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2024 GROUNDWATER AND SURFACE WATER

INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN

FORMER ASARCO EAST HELENA FACILITY

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September 2024

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2024 GROUNDWATER AND SURFACE WATER INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN FORMER ASARCO EAST HELENA FACILITY

1.0 INTRODUCTION

This Interim Corrective Action Performance Monitoring (CAPM) Plan summarizes groundwater and surface water monitoring activities to be conducted in 2024 at the former East Helena Facility[1] (the Facility) and the surrounding area (Figure 1-1), encompassing two groundwater plumes and the associated groundwater and surface water monitoring network. The primary goal of the 2024 CAPM Plan is to provide for collection of groundwater and surface water monitoring data to evaluate the effectiveness of Corrective Measures (CMs) and associated Institutional Controls (ICs) implemented to date as remedies at the Facility. The CMs and associated ICs have been developed to protect human health and the environment, by reducing mass loading of contaminants (primarily arsenic and selenium) to groundwater and surface water from Facility-related sources and subsequent offsite migration (CMs), and by mitigating potential exposures to contaminated soil and groundwater (ICs).

The 2024 Interim CAPM Plan (the Plan) describes the Facility-related comprehensive seasonal groundwater and surface water monitoring activities for 2024. The Plan identifies specific monitoring objectives and performance evaluation data analysis procedures, and describes the number, type, and location of samples to be collected to address objectives, as well as the sampling and analytical methodologies to be employed. The Plan will be utilized in association with other Facility planning and guidance documents, including the Quality Assurance Project Plan (QAPP) for Environmental Data Collection Activities (Hydrometrics, 2015), and the Data Management Plan (DMP) for Environmental Data Collection Activities (Hydrometrics, 2011). These documents include detailed discussions of the project and Facility history and background, as well as general requirements for data review, reporting, and management. Brief summaries of the Facility history and background are provided in this Plan for context.

1.1 PROJECT BACKGROUND

The Montana Environmental Trust Group, LLC, Trustee of the Montana Environmental Custodial Trust (Custodial Trust), is currently conducting Resource Conservation and Recovery Act (RCRA) Corrective Actions at the Facility pursuant to the First Modification to the 1998 RCRA Consent Decree (U.S. District Court, 2012) for the East Helena Facility, under the oversight of the US Environmental Protection Agency (EPA).

[1] The Facility refers to the approximately 142 acres previously occupied by the East Helena Lead Smelter.

RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS) evaluations have delineated soils and non-native fill material (i.e., slag, ore, concentrates, demolition debris) located in the former operating areas of the Facility impacted by contaminants, primarily arsenic, selenium, and certain trace metals. Contaminants within site soils and fill material are the result of more than a century of ore handling and processing; storage and disposal of smelting wastes and byproducts; and periodic releases of high contaminant-concentration plant process waters. The contaminated soils/fill represent the major current and/or historic sources of contaminant loading to groundwater. Loading of contaminants to groundwater has resulted in the generation and migration of groundwater plumes (arsenic and selenium) from the Facility to the north and northwest.

CMS evaluations were completed in 2016, and the Public Review Draft of the CMS Report (CH2M, 2018) was submitted to EPA in 2018 and was finalized in 2020 (METG, 2020). The EPA issued the Statement of Basis (SOB) for Groundwater, Surface Water, and Soil Corrective Measures (Remedy) Decision at Former ASARCO East Helena Facility in 2020 (EPA, 2020), and a Corrective Measures Implementation (CMI) Work Plan was subsequently prepared for the Facility (Hydrometrics, 2021). As detailed in the SOB and the CMI Work Plan, final CMs for the Facility include:

(1) An evapotranspiration (ET) cover system to reduce infiltration and leaching of unsaturated zone contaminants to groundwater;
(2) South Plant Hydraulic Control (SPHC) to lower groundwater levels on the Facility and decrease the mass and rate of migration of contaminants in groundwater;
(3) Source removals to excavate and consolidate highly contaminated soil from accessible areas to prevent ongoing contamination of groundwater; and
(4) Slag pile regrading and capping to reduce infiltration through slag and associated leaching of contaminants to groundwater.

The Facility CMs listed in items (1) through (3) above have been implemented; the final CM (item (4), slag pile capping) is scheduled for implementation after completion of the slag recovery project (excavation, crushing, and off-site transport of unfumed slag). The SOB and CMI Work Plan include provisions for long-term monitoring activities and development of final remedy performance monitoring, evaluation, and reporting requirements to be included in a final CAPM Plan. Information collected under this 2024 Interim CAPM Plan (and previous water resources monitoring and corrective action monitoring plans) will support evaluation of the effectiveness of the CMs implemented to date, and will also be used to develop a final CAPM program after all CMs specified in the SOB and CMI Work Plan, including slag pile capping, are completed at the Facility.

1.2 2024 MONITORING PROGRAM OBJECTIVES

As described above, the overall goal of the 2024 Interim CAPM Plan is to provide for collection of groundwater and surface water monitoring data to evaluate the effectiveness of CMs and ICs implemented to date at the Facility. The CMs and ICs are intended to reduce mass loading and migration of contaminants in groundwater and surface water, and to prevent exposure to contaminated media.

To achieve this overall goal, the Plan includes data collection to support the following objectives:

(1) Assessment of sitewide groundwater level trends and general groundwater flow directions;
(2) Assessment of groundwater quality trends for key constituents (arsenic, selenium, chloride, and sulfate) at specific wells located in both Facility source areas and downgradient areas;
(3) Assessment of arsenic and selenium plume geometry and stability;
(4) Evaluation of residential/public water supply well water quality in the area of Facility impacts;
(5) Evaluation of Prickly Pear Creek surface water flow and quality trends, from upstream of the Facility through the creek realignment area, and downstream to Canyon Ferry Road;
(6) Continued evaluation of groundwater chemistry in CAMU area wells;
(7) Continued assessment of additional Facility-related groundwater constituents (zinc and cadmium) that have persisted at elevated concentrations exceeding groundwater standards in selected on-Site wells; and
(8) Provide water quality and hydrologic data for use in developing a final CAPM program following completion of all CMs.

Assessment of groundwater level trends, groundwater quality trends, and arsenic and selenium plume geometry and stability (objectives (1), (2), and (3) above) will be addressed through a remedy performance monitoring data evaluation program appropriate to the remediation phase of a RCRA Corrective Action remediation project, as described in Section 2.0. The data evaluation strategy outlined in Section 2.0 is intended to provide a template (with appropriate modifications) for the final CAPM program to be developed following completion of all CMs. The Plan is structured as follows:

- Section 1.0 – Introduction;
- Section 2.0 –Performance Monitoring Data Evaluation Program;
- Section 3.0 – Sampling Locations and Frequency;
- Section 4.0 – Sampling Methods;
- Section 5.0 – Sample Handling and Documentation;
- Section 6.0 – Laboratory Analytical Procedures and Reporting; and
- Section 7.0 – References.

2.0 PERFORMANCE MONITORING DATA EVALUATION PROGRAM

In their *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action* (EPA, 2004), EPA defines performance monitoring as "the periodic measurement of physical and/or chemical parameters to evaluate whether a remedy is performing as expected." Additional EPA guidance on groundwater remediation completion strategies (EPA, 2013, 2014a, 2014b) includes a discussion of recommended remedy evaluation (performance monitoring) strategies. EPA recommends evaluating groundwater data and information on a well-by-well basis to monitor remedial action effectiveness during two distinct phases of groundwater restoration activities (EPA, 2013), including:

(1) The *remediation phase*, referring to the phase of the remedy where remedial activities are being actively implemented and groundwater data are used to monitor progress toward groundwater cleanup levels specified in a remedy decision document. The remediation phase is typically completed when monitoring data and evaluations demonstrate that the groundwater has reached the cleanup levels for all Contaminants of Concern (COCs) set forth in the Record of Decision (ROD) or other decision document; in the case of the East Helena project, the SOB (EPA, 2020) and the conditionally approved CMI Work Plan (Hydrometrics, 2021); and

(2) The *attainment monitoring phase*, occurring after the remediation monitoring phase is complete and groundwater has reached cleanup levels for all COCs.

The East Helena Facility is currently in the remediation phase, also referred to here as the Interim CAPM phase. During this phase, groundwater data "typically are collected to evaluate contaminant migration and changes in COC concentration over time" (EPA, 2014a), to address the following questions:

- Are groundwater elevations and flow directions as expected and have temporal and seasonal influences been assessed and considered?
- Are there changes (trends) in groundwater COC concentrations?
- Is there evidence of attenuation, degradation, and/or stabilization of COCs?
- Is the spatial (lateral and vertical) extent of contaminated groundwater changing?

The following performance monitoring data evaluation methods will be used to address these questions, which correspond to objectives (1), (2), and (3) in Section 1.2:

(1) Groundwater elevation and COC trend analysis (Section 2.1). Trend analysis of groundwater elevations (and general flow directions) and contaminant concentrations throughout the project area will allow direct assessment of changes in concentrations and groundwater elevations over time.

(2) Plume Stability analysis (Section 2.2). Plume stability analyses will allow evaluation of any changes in the spatial extent of the arsenic and selenium plumes both within and in the area downgradient of Facility source areas, as well as an integrated assessment of changes in concentrations averaged from multiple wells (as opposed to the individual well trend analysis).

As noted above, the 2024 Interim CAPM program addresses the current remediation phase of performance monitoring for the CMs implemented to date. The data evaluation program consists of empirical, analytical, and statistical methods as appropriate and is described below, including the specific techniques to be used as performance monitoring tools. The 2024 results will be summarized in a 2024 Interim CAPM Report.

2.1 TREND ANALYSIS

As recommended in EPA guidance (EPA, 2014a), trend analyses will be conducted at selected monitoring wells for the primary COCs at the Facility (arsenic and selenium), along with the indicator geochemical parameters sulfate and chloride (sulfate and chloride are relatively conservative indicators of historic groundwater quality impacts from smelter operations). Groundwater elevation trends (hydrographs) comparing pre-CM and post-CM groundwater elevations will also be prepared to evaluate CM effectiveness in terms of reducing groundwater elevations and groundwater interaction with contaminated soils.

The 2024 Interim CAPM concentration trend analysis will continue to focus on wells in two primary areas of interest:

(1) The main former source areas on the Facility, including the West Selenium area, North Plant Site Arsenic area, Slag Pile, and Former Acid Plant areas, to evaluate the source area groundwater quality response to CMs completed to date; and
(2) Selected wells along the downgradient margins of the selenium and arsenic plumes to evaluate the downgradient groundwater quality response to CMs completed to date.

The monitoring wells selected for concentration trend analysis are summarized in Table 2-1, along with the area targeted by each well and the 2024 monitoring frequency. Twenty-three wells have been selected for arsenic, selenium, sulfate and chloride concentration trend analysis; fourteen wells are also included as additional arsenic and selenium (COC) trend and plume delineation wells (Table 2-1). Well locations are shown on Exhibit 1. Groundwater elevation trend analysis will be based on data collected during the Spring and Fall 2024 comprehensive sitewide water level monitoring events.

Temporal trend plots of arsenic, selenium, sulfate, and chloride concentrations, along with groundwater levels, will be prepared and updated as data are collected in 2024, to provide an ongoing delineation of contaminant concentration and water level trends. Trend analyses will be conducted for the post-operational data set (data collected in 2002 and subsequent years after the smelter shut down) at each well, including the following two periods:

(1) RCRA Facility Investigation (RFI) period (2002-2011); and
(2) RCRA Interim Measure/Corrective Measure implementation period (2012-present).

Note that, during the Interim CAPM/remediation phase, changes in concentration at individual wells are expected to be visually apparent and may be variable as contaminant loading to groundwater from source areas decreases and localized flow patterns vary, and the groundwater system adjusts to a new post-CM steady state condition. Formal statistical trend testing (or other statistical tests) and specification of compliance wells at the CMI Work Plan-specified compliance boundary will be explicitly incorporated into the final CAPM program as appropriate, to determine whether concentrations at individual monitoring wells are meeting or are progressing toward meeting the media cleanup standards for groundwater noted in the SOB (EPA, 2020) and the CMI Work Plan (Hydrometrics, 2021).

2.2 PLUME STABILITY ANALYSIS

The second component of performance evaluation under this Interim CAPM Plan will consist of a plume stability analysis for the primary groundwater COCs, arsenic and selenium. While contaminant concentration trends at individual wells within and downgradient of the primary source areas on the Facility may show varying trends (increasing or decreasing), particularly prior to implementation of all CMs, evaluation of plume stability will allow an additional comprehensive assessment of plume characteristics in these areas, and any changes over time in metrics such as plume area, average plume concentration, and plume concentration centroid location.

Consistent with previous plume stability evaluations conducted for East Helena groundwater data, the calculation methods for arsenic and selenium plume stability will be based on methods outlined in Ricker (2008). In general, the procedure involves the following steps:

(1) Define the areas for which plume characteristics will be calculated. Arsenic and selenium plume areas in (1) Facility source areas and (2) downgradient of the Facility have been selected, to allow integration of results from multiple monitoring points into a single analytically-derived measure of plume characteristics. The plume stability evaluation areas on and downgradient of the Facility are shown on Figure 2-1.[2]
(2) Select a representative set of monitoring wells from the monitoring well network with sufficient spatial distribution to define the extent of the contaminant plume within the plume stability evaluation area over multiple years. The well set specific to the arsenic and selenium plume stability analysis will all be sampled during the Fall 2024 monitoring event (Table 2-2),

[2] Note that in 2021-2022, numerous wells in the Facility source area plume stability network were dry due to groundwater level decreases resulting from both the SPHC CM and successive years of low precipitation. If such conditions occur in 2024, plume stability metrics may not be computable for the Facility source area.

with some wells also sampled in Spring 2024 as part of the trend analysis monitoring outlined in Section 2.1. The plume stability analyses will be performed for the fall season only since this is the period of minimum year to year hydrologic variability (as compared to spring), and to reduce the spring season monitoring scope and costs. Note that the selected well sets for the areas downgradient of the Facility differ for each of the COCs, since the plume configurations are different for arsenic and selenium.

(3) For each well, calculate the annual average concentration of the COC (for wells where more than one 2024 data point was collected). A single average concentration will be calculated for paired or nested wells (see Table 2-2), to associate one concentration with a given location.

(4) Generate a grid file of interpolated concentration values within the given plume stability area for an individual monitoring year and contaminant, using spatial analysis software such as Surfer® by Golden Software. As noted in Ricker (2008), grid files will be generated on log-transformed concentration data for smoother interpolation, then transformed back to original concentration units prior to further calculations.

(5) Use the grid file to calculate various average plume metrics for the monitoring year, including:

   a. Plume area;

   b. Average plume concentration; and

   c. Plume centroid of concentration.

As described in Ricker (2008), calculated values of these metrics may then be compared over time to determine the presence or absence of any trends in total plume area or average plume concentration. For example, the average arsenic concentration greater than 0.010 mg/L within the plume stability area, calculated on an annual average basis for a range of monitoring years, can be plotted and tested to determine if there is a statistically significant trend. In addition, Ricker (2008) notes that the location of the plume centroid of concentration or mass can be calculated and mapped over time, to provide further evidence of temporal plume behavior and stability (i.e., whether the plume is expanding, stable, shrinking, or otherwise fluctuating).

In combination with the individual well trend evaluations discussed above, the plume stability metrics offer an efficient and objective process for assessing the performance of remedial measures over time. Comparison of hand-drawn plume maps based on specific monitoring events allows for interpretation of broad overall trends in plume geometry and configuration when maps from different monitoring events are compared. The plume stability calculations proposed in this Interim CAPM Plan, however, are intended to minimize potential bias and provide a more quantifiable comparison by using a consistent set of monitoring wells with suitable period of record, along with a consistent software-based gridding algorithm, and annual average concentrations to smooth out seasonal variability.

In summary, the performance monitoring approach for the East Helena Facility outlined above includes multiple data evaluation methods. Trend analyses of water levels throughout the project area, and COCs and indicator geochemical parameters in former Facility source areas and at the perimeter and downgradient extents of the selenium and arsenic plumes will allow direct assessment of changes in concentration and groundwater elevations over time, and year-to-year, in response to CMs as well as external influences (i.e., climate). Plume stability analyses will allow evaluation of any fluctuations in the spatial extent of the arsenic and selenium plumes in the area downgradient of Facility sources and an integrated assessment of concentration changes at multiple on-Facility and downgradient wells.

