Water & Environmental TECHNOLOGIES

September 23, 2015

Aimee Reynolds
Department of Environmental Quality
PO Box 200901
Helena, MT 59620-0901

RE: Joint Livingston Restoration Group (LRG) and BNSF Railway Company (BNSF) Submittal -Final Air Sparge/Soil Vapor Extraction Pilot Test Work Plan- Burlington Northern Livingston Shop Complex (September 2015)

Dear Ms. Reynolds:

This letter outlines amendments to the Final Air Sparge / Soil Vapor Extraction Pilot Test Work Plan. The following amendments to the work plan are provided in response to comments provided by CDM Smith, Consulting in a letter dated September 15, 2015, and discussion during a conference call held on September 22, 2015. The conference call was attended by representatives of DEQ and its consultant CDM Smith, BNSF and its consultant Kennedy/Jenks, and Water & Environmental Technologies as representatives of the Livingston Restoration Group. In addition to the information outlined below, minor clarification edits were made to the Final Work Plan to DEQ. Therefore, the electronic submittal of the work plan includes two modifiable text documents including one redline-strikeout format to simplify review of edits, and one "clean" copy with all changes.

The following outlines CDM's comments along with Water & Environmental Technologies' responses/amendments to the comments.

Specific Comments

1. Regarding Specific Comment #2: There remains some uncertainty regarding exactly how much radius of influence (ROI) will be achieved in the sparge wells, and the proposed monitoring points are all located at least 20 feet away from the first sparge point. CDM Smith agrees that small changes in permeability can facilitate lateral spread of bubbles, but this spacing assumes at least a 20-ft ROI, despite the fact that the US Army Corps of Engineers (USACE) Engineering Manual indicates a smaller ROI is typical. Monitoring points should be located well within the ROI to confirm the ROI, and located at different/staggered distances in the different directions (i.e. not 20 feet in both directions). Please revise the monitoring network accordingly. This will facilitate interpolation of the data to determine the ROI to be used for spacing. Further discussion and planning regarding appropriate well spacing for the next phase should be deferred until the results of the first single-well test are available.

Response: Monitoring point/wells will be adjusted/added to the AS ROI layout. The work plan specifies five monitoring points; three set on a line north of the test well at distances of 20, 30, and 40 feet; two set on a line 90° to the east at distances of 20 and 30 feet. The adjusted monitoring layout will include six monitor wells; three to the north at distances of 5, 15, and 25 feet; and three 90° east of the north line at distances of 10, 20, and 30 feet.

2. Regarding Specific Comment #5: Please install the check valves at the sparging manifold to avoid burial and maintenance issues.

Response: As a change to the work plan, which specifies a check valve at each well head, this amendment specifies the AS system will have a single check valve placed in the header of the sparge manifold.

3. Regarding Specific Comment #7: All sparging piping used should be designed and rated for use with compressed air. Please confirm that the high density polyethylene (HDPE) pipe planned for conveying compressed air with this system is appropriately rated and, if it is not, replace it with pipe that is rated for use with compressed air.

Response: Injection line specifications will exceed maximum system pressures of 15 psi for compressed air. In addition, injection line specifications will assure no deformation or failure for potential maximum system design temperatures of 117 degrees F occurring during peak summer ambient temperatures.

5. Regarding Specific Comment #8: Taking into consideration the air sparge flow into the SVE flow is appropriate and appreciated. However, please note that the ROI shape may deform as a result of the sparging. The contingency measures and safety factors listed in Section 5.2 of the revised Work Plan are appropriate.

No response.

6. Regarding Specific Comment #19 and Section 3.0, last paragraph: Air sparge (AS) monitoring points should be screened in the groundwater, and not in the vadose zone, to avoid adding bias to the ROI estimation. For the purposes of air sparge pilot testing, air/helium distribution matters in groundwater only. Therefore, different vapor monitoring points will be needed for assessing soil vapor extraction (SVE). Please clarify the planned location and screen depth intervals for all the AS and SVE monitoring points.

Response: Monitoring points will consist of 2-inch diameter wells screened entirely below the water table. Wells will include nested pairs with off-set well screens; one spanning the upper portion, and one spanning the lower portion, of the alluvial aquifer saturated thickness. The wells will be fitted with a sealed cap and sampling ports to allow collection of pressure readings and helium measurements.

7. Section 3: Helium concentration in the injection gas stream should be maintained at less than 10% to minimize buoyancy/density effects versus air. Please indicate the planned injection rate in the Work Plan.

Response: Helium will be injected directly into the injection line of the sparge test unit. The helium supply will be equipped with a flow regulator and the air sparge injection line equipped with flow and pressure gauges. A sample port will be placed at the well head to verify helium concentration in the injected air stream at or below 10% by volume.

Please call me at (406) 782-5220 if you have any questions regarding the Final Work Plan or the responses provided below.

Sincerely,

Patrick Thomson, PG
Senior Hydrogeologist

FINAL
AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN

Burlington Northern Livingston Shop Complex Facility, Livingston, Montana

Prepared for:

Livingston Restoration Group

Livingston, MT

Prepared by:

Water & Environmental TECHNOLOGIES

Moonlight Professional Building
480 East Park Street, Suite 200
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September 2015

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1.0 INTRODUCTION

This Air Sparge / Soil Vapor Extraction Pilot Test Work Plan (Work Plan) has been prepared by Water & Environmental Technologies (WET) in conjunction with BNSF Railway Company (BNSF) and Kennedy/Jenks Consultants as part of the ongoing remedial activities at the Burlington Northern Livingston Shop Complex Facility, in Livingston, Montana (Facility).

2.0 OBJECTIVES

The activities described in this Work Plan will be used to test air sparge/soil vapor extraction (AS/SVE) for its ability to remove chlorinated volatile organic compounds (CVOCs) from the alluvial aquifer groundwater at the Facility (Figure 1) and decrease dissolved CVOC concentrations and mass discharge downgradient of the installed system. The proposed location for the AS/SVE system is presented on Figure 2. The specific objectives are to:

1) Conduct a radius of influence (ROI) test on a single air sparge (AS) well to evaluate system well spacing;
2) Install an AS system to volatilize dissolved CVOCs from the alluvial aquifer as groundwater flows past the AS curtain;
3) Install a SVE system to collect the volatilized CVOCs;
4) Conduct baseline and startup monitoring to measure zones of influence; and
5) Conduct long term system performance monitoring to evaluate the technology's ability to remove mass and decrease dissolved CVOC concentrations downgradient of the curtain.

Information gathered during implementation of the Work Plan will be used to determine whether AS/SVE technology should continue to be utilized to remove dissolved phase CVOCs from the alluvial aquifer. Pending the results of the pilot test performance, additional wells may be installed to complete the curtain wall, and systems may be installed in other areas of the Facility to remove mass and reduce mass flux from known or suspected source areas.

3.0 RADIUS OF INFLUENCE TESTING

The initial phase of work for the AS/SVE system will involve the installation of a single AS well located near the center of the proposed sparge curtain (Figure 3) to conduct an air injection test. In addition to the AS test well, twelve wells will be installed in pairs at six locations (nested) to monitor influence during testing. Each well will be screened entirely beneath the water table and each well pair will include a shallow and deep well screened at discrete intervals. The interval and screen length of each well pair will be dependent on field conditions and provide for separation between screened intervals. The saturated thickness is anticipated to be between 10 and 12 feet. As such, the screen length for each well is anticipated to be approximately three to four feet, providing vertical separation between screens and to maintain saturation above the upper screen. The well pairs will be placed at distances of 5, 15, and 25 feet from the test well, on a line north and perpendicular to the groundwater flow direction; and at distances of 10, 20 and 30 feet east of the test well on a line parallel to groundwater flow,

In addition to the nested wells screened in groundwater, each boring will include a vapor monitoring point (VMP) screened in the vadose zone. Also, a sixth VMP will be installed approximately 70 feet from the AS test well.The purpose of these points are to measure pressure influence during the AS test and to

monitor effects of the SVE system after system startup as discussed in Section 5.2. The AS pilot test well and VMPs will be installed as described in Section 4.2.1 and 4.5.2.

Following completion of the AS well and VMPs and allowing sufficient time for well seal stabilization, a pilot test will be conducted to determine the ROI for air sparging. AS test results will be discussed with the parties (DEQ, BNSF, CDM Smith, and Kennedy/Jenks Consultants) and the AS system well spacing determined. A rental compressor will be utilized to conduct the ROI test and will be sized to provide flows and pressures consistent with the system design parameters described in Section 4.1. In addition, helium will be used as a tracer gas. The helium will be entered directly into the injection line of the sparge test unit. The helium supply will be equipped with a flow/pressure regulator to maintain a helium concentration at or below 10% by volume of the injected air stream. Helium concentrations will be measured from the injection stream via a sample port at the well head using a helium meter at regular intervals throughout the test to establish a helium concentration curve for the injected air.

Monitoring of the AS well will include background pressure readings prior to start up. Upon startup, measurements of pressure will be collected from the vapor monitoring points and helium concentrations will be collected at approximately 15-minute intervals from each of the monitoring wells. Pressure will be measured using magnelelic gauges while helium will be measured using a helium meter. The ROI will be determined by results of the measured helium concentrations and pressure readings collected during the duration of the test. Monitoring points within the ROI should exhibit a sharp rise in both soil gas pressure and helium concentration once bubbles of air/helium reach the monitoring well. Monitoring points lying outside the ROI would exhibit increased pressure and helium concentrations primarily via diffusion in the vadose zone; therefore, pressure and helium concentration curves at these locations should take longer to rise, and the rise would likely be more gradual.

4.0 AIR SPARGE (AS) SYSTEM DESCRIPTION

The proposed AS system includes approximately 15 air injection wells, three vapor extraction wells, an oil-free air compressor, a blower, granular activated carbon (GAC) canisters and associated piping, control valves and appurtenances. The final number of sparge wells will be dependent on results of the single well test described above. The system will also include the construction of four alluvial aquifer groundwater monitoring wells and two pairs of nested alluvial aquifer well groundwater monitoring wells (for a total eight wells), and five soil VMPs to monitor performance of the AS/SVE system. The AS/SVE system is proposed to be installed along the apparent axis of highest CVOC concentrations in the alluvial aquifer, just downgradient of monitoring well 14-5. The location is also downgradient of the area where the highest CVOC concentrations have been reported in the bedrock formation. The 15 injection wells will be placed in two staggered rows, approximately perpendicular to groundwater flow. The SVE wells will be located in between the two rows of AS wells. Figure 2 depicts the proposed AS and SVE well locations. WET conducted an initial reconnaissance of the proposed AS/SVE well locations with Montana Rail Link (MRL) on August 21, 2015. The proposed AS/SVE well locations appear to be feasible with respect to known underground utilities and surface features. MRL indicated that tracks on an abandoned rail spur located at the curtain's north end can be removed. Actual AS/SVE well locations may vary based on unforeseen underground utilities.

According to the U.S. Army Corps of Engineers (USACE) In Situ Air Sparging Guidance Document (USACE 2013), the effective ROI of an AS well is likely to be no more than 15 to 20 feet; however, a 2001 Technical Report published by the Naval Facilities Engineering Command indicates that the ROI can be greater than 30 feet in sand and gravel aquifers (NFESC, 2001). Therefore, a well spacing of 30 feet was chosen for the proposed system (between wells of the same row and between the two rows). Based on the more conservative USACE effective ROI of 20 feet, the 30 foot well spacing will provide an estimated 25 percent overlap between wells, which should be sufficient to volatilize a significant portion of the dissolved plume, but not result in appreciable groundwater mounding that would significantly alter the groundwater flow through the pilot test area. The second, offset row is expected to volatilize additional dissolved CVOCs that pass through the first row of AS wells.

4.1 AS SYSTEM DESIGN PARAMETERS

4.1.1 Injection Flow Rate

The USACE In-Situ Air Sparging Guidance (USACE, 2013) suggests that air flow rates may only be limited by the maximum allowable injection pressure at a given site. However, this USACE document also acknowledges several other studies recommending injection rates ranging from 3 to 25 standard cubic feet per minute (scfm) of air. A total air flow rate of approximately 150 scfm is proposed to provide approximately 10 scfm continuously to each well. The air compressors will be oversized, as discussed in Section 4.2.4, to allow for system flexibility.

4.1.2 Injection Pressure

Four parameters were evaluated to determine the minimum pressure required to inject air into the formation: hydrostatic pressure, friction loss from piping, filter pack air entry pressure, and formation air entry pressure. The maximum injection pressure should not exceed the formation's fracture pressure (or overburden pressure), which includes the soil weight and water column weight. Discussions of these factors, as well as supporting calculations, are provided in Appendix A, and the resulting operating pressures are listed below:

Minimum injection pressure $= P_{hydrostatic} + P_{friction\ loss} + P_{filter\ pack} + P_{formation}$

$= 4 \text{ to } 7 \text{ psi} + 1 \text{ psi} + 0.14 \text{ psi} + 0.5 \text{ psi}$

$\mathbf{= 6 \text{ to } 9 \text{ psi}}$

Maximum injection pressure $= P_{fracture} * 70\%_{\text{ (safety factor)}}$

$\mathbf{= 17.7 \text{ psig } (0.7) = 12.4 \text{ psig}}$

The estimated required injection pressure (6 to 9 pounds per square inch [psi]) is less than the calculated maximum injection pressure (12.4 psi) using conservative assumptions. The radius of influence of injected air will increase with injection pressures above the minimum.

4.2 AS SYSTEM COMPONENTS

The AS system will consist of approximately 15 wells, piping, an air compressor, and additional appurtenances, as described in the following subsections. AS/SVE construction documents will be provided to DEQ prior to any bidding or procurement.

4.2.1 AS Wells

Borings for AS wells will be eight inches in diameter, advanced using a rotosonic drill rig, and will be completed to the alluvium/bedrock interface by a Montana-licensed water well driller. Sparge wells will be constructed in the borings using two-inch diameter, schedule 40 blank polyvinyl chloride (PVC) casing from the surface to approximately two feet above the alluvium/bedrock interface. The bottom two feet of the borehole will be screened with 0.010-inch, slotted schedule 40 PVC. Typical AS well construction details are shown on Figure 4.

The annular space in each well will be filled with 10-20 silica sand from the bottom of the borehole (typically the alluvium/bedrock interface) to approximately one foot above the top of the well screen, followed by bentonite chips to approximately one foot above the historical high groundwater elevation, followed by grout to approximately 1 foot below the surface. Each well will be protected with a flush-mount well monument secured in a steel-reinforced concrete pad.

