Environmental Resources, LLC
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December 5, 2024

Ms. Daphne Ryan
DEQ-PTCS
P.O. Box 200901
Helena, MT 59620

Subject: Groundwater Monitoring Work Plan
Green's Sales Bulk Plant, Malta, Montana
DEQ Facility ID No. 36-13519, (TID 26322)
DEQ Release No. 2573, Work Plan ID 34910

Responsible Party: Mr. Stan Green
Green's Sales, Inc.
P.O. Box 1091
Malta, Montana 59538

Dear Ms. Ryan:

Environmental Resources, LLC is pleased to submit this Groundwater Monitoring Work Plan to outline activities associated with groundwater monitoring and reporting 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 August 22, 2024.

Submitted by
Environmental Resources, LLC

Robert H. Waller, Principal Geologist

Attachments

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1.0 Executive Summary

Environmental Resources, LLC has been retained by Green's Sales, Inc. to investigate and remediate petroleum contaminated soil and groundwater discovered at the former Green's Sales Bulk Plant facility in Malta, Montana. Site geology is characterized by fine-grained alluvium deposited by the easterly flowing Milk River. Sandy and silty clay mixed with interbedded sand and sandy gravel is encountered from ground surface to approximately 15-16 feet below ground surface and is underlain by saturated sandy gravel. Shallow groundwater occurs at approximately 16-20 feet below ground surface and flows northerly toward the Milk River situated approximately 800 feet northeast of the project site. Shallow groundwater is not potable in this area and is not typically used for human consumption.

The project site was used as a bulk fuel storage facility until 1995. A petroleum release was discovered beneath a single fuel dispenser on April 24, 1995 during demolition of the bulk facility. Installation of eight groundwater monitoring wells delineated a dissolved petroleum contaminant plume and an area of free phase diesel fuel contamination. Remediation work consisting of dual phase vapor extraction (DPVE) has resulted in a significant reduction in free phase diesel fuel contamination beneath the site. Due to persisting dissolved phase contamination, additional groundwater monitoring work has been requested by DEQ.

2.0 Facility Summary and Current Conditions

The Green's Sales, Inc. Bulk Plant petroleum release site is located within the city limits of Malta, Montana at 435 North First East along U.S. Highway 2 on property leased from the Burlington Northern Santa Fe Railroad as shown in Figure 1. The Milk River is situated approximately 600 feet northwest of the project site.

A petroleum release was discovered beneath a single fuel dispenser on April 24, 1995 during demolition of the bulk facility (Figure 2). A Remedial Investigation was requested by DEQ in response to the elevated levels of petroleum hydrocarbons in the soil and groundwater beneath the site and eight groundwater monitoring wells were installed as shown on Figure 3. The majority of the dissolved petroleum contamination measured at the project site consists of diesel fuel with some mixed gasoline contamination. Previous remediation efforts have included extracting in excess of 7000 gallons of groundwater from monitoring well MW-1 using a vacuum truck. Free phase diesel fuel contamination that was previously measured in monitoring well MW-1 appears to have been mitigated using the vacuum extraction remediation. However, dissolved diesel fuel contamination persists in groundwater penetrated by monitoring wells MW-1, MW-4 and MW-5.

The monitoring well network was last monitored in 2022. DEQ requested additional groundwater monitoring work and the following sections outline methods that will be used to conduct that work.

3.0 Purpose and Objectives

The purpose of this investigation is to assess current groundwater quality beneath the project site. Specific objectives of the investigation include:

1) Conduct an onsite inventory and status of all Facility monitoring wells to include the following: well redevelopment and wells that require repair or replacement.
2) Collect data needed to design a pilot test which may include: slug test to determine hydraulic conductivity, a soil sample for biological analysis, etc.
3) Monitor groundwater semi-annually for one year.
4) Collect groundwater samples for laboratory analysis from monitoring wells using low flow sampling methodology.
5) Analyze samples at an analytical laboratory in accordance with Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases. Also analyze groundwater samples for Intrinsic Biodegradation Indicators (IBIs).
6) Validate all laboratory data.
7) Prepare an Interim Data Submittal (IDS).
8) Update the Release Closure Plan (RCP).
9) Prepare a Groundwater Monitoring Report.

