AIR WATER SOIL

November 4, 2024

Mr. Dave Douglas
Mountain View Co-Op
P.O. Box 1299
Great Falls, Montana 59403-1299

Subject: Groundwater Monitoring Work Plan
Mountain View Co-Op – 1000 Smelter Avenue, Great Falls, Montana
DEQ Facility ID 07-0004 (TID 18320); Release 1728; WPID 34946
AWS Project 14064.3.6

Dear Mr. Douglas,

Air Water Soil, LLC (AWS) is pleased to present this work plan to complete groundwater monitoring activities at the Mountain View Co-Op petroleum release site (hereafter, “the Site”). The Site is located at 1000 Smelter Avenue in Great Falls, Montana.

AWS has prepared this work plan on behalf of Mountain View Co-Op in response to an October 7, 2024, *Groundwater Monitoring Work Plan Required* letter issued by the Montana Department of Environmental Quality Petroleum Tank Cleanup Section (DEQ). As requested by DEQ, this work plan has been created to satisfy the requirements stipulated in the *Montana Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases* document, draft dated March 2021 (Work Plan Guidance). The guidance does not require submittal of reference figures, and none are included herein.

SITE DESCRIPTION

The Site is an active petroleum distribution facility that provides retail sale of gasoline and diesel fuel products. Fuel is stored in six underground storage tank (UST) systems and dispensed via retail dispenser islands.

Previous investigations have resulted in the drilling and construction of 8 monitoring wells across the Site. Interior well depths range from 26 to 50 feet below ground surface (bgs), with screened sections beginning at 5 to 10 feet bgs and extending to the full depth of each well.

Drilling has identified sand and clay sediments from just below the pavement section to depths between 12 and 30 feet bgs. The sediments are underlain by mudstone bedrock, with of sandstone and limestone lenses, to depths greater than 50 feet bgs. Shallow groundwater is present and saturated conditions exist at depths greater than 10 feet bgs.

Groundwater flow has historically been reported from north to south below the Site. This flow mimics the regional topography, which also slopes downward from north to south in the area.

BACKGROUND

The petroleum release has been extensively investigated per the requirements of the DEQ. AWS's understanding of the extensive investigative history is based on information provided by Mountain View Co-Op from their previous consultants.

- **1995** – Release 1728 was identified during the replacement of underground storage tanks and piping. Atlatl Inc./ JBR Environmental Consultants, Inc. (JBR) installed a soil vapor extraction system around the tank basin and along the piping trenches to treat contamination left in place.
- **2000 through 2001** – JBR completed direct push investigations and found that soils were minimally impacted by petroleum hydrocarbon contamination.
- **2001** – JBR drilled and constructed monitoring wells MW-1 and MW-2. Subsequent sampling of groundwater from these wells found petroleum contaminant concentrations above regulatory guidelines.
- **2006** – JBR continued to investigate the release and drilled and completed wells MW-3, MW-4, MW-5, MW-6, and MW-7.
- **2007** – JBR replaced well MW-2, because it had been destroyed, and drilled and completed well MW-8.
- **2007 through 2012** – JBR continued to monitor all wells. Petroleum impacted groundwater, at concentrations above regulatory guidelines, was initially identified in wells MW-1, MW-2, MW-4, and MW-6. By 2012, concentrations had reduced to be below regulatory standards in all wells except well MW-1.
- **2016** – CTA Environmental completed groundwater monitoring in January and July. Monitoring data from both events identified petroleum contamination above DEQ promulgated guidelines only in well MW-1.
- **2021** – AWS completed groundwater monitoring in September. Monitoring data continued to identify petroleum contamination above DEQ promulgated guidelines only in well MW-1.
- **2022** – Mountain View Co-Op opted to remodel the entire Site. This included razing the existing buildings, removing and replacing the UST systems, grading the Site, and constructing a new Site convenience store. The following incidents occurred during the remodel work:
  - A diesel fuel release was identified during removal of the existing UST systems. This release was reported to DEQ and given the Incident Identifier CVID 24284. The release appeared to be caused by tank overfill events that occurred prior to secondary containment requirements mandated for tank systems beginning in 2015.

- Mountain View Co-Op had their contractor excavate and remove visibly impacted tank basin materials associated with release CVID 24284. This resulted in approximately 200 cubic yards of impacted material being transported offsite for disposal.
- To accommodate the installation of new UST systems, Mountain View Co-Op had their contractor deepen and widen the former UST basin area. During the excavation work, Mountain View Co-Op and AWS personnel visibly identified the location of residual petroleum-impacted soil and bedrock from Release 1728 as present below the former USTs.
- The excavation work deepened the tank basin by approximately 1 to 1.5 feet across a 2,400 square foot area. The excavated materials were notably impacted by Release 1728; and thus, the work resulted in the remediation of approximately 89 to 133 cubic yards of petroleum impacted materials.
- Mountain View Co-Op personnel collected and laboratory analyzed samples from the base of the excavation area. As noted in an October 5, 2022, report prepared by AWS and submitted to DEQ for the closure of the CVID 24284 incident, the sampling confirmed that only a small area of residual petroleum impacted soil and bedrock was left in place. This finding was based on the concentrations being compared to maximum allowed concentrations promulgated by the DEQ at that time.

OBJECTIVES

This work plan has been prepared to address the following objectives for DEQ's requested work:

- Define the condition and usefulness of the 8 existing monitoring wells after the extensive Site construction and remodeling activities that occurred in 2022.
- Recommend wellhead repairs, well redevelopment, well abandonment and/or replacement, as needed, after the onsite inventory has been completed.
- Submit a work plan modification, if needed, to address the well needs.
- Define current groundwater petroleum contaminant concentrations and compare them to Risk-Based Screening Level (RBSL) values provided in the most current version of Montana's *Risk-Based Corrective Action Guidance for Petroleum Releases* (RBCA Document).
- Recommend strategies that will lead to closure of Release 1728.

