

NCI Engineering Co.

June 15, 2016

Mr. Christopher Herman, Environmental Science Specialist
DEQ-Petroleum Tank Cleanup Section
P.O. Box 200901
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J&K Properties LLC
2750 Evergreen Dr
Great Falls, MT 59404

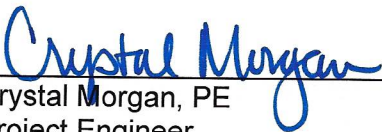
RE: Groundwater Monitoring Work Plan and Budget for the Petroleum Release at Vaughn Truck Stop, MT Highway 200 and 2nd Street, Vaughn, Cascade County, Montana; Facility ID 07-09910 (TID 18791), Release 449, Work Plan 35185

Dear Mr. Herman,

In a letter dated May 4, 2026, the MT DEQ requested a Groundwater Monitoring Work Plan for the above referenced facility. The work plan generally requests an perform groundwater monitoring at two site monitoring wells (MW-8 and MW-11 only) semi-annually for three years. At any time, if the wells have contaminant levels below RBSLs for two consecutive sampling events, the engineer will stop work and proceed with closure for this release.

The enclosed work plan is proposed for the groundwater monitoring work. Thank you for your assistance.

Respectfully,
NCI Engineering Co.


Crystal Morgan, PE
Project Engineer

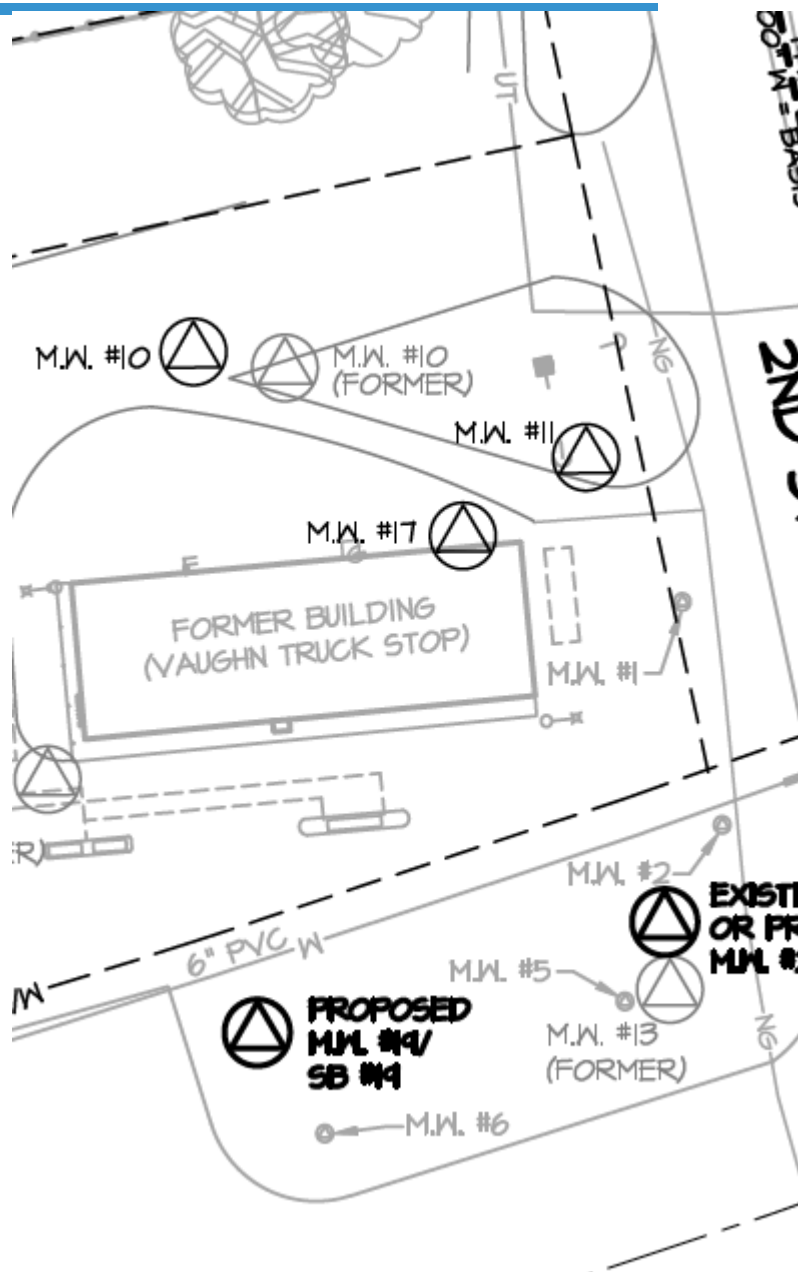
Enclosures

Former Vaughn Truck Stop

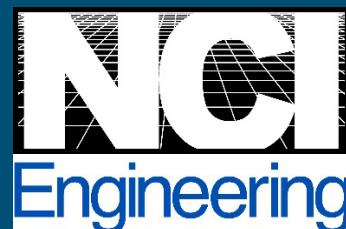
Remedial Investigation Work Plan

DEQ Facility ID #07-09910

DEQ Release # 449



June 2026



GROUNDWATER MONITORING WORK PLAN

**Former Vaughn Truck Stop
Highway 200
Vaughn, Montana**

**DEQ Facility ID # 07-09910
DEQ Release # 449**

June 2026

PREPARED FOR:

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PREPARED BY:

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1.0 **INTRODUCTION**

In a letter dated May 4, 2026, the MT DEQ requested a Groundwater Monitoring Work Plan for the above referenced for the Former Vaughn Truck Stop.

The work plan generally requests an perform groundwater monitoring at two site monitoring wells (MW-8 and MW-11 only) semi-annually for three years. At any time, if the wells have contaminant levels below RBSLs for two consecutive sampling events, the engineer will stop work and proceed with closure for this release. Below is the proposed work plan on fieldwork to be performed at the site following MT DEQ approval:

- ☐ Complete semi-annual groundwater monitoring events for 3 years. Sampling events will be completed in April for a high groundwater event and October for a low groundwater event. Purge water will be disposed per DEQ guidance. Groundwater elevations, average flow directions, and groundwater gradient should be defined during the annual event. Field parameters should be measured during the event, including DO, ORP, pH, specific conductance, and temperature. Groundwater samples should be collected (via low flow technology) from MW-11 and MW-8, and analyzed for volatile organic compounds (VOC), volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH) screen and lead scavengers. All laboratory samples will be submitted to Energy Laboratories, Inc. in Helena for analysis.
- ☐ Validate all laboratory analytical data using DEQ's Data Validation Summary Form (DVSF) and include with report.
- ☐ Discuss ongoing WP tasks and results with DEQ's project manager; as necessary, submit written agreed-upon WP modifications.
- ☐ Prepare and submit Interim Data Submittal after each April/Oct sampling event and one final Groundwater Monitoring Report at the end of the groundwater monitoring events. The IDS submittal will follow DEQ guidelines. Final report will include data summary tables, site maps, including potentiometric map. Prepare and discuss a Release Closure Plan (RCP) for the facility with DEQ case manager. Following discussion, revise and submit RCP to MT DEQ with reporting.

2.0 SITE HISTORY

2.1 General

The Vaughn Truck Stop property formerly contained a service station, convenience store, and restaurant, and began operation in about 1960. It is located in Vaughn, Montana near the crossroads of Interstate 15 and State Highway 89/200, approximately 12 miles north of Great Falls. See Figure 1.

2.2 Discovery of Contamination

Five (5) UST's previously existed on the property. Upon UST removal in February 1992, two feet of free product was discovered on the groundwater. NCI Engineering contracted with the Vaughn Truck Stop to remediate the property by excavation, removal and treatment of contaminated soils and groundwater at a state-licensed landfarm. In addition, a section of the public water main was replaced to reduce the potential for human exposure to the petroleum pollutants.

2.3 Facility Site Map

The Vicinity Map for the Former Vaughn Truck Stop is shown in **Figure 1**. The Site Map is shown in **Figure 2**.

2.4 Site History and AST/UST Systems

Five (5) UST's previously existed on the property. Upon UST removal in February 1992, two feet of free product was discovered atop the groundwater. NCI contracted with the Vaughn Truck Stop to remediate the property by excavation, removal and treatment of contaminated soils and groundwater at a state-licensed landfarm. In addition, a section of the public water main was replaced to reduce the potential for human exposure to the petroleum pollutants.

Approximately 7,000 cubic yards of petroleum-contaminated soil and 20,000 gallons of petroleum-contaminated groundwater were removed from the site. Approximately 250 feet of public water main, consisting of PVC pipe and standard rubber gaskets in the area of worst-case petroleum contamination, were replaced with new ductile iron pipe and hydrocarbon-resistant nitrile gaskets. Lab results showed that residual contamination remained in many areas, including under the existing (former) building, beneath 2nd Street, under the property to the east (vacant at the time), and beneath US Hwy 89/200 to the south.

Samples collected from monitoring wells at the site in 1999 indicated elevated levels of benzene remained at the site, particularly around the slab of the former building. Benzene concentrations exceeding the groundwater RBSL of 5 ppb were detected in MW-10, MW-11, MW-12, and MW-13, which surrounded the building.

In July 2000, DEQ requested that groundwater monitoring continue, that MW-8 be repaired or replaced, and that one additional well be installed in the former tank location east of the building. The letter also stated that, if the building was razed by the owner, DEQ requested a work plan for the removal of contaminated soil under the building. The building was removed and a Corrective Action and GW Monitoring Work Plan was prepared and submitted to DEQ.

Additional corrective action fieldwork was conducted in December 2003. The CA work consisted of the removal and disposal of contaminated soils and groundwater from beneath the former building. Concrete, contaminated soils and groundwater were hauled to the Shumaker Landfarm near Great Falls for disposal. The excavation continued until no signs of residual contamination existed, based on staining, odor, and/or PID readings. The excavation extended beneath the building to approximately 18 feet below ground surface (bgs). Groundwater was encountered at approximately 15 feet bgs. During this second phase of corrective action, the final volume of contaminated soils transported to the landfarm was 1,792 cubic yards.

Approximately 29,750 gallons of contaminated groundwater were transported from the site to the landfarm for disposal. Eight (8) soil samples were collected from the excavation. Five (5) of the soil samples collected from the completed excavation, both bottom samples, the "South Wall West 1/3" sample, the "South Wall East 1/3" sample and the "West Wall" sample, were below MDEQ Tier 1 RBSL's for subsurface soil within ten feet of groundwater. The remaining samples ("North Wall West 1/3" sample, "East Wall" sample, "North Wall East 1/3" and the "South Wall East 1/3" sample) contained minor exceedences for benzene and C₉ to C₁₀ Aromatics.

NCI's AMS Power Probe® direct push drill rig was used to advance two (2) soil borings at the site to a depth of 20 feet bgs. The borings were completed as two-inch monitoring wells (MW-17 and MW-8). No soil sample was collected from the location of MW-17 due to boring refusal. One (1) soil sample was collected at 12 feet bgs during the advancement of the boring completed as MW-8. The results for that soil sample had exceedences for both benzene and C₉ to C₁₀ Aromatics.

Groundwater monitoring was conducted at the site in January 2004 and in two (2) subsequent monitoring events (May and August 2004). Groundwater samples were collected from the two (2) new wells (MW-8 and MW-17) and four (4) existing wells (MW-11, MW-14, MW-15, and MW-16). No free product was detected in any of the wells during the monitoring. The 2004 monitoring events showed evidence of residual groundwater contamination at MW-8, MW-11 and MW-17; with several RBSL exceedences reported. During the same 2004 sampling events, monitoring wells MW-14, MW-15 and MW-16 showed no exceedences of Montana Tier 1 RBSL's.

In June 2006, DEQ requested the installation of replacement monitoring wells, MW-9, MW-10 and MW-13 as two-inch monitoring wells and semi-annual groundwater monitoring for a period of one year.

In February 2007, three (3) two-inch groundwater monitoring wells (MW-9, MW-10, MW-13) were installed using NCI's Power Probe drill rig. The wells were located near the location of former wells with the intent that new wells would replace previous wells. The first groundwater monitoring event was performed at the site on March 30 and April 4, 2007. Groundwater monitoring was conducted at six (6) wells (MW-8, MW-9, MW-10, MW-11, MW-13, and MW-17). A second event was conducted in October 2007.

Contamination levels observed during the two monitoring events provide evidence that past remedial activities at the site (excavation/landfarming) removed the majority of onsite soil contamination. MW-11, the only well that has not been replaced, appears to show significant decreases in contaminant levels. Since February 1999, groundwater concentrations decreased from 2010 ppb benzene and 4730 ppb TPH to 105 ppb benzene and 903 ppb TPH. RBSL exceedences during the October 2007 monitoring event supported previous conclusions that residual contamination exists in MDT R/W located south of the property. This area could not be excavated during the two phases of remedial action work. However, the contamination does not appear to present an appreciable threat to public health or the environment.

In a letter dated December 17, 2012, DEQ requested a Standardized Groundwater Monitoring Corrective Action Plan (CAP MR-01), in response to the Additional Remedial Investigation Report submitted by NCI in January 2008. This CAP is being submitted in response to DEQ's request. NCI submitted a work plan in January 2013. Monitoring wells MW-11, MW-13 and MW-17 reported exceedences of Tier 1 RBSLs during a June 2013 sampling event. MW-8, MW-9, and MW-10 contained no Tier 1 RBSL exceedences during the monitoring event. The groundwater levels during this event suggest a gradual decrease in contamination levels at the site. Although the site has seen decreased levels in contamination, contamination continues to be present. The contamination plume is well defined on and off-site.