Following construction, AS wells will be developed by surging and pumping or hand-bailing to remove fine sediment from the well and filter pack. Wells will be developed until the pumped or bailed groundwater is relatively free of sediments. Well development procedures are identified in SOG-15 (Appendix A of the Facility-Wide Sampling and Analysis Plan [Facility-Wide SAP], Kennedy/Jenks Consultants, 2006).

A tee will be installed at each wellhead to allow lateral connection of the air injection line as shown on Figure 4. The vertical portion of the tee (top of well casing) will have an airtight cap with a threaded port for access to the well.

A single check valve will be placed in the AS manifold to prevent temporary back-pressure in the screened interval of the aquifer from forcing air and water into the wells when airflow to a well ceases. This will minimize the mobilization of silt towards the AS well particularly during pulsed operation.

A Montana licensed professional land surveyor will survey the new wellheads to determine the locations and vertical elevations with respect to the North American Vertical Datum 1988 (NAVD 88). Survey results will provide an accuracy of plus or minus 0.1 foot horizontally and plus or minus 0.01 foot vertically.

Newly installed air sparge wells will be designated DG-AS-1 through 15 (for Downgradient Air Sparge Wells 1 through 15).

4.2.2 Lateral Piping

Lateral piping connecting each AS well to the injection manifold will consist of one to two-inch diameter plastic pipe encased in protective conduit and installed in a typical utility trench at a depth of

approximately three feet (details shown on Figure). The protective conduit will be secured to the sidewall of the flush mount well monument or adjacent access vault at each well head and will penetrate the floor of the system enclosure for connection to the injection manifold.

Injection lines will be rated for use with compressed air and be rated for a minimum of 30 psi for compressed air. In addition, injection line specifications will assure no deformation for potential maximum system design temperatures of 117 degrees F potentially occurring during peak seasonal ambient temperature. The air line conduit will be bedded in appropriate backfill material to at least six inches over the top of the pipe, and the remaining backfill will be brought flush with the surrounding surface. Heat tape will be installed in the conduit to prevent freezing of condensed water vapor.

4.2.3 Injection Manifold and Headers

The AS manifold will be constructed of galvanized steel pipe and equipped with a main pressure relief valve (set to open at the maximum design injection pressure), main throttle valve, pressure gauge, and either a flow meter or sample port for temperature and velocity measurements.

Headers will tee from the manifold and distribute air to the individual lines serving AS wells. Each header will be equipped with a two-position solenoid shutoff valve, manual throttle valve, pressure gauge (0-20 psi), flow meter (0-20 scfm rotameter, Dwyer RMC-107-BV), and a pressure relief valve.

4.2.4 Air Compressor and Ancillary Equipment

Two 10-horse power, rotary claw compressors connected in parallel will provide the capacity to inject at least 150 scfm continuously at an air injection pressure of at least 9 psi but not greater than 13 psi. The compressor motors will be powered using a three-phase variable frequency drive (VFD) and controller to conserve power, reduce wear on the compressor motor, and allow for some adjustment of operating pressures and flow rates without the need for throttle valves. The compressors will be equipped with an external heat exchanger to reduce injection air temperature.

4.3 SOIL VAPOR EXTRACTION (SVE) SYSTEM DESIGN AND INSTALLATION

The proposed system includes the use of SVE technology to capture the gaseous phase CVOCs produced by the AS system. The SVE system is also expected to remove residual CVOCs adsorbed to shallow soils within its ROI.

4.3.1 SVE Well Locations

Three SVE wells will be installed along the centerline of the sparge curtain and spaced on approximate 100-foot centers, consistent with an observed conservative ROI of 100 feet for the former Electric Shop and Locomotive Shop SVE systems. The proposed locations of SVE wells are shown on Figure 2, however actual locations may vary slightly depending on the locations of surface features such as rails and underground utility conflicts.

The SVE sizing parameters and anticipated resulting ROI were determined based on data from the 2nd Revised Bioventing Extraction/Injection Design Study Report, prepared by Kennedy/Jenks Consultants, dated July 2011, which reported a ROI of approximately 150 feet at an extraction flow rate of approximately 100 scfm (Kennedy/Jenks Consultants, 2011a). The SVE system proposed in this Work

Plan specifies a higher flow rate of 167 scfm at each of three wells to compensate for the additional air that will be injected by the AS system. In addition, although a roughly 100-foot ROI is anticipated, a-ROI of as little as 60 to 70 feet would provide coverage across the entire sparge curtain as it is currently sized.

Section 5.2 describes procedures to test the actual area of influence of the SVE system after it is installed. A single-well SVE test prior to full-scale system construction is not favorable because 1) the AS curtain must be operating to test SVE capture efficiency during actual operating conditions, and 2) once the AS curtain is operating, an SVE system consisting of more than a single well should be in place and ready to be operated. If the SVE step tests described in Section 5.2 indicate the proposed system has insufficient influence, DEQ will be consulted and either additional blower capacity will be added, or additional wells installed..

4.3.2 SVE Well Design

The SVE well borings will be advanced to approximately 20 feet below ground surface (bgs), which is approximately equivalent to one foot above the seasonal high groundwater table elevation. The SVE wells will be completed with 4-inch diameter schedule 40 PVC with 12 feet of 0.010-inch machine slotted casing set at the base of the boring.

The annular space of each SVE well will be filled with 10-20 silica sand installed 1 foot above the top of the slotted casing and sealed with two feet of hydrated bentonite chips. The remaining annulus will be backfilled with cement-bentonite grout to the surface. Each SVE wellhead will be protected with similar monuments and concrete pads as are specified for AS wells.

A Montana licensed professional land surveyor will survey the new wellheads to determine the locations and vertical elevations with respect to the NAVD 88.

Newly installed SVE wells will be designated DG-SVE-1, DG-SVE-2, and DG-SVE-3 (for Downgradient SVE Wells 1 through 3).

4.3.3 SVE Piping and Manifold

Individual vacuum lines consisting of 3-inch Schedule 80 PVC will be run from each well to headers connecting to a vacuum manifold in the system enclosure building. Each header will be equipped with a PVC gate valve, ¼-inch labcock sample port, and a flow monitoring port consisting of a ½ x ¼ -inch brass bushing with a ¼-inch brass plug tapped directly into each extraction well manifold line. Care will be taken to install individual SVE extraction lines with a continuous 1-percent slope from the manifold to the individual well connections to promote drainage of condensed water to the wells. Typical completion details are shown on Figure 5.

4.3.4 SVE Blower

The SVE blower will provide the capacity to extract up to 500 scfm at a vacuum of 80 inches water. It will be equipped with a moisture separator, or knockout drum, and a manual dilution valve between the blower inlet and the vacuum manifold. The SVE blower exhaust will connect three 1,000-pound capacity, vapor-phase GAC units arranged in series. If needed, a heat exchanger will be added to the

treatment train to optimize moisture content of the effluent and maximize GAC removal efficiency. Treated soil vapor will be discharged to the atmosphere under the oversight of the Montana Department of Environmental Quality (DEQ).

4.4 SYSTEM ENCLOSURE

It is anticipated that the enclosure will be a pre-manufactured shed, set on a gravel base. Details of the system enclosure and other AS/SVE system construction documents will be provided to DEQ prior to any bidding or procurement.

4.5 MONITORING NETWORK DESIGN AND INSTALLATION

Groundwater monitoring wells and soil vapor monitoring points will be installed and sampled to evaluate system performance.

4.5.1 Groundwater Monitoring Well Design and Installation

Eight groundwater monitoring wells will be installed by a Montana-licensed water well driller, to supplement the existing alluvial aquifer monitoring well network and assess dissolved CVOC concentrations in groundwater upgradient and downgradient of the AS system. The approximate locations of new groundwater monitoring wells are shown on Figure 2; however, actual locations will be selected in the field in consultation with the DEQ and will be dependent on results of ROI test(s).

The well locations centered along the length of the sparge curtain, both up and downgradient of the curtain, will include two nested well pairs (see Figure 2). One well in each pair will be screened across the entire saturated (alluvial) zone to evaluate average concentrations, and the other well in each pair will be screened over the bottom three feet of alluvium to evaluate deeper alluvial groundwater. All other new groundwater monitoring wells will be screened across the entire saturated alluvial zone.

Wells will be constructed in general accordance with SOG-14 (Appendix A of Facility-Wide SAP). Well materials will be 2-inch diameter Schedule 40 PVC casing and 0.010-inch slotted Schedule 40 PVC well screen.

Silica sand filter pack material will be placed in the annular space from the bottom of each well to approximately 2 feet above the top of the well screen, followed by a granular bentonite seal to prevent the infiltration of surface water. The wellheads will be sealed with locking caps and covered with steel flush-mount well monuments set in a concrete pad.

Following construction, monitoring wells will be developed by surging and pumping or hand-bailing to remove fine sediment from the well and filter pack. Wells will be developed until the pumped or bailed groundwater is relatively free of sediments. Well development procedures are identified in SOG-15 (Appendix A of the Facility-Wide SAP).

A Montana licensed professional land surveyor will survey the new wellheads to determine the locations and vertical elevations with respect to the NAVD 88.

New groundwater monitoring wells will be designated with the year in which they are installed and the sequential number representing the order of well installation for that year (e.g., "15-5" for the fifth well installed in 2015).

4.5.2 Vapor Monitoring Point Design and Installation

Seven vapor monitoring points will be installed in the approximate locations shown on Figure 2. Six of the vapor monitoring points will be set in the same boring as the AS ROI monitoring wells. Borings for the remaining VMP will be drilled to a depth of approximately 15 feet using a Geoprobe direct-push drill rig (or contingent drilling technology). All VMPs will be screened using a 3/8-inch diameter, one-foot long stainless steel mesh screen connected to ¼-inch Teflon tubing extended to the surface.

Each monitoring point will be screened from approximately 14 to 15 feet bgs, with the annulus backfilled using 10-20 grade silica sand. The annular space above the sand will be filled with hydrated bentonite. Each soil vapor monitoring point will be completed with an appropriate wellhead protector set in a concrete monument and stamped with the well identifier. A typical completion detail is presented on Figure 4.

New vapor monitoring points will be designated with VMP for vapor monitoring point, followed by a sequential number continuing from the most recently installed existing VMP at the Facility.

Prior to sampling, vapor monitoring points will be allowed to rest a minimum of one week following installation to allow formation stabilization.

5.0 SYSTEM STARTUP AND OPTIMIZATION

Data will be collected during startup to confirm the suitability of the design flow rate and injection pressure. Data collection procedures for the SVE system and AS system are discussed in detail in the following subsections.

5.1 AS SYSTEM STARTUP

To verify that the surface mechanical system is working as designed, the system first will be run with the main throttle valve completely open. Once it is determined that the compressor and ancillary equipment are operating normally, and after the SVE system has been started, tested, and optimized as described above, the main throttle valve will be closed and air will be delivered to the AS wells.

Flow rate and pressure measurements will be collected at the manifold, headers, and initially, at each operating well head. Pressure data from the manifold and headers in the system enclosure will be compared with data from wellheads and used to measure actual friction losses from piping and fittings and determine proper injection pressures at each header.

To attempt to measure the magnitude and extent of mounding and the duration of the transient mounding stage (Figure 6), transducers will be installed in the eight new groundwater monitoring wells during the first month of system operation. The transducers will collect continuous water level measurements during baseline conditions, during startup when several operating well configurations are tested, and during the

first (approximately) two weeks of operating in the chosen well configuration. Barometric pressure will be monitored concurrently with water levels to aid in normalizing groundwater level data.

In addition to continuous water level measurements in monitoring wells, field personnel will collect frequent water level measurements in the eight new monitoring wells during the first day of system startup, during which time the system will be turned on and off several times in different well configurations and for various durations. Mounding and dissolved oxygen data from these locations at varying distances from active AS wells will aid in determining the duration of the transient mounding period, and, ultimately, the optimum cycle configuration and pulse frequency and duration.

Following the first day of system startup and collection, the AS system will be operated continuously for a period of two to four months to allow the effects of treatment to manifest in downgradient monitoring wells, and to provide sufficient time to interpret startup data .

5.2 SVE SYSTEM STARTUP

Procedures for startup of the SVE system generally follow those proposed in the Addendum No. 1 to Final Task F Stage I – Part 2 Pilot Test Work Plan for VOC-Containing Alluvial Aquifer Groundwater (Kennedy/Jenks Consultants, 2009), and as reported in the Revised Task F Stage I – Part 2 SVE Report (Kennedy/Jenks Consultants, 2011b).

5.2.1 SVE Startup Monitoring Equipment

The following equipment will be used to conduct the pilot test:

- Magnehelic gauges for measuring vacuum/pressures within the system and at the observation points (assess vacuum response).
- Hot wire anemometer for measuring soil vapor flow rates within the system and temperature of the inlet soil gas.
- Photoionization detector (PID) for measuring VOC concentrations within the system.
- Vacuum air pump and Tedlar bags for collection of soil vapor samples from the blower inlet and field samples of air effluent from selected locations.
- Multichannel gas analyzer for measuring oxygen gas and carbon dioxide concentrations at the SVE well and observation points.
- Barometer for monitoring atmospheric pressure.

Vacuum and flow measurements performed within the system include: (a) inlet, (b) outlet of moisture separator, (c) inlet to lead carbon vessel; (d) between lead and lag carbon vessels, and (e) inlet to the blower. Pressure and temperature recorded from blower discharge pressure and temperature gauges.

5.2.2 SVE Startup Monitoring Procedures

The startup phase of the pilot test will include two performance test methods (step and constant rate).

- Stepped rate test for estimating vent capacities and system curves (i.e., plots of air flow yield versus applied vacuum at the wellhead).

- Constant-rate test for evaluating areas of vacuum influence, efficiencies (head loss between the vent and subsurface soil), etc.

A stepped-rate test is conducted first to determine the actual capacity of the SVE well and to select a flow rate for conducting the constant-rate test. A constant-rate performance test is conducted after the stepped-rate test to determine the actual area of vacuum influence and efficiency of the SVE well. Constant-rate performance tests are usually conducted under steady-state conditions in which subsurface vacuums have stabilized.

