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/QSI 2020

0 200 400 800
Feet

FIGURE 1

PIONEER TECHNICAL SERVICES, INC.

ORGANIC POLLUTANTS SURFACE WATER SAMPLING LOCATIONS

DATE: 12/20/2022

Path: Z:\Shared\Active Projects\ARCO\BPSOU\BRW\GIS\Z_OrganicPollutantsTM_Locations\BRW_OrgncPolutTM_F_001_SampLocs_22.mxd

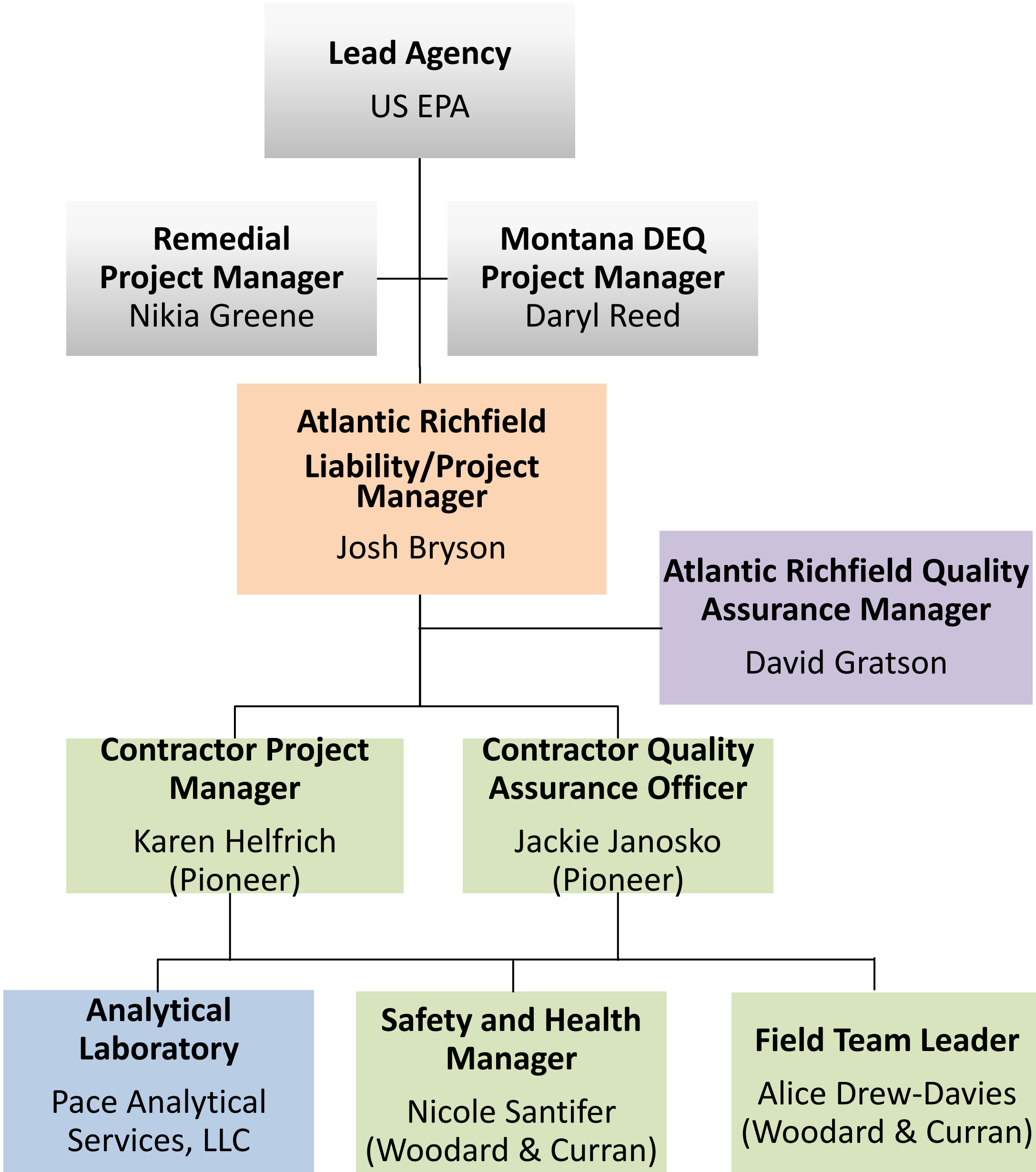

Figure 2

PIONEER TECHNICAL SERVICES, INC.

Project Organization Chart

TABLES

Table 1. Site Investigation Locations

Location	Design Purpose	Northing (Approximate)	Easting (Approximate)	Surface Water Sampling	
				Sample ID	Analytical Group From Table 2
Existing Surface Water Locations					
SS-06A	Organic Pollutant Characterization	651180	1192652	BRW-SS06A-*mmddyyyy*	1, 2, 3, 4, 5, 6, 7, 8, 9
BRW-SS-01	Organic Pollutant Characterization	651136	1194637	BRW-BRWSS01-*mmddyyyy*	1, 2, 3, 4, 5, 6, 7, 8, 9
SS-04	Organic Pollutant Characterization	651043	1197358	BRW-SS04-*mmddyyyy*	1, 2, 3, 4, 5, 6, 7, 8, 9
SS-01.35	Organic Pollutant Characterization	649683	1199562	BRW-SS01.35-*mmddyyyy*	1, 2, 3, 4, 5, 6, 7, 8, 9
Quality Assurance Samples					
Field Duplicate	Verify sampling procedures, 1 per 20 samples	-	-	Sample location to be followed by "(T)". For example, BRW-SS06A(T)-*mmddyyyy.*	3, 4, 5, 6, 7, 8, 9
Equipment Blank	Verify equipment decontamination procedures, 1 per 20 samples	-	-	Sample location to be followed by "(R)". For example, BRW-SS06A(R)-*mmddyyyy* .	3, 4, 5, 6, 7, 8, 9
Field Blank	Verify DI water concentrations, 1 per 20 samples	-	-	Sample location to be followed by "(F)". For example, BRW-SS06A(F)-*mmddyyyy* .	3, 4, 5, 6, 7, 8, 9
Trip Blank	Determine if samples were contaminated during storage and/or transportation back to the laboratory, 1 per sample event	-	-	BRW-TB-*mmddyyyy*	3, 4, 5, 6, 7, 8, 9