3.0 SAMPLING LOCATIONS AND FREQUENCY

This section of the Interim CAPM Plan describes the groundwater and surface water sampling locations and the frequency of sampling selected to meet the project objectives described in Section 1.2. Details on sampling methodologies, sample handling, and analytical requirements are presented in Sections 4.0, 5.0, and 6.0, respectively. The 2024 Plan will be implemented in accordance with the QAPP and DMP for the East Helena Facility (Hydrometrics, 2015 and 2011).

Based on the Interim CAPM objectives, the 2024 monitoring program includes periodic monitoring at a set of groundwater and surface water locations with sufficient spatial distribution to provide a synoptic evaluation of groundwater and surface water conditions utilizing water level hydrographs, streamflow measurements, groundwater potentiometric maps, temporal concentration trend graphs, and assessments of contaminant plume geometry and stability. The 2024 groundwater monitoring well network includes a subset of monitoring wells on the Facility (on-site wells), as well as monitoring, residential, and municipal water supply wells in areas upgradient and downgradient of the Facility (off-site wells). On-site sampling locations include selected wells located near identified contaminant sources and along plume migration pathways. Off-site sampling locations include monitoring wells located in East Helena, in and north of Lamping Field (west of East Helena), and residential and municipal water supply wells located downgradient (north and northwest) of the Facility.

All 2024 groundwater and surface water sampling locations are shown on Exhibit 1. Surface water monitoring locations are located along Prickly Pear Creek and a spring fed drainage tributary to Prickly Pear Creek, and are also shown on Figure 3-1. Residential and water supply well sampling locations are also shown on Figure 3-2. Table 3-1 presents the 2024 schedule for various groundwater and surface water monitoring activities, along with the monitoring objectives addressed by each activity.

3.1 GROUNDWATER MONITORING

Wells included in the 2024 groundwater monitoring program are summarized in Tables 3-2 (monitoring wells) and 3-3 (residential and water supply wells). Table 3-2 summarizes the monitoring wells to be sampled in the spring and fall, and the objectives addressed by each monitoring well (note that some wells address multiple objectives). All groundwater monitoring activities will support objective (8) under Section 1.2, providing water quality and hydrologic data for use in developing a final CAPM program once all Facility CMs are completed.

Groundwater level and water quality sampling will be performed in accordance with applicable SOPs summarized in Sections 4.0 and 5.0 and provided in the project QAPP. Field parameters and static water levels will be recorded when groundwater samples are collected. Samples will be analyzed for common constituents and dissolved metals, with residential and municipal water supply wells analyzed for total metals as well as dissolved, as described in Section 6.0. Monitoring well sampling and water level measurement activities will be performed in the shortest period practical (1 day for comprehensive water level measurement events, 3 to 4 days for the Spring 2024 monitoring event, and 7 to 12 days for the Fall 2024 monitoring event) to provide a synoptic overview of hydrogeologic conditions. The sampling schedule for residential and municipal water supply wells will depend on coordination with well owners to arrange access; however, sampling and water level measurement activities will be performed in the shortest period practical.

3.1.1 Sitewide Water Level Monitoring

A Facility-wide set of 170 monitoring wells and piezometers is scheduled for measurement of groundwater levels in 2024. Measurement locations are shown on Exhibit 1 and summarized in Table 3-2. Water level data will be used to evaluate groundwater elevation trends as described in Section 2.1. This data will also be used in combination with surface water flow and elevation data to develop groundwater potentiometric surface maps and to monitor groundwater/surface water interactions on a seasonal basis. Water levels will be measured in residential wells where access permits during the residential well monitoring events described in Section 3.1.4.

Water level monitoring will be performed in spring and fall, to capture seasonal variability during typical high and low water level periods. Water level measurements will be obtained in accordance with applicable SOPs summarized in Sections 4.0 and 5.0. The sitewide water level measurements will be obtained prior to initiation of the spring and fall sampling events. Sitewide water level monitoring events will also be conducted in coordination with the surface water elevation and flow measurement monitoring events described in Section 3.2, to provide a complete representation of groundwater and surface water elevations across the project area. Manual measurements will be obtained at all locations to an accuracy of ± 0.01 feet.

3.1.2 Spring 2024 Monitoring Well Sampling

A total of 24 monitoring wells are scheduled for sampling in Spring 2024 (Table 3-2, Exhibit 1). This includes the 23 wells listed in Table 2-1 for semiannual monitoring and one former private well (Dartman) being sampled by the Custodial Trust to provide information to the East Helena School District. Monitoring at these locations will allow ongoing evaluation of groundwater quality trends in Facility source areas (including the West Selenium Area, the North Plant Arsenic Area, the former Acid Plant area, and the Slag Pile), and at selected wells along the perimeter of the downgradient arsenic and selenium plumes, as described in Section 2.1. Due to the limited scope of the Spring 2024 monitoring, updated sitewide arsenic and selenium groundwater plume maps will not be prepared based on the spring data set; plume maps will be updated based on the Fall 2024 data set as described below.

Well purge comparison sampling was conducted in 2022 and 2023 to assess the comparability of groundwater quality data collected by a low-flow/low-volume purge method (Waterra inertial pump) and a standard purge method traditionally used for many years to sample on-site and off-site monitoring wells (Grundfos submersible pump). As outlined in the 2022 and 2023 Interim CAPM Reports (Hydrometrics, 2023 and 2024), comparison sampling has demonstrated that low-flow and standard purge methods generate comparable water quality data. The low-flow/low-volume purge method was implemented as the routine monitoring well sampling method for the 2023 Interim CAPM program, and will be utilized as the routine sampling method for the 2024 program. Additional details regarding the low-flow/low-volume method are in Section 4.0.

The representativeness and comparability of data collected using the inertial pump and submersible pump methods will continue to be verified during implementation of the 2024 Interim CAPM Plan through sampling of selected wells using both methods and comparison of the resulting data sets. As shown in Table 3-2, three wells will be sampled using both the low-flow and standard purge methods in Spring 2024:

- EH-114;
- EH-126; and
- EH-141.

These wells are located in critical areas near the downgradient boundaries of the current arsenic and selenium groundwater plumes. Low-flow samples will be collected first, followed by standard purge samples. Additional purge method verification sampling will be conducted at these three wells and one additional well (EH-59) during the Fall 2024 monitoring event, as described below in Section 3.1.3.

Two of the wells included in the 2024 monitoring program are former residential water supply wells with perforated steel casing (2843 and 2853 Canyon Ferry Road). When the wells were still in service and being pumped regularly, samples were collected from hose attachments or hydrants; after the wells were taken out of service, a pump contractor was retained to install a submersible pump capable of purging large volumes (400+ gallons) at high rates (10 to 15 gallons per minute) to provide adequate purge volumes since the wells were not completed as monitoring wells, but as water supply wells with typical slotted steel casing completion. In October 2023, field personnel retrofitted the wells with PVC casing and screen to allow sampling with the low-flow/low-volume Waterra pump. Samples were obtained using the low-flow/low-volume method; however, as discussed in the 2023 Interim CAPM Report (Hydrometrics, 2024), geochemical anomalies in the October 2023 samples compared with previous samples collected with the high-volume pump suggest that the Waterra method did not provide representative samples. October 2023 geochemical data indicated localized reducing conditions in the vicinity of the well bores, potentially related to aging of the steel well casing. Therefore, sampling of these two wells in 2024 will again utilize the high-volume purge method.

3.1.3 Fall 2024 Monitoring Well Sampling

A total of 77 monitoring wells are scheduled for sampling in Fall 2024 (Table 3-2, Exhibit 1). The Fall 2024 sampling event will support multiple objectives, and includes the 37 wells listed in Table 2-1, the 59 plume stability evaluation wells listed in Table 2-2, seven wells intended to evaluate ongoing zinc and cadmium concentration distributions and trends in areas where elevated concentrations have previously been observed, the 11 CAMU area monitoring wells, and the Dartman well described in Section 3.1.2 (note that some wells support multiple objectives). Monitoring at these locations will allow completion of the trend analysis and plume stability evaluations described in Sections 2.1 and 2.2, respectively. The specific objective(s) addressed by each of the 77 wells are denoted in Table 3-2. Updated sitewide arsenic and selenium groundwater plume maps and a groundwater potentiometric map will also be prepared based on the Fall 2024 data set. The three wells listed above to be sampled by both low-flow and standard purge methods during the spring sampling event (EH-114, EH-126, and EH-141) will also be sampled by both methods in the fall, along with well EH-59.

3.1.4 Residential / Municipal Water Supply Well Monitoring

Residential and public water supply wells are included in the 2024 groundwater monitoring program to allow evaluation of residential/public water supply well water quality in the area of former Facility impacts. As noted in the RCRA groundwater protection guidance (EPA, 2004), documenting and addressing potential human exposures is one of EPA's high priority short-term protection goals. Data submittals describing the residential/public water supply monitoring results and potential exceedances of applicable water quality standards are provided to individual well owners following the receipt and validation of laboratory data for each monitoring event.

The residential and municipal water supply wells included in the 2024 monitoring program are listed in Table 3-3 and are shown on Exhibit 1 and Figure 3-2. Monitoring is scheduled at 16 wells on a semiannual basis (Spring and Fall 2024). Note that, based on a well owner survey conducted in 2015, several identified residential wells are not included on the current sampling schedule, due to lack of access, inoperative pumps, or other reasons (see Table 3-3). Certain wells have been abandoned as part of the ongoing voluntary residential well abandonment program promoted and being funded by the Custodial Trust (Table 3-3). In addition, four wells located in areas affected by elevated background arsenic concentrations have also been removed from the routine Interim CAPM monitoring program as of 2024. These wells are shown on Exhibit 1 and in Table 3-3 (shaded cells) for informational purposes, but are not included on the 2024 monitoring schedule.

3.2 SURFACE WATER MONITORING

This section describes the locations selected for monitoring water levels, water quality, and streamflow in surface water bodies near the Facility. Surface water sampling and measurement locations and frequencies are listed in Table 3-4 and shown on Figure 3-1. The surface water monitoring program is intended to provide data for evaluation of surface water flow and quality trends, from upstream of the Facility through the Prickly Pear Creek realignment area, the City of East Helena, and downstream to Canyon Ferry Road.

3.2.1 Elevation Monitoring

Surface water elevation measurements will be collected approximately concurrently with sitewide groundwater level monitoring events in Spring and Fall 2024 (Table 3-4). Surface water elevation measurements will be obtained using a survey-grade global positioning system (GPS) instrument. Sites selected for elevation monitoring (11 sites) are listed in Table 3-4 and shown on Figure 3-1.

3.2.2 Surface Water Flow and Water Quality Sampling

Surface water flow measurements and water quality monitoring will be conducted during Spring (high flow) and Fall (low flow) conditions at 9 sites (Table 3-4, Figure 3-1). Samples from location Trib-1B, a spring flow site emanating from the ground in a vegetated area, are susceptible to entrainment of sediment from disturbances introduced by sampling activities, particularly under low flow conditions. Samples will only be collected from site Trib-1B if there is sufficient defined flow to obtain a clean representative sample without disturbing the spring and introducing suspended material into the sample. The surface water monitoring events will be coordinated as closely as practical with the semiannual groundwater monitoring events to obtain a comprehensive synoptic understanding of groundwater and surface water conditions near the Facility.

Instantaneous flow measurements will be obtained using current velocity meters and the cross-section method, or (for smaller flows) flumes or volumetric methods (see Section 4.2.2). Surface water quality sampling will be conducted from downstream to upstream in a single day, to provide information on streamflow gains and losses, potential interactions with groundwater, and in-stream parameter loading trends across various stream reaches, while minimizing the possibility of temporal variability to the extent practicable.

The surface water monitoring will be performed in accordance with applicable SOPs summarized in Sections 4.0 and 5.0. Field parameter measurements and streamflows will be recorded when samples are collected. Samples will be analyzed for common ions and total recoverable metals as described in Section 6.0.

4.0 SAMPLING METHODS

Groundwater and surface water sampling activities will be conducted in accordance with the procedures described in this section of the Interim 2024 CAPM Plan. Standard Operating Procedures (SOPs) for planned field activities are listed in Table 4-1. The sampling methods outlined below for groundwater (Section 4.1) and surface water (Section 4.2) are consistent with methods described in previous Interim CAPM Plans. Collection of field quality control (QC) samples for groundwater and surface water is discussed in Section 4.3. Groundwater and surface water sampling methods are based on the procedures described in the SOPs and in the East Helena QAPP (Hydrometrics, 2015). Some of the procedures specified in this Plan may differ slightly from those outlined in the SOPs and/or the QAPP; in those circumstances, the procedures outlined in this Plan will be used to conduct sampling activities.

4.1 GROUNDWATER MONITORING

Groundwater samples will be collected from both monitoring wells and residential or municipal water supply wells in 2024. Procedures for collection of samples at these two types of wells differ, since water supply wells typically have dedicated pumps installed, and are pumped frequently in comparison to monitoring wells. Collection of samples from monitoring wells (Section 4.1.1) and water supply wells (Section 4.1.2) are discussed separately below.

4.1.1 Monitoring Well Samples

The collection of groundwater samples from site monitoring wells generally will consist of three steps:

(1) Measurement of static water level;
(2) Well purging and monitoring for field parameter stabilization; and
(3) Water quality sample collection.

4.1.1.1 Static Water Level Measurement

Before collection of samples or introduction/removal of any equipment into or out of the well, the static water level will be measured, to the nearest 0.01 foot, at each well using an electric water level probe to determine the depth of groundwater below a specified measuring point (typically the top of the polyvinyl chloride [PVC] well casing). Water level measurements and surveyed measuring point elevations will be used to compute groundwater elevations at each well location. A complete set of static water level measurements will be obtained at all wells designated for water levels before initiating a water quality sampling event (see Section 3.1.1). This procedure allows static water levels to be measured over a shorter time period (usually one day) for generating groundwater potentiometric maps, than would be possible if measurements were collected concurrently with water quality sampling activities (i.e., days to weeks).

4.1.1.2 <u>Well Purging, Field Parameter Measurement, and Water Quality Sample Collection</u>

In general, groundwater sampling will proceed in order from wells with lower concentrations of constituents of concern to wells with higher concentrations, based on previous data collected at the Facility, to reduce the potential for cross-contamination of water samples. Field personnel will determine the appropriate sampling order before conducting sampling in cooperation with the field team leader. Dedicated high-density polyethylene (HDPE) tubing is installed in all monitoring wells. As described in Sections 3.1.2 and 3.1.3, routine monitoring well sampling in 2024 will be conducted using an inertial pump and a low-flow/low-volume purge method. Selected wells will be sampled using both the low-flow purge and the traditional standard purge method (3 to 5 well volume purge) for comparison during the spring and fall 2024 monitoring events. Two former water supply wells will be sampled using a high-volume/high purge rate submersible pump provided by a pump contractor (Section 3.1.2). Sampling methods are described below.

Low-Flow / Low-Volume Purge Method

Low-flow sampling will be conducted in general accordance with Hydrometrics' Standard Operating Procedure HSOP-105, *Low Flow/Minimal Drawdown Groundwater Sampling for Monitoring Wells* (Table 4-1). Required equipment and supplies for Waterra sampling with dedicated tubing include the following:

- Waterra Inertial Pump actuator.
- Dedicated sample tubing appropriate to the well diameter. Tubing should be constructed of inert materials appropriate for the target analytical constituents, such as stainless steel, low or high-density polyethylene (HDPE if > 50 feet to groundwater), Teflon®, or similar materials. Pump tubing should be graduated to allow for accurate placement of the pump intake at a specified depth.
- Check valve for tubing at each well. For small diameter tubing, it is recommended to set check valves in tubing prior to arrival at monitoring well. To prepare small diameter (1/4") check valves: insert the top piece, the ball and the bottom piece into the tubing, then heat until tubing shrinks to secure check valve. For larger diameter (3/4") tubing, check valves are a single unit and just need to be securely inserted into the bottom of the tubing.
- Tubing guides (2 – 3 foot hard plastic sleeves) and hose clamps to reduce flex in tubing above PVC well. The guides also help to stabilize the tubing in the center of the well reducing friction between tubing and PVC at depth.
- Peristaltic pump (if required) and associated tubing.
- Generator (and fuel) or other power supply.
- Device for measuring depth to water (electric water level probe or other device).
- Flow measurement equipment, such as an inline flowmeter, calibrated bucket and stopwatch, or graduated cylinder. The bucket should be relatively small (< 1 liter) for collection of low-flow measurements.

