Environmental Resources, LLC
P.O. Box 5305, Bozeman, Montana 59717 Phone (406) 582-8491 email: ruwaller@gmail.com

February 5, 2025

Mr. Eric Kreuger
DEQ-PTCS
P.O. Box 200901
Helena, MT 59620

Subject: Remedial Investigation Work Plan
Elser Oil Bulk Plant, Sheridan, Montana
Facility ID No. 28-02043, (TID) 24575
DEQ Release No. 2496, Work Plan ID No. 34977

Responsible Party: A.M. Welles, Inc., Dba McLeod Mercantile
Tim Hokanson
P.O. Box 2808
Norris, Montana 59745

Dear Mr. Hokanson:

Environmental Resources, LLC is pleased to submit this Remedial Investigation Work Plan to outline activities associated with additional investigation of subsurface petroleum contamination at the above referenced petroleum release site. Submittal of this work plan was requested by the Montana Department of Environmental Quality (DEQ) in a letter dated December 9, 2024.

Submitted by
Environmental Resources, LLC

Robert H. Waller, Principal Geologist

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1.0 EXECUTIVE SUMMARY

Environmental Resources, LLC has been retained by McLeod Mercantile to investigate and remediate petroleum contaminated soil and groundwater discovered at the former Elser Oil petroleum storage facility in Sheridan, Montana. A petroleum release was discovered in December 1994 in a leaking pipe delivering unleaded gasoline.

Approximately 5500 gallons of unleaded gasoline were released based on inventory records. Approximately 30 cubic yards of petroleum contaminated soil were removed as an initial response action. Several houses in the vicinity experienced gasoline vapors resulting from the release. Soil vapor extraction (SVE) systems were installed in two residential yards to prevent further vapor migration.

The former Elser Oil Bulk Plant petroleum release site is located at the northeast corner of the intersection of U.S. Highway 287 and W. Hamilton Ave. in Sheridan, Montana as shown on Figure 1. The site is situated in the northeast quarter of the southeast quarter of Section 27, Township 4 South, Range 5 West, Montana Principal Meridian.

The project site is located on an alluvial fan. Regional topography slopes gently to the southwest. Groundwater is encountered at 7-11 feet below ground surface and flows westerly toward the Ruby River. Shallow groundwater may be utilized for human consumption.

2.0 FACILITY SUMMARY AND CURRENT CONDITIONS

A petroleum delivery piping release consisting of approximately 5500 gallons of gasoline was discovered at the former Elser Oil project site in December 1994. Petroleum product storage and dispensing systems used at the project site consisted of an aboveground storage tank (AST) system and a single dispenser island. No previous petroleum releases have been reported and no compliance violations have been recorded. The AST system was replaced with an underground storage tank (UST) system in 2006.

Petroleum hydrocarbon vapors were encountered in several residences during the winter and spring of 1995. Soil vapor extraction (SVE) systems were installed in two residential yards to mitigate the vapor intrusions and a soil vapor extraction system was installed in the leak vicinity. The SVE system operated from December 1995 until 1998 when the system was shut down due to lack of hydrocarbon production.

A subsurface investigation was initiated by MSE-HKM in two phases with a total of five soil borings and six groundwater monitoring wells as shown on Figure 2. Dissolved petroleum contamination was found in two of the monitoring wells, MW-1 and MW-5. Subsequent groundwater analyses from monitoring events conducted from June 1995 through December 2005 indicate a steady decline to non-detectable levels.

DEQ requested additional groundwater monitoring work to assess the current groundwater quality beneath the site since no monitoring work had been conducted since 2005. Environmental Resources, LLC conducted a site visit in April 2020 and attempted to collect groundwater samples from all six groundwater monitoring wells. All of the groundwater monitoring wells were dry except for monitoring well MW-6 which contained approximately two inches of free phase gasoline product floating at 12.86 feet below ground surface. In response, DEQ requested additional soil boring work and replacement of the dry monitoring well network.

Environmental Resources, LLC submitted a Corrective Action Work Plan which was approved by DEQ on October 26, 2020. The scope of work included installing ten soil borings, completing six of the borings as monitoring wells as shown on Figure 3 and excavating approximately 120 cubic yards of petroleum contaminated soil. Subsequent groundwater monitoring work indicates that the extent and magnitude of the petroleum release has been adequately defined.

DEQ has requested additional Remedial Investigation work. The following sections outline tasks necessary to complete the investigation and methods used to accomplish the additional work.

3.0 PURPOSE AND OBJECTIVES

The purpose of this investigation is to determine the extent and magnitude of petroleum contamination in soil and groundwater beneath the project site and to assess risks that the petroleum release may pose to environmental receptors. Specific objectives of the investigation include:

- Install one soil boring and complete as a groundwater monitoring well.
- Collect soil samples from the soil boring and analyze for Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) Screen.
- Conduct groundwater monitoring semi-annually for one year at all Facility monitoring wells. Gauge fluid levels at all Facility monitoring wells.

- Collect groundwater samples at all monitoring wells using low flow sampling methodology.
- Analyze groundwater samples for VPH and EPH Screen.
- Validate all laboratory analytical data using DEQ's Data Validation Summary Form (DVSF).
- Prepare an Interim Data Submittal (IDS) for each interim groundwater monitoring event.
- Update the Release Closure Plan (RCP).
- Prepare and submit a Remedial Investigation Report.

4.0 SCOPE OF WORK

4.1 Soil Boring and Monitoring Well Completion

One soil boring will be advanced at the location shown on Figure 4. The soil boring will be advanced to 20 feet below ground surface and completed with 15 feet of 0.020" slotted well screen and five feet of blank casing. The annulus around the well screen will be filled with 10-20 mesh Colorado silica from total depth to approximately one foot above the top of the screened interval and bentonite chips will be used to fill the remaining annulus to ground surface. The monitoring well will be completed with a bolt-down steel manhole cover and fitted with a locking compression plug.

A lithologic log will be completed in the field as the boring is drilled. The boring will be completed in accordance with all applicable local, state and federal laws, rules and administrative requirements.