In a letter dated March 14, 2022, the MT DEQ requested a Remedial Investigation Work Plan for the above referenced for the Former Vaughn Truck Stop. Remedial investigation fieldwork was completed at the site starting in October 2024 – June 2025 and objectives have been met. A Well Assessment was conducted on October 11, 2024. On May 5, 2025, soil borings were advanced and monitoring wells were installed. Groundwater monitoring was conducted on June 17, 2025. Two (2) soil borings were advanced to 20 feet bgs. No petroleum odor or staining was noted in SB-18; and all except one sample at 12'-13' had a petroleum odor at SB-19. PID results indicated 0 ppm readings for all samples, except SB-19 12'-13' of 13 ppm. Two (2) soil samples were collected from each soil boring. One soil sample resulted in benzene exceedance of 0.084 ppm (RBSL 0.07 ppm) and Total Petroleum Hydrocarbon (TPH) exceedance of 111 ppm (RBSL 100 ppm). No other soil

samples reported Tier 1 RBSL exceedences during the fieldwork activities. Groundwater monitoring was again conducted in October 2025. Results indicated exceedences of RBSLs in at MW-8 and MW-11 only. Natural biodegradation is slowly occurring at the site, with significant reduction in contaminant levels since the release was identified.

In May 2026, DEQ requested the groundwater monitoring well at MW-8 and MW-11, semi-annually for 3 years. This work plan identifies the proposed work as this site moves toward closure.

3.0 Summary of Facility Conditions

3.1 General Geology, Contamination Fate and Transport

Lithologic characteristics derived from the U.S. Soil Conservation Service show that soils on this site are *“comprised of Binna Series soil. The Binna Series is a loam which consists of deep, well-drained soils that formed in alluvium. They are generally found on terraces at elevations of 3300 to 4100 feet. Slopes are nearly level. Typically, the surface layer is grayish brown loam about 9 inches thick and is calcareous. The underlying material is light gray and light grayish brown, calcareous loam, gravelly sandy loam, and very gravelly loamy sand to a depth of 60 inches or more. Permeability is moderate to a depth of 28 inches and moderately rapid below. The available water capacity is moderate. Reaction is mildly alkaline in the upper 9 inches and moderately or strongly alkaline below.”*

From remedial investigations, it was concluded that soils limited the travel of contamination and subsoil contamination was not extensive. Site surfacing is primarily gravel for the facility. Wells located outside the property lines are either in landscaping or the roadside ditch. Figures from the last 2013 report that indicate groundwater flow and contamination plume are included in Section 4.

3.2 Community Water Supply

Vaughn is served with a public water supply system. A water main runs along the HWY 200.

3.3 First Groundwater

Depth to first groundwater at the facility is typically, 10-13' bgs.

3.4 Contaminants of Concern, Exposure/Receptors

Gasoline contamination is present at the facility. A water main is located in HWY 200 and a hydrant extension to the property corner. Construction contractors may be exposed to soil/groundwater while working on the water system. Other underground utilities are unknown. A Release Closure Plan has not yet been completed but is planned as part of this work plan.

4.0 Work Plan Site Maps

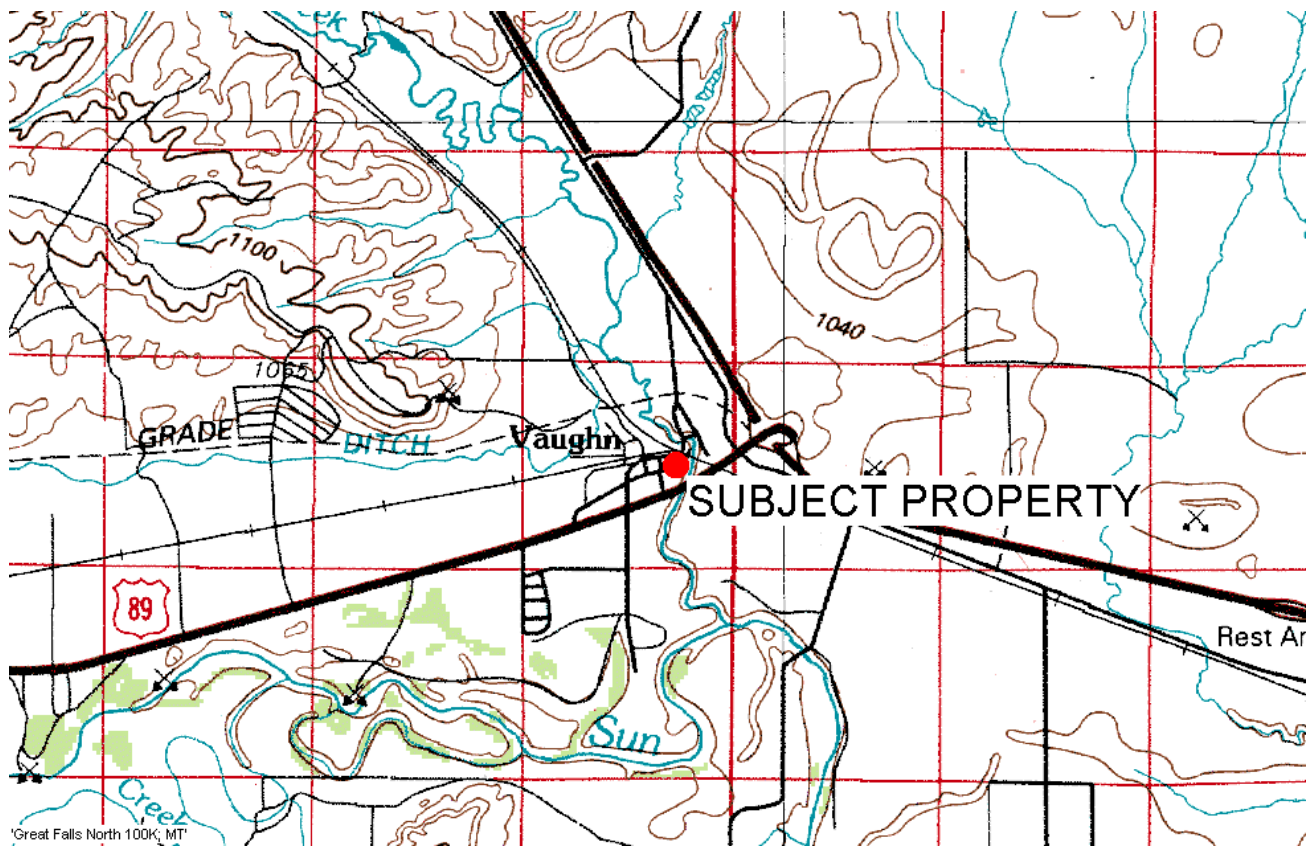
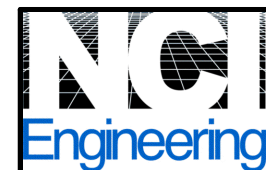
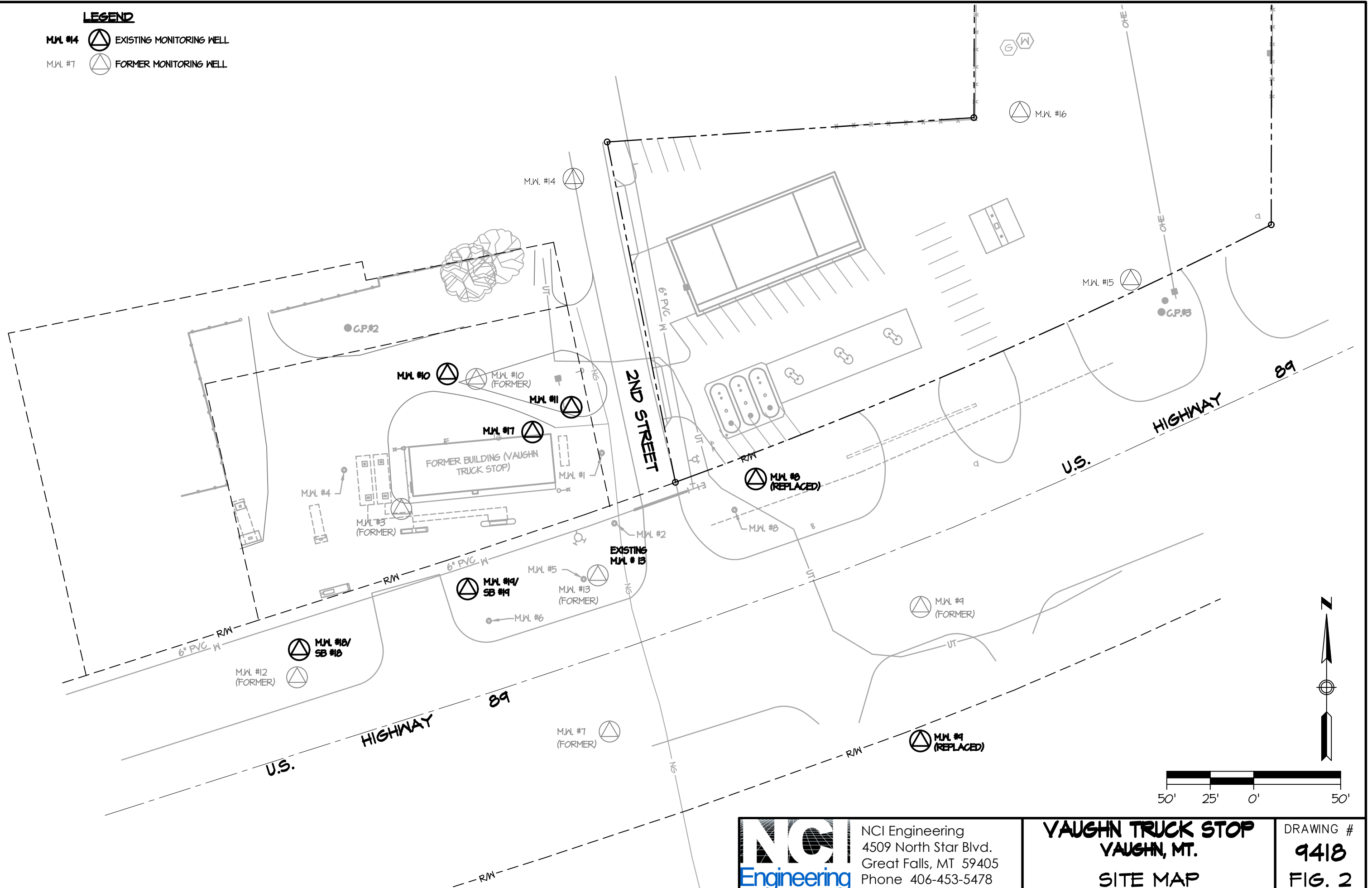


Figure 1 – Vicinity Map
Scale 1" ≈ 1 mile

Source: USGS Quadrangle Maps
7.5-Minute Series (Topographic)
"Great Falls North, Montana"

LEGEND

- M.W. #14  EXISTING MONITORING WELL
M.W. #7  FORMER MONITORING WELL



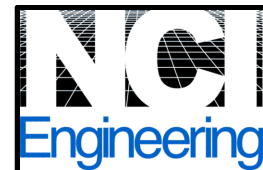
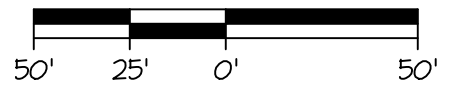
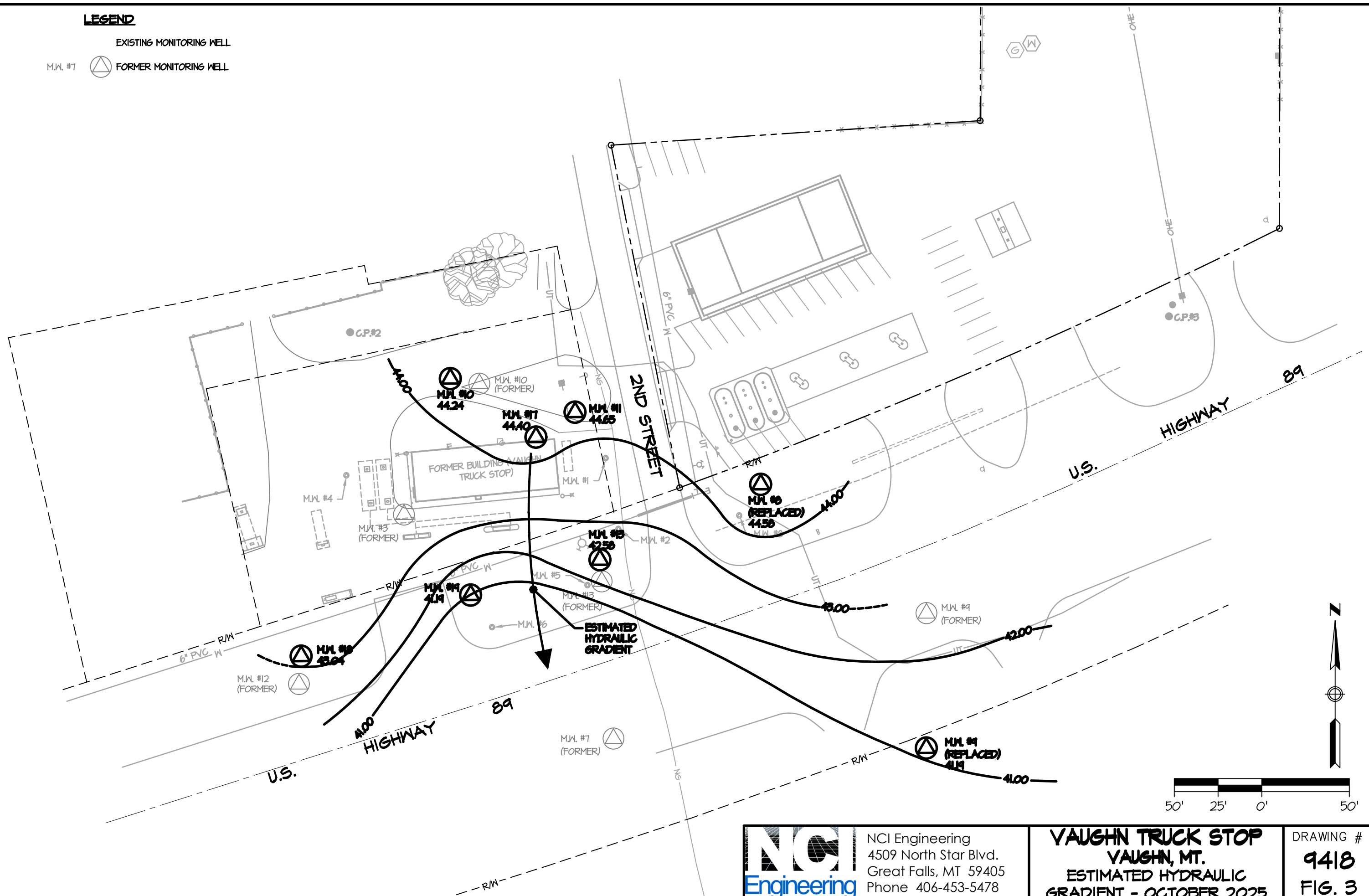
NCI Engineering
4509 North Star Blvd.
Great Falls, MT 59405
Phone 406-453-5478