- Purge water collection bucket and storage container.
- Field multiparameter meter and flow-through cell. Field meters will be calibrated daily according to factory instructions, with calibration results recorded on calibration forms.
- Sample collection supplies (e.g., bottles, preservatives, filters, coolers).
- Sampling documentation materials (field notebook, field sampling forms or data sheets, chain-of-custody documentation).

The procedure for implementing low-flow Waterra sampling is summarized below.

(1) Remove well cap and measure depth to groundwater from the designated measuring point (and total well depth, if not known). Total well depth may also be obtained from well logs or previous measurements. Record information in field notebook and on field forms. Leave water level probe in well to monitor water level drawdown during purging.

(2) Calculate one casing volume (volume of water in the casing) using the formula V=0.0408 x (TD-SWL) x (D^2), where TD is the well total depth (feet below measuring point), SWL is the depth to water (feet below measuring point), and D is the well casing inner diameter (inches). Record information in field notebook and on field sampling form.

(3) Set up multimeter, flow through cell, and peristaltic pump (if appropriate).

(4) Move Waterra arm to downstroke position. Set Waterra pump to lowest speed. Attach power supply cord.

(5) Connect sample tubing to silicone tubing and auxiliary peristaltic pump (if using), and flow through cell. Field parameters will be measured using a flow-through device to minimize potential effects from atmospheric exposure.

(6) Direct discharge line and flow-through cell waste line into containers to contain purge water and measure flow. Start Waterra on low speed to confirm free movement of the guides, and adjust alignment as necessary.

(7) Slowly increase Waterra speed, note start time on field form. Measure pumping rate and allow several tubing/flow cell volumes to pass through equipment.

(8) Begin recording field parameter measurements (pH, dissolved oxygen, water temperature, specific conductance, turbidity, and oxidation-reduction potential or ORP) and pumping groundwater level at three- to five-minute intervals. Per HSOP-105, drawdown during low-flow sampling should be maintained at less than 0.3 feet. Pumping rates are typically on the order of 0.5 to 1.0 liters per minute (lpm). Periodically remeasure pumping rate to determine any variability. Note that the interval between field parameter measurements should allow sufficient time for the volume of water in the flow-through cell to be completely replaced by fresh groundwater, so modifications to the three- to five-minute rule of thumb may be necessary.

(9) A minimum of five sets of field parameter measurements will be collected during well purging to monitor stabilization of field parameters. Field parameter stabilization is based on three

successive readings of field parameters that agree to within the stabilization criteria noted in Table 4-2.

(10) Final field parameter measurements will be recorded and water quality samples collected using the low-flow/low-volume method after parameter stabilization has occurred, **or** the well has been pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed, **or** five well volumes have been removed although stabilization criteria are not yet met. Pumping wells dry will be avoided if possible by reducing pumping rates.

Standard Purge Method

Submersible pumps (either a 12-volt submersible pump or a 2-inch Grundfos submersible pump or equivalent) will be utilized for purging and sampling. Purging will consist of removing three to five well volumes while routinely monitoring the field parameters pH, dissolved oxygen, water temperature, specific conductance, turbidity, and ORP using a calibrated field meter and flow-through cell.

Following removal of the first well volume, field measurements will be collected at regular time intervals during purging of the second and third well volumes, based on the purge rate and required purge volume. A minimum of five sets of field parameter measurements will be collected during well purging to monitor stabilization of field parameters. Stabilization criteria are shown in Table 4-2.

Samples for laboratory analysis using the standard purge method will be collected only after one of the following purge conditions is met:

- A minimum of three well volumes has been removed, and three successive field parameter measurements agree to within the stability criteria given in Table 4-2.
- At least five well volumes have been removed although field parameter stabilization criteria are not yet met.
- The well has been pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed. Pumping wells dry will be avoided if possible by reducing pumping rates.

Groundwater sampling equipment reused between monitoring locations using the standard purge system (flow cell, short piece of discharge line used to connect to the dedicated well tubing, submersible pump system, and any non-dedicated tubing) will be thoroughly decontaminated between uses. Equipment decontamination will consist of the following steps:

- Rinse with soapy water (clean tap water plus Alconox or other non-phosphate detergent).
- Rinse thoroughly with clean tap water.
- Final rinse with deionized water.

The effectiveness of the decontamination procedure will be evaluated through the periodic collection of equipment rinsate and deionized water blanks, as outlined in Section 4.3, the East Helena Facility QAPP and SOPs.

High-Volume Purge Method

A high-volume submersible pump will be installed by a pump contractor for purging and sampling former water supply wells 2843 and 2853 Canyon Ferry Road. Consistent with previous practice, purging will consist of pumping at a rate of approximately 10 to 15 gallons per minute to remove approximately three well volumes (400+ gallons), while routinely monitoring the field parameters pH, dissolved oxygen, water temperature, specific conductance, turbidity, and ORP for stability using a calibrated field meter and capturing purge water in a bucket. Field measurements will be collected at approximately 5-minute intervals during the purging process. A minimum of five sets of field parameter measurements will be collected during well purging to monitor stabilization of field parameters. Stabilization criteria are shown in Table 4-2. Samples for laboratory analysis using the high-volume purge method will be collected after total purge volumes exceed approximately 3 well volumes.

Purge water and any decontamination water generated during groundwater sampling activities will be handled in accordance with the following process:

EAST HELENA FACILITY GROUNDWATER SAMPLING PURGE WATER HANDLING PROCEDURE

1. Well purge and decontamination water from wells that do not exceed any water quality standards (based on the most recent data), and are not located within the City of East Helena or on the Facility, may be discharged to the ground near the well, where it will not cause a discharge to surface water.
2. Well purge and decontamination water generated at wells in the City of East Helena, on the Facility, or that do exceed one or more water quality standards (based on previous data) will be containerized discharged at the City of East Helena water treatment plant if approved by City personnel, based on disposal volumes and water quality. Alternatively, purge and decontamination water may be transferred to storage tanks near the Phase II CAMU for storage and eventual off-site disposal.

Following well purging, final field parameter measurements will be collected and recorded, and groundwater quality samples will be obtained. Sample bottles will be filled directly from a sampling port, before the pumped water passes through the flow-through cell. Samples for dissolved metals analyses (including the common cations calcium, magnesium, sodium, and potassium) will be filtered through a 0.45-micrometer (µm) filter before preservation. Samples for common anions (sulfate, chloride, bicarbonate) will not be filtered.

Clean sample containers will be obtained from the analytical laboratory before sample collection. Following sample collection, samples will be preserved as appropriate, and stored on ice in coolers at

≤6°C during transport. Water quality sample container and preservation requirements are specified in the project QAPP (Hydrometrics, 2015) and in Table 4-3.

All samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook and on standard field forms.

4.1.2 Water Supply Well Samples

Collection of water samples from residential or municipal water supply wells will follow the same general sequence as that for monitoring wells:

(1) Measurement of static water level.
(2) Well purging and monitoring for field parameter stabilization.
(3) Water quality sample collection.

An SOP for residential/municipal water supply well monitoring developed by METG (METG-SOP-001) is included in Table 4-1 and in Appendix A, and should be consulted as the guide for conducting water supply well sampling as part of this Interim CAPM Plan. A general description of the private well monitoring procedure is provided below.

Property access and a scheduled sampling time will be arranged with the well owner prior to visiting the site for sampling. Static water level measurements will be obtained prior to sampling, at those water supply wells where an access port is present.

Purging of private wells will be accomplished through a purge hose (as necessary), with water discharge directed away from the wellhead and any nearby buildings. Purge volumes will generally be based on an estimate of the total water present in the well casing, piping, and water storage system (i.e., pressure tank), and approximately three well volumes will be purged prior to sampling. Purge rates will be determined volumetrically using a five-gallon bucket. Field parameter measurements will be collected at the beginning, middle, and end of the purging cycle, using a flow cell or other system arranged to allow flow of purged water across field parameter sensors prior to contact with the atmosphere.

Purge rates will be reduced prior to collecting samples. If a purge hose was used, the hose should be removed and water samples collected directly from the faucet or spigot. Private well samples will be collected for analysis of common constituents, dissolved metals, and total metals in accordance with Table 4-3. Following sample collection, samples will be preserved as appropriate, and stored on ice in coolers at ≤6°C during transport. All samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook and on standard field forms. Prior to leaving the sampling location, the homeowner will be notified that sampling has been completed.

4.2 SURFACE WATER MONITORING

Surface water monitoring will consist of one or more of the following steps (depending on the monitoring schedule):

(1) Measurement of water elevation;
(2) Measurement of streamflow; and
(3) Water quality sample collection.

4.2.1 Water Elevation Measurement

Water elevation measurements for ponds and flowing water sites will be collected using a survey-grade GPS instrument. Real-time kinematic (RTK) surveys will be conducted using a base station set up at a known East Helena control point (typically a monitoring well). Data collected will include horizontal coordinates (NAD83 Montana State Plane international feet) and elevations in feet above mean sea level (AMSL).

4.2.2 Streamflow Measurement

Surface water flow measurements at flowing water sites will be collected using a HACH Model FH950.1 current meter and wading rod (area-velocity method) or equivalent equipment following the appropriate project SOPs (see Table 4-1). If measurement conditions are unsafe because of high flows, the field sampling team will estimate the flow.

Measurement of streamflow is performed in accordance with the area-velocity method developed by the U.S. Geological Survey (USGS) (Turnipseed and Sauer, 2010). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to either (1) six-tenths of the total subsection depth, or (2) at two-tenths and eight-tenths if the water depth exceeds 2.5 feet (with these velocities averaged for subsequent flow calculation). The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach that is as straight and free of obstructions as possible, to minimize potential measurement error introduced by converging or turbulent flow paths.

4.2.3 Field Parameters and Water Quality Sample Collection

Field parameters measured at surface water quality monitoring sites will include the following:

- pH;
- Specific conductance;
- Dissolved oxygen; and
- Water temperature.

Field meters will be calibrated daily according to factory instructions, with calibration results recorded in the field notebook and/or on calibration forms. Field parameter measurements will be obtained directly in the stream if possible; however, high-velocity areas should be avoided to limit possible pH measurement errors caused by streaming potentials. Alternatively, a clean container may be filled with sample water for parameter measurement. Results are recorded in the field notebook and on standard sample forms. Field meters are checked periodically throughout the day for drift by measuring standard solutions (pH buffers, specific conductivity solutions, etc.), and are recalibrated as necessary.

A water quality sample will be collected from each surface water monitoring location by passing an uncapped sample container across the area of flow. When wading, samples are collected across the area of flow upstream of the sampler; during unsafe wading conditions, samples are collected from the stream bank. Samples will be preserved as appropriate for the intended analysis and stored on ice in coolers at ≤6°C for transport. Note that surface water samples will be analyzed for total recoverable metals concentrations (unfiltered samples). Water quality sample container and preservation requirements for surface water sites are specified in the project QAPP (Hydrometrics, 2015) and in Table 4-3.

All samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook and on standard field forms.

4.3 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be collected and analyzed as part of the 2024 groundwater and surface water monitoring programs in accordance with the following procedures:

- Equipment rinsate blanks (monitoring well sampling only).
- Deionized (DI) water blanks (groundwater and surface water sampling, including both monitoring and water supply wells).
- Field duplicate samples (groundwater and surface water sampling, including both monitoring and water supply wells).

4.3.1 Field Blanks (DI and Rinsate Blanks)

Field DI blanks consist of deionized water placed directly from storage containers into sample containers and preserved. DI blanks for monitoring well samples, water supply well samples, and surface water samples will be collected at a frequency of 5%, or one per twenty natural samples (1/20) calculated over the course of the monitoring event. Deionized water for collection of field blanks will be obtained from the analytical laboratory.

Equipment rinsate blanks consist of reagent grade (deionized) water processed through decontaminated sampling equipment (including filtration equipment as appropriate), collected into sample bottles and preserved as appropriate. One equipment rinsate blank will be collected during each semiannual groundwater monitoring event, associated with the pumping equipment used to collect the standard 3 to 5 well volume comparison samples. Rinsate blanks are not required for the low-flow sampling method since all equipment is dedicated (no equipment is reused between wells).

4.3.2 Field Duplicates

Field duplicate samples are replicate samples from a single sampling location submitted to a laboratory for the same set of analyses. For the purposes of this project, field duplicates will be collected by filling two sets of sample containers consecutively from the sampling location. Duplicates will be sent to the same laboratory, but will be identified with different sample numbers. Field duplicates for monitoring well and water supply well groundwater samples, as well as surface water samples will be collected at a minimum frequency of 5%, or one per twenty natural samples (1/20) over the course of the monitoring event.

All field QC samples will be submitted blind to the laboratory (QC samples will be packaged and shipped in such a manner that the laboratory will not be aware of the nature of the samples). Additional information regarding collection of duplicate samples is provided in the applicable SOP and in the project QAPP (Hydrometrics, 2015).

5.0 SAMPLE HANDLING AND DOCUMENTATION

All samples transferred to the laboratory for analysis will follow standard documentation, packing, and chain-of-custody procedures. Samples will be stored in iced coolers or refrigerated following collection, then hand-delivered to the laboratory in iced coolers to maintain sample temperatures of ≤6°C. The SOPs for sample labeling, documentation, and chain-of-custody procedures are listed in Table 4-1 and discussed further in the project QAPP (Hydrometrics, 2015).

Sample custody (responsibility for the integrity of samples and prevention of tampering) will be the responsibility of sampling personnel until samples are shipped or delivered to the laboratory. Any containers used to ship samples via independent courier will be sealed with custody seals before shipping, and the receiving laboratory will record the condition of the seals upon arrival to ensure that the containers have not been opened during transport. Custody seals are not required for samples that are maintained under the direct custody of sampling personnel until being hand-delivered to the laboratory. Upon arrival at the laboratory, sample custody shifts to laboratory personnel, who are responsible for tracking individual samples through login, analysis and reporting. At the time of sample login, the laboratory will assign a unique laboratory sample number, which can be cross-referenced to the field sample number and used to track analytical results.

Documents generated during sample collection will consist of:

(1) Sample collection field notes and forms;
(2) Chain-of-custody forms; and
(3) Shipping receipts in the event that samples are sent to a laboratory via independent courier.

Sampling activities will be recorded in a project-specific field notebook, and the appropriate water sample collection form will be completed. Each sample will be identified with a unique sample number, along with the date and time of collection, on adhesive labels attached to sample bottles. All labels will be completed using waterproof ink.

Field notebooks used to record pertinent sampling information will include, at a minimum, the following:

- Project name;
- Date and time;
- Sample location;
- Sample number;
- Sample depth (if applicable);
- Media type;
- Field meter calibration information;

- Sampling personnel present;
- Analyses requested;
- Sample preservation;
- Field parameter measurements;
- Weather observations; and
- Other relevant project-specific site or sample information.

Entries will be made in permanent ink. Corrections to field notebooks will be made by crossing out erroneous information with a single line and initialing the correction. Field books will be signed and dated at the bottom of each page by personnel making entries on that page.

Individual samples (including QC samples) will be assigned unique sample numbers according to the following sample numbering scheme:

AAA[A]-YYMM-XXX

where AAA[A] is a three- or four-character code denoting the project, YYMM is a four-digit code denoting the year and month (e.g., 2406 for June 2024), and XXX is a three-digit code incremented sequentially for each successive sample.

6.0 LABORATORY ANALYTICAL PROCEDURES AND REPORTING

Laboratory analysis will be conducted by Energy Laboratories' Helena, Montana branch. Energy Laboratories is certified by EPA Region 8 and the State of Montana under the Safe Drinking Water Act. Field parameters will be analyzed by field personnel using the procedures outlined in Section 4.0 above, and in the applicable SOPs (see Table 4-1). All laboratory analysis will be fully documented and conducted in accordance with EPA-approved and/or industry standard analytical methods.