Table 2. Sample Collection, Preservation, and Holding Times

Analytical Group	Analytical Lab/Company[1]	Analyte	Analytical Method	Lab Reporting Limit	Lab Anticipated Minimum Detection Limit	Circular DEQ-7 Required Reporting Value[2]	Circular DEQ-7 Standards[2]	Holding Time	Container Size	Additional volume required if MS/MSD requested.	Trip Blank Requirements	Preservation[3]	Justification
Surface Water Field Parameters													
(1)	Woodard & Curran	Water level	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Determine depth-to-water to monitor surface water conditions.
(2)	Woodard & Curran	Temperature	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Determine general stabilization parameters during sampling activities.
		Turbidity											
		Specific Conductance (SC)											
		Dissolved Oxygen (DO)											
		pH											
Surface Water Laboratory Samples													
(3)	Pace	**Polychlorinated biphenyls (PCBs) - Total**	EPA 8082A	0.1 µg/L	0.0398 µg/L	0.08 µg/L	$6.4x10^{-4}$ µg/L (Sum of all Aroclor Analyses)	1 Year	2, 1L amber glass	6, 1L amber glass	NA	Raw	Identify if select organic pollutants and/or any similar compounds exists in surface water upstream and downstream of BRW.
		Aroclor 1016		0.1 µg/L	0.0398 µg/L								
		Aroclor 1221		0.1 µg/L	0.0407 µg/L								
		Aroclor 1232		0.1 µg/L	0.0433 µg/L								
		Aroclor 1242		0.1 µg/L	0.0428 µg/L								
		Aroclor 1248		0.1 µg/L	0.0489 µg/L								
		Aroclor 1254		0.1 µg/L	0.0407 µg/L								
		Aroclor 1260		0.1 µg/L	0.0493 µg/L								
		Aroclor 1262		0.1 µg/L	0.0478 µg/L								
		Aroclor 1268		0.1 µg/L	0.0439 µg/L								
(4)	Pace	**Pentachlorophenol (PCP)**	EPA 8270E SIM	0.3 µg/L	0.0927 µg/L	0.1 µg/L	0.3 µg/L	7/40 Days[4]	2, 1L amber glass	6, 1-L amber glass	NA	Raw	
(5)	Pace	**Dioxin and Furan Congeners**	EPA 1613B	--	--	Lowest detection level for the approved analysis method, which includes EPA Method 1613, Revision B.	0.05 pg/L (Equivalent concentration of 2,3,7,8-TCDD based on the toxicity equivalency factors (TEF) will apply)	1 Year	2-1L amber glass	6, 1-L amber glass	NA	Raw	
		2,3,7,8-TCDD		10 pg/L	2.16 pg/L								
		2,3,7,8-TCDF		10 pg/L	2.34 pg/L								
		1,2,3,7,8-PeCDD		50 pg/L	2.73 pg/L								
		1,2,3,7,8-PeCDF		50 pg/L	2.45 pg/L								
		2,3,4,7,8-PeCDF		50 pg/L	2.55 pg/L								
		1,2,3,4,7,8-HxCDD		50 pg/L	5.01 pg/L								
		1,2,3,6,7,8-HxCDD		50 pg/L	4.45 pg/L								
		1,2,3,7,8,9-HxCDD		50 pg/L	4.25 pg/L								
		1,2,3,4,7,8-HxCDF		50 pg/L	4.61 pg/L								
		1,2,3,6,7,8-HxCDF		50 pg/L	4.77 pg/L								
		1,2,3,7,8,9-HxCDF		50 pg/L	4.7 pg/L								
		2,3,4,6,7,8-HxCDF		50 pg/L	5.44 pg/L								
		1,2,3,4,6,7,8-HpCDD		50 pg/L	4.66 pg/L								
		1,2,3,4,6,7,8-HpCDF		50 pg/L	5.06 pg/L								
		1,2,3,4,7,8,9-HpCDF		50 pg/L	4.62 pg/L								
		OCDD		100 pg/L	12 pg/L								
		OCDF		100 pg/L	13.2 pg/L								
(6)	Pace	**Volatile Petroleum Hydrocarbons (VPH)**	MT VPH	--	--	--	--	14 Days	3, 40-mL amber vials	9, 40-mL amber vials	3, 40-mL amber vials	Unfiltered, acidified with HCl, Zero Headspace.	
		C5 to C8 Aliphatics (unadjusted & adjusted)		100 µg/L	30 µg/L	None	None						
		C9 to C12 Aliphatics (unadjusted & adjusted)		100 µg/L	30 µg/L	None	None						
		C9 to C10 Aromatics		100 µg/L	30 µg/L	None	None						
		Volatile Petroleum Hydrocarbons		200 µg/L	70 µg/L	None	None						
		Benzene[5]		5 µg/L	1.67 µg/L	0.6 µg/L	5 µg/L						
		Toluene[5]		5 µg/L	1.67 µg/L	1 µg/L	1,000 µg/L						
		Ethylbenzene[5]		5 µg/L	1.67 µg/L	1 µg/L	700 µg/L						
		o-Xylene[5]		5 µg/L	1.67 µg/L	1 µg/L	1,000 µg/L						
		m-&p-Xylenes[5]		10 µg/L	3.33 µg/L	2 µg/L	1,000 µg/L						
		Methyl-tert-butyl ether (MTBE)[5]		5 µg/L	1.67 µg/L	1 µg/L	30 µg/L						
(7)	Pace	**Extractable Petroleum Hydrocarbons (EPH) Fractionation**	MT EPH	--	--	--	--	14 Days	2, 1-L amber glass	6, 1-L amber glass	NA	Unfiltered, acidified with HCl	
		C9 to C18 Aliphatics		0.60 mg/L	0.20 mg/L	None	None						
		C19 to C36 Aliphatics		0.60 mg/L	0.20 mg/L	None	None						
		C11 to C22 Aromatics (unadjusted & adjusted)		0.60 mg/L	0.20 mg/L	None	None						
		Total Extractable Hydrocarbons		0.60 mg/L	0.20 mg/L	None	None						
		Total Petroleum Hydrocarbons		0.60 mg/L	0.20 mg/L	None	None						
(8)	Pace	**Polycyclic Aromatic Hydrocarbons (PAHs)**	EPA 8270E SIM	--	--	--	--	7/40 Days[4]	2, 1-L amber glass	6, 1-L amber glass	NA	Raw	
		1-Methylnaphthalene		0.04 µg/L	0.00944 µg/L	None	None						
		2-Methylnaphthalene		0.04 µg/L	0.00710 µg/L	None	None						
		Acenaphthene		0.04 µg/L	0.00653 µg/L	10 µg/L	70 µg/L						
		Acenaphthylene		0.04 µg/L	0.00562 µg/L	None	None						
		Anthracene		0.04 µg/L	0.00491 µg/L	10 µg/L	2,100 µg/L						
		Benzo(a)anthracene		0.04 µg/L	0.00765 µg/L	0.1 µg/L	0.5 µg/L						
		Benzo(a)pyrene		0.04 µg/L	0.00801 µg/L	0.1 µg/L	0.05 µg/L						
		Benzo(b)fluoranthene		0.04 µg/L	0.00831 µg/L	5 µg/L	0.5 µg/L						
		Benzo(g,h,i)perylene		0.04 µg/L	0.00877 µg/L	10 µg/L	None						
		Benzo(k)fluoranthene		0.04 µg/L	0.00852 µg/L	0.1 µg/L	5 µg/L						
		Chrysene		0.04 µg/L	0.00870 µg/L	0.1 µg/L	50 µg/L						
		Dibenzo(a,h)anthracene		0.04 µg/L	0.00793 µg/L	0.1 µg/L	0.05 µg/L						
		Fluoranthene		0.04 µg/L	0.0126 µg/L	10 µg/L	20 µg/L						
		Fluorene		0.04 µg/L	0.00621 µg/L	5 µg/L	50 µg/L						
		Indeno(1,2,3-cd)pyrene		0.04 µg/L	0.0102 µg/L	0.08 µg/L	0.5 µg/L						
		Naphthalene		0.04 µg/L	0.0146 µg/L	10 µg/L	100 µg/L						
		Phenanthrene		0.04 µg/L	0.0140 µg/L	0.2 µg/L	None						
		Pyrene		0.04 µg/L	0.00911 µg/L	10 µg/L	20 µg/L						
(9)	Pace	**1, 2 dichloroethane (1,2 DCA)**	EPA 8260D	1 µg/L	0.169 µg/L	0.5 µg/L	5 µg/L	14 Days	3, 40-mL clear glass VOA vials	9, 40-mL clear glass VOA vials	3, 40-mL clear glass VOA vials	Unfiltered, acidified with HCl, Zero Headspace	
		1, 2 dibromoethane (EDB)	EPA 8011	0.01 µg/L	0.00458 µg/L	0.01 µg/L	0.017 µg/L	14 Days	3, 40-mL clear glass VOA vials	9, 40-mL clear glass VOA vials	3, 40-mL clear glass VOA vials	Unfiltered, preserved with HCl or Sodium Thiosulfate, Zero Headspace	