VAUGHN TRUCK STOP
VAUGHN, MT.
SITE MAP

DRAWING #
9418
FIG. 2

LEGEND

EXISTING MONITORING WELL
 M.W. #7  FORMER MONITORING WELL



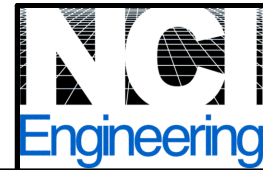
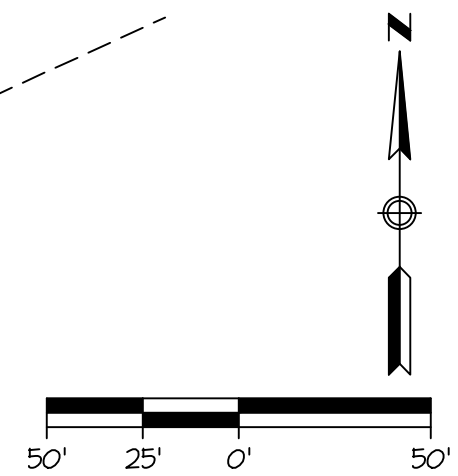
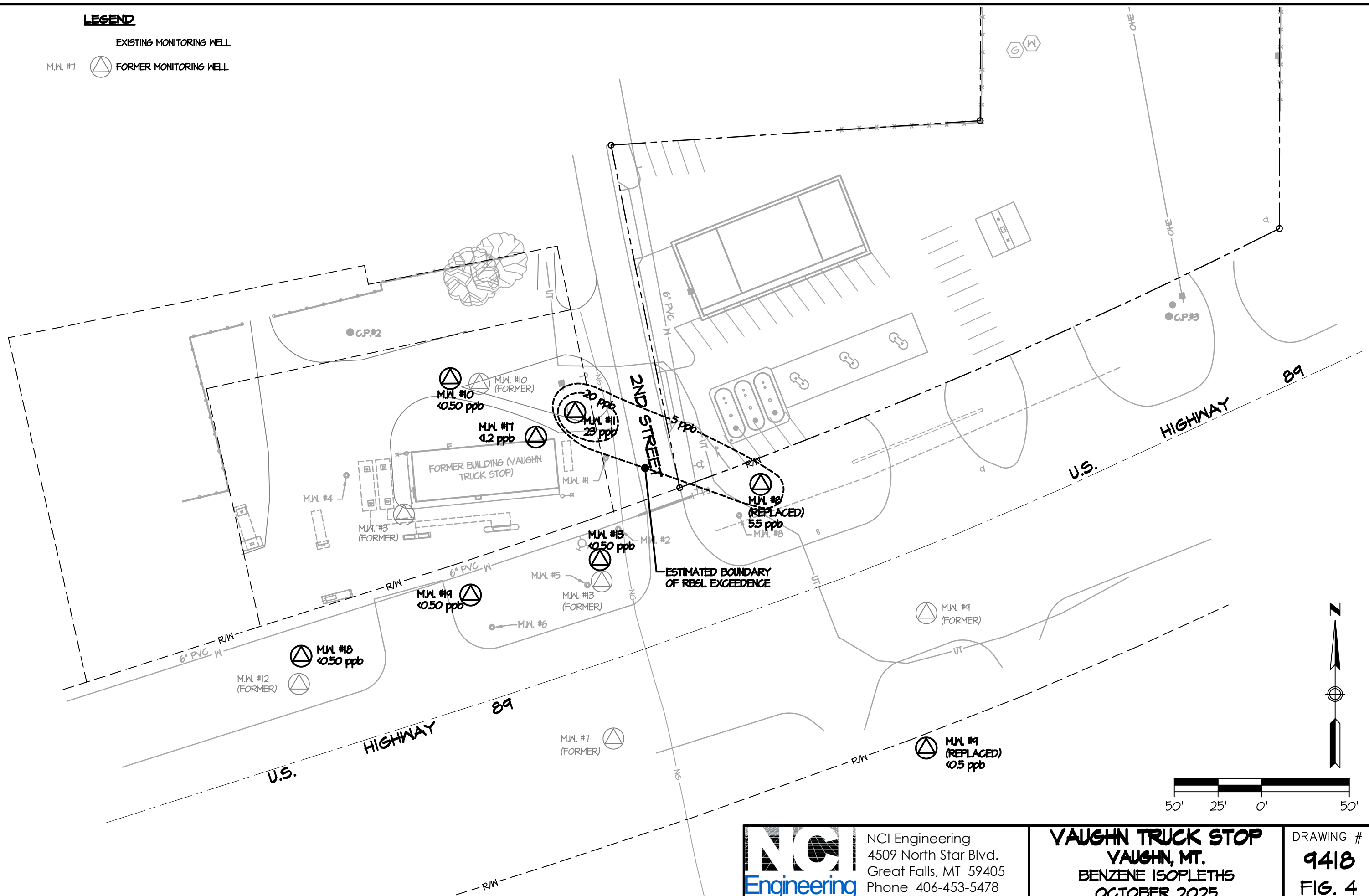
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 4509 North Star Blvd.
 Great Falls, MT 59405
 Phone 406-453-5478

VAUGHN TRUCK STOP
VAUGHN, MT.
ESTIMATED HYDRAULIC
GRADIENT - OCTOBER 2025

DRAWING #
9418
FIG. 3

LEGEND

EXISTING MONITORING WELL
 M.W. #7  FORMER MONITORING WELL



NCI Engineering
 4509 North Star Blvd.
 Great Falls, MT 59405
 Phone 406-453-5478

VAUGHN TRUCK STOP
VAUGHN, MT.
BENZENE ISOPLETHS
OCTOBER 2025

DRAWING #
9418
FIG. 4

5.0 **OBJECTIVES OF WORK**

The objectives of this Work Plan are described as follows:

- Monitor groundwater at monitoring wells MW-8, and MW-11 semi-annually for 3 years. Gauge fluid levels at all monitoring wells. Collect groundwater samples at all monitoring wells by low-flow sampling methodology. Sampling events will be completed in April for a high groundwater event and October for a low groundwater event. Purge water will be disposed per DEQ guidance. Groundwater elevations, average flow directions, and groundwater gradient should be defined during the annual event. Field parameters should be measured during the event, including DO, ORP, pH, specific conductance, and temperature. Groundwater samples should be collected (via low flow technology).

Analyze groundwater samples for VOC, VPH, EPH Screen and lead scavengers. All laboratory samples will be submitted to Energy Laboratories, Inc. in Helena for analysis.

- This will allow NCI to assess the current groundwater conditions at the site and monitor natural attenuation occurring at the site, including groundwater depth and hydraulic gradient, and to compare to historical groundwater conditions. Further, data will allow NCI to assess the current groundwater conditions at the site, to compare current contaminant concentration levels with historical conditions.
- Discuss ongoing WP tasks and results with DEQ's project manager; as necessary, submit written agreed-upon WP modifications.
 - This will allow NCI and DEQ to modify fieldwork activities to meet the needs of the current facility to determine to current extent of contamination and to adequately complete the information in the Release Closure Plan and determine recommendations for closure at the facility.
- Prepare and submit Interim Data Submittal after each April/Oct sampling event and one final Groundwater Monitoring Report at the end of the groundwater monitoring events. The IDS submittal will follow DEQ guidelines. Final report will include data summary tables, site maps, including potentiometric map. Prepare and discuss a Release Closure Plan (RCP) for the facility with DEQ case manager. Following discussion, revise and submit RCP to MT DEQ with reporting.
 - This report to DEQ will allow NCI to provide field data, analytical results and recommendations on the site with the intent of reaching stopping sampling once closure requirements are met.

6.0 SCOPE OF WORK / INVESTIGATIVE METHODS

6.1 Groundwater Monitoring

Groundwater monitoring will be conducted at two (2) existing groundwater monitoring wells (MW-8 and MW-11 only). Semi-annual groundwater monitoring events will be conducted for up to 3 years. Sampling events will be completed in approximately April for a high groundwater event and October for a low groundwater event. DEQ Groundwater Sampling Guidance is included in the Appendices of this work plan. Depth to groundwater, total well depth, and presence/absence of free product will be measured using NCI's ORS Interface Probe.

Field parameters, including dissolved oxygen, pH, specific conductance, temperature, and oxidation reduction potential, will be measured using NCI's Multi-parameter Water Quality Meter.

Groundwater samples will be collected at all monitoring wells by low-flow sampling methodology utilizing an Athena peristaltic pump. Samples will be analyzed for volatile organic compounds (VOC), volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH) screen analysis and lead scavengers. Samples from each monitoring well will be sent to Energy Laboratories in Helena for analyses. If the result of the EPH Screen analysis exceeds the screening level of 1000 parts per million (ppb), fractionation of the sample will be requested. All sampling will be performed in accordance with NCI's standard operating procedures & DEQ Sampling Guidance.

In accordance with DEQ's Technical Guidance Documents, purge water will be allowed to infiltrate to the groundwater by discharging it on the ground next to the well. The purge water will return to the same groundwater aquifer zone where the purge water originated. However, purge water containing any presence of free product will not be discharged and will be collected in a drum for disposal at Emeralds. Free product has not been evident at this site and is not expected.

6.2 Report

A Groundwater Monitoring Report documenting all field data and laboratory analyses will be prepared and submitted to DEQ following receipt and interpretation of analytical results. The report will incorporate all historic groundwater elevation and groundwater quality data and will make recommendations for remediation of the site to a resolved status. Report will include results, conclusions, and recommendations.

Groundwater Monitoring Interim Data Submittals will be submitted after each April-Oct sampling event (yearly IDS submittal) and one final Groundwater Monitoring Report at the end of the groundwater monitoring events. The IDS submittal will follow DEQ guidelines. Final report will include data summary tables, site maps, including potentiometric map. Prepare and discuss a Release Closure Plan (RCP) for the facility with DEQ case manager.

Following discussion, revise and submit RCP to MT DEQ with reporting.

6.3 Quality Assurance/Quality Control

Quality control samples collected during this investigation will include field duplicates and trip blanks. The following procedures will be used during sample collection to provide quality assurance and quality control (QA/QC), to minimize loss of volatiles, and to maintain the suitability of samples for analysis. Sample collection and analytical procedures will be consistent with SW-846. QA/QC methods to be used are defined below.

- One field duplicate sample will be collected during the advancement of boreholes, and during subsequent groundwater sampling. The samples will be a duplicate of a subsurface and groundwater sample that is suspected of contamination.
- Trip blanks are supplied by the laboratory and will accompany each cooler where samples are to be analyzed. One laboratory provided trip blank will accompany the samples in the cooler to the laboratory.
- All sample containers/preservatives will be supplied by a state-certified laboratory. Analyses will be performed by a state-certified laboratory.
- All samples will be handled in a manner which minimizes the loss of organic compounds to volatilization and biodegradation.
- All samples for analyses will be placed in a cooler on ice (at a temperature of 4° C) immediately following collection.
- Chain-of-custody procedures will be utilized during sampling and delivery.
- Documentation of the sampling and QA/QC procedures will include notes available for DEQ inspection. These notes will document the procedures for sampling and all other routine activities, and field notes describing the sequence of activities that took place in the investigation.

7.0 Schedule and Estimated Cost

7.1 Schedule

Groundwater monitoring serves many purposes, the results of which can be used to assess compliance with regulatory standards or evaluate the need for additional remedial action. Groundwater sampling is proposed in April and October following work plan approval and as weather allows. NCI will discuss data and information with DEQ case manager upon the completion of decision critical tasks such as groundwater events that suggest a change in circumstances and a need for a change in work plan. Per the guidance, also the following will be discussed with the project manager; recommended modifications to the work plan, receipt of analytical data, submittal of interim data submittals, updates to the release closure plan, other site-specific milestones.

7.2 Estimated Cost

A budget detailing costs for each work plan task requested for reimbursement is included for review. Estimated costs for this proposed petroleum investigation are provided in **Appendix A**.

8.0 References

NCI Engineering Co., (NCI) 2025. Former Vaughn Truck Stop Remedial Investigation Report
NCI Engineering Co, (NCI) 2013. Former Vaughn Truck Stop Groundwater Monitoring Report
Montana Bureau of Mines and Geology (MBMG). Ground Water Information Center
<https://mbmggwic.mtech.edu/>
United States Department of Agriculture, (USDA) Web Soil Survey
<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>
Montana Department of Environmental Quality (DEQ) Groundwater Sampling Guidance 2018
Montana Department of Environmental Quality (DEQ) Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases May 2021
Montana Department of Environmental Quality (DEQ) Disposal Of Untreated Purge Water From Monitoring Wells.
Montana Department of Environmental Quality (DEQ) Montana Risk-Based Corrective Action Guidance for Petroleum Releases. Feb 2024.
Montana Department of Environmental Quality (DEQ) Montana Cleanup Guidance for Petroleum Releases 2020
Montana DEQ - Waste Management and Remediation Division, Data Validation Summary Form (Version 1.3.0, Revised 1/26/18)

9.0 **Appendices**

Appendix B

Standard Operating Procedures

Groundwater Sampling

Managed Derived Waste

Standard Operating Procedures – Groundwater Sampling

The following identifies Standard Operating Procedures (SOPs) to be used for making field measurements and collecting samples. The following SOPs are included:

- Standard Operating Procedures #1: Groundwater Sampling
- Standard Operating Procedures #2: Equipment Decontamination
- Standard Operating Procedures #3: Sampling Shipping, Handling, and Custody.