4.0 Scope of Work

4.1 Groundwater Sample Collection and Analysis

Groundwater samples will be collected from monitoring wells MW-1-8 on a semi-annual schedule for one year. Groundwater elevations will be measured in all of the site monitoring wells prior to purging and sample collection. All of the well covers will be opened and the locking caps removed at least 30 minutes prior to obtaining water level measurements. Static water levels will be measured from a reference point on top of the north side of each well casing using a Keck ET-89 electronic water levels indicator. The water level indicator will be decontaminated prior to each measurement. Decontamination will be accomplished by scrubbing the indicator tip in an *Alconox®* wash solution, rinsing with a 10% methanol solution and triple rinsing with distilled water.

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 Volatile Petroleum Hydrocarbons (VPH), Extractable Petroleum Hydrocarbons (EPH) Screen and for IBIs at Energy Labs in Helena, MT.

4.2 Slug Testing

A series of slug tests will be conducted on groundwater monitoring wells MW-1-5 to provide information about the aquifer's hydraulic conductivity characteristics beneath the Green's Sales Bulk Plant facility. First, the static water level for each well will be measured and recorded with an electronic water level indicator. Then a sealed PVC cylinder filled with sand (the slug) will be lowered into the well below the water level and the subsequent rise in water level in the well will be measured and recorded. With the slug in, the falling water level in the well will be constantly monitored and recorded every ten seconds for one minute and then every 30 seconds until equilibrium is reached. Once the water level in the well has equilibrated, the slug will be removed (slug out), and the change in water level in the well will again be recorded over time as it rises to equilibrium. The changes in water level will be plotted against time using the Hvorslev method to determine hydraulic conductivity.

Hydraulic conductivity will be calculated using the following equation:

$$K = \frac{r^2 \times \ln(L/R)}{2LTo}$$

where: L = length of screened interval
r = inside radius of the well casing
R = inside radius of the well screen
To = time it takes for the water level in the well to fall to 37 percent of the initial change

and velocity values will be calculated using the following equation:

$$V = (K/n) \times (dh/dl)$$

where: V= groundwater velocity
K = hydraulic conductivity
n = porosity (estimated from published values by soil type)
dh/dl= hydraulic gradient

Slug testing data will be presented in the example table below.

Hydraulic Conductivity and Velocity Results From Slug Testing, Green's Sales Bulk Plant, Malta, Montana.

Monitoring Well Number	Hydraulic Conductivity (feet/day)	Velocity (feet/day)
MW-1 (slug in)		
MW-1 (slug out)		
MW-2 (slug in)		
MW-2 (slug out)		
MW-3 (slug in)		
MW-3 (slug out)		
MW-4 (slug in)		
MW-4 (slug out)		
MW-5 (slug in)		
MW-5 (slug out)		

4.3 Investigation Derived Waste

Drill cuttings, excess sample materials, drilling fluids, and water removed from a well during installation, development, and sampling 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.

4.4 Reporting

An IDS will be prepared and submitted following completion of the first semi-annual groundwater monitoring event. One Groundwater Monitoring Report will be prepared following completion of the second groundwater monitoring event. The RCP will be updated and included in the final report along with Data Validation Summary Forms (DVSF) and field data collection sheets.

4.5 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 for soil and groundwater sampling are included in Appendix B.

4.6 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

Costs for slug testing, groundwater monitoring and data collection are outlined on the attached Unit Cost Worksheets included in Appendix C.