SCOPE OF WORK

In order to achieve the stated objectives, AWS has prepared the following scope of work to include the following 10 tasks: 1) Preliminary Scoping and Work Plan Preparation; 2) Project Administration; 3) Mobilization; 4) Well Assessment; 5) Well Improvements; 6) Groundwater Monitoring; 7) Laboratory Analyses; 8) Data Validation; 9) Release Closure Plan Update; and 10) Report Preparation. AWS's proposed methods for these tasks are described in the following sections. Copies of referenced Standard Operating Procedure (SOP) documents are provided in Appendix C.

Task 1 – Preliminary Scoping and Work Plan Preparation

AWS completed a detailed evaluation of past investigative efforts to define data gaps and to develop objectives for this work plan. The preliminary evaluation guided the scoping of the herein presented tasks, and the effort was actual, reasonable, and necessary to the ongoing investigation and remediation of Release 1728.

This work plan and cost estimate (provided in Appendix B) have been created to satisfy the requirements stipulated in the Work Plan Guidance. Work plan preparation included designing the investigation, estimating costs to implement each task, creating figures, and preparing this document to address each of the tasks identified in the preliminary scoping effort.

Task 2 – Project Administration

Project management activities include correspondence with Mountain View Co-Op, DEQ staff, and Petroleum Tank Release Compensation Board (PTRCB) staff regarding the scope of work and project costs. Project management will also include coordinating site access; scheduling and coordination of subcontractors, field personnel and activities; procuring equipment and supplies, as necessary, to complete the scope of work; and budget tracking.

Task 3 – Mobilization

Mobilization includes labor and vehicle mileage costs for project travel necessary to complete the scope of work. This generally includes AWS personnel's travel to and from the site, as well as preparation time of up to 1 hour per mobilization event, as applicable, per PTRCB's standard reimbursement practice. Mobilization also includes costs for travel for delivery of samples to the analytical laboratory or shipping facility.

Field activities may be combined to reduce mobilization events and costs, where feasible. For the purpose of this work plan, the anticipated mobilization events necessary to complete the scope of work are summarized as follows:

- Well Assessment
  - 1 mobilization
  - Tech II
- Well Improvements
  - Unknown number of mobilizations (to be determined)
  - Uknown personnel (to be determined)
- Groundwater Monitoring
  - 2 mobilization events
  - Tech II

<u>Task 4 – Well Assessment</u>

AWS personnel will inspect and assess the viability of the 8 existing monitoring wells to determine if any of the wells need to be replaced, repaired, or abandoned. This will include:

- Visually assessing each wellhead condition, especially the condition of the visible surface seal and flush-mount cover, and documenting conditions at each of the 8 wells with photographs.
- Measuring the depth to water (DTW), and if present the depth to free product petroleum (DTP) in each monitoring well, following the procedures outlined in *AWS SOP-04* provided in Appendix C.
- Measuring the total depth of each monitoring well and comparing the measurement to known well construction information to determine if blockages are present.
- Visually assessing the color and turbidity of groundwater in each monitoring well by manually withdrawing water using a disposable bailer.

AWS will use all the gathered information to evaluate the current condition of each well and to formulate recommendations for repairs and replacements, as needed.

<u>Task 5 – Well Improvements</u>

After completion of the well assessment task, AWS will notify DEQ of the findings and will make recommendations for well improvements, as needed. At a minimum, additional work will include surveying the wells and creating an updated Site plan. The scope and fees associated with well improvement tasks will be presented to DEQ and PTRCB via *Corrective Action Modification, Form 8* documents.

<u>Task 6 – Groundwater Monitoring</u>

Groundwater monitoring will occur after completion of the Well Assessment and Well Improvements tasks. For purposes of this work plan, AWS assumes that all 8 existing wells will be utilized for groundwater monitoring. However, the actual number of wells monitored may change.

Groundwater monitoring will include groundwater sampling in accordance with *AWS SOP-06* (Appendix C) The monitoring work is intended to evaluate the current status of groundwater contamination below the Site and to measure water quality parameters so that remediation strategies can be evaluated. Specific analytical parameters to be evaluated at each well location are summarized in the groundwater monitoring analytical plan presented in Appendix A.

DTW and DTP will be measured following the procedures outlined in *AWS SOP-04* and groundwater monitoring will be completed in accordance with *AWS SOP-06 – Groundwater Sampling*. AWS anticipates utilizing a peristaltic pump system to obtain samples for this project. Natural samples will be collected from each of the specified monitoring wells, along with 1 duplicate sample collected from 1 monitoring well during the event.

Laboratory samples will be containerized, preserved, and transported to the analytical laboratory following the procedures outlined in *AWS SOP-08*, and in accordance with the referenced analytical methods, using vessels and preservatives provided by the analytical laboratory.

Reusable monitoring and sampling equipment will be decontaminated following *AWS SOP-01* prior to use in each monitoring well. Unused water evacuated from each well will be handled in accordance with *AWS SOP-56*.

Task 7 – Laboratory Analyses

AWS will request that Energy Laboratories, Inc. (Energy) analyze groundwater samples for the testing suite presented in Appendix A. Analyses will include determining concentrations of Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbon (EPH) contaminants in accordance with the RBCA Document. Supplemental analyses will also be completed to assess natural attenuation parameters and aquifer conditions. Duplicate samples, collected for data validation purposes, will only be analyzed for VPH contaminants.

Task 8 – Data Validation

Upon receipt of final laboratory analytical results for the groundwater sampling event, AWS will complete data validation in accordance with DEQ's *Data Validation Summary Form*. Data will be validated to assess the precision, accuracy, repetitiveness, comparability, and completeness of the reported parameters.