6.1 GROUNDWATER ANALYSES

Required parameters, analytical methods, and project-required detection limits (PRDLs) for 2024 groundwater quality samples collected at the Facility are shown in Table 6-1. Groundwater samples will be analyzed for physical parameters, common constituents and a comprehensive suite of trace constituents. Trace constituents will be analyzed as dissolved for monitoring well samples, and as both dissolved and total for private well samples.

The PRDLs for individual parameters have been set at concentrations normally achievable by routine analytical testing in the absence of unusual matrix interference. These limits will support project objectives for trend analysis and contaminant plume characterization as well as comparison with regulatory standards for groundwater (shown in Table 6-1 for reference). It must be recognized that the PRDL is a detection limit goal, which may not be achieved in all samples because of sample matrix interference or other problems. If a PRDL is not met by the laboratory, the data will be reviewed to determine if any actions (e.g., sample reanalysis or selection of an alternative analytical method) are required.

6.2 SURFACE WATER ANALYSES

Required parameters, analytical methods, and PRDLs for surface water quality samples collected at the Facility are shown in Table 6-2. Surface water samples will be analyzed for physical parameters, common constituents, and a comprehensive suite of trace constituents. The PRDLs for individual parameters have been set at concentrations normally achievable by routine analytical testing in the absence of unusual matrix interference and are equivalent to the required reporting values (RRVs) published in the most recent version of Circular DEQ-7 (Montana Numeric Water Quality Standards). These limits will support project objectives for evaluation of groundwater/surface water interactions, as well as comparison with regulatory standards for surface water; therefore, PRDLs for a number of parameters are different in surface water compared to groundwater. It must be recognized that the PRDL is a detection limit goal, which may not be achieved in all samples because of sample matrix interference or other problems. If a PRDL is not met by the laboratory, the data will be reviewed to determine if any actions (e.g., sample reanalysis or selection of an alternative analytical method) are required.

6.3 DATA REVIEW AND VALIDATION

Procedures for data review, validation, and reporting are presented and discussed in the project QAPP (Hydrometrics, 2015) and in the DMP (Hydrometrics, 2011), including control limits and criteria for specific types of field and laboratory QC samples, data validation and verification methods, potential corrective actions if criteria are not met, and database management issues. The DMP includes checklists for review of both field and laboratory documentation (prior to formal validation of laboratory data), and post-validation review and approval of the East Helena database (Hydrometrics, 2011). Both these checklists will be completed for each monitoring event conducted during 2024.

All data deliverables containing analytical data and QC information will be reviewed for overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in the project planning documents (including this CAPMP) are present. At a minimum, deliverables will include field notes and/or forms, transmittal information, sample chain-of-custody forms, analytical results, methods and practical quantification limits (PQL), and laboratory QC summaries. The reviewer will determine whether all required items are present and request copies of missing deliverables.

The number and type of samples collected will be compared to project specifications to ensure conformance with the sampling process design. Review of sample collection and handling procedures will include verification of the following:

- Completeness of submittal packages;
- Completeness of field documentation, including chain-of-custody documentation;
- Field equipment calibration and maintenance and/or quality of field measurements; and
- Adherence to proper sample collection procedures.

All data will be reviewed for completeness of deliverables, and adherence to the sampling and analytical protocols prescribed in this Interim CAPM Plan and the project QAPP (Hydrometrics, 2015). Data validation will include a detailed review of all analytical results, including:

- Reporting limits (RL) and PQLs vs. PRDLs;
- Holding times;
- Analytical methods;
- Field QC sample results; and
- Laboratory QC sample results.

Data qualifiers will be applied to any analytical results associated with QC exceedances, as outlined in the QAPP.

All project data will be archived in hard copy format, and also will be imported to and stored in the electronic project database software, along with associated data qualifiers. The project Data Management and Validation Coordinator will be responsible for reviewing, organizing, revising, and certifying the integrity of the project database. Maintenance and use of the project database, including uploading of analytical results and downloading of data in various formats to support other Facility-related investigations are presented in detail in the DMP (Hydrometrics, 2011).

6.4 DATA REPORTING

After all 2024 data is received from the laboratory and validated, a 2024 Interim CAPM Report will be prepared describing the scope and results of the monitoring conducted in 2024 under this Plan. The 2024 Interim CAPM Report will include an updated project background and introduction; a description of monitoring activities conducted in 2024, including sampling locations, frequencies, and methodologies; a summary of the 2024 monitoring results; and a data analysis section describing current groundwater conditions, the results of the performance evaluation monitoring metrics described in this Plan (water level trend analysis, water quality trend analysis, and plume stability evaluations), and the results of the purge method comparison sampling. In addition, the hydrogeologic conceptual site model (CSM) for the East Helena project will be updated and presented if warranted based on the 2024 monitoring results. An outline of the table of contents for the 2024 Interim CAPM Report is provided in Appendix B.

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TABLES

Table 2-1. 2024 Concentration Trend Analysis Monitoring Wells
Former Asarco East Helena Facility

Well	Target Area	Sampling Frequency
Arsenic/Selenium/Sulfate/Chloride Trend Analysis Wells		
DH-42	Acid Plant	Annual
DH-80	Acid Plant	Annual
DH-17	North Plant Arsenic	Semiannual
DH-79	North Plant Arsenic	Annual
DH-6	Slag Pile	Semiannual
DH-15	Slag Pile	Semiannual
DH-52	Slag Pile	Semiannual
DH-56	Slag Pile	Semiannual
DH-66	West Selenium	Semiannual
DH-8	West Selenium	Annual
2843 Canyon Ferry Road	Downgradient Selenium Plume	Semiannual
2853 Canyon Ferry Road	Downgradient Selenium Plume	Semiannual
EH-138	Downgradient Selenium Plume	Semiannual
EH-139	Downgradient Selenium Plume	Semiannual
EH-141	Downgradient Selenium Plume	Semiannual
EH-143	Downgradient Selenium Plume	Semiannual
EH-54	Downgradient Arsenic Plume	Annual
EH-59	Downgradient Arsenic Plume	Annual
EH-69	Downgradient Arsenic Plume	Annual
EH-111	Downgradient Arsenic Plume	Annual
EH-114	Downgradient Arsenic Plume	Semiannual
EH-115	Downgradient Arsenic Plume	Semiannual
EH-117	Downgradient Arsenic Plume	Annual
Additional Arsenic/Selenium Plume Delineation and Trend Monitoring Wells		
DH-53	Slag Pile	Semiannual
DH-55	Slag Pile	Semiannual
EH-60	Slag Pile/Downgradient Plumes	Semiannual
EH-103	Slag Pile/Downgradient Plumes	Semiannual
EH-120	Selenium Plume	Semiannual
EH-123	Selenium Plume	Annual
EH-124	Selenium Plume	Semiannual
EH-126	Selenium Plume	Semiannual
EH-129	Selenium Plume	Semiannual
EH-130	Selenium Plume	Annual
EH-134	Selenium Plume	Semiannual
EH-204	Selenium Plume	Annual
EH-210	Selenium Plume	Annual
PBTW-2	Arsenic Plume	Annual

NOTES:

Well locations shown on Exhibit 1.

Semiannual frequency = sampled in Spring and Fall 2024; Annual frequency = sampled in Fall 2024.

Table 2-2. 2024 Plume Stability Analysis Monitoring Wells
Former Asarco East Helena Facility

Arsenic Plume Stability Wells

Well/Well Set*
EH-104
EH-106
EH-110
EH-111
EH-114
EH-115
EH-117
EH-119
EH-120
EH-124
EH-50/100
EH-51/101
EH-52/102
EH-53
EH-54
EH-58
EH-59
EH-60/103
EH-62
EH-63
EH-65/107
EH-66/121
EH-69

Selenium Plume Stability Wells

Well/Well Set*
EH-104
EH-106
EH-110
EH-111
EH-114
EH-115
EH-117
EH-119
EH-120
EH-123
EH-124
EH-126
EH-129/134
EH-132
EH-206
EH-50/100
EH-51/101
EH-52/102
EH-53
EH-54
EH-60/103
EH-62
EH-63
EH-65/107
EH-66/121
EH-70/125
EH-130
EH-135
EH-138
EH-139
EH-141
EH-143
2843 Canyon Ferry
2853 Canyon Ferry

Plant Site Plume Stability Wells

Well/Well Set*
DH-6/15
DH-7**
DH-8
DH-17
DH-42
DH-52
DH-55
DH-56
DH-66
DH-67
DH-69
DH-80
EH-204

NOTES:

Well locations shown on Exhibit 1.

All wells will be sampled in Fall 2024; some wells also sampled in Spring 2024 to support other objectives (see Table 3-2).

*Data from well sets (paired wells) will be combined to yield a single overall average concentration for a given monitoring year for plume stability calculations.

**Well DH-7 is not sampled; data from nearby well EH-58 (700' north) is used to approximate the concentration at DH-7 for plume stability calculations.

Table 3-1. 2024 Interim Corrective Action Performance Monitoring Schedule and Objectives
Former Asarco East Helena Facility

		Groundwater Monitoring Activity				Surface Water Monitoring Activity		
Month		**Water Level Measurements**	**Residential / Municipal Water Supply Well Sampling Events**	**Spring Monitoring Well Sampling Event**	**Fall Monitoring Well Sampling Event**	**Elevation Monitoring**	**Flow Monitoring**	**Surface Water Quality Monitoring**
June		X	X	X		X	X	X
October		X	X		X	X	X	X
2024 Interim CAPM Plan Objective Addressed	*[1] Groundwater Level Trend / Flow Pattern Analysis*	X				X		
	[2] Groundwater Concentration Trend Analysis (Arsenic, Selenium, Sulfate, Chloride)			X	X			
	[3] Arsenic and Selenium Plume Stability Analysis				X			
	[4] Evaluate Residential / Public Water Supply Well Water Quality		X					
	[5] Evaluate Surface Water Quality and Flow Trends					X	X	X
	[6] Evaluate CAMU Area Groundwater Quality				X			
	[7] Ongoing Assessment of Zinc and Cadmium Distribution and Trends			X	X			
	[8] Provide water quality and hydrologic data for use in developing a final CAPM program once all Facility CMs are completed	X	X	X	X			

Table 3-2. 2024 Monitoring Well Sampling Schedule

Former Asarco East Helena Facility

Well ID	Screen Interval (feet bgs)	Unit[1]	Northing	Easting	MP Elevation	Spring 2024 Monitoring Event	Fall 2024 Monitoring Event	Monitoring Objectives Addressed			
								Trend Analysis	*Arsenic and Selenium Plume Stability Analysis*	*Zinc/Cadmium Distribution and Trends*	*CAMU Monitoring*
2843 Canyon Ferry[2]	145-165	Valley Fill	872346.42	1354330.00	Unknown	X[2]	X[2]	✓	✓		
2853 Canyon Ferry[2]	132-152	Valley Fill	872391.53	1354773.24	Unknown	X[2]	X[2]	✓	✓		
ASIW-1	53-73	Upper Aquifer	859803.75	1362064.52	3915.99						
ASIW-2	10-95	Upper Aquifer	860471.83	1363184.587	3909.13						
Dartman[3]	84	Upper Aquifer	864632.318	1360118.055	3863.03	X[3]	X[3]				
DH-1	40-50	Tertiary	861171.5317	1359021.49	3910.89						
DH-2	55.5-65.5	Upper Aquifer	859910.4322	1358532.443	3936.91						
DH-3	44-54	Tertiary	858002.572	1359985.218	3947.48						
DH-4	17-23	Upper Aquifer	859526.8209	1361217.199	3917.26						
DH-5	9-17	Upper Aquifer	859641.3787	1360792.818	3921.18						
DH-6	15-25	Upper Aquifer	861527.0799	1360252.419	3889.85	X	X	✓	✓		
DH-7	18.5-28.5	Upper Aquifer	861281.5224	1361580.684	3898.66						
DH-8	39-49	Upper Aquifer	860693.1656	1359404.724	3923.38		X	✓	✓		
DH-9	6.5-11.5	Upper Aquifer	860570.6829	1360370.607	3918.08						
DH-10A	5-10	Upper Aquifer	861456.8081	1360608.817	3886.97						
DH-13	35-45	Upper Aquifer	860561.0489	1359795.41	3923.91						
DH-14	34-46	Upper Aquifer	859527.8759	1361225.114	3916.06						
DH-15	41.5-50	Upper Aquifer	861541.0629	1360256.995	3889.82	X	X	✓	✓		
DH-17	31-41	Upper Aquifer	860997.414	1359668.631	3917.56	X	X	✓	✓	✓	
DH-18	55.5-63.5	Deeper System	860535.2929	1359814.833	3924.93						
DH-20	21-31	Upper Aquifer	858989.371	1360128.453	3927.09						
DH-22	24-34	Upper Aquifer	859690.0706	1359816.234	3948.63						
DH-23	10-20	Upper Aquifer	860270.2165	1360217.49	3931.82						
DH-27	19-29	Upper Aquifer	859923.8461	1360046.461	3946.21						
DH-30	12-22	Upper Aquifer	859935.1871	1360099.556	3943.24						
DH-36	21-31	Upper Aquifer	860631.4997	1359936.338	3920.66						
DH-42	24-34	Upper Aquifer	859587.2008	1359938.798	3942.63		X	✓	✓		
DH-47	5-15	Upper Aquifer	859460.0231	1360402.023	3926.82						
DH-52	7-17	Upper Aquifer	861372.1393	1360876.159	3889.18	X	X	✓	✓		
DH-53	7-17	Upper Aquifer	861343.6803	1361117.666	3892.87	X	X	✓			
DH-55	83-93	Upper Aquifer	860568.8169	1360945.555	3972.76	X	X	✓	✓		
DH-56	70-85	Upper Aquifer	861098.4318	1360350.744	3958.17	X	X	✓	✓		

Table 3-2. 2024 Monitoring Well Sampling Schedule

Former Asarco East Helena Facility

Well ID	Screen Interval (feet bgs)	Unit[(1)]	Northing	Easting	MP Elevation	Spring 2024 Monitoring Event	Fall 2024 Monitoring Event	Monitoring Objectives Addressed			
								Trend Analysis	*Arsenic and Selenium Plume Stability Analysis*	*Zinc/Cadmium Distribution and Trends*	*CAMU Monitoring*
DH-57	23-28	Upper Aquifer	860328.9453	1360256.385	3929.53						
DH-58	9-24	Upper Aquifer	860620.3468	1360149.799	3919.33						
DH-59	10-25	Upper Aquifer	859632.0757	1360058.605	3937.44						
DH-5A	8-18	Upper Aquifer	859639.6847	1360786.267	3921.92						
DH-61	20-30	Upper Aquifer	860401.8562	1359292.931	3926.84						
DH-62	65-75	Deeper System	860406.7352	1359291.47	3926.95						
DH-65	60-70	Upper Aquifer	861207.1996	1360879.405	3945.85						
DH-66	38-48	Upper Aquifer	861005.14	1359333.409	3919.28	X	X	✓	✓	✓	
DH-67	36-46	Upper Aquifer	861657.6447	1359095.512	3899.77		X		✓		
DH-68	40-50	Upper Aquifer	859814.1624	1361072.196	3943.28						
DH-69	30-40	Upper Aquifer	859899.5982	1360783.894	3934.49		X		✓		
DH-70	24-30	Upper Aquifer	859738.6045	1360346.814	3933.91						
DH-71	25-34	Upper Aquifer	859876.6862	1359640.544	3944.88						
DH-72	40-50	Deeper System	859627.5477	1360069.202	3939.67						
DH-73	38-48	Upper Aquifer	860573.7778	1360394.401	3918.08						
DH-74	118-128	Upper Aquifer	860942.4611	1360679.466	4006.44						
DH-75	136-146	Upper Aquifer	860942.0961	1360685.114	4006.54						
DH-76	104-124	Upper Aquifer	860173.6276	1360887.058	3994.28						
DH-77	38-48	Upper Aquifer	860292.48	1359639.25	3932.20		X			✓	
DH-78	35-45	Upper Aquifer	860848.96	1359368.22	3921.12						
DH-79	32-42	Upper Aquifer	860422.215	1359937.191	3928.80		X	✓	✓		
DH-80	20-30	Upper Aquifer	859665.447	1360005.892	3942.36		X	✓	✓	✓	
DH-82	39-49	Upper Aquifer	861377.161	1359161.969	3908.18						
DH-83	49.5-54.5	Upper Aquifer	860783.429	1359388.46	3922.14						
East-PZ-1	14-34	Valley Fill	860384.383	1362260.694	3911.93						
East-PZ-2	29	Valley Fill	859218.097	1362203.254	3924.58						
East-PZ-4	28.00	Valley Fill	857903.643	1362039.588	3935.66						
East-PZ-6	19-26	Tertiary	857123.21	1362002.493	3943.83						
East-PZ-7	28-33	Tertiary	858720.489	1361949.299	3928.83						
EH-50	25-45	Upper Aquifer	862195.6926	1358817.999	3889.39		X		✓		
EH-51	10-30	Upper Aquifer	862186.9796	1359828.415	3880.09		X		✓		

