Water & Environmental TECHNOLOGIES

480 East Park Street | Butte, Montana 59701
(406) 782-5220
info@waterenvtech.com
waterenvtech.com

Work Plan for the Petroleum Release at the former Noons 577

1001 9th St SW, Great Falls, Montana, Facility ID 07-00086 (TID 18328), Release 3331, Work Plan 35064

Prepared for:
MDEQ Petroleum Tank Cleanup Section
P.O. Box 200901
Helena, Montana 59620

Responsible Party:
Hi Noons Petroleum
Drik Cooper

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EXECUTIVE SUMMARY

The former Noon's 577 (Facility) is located at 1001 9th Street NW, Great Falls, MT and is currently operated as Cascade Granite, a countertop showroom. Figure 1: Site Location Release 3331 was discovered in the vicinity of the former fueling station's underground storage tanks (USTs) and pump island in 1998 as part of a property transaction.

The Department of Environmental Quality (DEQ) issued a workplan request letter (WPR) dated June 26, 2025, requesting additional corrective action at the Facility. The scope of work outlined

in DEQ's WPR includes assessment of existing air sparge/ soil vapor extraction (AS/SVE) system, and groundwater monitoring to assess the current conditions. These activities will be conducted in accordance with the standard operating procedures (SOPs) and standard operating guidelines (SOGs) listed below, and any site-specific clarifying notes or proposed deviations from the SOPs are provided in the subsequent sections of this work plan. SOPs are included as **Appendix A**.

- SOP-0-1: Instrument Calibration Process
- SOP-1: Field Logbook and Forms
- SOP-2: Equipment Decontamination
- SOP-3: Sample Nomenclature, Documentation, and Chain of Custody
- SOP-4: Sample Package and Shipping
- SOP-5: Field Measurement of Groundwater Levels/ Light Non-Aqueous Phase Liquid Levels
- SOP-6: Measurement of Field Parameters
- SOP-7: Field Sample Filtration
- SOP-8B: Groundwater Sampling – Low Flow Method
- SOP-16: Quality Control Sampling
- SOP-17: Management of Investigation Derived Waste
- WET Data Verification & Validation SOG

Implementation of this work plan is proposed to begin on approval of this Work Plan and take approximately one year to complete, depending on availability of contractors and equipment.

1 FACILITY AND RELEASE BACKGROUND

The former Noon's 577 (Facility) is located at 1001 9th Street NW in Great Falls, Cascade County Montana and is currently operated as an unrelated entity: Cascade Granite, a countertop showroom. Release 3331 was discovered in 1998 during a Phase II investigation for multiple Gasmat locations in Montana as required for a property transaction. The resulting 1998 Remedial Investigation included the installation of six monitoring wells and confirmation of petroleum contamination in the groundwater.

Two USTs were removed in 2002 by Keneco Petroleum. And an excavation of contaminated soils was completed in January 2003. The excavation was limited by bedrock at 16 feet below ground surface (bgs). To address source contamination that could not be removed by excavation, WET installed a soil vapor extraction (SVE) and air sparge (AS) system that began operation on October 2, 2006. The 2012 Groundwater Monitoring Report indicated that groundwater concentrations of contaminants of concern had shown reducing trends and that the AS/SVE system was no longer in operation.

DEQ issued a work plan request letter (WPR) dated June 26, 2025, requesting additional corrective action at the Facility. The scope of work outlined in DEQ's WPR includes:

- Evaluate on-site equipment to assess feasibility of future use
- Maintenance mechanical components of AS/SVE system
- Re-install disconnected power to AS/SVE system
- Conduct a pilot test to assess effectiveness of AS/SVE system
- Conduct one round of groundwater monitoring
- Determine appropriate sampling intervals, parameters, and other data needed to optimize and assess the performance of the AS/SVE system.
- Validate all laboratory analytical data using DEQ's Data Validation Summary Form (DVSF).
- Discuss ongoing WP tasks and results with DEQ's project manager; submit written agreed-upon WP modification as required to complete the WP objectives.
- Prepare and submit report detailing the results of the AS/SVE pilot test and groundwater monitoring event. The report will follow the DEQ Cleanup Report guidance and include appended groundwater monitoring field forms, laboratory analytical data, completed DVSFs and an updated RCP.
- Standardized DEQ WP and Report formats will be used, and Reports will be submitted electronically.

The remaining sections of this WP detail WET's proposed approach to complete these specified tasks.

2 PURPOSE AND OBJECTIVES

The purpose of the proposed actions is to determine if the existing AS/SVE system can be utilized to treat remaining dissolved phase contamination, and to continue to assess the dissolved phase contamination at the Facility.

In order to write a Work Plan to utilize existing equipment, it was necessary to assess existing infrastructure. Power supply to the system was found to be intact but inactive. The AS/SVE equipment in the equipment housing was in poor condition with evidence of a small animal nesting in the equipment housing. Site AS wells were intact but SVE well monuments were backfilled with sand and detached from lateral lines. Thus, it is not feasible to conduct a pilot test with existing infrastructure.

The presence of free product means that an injection of a product such as PetroFix to treat the contaminant plume would have uncertain results.

These developments have been discussed with DEQ Project Officer. In communication on January 16, 2026, DEQ PO and WET concluded that deploying absorbent socks where free product is measurable and conducting monitoring is necessary to better understand the amount of free product present so that remedial action could be selected.

3 WORK PLAN TASKS

All tasks required for the implementation of this work plan are detailed in the following sections.

3.1 WORK PLAN

WET will prepare Work Plan 35064 in response to the DEQ Work Plan Request letter dates June 16, 2025, including Attachment A: Project Cost Estimate

3.2 PROJECT MANAGEMENT

WET personnel will provide responsible party (Dirk Cooper of Hi-Noons Petroleum) and DEQ's project manager with updates on ongoing WP tasks and relevant results on an as-needed basis. Additionally WET personnel will coordinate work with site operator (Cascade Granite). Other duties associated with this task include preparing a task-specific health and safety plan, scheduling maintenance, scheduling field work, project reporting administration, monitoring the project budget and deliverables, and any submitted written agreed-upon WP modifications to complete the objectives.

3.3 MOBILIZATION

WET will mobilize to the site five times to complete the required work. One trip will be for ground water monitoring and absorbent sock deployment. Three trips will be for absorbent sock check and replacement. One trip will be for the final absorbent sock check and replacement in addition to equipment decommissioning.

Each round trip will consist of approximately 10 miles, 30 minutes of driving and 1 hour of loading/unloading. While efforts will be made to utilize personnel from WET's Great Falls office location, WET cannot guarantee the availability of appropriate staff from that location and has estimated costs for groundwater monitoring to be staffed by Butte office location. Each round-trip mobilization consists of 325 miles, approximately five hours driving and one hour of loading/unloading for a total of six hours of travel time per trip, for WET Staff Engineer or Scientist.

Additionally, a stop is included for the return trip of staff engineer/scientist in Helena for delivery of samples to Energy Laboratories due to short sample hold times. This is further discussed in Section 3.9.