Task 9 – Release Closure Plan Update

Following completion of all field tasks and receipt of final analytical data, AWS will update the previous Release Closure Plan (RCP) for Release 1728. Available data will be evaluated to help determine an appropriate remediation plan to address residual contamination from the petroleum release. The updated RCP will also aid in identifying data gaps which may need to be addressed for Release 1728.

Task 10 – Report Preparation

Following completion of Tasks 2 through 9, including receipt and review of all final analytical data, AWS will prepare a summary report which will comply with DEQ's *Groundwater Monitoring Report (GWM*) format. The report will include a discussion of findings from the activities completed as part of this scope of work; a discussion of the data validation; a discussion of the updated RCP; and a discussion of conclusions and recommendations for future activities.

Data will be presented in tabular form and select information will be presented on a site diagram(s). The report will be submitted to Mountain View Co-Op and DEQ electronically, in Portable Document Format (PDF); a hard copy will not be prepared or provided.

SCHEDULE

AWS will initiate the scope of work following our receipt of Mountain View Co-Op's authorization to proceed, which shall follow our receipt of DEQ approval of this work plan. The actual project schedule will be contingent on various conditions which are indeterminable at the time of preparation of this document, including but not limited to approval from all listed parties, weather, and availability of AWS personnel. AWS will coordinate with Mountain View Co-Op, DEQ and other stakeholders as appropriate.

FEE

AWS's fee for completing the scope of work described in this work plan will be assessed on a time-and-materials basis, in accordance with the attached Cost Estimate (Appendix B). Our estimated total fee for completing the scope of work detailed in this work plan is approximately **$15,151.** Our cost estimate has been prepared using AWS's current, PTRCB-approved 2024 labor and equipment rates and reimbursable costs. The services provided will be invoiced using rates approved by the PTRCB for the current billing period.

Actual costs may vary depending on a variety of factors, including but not limited to unforeseen delays or other necessary but unexpected changes to the scope of work. AWS will coordinate changes to the scope of work with Mountain View Co-Op and DEQ, as appropriate.

LIMITATIONS

The scope of work included in this work plan has been prepared for Mountain View Co-Op and includes only those services described above. This work plan does not include remedial or disposal services, or costs for such services, beyond those listed specifically in the scope of work.

AWS cannot and does not warrant that the scope of services described in this work plan will be adequate to identify all potential environmental conditions or latent conditions at the Site. Our scope of work will be performed with a standard of care meeting or exceeding that of other environmental consultants performing similar work in the area.

ACCEPTANCE

A complete copy of this Work Plan will be submitted on behalf of Mountain View Co-Op to Mr. Donnie McCurry with DEQ. After his review and approval, AWS will confirm your approval before proceeding to complete the scope of work presented herein.

Please contact us in our Great Falls office (406.315.2201) if you have any questions or concerns regarding this project. We appreciate your business and look forward to work with you on this project.

Respectfully Submitted,

Alan Frohberg, P.E.
Project Manager
alan@airwatersoil.com

Appendices: A – Groundwater Monitoring Analytical Plan
B – Cost Estimate
C – Standard Operating Procedures

cc: Mr. Donnie McCurry, Montana DEQ PTCS, P.O. Box 200901, Helena, MT 59620. Transmitted via DEQ FTP server.

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APPENDIX A

Groundwater Monitoring Analytical Plan

GROUNDWATER MONITORING ANALYTICAL PLAN

Groundwater Monitoring Work Plan
Mountain View Co-Op – 1000 Smelter Avenue, Great Falls, Montana
DEQ Facility ID 07-0004 (TID 18320); Release 1728; WPID 34946

Wells	Depth to Water (DTW)	Volatile Petroleum Hydrocarbons (VPH) *(MT VPH Method)*	Extractable Petroleum Hydrocarbons (EPH) Screen *(MT EPH Method)*	EPH Fractions *(MT EPH Method)*	1,2-dichloroethane (DCA) *(Method 8260B)*	Ethylene Dibromide (EDB) *(Method 8011)*	Alkalinity *(Method A2320B)*	Dissolved Methane *(Method SW8015M)*	Sulfates *(Method E300.0)*	Sulfides *(Method A4500-SF)*	Nitrogen, Nitrate + Nitrite *(Method E353.2)*	Dissolved + Total Iron and Manganese *(Methods E200.7/E200.8)*
MW-1	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-2	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-3	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-4	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-5	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-6	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-7	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
MW-8	✓	✓	✓	✓	✓	--	✓	✓	✓	✓	✓	✓
Duplicate	--	✓	--	--	--	--	--	--	--	--	--	--

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APPENDIX C

Standard Operating Procedures

EQUIPMENT:

- Disposable gloves (e.g., latex, nitrile)
- Eye protection
- Phosphorus-free detergent concentrate (e.g., Alconox®, Liquinox®)
- Concentrated alcohol (e.g., isopropyl, methanol) to make 10% solution
- Concentrated nitric acid to make 10% solution
- Deionized (DI), distilled, or potable tap water
- Spray bottles, collapsible dispensers, buckets, basins
- Scrub brushes
- Disposable wet-wipes
- Paper towels
- HEPA-filtered vacuum
- Garbage bags

PROCEDURE:

Decontamination of asbestos sampling tools and equipment is generally accomplished using HEPA-filtered vacuums, disposable wet-wipes, or water and paper towels. Cleaning is continued until visible contaminants are removed to prevent cross contamination between samples, and to prevent potential fiber exposure.

Decontamination of petroleum investigation sampling equipment generally includes a 3-step process: 1) detergent scrub; 2) alcohol/acid rinse; and 3) water rinse.