Table 3-2. 2024 Monitoring Well Sampling Schedule

Former Asarco East Helena Facility

Well ID	Screen Interval (feet bgs)	Unit[1]	Northing	Easting	MP Elevation	Spring 2024 Monitoring Event	Fall 2024 Monitoring Event	Monitoring Objectives Addressed			
								Trend Analysis	*Arsenic and Selenium Plume Stability Analysis*	*Zinc/Cadmium Distribution and Trends*	*CAMU Monitoring*
EH-52	5-13	Upper Aquifer	862191.6556	1360752.337	3880.50		X		✓		
EH-53	25-35	Upper Aquifer	863387.4722	1358268.831	3872.82		X		✓		
EH-54	8-18	Upper Aquifer	863345.3893	1359822.332	3869.66		X	✓	✓		
EH-58	21-31	Upper Aquifer	861985.385	1361553.2	3888.15		X		✓		
EH-59	8-18	Upper Aquifer	862766.0055	1361023.244	3876.57		X[4]	✓	✓		
EH-60	22-28	Upper Aquifer	862093.3668	1359295.783	3888.46	X	X	✓	✓		
EH-61	36-45	Upper Aquifer	862095.8588	1359282.097	3889.77						
EH-62	25-45	Upper Aquifer	863373.6172	1358812.977	3875.07		X		✓		
EH-63	20-35	Upper Aquifer	862682.4886	1359427.431	3878.32		X		✓		
EH-65	20-35	Upper Aquifer	862702.9806	1358789.927	3879.96		X		✓		
EH-66	28.5-38.5	Upper Aquifer	864406.8992	1358105.331	3869.48		X		✓		
EH-67	27-37	Upper Aquifer	864405.9092	1358454.566	3869.46						
EH-68	15-25	Upper Aquifer	863877.1312	1360331.472	3867.60						
EH-69	26-36	Upper Aquifer	863791.1154	1360852.608	3869.10		X	✓	✓		
EH-70	40-50	Upper Aquifer	864971.9141	1357077.783	3863.48		X		✓		
EH-100	52-60	Upper Aquifer	862197.1906	1358800.894	3889.83		X		✓	✓	
EH-101	34-45	Upper Aquifer	862185.0606	1359841.734	3879.95		X		✓		
EH-102	25-35	Upper Aquifer	862174.5306	1360751.101	3880.45		X		✓		
EH-103	59.5-74.5	Upper Aquifer	862095.3328	1359303.117	3890.54	X	X	✓	✓		
EH-104	38-48	Upper Aquifer	862312.6614	1358282.522	3887.83		X		✓		
EH-106	31-46	Upper Aquifer	862709.9336	1358337.119	3882.07		X		✓		
EH-107	68-78	Upper Aquifer	862700.4946	1358801.991	3880.15		X		✓		
EH-110	40-55	Upper Aquifer	862408.9392	1359199.735	3884.05		X		✓		
EH-111	39-49	Upper Aquifer	863063.8249	1358121.671	3876.50		X	✓	✓		
EH-114	42-52	Upper Aquifer	863127.7487	1357769.757	3878.07	X[4]	X[4]	✓	✓		
EH-115	39-49	Upper Aquifer	862717.8146	1357963.035	3883.29	X	X	✓	✓		
EH-117	33-43	Upper Aquifer	863491.194	1357815.102	3871.33		X	✓	✓		
EH-119	58-68	Upper Aquifer	863617.6238	1357263.087	3873.75		X		✓		
EH-120	55-65	Upper Aquifer	864330.2403	1357409.933	3865.78	X	X	✓	✓		
EH-121	59-69	Upper Aquifer	864410.1362	1358127.823	3869.49		X		✓		
EH-122	60-65	Upper Aquifer	864415.3102	1358469.648	3868.08						

Table 3-2. 2024 Monitoring Well Sampling Schedule

Former Asarco East Helena Facility

Well ID	Screen Interval (feet bgs)	Unit[1]	Northing	Easting	MP Elevation	Spring 2024 Monitoring Event	Fall 2024 Monitoring Event	Monitoring Objectives Addressed			
								Trend Analysis	*Arsenic and Selenium Plume Stability Analysis*	*Zinc/Cadmium Distribution and Trends*	*CAMU Monitoring*
EH-123	50-60	Upper Aquifer	863027.3459	1356631.306	3885.71		X	✓	✓		
EH-124	64-74	Upper Aquifer	863928.3931	1356666.492	3874.46	X	X	✓	✓		
EH-125	59-69	Upper Aquifer	864978.443	1357089.97	3863.22		X		✓		
EH-126	63-73	Upper Aquifer	865515.797	1356002.798	3870.00	X[4]	X[4]	✓	✓		
EH-127	63-73	Upper Aquifer	865361.5553	1357810.281	3860.75						
EH-128	34-44	Upper Aquifer	863371.5473	1355903.641	3892.17						
EH-129	80-90	Upper Aquifer	865649.6907	1355425.088	3870.21	X	X	✓	✓		
EH-130	68-78	Upper Aquifer	866018.012	1356641.209	3858.55		X	✓	✓		
EH-131	74-84	Valley Fill	867032.6409	1356912.021	3834.44						
EH-132	70-80	Upper Aquifer	864040.3529	1355360.408	3893.90		X		✓		
EH-133	85-95	Upper Aquifer	864766.2675	1355354.834	3884.36						
EH-134	54-64	Upper Aquifer	865643.4817	1355425.545	3870.21	X	X	✓	✓		
EH-135	55-65	Upper Aquifer	865688.5946	1357384.976	3852.25		X		✓		
EH-136	64-74	Valley Fill	866625.8837	1357248.902	3838.59						
EH-137	75-85	Valley Fill	867047.7809	1357895.667	3839.66						
EH-138	55-85	Valley Fill	867179.0458	1355646.472	3839.70	X	X	✓	✓		
EH-139	47-57	Valley Fill	867197.4533	1354635.304	3839.78	X	X	✓	✓		
EH-140	56-86	Valley Fill	867962.262	1356224.787	3812.08						
EH-141	60-90	Valley Fill	868713.295	1354782.704	3813.32	X[4]	X[4]	✓	✓		
EH-142	80-120	Valley Fill	870077.471	1353868.6	3804.68						
EH-143	100-125	Valley Fill	870683.749	1354372.763	3803.37	X	X	✓	✓		
EH-144D	143.5-168.5	Valley Fill	874170.144	1354086.122	3778.86						
EH-144M	118-128	Valley Fill	874170.205	1354096.294	3778.95						
EH-144S	83-103	Valley Fill	874170.357	1354091.18	3778.70						
EH-145D	211-241	Valley Fill	873225.38	1355535.01	3789.60						
EH-145S	167-187	Valley Fill	873230.40	1355543.75	3790.09						
EH-200	38-48	Tertiary	862018.257	1353065.25	3953.33						
EH-201	99-119	Tertiary	861475.904	1353968.192	3973.48						
EH-202	70-90	Tertiary	861250.6755	1357113.736	3930.56						
EH-203	125-145	Tertiary	860233.8575	1356623.211	4003.92						
EH-204	55-65	Tertiary	860660.9927	1358703.601	3925.69		X	✓	✓		

Table 3-2. 2024 Monitoring Well Sampling Schedule

Former Asarco East Helena Facility

Well ID	Screen Interval (feet bgs)	Unit(1)	Northing	Easting	MP Elevation	Spring 2024 Monitoring Event	Fall 2024 Monitoring Event	Monitoring Objectives Addressed			
								Trend Analysis	*Arsenic and Selenium Plume Stability Analysis*	*Zinc/Cadmium Distribution and Trends*	*CAMU Monitoring*
EH-205	24-34	Upper Aquifer	861652.5237	1358687.062	3900.66						
EH-206	33-53	Upper Aquifer	862969.4011	1356012.784	3898.10		X		✓		
EH-208	60-85	Valley Fill	863930.4941	1354401.573	3910.58						
EH-209	96-116	Valley Fill	864742.1995	1353102.001	3898.34						
EH-210	50-60	Deeper System	861653.6027	1358674.679	3901.19		X	✓			
EH-211	40-50	Valley Fill	862223.936	1356747.917	3905.75						
EH-212	57-72	Valley Fill	862222.628	1356753.36	3905.90						
EHMW-3	80-130	NA	868386.9702	1356618.424	3825.45						
EHTW-3	NA	NA	868576.0698	1356692.192	3827.66						
IW-01	NA	Upper Aquifer	864945.874	1354765.643	3888.28						
IW-02	NA	Upper Aquifer	865731.883	1353973.511	3871.08						
MW-1	58-68	Tertiary	858771.6535	1358766.757	3953.05		X				✓
MW-2	56.0-66.0	Tertiary	859191.6356	1358745.842	3945.97		X				✓
MW-3	38.5-48.0	Tertiary	859196.8246	1359132.386	3940.95		X				✓
MW-4	54-64	Tertiary	858802.4764	1359150.013	3947.06		X				✓
MW-5	55-65	Tertiary	858414.7012	1358930.241	3956.18		X				✓
MW-6	30-40	Tertiary/Qal	858876.2702	1359556.469	3938.14		X				✓
MW-7	44-57	Qal	858777.0044	1358177.774	3963.67		X				✓
MW-8	44.5-64.5	Tertiary	857962.2351	1359400.931	3958.65		X				✓
MW-9	50-70	Valley Fill	857977.442	1358978.984	3959.01		X				✓
MW-10	42-62	Valley Fill	858554.2009	1359549.266	3946.28		X				✓
MW-11	49.6-69.6	Tertiary	857959.4701	1358516.749	3973.33		X				✓
PBTW-1	29-46	Upper Aquifer	861055.8909	1359662.678	3914.59						
PBTW-2	30-54	Upper Aquifer	861165.7887	1359622.427	3906.73		X	✓			
Plant Road Test Well	217-346	Upper Aquifer	868122.60	1359602.00	3838.72						
PPCRPZ-02	<10	Upper Aquifer	858388.3477	1360904.918	3919.76						
PRB-1	35-50	Upper Aquifer	861019.372	1359488.184	3918.37						
PRB-2	37-52	Upper Aquifer	861114.8098	1359753.598	3905.34						
PRB-3	36-51	Upper Aquifer	860983.812	1359418.527	3919.19						
PZ-36A	<10	Upper Aquifer	864560.517	1358731.291	3858.96						
PZ-36B	<10	Upper Aquifer	864557.572	1358724.518	3858.75						

Table 3-2. 2024 Monitoring Well Sampling Schedule

Former Asarco East Helena Facility

Well ID	Screen Interval (feet bgs)	Unit[(1)]	Northing	Easting	MP Elevation	Spring 2024 Monitoring Event	Fall 2024 Monitoring Event	Monitoring Objectives Addressed			
								Trend Analysis	*Arsenic and Selenium Plume Stability Analysis*	*Zinc/Cadmium Distribution and Trends*	*CAMU Monitoring*
PZ-36C	20-25	Upper Aquifer	864554.645	1358718.763	3859.60						
PZ-9A	<10	Upper Aquifer	865510.378	1357868.389	3850.70						
PZ-9B	<10	Upper Aquifer	865507.227	1357867.095	3849.43						
SC-1	75-85	Upper Aquifer	862196.3525	1358838.975	3890.42						
SDMW-1	25.6-45.6	Upper Aquifer	860514.593	1359962.878	3925.11		X			✓	
SDMW-2	22.5-42.5	Upper Aquifer	860448.2571	1359851.228	3928.09						
SDMW-3	19-39	Upper Aquifer	860203.9396	1359859.357	3935.14						
SDMW-4	19-39	Upper Aquifer	860218.1176	1360144.94	3936.10						
SDMW-5	29-49	Upper Aquifer	860446.6991	1359750.308	3929.86		X			✓	
TW-1	25-40	Upper Aquifer	860392.8781	1359940.799	3930.10						
TW-2	NA	NA	860351.2	1359895.9	3931.44						
ULM-PZ-1	<10	Upper Aquifer	857498.249	1360521.727	3924.40						
ULTP-1	<10	Upper Aquifer	858779.0631	1360264.292	3919.63						
ULTP-2	<10	Upper Aquifer	858262.1761	1360427.46	3921.23						
					Total # Wells Per Event	**24**	**77**				
					Total # Planned Non-QC Samples for 2024	**101**					
							# Wells Addressing Objective	**37**	**59**	**7**	**11**

NOTES: Water levels will be measured in all wells (170 wells total) as part of the Spring and Fall monitoring events.
All monitoring locations shown on Exhibit 1
Total number of planned groundwater quality samples does not include field quality control samples
Field QC (rinsate blank, DI blank, and duplicate samples) each collected at frequency of 1 per 20 groundwater samples
(1) Unit refers to hydrostratigraphic unit. Upper Aquifer and Deeper System refer to units on plant site and downgradient through Lamping Field. Other wells identified by geologic unit.
(2) Former residential water supply wells to be sampled using high-volume/high purge rate method.
(3) Samples collected from Dartman well by Custodial Trust to provide information to East Helena School District
(4) Purge method verification samples to be collected during 2024 monitoring event(s).
NA - Not Available
bgs - below ground surface

Table 3-3. 2024 Residential/Municipal Water Supply Well Sampling Schedule
Former Asarco East Helena Facility

Map ID[1]	Northing	Easting	Status
Known Active Wells - Scheduled for Spring and Fall Sampling in 2024			
R1	863425.39	1359501.01	Active
R2	863266.68	1359337.84	Active
R3	863296.03	1360955.74	Active
R4	863053.71	1361184.11	Active
R5	864206.53	1358674.56	Active
R6	866156.57	1356934.48	Active
R7	872346.42	1354330.00	Active
R8	872391.53	1354773.24	Active
R9	872086.41	1355030.70	Active
R10	863376.30	1361815.27	Active
R11	863255.39	1358240.44	Active
R12	861502.42	1362101.41	Active
R13	863233.58	1359840.14	Active
R14	872558.37	1356681.06	Active
R15	871444.75	1356882.84	Active
R16	868437.60	1356673.10	Active
Inactive/Inoperative/Not Located/No Access Wells - No Sampling Scheduled			
A	862450.60	1359157.38	No Access
B	861861.51	1361212.16	No Access
C	861854.50	1361415.54	No Access
D	863069.96	1361069.38	No Access
E	862259.92	1355055.07	No Access
F	862355.37	1362082.87	No Access
G	861830.00	1362540.24	No Access
H	862864.36	1360861.52	No Well Located
I	863109.81	1359725.42	No Well Located
J	863257.08	1358568.29	No Well Located
K	863278.12	1357979.20	No Well Located
L	863327.86	1360948.64	Pump Inoperative
M	863250.07	1358456.08	Pump Inoperative
N	863264.10	1358105.44	Pump Inoperative
O	863671.87	1362422.81	Pump Inoperative
Background Arsenic Wells Removed from Program in 2024 - No Sampling Scheduled			
BG1	855347.37	1359909.48	Active
BG2	861784.41	1356574.41	Active
BG3	861925.29	1356400.09	Active
BG4	861781.59	1356290.54	Active
Abandoned Wells			
X1	863237.91	1360019.06	Abandoned
X2	863270.75	1359501.67	Abandoned
X3	862873.52	1360767.10	Abandoned
X4	863250.07	1359185.43	Abandoned
X5	863263.27	1359031.01	Abandoned
X6	863256.45	1359904.15	Abandoned
X7	863256.45	1359757.14	Abandoned

NOTES: (1) See Exhibit 1 and Figure 3-2

Table 3-4. 2024 Surface Water Monitoring Schedule
Former Asarco East Helena Facility

Site ID	Northing	Easting	Description	Water Elevation Measurements (GPS Survey)	Instantaneous Flow Measurements	Water Quality Monitoring
				Spring and Fall		
PPC-3A	856283.87	1361694.37	Prickly Pear Creek upstream of former smelter site	X	X	X
Trib-1	857970.07	1360217.21	Tributary drainage at railroad bridge crossing, upstream of site Trib-1B and 2018 soil removal area	X	X	X
Trib-1B	858476.27	1360181.89	Tributary drainage south of Facility, upstream of site Trib-1D and downstream of 2018 soil removal area	X	X	X
Trib-1D	859392.30	1361402.33	Tributary drainage immediately upstream of Prickly Pear Creek confluence	X	X	X
PPC-4A	858437.51	1361223.39	Prickly Pear Creek realigned channel upstream of former smelter dam, in former Upper Lake area	X	X	X
PPC-5A	859596.18	1361507.01	Prickly Pear Creek realigned channel downstream of former smelter dam; near historic site PPC-5	X	X	X
PPC-7	861473.74	1360743.50	Prickly Pear Creek channel upstream of Highway 12 bridge; between slag pile and Highway 12	X	X	X
PPC-8	863372.55	1360137.99	Prickly Pear Creek at West Gail Street in East Helena	X		
PPC-36A	864556.11	1358753.31	Prickly Pear Creek approximately 3,500 feet downstream of former smelter site	X	X	X
PPC-9A	865555.92	1357841.22	Prickly Pear Creek approximately 5,250 feet downstream of former smelter site	X		
SG-16	872677.17	1350559.96	Prickly Pear Creek downstream of Canyon Ferry Road bridge	X	X	X
Total Measurements Per Monitoring Event				**11**	**9**	**9**
Total Monitoring Events				**2**	**2**	**2**
Total Measurements for 2024				**22**	**18**	**18**

NOTES: All monitoring locations shown on Figure 3-1.