[1]Atlantic Richfield may choose to use a different laboratory based on project needs. Regardless of the laboratory chosen, Atlantic Richfield will ensure the necessary reporting limits, required methodology, and the specified quality assurance/quality control and data validation requirements are followed as detailed in the BRW Organic Pollutant Surface Water Sampling QAPP. Agencies will be informed of any changes in the reporting limits, methodology, or the quality assurance/quality control and data validation procedures.

[2]Required Reporting Value and Surface Water Human Health Standards from the Circular DEQ-7 Montana Numeric Water Quality Standards. Montana Department of Environmental Quality. June 2019. For those analytes that do not have human health surface water standards, the entry is "None".

[3]In addition to the preservation listed, all samples will be cooled to <6 °C. Not all analyses require this but because multiple containers will be collected at most sites, all samples will be cooled.

[4]Max Hold Time for Sample Prep/Max Hold Time for Analysis after Sample Prep

[5]It is recognized that the Lab Anticipated Minimum Detection Limit and Lab Reporting Limit are higher than the Circular DEQ-7 Required Reporting Value. Because the Lab Anticipated Minimum Detection Limit is lower than the Circular DEQ-7 Standard, in some cases by several orders of magnitude, and because there are no action levels for this investigation it was determined that the laboratory method is sufficient for the purpose of the investigation.

Units: pg/L - picograms per liter
µg/L - microgram per liter

Table 3 - Project Sampling SOP References

Reference Number	Title, Revision Date	Originating Organization	QAPP Location
G-4	Field Logbook/Photographs	ARCO	BPSOU Surface Water QAPP
SOP-SA-01	Soil and Water Sample Packaging and Shipping	Pioneer	BRW Organic Pollutant Surface Water Sampling QAPP
SOP-SA-04	Chain of Custody Forms For Environmental Samples	Pioneer	BRW Organic Pollutant Surface Water Sampling QAPP
SOP-H-01	Water Sampling Equipment Decontamination	TREC, Inc.	BPSOU Surface Water QAPP
SOP-H-05	Calibrate YSI Professional Plus Multi-Meter	TREC, Inc.	BPSOU Surface Water QAPP
SOP-SW-01	Surface Water Sampling	TREC, Inc.	BPSOU Surface Water QAPP
SOP-SW-06	Read Staff Gauge	TREC, Inc.	BPSOU Surface Water QAPP
SOP-SW-25	Surface Water Sampling for VOCs and Other Organics	TREC, Inc.	BRW Organic Pollutant Surface Water Sampling QAPP

Table 4. Precision, Accuracy and Completeness Calculation Equations

Characteristic	Formula	Symbols
Precision (as relative percent difference, RPD)	$RPD = \frac{(x_i - x_j)}{\left(\frac{x_i + x_j}{2}\right)} \times 100$	x_i, x_j: replicate values of x
Precision (as relative standard deviation, RSD, otherwise known as coefficient of variation)	$RSD = \frac{\sigma}{\bar{x}} \times 100$	σ: sample standard deviation $\bar{x}$: sample mean
Accuracy (as percent recovery, R, for samples without a background level of the analyte, such as reference materials, laboratory control samples and performance evaluation samples)	$R = \frac{x}{t} \times 100$	x: sample value t: true or assumed value
Completeness (as a percentage, C)	$C = \frac{n}{N} \times 100$	n: number of valid data points produced N: total number of samples taken

Appendix A
Standard Operating Procedures

PURPOSE	To provide standard instructions for soil and water sample packaging and shipping.
SCOPE	This practice has been prepared for the Pioneer Technical Services, Inc. (Pioneer) workforce and applies to work carried out by and on behalf of Pioneer. All members of the Pioneer workforce who conduct the work shall be trained and competent in the risk-assessed work described below.