3.4 EQUIPMENT DECOMMISSIONING

The existing site AS/SVE system machines are a Gast Model R3 105N-50 regenerative blower to provide air to the air sparge system and a Gast Model R5125Q-50 2 hp regenerative blower to keep the vadose zone under pressure conditions. These regenerative blowers have not been used for 15 years and have no feasible use onsite in their current condition. WET will remove both blowers and decommission the equipment shed.

3.5 FREE PRODUCT ACTIVITIES

WET will conduct four quarters of quarterly monitoring on the free product observed in the Facility monitoring wells. One round of free product activities will be combined with the one groundwater monitoring event. On February 29, 2024, 0.03 feet of free product was observed in MW-1.

Product monitoring will include liquid level measurements at MW-1, MW-3, and MW-7. Fluid levels will be measured with an oil-water interface meter prior to purging the well in accordance with WET standard operating procedure (SOP) SOP-5: Measurement of Fluid Levels and recorded on the WET Groundwater Sampling Form in accordance with WET SOP-1: Field Logbook and Field Sampling Forms. SOPs are included as Appendix A.

If free product is encountered in MW-1 or any well, an absorbent sock will be weighed and then deployed in that well. During the next product monitoring event, the sock will be recovered and dried. Once dry, the sock will be re-weighed to determine how much product has been recovered; data will be recorded in accordance with WET SOP-1: Field Logbook and Field Sampling Forms. A new absorbent sock will be immediately deployed into any well with measurable free product.

3.6 GROUNDWATER MONITORING

WET will conduct one groundwater monitoring event at all of the Facility monitoring wells (MW-1, MW-3, MW-6, MW-7 and MW-8). Monitoring wells will be purged and sampled using a peristaltic pump following procedures specified in this workplan and WET SOP-8B Groundwater Sampling – Low Flow Method (Appendix A) and DEQ's Groundwater Sampling guidance (2018). Fluid levels will be measured with an oil-water interface meter prior to purging the well in accordance with WET standard operating procedure (SOP) SOP-5: Measurement of Fluid Levels and recorded on the WET Groundwater Sampling Form in accordance with WET SOP-1: Field Logbook and Field Sampling Forms. SOPs are included as Appendix A. Any monitoring well containing free product will not be sampled.

Groundwater field parameters for each well will be measured by YSI® Professional Plus with Quatro cable multi-meter, Geotech or Hach turbidity meter, and a Geotech or Heron oil/water interface probe, in accordance with SOP-06: Measurement of Field Parameters. Field parameter measurements consist of recording initial depth to water, temperature, specific conductivity (SC), dissolved oxygen (DO), pH, oxidation reduction potential (ORP), turbidity, final depth to water, and volume during purging. Temperature and drawdown will be monitored but are not subject to stabilization criteria. Field parameter readings should be recorded every 3-5 minutes until three consecutive readings are within stabilization range. Once parameters stabilize according to the criteria in **Table 1**, a groundwater sample will be collected in laboratory-supplied bottles for laboratory analysis as described in Section 3.7. Samples collected for analysis of dissolved metals (iron and manganese) will be filtered prior to adding preservative as described in SOP-7: Field Sample Filtration.

Table 1. Stabilization Parameters

Water Quality Parameter	Unit	Stabilization Range	Exception
pH	standard units (s.u.)	±0.1 s.u.	
Specific Conductance (SC)	microsiemens per centimeter (µS/cm)	±3%	
Dissolved Oxygen (DO)	milligrams per liter (mg/L)	±10%	<0.50 mg/L
Turbidity	nephelometric turbidity units (NTU)	±10%	<5 NTU
Oxidation/Reduction Potential (ORP)	millivolts (mV)	±10 mV	

One duplicate and one field blank will be collected during each monitoring event for quality assurance/quality control (QA/QC) purposes. The duplicate will be collected from a well that has historically exhibited detectable concentrations of contaminants simultaneously with its parent sample. The field blank will be collected during representative sampling conditions at the Facility with laboratory provided organic-free deionized water. Both the duplicate and the field blank will be analyzed for the same constituents as the natural samples. Reusable equipment (oil/water interface probe, bladder pump) will be decontaminated between wells in accordance with SOP-2: Equipment decontamination (**Appendix A**).

3.7 LABORATORY ANALYSIS

Groundwater samples will be sent for laboratory analysis after following the procedures outlined in WET SOP-4: Sample Nomenclature, Documentation, and Chain of Custody and WET SOP-3: Sample Package and Shipping (**Appendix A**).

Groundwater samples including QA/QC samples will be analyzed for volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH) screen, EPH fractionation

without polycyclic aromatic hydrocarbons (PAHs) if the sample exceeds an EPH screen result of 1,000 µg/L, and lead scavengers EDB and 1,2-DCA. Additionally, intrinsic biodegradation indicator (IBI) samples (nitrite, nitrate, sulphate, sulfite, methane, dissolved iron, dissolved manganese) will be collected. All samples will be analyzed by Energy Laboratories in Helena, MT.

Due to the short hold time for nitrite samples, samples will be hand delivered to the laboratory following collection.

3.8 DATA VALIDATION SUMMARY FORMS (DVSF)

WET personnel will validate the laboratory analytical report in accordance with EPA's National Functional Guidelines for Organic Constituents and the WET standard operating guideline (SOG)-Data Verification & Validation. A data validation summary form (DVSF) will be prepared for the lab report in the MT DEQ format.

3.9 INVESTIGATION DERIVED WASTE (IDW)

Following the DEQ disposal of untreated purge water from monitoring guidance dated July 15, 2015, the purge water originates form the shallowest aquifer, is not likely to result in an exceedance of soil screening levels, is not discharged to a surface water, and is not from a mine audit or long-term pumping test. Therefore, the purge water from the groundwater sampling event will be discharged to pervious Facility ground.

4 COST, SCHEDULE, AND REPORTING

4.1 COST

Work effort level has been estimated using best professional judgement and typical scenarios related to work of this type. A detailed cost estimate for the required work is provided in **Appendix B**.

4.2 SCHEDULE

WET will begin implementation of the WP immediately upon DEQ approval. Notification for each event will also be sent to the Responsible Party, the DEQ Project Manager, and the Facility business operator prior to conducting field work.

4.3 REPORTING

WET will prepare an Additional Corrective Action Report detailing the finding of the absorbent sock deployment and the groundwater monitoring events. The Additional Corrective Action Report will include all of the content outlined in the Additional Corrective Action Report format as well as appended groundwater monitoring forms, laboratory analytical data, completed DVSFs, and an updated Release Closure Plan (RCP).

5 REFERENCES

EPA, 2014. National Functional Guidelines for Superfund Organic Methods Data Review, August.

Figure 1

Site Location

Property Boundary

N
W E
S

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	5/15/24	LG	IS
2				
3				
4				
5				

NOTES
Boundaries and locations are approximate.
Imagery taken July 2014.