Drill cuttings will be logged for lithology, texture, color, moisture and volatile petroleum content. All soil samples will be visually classified for texture using the Unified Soil Classification System (USCS) according to ASTM-D-2488. Soil samples from two foot intervals and from obvious areas of petroleum discoloration will be analyzed for volatile petroleum hydrocarbons using a Photovac 2020 photo ionization detector (PID) with a standard heated jar headspace method. Laboratory soil samples will be retained from the upper ten foot interval that exhibits the highest headspace reading and from the bottom of the boring. Up to two soil samples will be retained for VPH and EPH Screen analysis at Energy Labs in Helena, MT. One QA/QC soil sample will be collected and analyzed for VPH and EPH Screen.

4.2 Well Development

The newly installed monitoring well will be developed for a minimum of one hour using a submersible pump until at least ten well volumes of groundwater are removed and no further improvements in water clarity are noted. Turbidity will be measured and recorded prior to and following development. Due to the coarse nature of the aquifer, a surge block will not be deployed.

The newly installed monitoring well will be surveyed for elevation within $\pm$ 0.01 feet by a Montana Registered Land Surveyor and referenced to a local USGS benchmark.

4.3 Groundwater Sample Collection and Analysis

Groundwater samples will be collected following a 72-hour stabilization period following development. Groundwater samples will be collected from all of the newly installed and existing groundwater monitoring wells during two semi-annual monitoring events to be conducted during March 2024 and September 2024. Prior to sample collection, data will be collected from all onsite monitoring wells and recorded in a field notebook. All of the well covers will be opened and the locking compression caps will be removed upon arrival at the project site. The wells will be allowed to equilibrate to the atmosphere for at least 30 minutes prior to measuring static water levels. Following the equilibration period, a thoroughly decontaminated oil/water interface probe will be used to check for and measure free phase petroleum contaminant thicknesses.

An electronic water level indicator will be used to measure the static water level in each well casing. The water level indicator tip will be scrubbed in an Alconox or similar wash solution and triple rinsed with de-ionized water prior to and following each measurement. All of the depth to water measurements will be collected from a reference point used to determine the casing elevation for each well.

Groundwater samples will be collected from monitoring wells MW-7-12 and from the newly installed groundwater monitoring well. Additionally, one QA/QC groundwater sample will be collected from monitoring well MW-9 during each monitoring event. Following measurement of the static water levels, sample collection will commence using a submersible pump and low flow sampling methods. Indicator parameters turbidity, oxidation-reduction potential, dissolved oxygen, pH, specific conductance and temperature will be measured during sample purging. Samples will be collected when the measured indicator parameters stabilize according to Section 2.5 of the DEQ Groundwater Sampling Guidance (2018). Samples will be decanted into appropriate sample containers, preserved and placed on ice while awaiting delivery to the analytical laboratory. Groundwater samples will be analyzed for VPH and EPH Screen at Energy Labs, Helena, MT.

4.4 Investigation Derived Waste

Drill cuttings, excess sample materials, drilling fluids, and water removed from a well during installation, development, and aquifer testing and all other investigation derived wastes will be disposed of according to all applicable local, state and federal laws and regulations governing the disposition of investigation derived wastes. Drill cuttings will be drummed and characterized for disposal. Development and purge water discharged from the site monitoring wells will be disposed according to DEQ's purge water disposal flowchart.

4.5 Reporting

A Remedial Investigation Report will be prepared following completion of this Remedial Investigation Work Plan. An IDS will be prepared following completion of the first monitoring event. All laboratory data will be validated using DEQ's Data Validation Summary Form. The Release Closure Plan will be updated to reflect the results of this investigation.

4.6 Investigative Methods

Methods practiced during this investigation will follow generally accepted practices of similar consulting firms in the same geographical area. Quality Assurance/ Quality Control methods will be employed throughout all phases of this investigation to ensure meaningful and reproducible results and data. Standard Operating Procedures (SOP) for soil and groundwater sampling are included in Appendix D.

4.7 Health and Safety

Health and safety issues will be addressed throughout this investigation to prevent exposure of site workers and other onsite personnel to potentially hazardous situations and chemical compounds. Several physical hazards will inherently be present throughout the field investigation while heavy equipment is being utilized for soil borings and monitoring well installation. Site specific health and safety precautions and information will be contained in a Health and Safety Plan which will remain onsite during all field activities.

5.0 BUDGET/SCHEDULE

A detailed cost summary is attached in Appendix B.

The proposed scope of work is anticipated to be completed by December 30, 2025. We anticipate that the drilling will be completed in March 2025 and groundwater monitoring will be completed in September 2025.