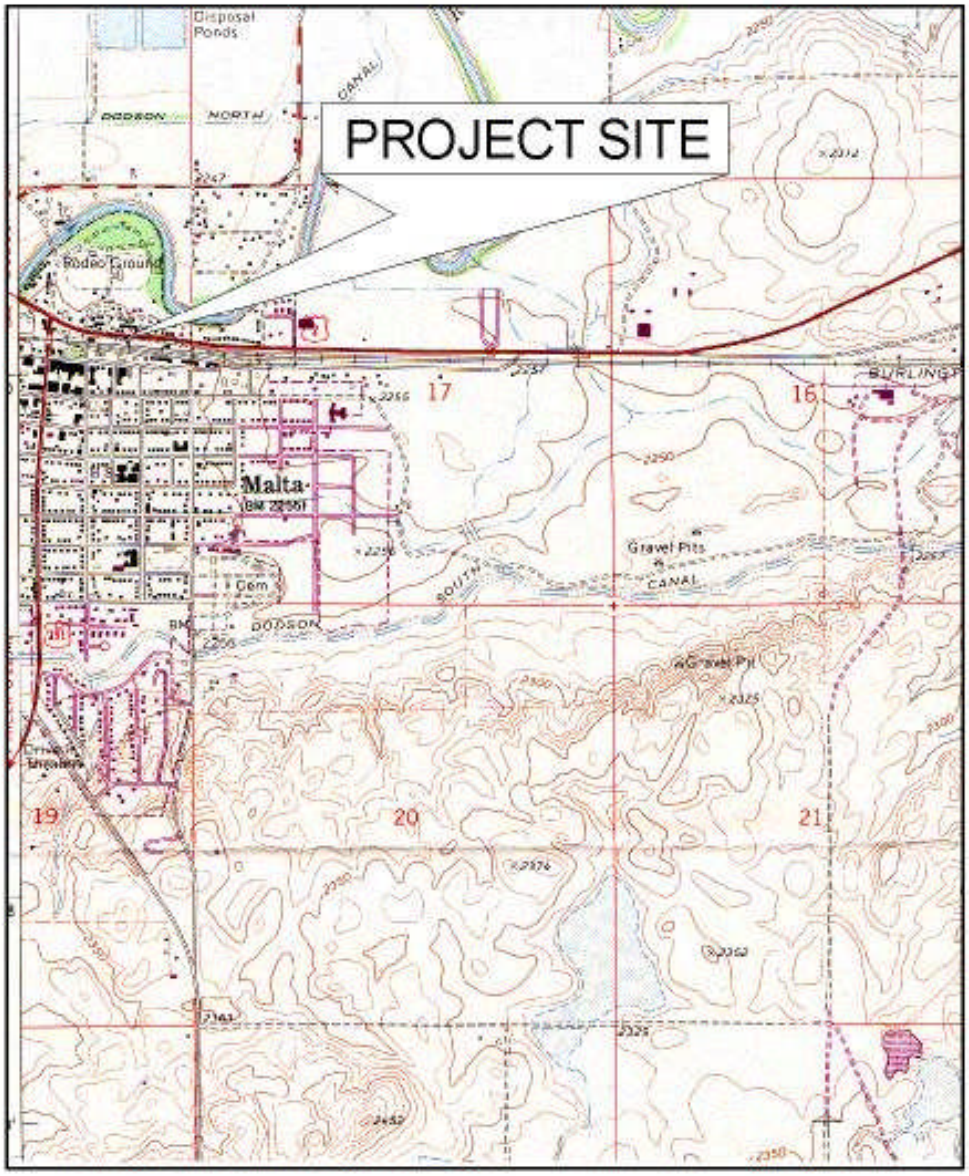
6.0 Limitations

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



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