SITE LOCATION

GASMAT #577 - GREAT FALLS, MT

FIGURE 1

JOB# NOONSM01

DATE:5/15/2024

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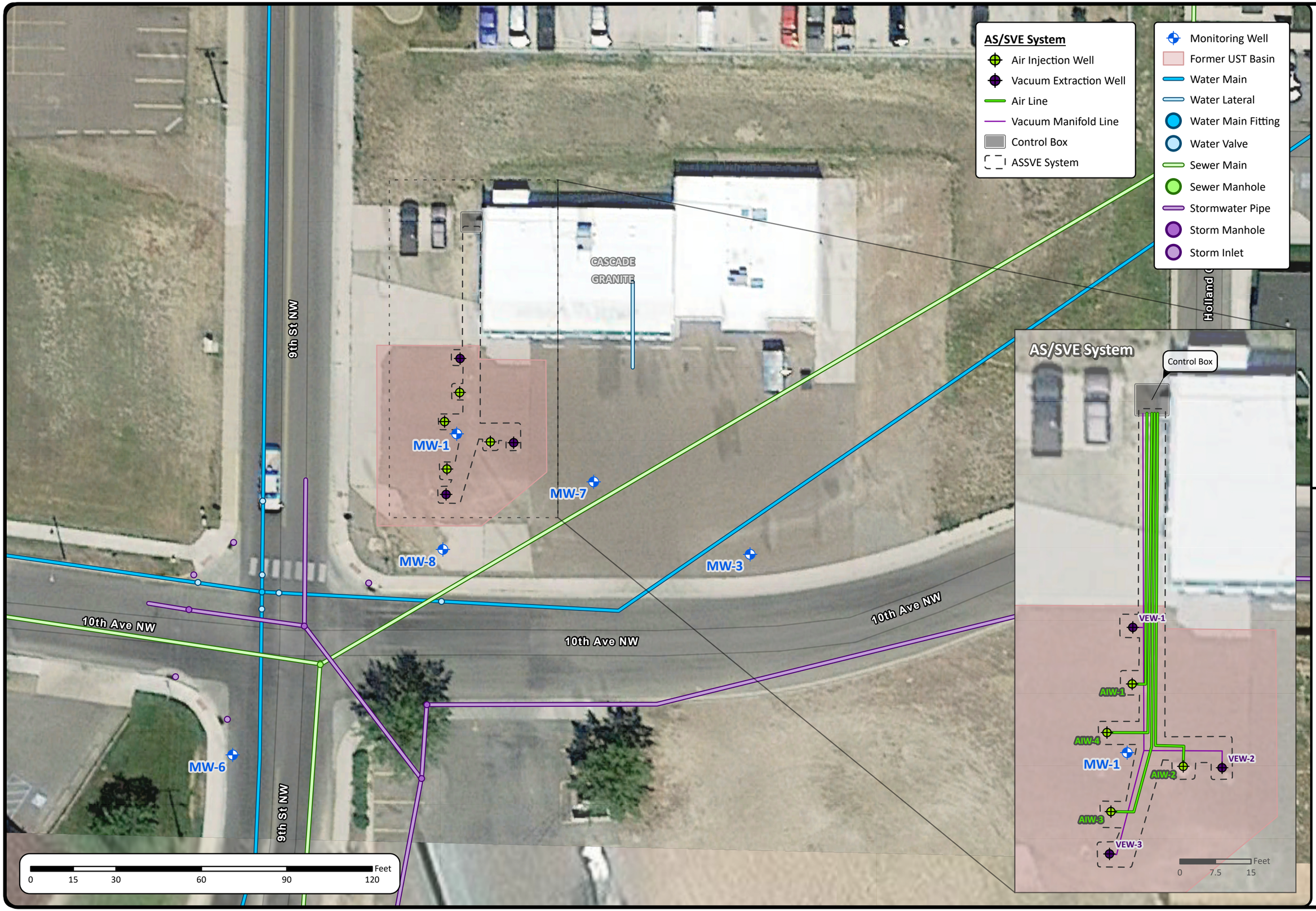
Figure 2

Site Details



N

W E

S

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	10/4/23	KK	IS
2	EDIT WELLS	5/15/24	LG	IS
3	ADD UTILITIES & FORMER UST BASIN	5/22/24	LG	IS
4				
5				

NOTES:
Boundaries and locations are approximate.
Imagery taken July 2014

MONITORING WELLS & AS/SVE SYSTEM

GASMAT #577 - GREAT FALLS, MT

FIGURE 2

JOB#: NOONSM01

DATE:5/22/2024

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Appendix A

Standard Operating Procedures

SOP-0-1

Instrument Calibration Process

Revised: December 2, 2021

Doc control #:

Introduction

The purpose of this Standard Operating Procedure (SOP) is to describe the sequence of activities to be followed when using any instrument that requires field calibration. Though this SOP is meant and required to be used in harmony with any other WET SOP that addresses calibration of a specific instrument, it supersedes any procedure described in a specific SOP if in conflict with those specified in this SOP (SOP-0-1). This SOP will become obsolete and will be removed from the WET suite of SOPs when all other pertinent SOPs are appropriately amended.

Equipment

- Calibration standard(s) (main source)
- Calibration standard(s) in packets or containers, and/or required hardware
- Instrument to be calibrated
- Instrument guide, manual or pertinent SOP where the calibration process of the given instrument is defined
- Instrument-specific health and safety items

Process

1. Before traveling with a field instrument, the instrument should be checked to ensure it is in good working order before leaving the office. Place the instrument in measuring mode, use calibration standards (if required) to test - measure all values that will be required in the field monitoring event. Values close to calibration standards are indicative of the instrument being in working conditions.
2. In the field: shortly before initiating field measurements at the work site, calibrate the instrument as instructed by the instrument instruction manual using standards contained in disposable packets or containers. The use of disposal packets eliminates a risk of contaminating the main source of the standard.
3. After field measurements are completed for the day, with the instrument in measuring mode, use calibration standards to measure their values. Record these values in the newly updated Calibration Record form.

Justification and Comments

Both EPA (1, 2) and Montana DEQ (3) in their guidance for groundwater sampling collection require checking whether the instruments remained in calibration by the end of the day. EPA (2) explains that the check of calibration is performed while the instrument is in the measurement mode, not calibration mode. EPA (1) expounds that the difference between the measured value and the initial calibration value is then compared to the drift criteria described in QAPP or SAP for the project.

If the QAPP or SAP do not list the drift criteria, EPA (1) provides drift criteria for DO, SI, pH, turbidity and ORP. For instruments that measure other parameters of water and instruments used for other media, the drift criteria must be specified and documented by the project manager (PM) or Lead Engineer / Scientist (LE/S) prior to taking the measurements. In such a case the PM is encouraged to research the instrument-relevant sources to be able to provide basis for the selected drift criteria.

If the instrument allowable drift criteria are not met, all data of the period in question will be marked with a qualifier “+” or “-“ (depending on the drift direction) and its usage determined by the PM or LE/S.