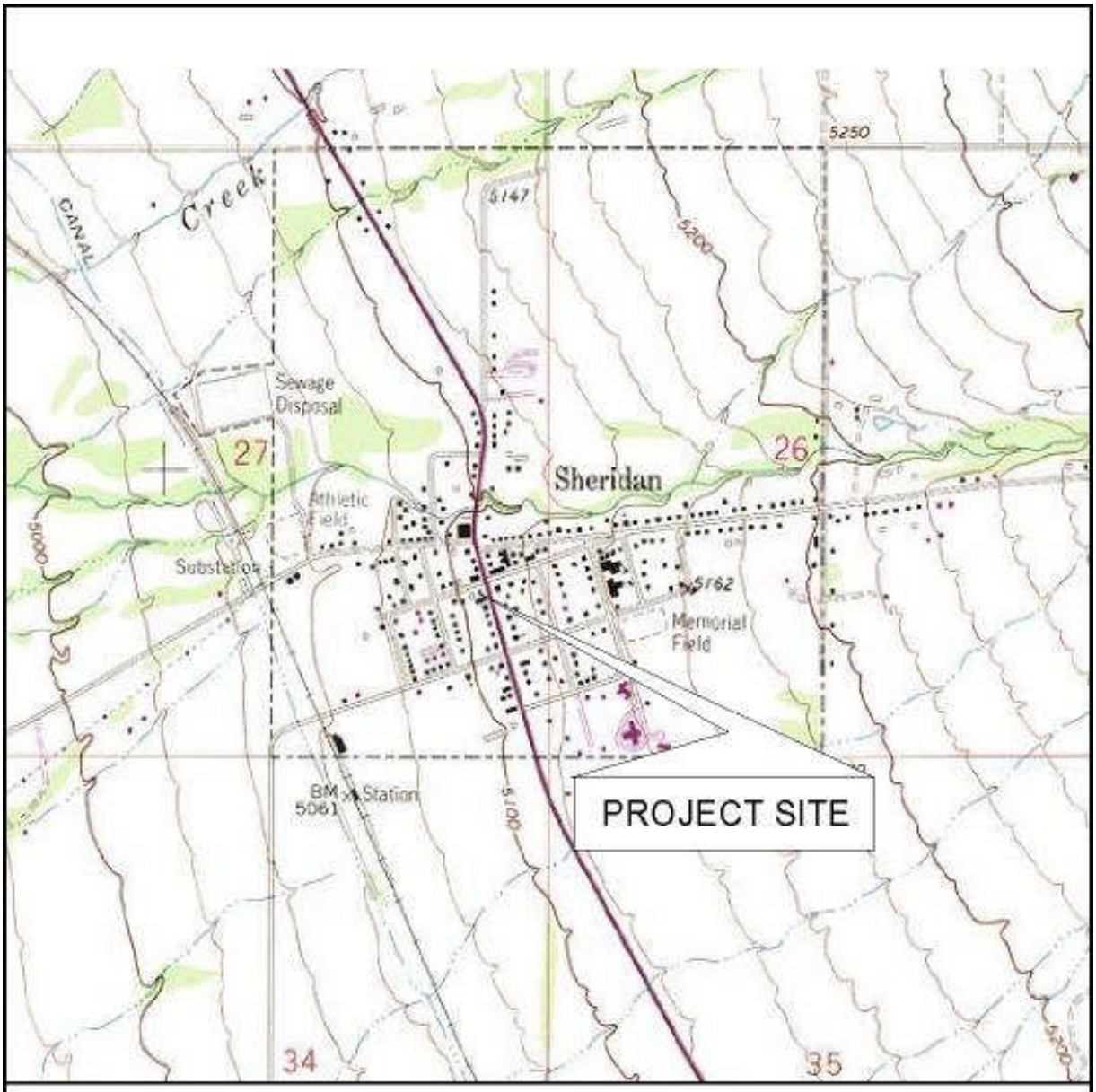
6.0 LIMITATIONS

This work was performed in accordance with generally accepted practices of other consulting firms conducting similar studies. Environmental Resources, LLC observed that degree of care and skill generally exercised by other consultants under similar conditions. Our findings and conclusions must not be considered as scientific certainties, but as opinions based upon our professional judgment based upon the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