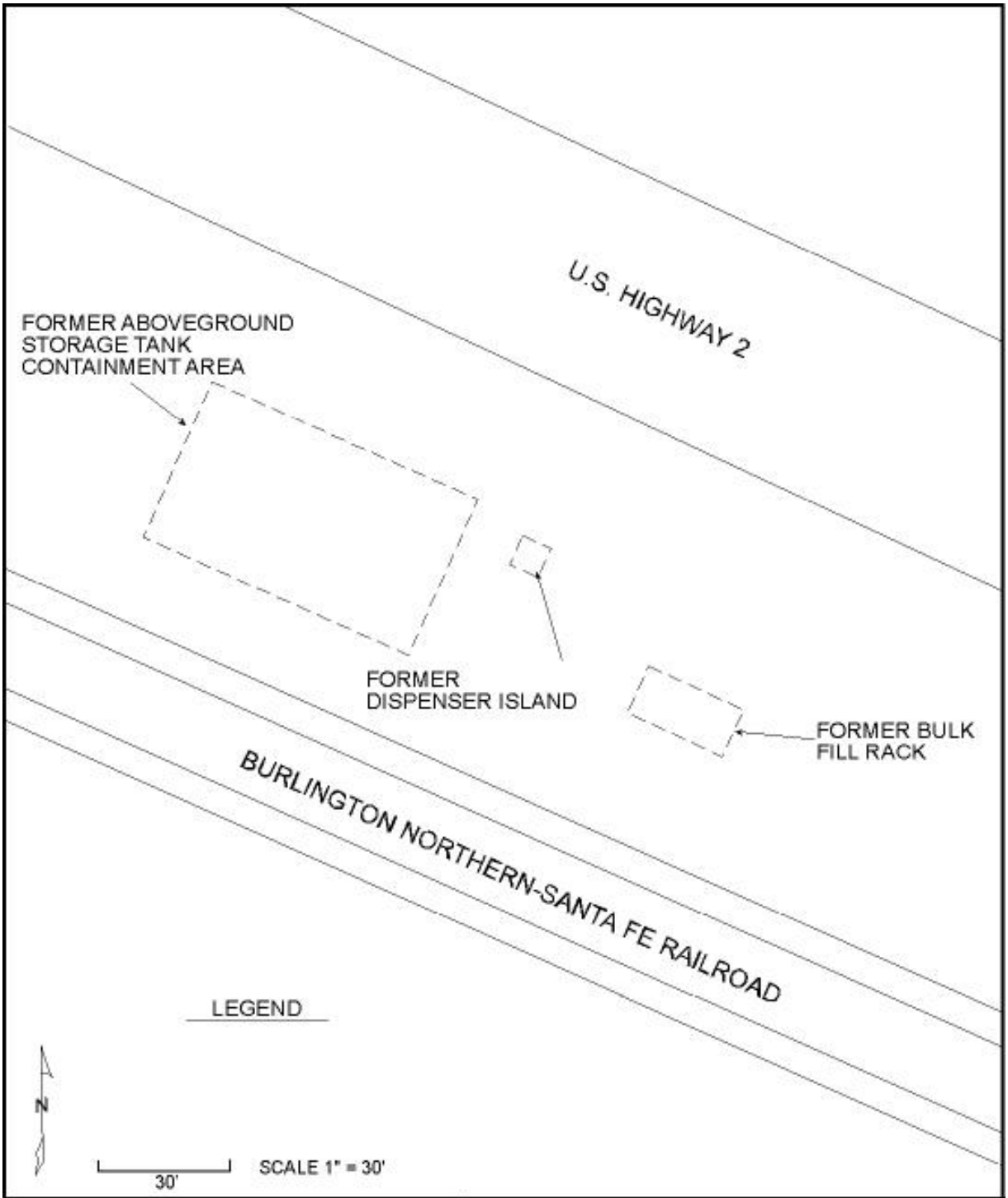
GREEN'S SALES BULK PLANT
MALTA, MONTANA
SITE INVESTIGATION
FIGURE 1, REGIONAL SITE LOCATION MAP