References

1. USEPA Region 1, 2017. Standard Operating Procedure, Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction potential [ORP], and turbidity)). EQASOP-FieldCalibrat3.
2. EPA Region 1, 2010. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. EQASOP-GW 001.
3. DEQ Montana, 2018. Groundwater Sampling Guidance. DEQ-WMRD-GWM-1.

Prepared by: _____ _____
(Marek Zaluski, Ph.D. Senior Hydrogeologist) Date

Approved by: _____ _____
(Elizabeth Erickson, Sr. Vice President, Quality Manager) Date

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SOP-1

FIELD LOGBOOK AND FORMS

All pertinent field investigation and sampling information will be recorded in a field logbook, field form, or a Daily Activity Log (DAL) during each day of the field effort and at each sample site. The field crew leader will be responsible for ensuring that sufficient detail is recorded in the field logbook or DAL. No general rules can specify the extent of information that must be entered in the field logbook or form. However, field logbooks, field forms, or DALs must contain sufficient information such that someone could reconstruct all field activities without relying on the memory of the field crew. All entries shall be made in indelible ink, weather conditions permitting. Each day's or site's entries will be initialed and dated at the end by the author.

At a minimum, entries on the field sheet or in field notebook must include:

- Project information and location
- Project and task number
- Date and applicable times
- Name(s) of field personnel
- Environmental, site, or weather conditions
- Safety briefing attendance
- Details of actual work effort, particularly any deviations from the field work plan or standard operating procedures
- Comments or observations regarding any unusual circumstances
- Any field measurements made (e.g., PID readings, pH, temperature)

For sampling efforts, specific details for each sample should be recorded using a standardized field form designed specifically for the sampling activity being conducted (e.g., low-flow groundwater monitoring, soil gas sampling). Sampling field forms contain fill-in-the-blank type information to ensure that all pertinent information will be recorded. In addition to the items listed above, the following information is recorded on field forms during sampling efforts:

- Sample identification
- Date and time samples were collected
- Sampling methods, particularly any deviations from field work plan or standard operating procedures
- Field data and measurements
- Containers used to collect samples
- Sample preparation (filtration, preservation)
- Analyses and methods requested
- Note any QA/QC samples collected (duplicates, blanks)

Strict custody procedures will be maintained with the field forms. Field forms must always remain with the field team while being used in the field. Upon completion of the field effort, the original field forms will be scanned and copied to the project folder. Original field forms will be filed in an appropriately secure manner.

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SOP-2

EQUIPMENT DECONTAMINATION

INTRODUCTION

The purpose of this section is to describe general decontamination procedures for field equipment. Decontamination will be performed on all non-dedicated and non-disposable sampling equipment that may contact potentially contaminated media. Field personnel must wear disposable latex or nitrile gloves while decontaminating equipment at the project site and change gloves between every sample. Personnel must take every precaution to prevent contaminating themselves with the wash water and rinse water used in the decontamination process.

EQUIPMENT

- Liquinox (or equivalent laboratory-grade detergent)
- Sufficient volume of tap water
- Sufficient volume of deionized water
- Sufficient volume of methanol or pesticide-grade acetone for organics
- Sufficient volume of any other decontamination solutions specifically required by the project work plan.
- Necessary containers for each decontamination station (totes or tubs, graduated cylinders or similar tubes, spray bottles, etc.)
- Tarp or other platform to form barrier between decontamination stations and ground (if necessary)
- Applicable brushes (if necessary)
- Aluminum foil (for soil sampling devices)
- Latex or nitrile gloves
- Paper towels
- Garbage bags

PROCEDURES

The following should be done in order to complete thorough decontamination:

1. Set up the decontamination zone downwind from the sampling area to reduce the chances of windborne contamination.
2. Visually inspect sampling equipment for contamination; use brush to remove visible material.
3. The general decontamination sequence for field equipment includes washing with Liquinox (or equivalent laboratory-grade detergent), deionized water rinse, additional solution rinse specified by project work plan, and triple deionized water rinse.
4. Store equipment in clean containment or according to project work plan if not used immediately.
5. All disposable items (e.g., paper towels, latex gloves), as well as rinse and wash water generated during decontamination, should be disposed of in accordance with SOP-17 (Management of Investigation-Derived Waste).

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SOP-3

SAMPLE NOMENCLATURE, DOCUMENTATION, AND CHAIN OF CUSTODY

INTRODUCTION

Sample documentation is an important step to ensure the laboratory, project manager, and field personnel are informed on the status of field samples. Depending on the specifics required for each project, several forms will need to be filled out. Most sample documentation forms are pre-printed carbonless triplicates, enabling copies to be filed or mailed from labs or offices. The forms will be completed by field personnel, who have custody of the samples. The office copy will be kept in the project file and subsequent copies sent to the laboratory, or other designated parties.

Responsibility for completing the forms will be with each field crew leader. It is important that the field crew leader is familiar with the completion process for filling out forms, and the expected information is included.

Potential documents to be completed clearly in indelible ink for each sample generated include:

- Field form(s) or field logbook
- Chain-of-custody forms
- Custody seal(s)

A chain-of-custody form will be generated for all samples collected in the field for laboratory analysis. The sampler may use a project-specific chain-of-custody form or a chain-of-custody form provided by the laboratory. It is of the upmost importance that the chain-of-custody form be filled out correctly. This form is the first thing that third parties and regulators verify when assessing the quality of the job.

FIELD EQUIPMENT

- Indelible ink pen(s)
- Field form(s) or field logbook
- Chain-of-custody form(s)
- Custody seal(s)

PROCEDURES

Sample custody records must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory and should accompany the sample through analysis and final disposition. The information to be included on the chain-of¬-custody form will include, but is not limited to:

- Accounting and reporting information
- Project number and/or site name (If there are any questions about this, contact the project manager)
- Sampler's name, information, and signature
- Unique sample identification number or name
- Date and time of sample collection

- Number of containers
- Sample media (e.g., soil, water, vapor, etc.)
- Sample preservative (if applicable)
- Requested analyses
- Comments or special instructions to the laboratory

Each sample will be assigned a unique sample identification number or name. The information on the chain-of-custody form, including the sample identification number or name, must correspond to the information recorded by the sampler on the field forms (refer to SOP-01) and the label on the sample container.

A sample is considered under a person's control when it is in their possession such that tampering is prevented. This includes placing the samples in an area of controlled access such as a building or locking the samples in a vehicle. When custody of a sample is relinquished by the sampler, the sampler will sign and date the chain-of-custody 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. Samples will be shipped to the analytical laboratory following the procedures in SOP-04. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples will be relinquished to the shipping service. The shipping service will not sign the chain-of-custody form; however, the samples can be tracked while in the custody of the shipping service. More than one sample may be included on a chain-of-custody form, if all the samples are for the same project. Copies of the chain-of-custody form will be maintained in the project file, in accordance with standardized or project-specific data management procedures.