Standard Operating Procedure #1: Groundwater Sampling

NCI Engineering Co. will be conducting the groundwater sampling. The Standard Operating Procedures for groundwater sampling follows ASTM Method D6771, and MT DEQ groundwater sampling guidance documents. The following equipment will be taken into the field for groundwater sampling:

- **Pump.** Water will be collected using a peristaltic discharge pump with an adjustable flow rate. ProActiveAlexis v2.0 model peristaltic pump is proposed.
- **Volume measuring device.** A graduated cylinder or similar is required for measuring flow rate.
- **Stopwatch.** A smart phone is sufficient.
- **Water level probe.** An electronic water-level indicator is required for water level measurements.
- **Water quality indicator.** Water will be pumped through a closed flow-through cell with instruments to measure temperature, pH, conductivity, dissolved oxygen, and oxidation-reduction potential.
- **Dedicated tubing.** Water will flow through dedicated polyethylene tubing from the pump to the flow-through cell. Tubing will be disposed of after use at each well.
- **Sample containers.** The analytical laboratory will provide sample bottles. Once collected, the sample bottles will be stored on ice in coolers.
- **Purge water containment.** All water that is removed from the well for purging will be collected and disposed of properly. Buckets can be utilized to collect any purge water.
- **Decontamination equipment.** Decontamination will include washing with a laboratory grade detergent (Liquinox or similar detergent)/clean-water solution, and rinsing with tap water.
- **Field notes and forms.** Field forms will need to be taken and chain-of-custody (COC) forms kept with the samples.

All equipment will be decontaminated and instruments calibrated according to manufacturer's instructions prior to sampling,. Samples will then be collected using the following steps:

1. Record the static water level in the monitoring well. Be careful not to go deeper than the top of the water to prevent mixing of water in the well.
2. Document total depth of the well, riser diameter, and static water level.
3. Determine the amount of tubing needed to reach at least the midpoint of the screen. The amount of tubing used outside of the well should be kept to a minimum, to prevent unnecessary heating of sampled water.
4. Place the pump with attached tubing into the well. Place the intake at the middle of the screened interval. Lower the tubing through the water column slowly to prevent excess turbidity.

5. Start the pump at the slowest possible rate to prevent unnecessary drawdown. Use the volume measurement device (e.g., graduated cylinder) and timing device to determine flow rate, if possible. Adjust the rate of the pump as needed.
6. Once the drawdown is stabilized, monitor water quality parameters for stabilization (Table 1), defined as meeting the criteria in Table 1 in three consecutive measurements. Each measurement of these parameters in the flow cell should be taken after complete replacement of the flow cell volume.

Table 1. Parameters that should be stable prior to sampling

Parameter	Stabilization criteria
pH	± 0.2 units
Conductivity	± 3%
Dissolved oxygen	± 10% or 0.2 mg/L (whichever is greater)
Eh or ORP	± 20 mV

7. Prepare the sample bottles with labels. Collect samples from the tubing. Do not change the pump rate. Collect at the same rate as purging to prevent excess turbidity.
 - a. Samples collected for volatile organic compound (VOC) analysis will be collected in three 40-mL volatile organic analysis (VOA) vials provided by the laboratory. Care should be taken to ensure that each vial is completely full of water, with as little air (headspace) as possible. To minimize headspace in the VOA vial, it is recommended that each vial be filled until a meniscus forms. Screw the top of the vial down over the meniscus. Place samples on ice immediately after sampling.
8. Decontaminate any other reusable equipment following Standard Operating Procedures #2: Equipment Decontamination. Dispose of tubing after sampling.

Standard Operating Procedures #2: Equipment Decontamination

If not new and certified pre-cleaned, sampling equipment will need to be decontaminated prior to starting field sampling. Decontamination procedures follow recommendations for equipment decontamination described in U.S. EPA (2001) and ASTM Method D5088. Sampling and sample processing equipment will be decontaminated before use according to the following procedures:

General Considerations for Decontamination of Reusable Sampling Equipment

1. All equipment that will contact a sampled medium will be decontaminated before and after use.
2. New powderless chemical-resistant gloves will be worn when performing equipment decontamination.
3. Wash/rinse tubs will be decontaminated before initial use and between sampling sites.
4. Detergent and rinse solutions used for decontamination procedures, unless in water sprayers, will be replaced with new solutions between sampling sites.
5. Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent contact with soil. If the equipment will not be used immediately, the equipment should be covered or wrapped with plastic sheeting or heavy duty trash bags to minimize potential contamination.

Sampling Equipment Decontamination

1. Put on disposable (powderless) gloves and other appropriate protective clothing before starting.

2. Wash equipment thoroughly with phosphate-free detergent (Liquinox or similar detergent) using a scrub brush.
3. Rinse with tap water. Shake off excess water.
4. If not used immediately, store cleaned equipment inside new sealable, uncolored plastic bags.

Delicate Equipment and Probes Decontamination

For sensitive equipment or equipment susceptible to water damage, clean by wiping successively with paper towels wet with detergent solution (if approved by manufacturer), and rinse with copious quantities of DI water.

Standard Operating Procedures #3: Sample Shipping, Handling, and Custody

This SOP describes how to properly handle and ship samples for chemical analysis while maintaining established COC requirements.

1. Plan to review and ensure that all samples are shipped within the prescribed sample hold times. Handling and hold time are guidelines from the analytical laboratory.
2. Review sample labels and make sure they are fully filled out.
3. Obtain enough COC forms and coolers to contain all of the samples that are being shipped.
 - a. Samples listed on a single COC form will not be split between coolers
 - b. One COC form must be used for each cooler.
4. Record the contact information on each COC form.
5. Record the following sample information on respective COC forms.
 - a. Sample ID
 - b. Date and time of sample collection
 - c. Sample matrix (e.g., water)
 - d. Number of sample containers sharing the same, respective sample ID
 - e. Analysis required for each sample (Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) Screen by EPA Method 8015M); and EPA 8260 VOC short list; water testing with EPA300.0, A2510 B, E353.2, E200.7_8.
6. Record the signature information at the bottom of the COC form.
7. Pack the cooler as follows:
 - a. Place a layer of bubble wrap and paper towels into the bottom of the cooler.
 - b. Wrap samples in bubble wrap provided by lab. Utilize packing peanuts to further cushion the samples.
 - c. Pack samples upright in cooler. Do not pack samples on their sides.
 - d. Pack samples with ice to keep cooled to approximately 4°C until received by the laboratory. Ice will be water frozen in excess sample bottles, and/or ice cubes within multiple re-sealable plastic bags to prevent water or ice from touching sample bottles.
 - e. Include the Laboratory provided Temperature Blank in the cooler.
8. Confirm the COC form and samples in the cooler match.
9. Seal the original COC form in a plastic re-sealable bag and tape the bag to the underside of the cooler lid (or the inside of the cooler).
10. For each cooler, sign and date COC seal (small stickers or tape with a line for a signature and date) or sections of evidence tape for each shipping container.

11. Place signed COC seals. Seals must be arranged so that the cooler cannot be opened without disturbing the seals.
12. Place clear packing tape over the COC seals.
13. Deliver cooler(s) to an Energy Labs location or deliver coolers to a UPS store for drop off in the afternoon before 5pm. The cooler can be delivered to a FedEx location or have FedEx pick up the cooler(s). Do not leave the cooler(s) at an unattended FedEx drop-off location. No samples will be shipped over a weekend.
14. All analytical samples will be sent to Energy Laboratories (ELI), Billings MT or Energy Laboratories (ELI), Helena, MT, for analysis. Utilize either the included UPS label or the included FedEx label (Fedex Standard Overnight) from Energy Laboratories. Setup for a FedEx pickup at our office online. Use the following information to set up the pick-up or the cooler can be taken to the airport FedEx drop off location:
Login: See file
Password: See file

UPS can be shipped from the UPS store on 10th Avenue South Great Falls.

Standard Operating Procedures – Management Derived Waste

The following identifies Standard Operating Procedures (SOPs) to be used for handling and disposing of derived waste from each applicable petroleum leaking underground storage tank site. The following SOPs are included:

- Standard Operating Procedures #1: Derived Waste Management

Standard Operating Procedures #1 – Derived Waste Management

INTRODUCTION

This SOP describes the management of investigation-derived waste.

EQUIPMENT

This list identifies possible equipment needed for disposal of derived waste, each site will be different and SOP describes the management of investigation-derived waste.

- Department of Transportation (DOT)-approved packaging (typically DOT drums) or other appropriate containers
- Funnel
- Bushing wrench
- 15/16-inch socket wrench
- Shovel
- Appropriate markers (spray paint, paint pen) and labels
- Plastic sheeting, gallon ziplocs
- Drip pans
- Pallets
- Personal protective equipment

PROCEDURES

Montana Department of Environmental Quality. Technical Guidance Document #10 - Options for Discharge of Hydrocarbon-Contaminated Wastewater should be followed for wastewater. The following identifies containers for soil disposal containers that requires disposal at a licensed facility.

Container Prep

- a. Place each container at the location on-site for licensed facility pick-up. If a pallet is needed place containers on pallet to be moved once full.
- b. Review containers and confirm they are compatible with the wastes to be stored in them. Bungtype drums should be used to contain liquids. If a liquid is corrosive, a plastic or polymer lined drum should be used.
- c. Contaminated soils should be placed in open-top drums. Liners are placed in the drums if the soils are corrosive or contains free liquids (other than water). Gaskets will also be needed on open-top drum lids.

Waste Disposal

- a. Generated wastes should be placed directly into storage containers. Depending on quantity, soils may be contained onsite on plastic sheeting and covered pending

analytical results. At certain sites, if it is known that the derived waste soils are not hazardous, it can be disposed of onsite (e.g., dispose the purge water on the ground, place soils back into test pits).

- b. If the waste 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.
- c. After filling a container/drum, seal it securely. Bung wrench or socket wrench, will be used for a bung-type or open-top drum, respectively.
- d. Label the container, as necessary, indicating its content, date, and location.

Hazardous Wastes

This SOP does not include handling Hazardous Wastes.

REFERENCE

Montana DEQ, Petroleum Release Section

Montana DEQ Technical Guidance Document #10 - Options for Discharge of Hydrocarbon-Contaminated Wastewater.

Appendix C

DEQ GWM Guidance 2021



Montana Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases

Draft
March 2021

	Department of Environmental Quality Waste Management and Remediation Division Petroleum Tank Cleanup Section Guidance Document	Number:	DEQ-PTCS-GWM
		Original Effect. Date:	September 2013
		Revision No.:	1
Document Type:	Technical Guidance		
Resource Contact:	Supervisor of Petroleum Tank Cleanup Section	Review Schedule:	Annual
Originating Unit:	Petroleum Tank Cleanup Section	Last Reviewed:	March 2021
Montana Groundwater Monitoring Work Plan and Report Guidance for Petroleum Releases			

Purpose:	The purpose of this document is to describe the objectives, expectations, and detailed items necessary for monitoring groundwater at a petroleum release to meet requirements in state laws; these include a groundwater monitoring work plan and a groundwater monitoring report of the work, data, results, and recommendations for additional remediation work to resolve the release.
Scope:	This guidance applies to petroleum products and constituents of petroleum products released to the environment from petroleum storage tank systems that are regulated under the Petroleum Storage Tank Cleanup Act (§75-11-301 et seq.) or the Montana Underground Storage Tank Act (§75-11-501 et seq.) and administrative rules promulgated thereunder. Accordingly, this guidance is applicable to petroleum releases defined by Administrative Rules of Montana (ARM) 17.56.5; and the requirements for compliance monitoring under ARM 17.56.6. This guidance supersedes all previous versions of guidance addressing groundwater monitoring at petroleum storage tank releases.

Revision Date	Revision Description
March 2021	Extensive update to and consolidation of the following work plan and report formats: Abbreviated Groundwater Monitoring Corrective Action Plan and Budget Format, Standardized Corrective Action Plan for Groundwater Monitoring, Abbreviated Report Form for Groundwater Monitoring at a Petroleum Release Site, and Standardized Report Format for Groundwater Monitoring at Petroleum Release.

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Referenced documents available at DEQ’s website:

- MT DEQ Risked-Based Corrective Action (RBCA) Guidance for Petroleum Releases
- MT DEQ Remedial Investigation (RI) Guidance for Petroleum Releases
- MT DEQ Remedial Alternatives Analysis (RAA) Guidance for Petroleum Releases
- MT DEQ Cleanup Guidance for Petroleum Releases
- MT DEQ Release Closure Plan (RCP) for Petroleum Releases
- MT DEQ Vapor Intrusion (VI) Guidance
- MT DEQ Groundwater Sampling Guidance
- MT DEQ Monitored Natural Attenuation
- MT DEQ Petroleum Release Closure Guidance
- MT DEQ Glossary of Terms
- Montana Quality Assurance Plan (QAP) for Investigation of Underground Storage Tank Releases

Montana Groundwater Monitoring Work Plan and Report Guidance

Montana Department of Environmental Quality (DEQ)
Petroleum Tank Cleanup Section (PTCS)

Overview

This DEQ guidance describes the objectives and expectations required for a groundwater monitoring work plan (WP) and report to comply with Montana law that addresses petroleum tank release (Release). These include specific items for a groundwater monitoring work plan and detailed items for a groundwater monitoring report. A Release in this guidance is defined by Administrative Rules of Montana (ARM) 17.56.5 and includes all reportable leaks, spills, and overflows of petroleum or petroleum products from petroleum storage tank (PST) systems including but not limited to underground storage tanks (UST), aboveground storage tanks (AST), piping, sumps, and dispensers.

ARM 17.56.605 requires the owners and operators (O/Os) of Releases to monitor the effectiveness of cleanup activities and monitor the extent, magnitude, and concentrations of dissolved contaminant plumes.

Objectives

The groundwater monitoring objectives for each Release are to collect sufficient information and data of documented quality needed to meet the following purposes: document the impacts and potential impacts on public health and the environment; recommend and select effective cleanup methods to protect human health and the environment; monitor the effectiveness of cleanup activities; and consider reliable closure pathways to resolve the Release. The groundwater monitoring WP and report discussed herein are intended for stand-alone monitoring efforts. When groundwater monitoring is part of a remedial investigation or cleanup work plan, the work plan and report are to comply with the requested and approved format.