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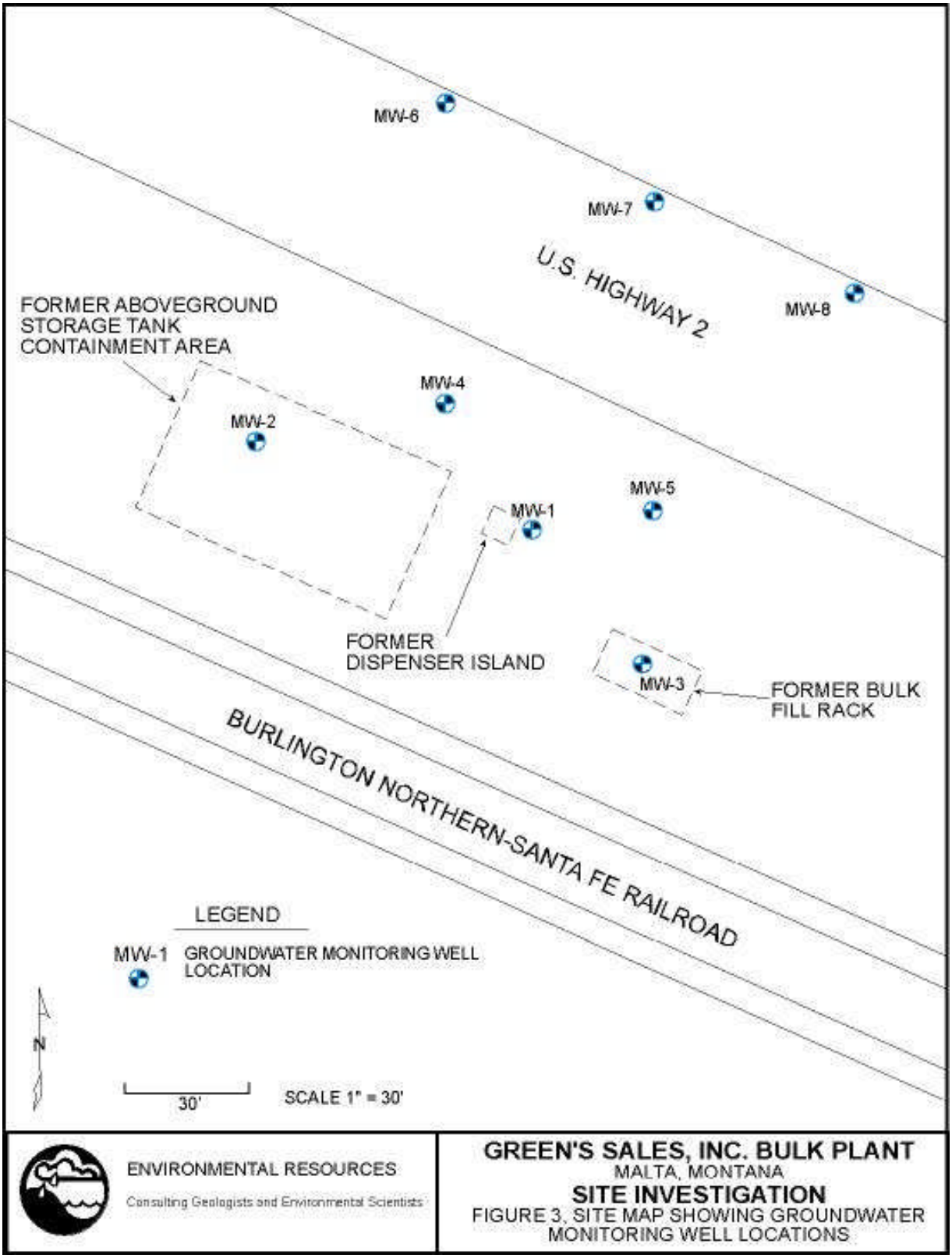
GREEN'S SALES, INC. BULK PLANT

MALTA, MONTANA

SITE INVESTIGATION

FIGURE 2, SITE MAP SHOWING SITE FEATURES



ENVIRONMENTAL RESOURCES

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GREEN'S SALES, INC. BULK PLANT

MALTA, MONTANA

SITE INVESTIGATION

FIGURE 3, SITE MAP SHOWING GROUNDWATER MONITORING WELL LOCATIONS

Appendix B
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.

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[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.

Appendix C
Unit Cost Worksheets