Table 4-1. Corrective Action Performance Monitoring Standard Operating Procedures
Former Asarco East Helena Facility

SOP #[(1)]	Title
HSOP-002	Determination, Identification, and Description of Field Sampling Sites
HSOP-003	Preservation and Storage of Inorganic Water Samples
HSOP-004	Chain-of-Custody Procedures, Packing and Shipping Samples
HSOP-005	Global Positioning System (GPS) Equipment Operation
HSOP-006	Field Measurement of pH, Dissolved Oxygen, Conductivity, ORP, and Temperature Using a Multi-Meter
HSOP-007	Decontamination of Sampling Equipment
HSOP-013	Equipment Rinsate Blank Collection
HSOP-020	Field Measurement of pH using a pH Meter
HSOP-022	Field Measurement of Dissolved Oxygen
HSOP-023	Field Measurement of Redox Potential (Eh)
HSOP-029	Labeling and Documentation of Samples
HSOP-030	Decision Process for Field Variances and Nonconformances
HSOP-031	Field Notebooks
HSOP-049	Use of a Flow Cell For Collecting Field Parameters
HSOP-058	Guidelines for Quality Assurance of Environmental Data Collection Activities: Data Quality Planning, Review, and Management
HSOP-071	Fluid Sampling With Peristaltic Pump
HSOP-073	Filtration of Water Samples
HSOP-079	Field Measurement of Specific Conductivity
HSOP-084	Field Measurement of Water Temperature
HSOP-102	Sampling of Municipal Wells
HSOP-105	Low Flow/Minimal Drawdown Sampling of Monitoring Wells for Inorganic Parameters
HSOP-109	Logging of Monitoring Wells - Geologic Conditions, Construction and Development
HSOP-110	Water Level Measurement with an Electric Tape
HSOP-111	Sampling Monitoring Wells for Inorganic Parameters
HSOP-215	Measurement of Stream or Pond Stage
HSOP-217	Streamflow Measurement Using a Parshall Flume
HSOP-219	Obtaining Water Quality Samples from Streams
HSOP-226	Streamflow Measurement Using a Flume
HSOP-227	Flow Estimation Method for Springs and Culverts
HSOP-237	Streamflow Measurement Using a Marsh-McBirney Water Current Meter
HSOP-244	Flow Measurements Using a Portable 90° V-Notch Cutthroat Flume
HSOP-246	Streamflow Measurement Using a Portable 3-inch Parshall Flume (Montana Flume)
HSOP-250	Synoptic Runs on Streams
METG-SOP-001[(2)]	Residential Well Sampling for Inorganic Parameters

Notes:

(1) SOPs were prepared by Hydrometrics, Inc. and presented in various plans (e.g., QAPP; Hydrometrics, 2015).

(2) SOP was prepared by METG and is presented in Appendix A.

Table 4-2. Well Purge Stability Criteria
Former Asarco East Helena Facility

Parameter (Units)	Stability Criteria
pH (standard units)	±0.1 pH unit
Water temperature (°C)	±0.2°C
Specific conductance (µmhos/cm)	±5% (SC ≤100 µmhos/cm)
	±3% (SC >100 µmhos/cm)
Dissolved oxygen (mg/L)	±0.3 mg/L

Notes:

Stability criteria obtained from USGS National Field Manual for the Collection of Water Quality Data: Chapter A4, Collection of Water Samples (September 2006).

ORP and turbidity measurements will be monitored during stabilization; however, given the inherent variability of these measurements, they will not be included as stabilization parameters during groundwater sampling under the 2024 Interim CAPMP.

Table 4-3. Sample Container and Preservation Requirements
Former Asarco East Helena Facility

Matrix	Parameters	Sample Container	Preservative
Groundwater	Field Parameters	None	None
	Common Constituents	1000 mL HDPE	Cool to ≤6°C
	Dissolved Metals[1]	250 mL HDPE	Filter samples (0.45 µm) HNO3 to pH <2 Cool to ≤6°C
	Total Metals [2]	250 mL HDPE	Unfiltered samples HNO3 to pH <2 Cool to ≤6°C
Surface Water	Field Parameters	None	None
	Common Constituents	1000 mL HDPE	Cool to ≤6°C
	Total Recoverable Metals	250 mL HDPE	Unfiltered samples HNO3 to pH <2 Cool to ≤6°C

Notes:

(1) Dissolved metals will be analyzed in both monitoring and residential / municipal water supply well samples.

(2) Total metals will be analyzed in residential / municipal water supply well samples only.

Table 6-1. 2024 Groundwater Sample Analytical Parameter List
Former Asarco East Helena Facility

Parameter	Analytical Method [1]	Project Required Detection Limit (mg/L)	Montana Groundwater Human Health Standards (mg/L)[2]
Physical Parameters			
pH	150.2/SM 4500H-B	0.1 s.u.	NA
Specific Conductance	120.1/SM 2510B	1 µmhos/cm	NA
TDS	SM 2540C	10	NA
TSS	SM 2540D	10	NA
Common Ions			
Alkalinity	SM 2320B	1	NA
Bicarbonate	SM 2320B	1	NA
Sulfate	300.0	1	NA
Chloride	300.0/SM 4500CL-B	1	NA
Bromide	300.0	0.05	NA
Calcium	215.1/200.7	1	NA
Magnesium	242.1/200.7	1	NA
Sodium	273.1/200.7	1	NA
Potassium	258.1/200.7	1	NA
Trace Constituents (Total and/or Dissolved) [3][4]			
Antimony (Sb)	200.7/200.8	0.003	0.006
Arsenic (As)	200.8/SM 3114B	0.002	0.01
Cadmium (Cd)	200.7/200.8	0.001	0.005
Copper (Cu)	200.7/200.8	0.001	1.3
Iron (Fe)	200.7/200.8	0.02	NA
Lead (Pb)	200.7/200.8	0.005	0.015
Manganese (Mn)	200.7/200.8	0.01	NA
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.001	0.002
Selenium (Se)	200.7/200.8/SM 3114B	0.001	0.05
Thallium (Tl)	200.7/200.8	0.001	0.002
Zinc (Zn)	200.7/200.8	0.01	2
Field Parameters [5]			
Static Water Level	HSOP-110	0.01 ft	NA
Turbidity	HSOP-053	0.1 NTU	NA
Water Temperature	HSOP-006	0.1 °C	NA
Dissolved Oxygen (DO)		0.01 mg/L	NA
pH		0.01 pH standard unit	NA
ORP/Eh		1 mV	NA
Specific Conductance (SC)		1 µmhos/cm	NA

Notes:

(1) Analytical methods are from the most recent edition of *Standard Methods for the Examination of Water and Wastewater* (SM); *Methods for the Determination of Metals in Environmental Samples,* Supplement I, EPA/600/R-94/111 (May 1994); or *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).

(2) Standards from Montana Circular DEQ-7 (June 2019 Version). NA = not applicable (no human health standard).

(3) Residential/water supply well samples will be analyzed for both total and dissolved trace constituents; monitoring well samples will be analyzed for dissolved metals only

(4) Samples to be analyzed for dissolved constituents will be field-filtered through a 0.45 µm filter.

(5) Field parameters will be measured in a flow cell in accordance with project SOPs.

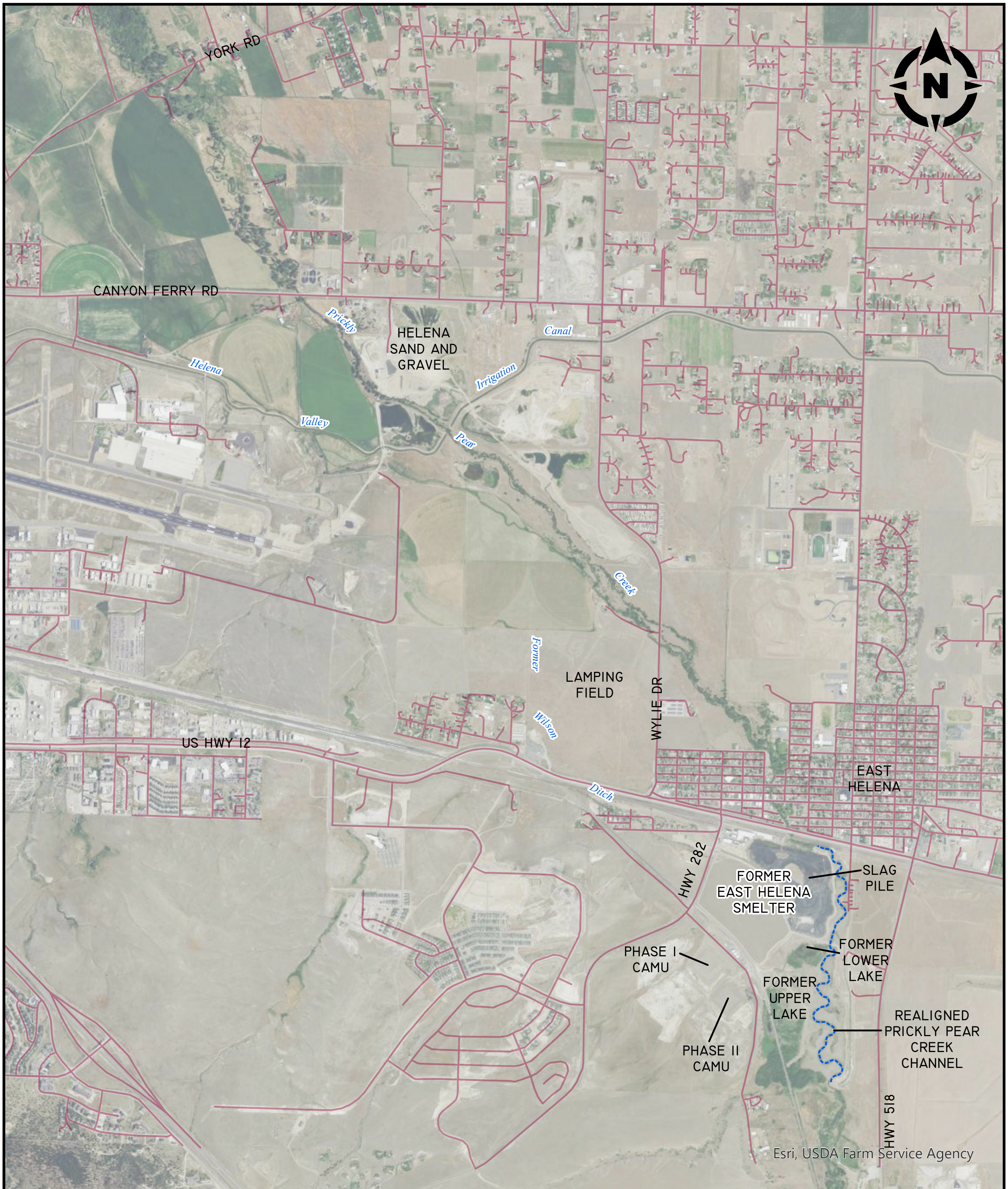
Table 6-2. 2024 Surface Water Sample Analytical Parameter List
Former Asarco East Helena Facility

Parameter	Analytical Method (1)	Project Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	1
Magnesium	242.1/200.7	1
Sodium	273.1/200.7	1
Potassium	258.1/200.7	1
Trace Constituents (Total Recoverable)		
Antimony (Sb)	200.7/200.8	0.0005
Arsenic (As)	200.8/SM 3114B	0.001
Cadmium (Cd)	200.7/200.8	0.00003
Copper (Cu)	200.7/200.8	0.002
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.0003
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.000005
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Thallium (Tl)	200.7/200.8	0.0002
Zinc (Zn)	200.7/200.8	0.008
Field Parameters		
Stream Flow	HSOP-237/-244	NA
Stream Stage/Elevation	HSOP-005	
Water Temperature	HSOP-006	0.1 °C
Dissolved Oxygen (DO)		0.01 mg/L
pH		0.01 s.u.
Specific Conductance (SC)		1 µmhos/cm

Notes:

(1) Analytical methods are from the most recent edition of *Standard Methods for the Examination of Water and Wastewater* (SM); *Methods for the Determination of Metals in Environmental Samples,* Supplement I, EPA/600/R-94/111 (May 1994); or *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).