Stepped-Rate Test Procedures: In general, a stepped-rate test consists of applying various vacuums on a SVE well and measuring the vapor flow rate for each step. A typical test usually takes approximately four to eight hours per SVE well to complete. The stepped-rate test will proceed using the following steps:

1) Connect the intake line from the SVE equipment to the SVE well.
2) Open dilution valve completely. Turn on the blower to extract soil vapor and measure and/or record the following:
    a. Time.
    b. Flow rate from the SVE well (should be zero).
    c. Flow rate from the dilution line (should be 100 percent blower capacity).
    d. Vacuum at the SVE well (should be approximately zero).
3) Increase the vacuum at the SVE well in a series of equal time/vacuum steps by closing the dilution valve. Each time step will be long enough to allow steady state to be reached (at least 10 minutes) and the dilution valve will be adjusted to maintain a fairly constant (±10 percent) vacuum and flow rate. The vacuum in the SVE well will be increased in approximately five equal increments based on the blower capacity.
4) At the end of each step, measure and/or record:
    a. Time.
    b. Inlet temperature.
    c. Vacuum at the SVE well, vapor monitoring points, and within the system.
    d. Pressure and temperature at blower discharge.
    e. Flow rates from the SVE well and dilution line.
    f. Organic vapor concentrations in the SVE well, between lead and lag GAC vessels, and blower discharge using a PID.
    g. Oxygen and carbon dioxide concentrations in extracted soil gas.
    h. Barometric pressure and ambient temperature.

Soil gas samples will be collected from the blower inlet using Tedlar bags and tested with the PID. Additional samples can be collected and submitted for VOC analyses using Environmental Protection Agency (EPA) Method 8260B (Tedlar bag) or TO-15 (Summa canister) to calibrate the field results.

5) Develop the system curve by plotting applied vacuum versus the resulting air flow rates and determine the optimal flow rate for conducting the constant-rate test. Develop the ROI map by plotting the vacuum response at each observation point in plan and cross-section view to assess

the extent and shape of the area of vacuum influence induced by the SVE well at each vacuum step.

To calculate the ROI, the log of the vacuum is plotted versus distance; vacuum influence is considered present at an induced vacuum level of 0.1 inches water column or greater.

Constant-Rate Test Procedures: Constant-rate tests are performed using the highest flow rate obtainable as determined by a stepped-rate test, and the resulting subsurface vacuums as measured at several observation points distributed at increasing distance from the SVE well. Using these vacuums influence measurements around the SVE well, a vacuum distribution can be developed. A typical test usually takes four to eight hours per SVE well to complete. The constant-rate test will proceed using the following steps:

1) Connect the intake line from the SVE equipment to the SVE well.
2) Turn on the blower configured to extract soil vapor and close the dilution valve until the desired vacuum/flow rate is achieved.
3) Begin to measure and record the vacuum at each observation point, beginning with the observation point closest to the SVE well. Begin by measuring the vacuum response at each observation point at 10 to 15 minute intervals until the vacuum readings begin to level off.
4) Once vacuums at the observation points have stabilized within ±10 percent for 30 minutes, measure and/or record:
    a. Time.
    b. Inlet temperature.
    c. Vacuum at the SVE well, observation points, and within the system.
    d. Pressure and temperature at blower discharge.
    e. Flow rates from the SVE well and dilution line.
    f. Organic vapor concentrations in the SVE well, between lead and lag GAC vessels, and blower discharge using a PID.
    g. Oxygen and carbon dioxide concentrations in extracted soil gas.
    h. Barometric pressure and ambient temperature.

Soil gas samples would be collected from the blower inlet using Tedlar bags and tested with the PID. Additional samples can be collected and submitted for VOC analyses using U.S. Environmental Protection Agency (EPA) Method 8260B (Tedlar bag) or TO-15 (Summa canister) to calibrate the field results. The soil gas samples would be collected at the start and conclusion of the constant rate test.

5) Develop the ROI map by plotting the vacuum response at each observation point in plan and cross-section view to assess the extent and shape of the area of vacuum influence induced by the SVE well, as well as the pneumatic losses attributable to the SVE well itself.

If ROI data indicate insufficient coverage across the sparge curtain, additional SVE wells will be installed and/or the total flow rate will be increased, as necessary.

6.0 LONG TERM PERFORMANCE MONITORING

Long term groundwater and SVE system monitoring results will provide information to assess the effectiveness of AS/SVE technology in reducing alluvial aquifer CVOC concentrations. Data and information to obtain will include the following:

- SVE system mass removal data including flow rates and PCE concentrations in soil gas captured from each well and by the SVE system as a whole; and
- Water quality data including the upgradient and downgradient dissolved CVOC concentrations.

6.1 LONG TERM SOIL GAS MONITORING

Soil gas and SVE system monitoring will be conducted to assess the effective capture zone and mass removal rate of the SVE system, as well as longer-term concentration trends of CVOCs in the vadose zone. The SVE monitoring schedule is as follows:

- Baseline samples will be collected prior to system startup from the five newly installed vapor monitoring points as well as from existing monitoring point SGP-6.
- Routine SVE monitoring.

Baseline monitoring will include vacuum measurements and soil gas samples collected in Tedlar bags for PID screening and/or laboratory analysis. Routine SVE monitoring will consist of vacuum measurements and sample collection for field screening and/or laboratory analysis at soil vapor monitoring points, as well as vacuum measurements, flow rate measurements, and sample collection for field screening and/or laboratory analysis from SVE system components including each SVE well header, and the main SVE manifold.

Samples will be collected from the pre-, mid-, and discharge stream from GAC filters weekly for the first month, and monthly thereafter (or in accordance with any more stringent permit requirements) and submitted to Energy Laboratories in Helena, Montana for CVOC analysis using EPA Method TO-17. Effluent concentration limits for benzene, ethylbenzene, PCE, and TCE will match the Final Task I indoor air cleanup levels DEQ, 2012). Limits for any additional VOCs detected in the discharge stream will follow current EPA Regional Screening Levels for residential air.

6.2 LONG TERM GROUNDWATER MONITORING

The most important performance indicator will be the measured CVOC concentration trends in the alluvial aquifer between upgradient and downgradient wells. Therefore, routine groundwater monitoring will be conducted on the eight newly constructed alluvial aquifer wells as well as existing alluvial aquifer wells 14-5, LB-2, 89-7, L-88-12, 12-7, and 12-8. The proposed monitoring schedule for the first year of operation is as follows:

- Baseline monitoring prior to startup;
- Monthly for 6 months after startup; and
- Quarterly after first six months of operation for two events.

WET personnel will coordinate monitoring events with BNSF and share data from wells currently undergoing routine monitoring when timing allows. Groundwater data collected by BNSF from further downgradient wells will be utilized as needed to assess spatial changes in the dissolved CVOC plume.

Groundwater monitoring will generally be conducted using low-flow purge and sample procedures presented in SOG-8 (Appendix A of the Facility-Wide SAP). During purging, water quality parameters (temperature, pH, specific conductivity, oxidation-reduction potential, and dissolved oxygen) will be measured. Groundwater samples will be collected in laboratory supplied containers and submitted to Energy Laboratories in Helena or Billings, Montana for analysis of VOCs using EPA Method 8260. Well purging and sampling information will be recorded in field notebooks and groundwater sample information forms.

6.2.1 Quality Assurance/Quality Control (QA/QC) Sample Collection

Field and laboratory QA/QC samples will be collected using the procedures and at the frequencies identified in Section B2.5 of the Facility-Wide QAPP (Appendix B of the Facility-Wide SAP). QA/QC samples will be analyzed for the same constituents as the natural samples.

6.2.2 Sample Labeling

Sample identifiers will correspond to the well or vapor monitoring point identifier. VMP sample identifiers will also include the depth from which the sample was collected (i.e., 5, 10, or 15 feet). QA/QC samples will be labeled according to Section B2.3.3 of the Facility-Wide QAPP.

6.2.3 Chain-of-Custody Procedures

The chain-of-custody procedures presented in Section B2.3.2 of the Facility-Wide QAPP will be followed.

6.2.4 Sample Shipping and Handling

The sample shipping and handling procedures discussed in Section B2.3.4 of the Facility-Wide QAPP and SOG-3 (Appendix A of the Facility-Wide SAP) will be followed.

7.0 HEALTH AND SAFETY PLAN (HASP)

A task-specific HASP for the construction, startup, and operation of the AS/SVE system was prepared in accordance with applicable health and safety regulations. The task-specific HASP is provided in Appendix B and is designed for use in conjunction with the Facility-Wide Health and Safety Plan (Revision No. 3) (Kennedy Jenks Consultants, 2008). The task-specific HASP will be finalized and signed after this Work Plan is approved.

8.0 PERMITS

The City of Livingston requires permits to construct groundwater monitoring wells; these permits will be obtained prior to well construction activities. A permit may also be required for installation of electrical service to the temporary operation shed.

An Underground Injection Control (UIC) permit for the AS system will be acquired from EPA Region 8, if required.

9.0 INVESTIGATION– DERIVED WASTE (IDW) MANAGEMENT

The IDWs that will be generated during implementation of the pilot test are listed below:

- IDWs generated during soil boring and soil sampling activities include soil cuttings, decontamination water, and non-indigenous IDW.
- IDW generated during monitoring well construction and groundwater sampling activities include well development water, decontamination water, purge water, and non-indigenous IDW.

Since the pilot test is being conducted in an area containing F-listed constituents, construction/development water, purge water, soil cuttings, and decontamination water generated during field activities are expected to contain F-listed constituents. Therefore, these IDW will be contained in a secured area as described in Section 8.0 of the Facility-Wide SAP and associated Addenda and be managed as hazardous wastes, unless determined otherwise through analytical testing and DEQ "no-longer contained-in" determinations.

Non-indigenous IDW will be handled as a non-hazardous waste in accordance with Section 8.4.3 of the Facility-Wide SAP and associated Addenda unless the materials are saturated with solvent-containing groundwater or solvent-containing decontamination water, or materials are coated with solvent-containing soil or residue that cannot be removed. In that case, the non-indigenous IDW will be managed as hazardous waste in accordance with Section 8.4 of the Facility-Wide SAP.

10.0 SCHEDULE

WET will begin implementing this Work Plan within 30 days following DEQ approval, pending subcontractor availability. The work will also be coordinated with the proposed scope for the Bedrock Hydraulic Testing Work Plan (Kennedy/Jenks Consultants, 2015), so as to optimize the use of field staff and subcontractors. A detailed schedule of activities will be provided to DEQ at least 10 days prior to initiating field work.

11.0 DELIVERABLES

Laboratory data collected during the field investigation will be made available to the DEQ within 5 days of receipt from the laboratory. Water level monitoring data collected during system startup will be summarized in a technical memorandum and provided to DEQ after the first two months of operation to begin discussions of potential cycling configurations.

Within seven months of system startup, performance monitoring data for the first six months of operation will be compiled and summarized in a preliminary operation technical memorandum, which will include a summary of field activities and an evaluation of the system operational data. Following operation of the pilot test for one year, an Air Sparge/Soil Vapor Extraction Pilot Test Report (Report) will be prepared. The Report will be submitted within 14 months of system startup and will include the relevant components of a Supplemental Investigation Report, which are outlined in Section 5.1.5 of the Statement of Work for spring 2005 Activities.

12.0 DATA VALIDATION AND MANAGEMENT

Both field and laboratory data generated during the implementation of the Pilot Test will be managed as described in Section B2.10 of the Facility-Wide QAPP. Performance data generated during system startup and optimization will be reviewed, verified, and validated as necessary, and all groundwater and soil gas analytical data will be validated as outlined in Section B4.0 of the Facility-Wide QAPP.

13.0 ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLs)

ERCLs developed by DEQ for the Facility are included in Appendix A of the Record of Decision (DEQ, 2001). An evaluation of how the activities conducted during this pilot test will comply with ERCLs is included in Appendix C of this Work Plan. Activities identified in this Work Plan comply with ERCLs.

14.0 REFERENCES

DEQ, 2001. Record of Decision, Burlington Northern Livingston Shop Complex, Montana Department of Environmental Quality, Remediation Division, September 2001.

DEQ, 2012. Final Task I Risk Assessment Amendment Number 2, Burlington Northern Livingston Shop Complex, Montana Department of Environmental Quality, Remediation Division, August 2012.

Kennedy/Jenks Consultants, 2006. Final Facility-Wide Sampling and Analysis Plan, Burlington Northern Livingston Shop Complex, Livingston, Montana, Kennedy/Jenks Consultants, March 2006.

Kennedy/Jenks Consultants, 2009. Addendum No. 1 to Final Task F Stage I – Part 2 Pilot Test Work Plan for Volatile Organic Compound-Containing Alluvial Aquifer Groundwater, Burlington Northern Livingston Shop Complex, Kennedy/Jenks Consultants, November 2009.

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Kennedy/Jenks Consultants, 2011a. 2nd Revised Bioventing Extraction/Injection Design Study Report, Burlington Northern Livingston Shop Complex, Kennedy/Jenks Consultants, July 2011

Kennedy/Jenks Consultants, 2011b. Revised Task F Stage I – Part 2: Soil Vapor Extraction (SVE) Report, Burlington Northern Livingston Shop Complex, Kennedy/Jenks Consultants, June 2011.

Kennedy/Jenks Consultants, 2015. Bedrock Hydraulic Testing Work Plan, Burlington Northern Livingston Shop Complex, Kennedy/Jenks Consultants, August 2015.

NFESC, 2001. Final Air Sparging Guidance Document, Naval Facilities Engineering Command, Technical Report TR-2193-ENV, August 2001.

USACE, 2013. In-Situ Air Sparging, United States Army Corps of Engineers, EM 200-1-19, December 2013.

USEPA, 2015. Regional Screening Levels, Screening Levels for Chemical Contaminants. United States Environmental Protection Agency, June 2015.