WORK INSTRUCTIONS

The following instructions are intended to provide sufficient guidance to perform the task in a safe, accurate, and reliable manner. Should these instructions present information that is inaccurate or unsafe, operations personnel must bring the issue to the attention of the Project Manager and the appropriate revisions made. All work carried under this SOP will be consistent with procedures and policies described in the appropriate Operation, Maintenance, and Monitoring (O&M) Plan (where applicable), appropriate Site-Specific Health and Safety Plan (SSHASP), and Pioneer Corporate Health and Safety Plan (HASP).

TASK	INSTRUCTIONS
1. Preserve the samples.	Water samples will be preserved, if required, according to SOP-SA-02 Sample Preservation and Containerization for Aqueous Samples, and SOP-SA-02B Sample Preservation and Containerization for Aqueous Samples for VOAs.
2. Place the sample containers in Ziploc bags.	Based on the analytes requested (e.g., low level mercury, low level chromium, etc.), it may be necessary to place each filled sample container in separate Ziploc bags to prevent cross contamination, keep the container clean, dry, and isolated, and protect the sample label. In most cases, all sample containers collected from a specific sample location are placed in a large Ziploc bag and shipped together.
3. Package the samples.	Place samples in a cooler, which has been previously lined with a plastic bag. Surround the samples with non-contaminating packaging materials to reduce movement and absorb any leakage. Double bag the ice and place it in the cooler. Seal the plastic bag in the cooler to contain the samples, packing material, and ice.
4. Review and sign COC forms.	The Field Team Leader or their designated representative will double check the chain-of-custody (COC) forms to assure those samples recorded on the COC forms are in the cooler. The Field Team Leader or the designated representative will then sign the chain-of-custody form to relinquish custody. One copy of the signed COC form will remain with the Field Team Leader. Make a photocopy of the completed forms, if there are no carbon copies available.
5. Tape paper work to cooler.	Place paper work in a sealed Ziploc bag and tape it to the inside of the cooler lid.
6. Bag samples for separate analytical batches.	If the shipping cooler contains more samples than can be analyzed in one analytical batch, the laboratory may request that the samples in the cooler be bagged for separate analytical batches. This may be necessary so that the appropriate Quality Control/Quality Assurance samples are included in each analytical batch. In this case, fill out separate COC forms for each batch and include the forms in the

	appropriate plastic bags. Place the COC forms for each batch in a sealed Ziploc bag. The COC forms for each batch should be placed at the top of the plastic bag so that they are clearly visible to laboratory personnel when they open the plastic bags.
7. Label the cooler.	Label the cooler with the appropriate labels to describe the content of the cooler (e.g., NOS, flammable liquids, flammable solids, this side up, fragile, etc.). Close the cooler and place the appropriate shipping labels (e.g., overnight shipping from Federal Express, UPS, or the United States Postal Service or equivalent) on the lid of the cooler.
8. Sign COC seals.	The Field Team Leader or the designated representative will sign COC seals and place the signed seals over the opening edge of the cooler.
9. Tape the cooler.	Place tape over the custody seals and around the cooler.
10. Transport the cooler.	Transport the cooler(s) to a secure storage, to the shipping agent, or directly to the laboratory. If shipping the cooler, follow established federal and state regulations depending on cooler content.
Notes	Bagging of samples and lining of coolers is not necessary, if samplers transport the samples directly to the laboratory.

HSSE CONSIDERATIONS

This section to be completed with concurrence from the Safety and Health Manager.

SOURCE	*HAZARDS*	*WHERE*	*HOW, WHEN, RESULT*	*CONTROLS*
CHEMICAL	Potential contact with contaminated soil and water samples.	Sites.	Inadvertent exposure to contaminated soil and water samples could lead to adverse health effects.	Personnel will practice proper personal hygiene – wash hands prior to eating/drinking and when leaving the site. Employees will wear nitrile gloves and safety glasses when handling sample containers.
	Preservatives (HCL, HNO3, H2SO4, Zinc, Acetate, NaOH).	In bottles or added to bottles through sampling process.	Inadvertent exposure to preservatives could lead to adverse health effects.	Safety Data Sheets for each preservative chemical are available to all employees on the Pioneer company web site. Personnel will wear nitrile gloves and safety glasses when adding preservatives to samples bottles and when handling the bottles. Refer to the Chemical Flushing Guidelines available inside vehicle's first aid kit for first-aid procedures in case of contact with preservatives.
NOISE	Not applicable.			
ELECTRICAL	Not applicable.			
BODY MECHANICS	Bending, squatting, and kneeling.	During sample packaging.	Bending, squatting, and could result in muscle/back strains or other injuries.	Employees should stretch prior to starting work and they will take breaks when necessary.
	Improper lifting.	Sites.	Back injuries and muscle/back strains could result when using improper techniques to lift and carry coolers with samples.	Personnel will use proper lifting techniques – get a good grip, keep the load close to the body, lift with legs and not with back, and avoid lifting loads above shoulder's height. Two workers will lift/carry the coolers, if needed.

GRAVITY	Not applicable.			
WEATHER	Not applicable.			
RADIATION	Not applicable.			
BIOLOGICAL	Not applicable.			
MECHANICAL	Not applicable.			
PRESSURE	Not applicable.			
THERMAL	Not applicable.			
HUMAN FACTORS	Inexperienced and improperly trained worker.	Sites.	Inexperienced workers and improper training could cause incidents resulting in adverse health effects and/or property damage.	Employees will be properly trained in this procedure and other applicable procedures. Employees will implement stop work procedures, if necessary.
SIMOPS	Not applicable.			