FIGURES



2024 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN EAST HELENA FACILITY

PROJECT LOCATION AND SITE FEATURES

FIGURE 1-1

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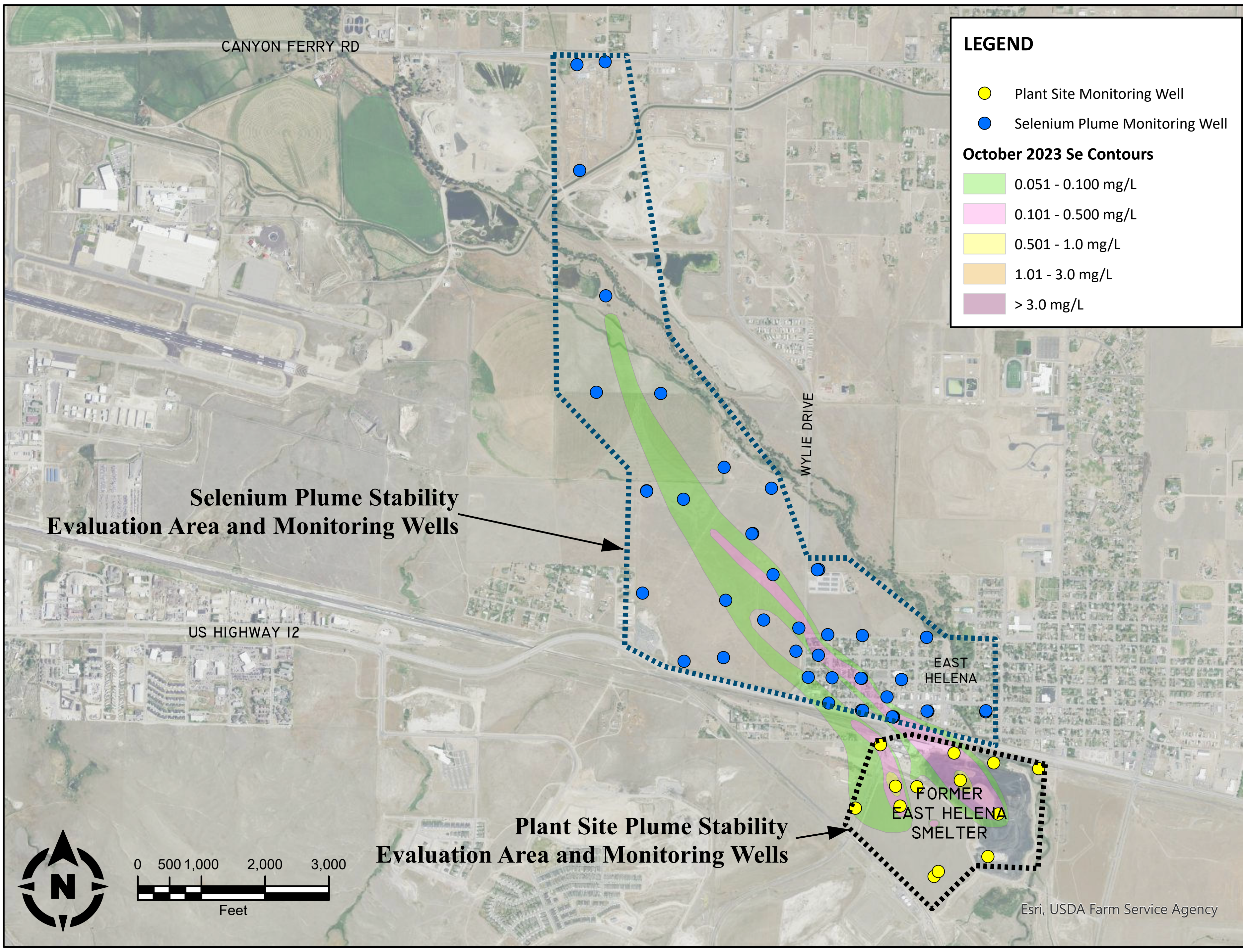
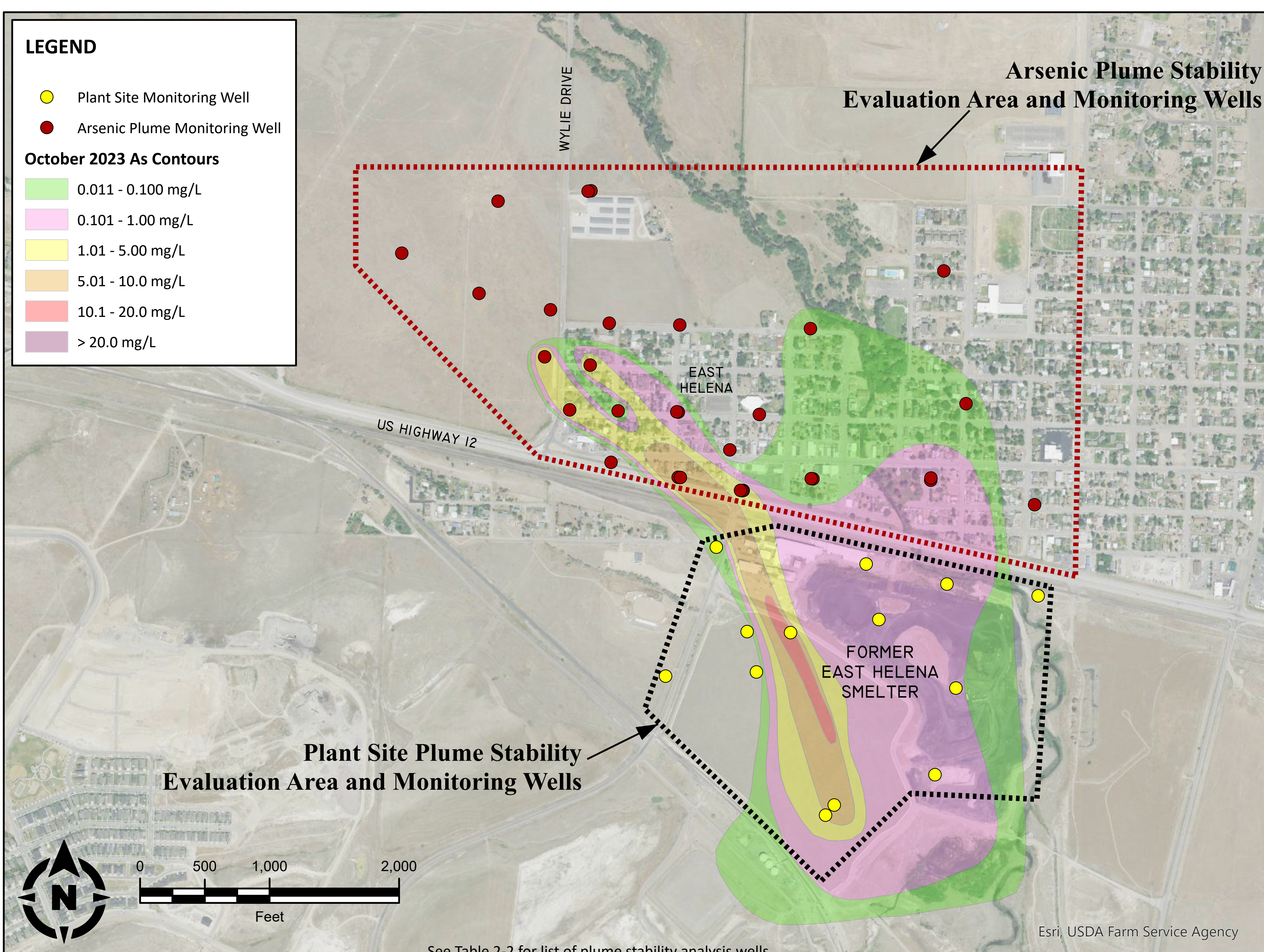
Hydrometrics, Inc.





2024 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN EAST HELENA FACILITY	**2024 PLUME STABILITY EVALUATION AREAS AND MONITORING WELLS**	FIGURE **2-1**

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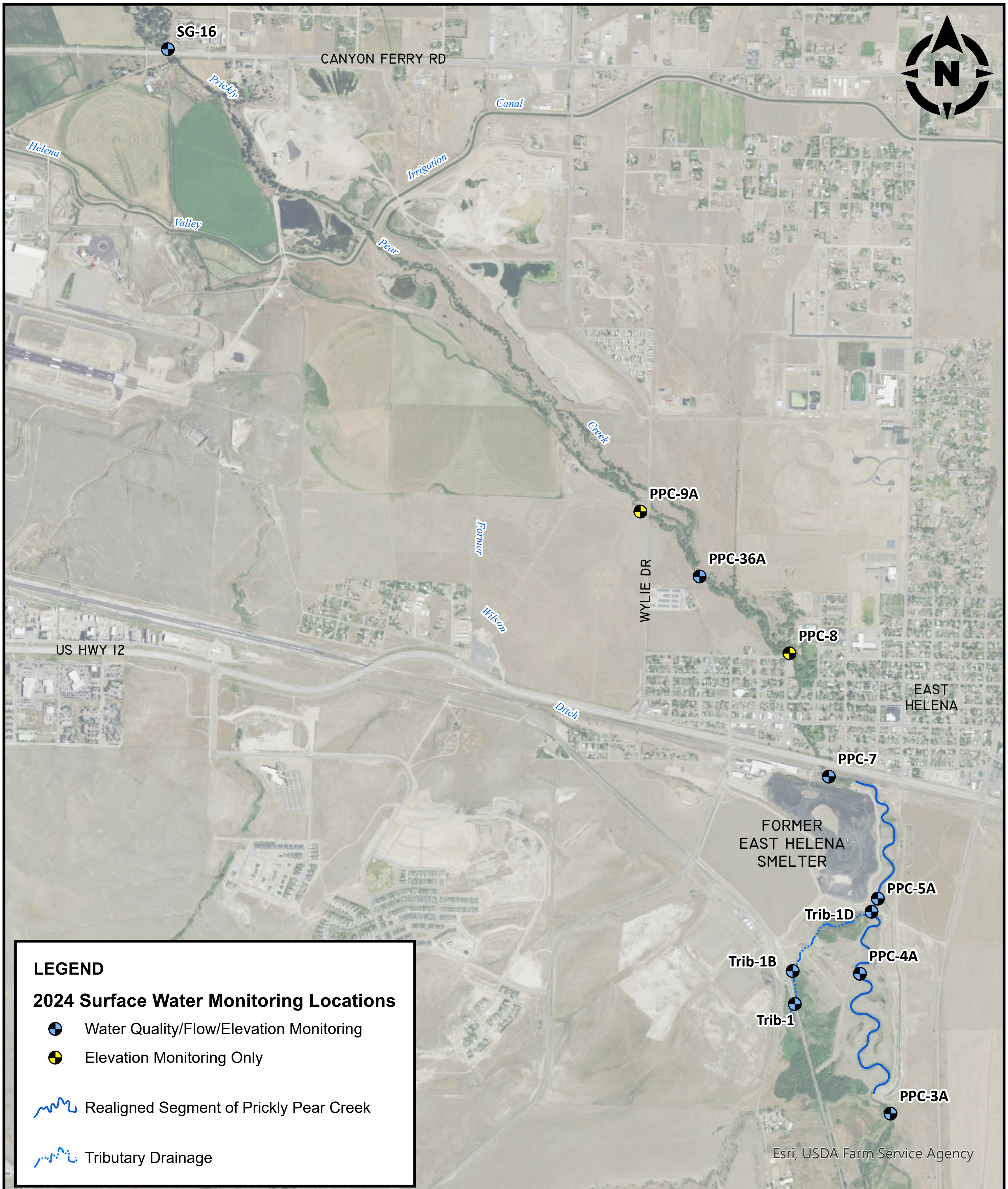
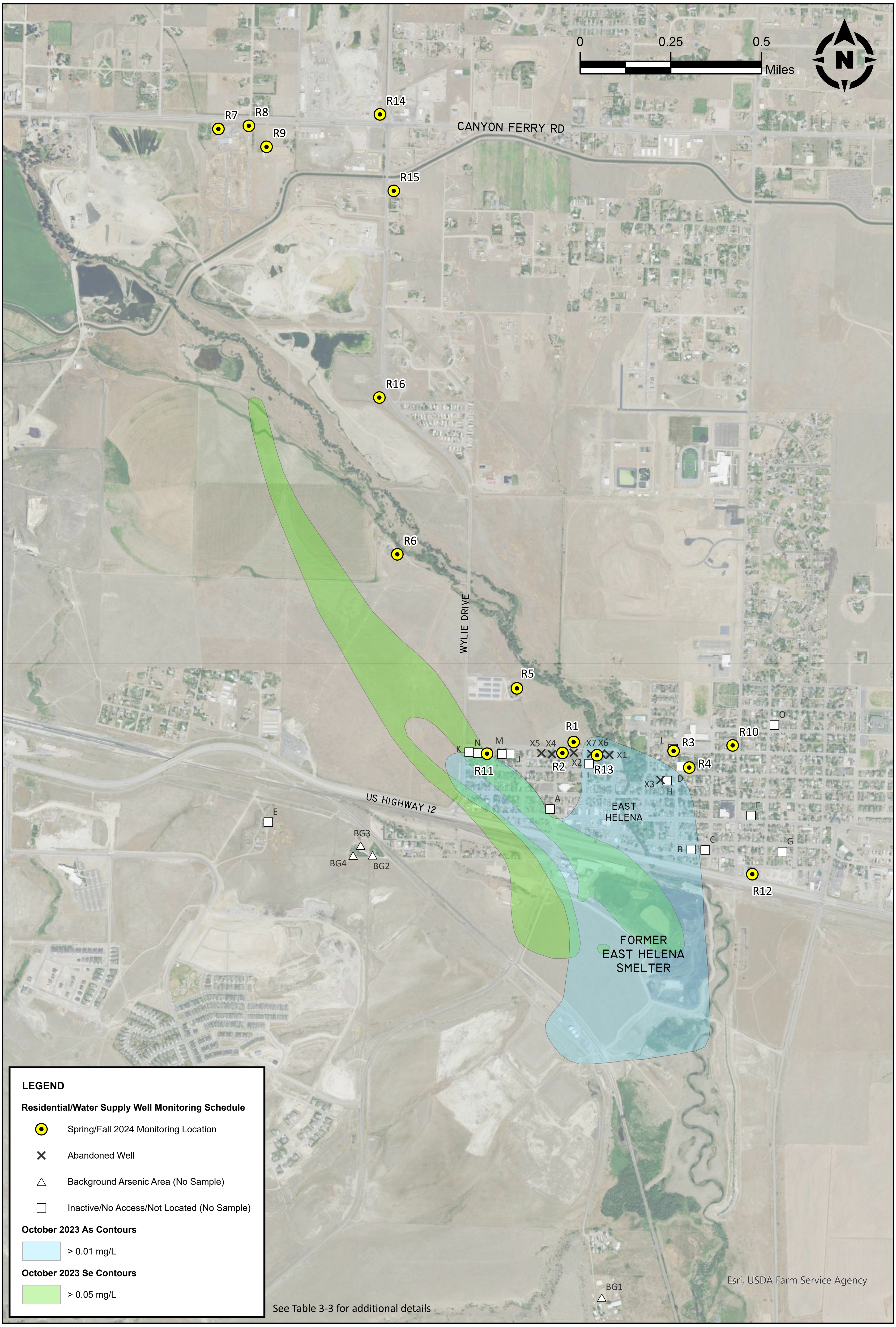
Hydrometrics, Inc.



0 1,000 2,000 Feet	2024 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN EAST HELENA FACILITY	**2024 SURFACE WATER MONITORING LOCATIONS**	**FIGURE** **3-1**



2024 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN EAST HELENA FACILITY	**2024 RESIDENTIAL / WATER SUPPLY WELL SEMIANNUAL SAMPLING SCHEDULE**	**FIGURE 3-2**

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Hydrometrics, Inc.

APPENDIX A

METG-SOP-001
RESIDENTIAL WELL SAMPLING
FOR INORGANIC PARAMETERS

STANDARD OPERATING PROCEDURE

RESIDENTIAL WELL SAMPLING FOR INORGANIC PARAMETERS

METG-SOP-001

1.0 PURPOSE

This procedure describes the methods to be used in collection of groundwater samples from private residential wells. The purpose of this standard operating procedure (SOP) is to describe the general methodology for collecting representative groundwater samples from residential wells within the vicinity of the Montana Environmental Trust Group – East Helena Site. The procedure is designed for sampling residential wells where inorganic constituents are the contaminants of interest. This procedure is intended to serve as guidance for field crews collecting these samples – this SOP does not cover communication with residential well owners (e.g., obtaining access authorization, sampling notification). Methods presented in this SOP are based on recent USGS guidance (USGS, 2006).

2.0 SCOPE

This procedure applies to all METG personnel and any assigned contractors tasked with sampling residential wells. The scope of work includes the preparation, preservation, collection, and submittal of samples for analytical analysis.

3.0 GENERAL

This technical procedure has been established to standardize the sampling team preparation, collection, preservation, and submittal of residential well water samples to the analytical laboratory. Analyses conducted on these samples may include inorganic compounds (metals, sulfate, anions, cations, etc.) and must be conducted by a Montana certified laboratory. Procedures and methodologies may only be added or changed at the direction of the METG or its designated contractor. To ensure the sample collected is representative of the groundwater, the system must be purged prior to sample collection. This SOP will be used in conjunction with the East Helena QAPP (Hydrometrics, 2010 or its equivalent) and applicable field sampling and analyses plans (SAPs) to ensure the sampling event is properly performed, documented and yields quality results.

4.0 RESPONSIBILITIES

METG and assigned field staff shall ensure that:

- Property access has been obtained at each well to be sampled;
- Each property owner is notified and provided with the anticipated sample date and time before each sampling event;

- Residential well sampling schedules are coordinated to extent practical with other METG directed groundwater monitoring activities; and
- Representative residential drinking water well samples are obtained according to this procedure and other applicable QAPP or SAP requirements.