FIGURES

Cinder Pile

Former Church Universal & Triumphant Building

Locomotive Shop

Warehouse

Boiler House

Car Shop

Wastewater Treatment Plant (WWTP)

Truck & Paint Shops

Turntable

Electrical Shop

Oil Reclamation Plant

Wheel Shop

MRL Shops

N

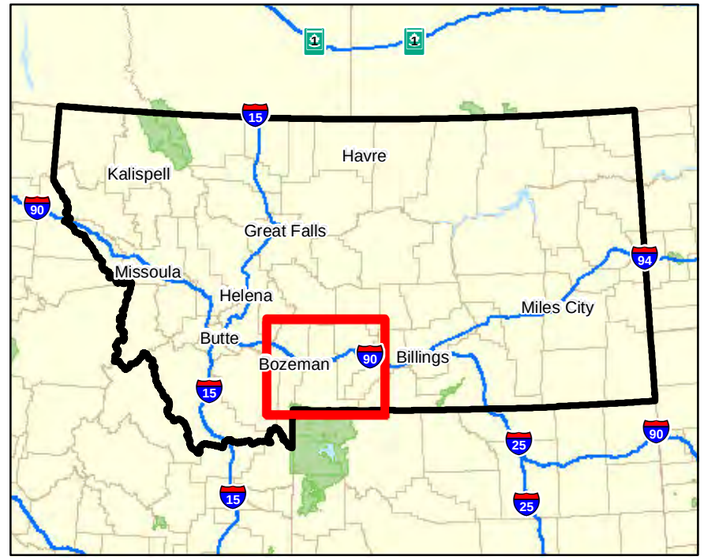
W

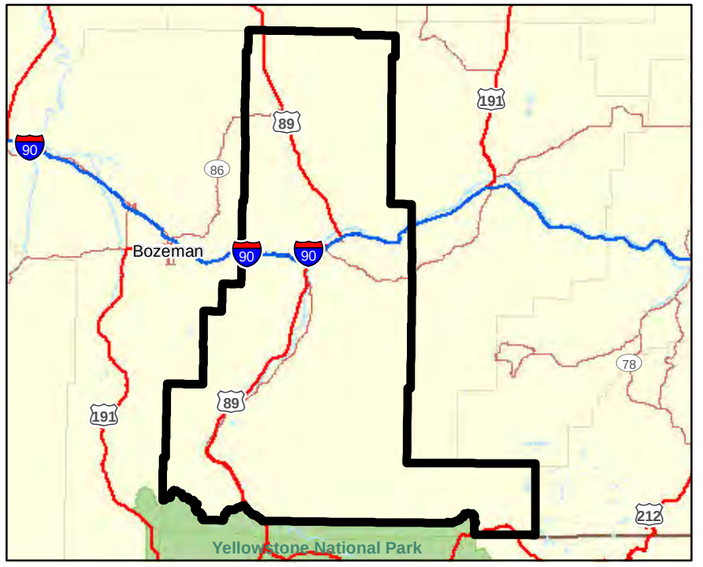
E

S

Feet

0 200 400 800 1,200 1,600





WATER & ENVIRONMENTAL TECHNOLOGIES, PC

SITE LOCATION

Burlington Northern Livingston Shop Complex

Job#: LRGM01 Task 8

Date: 8/3/2015

FIGURE 1

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Legend

- Proposed Alluvial Monitoring Well
- Proposed Nested Alluvial Well Pair
- Proposed Vapor Monitoring Point
- Alluvial Monitoring Well
- Soil Gas Probe
- Vapor Monitoring Point
- Proposed AS Well
- Proposed SVE Well
- Groundwater Flow Direction
- PCE Iso-concentration Contours, Winter/Spring 2015
- Air Sparge Treatment Zone
- SVE Capture Zone (Assume 100' ROI)

W N S E

Feet
0 150 300

Water & Environmental TECHNOLOGIES

PROPOSED AS/SVE SYSTEM AND MONITORING NETWORK LAYOUT

BN Livingston Shop Complex

Job#: LRGM01 Task 3

Date: 9/1/2015

FIGURE 2

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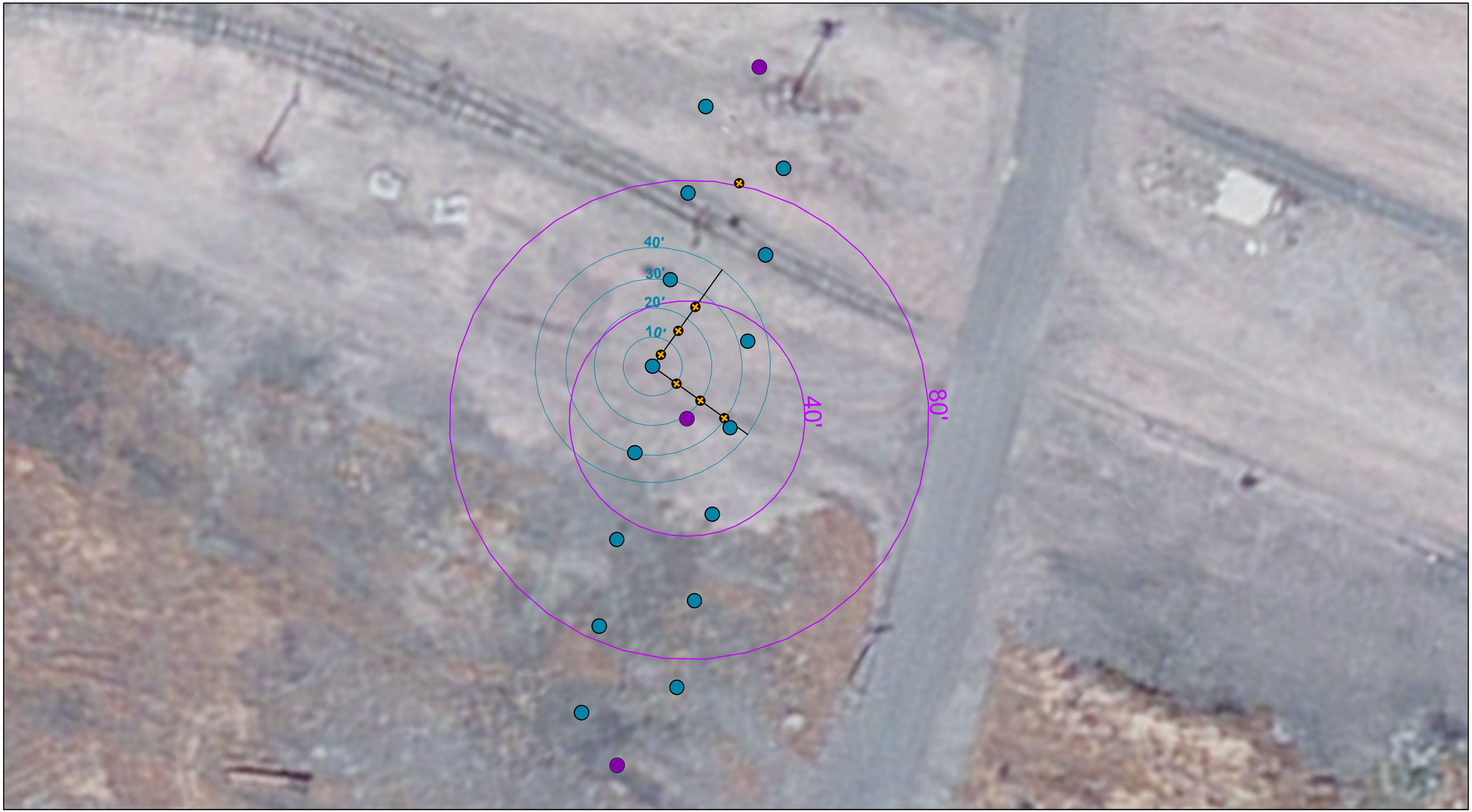


Legend

- Proposed AS Well
- Proposed SVE Well
- Proposed Vapor Monitoring Point
- Converted_Graphics
- Sparge Test Monitoring Point Radii
- SVE Step Test Monitoring Point Radii

Note: Single-well sparge test will be conducted prior to installation of remaining injection wells shown.

SVE step test will be conducted after full scale construction is completed to measure extraction influence under actual operating conditions.