Submitted by
Environmental Resources, LLC

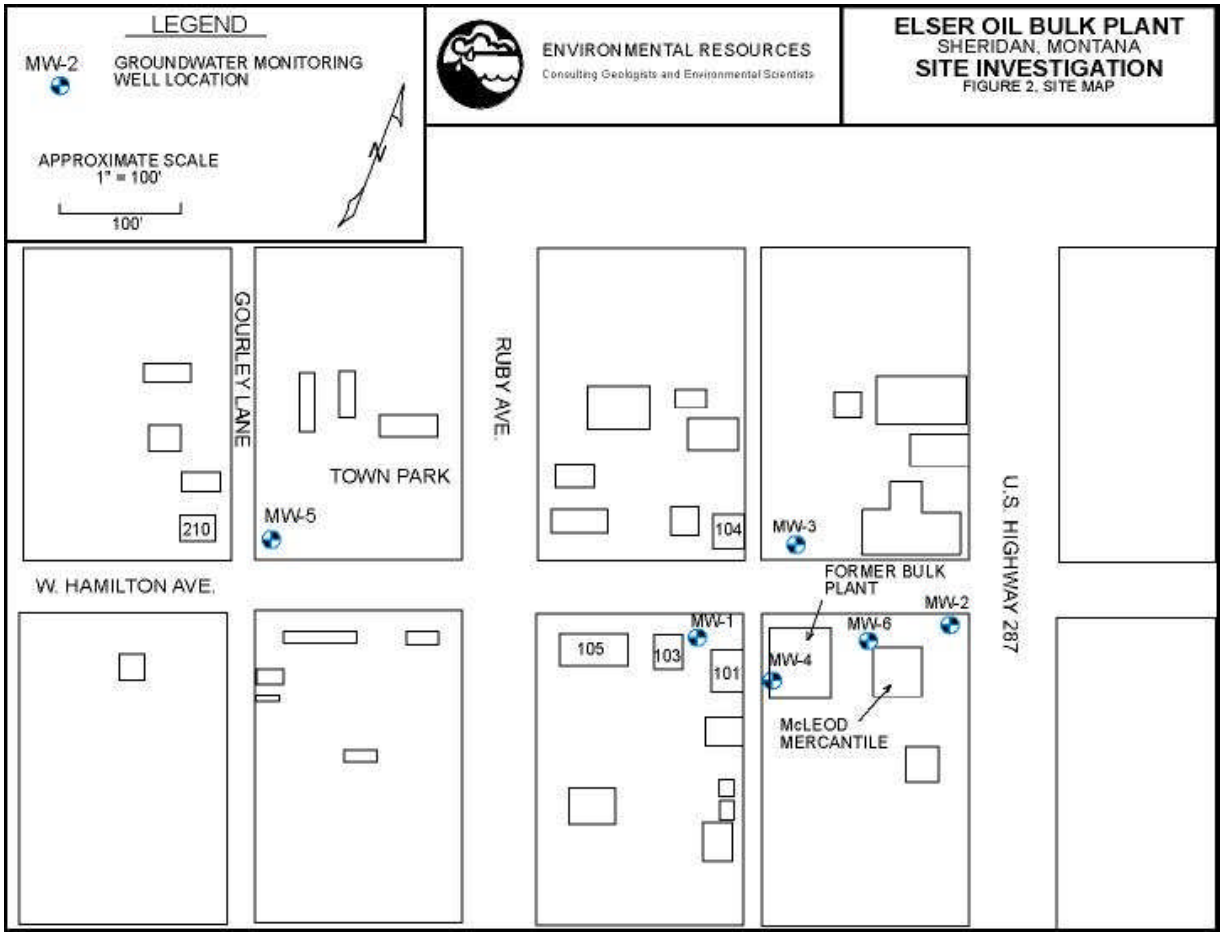
Robert H. Waller, Principal Geologist

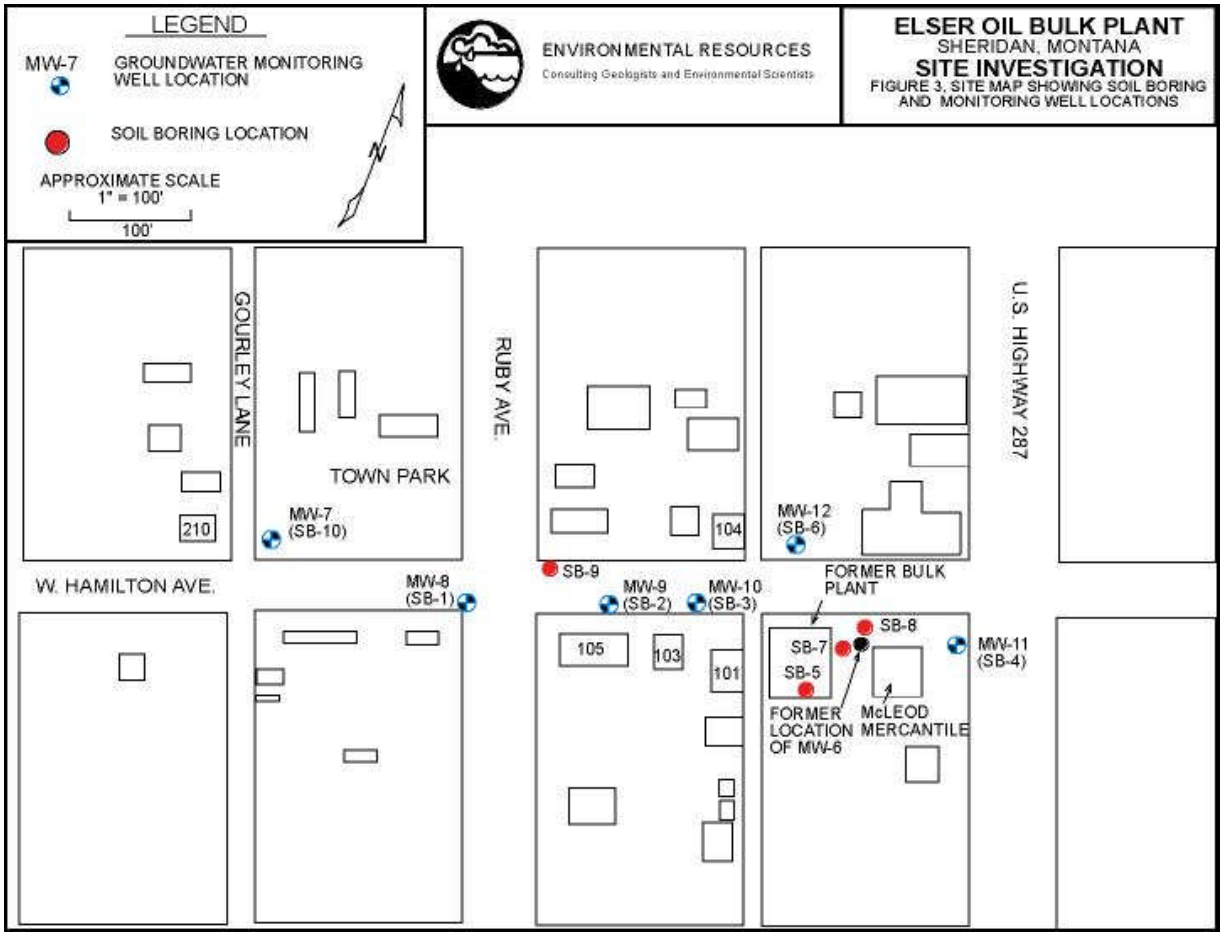
Appendix A
Figures

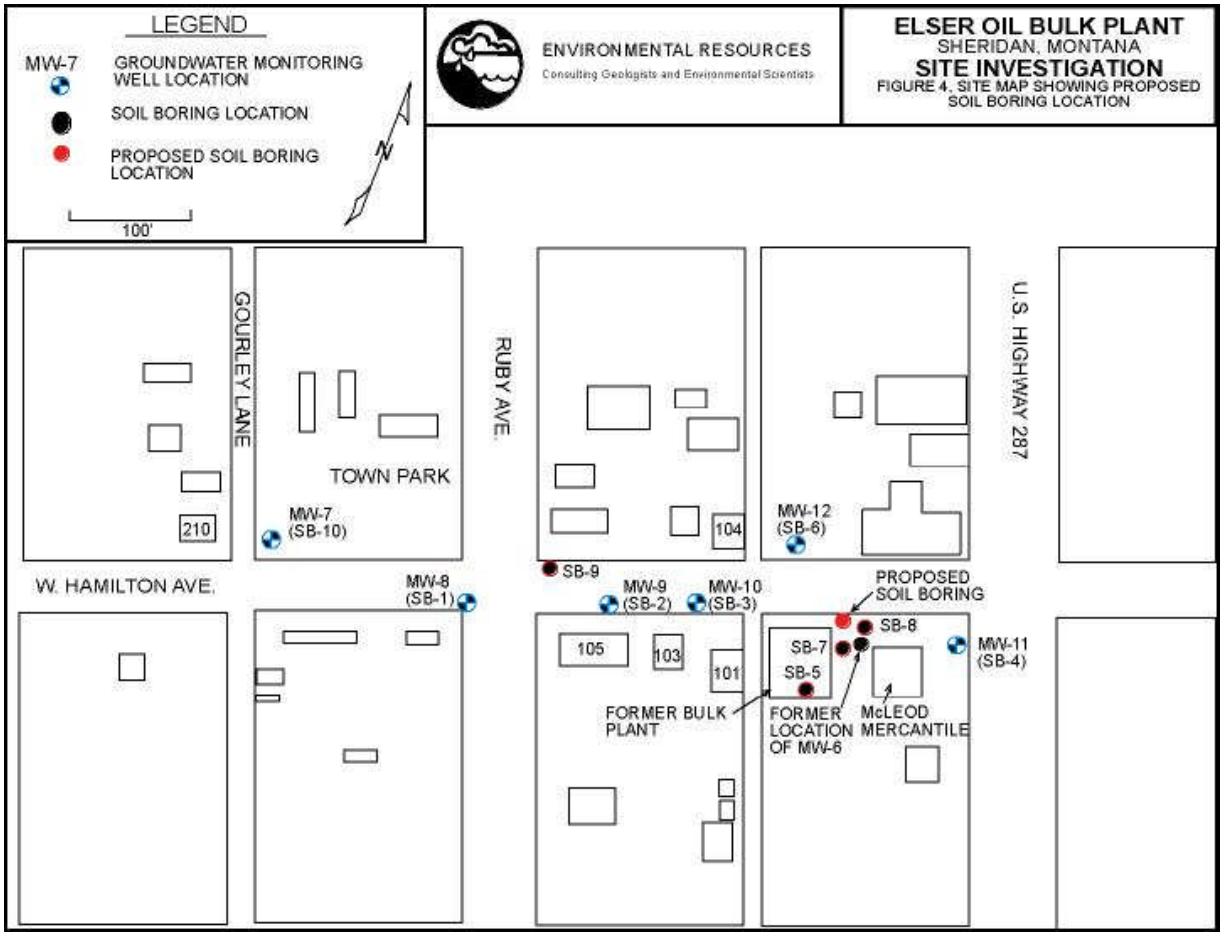


ENVIRONMENTAL RESOURCES
Consulting Geologists and Environmental Scientists

ELSER OIL BULK PLANT
SHERIDAN, MONTANA
SITE INVESTIGATION
FIGURE 1, SITE LOCATION MAP


LEGEND
MW-2
GROUNDWATER MONITORING WELL LOCATION
APPROXIMATE SCALE
1" = 100'
100'
ENVIRONMENTAL RESOURCES
Consulting Geologists and Environmental Scientists
ELSER OIL BULK PLANT
SHERIDAN, MONTANA
SITE INVESTIGATION
FIGURE 2, SITE MAP
GOURLEY LANE
RUBY AVE.
U.S. HIGHWAY 287
TOWN PARK
MW-5
210
104
MW-3
FORMER BULK PLANT
MW-2
MW-1
MW-6
MW-4
105
103
101
McLEOD MERCANTILE
W. HAMILTON AVE.


LEGEND
MW-7
GROUNDWATER MONITORING WELL LOCATION
SOIL BORING LOCATION
APPROXIMATE SCALE
1" = 100'
100'
ENVIRONMENTAL RESOURCES
Consulting Geologists and Environmental Scientists
ELSER OIL BULK PLANT
SHERIDAN, MONTANA
SITE INVESTIGATION
FIGURE 3, SITE MAP SHOWING SOIL BORING AND MONITORING WELL LOCATIONS
GOURLEY LANE
RUBY AVE.
U.S. HIGHWAY 287
TOWN PARK
MW-7 (SB-10)
210
104
MW-12 (SB-6)
W. HAMILTON AVE.
MW-8 (SB-1)
SB-9
MW-9 (SB-2)
MW-10 (SB-3)
FORMER BULK PLANT
105
103
101
SB-7
SB-5
SB-8
MW-11 (SB-4)
FORMER LOCATION OF MW-6