ADDITIONAL HSSE CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.	
REQUIRED PPE	Sampling site: hard hat, safety glasses, high-visibility work shirt or vest, long pants, work boots, and nitrile gloves. Off site: nitrile gloves.
APPLICABLE SDS	HCL, HNO3, H2SO4, Zinc, Acetate, and NaOH. Additional Safety Data Sheets (SDSs) will be maintained based on site characterization and contaminants.
REQUIRED PERMITS/FORMS	Per site/project requirements.
ADDITIONAL TRAINING	Per site/project requirements.

DRAWINGS, DOCUMENTS, AND TOOLS/EQUIPMENT The following documents should be referenced to assist in completing the associated task.	
P&IDS	
DRAWINGS	
RELATED SOPs/PROCEDURES/ WORK PLANS	SOP-SA-02 Sample Preservation and Containerization for Aqueous Samples and SOP-SA-02B Sample Preservation and Containerization for Aqueous Samples for VOAs.
TOOLS	Plastic bags, Ziploc bags, non-contaminating packaging materials, tape, COC seals, ice, and cooler.
FORMS/CHECKLIST	Chain-of-custody (COC) forms.

APPROVALS/CONCURRENCE By signing this document, all parties acknowledge the completeness and applicability of this SOP for its intended purpose. Also, by signing this document, it serves as acknowledgement that I have received training on the procedure and associated competency testing.	
SOP TECHNICAL AUTHOR	**DATE**
Julie Flammang **Julie Flammang**	**12/11/2014**
SAFETY AND HEALTH MANAGER	**DATE**
Tara Schleeman **Tara Schleeman**	**12/11/2014**

Revisions:

Revision	Description	Date

PURPOSE	This SOP establishes the requirements for documenting and maintaining environmental sample chain of custody from point of origin to receipt of sample at the analytical laboratory. This procedure shall apply to all types of air, soil, water, sediment, biological, and/or core samples collected in environmental investigations by Pioneer Technical Services, Inc. (Pioneer). It is applicable from the time of sample acquisition until custody of the sample is transferred to an analytical laboratory.
SCOPE	This practice has been prepared for the Pioneer Technical Services, Inc. (Pioneer) workforce and applies to work carried out by and on behalf of Pioneer. All members of the Pioneer workforce who conduct the work shall be trained and competent in the risk-assessed work described below.
DEFINITIONS	Chain of Custody: is an unbroken trail of accountability that ensures the physical security of samples, data, and records. Custody refers to the physical responsibility for sample integrity, handling, and/or transportation. Custody responsibilities are effectively met, if the samples are: • In the responsible individual's physical possession; • In the responsible individual's visual range after having taken possession; • Secured by the responsible individual so that no tampering can occur; or • Secured or locked by the responsible individual in an area in which access is restricted to authorized personnel only.

WORK INSTRUCTIONS

The following instructions are intended to provide sufficient guidance to perform the task in a safe, accurate, and reliable manner. Should these instructions present information that is inaccurate or unsafe, operations personnel must bring the issue to the attention of the Project Manager and the appropriate revisions made. All work carried under this SOP will be consistent with procedures and policies described in the appropriate Operation, Maintenance, and Monitoring (O&M) Plan (where applicable), appropriate Site-Specific Health and Safety Plan (SSHASP), and Pioneer Corporate Health and Safety Plan (HASP).

TASK	INSTRUCTIONS
Project Manager's Responsibilities	The Project Manager is responsible for overall management of environmental sampling activities, designating sampling responsibilities to qualified personnel, and reviewing any changes to the sampling plan.
Field Team Leader's Responsibilities	The Project Manager may act as the Field Team Leader or may choose to appoint a Field Team Leader. The Field Team Leader is responsible for general supervision of field sampling activities and ensuring proper storage/transportation of samples from the field to the analytical laboratory. Chain of Custody forms will be reviewed for accuracy and completeness to preserve sample integrity from collection to receipt by an analytical lab by the Field Team Leader. The review of Chain of Custody forms may be delegated to qualified personnel.

	The Field Team Leader is responsible for sample custody until the sample has been properly relinquished as documented on the chain of custody form.
Field Sampler's Responsibilities	The Field Sampler is responsible for sample acquisition in compliance with technical procedures, initiating the Chain of Custody, and checking sample integrity and documentation prior to transfer. Field samplers are also responsible for initial transfer of samples consisting of physical transfer of samples directly to the internal laboratory or transferred to a shipping carrier, (e.g., United Parcel Service or Federal Express) for delivery.
Laboratory Technician's Responsibilities	The receiving Laboratory Technician is responsible for inspection of transferred samples to ensure proper labeling and satisfactory sample condition. Unacceptable samples will be identified and segregated. The Laboratory Project Manager will be notified. The Laboratory Technician will review the Chain of Custody for completeness and file as part of the project's permanent record.
Samples Handling and Chain of Custody Forms	All samples shall be collected and handled in accordance with SOP-SA-01 Soil and Water Sample Packaging and Shipping and SOP-SA-02 Sample Preservation and Containerization for Aqueous Samples, or methods described in the Sampling and Analysis Plan (SAP) or work plan (WP). Samples will be transported in insulated coolers with ice ('blue ice' is acceptable) as necessary to maintain temperature at 4 °C+/- 2 °C until receipt by the analytical laboratory. The Field Team Leader or designated Field Sampler shall initiate the Chain of Custody form for the initial transfer of samples. A Chain of Custody form will be completed and accompany every sample. The form includes the following information: • Project code; • Project name; • Samplers signature; • Sample identification; • Date sampled; • Time sampled; • Analysis requested; • Remarks; • Relinquishing signature, data, and time; and • Receiving signature, date, and time. The Field Sampler relinquishing custody and the responsible individual accepting custody shall sign, date, and note the time of transfer on the Chain of Custody form.

	Note: if the transporter is not an employee of Pioneer, the Field Sampler may identify the carrier and reference the bill of lading number in lieu of the transporter's signature. One copy of the Chain of Custody form shall be filed as a temporary record of sample transfer by the Field Sampler. The original form shall accompany the samples and shall be returned to Pioneer as part of the contracted laboratory Quality Assurance/Quality Control (QA/QC) requirements. The original form will be filed as part of the project's permanent records. The Project Manager (or designee) shall track the Chain of Custody to ensure timely receipt of samples by an analytical laboratory.