Feet

0 15 30 60

Water & Environmental TECHNOLOGIES

SINGLE WELL INJECTION TEST AND SVE STEP TEST LAYOUT

BN Livingston Shop Complex

Job#: LRGM01 Task 3

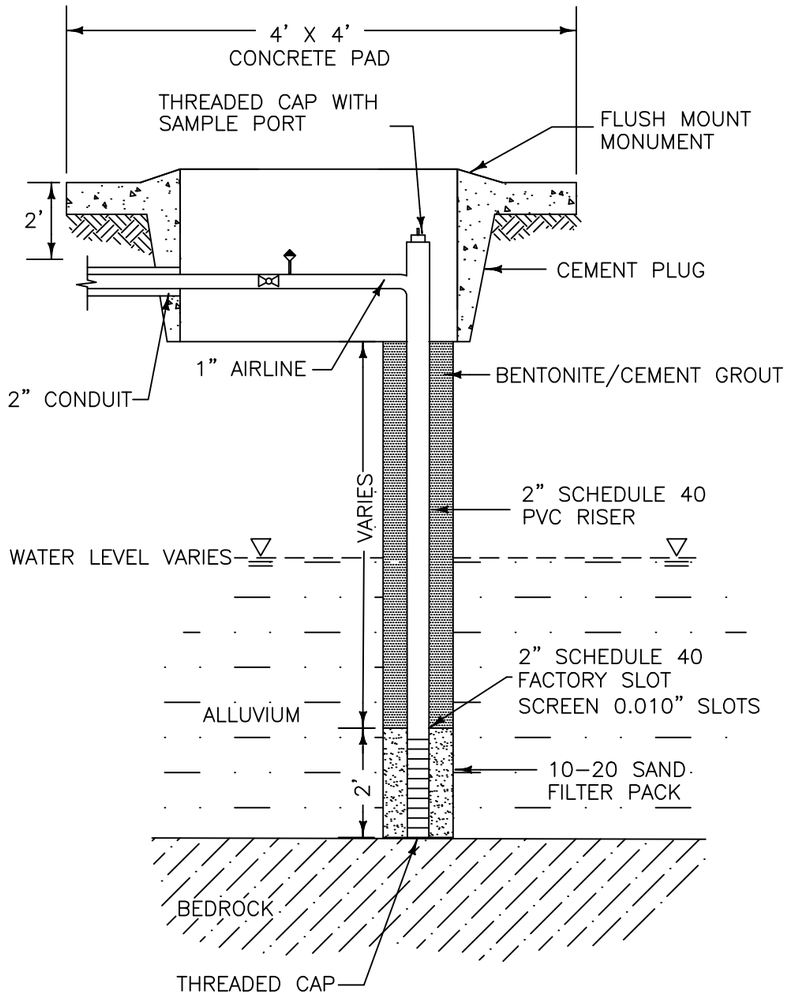
Date: 9/25/2015

FIGURE 3

Path: M:\LRGM01\Task8\Fig3_WorkPlan_FINAL.mxd, Author: jleprowse

1 AIR SPARGING WELL

Scale: NTS

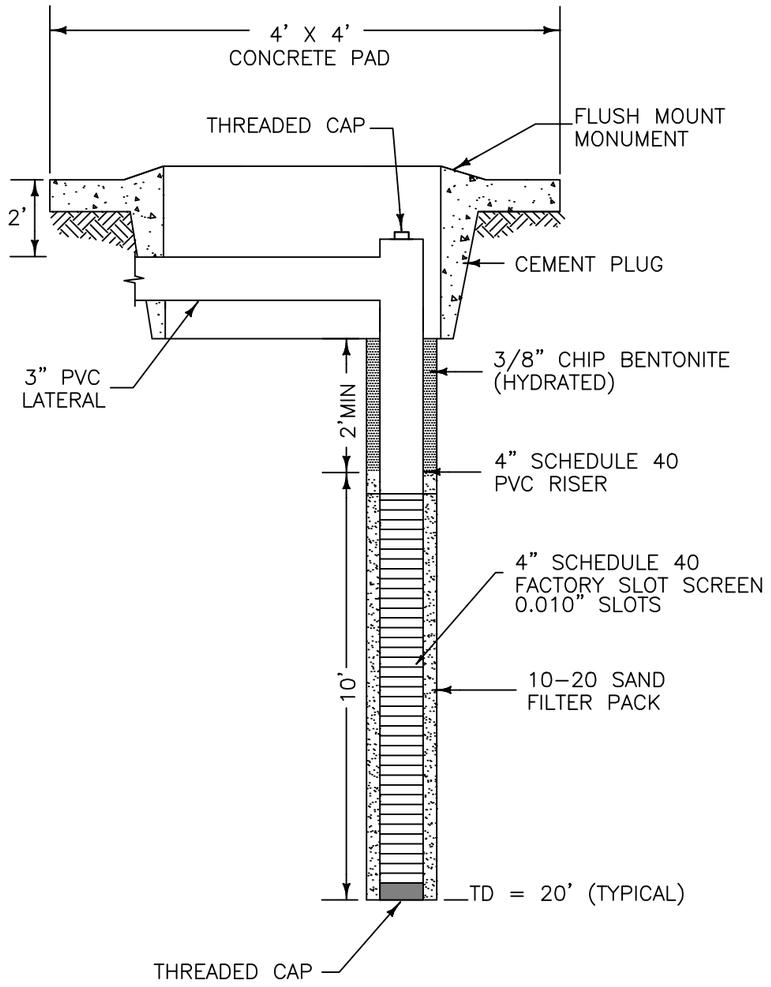


LEGEND

- FLOW DIRECTION
- VALVE
- SAMPLING PORT
- FLOW METER
- PRESSURE GAUGE
- TEMPERATURE GAUGE
- COMPRESSION FITTING

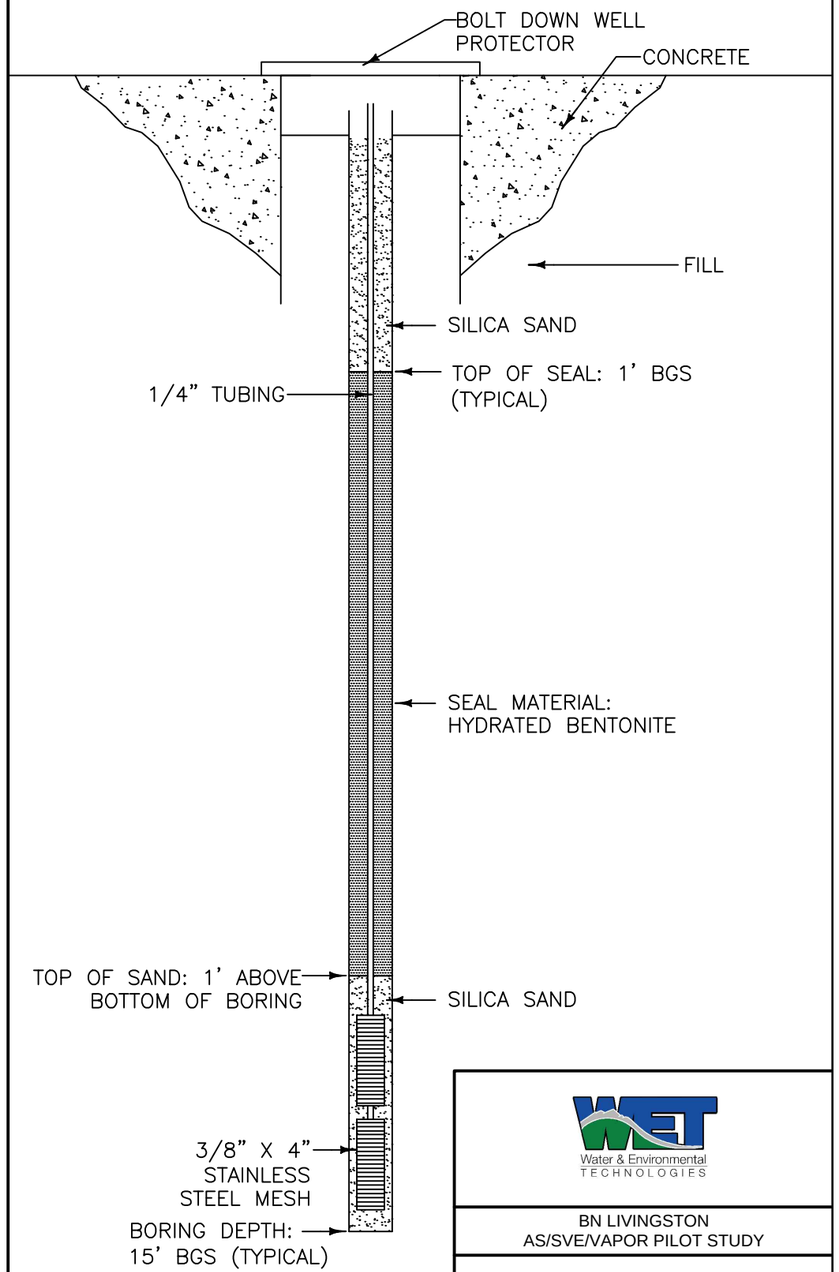
2 SOIL VAPOR EXTRACTION WELL

Scale: NTS



3 VAPOR MONITORING POINT

Scale: NTS



Water & Environmental TECHNOLOGIES

BN LIVINGSTON
AS/SVE/VAPOR PILOT STUDY

AS/SVE/VAPOR
TYPICAL WELL DETAILS

LRGM01-T8

DATE: 8/27/15

FIGURE 4

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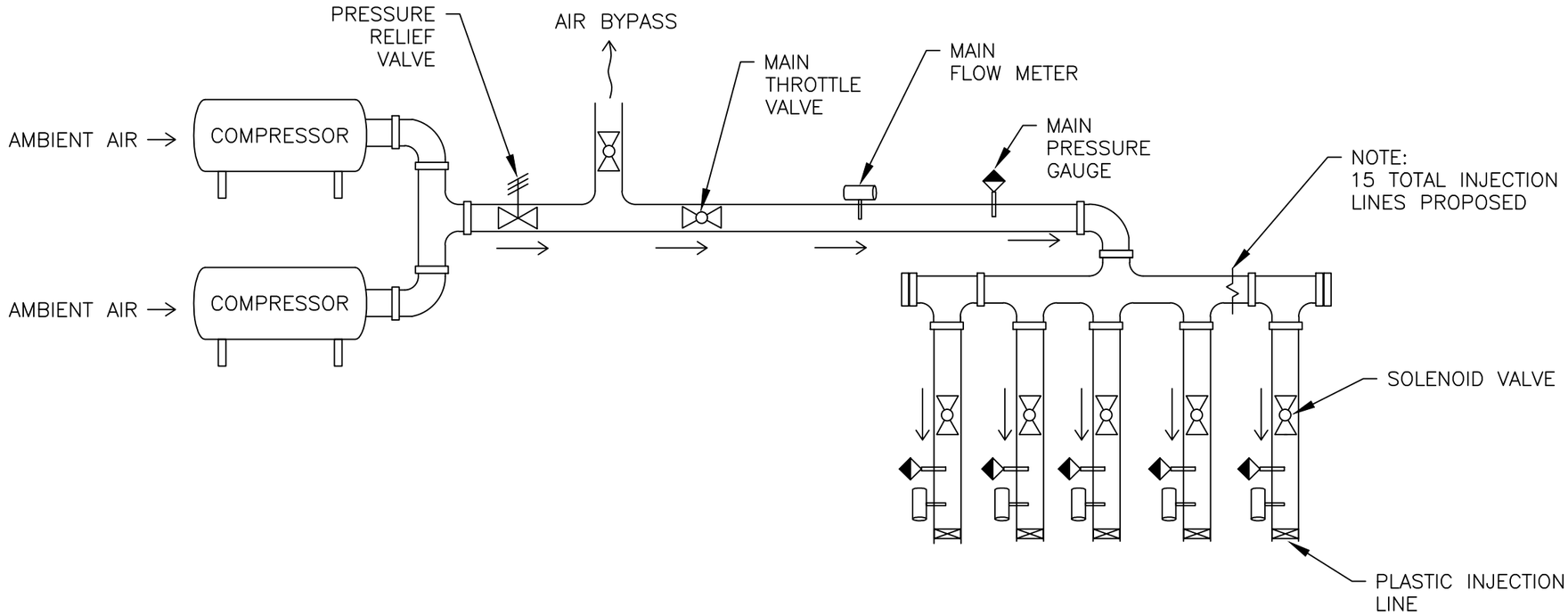
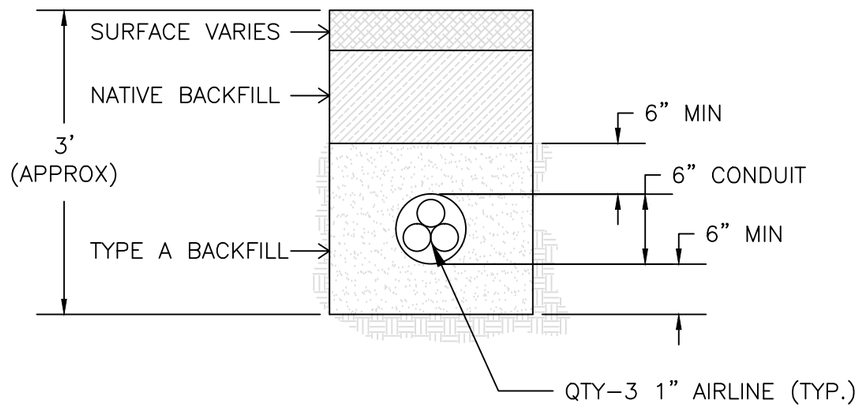


LEGEND

- FLOW DIRECTION
- PRESSURE RELIEF VALVE
- VALVE
- SAMPLING PORT
- FLOW METER
- PRESSURE GAUGE
- TEMPERATURE GAUGE
- COMPRESSION FITTING



Water & Environmental TECHNOLOGIES

BN LIVINGSTON
AS/SVE PILOT STUDY

PROCESS DETAIL
AIR SPARGING SYSTEM

LRGM01-T8

DATE: 8/27/15

FIGURE 5

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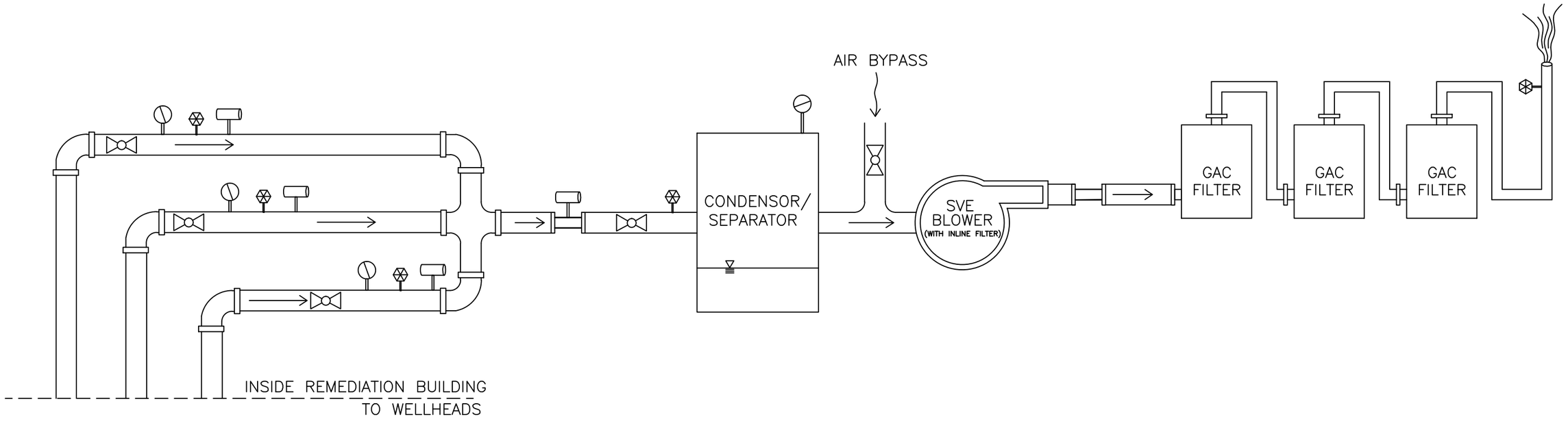

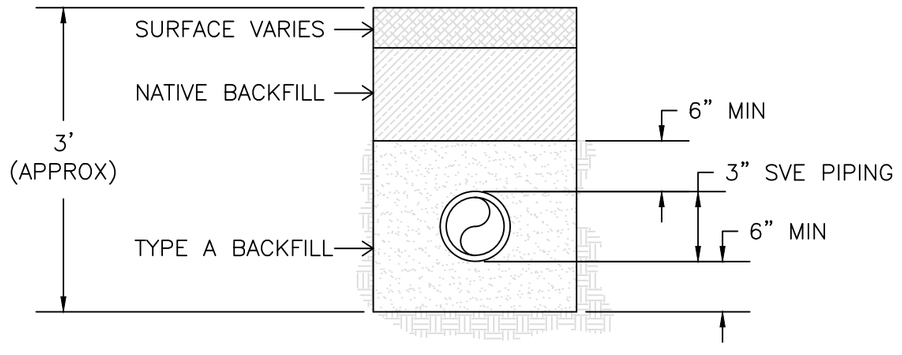

LEGEND

- FLOW DIRECTION
- VALVE
- SAMPLING PORT
- FLOW METER
- VACUUM GAUGE
- TEMPERATURE GAUGE

NOTE:
TRENCH AND PIPING AT APPROXIMATELY 1% SLOPE TOWARD WELL HEAD.

Water & Environmental TECHNOLOGIES

BN LIVINGSTON
AS/SVE PILOT STUDY

PROCESS DETAIL
SOIL VAPOR EXTRACTION SYSTEM

LRGM01-T8
DATE: 8/27/15

FIGURE 6

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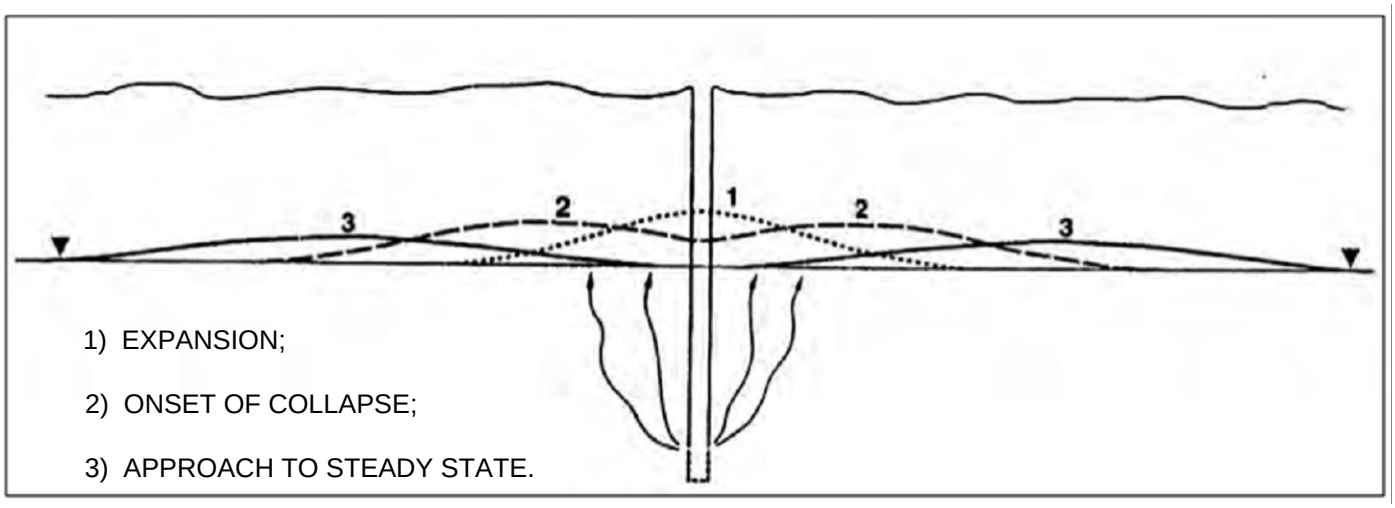


SOURCE: USACE, 2013

Water & Environmental TECHNOLOGIES

BN LIVINGSTON
AS/SVE PILOT STUDY

MOUNDING
AFTER AS SYSTEM STARTUP

LRGM01-T8

DATE: 8/28/15

FIGURE 7

Appendix A

Air Injection Pressure Calculations

AIR INJECTION PRESSURE CALCULATIONS

Hydrostatic Pressure

The hydrostatic pressure is that required to displace the water column in the injection well from its static level to the uppermost injection point, the top of the well screen. At typical values of water temperature and density, 14.7 pounds per square inch (psi) = 33.8 feet water (ft H2O), and, therefore, a hydrostatic pressure of 0.43 psi is required per foot of water column. The resulting injection pressure required to displace the column of water standing in the well pipe is calculated using the equation below:

$$Ph = 0.43 (zs - zw)$$

$$= 0.43(9 \text{ to } 16)$$

$$= 4 \text{ to } 7 \text{ psig}$$

where

Ph = hydrostatic pressure (psi gauge [psig])
zw = depth to groundwater (assumed 18-20 feet)
zs = depth to top of air sparge (AS) well screen (assumed 29-34 feet).

Friction Loss in Pipe

The head loss due to friction of air moving between the compressor and the well head is estimated to be approximately 0.002 psi per linear foot of injection line (with the assumed flow rate of 12 standard cubic feet per minute (scfm) and approximately one-inch inside-diameter, straight plastic pipe). The resulting friction loss for a 500-foot length of straight pipe is 1 psi, assuming additional minor losses from fittings and valves. For design purposes, the friction loss in each airline is assumed to be 1 psi.

It should be noted that pressure measurements will be collected both from well headers in the system enclosure building (i.e., manifold) and at wellheads; therefore, actual friction loss from lateral piping can be measured and injection pressure can be adjusted accordingly. The only component of friction loss that will not be directly measured is from the wellhead to the top of the well screen. U.S. Army Corps of Engineers (USACE) guidance states that these losses may be neglected for applications of AS under the following conditions:

- sparge well diameter > 2 inches,
- well pipe length < 100 feet, and
- airflow rate < 15 scfm.

Filter Pack Air-Entry Pressure

The air-entry pressure of the filter pack between the well screen and the formation is often less than 0.14 psi for uniform sands commonly used as filter pack (USACE, 2013). Therefore, it is assumed that once there is sufficient applied pressure to overcome the hydrostatic pressure in the well, air readily displaces

water from the filter pack. For use in calculating minimum required injection pressure, the filter pack air entry pressure is assumed to be 0.14 psi.