5.0 EQUIPMENT

Residential wells will be sampled using existing pumps installed in the wells by the property owners. Additional equipment needed to conduct sampling activities may include:

- Summary of addresses, well locations, preferred sampling location (inside, outside, spigot, faucet, etc.), estimated purge volumes (or calculator for determining purge volumes, holding tank volume), and other special instructions
- Distilled or deionized water
- 0.45 µm filter apparatus with inert filters
- Laboratory supplied pre-cleaned and preserved sample containers for analyses
- Stopwatch or watch with second hand
- Field logbook
- Sampling sheets
- Sample labels
- Chain-of-custody sheets
- Custody seals
- Chemical-free paper towels
- Waterproof pens (Sharpies)
- Paper towels
- Trash bags
- Nitrile gloves
- Garden hoses
- Buckets (5-gallon, 2-gallon)
- Pliers
- Standard connectors
- Sample coolers
- Extra-large zip-lock bags
- Ice for sample preservation
- Safety glasses
- Cell phone or two-way radio
- Water quality meters (Eh, pH, conductivity, ORP, temperature)

- Flow through cell
- Copies of Private Well Water Sampling Notice

6.0 PROCEDURES

6.1 Well Access

Upon arrive at the property, introduce yourself to the property owner/occupant and discuss the purpose of the sampling and the planned sampling protocols. Ask the property owner/occupant if they have been recently using the well and about the well's general usage. Record the answer.

If the information hasn't already been provided, the property owner should be questioned as to the well depth and pressure tank capacity, if known. Additionally, the owner should be asked if they have a water filtration or conditioning unit in their system. If a water filter is connected to the water system, permission should be asked to obtain the sample before the water passes through such systems. If the property owner is not home but has given permission to sample, consult the sampling instructions for the location of the outside spigot.

6.2 Well Purging

The purpose of purging the well is to remove any stagnant water within the system and to obtain a representative sample of the groundwater. The following steps should be followed to the extent practicable:

A. **Locate the well and sampling port**. Locate the sampling port nearest to the wellhead. The sampling port should be before the holding tank, pressure tank, water filtration, or water treatment system. If the sample port is outdoors, ask if the owner has a preference for where to discharge the purge water. It may be necessary to run a hose from the sampling port to an acceptable discharge location away from the house or other features.

B. **Obtain water level measurement** (see water level HF-SOP-010), if well has an access port. NOTE: electric water level probes are typically not recommended for sounding wells; instead, use a weighted measuring tape or other equipment. Measurements should not be made when the pump is operating.

C. **Prepare sampling port for purging.**

Houses with inside tap:

- If the faucet is fixed with an aerator (a small screen), remove the aerator carefully. If pliers are needed, place a nitrile glove or similar between the pliers and aerator to protect it.
- Establish a constant flow and determine the purge flow rate using a known volume container and timer.

Houses with outside spigot:

- If a hose is already connected, disconnect it.

- Attach the purge hose and direct end of hose so that water discharges away from the house, wellhead, etc.

D. **Determine the well purge volume.** This task can be done in advance and verified in the field, if information is obtained from the well owner before visiting the property. The volume of water to be purged before groundwater samples are collected will be calculated as follows:

- If the house has a holding tank and the volume is known, estimate length of piping to the well, and the well depth[1]. The total volume to purge the system is

  = tank volume[2] + well casing volume[3] + water line volume[4].

  The well casing volume, expressed in gallons (1 ft^3 = 7.48 gallons), is

  $$= \frac{\pi * d^2 * h}{77.01}$$

  Where:

  π = 3.14;
  d = Diameter of the well casing expressed in inches; and
  h = Total depth of the water column in the well in feet (well depth – static water level, see Static Water Level Determination HF-SOP-010).

- If the holding tank volume is unknown:
  - Assume a 35-gallon pressure tank.
  - Assume that ~ 5 gallons are contained in the water line.
  - Assume well volume ≈ 20 gallons.
  - Assume total purge volume = 60 gallons.

E. **Determine the purge time**

- Turn the spigot on and establish a constant flow. Determine the purge flowrate using a known volume container and a timer Time the filling of a 5-gallon bucket (outside) or a 2-liter beaker (inside).

- Calculate the purge time based on the purge rate in gallons per minute (gpm) and the total purge volume in gallons as follows:

---

1 The well depth may be obtained from well logs, owners statements, or direct measurements – if wellhead is accessible.

2 This value should include the volume of holding tank and/or pressure tank between the well and the sampling port. All samples should be obtained before any water filtration or water treatment systems.

3 A minimum of one well casing volume should be purged prior to sampling if the well is actively used. If the well has been stagnant or infrequently used three to five well casing volumes should be purged.

4 The water line volume can be calculated using the formula for the well casing volume by replacing d with the inside diameter of the pipe and h with the estimated length of the water line in feet.

$$= \frac{\text{Well Purge Volume (gallons)}}{\text{Purge Rate (gpm)}}$$

Where:

$$\text{Purge Rate} = \frac{\text{Volume of Container (gallons)}}{\text{Time to fill container (minutes)}}$$

Example:
Well Purge Volume calculated to be 60 gallons. If it takes 45 seconds to fill one 5-gallon bucket, the purge rate would be 6.8 gpm [5 gallons / 45 seconds (0.75 minutes)]. The estimated purge time would be about 9 minutes (60 gallons/6.8 gpm or 12 (# of bucket volumes in the system) x 45 (seconds) = 540 seconds or about 9 minutes.

F. **Purge the system**

- Let the water flow for the required purge time.
- Follow any homeowner instruction regarding where to direct the purge water. All reasonable efforts should be made to prevent water ponding near the residence.
- As the water system is purging:
  - Fill in the following information on the sample labels and apply them to the sample containers (see HSOP-29):
    - sample date;
    - sample time; and
    - samplers initials.
  - Complete entries in the Field Logbook (see Section 8 and HSOP-31)
  - Using a calibrated water quality measurement meters (YSI or equivalent)[5] and a low flow cell, record the following measurements at the beginning, middle and end of the purging period (see applicable SOP listed in Section 9):
    - dissolved oxygen;
    - oxygen reduction potential;
    - temperature;
    - pH;
    - specific conductance; and
    - turbidity (Hach Turbidometer or equivalent).

  Field parameters are considered "stable" when the variability between sequential measurements is as follows:

Parameter	Stability Criteria
pH	$\pm$0.1
Temperature (°C)	$\pm$0.2
SC (µmhos/cm)	$\pm$5% (SC $\leq$ 100) or $\pm$3% (SC > 100)

[5] Preference is that water quality parameters be measured using a low flow cell. Other measurement methods are acceptable, but should be documented.

Dissolved oxygen (mg/L)	±0.3
Turbidity (NTU)	±10% (NTU < 100)

Modifications of the standard purge procedure are allowable if site conditions, the project work plan, or study objectives dictate such modifications.

- Note and record any unusual color, turbidity or odor associated with the water as it is purging and during sampling.

6.3 Sample Collection

- Once purging is complete, sample collection can begin. If a hose was used to direct away the purge water, remove the hose before filling the sample bottles. To collect the sample:
    - Use a very low flow rate. Turn the faucet down to a flow of < 100 mL/min and allow the water to run a few seconds before collecting the sample.
    - Sample bottles may be filled directly from the tap for most analyses. For dissolved metal analyses water should be field filtered using 0.45 µm filter apparatus with inert filters (see HF-SOP-073).
    - Wear nitrile gloves to fill the sample bottles. This is to maintain the integrity of the sample and to protect your skin from any spillage of the preservative in the bottles.
    - Fill the bottles at arm's length, pointing away from you. Wear safety glasses.
    - Sample bottles should be filled as directed by the Analytical Laboratory.
    - Do not allow bottles with preservative to overflow. If a preserved bottle overflows, discard it and sample again with a new bottle to avoid dilution of the preservative.
    - Preserve and store samples as appropriate for the intended laboratory analysis.
    - After the samples have been collected, they should immediately be placed in an ice filled cooler until relinquished or shipped to the appropriate contract laboratory (see HSOP-4).
    - Replace any faucet aerators, or reattach homeowner's hose, if necessary.
    - Pick up and remove all waste and wipe up any water spillage.
    - If the owner is present, tell them you have completed the task and are leaving. If the owner is not present, place the "Private Well Water Sampling Notice" in the door or other convenient location (Note: do not place in mailbox).

7.0 DECONTAMINATION

Equipment that is shared between sampling locations (water level meters, water quality meters) should be decontaminated before leaving the property (see Decontamination of Sampling Equipment HSOP-7). Buckets and hoses should be emptied on site. If it is known that the residential well is contaminated, equipment should be thoroughly rinsed with potable water.

8.0 RECORDS

Accurate record keeping is necessary to demonstrate sampling methodologies and the validity of the samples. Field notes shall be kept in a bound field logbook as specified in the Field Notebook technical procedure (HSOP-31). Records shall be recorded using waterproof ink. Sampling records should include:

- Site Name/Number;
- Date and time of sampling;
- Names of Sampling Team members;
- Weather conditions;
- Location and address of residential well;
- Well use history;
- Location of sampling (inside or outside);
- Field sketch of property/structure showing where sample was collected;
- Photograph of well location and sampling port location;
- Description of sample port type (e.g., ¾” gate value, kitchen faucet with aerator)
- Calculations (e.g., calculation of purged volume);
- Data for purge volume calculation (e.g., well depth, SWL, casing diameter, etc.);
- Volume of water purged before sampling;
- Location of sample tap;
- Discharge rate of faucet;
- Starting field parameters;
- Progressive field parameters as a function of time;
- Demonstration of field parameter stabilization, (i.e., at least 3 consecutive stable measurements);
- Parameters (inorganic compounds, metals, etc.) for which sample is to be analyzed;
- Sample volume, number, and container types;
- Laboratory chain of custody form;
- Sample cooler shipping document number, if applicable;
- Sample preservation;

- QA/QC samples collected; and
- Irregularities or problems.

9.0 ASSOCIATED DOCUMENTS

A. Decontamination of Sampling Equipment **(HSOP-7)**

B. Water Level Measurement with an Electric Probe **(HF-SOP-010)**

C. Field Measurement of pH using a pH Meter **(HF-SOP-020)**

D. Field Measurement of Dissolved Oxygen **(HF-SOP-022)**

E. Field Measurement of Specific Conductivity **(HF-SOP-079)**

F. Field Measurement of Temperature **(HF-SOP-084)**

G. Filtration of Water Samples **(HF-SOP-073)**

H. Chain-of-Custody Procedures, Packing, and Shipping Samples **(HSOP-4)**

I. Labeling and Documentation of Samples **(HSOP-29)**

J. Field Notebooks **(HSOP-31)**

The following forms will be completed and retained in the project file:

A. Water Sampling Form;

B. Chain-of-Custody Form; and

C. Shipping receipts.

10.0 REFERENCES

USGS, 2006. *National Field Manual for the Collection of Water-Quality Data: Chapter A4, Collection of Water Samples.* USGS TWRI Book 9, September 1999; Revised 2006..

Hydrometrics, 2010. *Quality Assurance Project Plan for Environmental Data Collection Activities – East Helena Facility*. Prepared by Hydrometrics, Inc. for the Montana Environmental Trust Group. May 2010.

METG
Montana Environmental Trust Group

Date/Time: ________________________

Dear Neighbor:

Thank you for allowing us to sample your well today. We will be submitting the water sample for analytical testing. We anticipate the results of this testing will be available in approximately one month and will provide the results to you.

Please feel free to contact METG if you have any questions or concerns regarding this sampling by either:

Phone: (406) 227-3734 or
Email at lg@g-etg.com

You cooperation is greatly appreciated.

Sincerely,

Montana Environmental Trust Group, LLC
1000 Smelter Road, P.O. Box 1230
East Helena, MT 59635

METG
Montana Environmental Trust Group

Date/Time: ________________________

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East Helena, MT 59635

APPENDIX B

2024 INTERIM CORRECTIVE ACTION

PERFORMANCE MONITORING REPORT

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2024 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT

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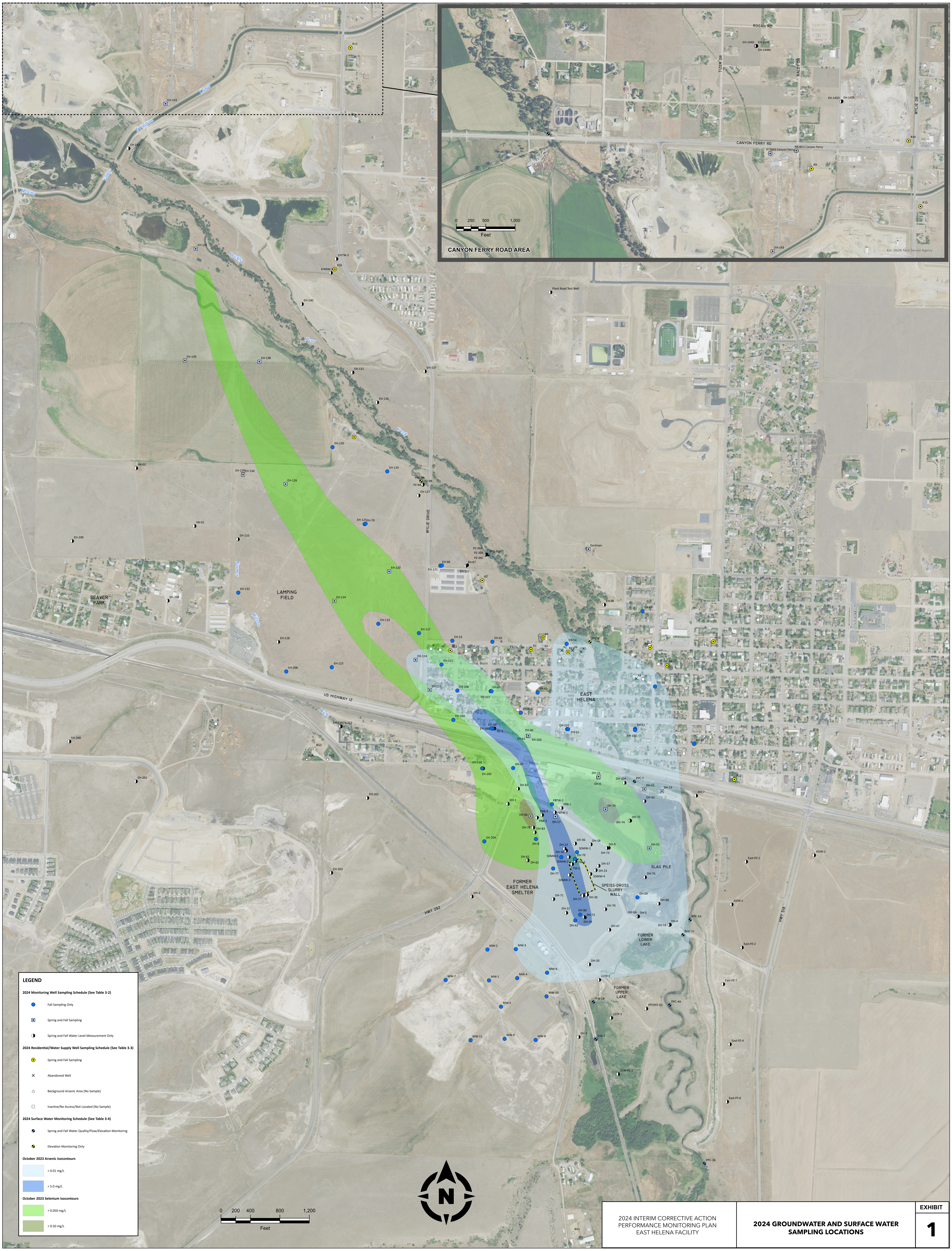
EXHIBIT 1

2024 GROUNDWATER AND SURFACE WATER

SAMPLING LOCATIONS



2024 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING PLAN
EAST HELENA FACILITY

2024 GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS

EXHIBIT **1**

Updated by: mwalker 5/1/2024 1:02 PM
G:\PROJECT\10022\2024 CAPMP\2024CAPMP.aprx [Exhibit1; Exhibit1_2024_Wells]

Hydrometrics, Inc.