Expectations

DEQ expects an owner and/or operator (O/O) of a PST system – including properties that historically had a PST system (Facility) – associated with a Release to accomplish the following:

- Obtain professional environmental consulting services to plan and monitor groundwater; the consultant represents the O/O and should be experienced with successful investigations, cleanups, and resolutions of Releases;
- Meet with the O/O's consultant and DEQ's project manager to discuss the Release, plan work required to monitor groundwater, and develop a plan to resolve the Release;
- Prepare and submit a Groundwater Monitoring work plan (WP) to DEQ for review and approval;
- Monitor groundwater according to a DEQ-approved WP and maintain contact with DEQ. Recommend and discuss WP modifications required to achieve the monitoring objectives. DEQ will approve agreed upon WP modifications;
- Submit Interim Data Submittals and Groundwater Monitoring Report(s) that include an updated Release Closure Plan;

Groundwater should be monitored using current scientific and engineering principles, technology, and methods to complete with a reasonable degree of certainty of the following:

- Monitor the extent and magnitude of petroleum impacts to surface water and groundwater via collection and appropriate laboratory analysis of samples as specified in DEQ's RBCA Guidance Document Table C – Testing Procedures for Groundwater and in the Montana Quality Assurance Plan for Investigation of Underground Storage Tanks (MT QAP).
- Assess trends of petroleum contaminant concentrations and geochemical indicators in groundwater to determine the extent to which additional investigation, remediation, and/or monitoring is necessary to resolve the release.
- Identify and mitigate risks that may pose an immediate threat to receptors; and the O/O or their representative should immediately notify DEQ.
- Identify issues and obstacles that interfere with achieving the groundwater monitoring objectives; promptly discuss issues with DEQ's project manager; and recommend appropriate modifications to the WP that will ensure the objectives are met.
- Prepare detailed maps and summary tables that illustrate and summarize the site-specific data.
- Update the Release Closure Plan using the DEQ-provided form.
- Prepare and submit Groundwater Monitoring Report(s) to DEQ.

Groundwater Monitoring Work Plan and Report Procedures

The WP and report expectations discussed in this guidance and detailed below address the issues and expectations for most petroleum releases. Use of this guidance will facilitate preparation and review of documents; ensure that required information is collected to document the impacts and potential impacts on public health and the environment; monitor the effectiveness of cleanup methods; and consider reliable closure pathways to resolve the Release.

O/Os and their consultants are encouraged to contact DEQ's project managers to confer on draft work products as they are being prepared for groundwater monitoring, clarify any portion of a WP request that is not clearly understood, and propose site-specific modifications to WP tasks necessary to meet monitoring objectives. DEQ will work with the O/Os and their consultants to define the additional WP tasks and expectations. Only DEQ can approve modifications to the WP tasks and report expectations in this guidance.

DEQ will use this Groundwater Monitoring Work Plan and Report Guidance to review submitted WPs and reports. DEQ's approval of the modifications is required before the work is completed, not after. O/Os and their consultants may proceed with work plan tasks prior to DEQ's approval of the WP; however, there is a risk of work completed prior to DEQ's approval might result in methods, data, or information not being approved after-the-fact and additional or different work being required.

Groundwater Monitoring Work Plan Process

When DEQ requests groundwater monitoring, the O/O and their consultant will prepare a WP in accordance with the expectations for a Groundwater Monitoring WP (refer to WP Expectations detailed below) and submit the WP to DEQ for approval. DEQ may also provide site-specific guidance to the O/O for additional items to be included or excluded in the Groundwater Monitoring WP.

DEQ will review and approve the WP if it meets the detailed Groundwater Monitoring WP Expectations listed below and site-specific guidance provided by the DEQ project manager. The O/O will be notified of DEQ's approval and a deadline to have the work outlined in the WP completed and a report submitted to DEQ. DEQ will determine a reasonable deadline based upon severity of risks posed to human health, safety, and the environment, the amount of prior work completed, and other relevant factors.

Because groundwater monitoring serves multiple purposes (e.g., compliance monitoring, performance monitoring, etc.) modifications to the work plan may be required such as: extension of the deadline, additional monitoring events, modification of the analytical suite, or modification of the wells sampled. The O/O and their consultant are expected to communicate with DEQ regarding recommendations to modify the WP to better achieve groundwater monitoring objectives and about any issues that are not clearly understood regarding completion of the WP. If conditions are identified that may pose an immediate risk to receptors at any time during groundwater monitoring, the O/O or their consultant should immediately notify DEQ and take steps to mitigate the risks.

Groundwater Monitoring Report Process

It is DEQ's intent to outline the reporting process for Interim Data Submittals and the comprehensive Groundwater Monitoring Report. Interim Data Submittals should clearly document individual groundwater monitoring events. A comprehensive Groundwater Monitoring Report is to be submitted at the agreed upon frequency to document the methods and results of all groundwater monitoring events not previously reported (refer to Report Expectations detailed below).

Upon completion of fieldwork and receipt of analytical data, updated tables and figures are to be prepared and submitted as an Interim Data Submittal. The O/O and/or their consultant will discuss the results with DEQ, assess the remaining scope of the approved work plan, and evaluate the need for work plan modifications.

Upon completion of all mutually agreed upon groundwater monitoring events, the O/O should document the results of the groundwater monitoring in accordance with the Groundwater Monitoring Report Expectations below and site-specific guidance provided by the DEQ project manager. The results of all WP tasks, conclusions, recommendations, an updated Release Closure Plan, and all supporting data should be included in the Groundwater Monitoring Report. DEQ will evaluate the submitted report based on the detailed report expectations listed below; if DEQ determines additional information, data, analysis, or corrections are required to meet groundwater monitoring objectives, DEQ will notify the O/O and their consultant of report deficiencies.

Groundwater Monitoring – Work Plan Expectations

This section describes items to assist O/Os and their consultants to meet the minimum requirements for a Groundwater Monitoring Work Plan (WP) as required by Montana laws for petroleum storage tank (PST) systems, including properties that historically had a PST system (Facility). This guidance provides O/Os and their consultants with the basic expectations for a Groundwater Monitoring WP before it will be approved by DEQ. It is the O/O's responsibility to confer with the DEQ project manager to determine if, and what, modifications to the WP will be necessary based on potentially changing conditions at the Facility.

DEQ will evaluate the submitted WP against the Groundwater Monitoring WP requirements listed below and site-specific guidance provided by the DEQ project manager. If the WP adequately address all requirements, the WP will be approved. If the WP is not approved, DEQ will notify O/Os and their consultant of deficiencies.

Section 1: Title Page

Cover letter should be no longer than one page and include the following:

- Date
- Responsible party's name, mailing address, and email address
- Contact person's name, mailing address, and email address (if different from above)
- Subject line with the following information:
 - Groundwater Monitoring Work Plan for the petroleum release at (Facility name, street address, town), MT (zip code)
 - DEQ Facility ID (number), Treads ID (number), Release (number), and Work Plan (number)
- Introductory paragraph containing reference to DEQ's request for a Groundwater Monitoring Work Plan and general scope of work to be conducted
- Consultant's name, mailing address, and email address (if not on letterhead)

Section 2: Facility History/ Release Background

Summarize the currently known history of the Facility and Release background based on information detailed in previously completed corrective action reports, including the following:

- Previous Facility use/owner/operator information
- Current Release: notification date, cause and source, type and amount of petroleum products lost
- Type of petroleum products past and present stored at Facility
- Known and suspected contaminants of concern
- Summary of assessment and cleanup actions undertaken including dates of actions and/or operation
- Average depth of groundwater that will be sampled
- Potential exposure and/or receptor concerns as identified in the Conceptual Site Model or Release Closure Plan

Section 3: Objectives of Groundwater Monitoring

State the site-specific objectives for the Groundwater Monitoring of this Release.

- Specific goals of groundwater monitoring (e.g., compliance monitoring, performance monitoring, assessment of geochemistry to enhance attenuation, evaluate trends, etc.)
- Criteria that will be measured to assess compliance with stated goals and objectives
- Potential modifications to the work plan to meet goals and objectives based on the measured criteria

Section 4: Minimum Work Plan Tasks

This section defines expectations for tasks that will be defined, planned, and budgeted in the WP; however, they are not intended to be performed during the generation of the WP. Rather the work defined in most of these tasks will occur during the implementation of the DEQ-approved WP.

- Project management for all tasks related to the WP
- Describe the WP tasks; and solicit bids as required from subcontractors
- Prepare a WP and submit it to DEQ for approval
- Mobilization and travel to/from the Facility to conduct onsite WP tasks
- Assess Completeness of Receptor Survey completed previously as described in the MT DEQ Remedial Investigation (RI) Guidance for Petroleum Releases
 - Potential exposure media, exposure points, and receptors in the Release area (e.g., surface/subsurface soil, groundwater, surface water, structures, utility corridors, drinking water and irrigation wells, storm and sanitary sewers, and sumps) have previously been identified during the Remedial Investigation and mitigated by remedial action. Assess conditions to confirm that new receptors are not present and that mitigating factors limiting the exposure of potential receptors to residual petroleum contamination are still in place.
- Monitor groundwater to achieve the specific goals and objectives of monitoring, for more details of how to develop a sampling plan, see the MT QAP:
 - Identify monitoring wells to be gauged and sampled
 - Identify the schedule (e.g., seasonal high or low groundwater conditions) and frequency (e.g., semiannual, annual, biennial, etc.) of monitoring
 - Description of sampling methodology and site-specific conditions that may affect sampling (e.g., depth to groundwater, low-yield aquifer, etc.)
 - Methods of waste disposal: spent non-reusable sampling equipment, spent personal protective equipment (PPE), water used for decontamination of reusable equipment, and purge water
 - Standard Operating Procedures (SOPs) for fluid level measurements, sampling and sample preservation methodology, field parameter measurements, decontamination of reusable sampling equipment, laboratory analysis, etc.
 - Describe the QC protocols (as outlined in the MT QAP), including the collection of duplicates, blanks, etc. and the acceptance criteria for laboratory and field QC samples.
 - Identify the analytical suite based on the nature and date of the release, historical monitoring data, and identified objectives of monitoring
 - Submit all samples to an analytical laboratory for analysis of petroleum constituents as outlined by Montana Risk-Based Corrective Action Guidance for Petroleum Releases (RBCA Guidance) and to achieve the identified monitoring objectives
 - Chain-of-custody procedures
- Prepare and submit Interim Data Submittals according to specifications detailed below

- Participate in meetings with the O/O and DEQ's project manager to discuss the results of groundwater monitoring and recommend additional work to achieve the monitoring objectives. DEQ will approve agreed upon WP modifications. Examples of WP modifications include the following:
 - Monitoring well repair and/or redevelopment to ensure sample integrity
 - Additional monitoring events or monitoring frequency changes to confirm anomalous data, confirm trends, or extend monitoring timeline
 - Modification to the monitoring wells selected for sampling
 - Modification to the analytical suite
- Prepare detailed maps to illustrate the results of WP tasks (see Groundwater Monitoring Report Expectations below)
- Update the Release Closure Plan (RCP)
 - Update the existing RCP to assess the performance of continued groundwater monitoring to advance the Release to closure in the projected timeframe
- Prepare a detailed Groundwater Monitoring report
 - Consolidation and tabulation of data
 - Evaluation and interpretation of data and results
 - Results, Conclusions, and Recommendations

Section 5: Schedule and Reporting

Groundwater monitoring serves many purposes, the results of which can be used to assess compliance with regulatory standards or evaluate the need for additional remedial action. O/O or their consultant is expected to provide sufficient data and information to have a discussion with DEQ's project manager upon the completion of decision-critical tasks such as the following:

- Recommend modification(s) to the work plan
- Receipt of analytical data
- Submittal of Interim Data Submittals
- Updates to the Release Closure Plan
- Other site-specific milestones

Section 6: Appendices for Work Plan

DEQ may require site-specific attachments to the WP; however, the following appendices for a Groundwater Monitoring WP are expected.

- Standard Operating Procedures (SOPs) for all methods and sampling protocols
- Budget detailing costs for each WP task if the O/O expects to apply for reimbursement from the Petroleum Tank Release Compensation Fund, or upon DEQ's request

Groundwater Monitoring – Interim Data Submittal Expectations

Owners and operators (O/O) of properties with petroleum releases (Release) from petroleum storage tank (PST) systems, including properties that historically had a PST system (Facility), are required under Montana law to monitor petroleum contamination in groundwater associated with a petroleum release (Release) and to evaluate the risk it poses to human health, safety, and the environment. This outline provides O/Os and their consultants with the basic Expectations for a Groundwater Monitoring Interim Data Submittal. It is the O/O's responsibility to stay in contact with the DEQ project manager to determine whether modifications to the WP will be necessary to complete groundwater monitoring objectives.

DEQ will evaluate the submitted Interim Data Submittal against the detailed expectations listed below; and if found to adequately document monitoring and address all requirements, the Interim Data Submittal will be accepted. If DEQ determines additional information, data, or corrections are required to meet groundwater monitoring objectives then DEQ will notify the O/O and their consultant of deficiencies.

Cover Letter

- Subject: Groundwater Monitoring - Interim Data Submittal
- Facility name
- Facility address
- DEQ Facility ID Number, Treads Facility ID Number, Release Number, and Work Plan ID
- Responsible party's name, mailing address and phone number
- Contact person's name, mailing address and phone number (if different from above)
- Date Interim Data Submittal prepared
- A brief (one page or less) executive summary of the groundwater monitoring event
 - Provide the date(s) of groundwater monitoring
 - Identify the sampling points (monitoring wells, tap water, etc.)
 - Identify the sampling method(s)
 - Identify sampling points that have been damaged, need repair, or need redevelopment
 - Identify deviations from the approved work plan
 - Comment on the validity/usability of the data
 - Describe any changes to the facility or adjacent properties that have occurred since the last monitoring event that may influence groundwater monitoring results
- Present groundwater analytical results and field parameters in cumulative table(s) including field data such as sample identification, screened interval, depth to fluid(s), free-product thickness (if present), and collection date (refer to example Groundwater Table below).
 - Groundwater analytical results should be compared to current Risk-Based Screening Levels (RBSLs) published in RBCA.
 - Intrinsic Biologic Indicators (IBI) analytical results and related field parameters should be documented and presented as provided in the IBI section and Example section below.