Formation Air-Entry Pressure

The fourth component of the injection pressure is the air-entry pressure of the formation. USACE guidance reports negligible air entry pressure for coarse sands (< 0.044 psi), up to 0.44 psi for fine to medium sand (USACE, 2013). It is assumed that the AS wells will be completed in coarse grained alluvium; however, to ensure sufficient compressor capacity, the formation air entry pressure will be assumed to be up to 0.5 psi.

Resulting Minimum Injection Pressure

The sum of the above calculated components of injection pressure is as follows:

$$\textit{Minimum injection pressure} = P_{hydrostatic} + P_{friction\ loss} + P_{filter\ pack} + P_{formation}$$

$$= 4 \text{ to } 7 \text{ psi} + 1 \text{ psi} + 0.14 \text{ psi} + 0.5 \text{ psi}$$

Minimum injection pressure = 6 to 9 psi

The actual minimum injection pressure will be calculated after installation of each AS well and operating pressures will be adjusted accordingly.

Overburden Pressure

The maximum injection pressure should not exceed the overburden pressure, or fracture pressure, of the formation. The overburden pressure was calculated using equations from USACE guidance as follows:

$$P_{soil\ column} = (\text{depth to top of well screen})\ (\text{s.g. of soil particle})\ (1 - \varphi)\ (62.4 \text{ lbs/ft3})$$

$$P_{water\ column} = (\text{depth to top of well screen} - \text{depth to water table})\ (\text{s.g.water})\ (\varphi)\ (62.4 \text{ lbs/ft3})$$

$$\textit{Total overburden pressure} = P_{soil\ column} + P_{water\ column}$$

Assumptions:

- Soil particle specific gravity of 2.7,
- Weight of water is 62.4 pounds per cubic feet (lbs/ft3)
- Conservative (low) water table depth at 22 feet,
- Conservative (shallow) top of AS well screen at 28 feet,
- Conservative porosity of 50 percent or 0.5, and
- A safety factor of 70 percent of total overburden pressure is used.

Therefore:

$$P_{soil\ column} = 28 \text{ ft} * 2.7 * (1 - 0.5) * 62.4 \text{ lbs/ft3} = 2{,}359 \text{ pounds per ft2}$$

*$P_{water\ column}$ = (28-22) ft * 0.5 * 62.4 lbs/ft3 = 187 pounds per ft2*

Total overburden pressure = 2,546 lbs/ft2 = 17.7 psig at 28 feet.

Maximum injection pressure = 17.7 psig (0.7) = 12.4 psig

The estimated required injection pressure (6 to 9 psi) is less than the calculated maximum injection pressure using conservative assumptions.

Appendix B

HASP

Air Sparge/Soil Vapor Extraction Pilot Test System – HEALTH AND SAFETY PLAN

Date Approved by Safety Supervisor:

Task Site Safety Officer: Patrick Thomson Phone: 406-782-5220

Task Field Site Safety Officer: Steve Nicholls/Patrick Thomson Phone: 406-490-0329 (cell)

Task Description:
The AS/SVE Pilot Test System installation addresses technical feasibility of removing chlorinated volatile organic compounds (CVOCs) in groundwater downgradient of the shop complex source zone sediments.

The Task involves advancing borings using conventional drilling techniques and completing borings as air sparge (AS), soil vapor extraction (SVE), groundwater monitoring, and soil vapor wells. In addition soil, groundwater, and soil gas samples will be collected from the borings for characterization of CVOCs in soils, groundwater, and soil gas.

Additional health and safety procedures are explained herein. Field work performed during the Task will adhere to safety protocols specified in the *Facility-Wide Health and Safety Plan (Revision No. 3)* (HASP) dated May 2008.

Task-specific health and safety protocols, and additional health and safety protocols and/or deviations from the *Facility-Wide Health and Safety Plan (Revision No. 3)*, if applicable, are outlined in this task-specific HASP.

Summary Information

Activity	Approx. Start Date	Approx. Duration (Days)	Field Personnel	CPR	First Aid
Oversee advance of soil bores and AS/SVE well/system install	TBD	1 week	Patrick Thomson Steve Nichols John Babcock Mike Shirley	X X X	X X X
Overseeing advance of soil bores and completion of groundwater monitoring well.	TBD	1 days	Patrick Thomson Steve Nichols John Babcock Mike Shirley	X X X	X X X

HAZWOPER and BNSF Safety Training:

___No _x_Yes Field personnel 40-hour and 8-hour HAZWOPER trained.

Field personnel to wear a photographic identification badge and carry proof of current BNSF training when working at the Livingston railyard.

Applicable Sampling and Analysis Plan (SAP) and Standard Operating Guidelines (SOGs):

1. *Final Facility-Wide Sampling and Analysis Plan*

2. SOG-1, -2, -3, -4A, -4B, -5, -7, -8, -12, -13, -14, -15, -16 (Appendix A of *Final Facility-Wide Sampling and Analysis Plan*)

3. Task-specific SAP in *Task F Stage 1 – Part 2 Pilot Test Work Plan for VOC-Containing Alluvial Aquifer Groundwater*, Section 6.0.

Study Area:

The work area includes the area east of the shop complex, north of the waste water treatment plant.

Locations of new wells to be constructed and sampled are shown on Figure 2

Task involves work within 25 feet of track:

___No _X_Yes If yes, describe means of work clearance and track control:

If work is to be performed within 25 feet of track, Montana Rail Link (MRL) will be notified that a flagger will need to be present at the work area. The flagger will oversee worker safety at the work area.

Health and Safety Risks: Potential exposure to VOCs in soils and groundwater during drilling (boring advancement) and sampling procedures. Also, potential exposure to VOCs in air during system operation monitoring and sampling. Use caution for potential presence of black widow spiders in wellhead enclosures.

Physical Hazards:

Hazards associated with operating a drilling rig (noise, dust, overhead equipment falling, high-pressure pneumatic lines), underground utilities, equipment hauling, traffic control, and slip and trip. Potential electric hazards associated with operating SVE system.

Potential Chemical Hazards:

Chemicals of Concern	**TWA-PEL/TLV in parts per million (ppm)**
Tetrachloroethene	100 ppm / 25 ppm
Trichloroethene	100 ppm / 25 ppm
Cis-1,2-Dichloroethene	200 ppm / 25 ppm
Vinyl chloride	1 ppm / 1 ppm
Chlorobenzene	75 ppm / 75 ppm
1,4-Dichlorobenzene	75 ppm / 10 ppm

Personal Protective Equipment (PPE):

_**X**_Initial–Level D: Hard hat, boots (steel-toe and shank), safety glasses (with side shields), orange-reflective vest, and hearing protection as needed when at Livingston railyard and during investigation activities.

List additional equipment (e.g., boot covers, Tyvek® coveralls, etc.): Coveralls and latex/chemical resistant gloves, as necessary.

___Upgrade-Level C: All of above plus half-face respirator with _____ cartridges

Personal Protective Equipment (PPE) continued: Other: (describe): Wear chemical resistant overalls, nitrile gloves. Provide an eye wash kit with two bottles, 1-liter each of buffered eyewash solution at chemical feed/mixing tank area.

Safety Measures and Monitoring:

Follow *Facility-Wide Health and Safety Plan (Revision No. 3)* guidance. Do not enter any areas not intended for normal occupancy (e.g., confined spaces).

Criteria for upgrading PPE *(list threshold values in breathing zones, or other triggers for upgrading PPE)*: Withdraw from area and re-assess PPE requirements if there are noticeable odors in work area or if routine air monitoring indicates elevated VOC concentrations.

Work Zones:

Work zones will be established during construction of groundwater monitoring wells and advancement of soil boring. No special work zones will be established around the wellhead for groundwater sampling. All field personnel (including subcontractors) must check in/check out with site safety officer (SSO) or field site safety officer (FSSO) on a daily basis.

Coordinate with MRL regarding work in close proximity to rail lines. Acquire adequate rail lock out and flag personnel as required.

Other Work Requirements:

Work only in areas with proper illumination or bring sufficient lighting to assess area for hazards.

Community Protection Measures:

Activities associated with drilling/well installation will be conducted on the railroad property. Therefore, no community protection measures are warranted. If necessary, access to the area will be cordoned off with flagging and/or fences/barricades. Assure that field activities do not present a hazard to traffic movement.

Task-Specific Training or Medical Surveillance Requirements:

Task-Specific Hazardous Materials: Chlorinated volatile organic compounds present and adhered to vadose zone and saturated zone sediments, and dissolved in groundwater.

Task-Specific Decontamination Procedures:

If accidentally exposed to chemicals, flush skin with water for 5 minutes. If chemicals get in eyes, flush with eyewash, then water, and seek medical attention.

Task-Specific Contact Telephone Numbers:

1. Patrick Thomson (406) 782-5220

2. See *Facility-Wide Health and Safety Plan (Revision No. 3)* (Table 3) for additional emergency contact information

Task-Specific Coordination Requirements with BNSF and MRL:

Schedule drilling activities with MRL prior to beginning activity.

Task-Specific Requirements from the Facility-Wide HASP:

Follow all applicable requirements of *Facility-Wide Health and Safety Plan (Revision No. 3)*.

Task-Specific Deviations from Facility-Wide HASP:

None

Emergency Response (Contingency) Plan:

See *Facility-Wide Health and Safety Plan (Revision No. 3)* (Section 7.0)

Hazardous Material Used for Task (Attach MSDSs and Submit to BNSF and MRL): See *Facility-Wide Health and Safety Plan (Revision No. 3)* (Appendix A – Hazard Communication and Material Safety Data Sheets. Sampling/field screening solutions
Map and Directions to Hospital: See attached figure.
SIGNATURES
Task Manager: Patrick Thomson (406) 782-5220 / Cell (406) 490-0329
Project Manager: Dave Erickson (406) 782-5220 Cell (406) 490-2915
Site Safety Officer: Patrick Thomson (406) 490-0329 Steve Nicholls (406) 491-2778

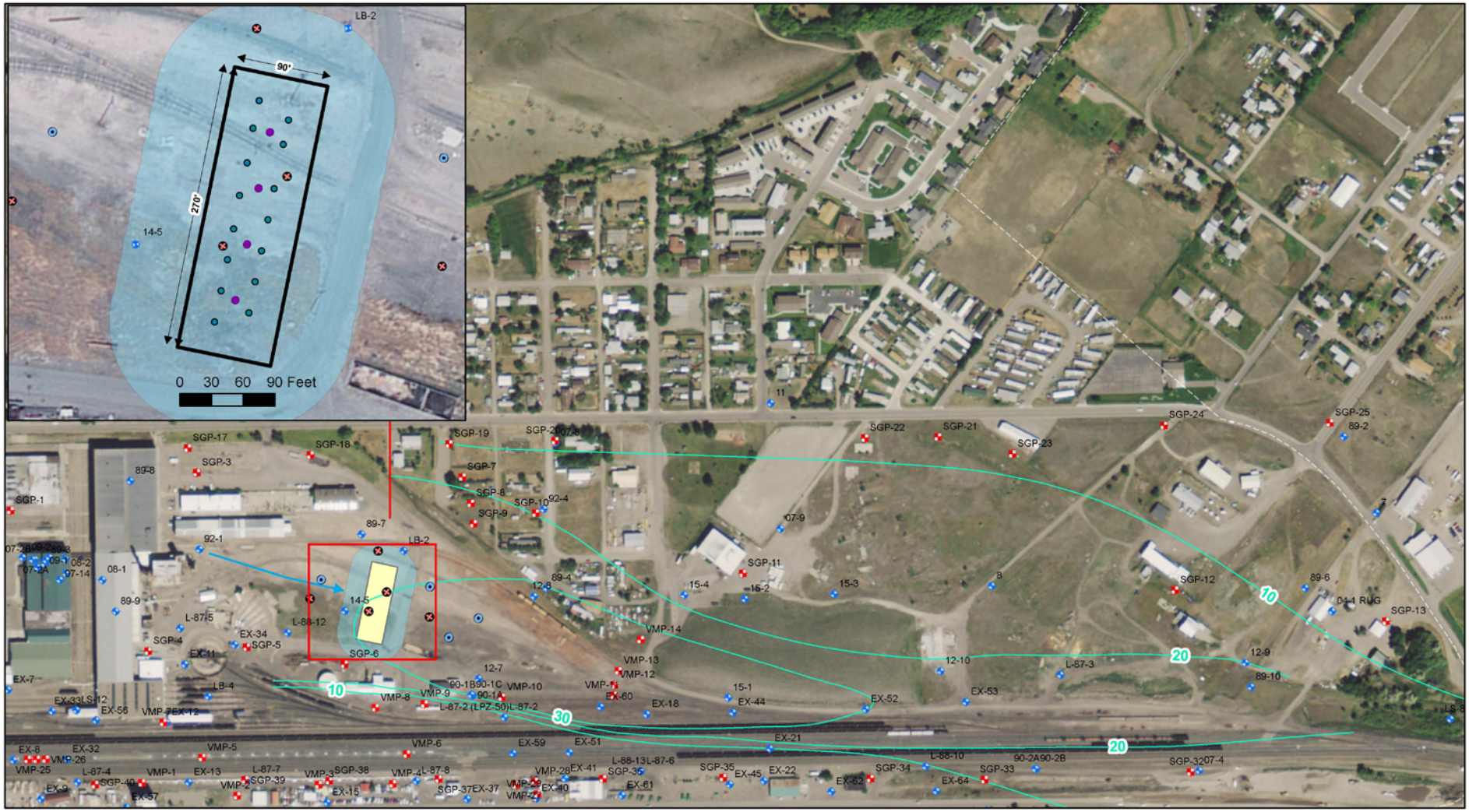
ATTACHMENTS

Attachment 1 – Locations of Field Activities
• Figure 2 from LRG *AS/SVE Pilot Test Work Plan for VOC-Containing Alluvial Aquifer Groundwater*

Attachment 2 – Route to Hospital
• Hospital Location and Route Map – Figure 3 from *Facility-Wide Health and Safety Plan Revision No. 3)*