McLEOD MERCANTILE


LEGEND
MW-7
GROUNDWATER MONITORING WELL LOCATION
SOIL BORING LOCATION
PROPOSED SOIL BORING LOCATION
100'
N
ENVIRONMENTAL RESOURCES
Consulting Geologists and Environmental Scientists
ELSER OIL BULK PLANT
SHERIDAN, MONTANA
SITE INVESTIGATION
FIGURE 4. SITE MAP SHOWING PROPOSED SOIL BORING LOCATION
GOURLEY LANE
RUBY AVE.
U.S. HIGHWAY 287
TOWN PARK
MW-7 (SB-10)
210
104
MW-12 (SB-6)
W. HAMILTON AVE.
MW-8 (SB-1)
SB-9
MW-9 (SB-2)
MW-10 (SB-3)
PROPOSED SOIL BORING
SB-8
105
103
101
SB-7
SB-5
MW-11 (SB-4)
FORMER BULK PLANT
FORMER LOCATION OF MW-6
McLEOD MERCANTILE

Appendix B
Cost Estimate

Appendix C
Bids

Petroleum Tank Release Compensation Board

Soil Boring/Monitoring Well Installation Unit Cost Worksheet

Contractor Information

Company Name: Boland Drilling
Address: 4701 N Star Blvd
City, State, Zip: Great Falls, MT 59405
Cost Estimator: Chris Boland
Signature:

Phone: 406-761-1063
Date: mo/day/year 1/16/2025

Project Information and Specifications

Facility ID #
Release #
WP ID #

Type of Drilling Equipment

Hollow-Stem Augers	
Air Rotary	x
Direct Push	
Other (please specify)	

Soil Boring

Number of Borings	1
Boring Diameter (inches)	6
Depth (per boring - ft)	20

Surface: Concrete Asphalt Barren
Soil Disposal: Onsite Stockpile Drums
Abandonment: Bentonite Soil Cuttings