- Present groundwater elevation calculations in a table
- Construct maps that illustrate the results of groundwater monitoring, including the following:
 - Potentiometric surface with groundwater flow direction(s)
 - Isopleth (iso-concentration) map depicting at least one analyte for each contaminant type (gasoline, diesel, etc.) that best depicts extent and magnitude of that contaminant type.
Consult with DEQ's project manager for selection of analytes depicted
- Completed well purging field sheets for each monitoring point sampled
- Laboratory analytical data package with chain-of-custody
- Completed Data Validation Summary Form(s)

Groundwater Monitoring – Report Expectations

Owners and operators (O/O) of properties with petroleum releases (Release) from petroleum storage tank (PST) systems including properties that historically had a PST system (Facility) are required under Montana law to monitor petroleum contamination in groundwater associated with a petroleum release (Release) and to evaluate the risk it poses to human health, safety, and the environment. This outline provides O/Os and their consultants with the basic Expectations for a Groundwater Monitoring Report (Report). It is the O/O's responsibility to stay in contact with the DEQ project manager to determine whether modifications to the WP will be necessary to complete groundwater monitoring objectives.

DEQ will evaluate the submitted Groundwater Monitoring Report against the detailed report expectations listed below; and if found to adequately document monitoring and address all requirements, the Report will be accepted. If DEQ determines additional information, data, analysis, or corrections are required to meet groundwater monitoring objectives then DEQ will notify the O/O and their consultant of report deficiencies.

Note: DEQ expects a certain amount of detail in reports submitted during the investigation, cleanup, and monitoring of a Release from a PST system to meet the requirements of Montana law. In many instances some information, such as facility history and release background has been previously reported in Remedial Investigation Report(s) or Cleanup Report(s). Information and details that have not changed significantly may be excerpted from other reports with little or no modification (e.g., facility location, geology, hydrogeology, sampling protocol followed for groundwater sampling, CSM, QA/QC procedures, Standard Operating Procedures (SOPs), etc.). However, all tables, maps, and the Release Closure Plan should be updated when additional data are collected or available for each successive report.

Title Page

- Title of report: Groundwater Monitoring Report
- Facility name
- Facility address
- DEQ Facility ID Number, Treads Facility ID Number, and Release Number
- Responsible party's name, mailing address and phone number
- Contact person's name, mailing address and phone number (if different from above)
- Consultant's name, address, and phone number
- Date report prepared

Executive Summary

The executive summary should not exceed one page in length. It should provide a succinct summary of the groundwater monitoring results, findings, conclusions, and recommendations.

Purpose and Objectives of Investigation

State the site-specific objectives for the Groundwater Monitoring of this Release.

- Specific goals of groundwater monitoring (e.g., compliance monitoring, performance monitoring, assessment of geochemistry to enhance attenuation, etc.)
- Criteria measured to assess compliance with stated goals and objectives
- Potential modifications to the work plan to meet goals and objectives based on the measured criteria

Facility History and Release Background

The history of the Facility should include information about the current and historical property use; and the physical and legal aspects of the property that may affect the Release and its impacts to human health and the environment. The background of the Release should include known and suspected petroleum sources, known and potential petroleum impacts, any actions taken to address the Release, and previous investigations of petroleum release(s) at the Facility.

- Describe the history of operation of PST system(s) at the Facility including the following:
 - Owner/operator of the property, the Facility, and of the PST system
 - Previous use information of Facility identified through previous assessments and corrective actions.
 - Current Release(s): date, cause and source, type and amount of petroleum product lost
 - Type of petroleum products stored at Facility (past and current)
 - Dates (if known) of installation and removal of all existing and former PST systems
 - Other available information that would be beneficial in assessing groundwater monitoring data, attenuation rates, data anomalies, etc.
- Summarize the method(s) and conclusions of the site investigation(s). The following information should be included:
 - Method(s) of investigation used to determine the magnitude and extent of petroleum contamination (e.g., borings, monitoring wells, test pits, etc.)
 - The extent of petroleum contamination in soil and groundwater
 - Potential human and/or ecological receptors identified; with discussion supported by the Conceptual Site Model portion of the Release Closure Plan
 - Potential preferential pathways (e.g., utility trenches) within the plume extents (lateral and vertical) that may affect groundwater flow
 - Site-specific conditions identified during the investigation that may affect groundwater monitoring activities, results, or attenuation of petroleum contamination in groundwater
- Describe all clean up actions taken to address petroleum contamination at the facility. The following information should be included for each occurrence:
 - Clean up actions taken
 - Dates of cleanup or system operations, including dates of prolonged system shut down(s), and transitions to subsequent phases of treatment
 - Off-site effects

Maps required to Illustrate Facility Location and Site Features

All maps should include a north arrow, scale, map legend, and title with the Facility name in the title block. It is recommended that a true-scale map from previous investigation and/or cleanup reports be the base for the maps in this report. Other maps which may have been produced for the site investigation and/or cleanup may be required to show location and site-specific conditions that influence the interpretation of groundwater monitoring data. At a minimum, the following maps are required to show site features and groundwater monitoring results.

- Site map(s) should illustrate Facility details (refer to example Site Map below) including the following:
 - Current and former USTs, ASTs, piping, dispensers, and other sources of petroleum
 - Facility buildings and structures
 - Locations of environmental and construction activities pertinent to the release (excavations, test pits, soil borings, samples, monitoring wells, recovery wells, sparge/injection points, etc.)
 - Remediation equipment and systems (if installed, current and historical)
 - Existing and former hazardous material/waste storage areas
 - Location of all current and previous Releases at Facility and on adjacent properties
- Potentiometric surface map(s) should include select Facility details to illustrate the location of current and historical features that may influence groundwater monitoring results. Additionally, include the following:
 - Current and former monitoring wells and sampling points; include all sampling points referred to in the cumulative data table and use unique symbols for active monitoring wells, abandoned monitoring wells, and temporary sampling points.
 - Annotated potentiometric surface elevation for each point measured during the monitoring event; numerical values considered anomalous and not used to contour the potentiometric surface should be shown in brackets, but still included
 - Potentiometric surface contours at an interval appropriate for the site and observed data to show the groundwater flow direction and gradient
 - The predominate groundwater flow direction(s) indicated
- Iso-concentration map(s) of at least one parameter for each fuel type (e.g., gasoline, diesel, etc.). Include select Facility details to illustrate the location of current and historical features that may influence contaminant migration and the following:
 - Consult the DEQ project manager to select the most representative parameter(s)
 - Current and former monitoring wells and sampling points; include all sampling points referred to in the cumulative data table and use unique symbols for active monitoring wells, abandoned monitoring wells, and temporary sampling points
 - Annotated concentration of the selected parameter; concentrations that exceed the applicable RBSL should be distinguished from those less than RBSLs by highlighting, bolding, or some other method
 - Iso-concentration contours at an interval appropriate for the site and observed data; one iso-contour should represent the RBSL

Receptor Survey

Potential receptors and migration pathways have been previously identified in the areas of petroleum-impacted soil and the groundwater plume during the remedial investigation and cleanup. Discuss the exposure potential for receptors as follows:

- Evaluate potentially complete pathways identified in the Conceptual Site Model of the Release Closure Plan
- Describe any changes to the site or neighboring area since the previous report that may have introduced new potential receptors or modified the mitigating factors limiting exposure of potential receptors to residual petroleum contamination

Groundwater Monitoring

Describe the method(s), equipment types, and results of the completed groundwater monitoring including fluid level measurements, monitoring methodology, laboratory analyses, evaluation of results and trends; include the following:

- Describe the typical monitoring well and sampling points: well diameter, screened interval, length of screen, type of native soil screened, surface completion, and total depth
 - If multiple aquifers are screened, describe the typical monitoring well for each aquifer
 - If a subset of well(s) deviate from the typical, identify the wells and describe the discrepancies
- Groundwater monitoring procedures including date, fluid-level measurement, sampling method, purging method, and stabilization parameters; sampling plans may be referenced and placed in appendices or in a standard operating plan (SOP) submitted to DEQ
- Document analytical procedures: name and address of laboratory, analytical methods, field duplicates, and blanks
- Discuss sample collection deviations from the WP, if any reporting limits are above screening levels, QC samples outside acceptance criteria and the usability of associated samples, completeness and other QC criteria required by the MT QAP.
- Describe method(s) of waste disposal: water from well-development, purging, decontamination, etc., and free product (if applicable)
- Describe well rehabilitation or redevelopment procedures (if applicable) including: date, type of development, volume of water removed, and water quality
- Provide results of surveyed locations and elevations of wellheads; describe referenced datum (if applicable)
- Describe characteristics of the aquifer(s) based on monitoring results, including
 - Hydraulic characteristics based on the observed purge rate and recovery
 - Measurements of fluid depths and calculated groundwater elevations should be presented in a cumulative data table
 - Direction(s) of groundwater flow
 - Perched or confined aquifer conditions
 - Other site-specific aquifer characteristics
- Present groundwater analytical results in cumulative table(s) including field data such as sample identification, screened interval, depth to fluid(s), free-product thickness (if present), and

collection date (refer to example Groundwater Table below). Groundwater analytical results should be compared to current Risk-Based Screening Levels (RBSLs) published in RBCA.

- Prepare maps according to the specifications provided above.
- If kriging or statistical analyses are used to interpolate potentiometric surface or iso-concentration contours, document and provide justification for the method used including the following: citations for kriging techniques or statistical analyses, identify the program used, analyses employed, grid boundary specifications, and other contouring methods (if multivariable). Note any modifications to the kriging outputs based on site-specific information.

Intrinsic Biodegradation Indicators (IBIs)

Intrinsic Biodegradation Indicator (IBI) data should be presented in a way that summarizes the attenuation processes occurring per sample point, what those processes mean in relation to attenuation rates of observed groundwater contaminant concentrations, position within the plume, limitations of respiration, and recommended amendments if necessary.

Describe the purpose and objectives of collected IBI data, the type of IBI data collected, and evaluation of results and trends; include the following:

- Detail parameters analyzed as part of the investigation of IBIs and include rationale for data point choice and associated analysis.
- Provide a table that includes analyte results and field parameter data (example provided below).
- Describe the processes occurring in the background (non-impacted) aquifer, upgradient, source, and peripheral wells and data points. Indicate spatially the predominant attenuation processes.
 - Note whether IBI parameter trends are increasing or decreasing in each well.
 - Provide an indication of the type and degree of respiration occurring in each well.
 - Compare and contrast attenuation processes between select sample locations. Wells to consider include those that represent background, source, and downgradient conditions.
 - Provide comments on IBI and natural attenuation processes as they relate to contaminant concentrations.
- Describe what limits degradation spatially, provide a discussion on the relationship between IBI parameters as they either inhibit or promote attenuation.
 - Additional statistical analysis of IBI data may be necessary based on consultation with the DEQ project officer.
- Provide site-specific recommendations for additional sample points, IBI analyses, groundwater monitoring schedules, and amendments as necessary to achieve closure.
- Document sources/citations pertinent to IBI discussion.

Data Validation and Usability Summary

Briefly summarize the results of data validation and make a statement as to the usability of the data; refer to the details in the data validation summary form appended to the report.

- Describe any deviations from the WP of sampling, sample preservation, shipping, etc. that may influence the validity and usability of the data
- Identify blanks collected (e.g., trip, field, equipment), their purpose, if detections were reported, conditions that may have contributed to reported detections, and the influence the analytical results of the blanks have on the usability of the data

- Identify duplicate samples and parent samples, calculate the relative percent difference, and explain how the results influence the validity and usability of the data
- Identify if any reporting limits are great than screening limits and influences on the usability of the data.
- Identify percent completeness of the planned vs. actual sampling and any influences on the usability of the data. Please see the MT QAP for a full description of quality assurance/quality control requirements.

Data and Results

Interpret all available data and describe in detail the results of the groundwater monitoring; technical evaluations should be stated with reasonable professional certainty and under the standard of care applicable and are expected to include at least the following:

- Describe the vertical and horizontal extent and magnitude of petroleum impacts to groundwater by referring to the table of cumulative groundwater monitoring data and constructed maps
- Describe the plume stability (i.e., expanding, stable, decreasing, migrating) with reference to specific wells that support the interpretation
- Describe the trends in contaminant concentrations, refer to the details in the tables and figures
 - Discuss the influence of cleanup action on the observed trend
 - Discuss the influence of groundwater elevation on the observed trend
 - Discuss the projected time that RBSLs will be reached

Release Closure Plan (RCP)

The O/O and their consultant should have developed a RCP to cleanup, monitor, and resolve the Release during the investigation and cleanup phases. Update the RCP based on the results of groundwater monitoring. The plan should be based on the data documenting the extent and magnitude of petroleum impacts, professional judgement, and experience in the area.

- Update the site-specific RCP based on the groundwater monitoring results and any changes to potential receptors or exposure scenarios. Use the RCP Excel spreadsheet format available at DEQ's website).
- Propose closure of the Release only if all the data demonstrate that there are no petroleum impacts exceeding RBSLs or regional screening levels for all media or that all exposure pathways are incomplete
- If attenuation rates suggest that RBSLs will not be reached within the timeframe previously estimated, re-evaluate cleanup options and determine if additional remedial action is necessary.
- Discuss the Release Closure Plan and proposed cleanup methods with DEQ's project manager while preparing the groundwater monitoring report and prior to submitting report to DEQ
- Update the RCP; include a brief discussion of the plan in the report text and append a copy of the completed RCP to the report

Conclusions

Briefly state whether the groundwater monitoring objectives have been met for the Release; technical conclusions should be stated with reasonable professional certainty and reference should be made to the

WP goals, objectives, and acceptance criteria. Conclusions must be supported by the data and discussion in the report. Include the following:

- Magnitude and extent of petroleum contamination in groundwater
- Apparent attenuation rates post-cleanup
- Suitability of conditions for continued attenuation
- Potential exposure pathways
- Effect on public health and the environment
- Closure pathways to resolve the Release

Recommendations

State recommendations for additional work required to cleanup, monitor, and close the Release.