Attachment 1

Locations of Field Activities



Water & Environmental TECHNOLOGIES

PROPOSED AS/SVE SYSTEM LOCATION

BNSF Livinston Shop Complex

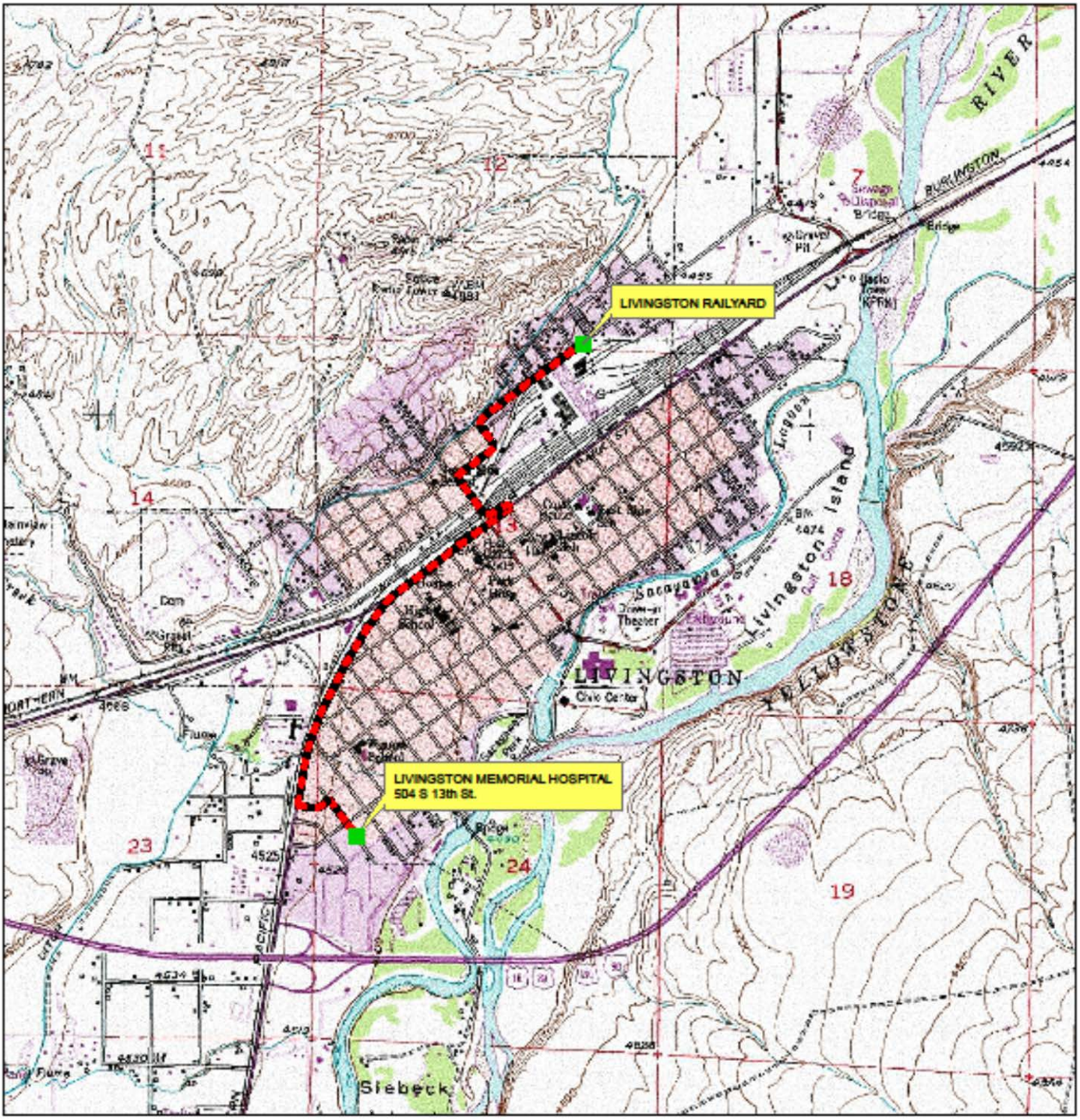
Job#: LRGM01 Task 3

Date: 7/24/2015

FIGURE 2

Attachment 2

Route to Hospital



Directions to Hospital

Proceed Southwest on E. Gallatin St.

Turn LEFT onto N. Main St.

Turn RIGHT onto Park St. (US-89)

Turn LEFT onto S. 13th St.

Hospital is on LEFT at 504 S. 13th St.

0 90 180 360 540 720 Miles

WATER & ENVIRONMENTAL TECHNOLOGIES, PC

DRIVING DIRECTIONS TO HOSPITAL

Livingston Montana

Job#: LRGM01

Date: 8/14/2013

FIGURE 2

Appendix C

ERCLs

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[a] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
FEDERAL AND STATE CONTAMINANT SPECIFIC ERCLS		
Surface and Groundwater Quality Standards (Applicable)		
Section 75-5-605, Montana Code Annotated (MCA)	Causing of Pollution Section 75-5-605 of the Montana Water Quality Act prohibits the causing of pollution of any state waters. Section 75-5-103(21)(a)(i) defines pollution as contamination or other alteration of physical, chemical, or biological properties of state waters which exceeds that permitted by the water quality standards. Placement of Wastes Section 75-5-605, MCA states that it is unlawful to place or cause to be placed any wastes where they will cause pollution of any state waters. Any permitted placement of waste is not placement if the agency's permitting authority contains provisions for review of the placement of materials to ensure it will not cause pollution to state waters.	Pilot test activities [air sparge (AS) injection and soil vapor extraction (SVE)] proposed in Air Sparge/Soil Vapor Extraction Pilot Test Work Plan will not impact surface water. The AS/SVE pilot test activities involve the injection of ambient air into the subsurface through well casings. This will force air into the aquifer to volatilize volatile organic compounds (VOCs) [i.e., tetrachloroethene (PCE)]. No physical change will occur in groundwater with exception of removal of VOCs.
Section 75-5-303, MCA	Nondegradation Section 75-5-303, MCA states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected, with certain limited exceptions.	
Groundwater Quality Standards		
40 Code of Federal Regulations (CFR) 141	Maximum Contaminant Levels and Maximum Contaminant Level Goals (Well-Suited) Because the aquifer affected by the site is currently and has been used as a drinking water source, the MCLs and non-zero MCLGs specified in 40 CFR Part 141 (Primary Drinking Water Standards) are well-suited requirements which are ultimately to be attained by the remedy for the site[1]. Because many of the MCLs are equivalent with the State groundwater standards, the Primary Drinking Water Standards are listed below with the State groundwater standards.	The Record of Decision (ROD) (DEQ, 2001) specifies groundwater remediation as part of the remedial action and allows the treatment of groundwater as part of the selected remedy. The AS/SVE Pilot Test Work Plan includes pilot testing a treatment technology to assess whether it will achieve the ROD cleanup levels.
40 CFR 143.3	Secondary Maximum Contaminant Levels (Well-Suited) Because the aquifer affected by the site is currently and has been used as a drinking water source, the Secondary Maximum Contaminant Levels (SMCLs) specified in 40 CFR Part 143.3 are well-suited requirements which are ultimately to be attained by the remedy for the site. 40 CFR 143.3 contains standards for color, odor (3 threshold odor number) and corrosivity which are well-suited to the remedial action.	To ensure state waters are not degraded/polluted, investigation-derived waste (IDW) generated during field activities associated with the AS/SVE Pilot Test Work Plan will be managed as outlined in the Facility-Wide Sampling and Analysis Plan and associated Addendum No. 1 and Addendum No. 2 (herein collectively referred to as the Facility-Wide SAP) . Investigation-derived water will be treated to the groundwater cleanup levels presented in the ROD and will meet all applicable permit requirements as specified in Petroleum Cleanup General Permit MTG7900013 before discharge to the Yellowstone River or disposed of according to the hazardous waste procedures specified in Section 8.4 of the Final Facility-Wide Sampling and Analysis Plan and the SAP Addendum (Facility-Wide SAP).
Administrative Rules of Montana (ARM) 17.30.1006	Montana Groundwater Pollution Control System (Applicable) ARM 17.30.1006 classifies groundwater into Classes I through IV based upon its specific conductance and establishes the groundwater quality standards applicable with respect to each groundwater classification. Based upon its specific conductance, the groundwater at the site must meet the standards for Class I groundwater. These standards are applicable. Concentrations of substances in Class I may not exceed the human health standards for groundwater listed in department Circular WQB-7.[2] For the primary contaminants of concern, the Circular WQB-7 standards and MCLs are listed below. For all contaminants of concern except vinyl chloride, the MCLs and Circular WQB-7 standards are equivalent.[3] All levels are ug/l and are dissolved phase. VOCs: Tetrachloroethene - 5.0; Trichloroethene - 5.0; Cis-1,2-Dichloroethene - 70; Vinyl chloride - 0.15; Chlorobenzene - 100; 1,4-Dichlorobenzene - 75 PAHs (SVOCs): Acenaphthene - 420; Anthracene - 2,100; Benzo(a)anthracene - 0.48; Benzo(a)pyrene - 0.048; Benzo(b)fluoranthene - 0.48; Benzo(k)fluoranthene - 4.79; Chrysene - 48; Dibenzo(a,h)anthracene - 0.048; Fluoranthene - 280; Fluorene - 280; Indeno(1,2,3-cd)pyrene - 0.48; Naphthalene - 28; Pyrene - 210 Lead - 15 For concentrations of parameters for which human health standards are not listed in WQB-7, ARM 17.30.1006 allows no increase of a parameter to a level that renders the waters harmful, detrimental or injurious to the beneficial uses listed for Class I water. This includes the following petroleum constituents. All levels are "ug/l" and are dissolved phase.	The use of AS injection is not anticipated to require a Montana Groundwater Pollution Control System (MGWPCS) permit under ARM 17.30.1023, because the pilot test injection medium is ambient air and the work is being performed under the Statement of Work for the Spinr 2005 Activities (Spring 2005 SOW) (DEQ, 2005). All substantive requirements of these regulations will be met. Actions included in the AS/SVE Pilot Test Work Plan will not introduce any substance to the groundwater system. The AS/SVE pilot test is being conducted to remove VOCs from groundwater to reduce concentrations below ROD cleanup levels and/or State of Montana water quality standards (DEQ-7).
ARM 17.30.1011	ARM 17.30.1011 provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless degradation may be allowed under the principles established in Section 75-5-303, MCA, and the nondegradation rules at ARM Title 17,chapter 30, subchapter 7.	Activities included in the AS/SVE Pilot Test Work Plan will not degrade groundwater quality and comply with all non-degradation rules.
Surface Water Quality Standards (Applicable)		
Montana Water Quality Act, Section 75-5-101, et seq., MCA Federal Clean Water Act, 33 U.S.C. §§ 1251, et seq.	The Montana Water Quality Act, Sections 75-5-101 et seq., establishes requirements for restoring and maintaining the quality of surface and ground waters and the federal Clean Water Act, 33 U.S.C. Sections 1251 et seq., establishes requirements for restoring and maintaining the quality of surface waters. Under these Acts the state has authority to adopt water quality standards designed to protect beneficial uses of each water body and to designate uses for each water body. Montana's regulations classify state waters according to quality, place restrictions on the discharge of pollutants to state waters and prohibit the degradation of state waters.	To ensure state waters are not degraded/polluted, IDW generated during field activities associated with this AS/SVE Pilot Test Work Plan will be managed as outlined in the Facility-Wide SAP. Investigation-derived water will be treated to the groundwater cleanup levels presented in the ROD and will meet all applicable permit requirements as specified in Petroleum Cleanup General Permit MTG7900013 before discharge to the Yellowstone River or disposed of according to the hazardous waste procedures specified in the Facility-Wide SAP.
ARM 17.30.611	ARM 17.30.611(1) (Applicable) provides that the waters of the Yellowstone River drainage upstream of the Laurel water supply intake, which includes the Livingston area, are classified "B-1" for water use.	Tasks included in this AS/SVE Pilot Test Work Plan will not degrade groundwater and will not adversely affect surface water.
ARM 17.30.623	ARM 17.30.623 provides that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters which would remain in the water after conventional water treatment may not exceed the applicable standards set forth in department Circular WQB-7.	
WQB-7 standards	WQB-7 provides that "For surface waters the Standard is the more restrictive of either the Aquatic Life Standard or the Human Health Standard." For the primary Contaminants of Concern the Circular WQB-7 standards are the same as listed above in groundwater.	
ARM 17.30.623	The B-1 classification standards at ARM 17.30.623 also include the following criteria: 1) Dissolved oxygen concentration must not be reduced below the levels given in department Circular WQB-7; 2) Hydrogen ion concentration (pH) must be maintained within the range of 6.5 to 9.5; 3) the maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units; 4) Temperature increases must be kept within prescribed limits; 5) No increase are allowed above naturally occurring concentrations of sediment, settleable solids, oils, floating solids, which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife. 6) True color must be kept within specified limits.	