Soil Sampling

Continuous Soil Sampling	
Interval Soil Sampling (specify interval)	
No Sampling	

Monitoring Well Specifications

Number of Wells	1
Surface: Concrete Asphalt Barren	
Depth (per well)	20
Estimated Depth to Groundwater (ft)	
Boring Diameter (inches)	6"
Casing Diameter and type (inches)	2" pvc

Surface Completion: Flush Mount Aboveground

Cost Estimate Explanation:

(1) Mobilization/Demobilization: Includes all costs and mileage to transport equipment, materials, and personnel to and from the site location. More than one mobilization event of either the drilling rig or support vehicle will require justification and pre-approval by the DEQ-PRS and Board staffs. This item should be estimated on a per mile unit rate

(2) Soil Boring Installation: Includes all costs (labor, equipment, and materials) to drill, collect soil samples and abandon soil borings, as well as decontaminate equipment. Drilling costs should be estimated using a per foot unit rate. Unit cost should include handling of contaminated soil by stockpiling or placing in drums. Assume level "C" personal protective equipment.

(3) Monitoring Well Installation: Includes all costs (labor, equipment, and materials) to drill, collect soil samples, and complete monitoring well to specifications and according to Montana Well Drillers Board rules, as well as decontaminate equipment. Drilling costs should be estimated using a per foot unit rate. Unit cost should include handling of contaminated soil by stockpiling or placing in drums. Assume level "C" personal protective equipment.

(4) Drilling Standy: Drilling standby should be estimated on an hourly basis. Prior approval and justification for accumulating standby time is needed prior to billing.

(5) Well Development: Includes all costs (labor, equipment, and materials) to develop monitoring wells. This task should be estimated using a per well unit rate.

(6) Monitoring Well Abandonment: Includes all costs (labor, equipment, and materials) to properly abandon a well location according to the Montana Well Drillers Board rules. Abandonment costs should be estimated using a per well unit rate.

Soil Boring/Monitoring Well Installation Unit Cost Worksheet

TASK		UNIT COST		NUMBER OF UNITS	TOTAL COST
Mobilization/Demobilization (1)					
Mobilization/Demobilization: Drilling Rig	$	6.50	/mile	382	$ 2,483.00
Mobilization/Demobilization: Support Vehicle	$	3.50	/mile	382	$ 1,337.00
Soil Boring Installation (2)					
Drilling (0'-50' range per boring)	$	66.00	/foot	20	$ 1,320.00
Drilling (50'-100' range per boring)			/foot		$ -
Other (please specify) _____					$ -
Monitoring Well Installation (3)					
Drilling (0'-50' range per well)	$	30.00	/foot	20	$ 600.00
Drilling (50'-100' range per well)			/foot		$ -
Other (please specify) _____					$ -
Drilling Standby (4)					
-prior approval needed	$		/hour		#VALUE!
Well Development (5)					
Well Development	$150		/hour		$ -
Monitoring Well Abandonment (6)					
Abandonment	$		/well		#VALUE!
Lodging may only be paid at actual costs when documented by receipts.					
Per Diem					
Lodging: number of individuals =	2	$ 150.00	/person per day	1	$ 300.00
Food: number of individuals =	2	$ 30.50	/person per day	1	$ 61.00
			TOTAL PROJECT EXPENSE		**$6,101.00**
D.O.T. Drums	$120			1	$120.00

Additional Conditions/Comments/Costs:

Drill and construct 1 monitor well to 20' at Sheridan, MT

If you require assistance, call 406-841-5090.

Submit completed form to:

Petroleum Tank Release Compensation Board PO Box 200902, Helena MT 59620-0902

O'KEEFE DRILLING
P.O. Box 3810 - Butte, MT 59702
Office: (406) 494-3310 Fax: (406) 494-3301
Email: info@okeefedrilling.com

Client:	Bob Waller	Date:	20-Jan-25
Attention:	Bob Waller	Phone:	406-582-8491
Project:	Sheridan, MT	Main:	

PROJECT SPECIFICATIONS:			
Type of Rig:	GeoSonic	**Number of Wells:**	1
Location:	Sheridan, MT	**Expected Total Footage:**	20
Formation:	Sandy/cobbles	**Screen Length:**	15
Sampling:	Every 5'	**Screen Size:**	0.01
Decontamination:	No		
Other Details:	Must be able to use water		
	Flush Mount		
	Cuttings will need to be drummed		

Monitor Well/Soil Boring Installation
Unit Cost Worksheet

	Task		Unit Cost		Number of Units		Total Cost
Mobilization/Demobilization							
	Drill Rig	$	6.00	Miles	120	$	720.00
	Support Vehicle	$	2.50	Miles	120	$	300.00
Soil Boring Installation							
6"	Drilling 0-100 ft range	$	72.00	Per Foot	20	$	1,440.00
	Drilling Dry Surcharge - 10%			Total		$	144.00
Monitor Well Installation							
2"	Drilling 0-105 ft range	$	80.00	Per Foot	20	$	1,600.00
Drilling Standby & Safety Meeting							
	Prior Approval Needed	$	350.00	Per Hour		$	-
Other							
	DOT Drums	$	150.00	Each	1	$	150.00
	Move/Set-up	$	550.00	Per Hour	2	$	1,100.00
	Containerize Cuttings	$	350.00	Per Hour	0.5	$	175.00
	Telehandler	$	500.00	LS	1	$	500.00
			Total Project Expenses			**$**	**6,129.00**

**If water cannot be used, a surcharged will be added to the cost of drilling.

***Client is responsible for any line locates. Locate number can then me given to O'Keefe Drilling who then will request a ticket default.

****This bid is subject to change as warranted when the addition of prior unexpressed need for additional certifications, medical monitoring, sampling, containerization or other unforeseen change in the scope of work.

From: **Bob Waller** ruwaller@gmail.com
Subject: Re: Drill Bid
Date: January 17, 2025 at 8:52 AM
To: mthaztech@gmail.com

BW

Yes, thanks Paul.