Prepare detergent solution by mixing detergent concentrate with potable water in a large cooler or basin. Keep this mixture free from contaminants; draw small portions out into smaller basins/buckets as needed. Prepare 10% alcohol-in-water and 10% nitric acid-in-water solutions in collapsible containers and/or spray bottles. Methanol and nitric acid solutions should be prepared using DI or distilled water.

Decontamination should be performed in an area upwind of the contamination zone or otherwise reasonably free from contaminants of concern. Gross contaminants/debris should be removed from equipment and left in the sampling area(s) if practicable. Remove remaining gross contamination by scrubbing equipment with detergent solution in a small basin. Empty basin and refill with fresh detergent solution as necessary. Rinse with alcohol solution, nitric acid solution (when sampling for metals), and DI/distilled water.

Dry decontaminated equipment using paper towels or place in an area as free from contaminants of concern as practicable an allow to air dry.

Caution should be used to avoid direct contact with contaminated materials; gloves and eye protection should be worn during preparation of decontamination fluids and during decontamination of sampling equipment. Decontamination fluids should be prepared in a location as free from contamination as practicable.

DISPOSAL:

All disposable items (soiled wipes, used paper towels, vacuum filters, etc.) should be deposited into a garbage bag and properly disposed. Decontamination waste from asbestos decontamination may require disposal as asbestos waste.

Decontamination fluids for petroleum investigations do not need to be collected under most circumstances. Spread decontamination fluids over a paved surface, if practicable.

EQUIPMENT:

- Electric Water Level Indicator (well probe)
- Electronic Oil-Water Interface Probe (interface probe)
- Extra batteries
- Field sampling forms
- Decontamination equipment

CALIBRATION:

The well probe and interface probe should be checked annually at a minimum, or more frequently as needed, for proper operation prior to completing field activities. The well probe should be checked by lowering the probe into a cup of clean water and confirming the probe's proper response. The interface probe should be checked by lowering the probe into a cup containing both vegetable oil and clean water, and where the oil and water have had time to separate into two distinct layers, and confirming the probe's proper response to each layer.

GENERAL:

Measure the depth to water in all wells , using the well probe, from the north quadrant of the top of the well casing or from a designated measuring point, as appropriate. Measure and record vertical distance from measuring point to ground level (unless measuring point has been surveyed for elevation). Make sure the measuring point is labeled or marked on the well casing so future measurements can be made from the same location. Obtain a depth to water from the established measuring point to the nearest hundredth of a foot. Record data on appropriate field forms.

Decontaminate the well probe between each well in accordance with AWS SOP-01 and/or the project-specific SAP.

If free-product petroleum is known or suspected to be present in a well, an interface probe should be used to measure the depth to water and thickness of free product in the well.

Using the interface probe, measure the depth to the top of free-product below the designated measuring point. Continue to lower the probe until the bottom of the product/top of groundwater interface is reached. Record both measurements on field forms. Product thickness can be calculated by subtracting the depth to the top of free-product measurement from the depth to groundwater/free-product interface measurement.

Decontaminate the interface probe between each well in accordance with the AWS SOP-01 and/or the project-specific SAP.

EQUIPMENT:

- 5-gallon bucket graduated in gallons
- Low-flow cell or 12-ounce glass jar
- Hydrogen potential (pH) and temperature meter
- Specific conductance (SC) meter
- Dissolved oxygen (DO) meter
- Oxidation/reduction potential (ORP) meter
- Turbidity meter
- Coolers and ice
- Sample bottles
- Sampling pump – Peristaltic or Bladder-type with controller and compressor
- Disposable bladders (if using bladder pump)
- Disposable tubing
- Bailer(s)
- Bailer rope or Teflon cable reel
- Preservatives
- Disposable in-line filters or filter apparatus with filter media
- Field sampling forms
- Decontamination equipment and indelible marker
- Fluids
- Stopwatch
- Electronic Oil-Water Interface Probe (interface probe)
- Graduated vessel

MAINTENANCE:

All equipment should be inspected for damage and proper functionality (including battery charge) prior to use in the field. Unstable or "drifting" measurement readouts may be indicative of damaged probes/sensors, especially if the problem persists following recalibration. Damaged or improperly functioning equipment should be repaired or replaced as appropriate.

All meters, probes, pumps, sampling equipment, and sample vessels should be decontaminated in accordance with AWS SOP- 01 and following completion of sampling.

CALIBRATION:

Instruction manuals should always be kept with meters, especially sections pertaining to calibration and trouble shooting. Keep spare batteries with each meter. Calibration fluids appropriate for the anticipated sample ranges (pH 4.01 buffer solutions for acidic samples) should be kept with meters and should not be used if marked expiration dates have been exceeded. Several small sample vessels should be kept with meters for calibration and sample analyses.

Calibration of individual meters will vary; calibration should always be performed in accordance with the manufacturer's recommendations. In general, most meters should be calibrated at the beginning of each field day, at a minimum. Additional calibrations may be necessary if meter readings become questionable. Performance of "bump testing" to determine whether meters are within acceptable calibration ranges is advisable for sampling events longer than approximately 6 hours.

DO meters calibrate with barometric pressure. ORP and SC meters may only require periodic calibration using calibration solutions appropriate for the anticipated sample ranges. Two or three-point calibration is advisable for most pH meters; for two-point calibrations, consideration should be given to the anticipated sample range. Turbidity meters use four standards for calibration (800 NTU, 100 NTU, 20 NTU, and 0.02 NTU), if 20, 100, or 800 NTU drifts more than 10% the solution needs to be replaced. Temperature sensors for most meters do not require calibration.