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SOP-4

SAMPLE PACKAGE AND SHIPPING

PACKAGING

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

1. Label all sample containers with indelible ink (on the label, on the side, not on the cap or lid). Place labeled sample bottles in a high-quality cooler containing an adequate amount of ice (sealed inside two Ziploc bags) to maintain a temperature of 4°C or less inside the cooler. Freeze packs, or "Blue Ice" are NOT to be used. Ensure the cooler drain plug is taped shut.
2. Place the samples in an upright position and wrap the samples with absorbent, cushioning material for stability during transport. Samples should not be loose; the cooler should be able to withstand tough handling during shipment without sample breakage.
3. A temperature blank is to be included in each cooler.
4. When sampling for volatile organic compounds, a trip blank supplied by the lab must be included in each cooler.
5. Fill out the appropriate shipping forms and place in a Ziploc bag then tape it to the inside lid of the shipping container. Shipping forms usually consist of a chain-of-custody form, which documents the samples included in the shipment and specifies the laboratory analyses for each sample. *Note: There should be one chain-of-custody form per cooler, which only lists the samples that are present in that cooler. For large sample efforts requiring samples be shipped in two or more coolers, DO NOT fill out a single chain-of-custody form for the entire set of samples and place multiple copies of the same form in multiple coolers.*
6. Close and seal the cooler using packing tape.
7. Place completed custody seals on the cooler such that the seals will be broken when the cooler is opened. The custody seal must contain, at minimum, the signature of the person relinquishing custody of the samples and the date the cooler is sealed. Secure the custody seals on the cooler with clear packing tape.
8. Secure the shipping label with address, phone number, and return address clearly visible. If carrier labels (UPS or FedEx) were provided by the laboratory, affix the label(s) to the top of the cooler(s) and get a receipt from the carrier when dropping off the cooler(s) for shipment.
9. Plan ahead for shipping. If holding times are likely to be exceeded when using a carrier, the samples may need to be hand-delivered. Similarly, if outdoor temperatures are extremely hot or extremely cold, which could result in freezing of samples or cooler temperatures exceeding 4 degrees C during transit, samples may also need to be hand-delivered

SHIPPING HAZARDOUS MATERIALS/WASTE

Hazardous materials need to be shipped using procedures specified under Federal Law. Samples need to be shipped in Ziploc bags or paint cans filled with packing material, depending on the level of hazard. Special package labeling may be needed. Consult the project manager for specific shipping procedures.

SHIPPING AIR AND SOIL VAPOR SAMPLES

Hazardous materials need to be shipped using procedures specified under Federal Law. Samples need to be shipped in Ziploc bags or paint cans filled with packing material, depending on the level of hazard. Special package labeling may be needed. Consult the project manager for specific shipping procedures.

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SOP-5

FIELD MEASUREMENT OF GROUND-WATER LEVELS/LIGHT NON-AQUEOUS PHASE LIQUID LEVELS

INTRODUCTION

In general, groundwater levels (and LNAPL levels, if applicable) in wells will be measured prior to commencing development, purging, sampling, pumping tests, or other activities that disturb the fluid pressure relationships in the well. Measurements may be taken during such events for purposes other than determining static conditions and may also be taken to determine static conditions after such activities if an appropriate period has elapsed to allow steady-state conditions to return.

EQUIPMENT

- Electronic water level monitoring probe (for water levels only),
- Electronic multi-phase interface monitoring probe (for measuring water levels and LNAPL levels)
- Keys for well locks
- Tools to open well covers (e.g., socket wrench, spanner wrench, etc.)
- Watch or stopwatch
- Pens and field logbook or other appropriate field forms (e.g., groundwater purge and sample forms)
- Monitoring well construction data (for total depth and screen intervals of well)
- Personnel and equipment decontamination supplies (refer to SOP-2)

PROCEDURES

1. If more than one well will be measured, conduct measurements in the order of lowest to highest chemical concentrations previously detected in samples from the monitoring wells.
2. Allow the well to equilibrate by removing the protective cap and leaving the well open for a period before beginning taking measurements. Generally, removing all site well caps prior to collecting the first liquid level measurement provides sufficient time to reach equilibrium.
3. Examine the monitoring well for any structural damage, poorly fitting caps, and leaks into the inner casing. Record all well maintenance issues on the appropriate field sampling form or field log book.
4. If LNAPL is not present, use a pre-cleaned water level probe or equivalent to measure depth to water from the indicated survey mark on the well casing. If a mark is not present, measure from the top of the northern side of the well casing.
5. If LNAPL may be present, use a pre-cleaned, electric, multi-phase interface probe to measure depth of the LNAPL and depth to water. Record both measurements on the sampling form or field logbook. Unless otherwise instructed, always measure depths to LNAPL layer and groundwater from the indicated survey mark. If a mark is not present, measure from the top of the northern side of the well casing.
6. Repeat measurements at least once by lifting the probe tape at least one foot out of the well, allowing the measurer to confirm the accurate foot, tenth-of-a-foot, and hundredth-of-a-foot mark on the tape.
7. Follow personnel and equipment decontamination procedures outlined in SOP-2.

Water & Environmental TECHNOLOGIES

SOP-6

MEASUREMENT OF FIELD PARAMETERS: Temperature, Dissolved Oxygen (DO), Specific Conductance, pH, Oxidation Reduction Potential, and Turbidity

INTRODUCTION

This guideline describes the procedures typically used to measure the temperature, DO, Specific Conductance (SC), pH, Oxidation Reduction Potential (ORP), also referred to as redox potential, and turbidity of ground- or surface water.

EQUIPMENT

- Multi-parameter water quality meter
- Flow-through cell or plastic cup
- Transport/calibration cup
- Probe sensor guard
- Operations manual
- Spare batteries
- Standard conductivity calibration solutions [447, 1413, 2074, 8974 microSiemens per centi meter (µS/cm)]
- pH buffers (4.00, 7.00, 10.00)
- ORP calibration solution
- Pens, field logbook, and/or appropriate field forms (e.g., groundwater purge and sample form)
- Personnel and equipment decontamination supplies

PROCEDURES

Calibrate multi-parameter water quality meter at the office prior to commencement of field activities to check instrument is in proper working order. At a minimum, calibrate before use each day (or more frequently as necessary) as indicated below. The initial daily calibration may be performed at the office (if located in proximity to the site), motel, or in the field.

1. Press the On/Off key. Check the battery charge indicator located at the bottom of the liquid crystal display (LCD) screen. Replace batteries if the battery charge indicator is low.
2. Calibrate the meters according to the manufacturer's instructions. *Note: The meter must be calibrated for each field parameter in accordance with the instructions in the operations manual at the beginning of each sampling day. Additional calibrations may be performed during the day if deemed necessary.*
3. If instruments were used in humid or wet environmental conditions, store them in the case open overnight for evaporation so that moisture and mold do not infiltrate sensitive parts.
4. Multi-parameter water quality meter use:
   a. Connect the probe sensor to the flow-through cell. If the flow cell is not used, make sure the probe sensor guard is installed.
   b. Begin passing water into the flow-through cell. If the flow-through cell is not used, place the probe module into a sample of the water or directly into the body of water being evaluated. Be sure to completely immerse all sensors into the water.
   c. Provide a constant flow of fresh water across the probe module to actuate readings.

d. Observe the meter's LCD display and record the values on the groundwater purge and sample form or field logbook.
e. Once purging is complete, remove the probe from the sample water and rinse the probes and flow-through cell with distilled water.