> On Jan 17, 2025, at 8:38 AM, <mthaztech@gmail.com> <mthaztech@gmail.com> wrote:
>
> Bob,
> Based on the last time we were in Sheridan I am going to decline to bid on this one.
> Thanks,
> Paul
>
> -----Original Message-----
> From: Bob Waller <ruwaller@gmail.com>
> Sent: Friday, January 17, 2025 8:18 AM
> To: Haztech Drilling <mthaztech@gmail.com>
> Subject: Drill Bid
>
> Hi Paul, I need a bid for one well in Sheridan, MT, 2" diameter, 20 feet deep, 15 feet of screen, flush mount, cuttings will be drummed. Drilling conditions will be difficult as there are cobbles 8-12" in subsurface. Let me know if you have questions. Thanks,
> Bob Waller
>
> --
>

Appendix D
Standard Operating Procedures

3.0 SAMPLING PROCEDURES

Sampling activities at LUST Program sites could include the collection of surface soils, subsurface soils, sediment, and ground water samples. Samples will be recovered by a variety of drilling and sampling methods, placed in containers appropriate for the intended analyses, preserved as necessary, labeled and sealed according to established MF procedures, and transferred under Chain-of-Custody (COC) protocol to a certified laboratory for analysis. All sample information will be written into a field log book by the field technician or field team leader at the time of sample collection. Table 3-l summarizes sample containers, holding times, and preservative requirements for organic, inorganic, and petroleum hydrocarbon analyses. Section 4.0 addresses sample documentation and custody procedures, and Section 6.0 describes the analytical procedures that will be used to conduct site characterization.

The phased corrective action work plans will contain detailed information regarding specific sampling requirements for field investigations at the various LUST sites. This information will be based on the following factors:

1. Site sampling rationale
2. Sampling techniques and equipment
3. Sample selection criteria
4. Sample documentation, handling, and shipment
5. Well installation design
6. Preparation and decontamination of sampling equipment
7. Waste characterization

The sampling procedures described in the following sections; however, outline specific protocol to be followed for each different environmental matrix in order to provide SOGs and SOPs that will ensure uniform sampling techniques regardless of the person(s) conducting the sampling.

General locations for surface sampling points, test pits, bore holes, and monitoring wells will be initially located using site plans, city/county maps, and/or topographic maps and documented by survey from an appropriate site benchmark. Sampling locations will be mapped to scale and recorded in a field log book. This information will then be transferred to the appropriate logs or profiles (to scale) for reporting purposes.

3.1 Soil Sampling

Prior to any sampling event, all sample equipment, lab containers and personal protective equipment (PPE) will be assembled near the sample area. Sample containers will be labeled prior to depositing sample contents.

Surface Sampling

Disposable Teflon scoops or cleanable, depth-calibrated hand augers or shovels will be used to collect soils from the upper two or three feet of the soil horizon. Soil samples will be collected from the auger flight at the point corresponding to the required depth after the hand auger has been slowly removed from the bore hole. If necessary, a tube sampler can be attached to the auger rods after advancing the bore hole to the desired depth. The sample will be collected by inserting the tube sampler into the open bore hole and advancing the sampler into the deposits at the base of the boring. Whenever possible, individual, disposable trowels will be used for each sampling event. Otherwise, sampling equipment will be decontaminated prior to each use. Decontamination procedures are outlined in Section 3.5.

Test Pit Excavation and Sampling

Test pits will be excavated in compliance with all applicable Occupational Safety and Health Act (OSHA) regulations, especially those regarding excavation and side-wall stabilization requirements. Walls will be cut as near vertical as possible to facilitate stratigraphic logging. Test pit dimensions will be recorded in a field log book.

Photographs of specific geologic features may be taken for documentation purposes. A scale or item providing a size perspective and the test pit number will be included in each photograph. The frame number and picture location will also be documented in the log book and printed on the back of the photograph.

Each test pit will be inspected visually, for odors, or with a PID to determine if soil and/or groundwater samples are necessary. Soil samples may be obtained from the backhoe bucket if test pit depth precludes safe entry. All test pits will be backfilled with excavated soil following inspection and/or sampling. Pits will be backfilled and compacted to original grade unless disposal of contaminated soil from the excavation is necessary. In such cases, DEQ landfarming requirements will be followed, and the excavation will be backfilled with clean soil.

Subsurface Sampling

Borings for monitor well completion are typically advanced by two methods, air rotary and hollow stem auger. The casing will be of the flush joint or flush couple type and of sufficient size to allow for soil sampling, coring and/or well installation. All casing sections must be straight and free of any obstructions. Hollow stem augers or solid flight augers with casing may be used according to specific project requirements. Rotary drilling may be used in dense formations to advance to the required sample depth where a split spoon sampler or a coring device can be used to obtain the sample. The drilling method chosen will be site-specific based on past borings in the project area and the site's geological conditions.

The use of re-circulated water shall not be permitted when casing is being driven, unless specified in project procedures, directed and properly documented by the geologist/engineer, and approved by DEQ. If re-circulated water is used, all loose material within the casing will be removed by washing to the required sampling depth using a minimum amount of water. Care must be taken to limit recirculation of the wash water to those times when the water supply is extremely limited or unavailable.

Representative subsurface soil samples will be obtained using a split spoon sampler advanced using the standard penetration test (SPT), which allows for the assessment of resistance within the deposits. Samples will be taken continuously when using a hollow stem auger. The interval exhibiting the maximum PID reading will be selected for the collection of analytical samples. Discharge from air rotary cyclones, or cuttings from cable tool rigs or solid stem augers will be screened for VOCs using a PID and will be logged continuously. Split spoon samples taken at the saturated zone and elsewhere will be logged as determined necessary by changes in field conditions.

The split spoon sampler must be opened upon removal from the casing to expose the cored material. If material recovery is inadequate, further attempts must be made until the amount of material is of a sufficient quantity for the required sample size. The sampling device must then be decontaminated before the next sampling event (see Section 3.5).