PROCEDURE:

AWS will complete groundwater sampling in accordance with the procedures presented below. Where applicable, groundwater sampling procedures will also be completed in accordance with the current version of DEQ's *Groundwater Sampling Guidance.*

Initial Measurements - Begin by determining the depth-to-water (DTW) in accordance with the AWS SOP-04, and/or the project-specific SAP. If DO is a desired field analysis, gently lower the DO meter's probe, calibrated per manufacturer's guidelines, to just beyond the DTW observed in the previous step. Once submerged, readings will begin trending in a consistent increasing or decreasing manor, until a transitional point is reached and the initial trend is reversed. This transitional point should be recorded on the appropriate sampling form as the pre-purge DO.

Well Purging - Purging must be performed on all wells prior to sample collection. Well purging will be accomplished using a peristaltic pump, bladder pump, or with a disposable polyethylene bailer. The specific purging method shall be chosen based on the following: DTW; diameter of well; existing well configuration; contaminant(s) of concern; and/or, the project-specific SAP. Sampling is generally not conducted when free product (e.g., light non-aqueous phase liquid, or LNAPL) is present.

Where pumping methods are used, field water quality indicators (WQIs) will be observed and recorded in approximate five-minute intervals. Evacuation of fluids will continue until DO, pH, SC, ORP, and turbidity readings stabilize. Stabilized readings will include changes of no more than 0.1 standard unit (su) for pH and no more than 3 percent (%) for SC, no more than 10 percent (%) for DO and turbidity, and 10 millivolts (mV) for ORP.

Where bailer methods are used, purging should remove at least three (3) casing volumes of fluid from the well and until stabilized WQIs are achieved. The following equation is used to calculate well casing volume in gallons:

$$V = 3.14 \times (r^2) \times h \times 7.48$$

Where: V = volume (gallons)
r = well radius (feet)
h = height of water column in well (feet)

The radius of the well pack will be used for the well radius (r) for calculating volumes. For example, a 2-inch diameter PVC monitoring well installed in a 6-inch diameter borehole with sand filter pack would use a well radius of 3 inches or 0.25 feet.

The height of the water column (h) is calculated as the total well depth minus the DTW measurement for the well.

WQIs will be observed during bailing of each well, if feasible. Stabilized readings will include changes of no more than 0.1 su for pH, no more than 3% for SC, no more than 10% for DO or turbidity, and no more than 10 mV for ORP. If WQIs have not stabilized after five (5) casing volumes have been evacuated, it is at the discretion of the AWS field technician whether to collect a sample or to continue purging.

The actual pumping duration and/or volume of water purged from the well, along with the WQI readings, must be recorded on appropriate sampling forms for all methods of purging.

Wells with documented or expected low yield/slow recovery may require sample collection without prior purging due to limited available water volume.

If the recovery of a low-yield well exceeds 2 hours after purging, a sample shall be extracted as soon as sufficient volume is available in the well. At no time will a monitoring well be pumped dry if the recharge rate causes formation water to cascade down interior portions of the well casing, causing an accelerated loss of volatile organics and change in pH.

General Well Sampling - Wells must be sampled from the least contaminated to the most contaminated, if known. Open well and measure DTW in accordance with the AWS SOP-04. Decontaminate all sampling/down-well equipment in accordance with the AWS SOP-01. Use disposable nitrile gloves throughout decontamination and sampling procedures and use new gloves for each sampling point.

The actual pumping duration and/or volume of water removed from the well, along with all WQI readings, must be recorded on appropriate sampling forms for all methods of sampling.

Low-Flow Method - The goal of low flow purging and sampling is to collect water samples that reflect the total mobile organic and inorganic loads transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. During this procedure, emphasis is placed on minimizing hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations.

WQIs are monitored during purging to identify stabilized conditions to determine when sample collection may begin. Stabilized readings will include changes of no more than 0.1 su for pH, no more than 3% for SC, no more than 10% for DO or turbidity, and no more than 10 mV for ORP.

The low-flow method should be implemented with a positive-lift pump (e.g., peristaltic or bladder pump). The pump intake should be located within the well-screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The following equation is used to calculate the pump intake depth or sampling depth:

$$SD = DTW + [(TD - DTW) \div 3]$$

Where: SD = Sampling depth (feet)
DTW = Depth to water (feet)
TD = Total well depth (feet)

Note this equation places the pump intake in the upper one-third of the water column and should be modified to sample from deeper depths, accordingly (e.g., if wanting to sample from the middle of the water column, replace the value of 3 with 2 in the equation).

The low-flow cell should be set up over the 5-gallon bucket so that the pump tubing discharge flows into the cell and overflows into the bucket. The pH, temperature, SC, and ORP (if used) meters should be set up to monitor water quality in the low-flow cell during purging and sampling.

Disposable tubing should be cut to a length that extends from the down-well bladder pump, or sampling depth for peristaltic pump, to the low-flow cell discharge point.

DTW should be measured before installing the pump and continuously recorded during purging at consistent intervals (e.g., 5 or 10 minutes). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure drawdown of less than 0.3 foot or stabilization of the water level. If the minimal drawdown that can be achieved exceeds 0.3 foot, but remains stable, continue purging until the three (3) casing volumes are removed and/or water quality parameters stabilize.

The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 foot and WQIs have stabilized, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Bailer Method – Removal of water from the well by bailing will be accomplished using a new, disposable, polypropylene (or other material specified in the SAP), bailer and a spool of polypropylene rope or equivalent bailer cord (e.g., Teflon-coated stainless-steel cable). The length of the bailer and cord should be sufficient for the bailer intake to reach the middle of the well-screen section, and to allow evacuation of water from the lower one-third of the well casing, if needed.

Bailing should be a semi-continuous procedure of removing water from the upper one-half of the water column. Care should be taken not to disturb sediment in the bottom of the well.