HSSE CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.				
SOURCE	***HAZARDS***	***WHERE***	***HOW, WHEN, RESULT***	***CONTROLS***
CHEMICAL	Potential contact with contaminated water/soil samples. Preservatives (HCL, HNO_3, H_2SO_4, Zinc, Acetate, and NaOH).	Outside of bottles. Outside of bottles.	Inadvertent exposure to contaminated water/soil samples could lead to adverse health effects. Inadvertent exposure to preservatives could lead to adverse health effects.	Personnel will practice proper personal hygiene – wash hands prior to eating/drinking and when leaving the site. Employees will wear nitrile gloves and safety glasses when handling sample containers. Safety Data Sheets for each preservative chemical are available to all employees on the Pioneer company web site. Personnel will wear nitrile gloves and safety glasses when handling the bottles. Refer to the Chemical Flushing Guidelines available inside vehicle's first aid kit for first-aid procedures in case of contact with preservatives.
NOISE	Not applicable.			
ELECTRICAL	Not applicable.			
BODY MECHANICS	Improper lifting.	Sites.	Back injuries and muscle/back strains could result when using improper techniques to lift and carry packaged samples and coolers.	Personnel will use proper lifting techniques – get a good grip, keep the load close to the body, lift with legs and not with back, and avoid lifting loads above shoulder's height. Two workers will lift/carry packaged samples and coolers, if needed.
GRAVITY	Falls from slips and trips.	Uneven terrain, slick/muddy/wet surfaces and steep slopes.	Walking/working on slick/muddy/wet and uneven terrain could cause slips and trips resulting in	Workers will wear work boots with good traction and ankle support. Personnel will be aware of working/walking surfaces and choose a path to avoid hazards. Keep work areas as dry as possible.

			falls and injuries.	
WEATHER	Not applicable.			
RADIATION	Not applicable.			
BIOLOGICAL	Not applicable.			
MECHANICAL	Not applicable.			
PRESSURE	Not applicable.			
THERMAL	Not applicable.			
HUMAN FACTORS	Inexperienced and improperly trained worker.	Sites.	Inexperienced workers and improper training could cause incidents resulting in adverse health effects and/or property damage.	Employees will be properly trained in this procedure and other applicable procedures. Employees will implement stop work procedures, if necessary.
SIMOPS	Not applicable.			

ADDITIONAL HSSE CONSIDERATIONS This section to be completed with concurrence from the Safety and Health Manager.	
REQUIRED PPE	Safety glasses, high-visibility work shirt or vest, long pants, work boots, and nitrile gloves.
APPLICABLE SDS	HCL, HNO_3, H_2SO_4, Zinc, Acetate, and NaOH. Additional Safety Data Sheets (SDSs) will be maintained based on site characterization and contaminants.
REQUIRED PERMITS/FORMS	Per site/project requirements.
ADDITIONAL TRAINING	Per site/project requirements.

DRAWINGS, DOCUMENTS, AND TOOLS/EQUIPMENT The following documents should be referenced to assist in completing the associated task.	
P&IDS	
DRAWINGS	
RELATED SOPs/PROCEDURES/ WORK PLANS	SOP-SA-01 Soil and Water Sample Packaging and Shipping and SOP-SA-02 Sample Preservation and Containerization for Aqueous Samples.
TOOLS	Seals and labels; chain of custody forms; chain of custody seals (provided by contracted laboratory); packing and shipping materials; and cooler and ice.
FORMS/CHECKLIST	Chain of Custody Forms.

APPROVALS/CONCURRENCE

By signing this document, all parties acknowledge the completeness and applicability of this SOP for its intended purpose. Also, by signing this document, it serves as acknowledgement that I have received training on the procedure and associated competency testing.

SOP TECHNICAL AUTHOR	**DATE**
Julie Flammang **Julie Flammang**	**12/17/2014**
SAFETY AND HEALTH MANAGER	**DATE**
Tara Schleeman **Tara Schleeman**	**12/17/2014**

Revisions:

Revision	Description	Date

SOP – SW – 25

SURFACE WATER SAMPLING for VOCs and Other Organics

Authorized for use: 12/XX/2022 **Revision 0** **Reviewed:**	
SCOPE	This SOP addresses the manual collection of surface water samples.
RTRA(s) Referenced/ Reviewed	TRA1-001: Common Hazards, Driving, Manual Handling TRA1-005: Surface Water Sampling
STOP WORK TRIGGERS	Lightning (30 second rule) Extreme wind Unsafe conditions Inadequate PPE or equipment Water depth greater than three feet and life jacket, throw ring, and rescue skiff or railing are not on hand Inability to access the work area safely Defective equipment
MSDS (attach)	Arsenic Cadmium Copper Lead Mercury Zinc Hydrocarbon compounds, VPH, EPH, PAH, lead scavengers PCBs PCP Dioxins HCl Sodium Thiosulfate pH buffers (4.00 s. u., 7.00 s.u., 10.00 s.u.) Conductivity Standard (<3 ms/cm) Methanol
PPE REQUIRED	Hard hat Waders (rubber soles) Safety glasses High visibility shirt or vest Gloves (leather, impervious, and shoulder length gloves (calving gloves)) Long-sleeve shirt Long trousers
OTHER INSTRUCTIONS/SOPs	
REQUIRED TOOLS and SUPPLIES	Sample bottles Deionized water for decontamination Methanol for decontamination YSI Pro Plus meter Turbidity meter Table
Trained, Competent and Authorized Employees in this SOP	1. Tina Donovan 2. Alice Drew Davies 3. Matt Kilsdonk 4. Mat Erickson 5. Dalen Longfield 6. Kirsten Vose 7. Joe Moodry 8. Nate Beinemann
PROCEDURES	
Preparation/Precautions	Process VOC samples at the streamside, not at the vehicle. Do not leave vehicle running as this may contaminate VOC samples. The sample processing area should be free of contaminants, plastics, dirt, fumes, and oil residue. Within the vehicle, store VOC sampling equipment and supplies in a container free of contaminants. Trip blanks provided by the laboratory must be stored with empty and filled VOC vials throughout the sampling effort.