5. Place the probe sensor in the transport/calibration cup with 0.5-1 inch of 4.00 pH buffer for short-term/overnight storage for optimal calibration conditions the next day. Place the probe sensor in the transport/calibration cup with 0.5-1 inch of potable water for long-term storage. The transport/calibration cup should be sealed to prevent evaporation. *Note: Storing the probes in dry conditions will damage the sensors.*
6. Turbidity meter use:
   a. Fill a turbidity meter sample vial with water to the fill indication line. Cap the vial securely.
   b. Dry the outside of the sample vial. Line the arrow or alignment indication line on the vial with the arrow or alignment indication line on the turbidity meter. Push the vial all the way into the sample vial port. Ensure that the cap/cover is closed all the way.
   c. Ensure that the turbidity meter is on a level surface and will not be disturbed during the analysis process. Press the Read key. Do not disturb the turbidity meter or open the cap/cover during reading.
   d. Record the value provided. If the reading seems inaccurate, ensure that the sample vial is dry and does not have any streaking or staining and re-read the sample.

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SOP-7

FIELD SAMPLE FILTRATION

INTRODUCTION

The purpose of field sample filtration is to filter sediments and other foreign materials out of aqueous samples destined for analysis of dissolved-only constituents. If an in-line filter is unavailable, use the equipment and follow the procedures outlined below.

EQUIPMENT

- Filters; 0.45 (micro)m mesh, 47 mm diameter
- Tweezers/tongs
- Squirt bottle filled w/ deionized water
- Filtration funnel w/ magnetic base and rubber stopper
- Hand pump
- Flask, 1000 ml nalgene or equivalent w/ tubing port
- Clear plastic tubing to fit flask port, approximately 2'
- Temporary sample container filled with sample water as per SOP # GW-060
- Sample container (cubitainer) with label and green marking as per SOP # GW-060, Appendix A

PROCEDURES

Rinse the filter funnel and flask with distilled water or excess sample water.

1. Separate the funnel into its top and bottom portions.
2. In a wind-free environment, use the tweezers to separate a filter disc (white) from its wrapper and protector and place the filter on the bottom portion of the magnetic funnel. Do not touch the filter with your fingers – fingers can impart oil, dirt, or other contaminants to the filter. A drop of rinse water on the funnel screen (on the bottom portion of the funnel) will help keep the filter in place. Reconnect the top and bottom portion of the funnel. *Note: if a filter disc has been left on the screen from the previous sample, be sure to remove it before emplacing the new filter and decontaminate equipment, as necessary.*
3. Connect the funnel to the flask by inserting the rubber stopper on the bottom portion of the funnel into the flask neck.
4. Connect the hand pump and tubing to the flask tubing port.
5. Pour a small amount (50-100 mL) of sample water into the filter funnel.
6. Squeeze the hand pump until the sample water is pulled through the filter.
7. Rinse the flask by swirling the filtered water all around the inside of the flask.
8. Discard the rinse water.
9. Fill the funnel with sample water and squeeze the hand pump until the sample water is pulled through the filter. Continue adding sample water until all of it has been filtered.
10. Fill laboratory-supplied sample container(s) with filtered sample water.
11. Preserve and store the sample appropriately for the analytical method and project requirements.

12. Take the filtration funnel apart and observe the filter paper. Note on the field data sheet the presence of any sediment or other contaminants. Leave the filter disc in place until it is time to decontaminate the funnel and collect a subsequent sample.
13. Disassemble the remaining filtration equipment and secure all equipment for transport to the next sampling site.

Water & Environmental TECHNOLOGIES

SOP-8B

GROUNDWATER SAMPLING—LOW FLOW METHOD

INTRODUCTION

These instructions are in general accordance with the United States Environmental Protection Agency (EPA) Region One Low-Stress (Low-Flow) Standard Operating Procedure (September 2017), and are applicable for using an adjustable rate submersible, peristaltic, or bladder pump with the pump's intake placed at the midpoint of a 10-foot or less well screen or an open interval. Field instruments are already calibrated. The equipment is set up according to the diagram at the end of these instructions.

EQUIPMENT

- Documentation Items:
  - Field sampling forms or field tablet with appropriate Survey123 sampling forms
  - Pens and indelible markers
- Sampling Items:
  - Sample bottle(s)
  - Preservative(s)
  - Coolers for sample bottle(s)
  - Ice for cooler(s)
  - Filter(s) (if required)
  - Laboratory-grade deionized (DI) water (for field blanks)
- Equipment/Instrumentation:
  - Water level or interface meter
  - Pump
  - Pump controller
  - Tubing (poly and silicone)
  - Appropriately sized t-splitter
  - Bailer(s) and rope
  - Multi-parameter meter (temperature, dissolved oxygen [DO], specific conductance [SC], pH, oxidation/reduction potential [ORP]) with low-flow cell
  - Turbidity meter
  - Graduated cup
- Power (if required)
  - Generator
  - Air compressor
  - Fuel
- Investigation-Derived Waste (IDW)
  - Sampling tote with elevated rack (if necessary)
  - Five-gallon bucket(s)
  - Purge water tank (if necessary)
  - 2L graduated cylinders (for decontamination)
  - Decontamination liquids (tap water, laboratory-grade detergent, distilled or DI water, acids, etc.)

All sampling equipment shall be inspected for damage and repaired, if necessary, prior to arriving on-site.

GENERAL PROCEDURES—PURGING

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/ open interval).
2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, and set up the equipment.
3. Check well casing for a reference mark. If missing, make a reference mark on the northern side of the casing and notate in the field sampling form. Measure the water level (initial) to 0.01 ft. and record this information.
4. Measure product level, if present, and water level and record this information on the field sampling form. For wells of 2-inch diameter or less, the water level or interface meter will have to be removed from the well to install the pump, but then lowered back down the well after the pump is installed to monitor water level during the purge.
   a. If free product is present, the well is not to be sampled.
   b. If the water column is less than the length of the pump being used, or 12" if using a peristaltic pump, bailing the sample is the best option. See step 6c for bailing instructions.
5. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen, which is often the midpoint of the screen interval for fully submerged well screens, or at the midpoint of the portion of screen penetrating the saturated zone for well screens straddling the water table.
   a. a. Attach the pump discharge line to the t-splitter.
   b. b. Attach tubing between the other side of the t-splitter to the lower stem of the multi-parameter meter low-flow cell.
   c. c. Attach tubing to the lower part of the t-splitter and either a valve end or a clamp on the end of the tubing. This is for turbidity readings, as they must be collected prior to entering the low-flow cell.
   d. d. Attach tubing from the upper stem of the multi-parameter meter low-flow cell and run it to a purge tank or bucket.
6. Start the pump and monitor the water level to assess if drawdown is occurring.
   a. a. Slow the rate if drawdown occurs until water level holds stable or is drawing down slowly enough that it will not exceed the 0.33 ft max or below the top of the well screen.
   b. b. If the rate cannot be lowered enough to avoid excess drawdown (>0.33 ft), then record this deviation in the sampling form. If the water level stabilizes after exceeding 0.33 ft, calculate the volume of water between the initial water level and the stabilized water level and purge at least that amount of water before collecting a sample.
   c. c. If the well runs dry or the water level gets to a point where the pump can no longer produce water, then a bailer can be used. Collect samples for containers in order of priority, and if enough water is left in the well, collect a sample for the multi-parameter storage cup for a single set of parameters.
   d. d. Once the water level is stable, record the pump settings and purge rate using a graduated cup and a timing device. *Note: Flow rate should not exceed 500 mL/min.*
7. After starting the pump, turn on the multi-parameter and turbidity meters and take readings every three to five minutes. Three consecutive readings must be within stabilization criteria before collecting a sample. Stabilization criteria may be set by the specific project, but otherwise, use the stabilization criteria defined in table 1 below.