Bailed water should be gently poured into a decontaminated, 12-ounce glass jar equipped with pH, temperature, SC, and ORP (if used) meters to monitor water quality. Bailing will continue until the purging requirements stated previously are achieved.

Domestic Well Sampling – If an active domestic or irrigation well needs to be sampled, then the water needs to be initially purged. First, the total volume of water in the well casing is calculated using equation provided on Page 2 of this SOP. Thereafter, a minimum of three (3) casing volumes of water should be evacuated from the well prior to sampling.

Well purging should be accomplished by opening a faucet connected to the well pump. A faucet location should be selected as close to the well pump as possible. The faucet shall not be located after water treatment systems such as softeners or filtration units.

Flow from the faucet should be measured using a graduated vessel and stopwatch. Several measurements should be taken to monitor possible changing flows during the purging procedure.

If desired, WQIs may be monitored in the discharged fluid during the well purging.

Collecting Water Samples - Label each sample container with project number, sample location, well owner, date, time, sampler's initials, preservative, and analysis required. Wear new disposable nitrile gloves immediately prior to obtaining the sample.

For low-flow samples, several inches should be cut from the end of the sample effluent tubing (i.e., removing the portion in contact with the flow-through monitoring cell) before collecting water samples. A disposable in-line filter should be attached to the cut end of the tubing, as needed, prior to collection of filtered samples.

For domestic well sampling, pump flow should be reduced so that a constant minimal flow is achieved from the faucet. Samples should be collected directly from the faucet and not through rubber hoses. Filtered samples may be obtained by using a filter apparatus fitted with new filter media.

When using a bailer, take care to minimize degassing or contamination of the sample by submerging and withdrawing the bailer slowly to avoid splashing. Do not place the bailer on the ground. Filtered samples may be obtained by using a filter apparatus fitted with new filter media.

Add preservatives to the sample container prior to sample collection. Remove water from the well and transfer sample water directly into sample bottles (using an in-line filter or filter apparatus, as necessary), maintaining a slow linear flow with as little agitation as possible.

For volatile analyses, fill vials at the rate of about 100 milliliters per minute (24 seconds for 40 mL vial) or less. Fill each sample vial completely so the water forms a convex meniscus at the top to ensure no air space exists in the vial after it has been capped. After filling, immediately cap, invert, and gently tap the vial to check for trapped air. If air bubbles are present, un-cap vial, add more sample water and repeat procedure. If air bubbles continue to be present after repeated filling attempts, cap the vial, keep for laboratory analyses, and note the condition on the field form.

For inorganics samples not requiring preservatives, rinse sample containers three (3) times with sample water before final collection. Do not rinse containers for organics analysis.

Water samples should be preserved as described in the following table, or in accordance with instructions from the analytical laboratory, if different:

PARAMETER	NUMBER	CONTAINER	PRESERVATION	MAXIMUM HOLDING TIME UNTIL EXTRACTION / ANALYSIS
VOCs	3	40 mL glass VOA	6°C and HCL	14 days
VPH	2	40 mL glass VOA	6°C and HCL	14 days for extraction/ 28 days for analysis
EPH	2	1000 mL glass bottle	6°C	14 days for extraction/ 28 days for analysis
SVOCs	2	1000 mL glass bottle	6°C	7 days for extraction/ 40 days for analysis
Metals	1-2*	250 mL plastic bottle	6°C and HNO_3	6 months 28 days for mercury
Inorganics	1	Varies	varies	Varies – contact laboratory

Notes: VOCs – Volatile Organic Compounds; VPH – Volatile Petroleum Hydrocarbons; EPH – Extractable Petroleum Hydrocarbons; SVOCs – Synthetic Volatile Organic Compounds; mL – milliliter; °C – degrees Celsius; HCL – hydrochloric acid; HNO_3 – nitric acid. *Filtered and/or unfiltered.

Dispose purge water in accordance with AWS SOP-56.

Replace well cap and lock (if present) when sampling is complete, and replace all appurtenances on domestic wells (if present prior to work), when sampling is complete.

Prepare all necessary chain-of-custody forms, sampling forms, and other documentation. Package and ship samples in accordance with AWS SOP-08.

CHAIN-OF-CUSTODY PROCEDURES:

A chain-of-custody (COC) form must be prepared for all samples collected in the field for laboratory analysis. Multiple samples from the same sampling event, relating to a specific single project, may be included on a COC form. Samples from more than one project should not be included on the same COC form. The sampler should use a COC form provided by the laboratory performing sample analyses.

Completed COC forms must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory. The completed COC form should accompany the samples through analysis and final disposition. A copy(ies) of the COC form(s) should be maintained in the project file.

Information to be included on the COC form will include, but is not limited to:

- Project number / name
- Sampler's name and signature
- Date and time of sample collection, per sample
- Unique sample name/identification (ID)
- Number of containers per sample
- Sample media (e.g., soil, water, vapor)
- Sample preservative (if applicable)
- Requested analysis(es)
- Comments or special instructions to the laboratory

All samples must be assigned unique sample names/IDs. The information on the COC form, including the ID for a specific sample, must correspond to the information recorded by the sampler on the field forms, and the sample ID label on the sample container, for the respective sample.

A sample is considered under a person's control when it is in their possession. When custody of a sample is relinquished by the sampler, the sampler will sign and date the COC form and note the time that custody was relinquished. The person receiving custody of the sample will also sign and date the form and note the time that the sample was accepted into custody. The goal is to provide a complete record of control of the samples. Should the chain be broken (signed by the relinquisher, but not receiver, or vice versa), the integrity of the sample is lost and the reliability of the resulting analytical data may be degraded.

Samples must be packaged and shipped (or directly transported) to the laboratory following the procedures described below. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples must be relinquished to the shipping service. If possible, have the shipping service sign the COC form prior to placing the COC form in the sample cooler. If this is not possible (i.e., form placed in sealed cooler), a note should be included on the COC that the shipping company will receive the samples with the COC form inside the sample container.