Choose Sample Collection Location	1. Within the designated sampling site, choose a relatively straight stream reach with uniform flow. Avoid sample collection in backwater or ripples. Avoid areas downstream of a bridge as these areas may be impacted by road run-off. 2. Collect single-point samples at the centroid of the stream. Samples should be collected where stream velocity is representative of the average flow. Typically, this is mid-stream.
Surface Water Sample Collection	Volatile organic compounds (VOCs), along with several other organic analyses, glass vials or bottles preserved with HC or sodium thiosullfate. If preservative is present, the bottle cannot be dipped directly into the stream. Stream water is collected with a stainless steel (SS) or glass bottle. Always wear clean impervious gloves when collecting samples to protect both skin and sample integrity. Shoulder length vinyl gloves are available when necessary and should be worn in conjunction with impervious nitrile gloves. Always change gloves between sites to avoid cross-contamination. When entering a stream, always face upstream. Cross the stream cautiously, stepping sideways. Do not rush. Make sure to enter below the sampling point. 1. Read and record staff gage according to SOP-SW-06_ReadStaffGuage. 2. Place YSI meter in stream, downstream of the sample collection site, to collect the necessary parameters following the Field Parameter Measurement Section in SOP-SW-01. Place the meter in an area that the cord is not a tripping hazard. 3. Collect VOC sample aliquots first, followed by all other sample aliquots which require chemical preservation. 4. Wearing appropriate gloves, triple rinse the collection bottle with stream water. Once rinsed, submerge the sample collection bottle into the water body. Sample over nearly the full water depth but use care that the streambed is not disturbed. Avoid capturing any oily film or debris floating on the water surface in the bottle. Fill the bottle so that there is no headspace, then cap the bottle. 5. At the streamside, fill all VOC containers. Carefully, with as little agitation as possible, dispense the stream water from the collection bottle into the vials, completely filling one vial at a time. Fill each vial so there is a reverse or convex meniscus, taking care not to overfill so that preservative is lost. Once filled, immediately cap the vial. 6. Invert the securely capped vial and lightly tap to confirm that no air bubbles or void-space are present. If bubbles are present, top off the vial with a minimal volume of sample to re-establish the meniscus and repeat this until no bubbles are present. Once zero headspace containers are filled, bottles intended for additional organic analyses can be filled. Fill the bottles to at least the shoulder. 7. To fill bottles for non-VOC organic analyses, fill the bottles at the same point or using equal width increment (EWI) sampling techniques depending on the specifications in the project QAPP (point-source or EWI). 8. Collect the sample directly into the glass bottle, unless the project QAPP specifies that a SS bottle must be used to collect all sample aliquots. Fill the bottle to at least the shoulder. Collect over the entire stream depth, without touching the streambed with the collection bottle. 9. If using EWI technique, refer to SOP-SW-01, Surface Water Sampling. 10. Label the samples clearly in waterproof ink with a unique sample ID, sample date, sample time, sample analysis, sample preparation (i.e. preservative used), and sampler's initials. Place samples in cooler containing ice.
Decontamination	Decontamination is only necessary if sample bottles are reused for multiple sampling stations or if site-dedicated bottles are used for multiple sampling events. Prior to re-using the SS or glass bottle that was used to collect the VOC samples, or collecting an equipment contamination blank (ECB) rinse it with a solution of DI water and methanol. Follow with a triple rinse of DI water. Be sure to rinse all inside surfaces, which is best achieved by inverting the bottle three times. Cap the bottle. Do not store it in a plastic container, but do store it in an area free of contaminants.
FIELD PARAMETER MEASUREMENT	1) Field parameter meters shall be calibrated within 24 hours of use, following the manufacturer's instructions. Calibration will be documented in doForms and the field book. The doForm to use is located on the iPad at: Project: Butte Form: Butte-Rocker – Equip Calibr r3. 2) To measure parameters, remove plastic cover from bulkhead of meter. Replace with perforated protective metal cover. To place multi-meter in the stream, don impervious gloves, using shoulder length gloves, where necessary, and carry the multi-meter to approximately mid-stream, as the cord length allows. Place the meter far enough below the sampling site to avoid a tripping hazard as you enter and exit the stream. Gently place the meter on the streambed with the probes perpendicular to flow and allow it to equilibrate. After sampling is complete, record field parameters. Once parameters are recorded, enter the stream and retrieve the meter. Do not drag the meter across the streambed. 3) If meter type or sample location does not allow for immersion in the stream use the Flow Cell to submerge probes. Attach Flow Cell tubing to peristaltic pump and pump water through the Flow Cell. Allow field parameters to stabilize then record the parameters.
DOCUMENTATION	Complete documentation, including chain-of-custody, in accordance with project and QAPP requirements.
REPORTING	Complete reporting in accordance with project and QAPP requirements

SHIPPING	Refer to SOP-SW-01 for Shipping instructions.

Appendix B
Corrective Action Report

Corrective Action Report/ Corrective Action Plan

Project ID	Project Name	Document ID

Preparer's Signature/Submit Date	Submitted to:

Description of the requirement or specification	
Reason for the Corrective Action	
Location, affected sample, affected equipment, etc. requiring corrective action	
Suggested Corrective Action	(Continue on Back)
Corrective Action Plan	(Continue on Back) ☐ Approval signature/date:____________________ Approval of corrective actions required by EPA? ☐ Yes ☐ No ☐ EPA approval name/date:____________________ ☐ Corrective actions completed name/date:____________________
Preventative Action Plan	(Continue on Back) ☐ Preventative actions completed name/date:____________________

Corrective Action Report/
Corrective Action Plan

Suggested Corrective Action (Continued)	
Corrective Action Plan (Continued)	
Preventative Action Plan (Continued)	

Appendix C
Data Validation Checklists

Level A/B Assessment Checklist

1. General Information

Site:
Project:
Client:
Sample Matrix:

2. Screening Result

Data are:

1. Unusable ____
2. Level A ____
3. Level B ____

I. **Level A**

Criteria – The following must be fully documented.	**Yes/No**	**Comments**
1. Sampling date		
2. Sampling team or leader		
3. Physical description of sampling location		
4. Sample depth (soils)		
5. Sample collection technique		
6. Field preparation technique		
7. Sample preservation technique		
8. Sample shipping records		