Technical recommendations should be stated with reasonable professional certainty and should include the following

- Site-specific recommendations that are consistent with details in the groundwater monitoring report and summarized in the Release Closure Plan
- Propose a site-specific cleanup plan, if required
- Propose a site-specific monitoring plan, if required

Signature page should be signed and dated

Limitations

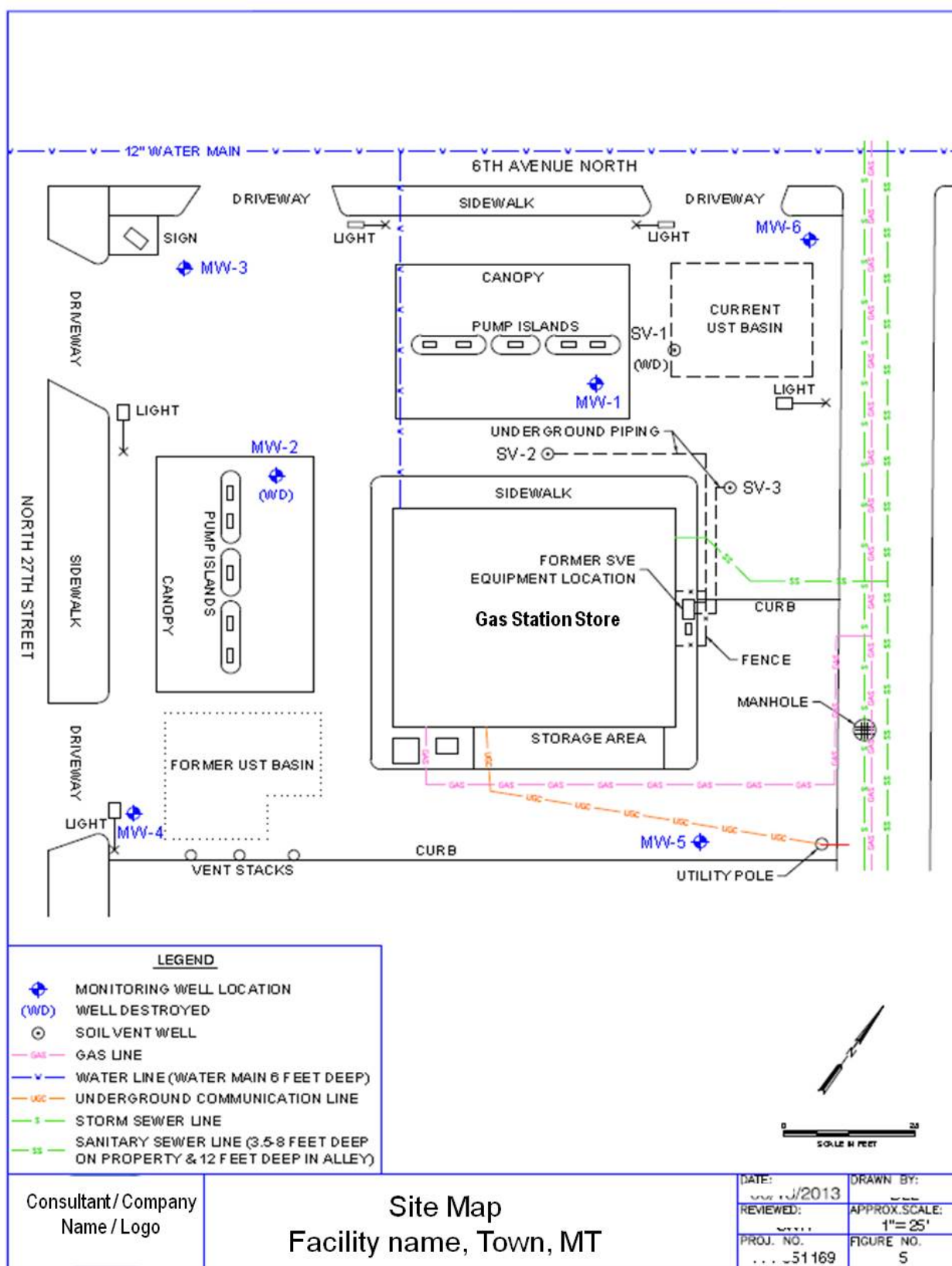
References

Appendices

DEQ may require site-specific attachments to the report; however, the following appendices for all Groundwater Monitoring Reports are typically required.

- Maps
- Tables summarizing laboratory analytical and field data
- Updated Release Closure Plan
- Groundwater sampling logs
- Laboratory reports including the following:
 - Original (or copy of original) analytical result reports
 - Chain of custody documentation
 - Sample receipt checklist(s)
 - Quality assurance/quality control report(s)
 - Chromatograms
- Completed Data Validation Summary Forms

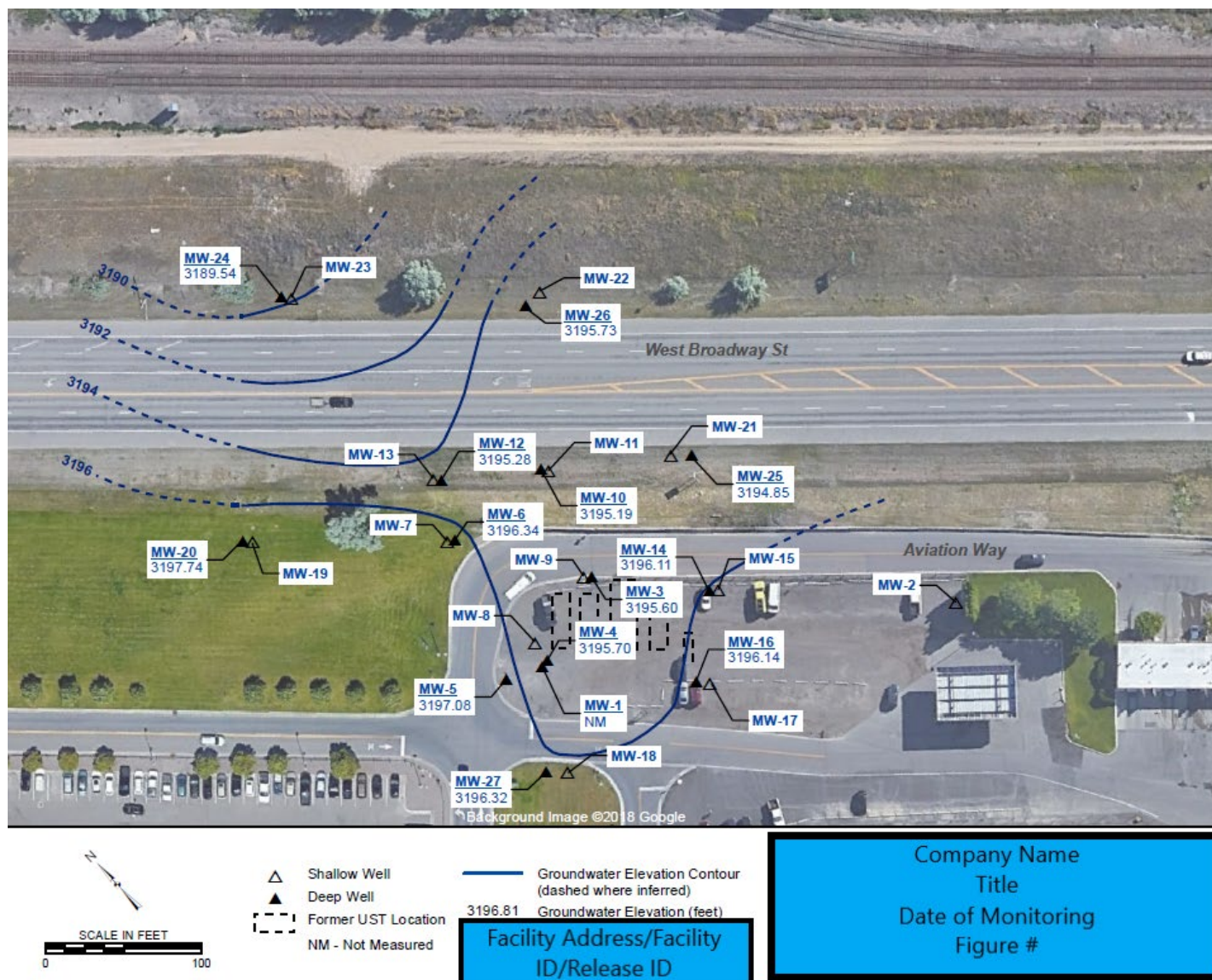
Example – Site Map (adapted from a submitted report)



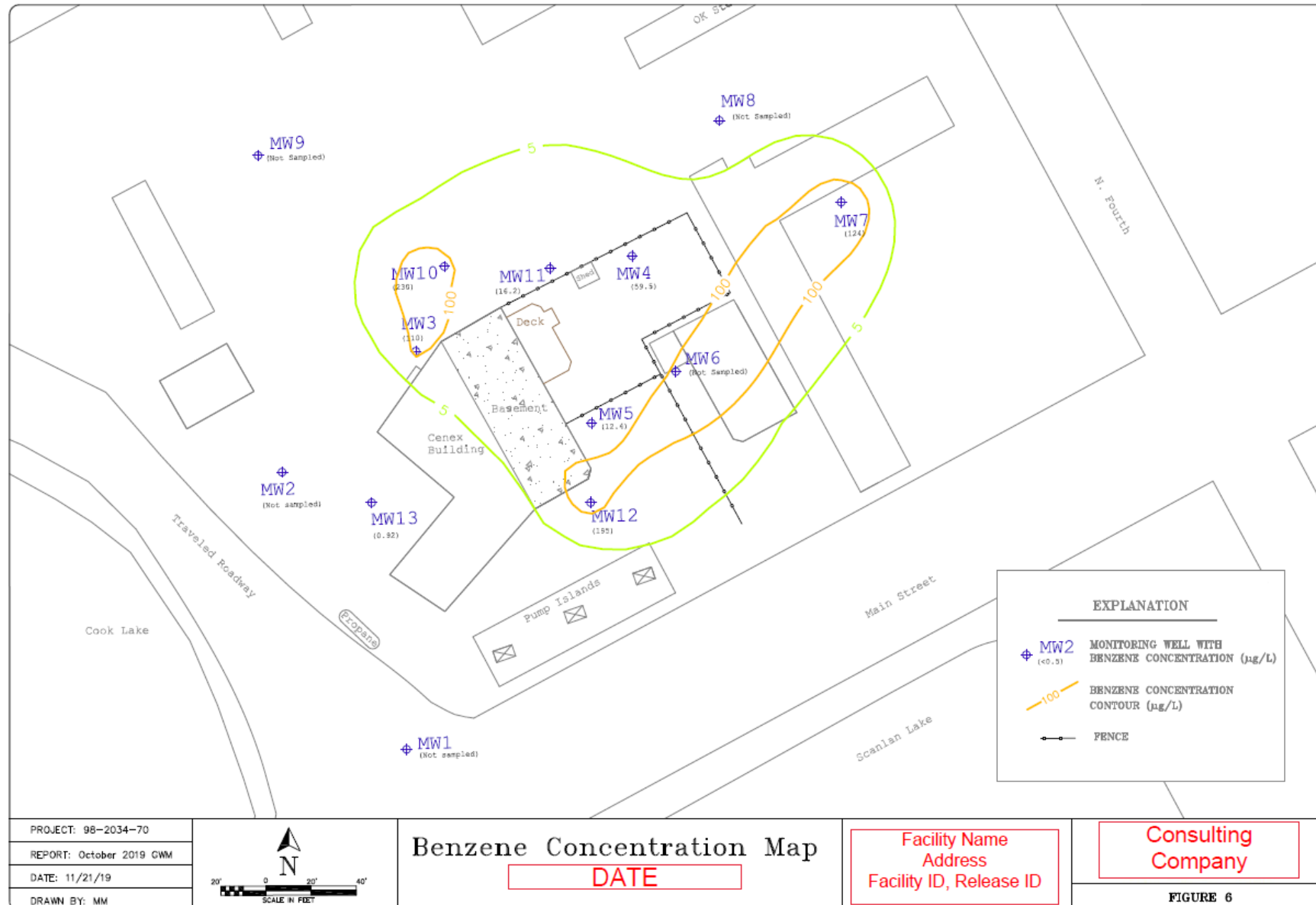
Example - Groundwater Elevation Map (adapted from a submitted report)



Example - Groundwater Elevation Map with Interpolated Contours (adapted from a submitted report)



Example - Chemical Concentration Contour Map (Adapted from a submitted report)