PACKAGING:

All environmental samples should be packaged and shipped using the following procedures:

- Label all sample containers with indelible ink (on the side of the container, not on the cap or lid).
- Place labeled sample containers in a sturdy outer shipping box or cooler. When samples must remain refrigerated, use a well-insulated cooler containing an adequate amount of ice, making sure the cooler drain plug is taped shut (if applicable). Water ice should be used whenever feasible. Use of dry ice is more likely to result in freezing of samples, and use of reusable (e.g., “blue”) ice packs is likely to result in samples exceeding the allowable temperature range.
- Place soil and water sample containers in an upright position and wrap the containers with cushioning material for stability during transport. Samples should not be loose; the cooler and packed samples should be able to withstand rough handling during shipment without sample container breakage. If feasible, all sample containers and ice bags should be placed inside at least 1 heavy plastic bag, inside the cooler. The top of the outer bag should be twisted and taped in a “goose neck” fashion to help prevent leaks. It is advisable to place absorbent materials in the outer bag when liquids (including water ice) will be shipped.
- Fill out the appropriate shipping forms and place the paperwork in a Ziploc® bag (or equivalent) and tape it to the inside lid of the shipping container. Shipping forms usually include: 1) a COC form, documenting the samples included in the shipment; 2) an analysis request form, specifying the laboratory analyses for each sample (these are usually on the same form but may be separate).
- If more than one cooler is used per COC, put a photocopy in each of the additional coolers and mark them as a copy. Clearly identify on the COC (and copies) the total number of coolers included in the sample group.
- Complete and apply a custody seal to the exterior of each cooler where the lid meets the cooler container. Close and seal the cooler using clear packing tape. Secure the shipment label with address, phone number and return address clearly visible.

SHIPPING HAZARDOUS MATERIALS / WASTE:

Hazardous materials need to be shipped using procedures specified under Federal Law.

Transportation regulations for shipping of hazardous substances and dangerous goods are defined by the U.S. DOT in 49 CFR, Subchapter C, Part 171 (October 1, 1988); IATA and ICAO. These regulations are accepted by Federal Express and other ground and air carriers.

According to U.S. DOT regulations, environmental samples are classified as Other Regulated Substances (ORS). ORS are articles, samples, or materials that are suspected or known to contain contaminants and/or are capable of posing a risk to health, safety, or property when transported by ground or air. Samples, substances, or materials from sources other than material drums, leachate streams, and sludges should be considered as ORS or environmental samples. Materials shipped under the classification of ORS must not meet any of the following definitions:

- Class 1: explosives
- Class 2: gases (compressed, liquefied, dissolved under pressure, or refrigerated)
- Class 3: flammable liquids
- Class 4: substances susceptible to spontaneous combustion

- Class 5: oxidizing substances
- Class 6: poisonous (toxic and infectious)
- Class 7: radioactive materials
- Class 8: corrosives.

Coordinate special shipping or direct-delivery arrangements with the Project Manager for samples meeting any of the definitions above.

EQUIPMENT:

- Disposal drums (typically steel)
- Adjustable wrench, end wrench, or ratchet/socket for drum lids
- Buckets
- Funnels
- Plastic sheeting (typically 6-mil or heavier)
- Utility knife or scissors
- Shovels (flat, spade, etc.)
- Plastic garbage bags

SOLID WASTE:

Solid investigation-derived waste (IDW) generally includes small quantities of soil generated from drilling or test pit excavations. Larger quantities of waste generated from remedial actions are excluded from this SOP.

Soil cuttings are typically placed back in the holes from which they originated, thereby negating the need for disposal. Similarly, if drill or test pit cuttings do not demonstrate evidence of contamination, as determined through visual or olfactory observations, or through field analysis of total volatile organic compounds (VOC; see AWS SOP-03), the cuttings may instead be spread on unpaved areas of the site. In such instances, coordinate with project stakeholders (e.g., the client, site owner, regulatory personnel, etc.) to determine acceptable areas for placement.

Cuttings which demonstrate evidence of contamination must be transported to an appropriate solid waste disposal facility, such as a licensed landfill or permitted land farm. Characterization of cuttings waste should be completed in accordance with the requirements of the disposal facility selected for the project, as requirements often vary by facility.

Contaminated cuttings may be temporarily stored at the site in steel drums, or stockpiled on paved surfaces or plastic sheeting, when characterization has been completed in advance. Care should be taken to limit the potential for runoff of contaminant from uncovered stockpiles in the event of a precipitation event. For example, berms under plastic sheeting around the perimeter of the stockpile will help prevent runoff. In any case, stockpiled cuttings should be loaded and transported for disposal as quickly as feasible.

Alternatively, when advanced characterization is not feasible, the cuttings may be placed in steel drums and temporarily stored at the site. In some cases, temporary storage of stockpiled soil may be required, in which case stockpiles should be placed on and covered by plastic sheeting, with covered berms utilized as appropriate to limit the potential for runoff of contaminant. Coordinate the temporary storage approach and locations with project stakeholders, and complete waste characterization, transport, and disposal as promptly as feasible.