II**. Level B**

Criteria – The following must be fully documented.	**Yes/No**	**Comments**
1. Field instrumentation methods and standardization complete		
2. Sample container preparation		
3. Collection of field replicates (1/20 minimum)		
4. Proper and decontaminated sampling equipment		
5. Field custody documentation		
6. Shipping custody documentation		
7. Traceable sample designation number		
8. Field notebook(s), custody records in secure repository		
9. Completed field forms		

Stage 2A Data Validation Checklist for Organics (GC) Sample Analysis

Site:
Project:
Sample Date(s):
Data Validator:

Case No:
Sample Matrix:
Analysis Date(s):
Validation Date(s):

Laboratory:
Analyses:

1. Holding Times

Analytes	Laboratory	Matrix	Method	Holding Time(s)	Collection Date	Batch	Prep Date	Analysis Date(s)	Holding Time Met (Y/N)	Affected Data Flagged (Y/N)

Were any data flagged because of holding time? Y ☐ N ☐
Were any data flagged because of preservation problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

2. Blanks

Were Method Blanks (MBs) analyzed at the frequency of 1 per analytical batch? Y ☐ N ☐
Were MBs within the control window? Y ☐ N ☐
Were any data flagged because of blank problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

3. Surrogates

Were surrogates present in all extracted samples (including QC)? Y ☐ N ☐
Were surrogate recoveries within the control window? Y ☐ N ☐
Were any data flagged because of surrogate problems? Y ☐ N ☐

Describe Any Actions Take:

Comments:

4. Laboratory Control Samples

Were Laboratory Control Samples (LCS) analyzed at the frequency of 1 per batch? Y ☐ N ☐
What was the source of the LCS? Unknown
Were LCS results within the control window? Y ☐ N ☐
Were any data flagged because of LCS problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

5. Duplicate Sample Results

Were Laboratory Duplicate Samples (LDS) analyzed at the frequency of 1 per batch? Y ☐ N ☐
Were LDS results within the control window? Y ☐ N ☐
Were any data flagged because of LDS problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

6. Matrix Spike Sample Results

Were Laboratory Matrix Spike Samples (LMS) analyzed at the frequency of 1 per batch?	Y		N	
Were LMS % Recovery (%R) results within the control window?	Y		N	
Were any data flagged because of LMS problems?	Y		N	

Describe Any Actions Taken:

Comments:

7. Field Blanks

Were field blanks submitted as specified in the Sampling Analysis Plan (SAP)?	Y		N			
Were field blanks within the control window?	Y		N		N/A	
Were any data qualified because of field blank problems?	Y		N		N/A	

Describe Any Actions Taken:

Comments:

8. Field Duplicates

Were field duplicates submitted as specified in the Sampling Analysis Plan (SAP)?	Y	X	N			
Were the field duplicates within the control window?	Y		N		N/A	
Were any data qualified because of field duplicate problems?	Y		N		N/A	

Describe Any Actions Taken: None required

Comments:

9. Overall Assessment

Are there analytical limitations of the data that users should be aware of?	Y		N	

If so, explain:

Comments:

10. Authorization of Data Validation

Data Validator
Name: **Reviewed by:**

Signature: ______________________________

Date: ______________ ______________________________

Stage 2A Data Validation Checklist for Organics (GC-MS) Sample Analysis

Site: **Case No:** **Laboratory:**
Project: **Sample Matrix:** **Analyses:**
Sample Date(s): **Analysis Date(s):**
Data Validator: **Validation Date(s):**

1. Holding Times

Analytes	Laboratory	Matrix	Method	Holding Time(s)	Collection Date	Batch	Prep Date	Analysis Date(s)	Holding Time Met (Y/N)	Affected Data Flagged (Y/N)

Were any data flagged because of holding time? Y ☐ N ☐
Were any data flagged because of preservation problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

2. Blanks

Were Method Blanks (MBs) analyzed at the frequency of 1 per analytical batch? Y ☐ N ☐
Were MBs within the control window? Y ☐ N ☐
Were any data flagged because of blank problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

3. Surrogates/Internal Standards

Were surrogates present in all extracted samples (including QC)? Y ☐ N ☐
Were surrogate recoveries within the control window? Y ☐ N ☐
Were any data flagged because of surrogate or internal standard problems? Y ☐ N ☐

Describe Any Actions Take:

Comments:

4. Laboratory Control Samples

Were Laboratory Control Samples (LCS) analyzed at the frequency of 1 per batch? Y ☐ N ☐
What was the source of the LCS?
Were LCS results within the control window? Y ☐ N ☐
Were any data flagged because of LCS problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

5. Duplicate Sample Results

Were Laboratory Duplicate Samples (LDS) analyzed at the frequency of 1 per batch? Y ☐ N ☐
Were LDS results within the control window? Y ☐ N ☐
Were any data flagged because of LDS problems? Y ☐ N ☐

Describe Any Actions Taken:

Comments:

6. Matrix Spike Sample Results

	Y		N	
Were Laboratory Matrix Spike Samples (LMS) analyzed at the frequency of 1 per batch?	Y		N	
Were LMS % Recovery (%R) results within the control window?	Y		N	
Were any data flagged because of LMS problems?	Y		N	

Describe Any Actions Taken:

Comments:

7. Field Blanks

	Y		N		N/A	
Were field blanks submitted as specified in the Sampling Analysis Plan (SAP)?	Y		N			
Were field blanks within the control window?	Y		N		N/A	
Were any data qualified because of field blank problems?	Y		N		N/A	

Describe Any Actions
Taken:

Comments:

8. Field Duplicates

	Y		N		N/A	
Were field duplicates submitted as specified in the Sampling Analysis Plan (SAP)?	Y	X	N			
Were the field duplicates within the control window?	Y		N		N/A	
Were any data qualified because of field duplicate problems?	Y		N		N/A	

Describe Any Actions Taken: None required

Comments:

9. Overall Assessment

Are there analytical limitations of the data that users should be aware of? Y [ ] N [ ]

If so, explain:

Comments:

10. Authorization of Data Validation

Data Validator
Name: **Reviewed by:**

Signature: ______________________________

Date: ______________ ______________