Example – Tabular Summary of Cumulative Groundwater Data

Example Table 2: Cumulative Groundwater Monitoring (2007 - 2013) at Facility Name, Address, City / Town																								
Facility ID: number, Release number																								
Sample / Field Data					Laboratory Analytical Data, ug/L																			
					Volatile Petroleum Hydrocarbons										Lead Scavengers		Extractable Petroleum Hydrocarbons							
Well / Boring ID	Water Depth, ft bgs	NAPL Thickness, ft	Groundwater Elevation (ft. MSL)	Date Sampled	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	Naphthalene	TPH	C ₅ - C ₈ Aliphatics	C ₉ - C ₁₂ Aliphatics	C ₉ - C ₁₀ Aromatics	EDB 1,2-Dibromoethane	DCA 1,2-Dichloroethane	EPH Screen	TEH	C ₉ - C ₁₈ Aliphatics	C ₁₉ - C ₃₆ Aliphatics	C ₁₁ - C ₂₂ Aromatics			
MW-1 (Measuring Point Elevation: 2956.45 ft. MSL)	Screened 5 ft to 15 ft bgs																							
	12.15	---	2,944.30	5/18/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	10.30	---	2,946.15	9/10/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	11.17	---	2,945.28	12/5/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	13.40	---	2,943.05	3/19/2008	<0.5	<0.5	<0.5	<1.5	<2	<1	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	10.40	---	2,946.05	6/3/2010	<0.25	<0.25	<0.25	<0.75	<1.0	5.4	<50.0	<50.0	<50.0	<50.0	NA	NA	<111	NA	NA	NA	NA			
	13.93	---	2,942.52	1/29/2013	<0.15	<0.23	<0.17	1.3J	<0.29	<0.35	11.7J	2.2J	1.0J	6.1J	<0.0063	<0.088	<112	NA	NA	NA	NA			
14.63	---	2,941.82	4/1/2013	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---			
MW-2 (2955.87 ft. MSL)	Screened 5 ft to 15 ft bgs																							
	11.65	---	2,944.22	5/18/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	10.52	---	2,945.35	9/10/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	11.11	---	2,944.76	12/5/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	11.66	---	2,944.21	3/19/2008	<0.5	<0.5	<0.5	<1.5	<2	<1	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	10.73	---	2,945.14	6/3/2010	<0.25	<0.25	<0.25	<0.75	<1.0	<2.5	<50.0	<50.0	<50.0	<50.0	NA	NA	<112	NA	NA	NA	NA			
	12.78	---	2,943.09	1/29/2013	<0.15	<0.23	<0.17	<0.34	<0.29	<0.35	1.7	<0.91	<0.86	0.55J	<0.0062	<0.088	<122	NA	NA	NA	NA			
13.37	---	2,942.50	4/1/2013	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---			
MW-3 (2956.54 ft. MSL)	Screened 5 ft to 15 ft bgs																							
	12.52	0.25	2944.25	5/18/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---			
	10.49	0.10	2946.14	9/10/2007	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---			
	12.14	sheen	2944.40	12/5/2007	1188	13	4	4	<2	51	17,800	7,500	3,600	2,050	NA	NA	3,000	2,800	280 J	230 J	370			
	12.52	sheen	2944.02	3/19/2008	1050	<1	<1	<3	<2	<5	11,560	5,500	2,600	1,500	NA	NA	1050	590	<200	<200	<200			
	---	---		6/3/2010	source area well removed during remedial excavation, April 2010																			
MW-3a (2956.48 ft. MSL)	Screened 5 ft to 15 ft bgs, replacement source-area well, 11/15/2012																							
	13.49	0.00	2942.99	1/29/2013	55	4.5	1.2	2.0	<2	11	1,755	880	815	950	NA	NA	340	NA	NA	NA	NA			
	14.05	0.00	2942.43	4/1/2013	6	<0.25	<0.25	<0.75	<1.0	<2.5	1,150	670	350	165	NA	NA	<111	NA	NA	NA	NA			
MW-4 (2955.72 ft. MSL)	Screened 4 ft to 14 ft bgs																							
	9.35	---	2,946.37	6/12/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	8.88	---	2,946.84	9/10/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	9.37	---	2,946.35	12/5/2007	<1	<1	<1	<3	<2	<5	<200	<100	<100	<20	NA	NA	<210	NA	NA	NA	NA			
	8.01	---	2,947.71	3/19/2008	<0.5	<0.5	<0.5	<1.5	<2	<1	<200	<100	<100	<20	NA	NA	<200	NA	NA	NA	NA			
	8.29	---	2,947.43	6/3/2010	<0.25	<0.25	<0.25	<0.75	<1.0	<2.5	<50.0	<50.0	<50.0	<50.0	NA	NA	<108	NA	NA	NA	NA			
	8.79	---	2,946.93	1/29/2013	<0.15	<0.23	<0.17	<0.34	<0.29	<0.35	<1.7	<0.91	<0.86	0.26J	<0.0062	<0.088	<114	NA	NA	NA	NA			
9.13	---	2,946.59	4/1/2013	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---			
MT DEQ RBSLs, 2018					5	1,000	700	10,000	30	100	NE	650	1,400	1,100	0.017	4	1,000	NE	1,400	1,000	1,100			
Bold: Analyte >DEQ RBSLs, MT DEQ Risk Based Corrective Action, 2018, Table 3					NA: Not analyzed					---: not sampled					ND: Not Detected					NE: Not Established				
J: Value is estimated - falls between detection limit & limit of quantitation					B: Analyte detected in method blank; not corrected for method blank concentration.																			

Example - Intrinsic Biodegradation Indicator/Monitored Natural Attenuation Data Table

Sample Intrinsic Biological Indicator/Monitored Natural Attenuation Data Table							
		Concentration/Measurement					
Well ID	Parameters Investigated	Sample Date	Sample Date	Sample Date	Sample Date	Trend Increasing/ Decreasing? (+ or -)	Position within the plume (upgradient, source, mid-point, peripheral, downgradient, etc.)
MW1	pH						
	DO (mg/L)						
	ORP (mV)						
	Nitrate + Nitrite						
	Manganese						
	Iron						
	Sulfate + Sulfite						
	Methane						
	Other						
	_TPH						
	_TEH						

Sample Intrinsic Biological Indicator/Monitored Natural Attenuation Data Table							
		Concentration					
<u>Well ID</u>	Parameters Investigated	Sample Date	Sample Date	Sample Date	Sample Date	<u>Trend</u> Increasing/Decreasing? (+ or -)	Position within the plume (upgradient, source, mid-point, peripheral, downgradient, etc.)
MW1	pH						
	DO (mg/L)						
	ORP (mV)						
	Nitrate						
	Nitrite						
	Mn4+						
	Mn2+						
	Ferric Iron						
	Ferrous Iron						
	Sulfate						
	Sulfite						
	Methane						
	Other						
	TPH						

Please Note: the sample data table provided above allows for easy presentation and interpretation of IBI results. The table provides space for commonly observed parameters observed in a basic IBI evaluation and can be expanded to include other analytes as necessary. Parameters provided are listed in order from top-to-bottom by order of greatest to least aerobic reactivity. It is the hope that data will be analyzed in order of highest aerobic reactivity to least aerobic reactivity to provide a more thorough evaluation of attenuation processes. Data should be compared to TPH and or TEH levels in each well to draw correlations between IBI parameters and concentration data as it relates to total respiration.

Release Closure Plan – Part 1: Site Summary & RI Results

MT DEQ Petroleum Tank Cleanup Section -- Release Closure Plan (7 Mar 2018)				
for the Investigation, Cleanup, Monitoring & Closure of Petroleum Releases				
Part 1: Site Summary & Remedial Investigation (RI) Results				
reference: MT DEQ Remedial Investigation (RI) Guidance for Petroleum Releases				
Consultant:			Date:	DEQ PM:
Facility Name / Address:				
Facility ID:		Release:	WP ID:	
Site Information	Release Cause, Source(s) & Petroleum Types:			
	other releases onsite and nearby:			
	Site Use(s) -- Former, Current & Planned:			
	Surface Conditions & Access:			
	former Petroleum Tank Systems:			
	current Petroleum Tank Systems:			
Subsurface	Other:			
	Stratigraphic sequence - layers & thicknesses:			
	Stratigraphic Continuity - Lateral Variation(s):			
	Groundwater Depth & Flow Direction(s):			
	Aquifer(s) unconfined, confined, perched:			
	Receptor Depth/Location (basements, utilities):			
Extent & Magnitude	Other:			
	Petroleum Types, Age & NAPL Mobility:			
	Surface Soil Impacts (0 to 2 ft bgs):			
	Vadose-Zone Soil Impacts:			
	Smear-Zone Soil Impacts:			
	Groundwater Impacts:			
	Surface Water Impacts:			
	Petroleum Vapor Impacts:			
Reports	Other:			
	RI and Monitoring Reports & Dates:			
	Pilot Tests & Results:			
	Results from Cleanup(s):			
What currently prevents Release Closure?				
additional information required for PMZ Closure:				
Information & Data Gaps:				
Recommendations and comments:				

Release Closure Plan – Part 2: CSM - Evaluation of Exposure Pathways

MT DEQ Petroleum Tank Cleanup Section -- Release Closure Plan						(7 Mar 2018)	
for the Investigation, Cleanup, Monitoring & Closure of Petroleum Releases							
Part 2: Conceptual Site Model (CSM) - Evaluation of Exposure Pathways							
reference: MT DEQ Risked-Based Corrective Action (RBCA) Guidance for Petroleum Releases							
Consultant: 0		Date: 1/0/1900		DEQ PM: 0			
Facility Name: 0				Complete Description for All Receptors Describe why a Receptor is not threatened or impacted; and Describe proposed Investigation, Cleanup, and/or Monitoring Methods for each threatened or impacted Receptor.			
Facility ID: 0		Release: 0				WVP ID: 0	
Petroleum Source(s)	Affected Medium	Exposure Medium / Point	Exposure Route			Receptor	
Required: Complete Description of the Source(s) of Petroleum Release	→ Surface Soil (0 - 2 ft bgs)	→ Soil	→ Ingestion Dermal	→ Resident and/or Worker			
		→ Soil	→ Leaching	→ Groundwater			
		→ Dust/Vapors	→ Inhalation	→ Resident and/or Worker			
		→ Surface Erosion to Surface Water and Sediment	→ Ingestion Dermal	→ Recreator, Ecological Receptor ¹			
	→ Sub-Surface Soil (> 2 ft bgs)	→ Soil	→ Ingestion Dermal	→ Construction Worker ²			
		→ Soil	→ Leaching	→ Groundwater			
		→ Indoor Air	→ Inhalation	→ Commercial or Residential Indoor Air			
		→ Dust/Vapors	→ Inhalation	→ Construction Worker			
		→ Buried Water Line	→ Ingestion Dermal	→ Resident and/or Worker			
		→ Buried Utility Line	→ Inhalation of Indoor Air	→ Indoor Resident and/or Worker			
	→ Groundwater	→ Groundwater	→ → →	→ State water ³			
		→ Indoor Air ⁴	→ Inhalation of Indoor Air	→ Resident and/or Worker			
		→ Groundwater and Vapors	→ Ingestion Dermal Inhalation	→ Construction Worker ²			
		→ Drinking Water	→ Ingestion Dermal	→ Resident and/or Worker			
		→ Surface Water and/or Sediment	→ Ingestion Dermal Inhalation	→ Recreator, Ecological Receptor			
		→ Buried Water Line	→ Ingestion Dermal	→ Resident and/or Worker			
		→ Buried Utility Line	→ Inhalation of Indoor Air	→ Indoor Resident and/or Worker			
		Data Gaps:					
	Recommendations:						
	Footnotes:						
	1. Ecological Receptors (e.g. plants and animals) can be added as a separate line associated with surface soil but it is not common for PTC sites.						
	2. Construction worker covers excavations conducted for building construction, utility installation and repair, as well as residents planting trees, etc.						
	3. Standard or RBSL exceedence are a complete pathway to a receptor, which is state water (or groundwater).						
	4. Indoor Air is the exposure medium for a potential or known vapor intrusion setting where a resident or an employee of a business may breathe petroleum vapor from the release.						

Release Closure Plan – Part 3: Evaluation of Cleanup Alternatives

MT DEQ Petroleum Tank Cleanup Section -- Release Closure Plan for the Investigation, Cleanup, Monitoring & Closure of Petroleum Releases								(7 Mar 2018)
Part 3: Evaluation of Cleanup Alternatives reference: MT DEQ Remedial Alternatives Analysis (RAA) Guidance for Petroleum Releases								
Consultant:		0		Date:		1/0/1900		
DEQ PM:		0						
Facility Name / Address: 0								
Facility ID: 0		Release: 0		WP ID: 0				
Administrative Rules of Montana 17.56.605(3) requires screening and selection of cleanup methods to develop a matrix evaluation of cleanup alternatives. A cleanup plan requires information on all alternatives and an explanation why any alternative was selected.		Enter appropriate site-specific Cleanup Methods that are based on RI results & CSM						
		No Action*	e.g. Excavation	e.g. Excavation & ORC	e.g. SVE & AS	fill-in as needed or leave blank	fill-in as needed or leave blank	fill-in as needed or leave blank
Evaluation Criteria	Performance	Estimated Costs						
	Protective of Human Health & Environment (e.g. residences, utilities, water supply, future use)							
	Method-specific regulatory requirements (e.g. disposal of impacted soil & water, access agreements)							
	Method-specific feasibility requirements (e.g. pilot tests, treatability studies)							
	Contaminant-specific requirements (e.g. method achieves soil & GW RBSLs & DEQ-7 standards)							
	Location-specific requirements (e.g. potential historical, cultural, or ecological significance, or site near wetlands, floodplains, surface water, endangered species / migratory bird habitat)							
	Reliability -- Short Term							
	Reliability -- Long Term							
	Implementation Issues & Limitations							
	Safety Issues							
	Effects on Public Health and Environment (includes Receptors)							
	Other site-specific criteria & issues:							
	Advantages of Cleanup Method:							
	Disadvantages of Cleanup Method:							
Est. Years to Complete Cleanup Method:								
Cleanup Recommendations:								
Information & Data Gaps:								
Recommendations and comments:								
* Note: Cleanup technologies may be removed or added as appropriate for each Release; however, the 'No Action' alternative must be evaluated for comparison at every Release.								

Release Closure Plan – Part 4: Compliance Monitoring and Monitored Natural Attenuation

MT DEQ Petroleum Tank Cleanup Section -- Release Closure Plan (7 Mar 2018)							
for the Investigation, Cleanup, Monitoring & Closure of Petroleum Releases							
Part 4: Compliance Monitoring reference: MT DEQ Remedial Alternatives Analysis (RAA) Guidance for Petroleum Releases							
Consultant:		0		Date:	1/0/1900		DEQ PM:
Facility Name / Address:		0					
Facility ID:		0		Release:	0		WP ID:
Compliance & Operation Monitoring Methods to Evaluate Effectiveness of each Cleanup Alternative Listed in Part 3							
Administrative Rules of Montana 17.56.605(6) requires the cleanup plan to include a plan and schedule for compliance monitoring to evaluate the effectiveness of cleanup activities.		No Action*	e.g. Excavation	e.g. Excavation & ORC	e.g. SVE & AS	fill-in as needed or leave blank	fill-in as needed or leave blank
Evaluation of Cleanup	Confirmation Sampling						
	Borings/ Monitoring Wells (MWs)						
	GW Monitoring (freq., wells, years)						
	System O/M (frequency & years)						
	Petroleum Vapor Monitoring (freq., locations, years)						
	Receptor Monitoring						
	Waste Management						
	Other site-specific monitoring:						
	Method(s) to Evaluate Interim Results and Optimize Cleanup:						
	Est. Years to Complete all Monitoring:						
Closure	Estimated costs for O/M & monitoring:						
	Estimated Total Years to Closure:						
	Natural Attenuation Trends:						
	What currently prevents Closure?						
	Is this a PMZ Closure Candidate?						
Other:							
Information & Data Gaps:							
Recommendations and comments:							
* Note: Cleanup technologies may be removed or added as appropriate for each Release; however, the 'No Action' alternative must be evaluated for comparison at every Release.							