In the event that gravel or other material prevents penetration by the split spoon, samples will be collected from the auger flights as the auger is retracted from the hole.

Compositing

Composite samples, if required, will be obtained by collecting an equal and sufficient amount of soil from each subsample location so that the final composite volume will provide enough sample for all required analyses. Stones and other hard inorganic objects, which are not likely to affect soil chemistry, will not be included in the samples.

Each composite subsample will have dedicated, disposable sampling equipment, i.e., glass or stainless steel bowls, polyethylene gloves, and Teflon scoops to prevent possible cross contamination. Soil subsamples collected for each composite will be deposited into a stainless steel mixing bowl. The soils will be commingled to represent a composite sample for that designated sample zone.

Waste Management

When sampling in any specific area is complete, the sampling equipment will be placed in plastic bags and labeled according to the sampling area. All disposable sampling equipment will then be stored in 55 gallon storage drums prior to disposal. Equipment from non-hazardous areas will be disposed of as uncontaminated debris. Contaminated sampling equipment will be disposed of according to local, state and federal regulations.

3.2 Sediment Sampling

Sediment sample points within surface water systems will be selected based on topography, erosion, transportation, ground water discharge, and accumulation. Accumulation areas typically reveal better data as compared with erosion or transport areas because minimized stream bottom dynamics allow undisturbed sediment accumulation[1]. Sediment samples taken from creeks will be extracted using a Shelby Tube (ST) or similar instrument.

A separate ST will be used for each sample location. This will eliminate the need for decontamination of the ST between sample areas. A one foot core sample, with a diameter of 2 inches, will be extracted and composited. The core sample will consist of the sediments at the water/sediment interface and extend to a depth of one foot. Four vertical slices, each of one-quarter inch thickness, equally distributed throughout the core, will be composited to represent a single composite sample. Stones and other hard inorganic objects, which are not likely to adsorb contaminants, will not be included in the samples.

[1]G. Allen Burton, Jr., Sediment Toxicity Assessment, Lewis Publishers 1992.

The sediment subsamples collected from each specified sample point will be deposited into glass or stainless steel mixing bowls. The sediments will be commingled to represent a composite sample of the core.

Each sample area will have dedicated sampling equipment, i.e., glass or stainless steel bowls, polyethylene gloves, and Teflon scoops and Shelby Tubes, to avoid possible cross contamination and the need for rinsate samples.

All disposable sampling equipment will be placed in plastic bags and labeled according to the sampling area. This equipment will then be stored in 55 gallon storage drums prior to disposal. Equipment used to collect samples which are shown to be non-hazardous will be disposed of as uncontaminated debris. Contaminated sampling equipment will be disposed of according to local, state and federal regulations.

3.3 Groundwater Sampling

The installation and sampling of groundwater monitoring wells will be performed according to established procedures which are designed to produce consistency between well locations. These specifications and procedures ensure meaningful analytical results and a high degree of quality in monitor well performance.

Groundwater Monitoring Well Installation

Wells will be drilled to a minimum depth of ten feet below the lowest seasonal groundwater elevation. Borings will be logged for lithology and monitored for petroleum hydrocarbon vapors using a photo-ionization detector (PID). Cuttings from selected intervals (modified by specific site conditions) will be placed in clean glass jars covered with aluminum foil where any volatile organic hydrocarbons (VOCs) will be allowed to equilibrate with the headspace air prior to PID analysis. All drilling equipment in contact with soil will be steam cleaned immediately after each well completion.

The well screen will consist of two or four inch diameter, flush-threaded, 0.020" slotted Schedule 40 polyvinyl chloride (PVC) pipe set from one foot off the bottom of the boring to five feet above the highest anticipated water table elevation. The PVC riser will extend three feet above ground surface. 10/20 mesh silica sand will be used to fill the annulus around the well screen from total depth to approximately one foot above the highest screened interval. Bentonite chips will be used to seal the well above the screened casing to within one-half foot of the ground surface. A locking well cover will then be cemented in place using Portland cement. Typically, the well head vaults will be finished at grade; however, wells in remote locations will include well covers which extend four feet above the ground surface. An as-built record of well construction will be completed on the boring log.

All monitoring wells will be allowed to equilibrate for 48 hours after construction. The wells will then be developed by continuous pumping, surging, or air lift methods until visibly clear water is discharged during the active portion of well development.

Monitor Well Sampling

All groundwater monitoring wells will be sampled after a 72-hour stabilization period following well development.

All equipment that is used for purging, sampling, or depth measurement will be decontaminated with an Alconox wash solution followed by a distilled water triple rinse prior to each use.

A groundwater sampling log will be completed for each sampling event.

The following procedure will be followed when sampling a groundwater monitoring well:

1. The depth-to-water will be measured using a clean M-Scope or steel tape. Measurement datum is the top of the well casing, north side. Measurement device will be decontaminated between wells.

2. Depth to the bottom of the well will be measured by a steel tape or M-Scope. If possible, this will be compared to the well construction log to determine inconsistencies, i.e. damaged casing, sediment in casing, etc. Measurement device will be decontaminated between wells.

3. The presample purge will consist of removing water under low flow conditions to produce steady state conditions within the screened interval based on turbidity, dissolved oxygen, oxidation-reduction potential, temperature, conductivity and pH. A small diameter submersible pump will be used to purge the wells. This pump will be decontaminated between wells. The volume purged and the field measurement data will be recorded using a well sampling data sheet.

4. Water samples will be obtained directly from the pump discharge. A clean pair of disposable polyethylene gloves will be worn during each phase of the well sampling activities.

5. Groundwater samples collected for dissolved metal analyses will be filtered prior to bottling. Filtration will be accomplished using either a peristaltic pump or portable hand pump and 0.45 micron (μm) filter paper. Samples will be filtered directly from collection device into sample containers.

Note that all fluids resulting from monitoring well installation, development, sampling, and equipment decontamination will be containerized separately in appropriately labeled 55-gallon drums and secured on-site pending the receipt of analytical results to determine disposal options.