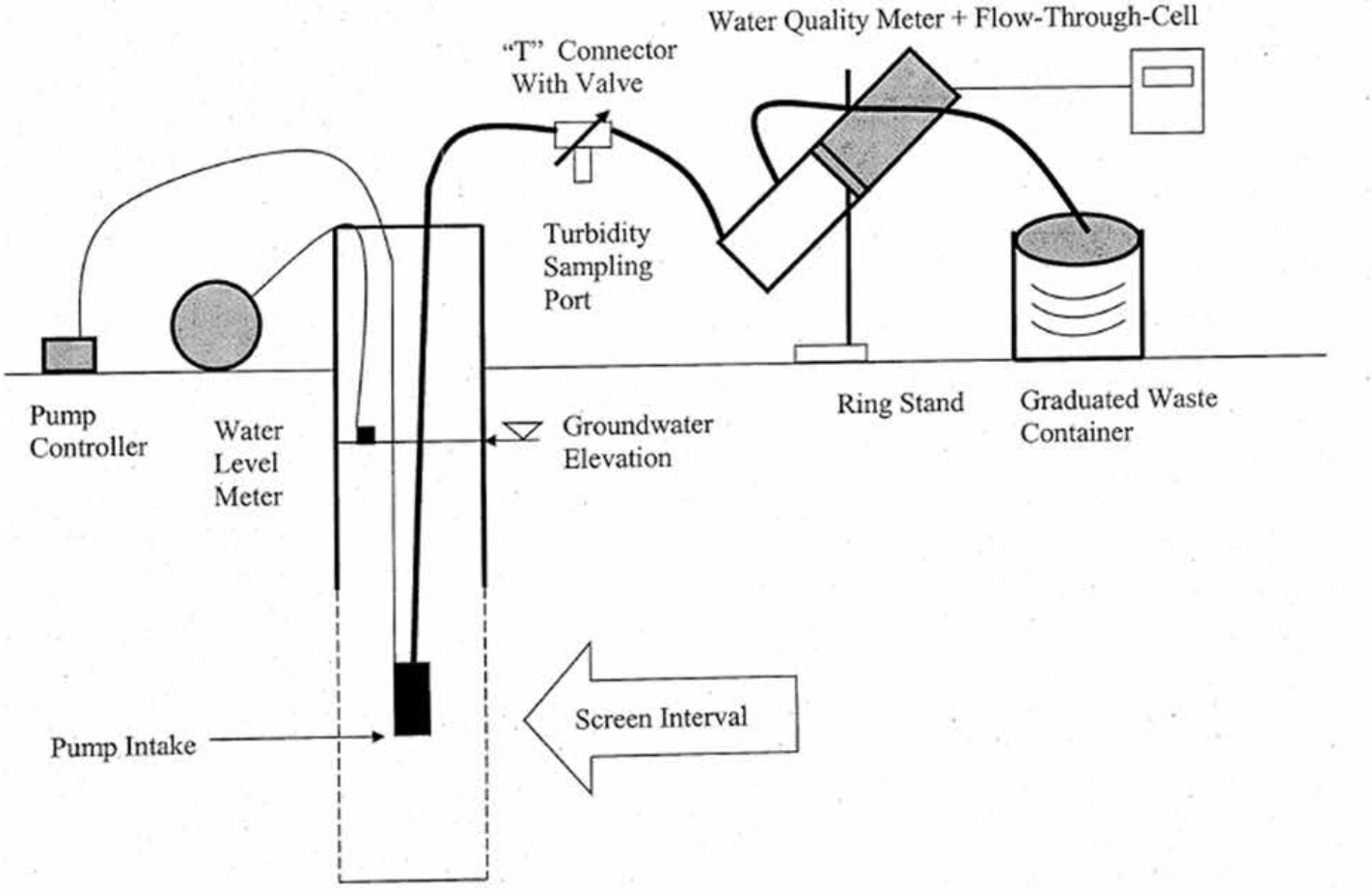
Table 1. Stabilization Criteria

Parameter	Unit	Stabilization Criteria	Exception
Dissolved Oxygen (DO)	milligrams per liter (mg/L	10%	<0.50 mg/L
Oxidation/Reduction Potential (ORP)	millivolts (mV)	±10 mV	
pH	standard units (s.u.)	±0.1 s.u.	
Specific Conductance (SC)	microsiemens per centimeter (µS/cm)	3%	
Turbidity	nephelometric turbidity units (NTU)	10%	<5 NTU

If these parameters do not stabilize by 30 minutes since start of purge, collect the sample and note a deviation of non-stabilized parameters and list which ones in field documentation.

8. Once criteria is met to collect a sample, turn off the multi-parameter and turbidity meters and disconnect the pump discharge tubing from the t-splitter and begin collecting water in the sample containers in order of priority. Collect, preserve, close, and store samples as soon as possible and according to the analytical method(s). *Note: Make sure sample collection takes place over a containerized area (sampling tote or bucket) so that spills are captured.*
    a. If collecting samples for organic compounds, including petroleum hydrocarbons, ensure that all engines (vehicles, generators, etc.) operate 20 feet downwind of the sampling area. Engines will be shut down prior to opening sample collection containers. During sample collection, pumps and meters should be powered using the vehicle battery or a portable battery. Use of disposable gloves will be used whenever fueling generators, to eliminate the possibility of cross-contamination of samples.
    b. Volatiles and dissolved gas analysis samples should be collected first, followed by semi-volatile organic compounds, then inorganic parameters, as required by the sampling and analysis plan.
    c. Field duplicate samples should be collected in conjunction with the natural/original/parent sample.
    d. Field equipment rinse samples should be collected in the same manner as a natural sample, after the decontamination process.
    e. Field blank samples are collected by pouring laboratory-grade DI water into sampling containers.
9. Once samples are collected, acquire a final depth-to-water measurement, and turn off the pump. Record the total purged volume by calculating the time from pump start to stop with the purge rate. Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