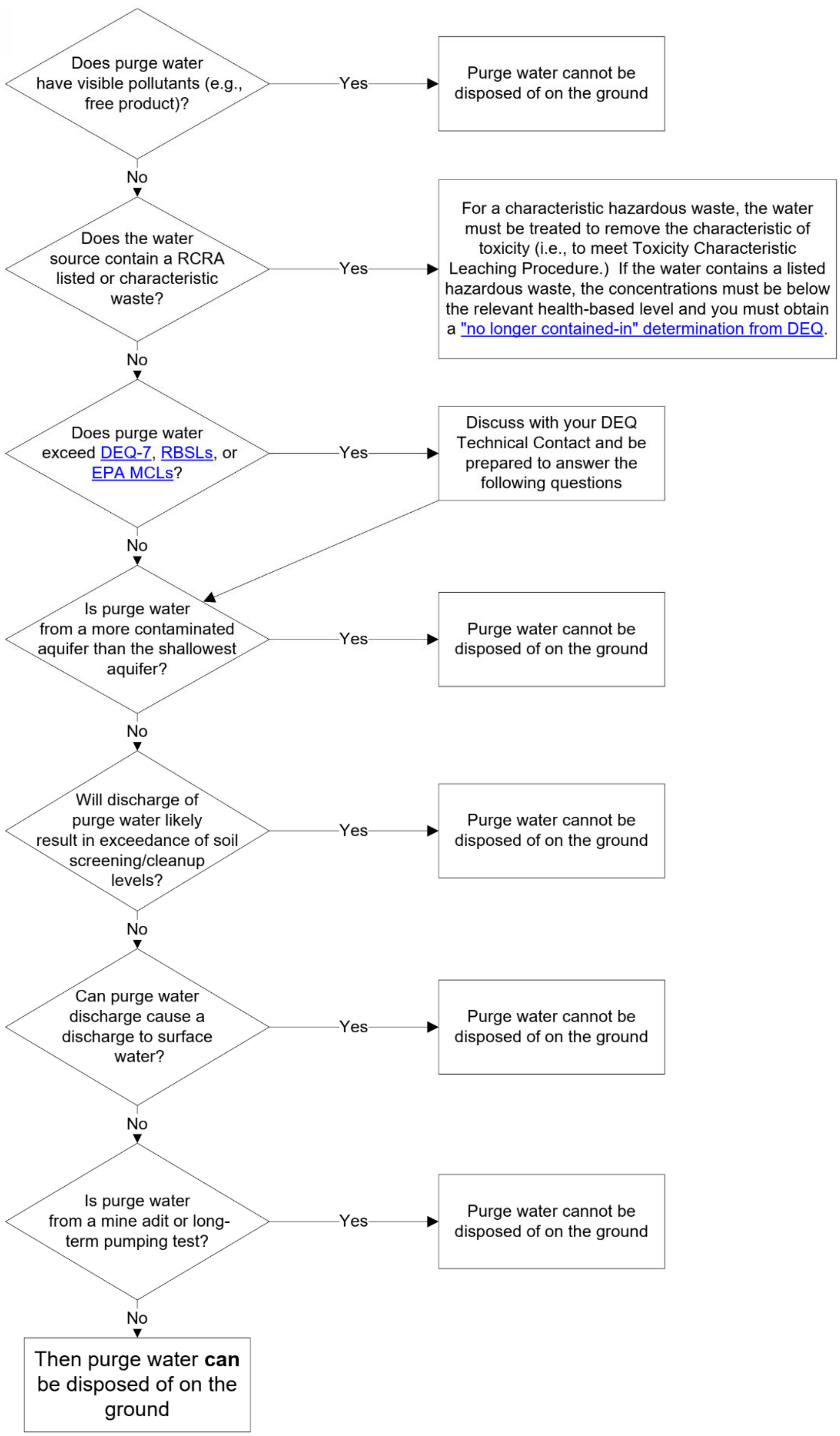
General trash and personal protective equipment waste shall be cleansed of any gross contaminated soil accumulation and shall be placed in plastic garbage bags and properly disposed at a licensed solid waste disposal facility.

LIQUIDS:

Liquid IDW includes purge water generated during well development and groundwater monitoring activities. Purge water shall be assessed in accordance with the Montana Department of Environmental Quality (DEQ) flow chart provided below.

Purge water assessed via the DEQ flow chart and determined not to contain known contaminants may be spread on the ground surface near the source well or boring. Where feasible, such purge water will be surface applied on paved surfaces. Purge water shall not be poured into storm water inlets, sewer manholes, natural drainages, or surface water bodies.

Purge water which is assessed via the DEQ flow chart and is determined to be contaminated shall be contained in drums and disposed at a licensed liquid waste disposal facility in accordance with that facility's disposal requirements. Alternatively, options for disposal of contaminated purge water may be discussed with DEQ in accordance with the flow chart on the following page. Temporary on-site storage of liquid waste in drums should be coordinated with project stakeholders. Characterization of liquid waste should be completed in accordance with the requirements of the disposal facility selected for the project, as requirements often vary by facility. Waste characterization and disposal should be completed as quickly as feasible.


Does purge water have visible pollutants (e.g., free product)?
Yes
Purge water cannot be disposed of on the ground
No
Does the water source contain a RCRA listed or characteristic waste?
Yes
For a characteristic hazardous waste, the water must be treated to remove the characteristic of toxicity (i.e., to meet Toxicity Characteristic Leaching Procedure.) If the water contains a listed hazardous waste, the concentrations must be below the relevant health-based level and you must obtain a "no longer contained-in" determination from DEQ.
No
Does purge water exceed DEQ-7, RBSLs, or EPA MCLs?
Yes
Discuss with your DEQ Technical Contact and be prepared to answer the following questions
No
Is purge water from a more contaminated aquifer than the shallowest aquifer?
Yes
Purge water cannot be disposed of on the ground
No
Will discharge of purge water likely result in exceedance of soil screening/cleanup levels?
Yes
Purge water cannot be disposed of on the ground
No
Can purge water discharge cause a discharge to surface water?
Yes
Purge water cannot be disposed of on the ground
No
Is purge water from a mine adit or long-term pumping test?
Yes
Purge water cannot be disposed of on the ground
No
Then purge water **can** be disposed of on the ground