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SOP-16

QUALITY CONTROL SAMPLING

Quality Control (QC) samples are submitted along with natural samples to provide supporting laboratory data to validate laboratory results. QC samples are submitted blind except for matrix spikes and trip blanks, and do not have any unique identifying codes that would enable the lab or others to bias these samples in any way. Usually, the time or sampling location is modified in a way which will separate blank and standard samples from the rest of the sample train. QC samples are identified only on field forms and in field notebooks. The following codes are typically used:

N	Natural Sample	Soil, water, air, or other of interest material from a field site
SP	Split Sample	A portion of a natural sample collected for independent analysis; used in calculating laboratory precision
D	Duplicate Sample	Two samples taken from the same media under similar conditions; also used to calculate precision Two samples taken from the same media under similar conditions; also used to calculate precision
FB	Field Blank	Deionized water collected in sample bottle; used to detect contamination introduced during the sampling process.
RB	Rinsate Blank	Deionized water run through or over decontaminated equipment; used to verify the effectiveness of equipment decontamination procedures
MS/MSD	Matrix Spike/Matrix Spike Duplicate	Certified materials of known concentration; used to assess Spike Duplicate laboratory precision and accuracy
TB	Trip Blank	Inert material (deionized water or diatomaceous earth) included in sample cooler; sent by the lab, the sample is used to detect any contamination or cross-contamination during handling and transportation.

In general, selected QC samples will be inserted into the sample train within a group of twenty samples. QC samples will be prepared in the field, apart from trip blanks. Trip blanks will be supplied by the laboratory and will accompany each sample cooler containing samples for analysis of volatile organic compounds.

Typical QC sample collection frequencies are presented in the table below. However, at some sites, especially ones where streams or ponds are sampled, QC samples may need to be taken at a higher frequency. Refer to the project-specific sampling and analysis plan or quality assurance plan for the appropriate QC sample frequency. Each field crew leader will be responsible for all QC samples prepared by that crew.

QC Sample	Purpose	Collection Frequency
Field Duplicate	Measure analytical precision	1 per every 20 samples
Matrix Spike/ Matrix Spike Duplicate	Measure analytical accuracy	1 per every 20 samples
Equipment Rinse Blanks	Evaluate effectiveness of equipment decontamination and sample handling procedures.	1 per sampling event per media type
Field Blank	Assess possible cross-contamination of samples due to ambient conditions during sample collection	1 per sampling event
Trip Blank	Evaluate sample preservation, packing, shipping, and storage	1 per cooler containing samples with volatile constituents

Methods for computing data validation statements can be found in EPA documents or obtained from Geomatrix.

Water & Environmental TECHNOLOGIES

SOP-17

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

INTRODUCTION

This SOP describes the management of investigation-derived waste (IDW). The project specific Sampling and Analysis Plan should be referenced for additions or deletions to the methods noted below.

EQUIPMENT

- Department of Transportation (DOT)-approved packaging (typically DOT 17E or 17H drums) or other appropriate containers
- Funnel
- Bushing wrench
- 15/16-inch socket wrench
- Shovel
- Appropriate markers (spray paint, paint pen) and labels
- Plastic sheeting
- Drip pans
- Pallets
- Personal protective equipment as specified in the Site-Specific Health and Safety Plan (HASP)

PROCEDURES

Preparing Containers

1. Place each container on a pallet if it is to be moved with a forklift after it is full.
2. Ensure that packaging materials are compatible with the wastes to be stored in them. Bung-type drums should be used to contain liquids. If a liquid is corrosive, a plastic or polymer drum should be used.
3. Solids should be placed in open-top drums. Liners are placed in the drums if the solid material is corrosive or contains free liquids (other than water). Gaskets are also used on open-top drum lids.

KNOWN OR ASSUMED NON-HAZARDOUS WASTE

1. As waste materials are generated, place them directly into storage containers. Alternatively, depending on quantity, soils may be contained onsite on plastic sheeting and covered pending analytical results. In certain instances, if it is known that the IDW is not hazardous, it can be disposed of onsite (e.g., dispose the purge water on the ground, place soils back into test pits).
2. If the IDW is placed into a container, do not fill storage containers/drums completely. Provide sufficient space so that containers will not be overfull if their contents expand.
3. After filling a storage container/drum, seal it securely. Use a bung wrench or socket wrench, for a bung-type or open-top drum, respectively.
4. Label the container indicating its content, date, and origin/location.
5. If it is known that the IDW is not hazardous, arrange for disposal of the IDW as a solid waste.

6. If no information exists as to determine whether the IDW is hazardous (e.g., records, analytical results, of other knowledge of the IDW properties), the IDW must be profiled to determine disposal options.
7. To profile the waste:
   a. Contact the proposed disposal facility to obtain the type of information the disposal facility will need before accepting the IDW, including necessary analytical data.
   b. If analytical data are needed, collect a sample or samples of the IDW and submit to an analytical laboratory.
   c. Upon receiving the analytical results, arrange for the proper disposal of the IDW.

Note: The disposal facility will rely on you to provide information regarding the types of constituents that may be present in the IDW.

HAZARDOUS WASTES

1. As waste materials are generated, place them directly into storage containers.
2. Do not fill storage containers/drums completely. Provide sufficient space for expansion.
3. After filling a storage container/drum, seal it securely. Use a bung wrench or socket wrench, for abung-type or open-top drum, respectively.
4. Label drums or other packages containing hazardous waste. To comply with marking and labeling requirements, affix a properly filled out yellow hazardous waste marker. Do not mark drums with Water & Environmental Technologies' name. All waste belongs to the client. Include the accumulation start date on the label.
5. During an ongoing investigation, use a paint marker to mark the contents, station number, date, and approximate quantity of material on each drum or other container.
6. Do not mix IDW with one another or with other materials. Do not place items such as Tyvek® suits, gloves, equipment, or trash into drums containing soils or liquids, and do not mix water and soil. Disposable protective clothing, trash, soil, and water materials should be disposed of in separate containers.
7. Place the containers in a secured area equipped with a secondary containment system, if appropriate.
8. While storing the IDW, the substantive standards in 40 Code of Federal Regulation (CFR) Parts 264 and 265 Subparts I and J or State equivalent must be complied with.
9. Dispose the IDW upon completion of the field work or incorporate the IDW into the remedial action upon initiation of the final remedy. If the IDW will be disposed offsite, the IDW will need to be manifested for transportation in accordance with federal or state requirements.

SUPERFUND REQUIREMENTS

Testing and management of IDW originating from within a Superfund area, such as operable of the Butte/Anaconda NPL Sites, must be addressed in Site-Specific SAPs.

REFERENCE

Montana Department of Environmental Quality. (Undated). Technical Guidance Document #10 - Options for Discharge of Hydrocarbon-Contaminated Wastewater. Montana Department of Environmental Quality, Remediation Division, Petroleum Release Section, Helena, Montana.

Appendix B

WET Project Cost Estimate