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[a] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
ARM 17.30.637	ARM 17.30.637 which prohibits discharges containing substances that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; (e) create conditions which produce undesirable aquatic life.	
ARM 17.30.705	ARM 17.30.705 provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM 17.30.708.	To ensure state waters are not degraded/polluted, IDW generated during field activities associated with the AS/SVE Pilot Test Work Plan will be managed as outlined in the Facility-Wide SAP. Investigation-derived water will be treated to the groundwater cleanup levels presented in the ROD and will meet all applicable permit requirements as specified in Petroleum Cleanup General Permit MTG7900013 before discharge to the Yellowstone River or disposed of according to the hazardous waste procedures specified in the Facility-Wide SAP.
Water Quality Act, Title 17, Chapter 30, Sub-Chapters 6 and 13 and ARM 17.30.1332	Stormwater Runoff (Applicable) Pursuant to authority under the Water Quality Act, Title 17, Chapter 30, Sub-Chapter 6, and Title 17, Chapter 30, Sub-Chapter 13, including ARM 17.30.1332, the Water Quality Division issues general stormwater permits for certain activities. For construction activities, the following permit must be obtained: General Discharge Permit for Storm Water Associated with Construction Activity, Permit No. MTR100000 (May 19, 1997). Generally, the permits require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, an individual MPDES permit or alternative general permit may be required.	AS/SVE pilot test activities will not impact surface water runoff at the Facility.
Ambient Air Quality Standards (Applicable)		
	The following standards are applicable at the site[4]:	AS/SVE pilot test activities will not result in exceedances of ambient air quality standards for lead or ozone.
40 CFR 50.12 and ARM 17.8.222	40 CFR 50.12 and ARM 17.8.222. Ambient air quality standard for lead. Lead concentrations in the ambient air shall not exceed the following 90-day average: 1.5 micrograms lead per cubic meter of air.	
40 CFR 50.9 and ARM 17.8.213 40 CFR 50.10	40 CFR 50.9 and ARM 17.8.213. Ambient air quality standard for ozone. No person shall cause or contribute to concentrations of ozone in the ambient air exceeding: 0.10 ppm 1-hour average (0.12 ppm federal standard). 40 CFR 50.10 establishes a daily maximum 8-hour average 0.08 parts per million (ppm).	
ARM 17.8.220	ARM 17.8.220. Ambient air quality standard for settled particulate matter. Particulate matter concentrations in the ambient air shall not exceed the following 30-day average: 10 grams per square meter.	
40 CFR 50.6 and ARM 17.8.223	40 CFR 50.6 and ARM 17.8.223. Ambient air quality standards for PM-10. PM-10 concentrations in the ambient air shall not exceed the following standards: 150 micrograms/cubic meter of air, 24-hour average; and 50 micrograms/cubic meter of air, expected annual average.	AS/SVE pilot test activities include well installations. However, these actions will include wetting and other best management practices related to fugitive dust control. Remedial actions will be halted if significant dust is generated and will not resume until adequate dust control measures are in place. These dust control measures will ensure that ambient air standards will not be exceeded during the proposed remedial action.
40 CFR 50.8 and ARM 17.8.212	40 CFR 50.8 and ARM 17.8.212. Ambient air quality standards for carbon monoxide. Carbon monoxide concentrations in the ambient air shall not exceed the following standards: 9 ppm 8-hour average; and 23 ppm for a 1-hour average (35 ppm for federal).	AS/SVE pilot test activities will not result in exceedances of ambient air quality standards for carbon monoxide.
Emission Standards (Applicable)		
Sections 75-2-101, et seq., MCA	Montana has promulgated standards to regulate emissions of certain contaminants into the air. The state emission standards are enforceable under the Montana Clean Air Act, Sections 75-2-101 et seq., MCA.	AS/SVE pilot test activities will not result in VOC emissions. Extracted soil vapors from the SVE system will be treated with granular activated carbon (GAC) prior to discharge to the atmosphere and routine samples will be collected to assure adherance to regulations.
ARM 17.8.304	ARM 17.8.304. Visible Air Contaminants. No source may discharge emissions into the atmosphere that exhibit an opacity of 20 percent or greater, averaged over six consecutive minutes. This standard is limited to point sources, but excludes wood waste burners, incinerators, and motor vehicles.	
ARM 17.8.308	ARM 17.8.308. Airborne Particulate Matter. Emissions of airborne particulate matter from any stationary source shall not exhibit an opacity of 20 percent or greater, averaged over six consecutive minutes. This standard applies to the production, handling, transportation, or storage of any material; to the use of streets, roads, or parking lots; and to construction or demolition projects.	
ARM 17.8.315	ARM 17.8.315. Odors. If a business or other activity will create odors, those odors must be controlled, and no business or activity may cause a public nuisance.	AS/SVE pilot test activities will not generate odors. No open burning will be conducted during implementation of the pilot test.
ARM 17.8.604	ARM 17.8.604. Prohibited open burning. Open burning of numerous specific materials, including but not limited to oil and petroleum products and hazardous wastes, is prohibited.	
ARM 17.8.705	ARM 17.8.705 requires that permits be obtained for the construction, installation, alteration, or use of specified air contaminant sources. All air permits required for remedial actions must be obtained.	According to the Air Resources Management Bureau of Montana Deprtament of Environmental Quality (DEQ), the proposed SVE system does not require air permits.
ARM 17.8.715	ARM 17.8.715 requires sources for which air quality permits are required to use best available control technology (BACT) or to meet the lowest achievable emission rate (LAER), as applicable.	
	FEDERAL LOCATION SPECIFIC ERCLS	
Criteria Classification of Solid Waste Disposal Facilities and Practices (Applicable and Well-Suited)		
40 CFR 257	Under the selected remedy, no solid or hazardous waste (other than media treated to cleanup levels) may be disposed on-site. The standards therefore are pertinent to the cinder pile (well-suited) and placement of ex situ soils treated to cleanup levels (applicable) and post-jurisdictional wastes (applicable). The criteria contained in 40 CFR Part 257, establish standards with which solid waste disposal must comply to avoid possible adverse effects on health or the environment. 40 CFR Part 257 includes the following standards: Section 257.3-1(a) requires that facilities or practices in the floodplain not result in the washout of solid waste so as to pose a hazard to human life, wildlife, or land or water resources. Section 257.3-2 provides for the protection of threatened or endangered species. Section 257.3-3 provides that a facility shall not cause the discharge of pollutants into waters of the United States. Section 257.3-4 states that a facility or practice shall not contaminate underground drinking water.	IDW will be generated during implementation of the AS/SVE pilot test(s). Depending on the constituents and concentrations present and upon approval from the DEQ, this material may be landspread at the Livingston railyard, or treated, if feasible, and landspread at the Livingston railyard. Alternatively, the IDW will be disposed offsite at an appropriate permitted disposal facility. See the Facility-Wide SAP for additional information on how IDW generated during implementation of the AS/SVE pilot test(s) will be managed to comply with these ERCLs. Landspreading of soil and water, if approved by DEQ, will not occur in areas of a floodplain nor be conducted in a manner to cause discharge of pollutants into water. Other IDW or solid waste generated during implementation of the AS/SVE pilot test(s) will be disposed offsite at an appropriate permitted disposal facility.

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[a] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
The Endangered Species Act (Well-Suited)		
16 U.S.C. §§ 1531 – 1544, 50 CFR Part 402, 40 CFR 6.302(h), 40 CFR 257.3-2	This statute and implementing regulations (16 U.S.C. § 1531 et seq., 50 CFR Part 402, 40 CFR 6.302(h), and 40 CFR 257.3-2) require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat. Compliance with this requirement involves consultation with the U.S. Fish and Wildlife Service (USFWS) and a determination of whether there are listed or proposed species or critical habitats present at the Site, and, if so, whether any proposed activities will impact such wildlife or habitat. No endangered or threatened species was identified onsite although the Yellowstone Trout is treated as a species of special concern by the State. Any action affecting federal or State endangered or threatened species must comply with all listed requirements.	AS/SVE pilot test activities will not impact endangered species. According to the ROD, no endangered species or threatened specifies were identified at the Facility, although the Yellowstone Trout is treated as a species of special concern by the State.
Sections 87-5-106, -107, -111, and -201, MCA	Sections 87-5-106, 107, and 111, MCA (Applicable): Endangered species should be protected in order to maintain and to the extent possible enhance their numbers. These sections list endangered species, prohibited acts and penalties. See also, §§ 87-5-106 and 87-5-201, MCA, (Applicable) concerning protection of wild birds, nests and eggs.	
ARM 12.5.201	ARM 12.5.201 (Applicable). Certain activities are prohibited with respect to specified endangered species.	
Migratory Bird Treaty Act (Well-Suited)		
16 U.S.C. §§ 703, et seq.	This requirement (16 U.S.C. § 703 et seq.) establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial action to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	AS/SVE pilot test activities will not impact migratory birds. Migratory birds may be present near the Facility. However, the Livingston railyard does not provide the majority of habitat for these species relative to the surrounding area, and no features exist that are particularly attractive to these species.
Bald Eagle Protection Act (Well-Suited)		
16 U.S.C. §§ 668, et seq.	This requirement (16 U.S.C. § 668 et seq.) establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial action to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagle.	AS/SVE pilot test activities will not impact bald eagles. Bald eagles may be present near the Facility. However, the Livingston railyard does not provide the majority of habitat for these species relative to the surrounding area, and no features exist that are particularly attractive to these species.
Historic Sites, Buildings, Objects, and Antiquities Act (Well-Suited)		
16 U.S.C. 461, et seq.	These requirements, found at 16 U.S.C. 461 et seq., provide that, in conducting an environmental review of a proposed action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR 62.6(d) to avoid undesirable impacts upon such landmarks. No historic sites were identified.	AS/SVE pilot test activities will not impact historic sites. According to the ROD, no historic sites were identified at the Livingston railyard.
Fish and Wildlife Coordination Act (Well-Suited)		
16 U.S.C. 661, et seq. and 40 CFR 6.302(g)	These standards are found at 16 U.S.C. § 661 et seq. and 40 CFR 6.302(g) and require that federally funded or authorized projects ensure that any modification of any stream or other water body affected by a funded or authorized action provide for adequate protection of fish and wildlife resources.	AS/SVE pilot test activities do not involve the modification of any stream or other water body.
Floodplain Management Order (Well-Suited)		
40 CFR Part 6, Appendix A, Executive Order No. 11,988	This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11,988) mandates that federally funded or authorized actions within the 100 year floodplain avoid, to the maximum extent possible, adverse impacts associated with development of a floodplain.	The proposed area(s) where the AS/SVE pilot test(s) will be implemented and locations of the proposed new wells are not located in the floodway or floodplain. Therefore, the AS/SVE pilot test activities will not impact a floodway or floodplain.
Protection of Wetlands Order (Well-Suited)		
40 CFR Part 6, Appendix A, Executive Order No. 11,990 Section 404(b)(1), 33 U.S.C. Section 1344(b)(1)	This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11,990) mandates that federal agencies and potentially responsible parties avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Section 404(b)(1), 33 U.S.C. § 1344(b)(1), also prohibits the discharge of dredged or fill material into waters of the United States. Together, these requirements create a "no net loss" of wetlands standard.	According to Montana's Natural Resource Information System, no wetlands have been identified in the Livingston area. AS/SVE pilot test activities will not impact wetlands.
STATE LOCATION SPECIFIC ERCLS		
Solid Waste Management Regulations (Applicable and Well-Suited)		
Solid Waste Management Act, Sections 75-10-201 et seq., MCA	Regulations promulgated under the Solid Waste Management Act, Sections 75-10-201 et seq., MCA, specify requirements that apply to the location of any solid waste management facility. Under the selected remedy, no solid or hazardous waste (other than media treated to cleanup levels) may be disposed on-site. The standards therefore are pertinent to the cinder pile (well-suited) and placement of ex situ soils treated to cleanup levels (applicable) and post-jurisdictional wastes (applicable).	Non-hazardous IDW such as personal protective equipment (PPE) and IDW that has determined to be non-hazardous through analytical testing generated during implementation of the AS/SVE pilot test(s) will be contained in 55-gallon drums or other appropriate containers and temporarily stored in a centralized storage area pending characterization and final disposition. If non-hazardous investigation-derived soil or water cannot be landspread at the Livingston railyard, it will be disposed offsite along with other non-hazardous IDW at an appropriate permitted disposal facility. See the Facility-Wide SAP for additional information regarding the management of IDW. Any other solid waste generated (i.e., tape removed from boxes, plastic bags and/or boxes containing supplies that are not reused, etc.) will be contained in a plastic garbage bag (if necessary) and placed in a garbage can for collection and appropriate disposal as solid waste. AS/SVE pilot test activities do not involve the cinder pile or propose treatment of soil (ex-situ). If treatment of soil (ex-situ) is proposed, a SAP addendum will be submitted to DEQ as discussed in Section 8.4.2 of the Facility-Wide SAP.
ARM 17.50.505(1)	Under ARM 17.50.505(1), a facility for the treatment, storage or disposal of solid wastes: (a) must be located where a sufficient acreage of suitable land is available for solid waste management; (b) may not be located in a 100-year floodplain; (c) may be located only in areas which will prevent the pollution of ground and surface waters and public and private water supply systems; (d) must be located to allow for reclamation and reuse of the land; (e) drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and (f) where underlying geological formations contain rock fractures or fissures which may lead to pollution of the ground water or areas in which springs exist that are hydraulically connected to a proposed disposal facility, only Class III disposal facilities may be approved.	Non-hazardous IDW generated during implementation of the AS/SVE pilot test(s) will be contained in 55-gallon drums or other appropriate containers and stored inside/near the Former C&P Packing Building (see Section 8.4.4 1 of the Facility-Wide SAP). The Former C&P Packing Building and surrounding areas represent sufficient acreage for IDW management. The area is not located in a 100-year floodplain. IDW will be stored in appropriate containers to prevent pollution of groundwater, surface water, and public supply systems.

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[a] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
Floodplain and Floodway Management Act and Regulations (Applicable)		
	A portion of the site is in a designated floodplain. The following standards are included here to indicate the restrictions on any related activities that might occur in or affect the floodway or floodplain.	The proposed area where the AS/SVE pilot test(s) will be implemented and locations of the proposed new wells are not located in the floodway or floodplain. Therefore, AS/SVE pilot test activities will not impact a floodway or floodplain.
Section 76-5-401, MCA and ARM 36.15.601	Residential, certain agricultural, industrial-commercial, recreational and other uses are permissible within the designated floodway, provided they do not require structures other than portable structures, fill or permanent storage of materials or equipment. Section 76-5-401, MCA; ARM 36.15.601.	
Section 76-5-402, MCA and ARM 36.15.701	In the flood fringe (i.e., within the floodplain but outside the floodway), residential, commercial, industrial, and other structures may be permitted subject to certain conditions relating to placement of fill, roads, and floodproofing. Section 76-5-402, MCA; ARM 36.15.701.	
ARM 36.15.602(6)	Domestic water supply wells may be permitted, even within the floodway, provided the well casing and well meets certain conditions. ARM 36.15.602(6).	
ARM 36.15.602(5), 36.15.605, and 36.15.703	Solid and hazardous waste disposal and storage of toxic, flammable, hazardous, or explosive materials are prohibited anywhere in floodways or floodplains. ARM 36.15.602(5), 36.15.605, and 36.15.703.	
Section 76-5-402, MCA	The following are prohibited in a floodway: buildings for living purposes or place of assembly or permanent use by human beings; any structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway; and the construction or permanent storage of an object subject to flotation or movement during flood level periods. Section 76-5-402, MCA.	The proposed area where the AS/SVE pilot test(s) will be implemented and locations of the proposed new wells are not located in the floodway or floodplain. Therefore, AS/SVE pilot test activities will not impact a floodway or floodplain.
Section 76-5-406, MCA and ARM 36.15.216	Section 76-5-406, MCA and ARM 36.15.216 contain substantive factors which address obstruction or use within the floodway or floodplain.	
ARM 36.15.604, ARM 36.15.602(1), and ARM 36.15.603	Further conditions or restrictions that generally apply to specific activities within the floodway or floodplain can be found at ARM 36.15.604 (increase in upstream elevation or significantly increase flood velocities); ARM 36.15.602(1) (excavation of material from pits or pools); ARM 36.15.603 (water diversions or changes in place of diversion).	
ARM 36.15.701(3)(c)	ARM 36.15.701(3)(c) requires that roads, streets, highways and rail lines must be designed to minimize increases in flood heights.	
ARM 36.15.701(3)(d)	Structures and facilities for liquid or solid waste treatment and disposal must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with DEQ regulations, which include certain additional prohibitions on such disposal. ARM 36.15.701(3)(d).	
ARM 36.15.702(2)	Standards applied to residential, commercial or industrial structures are found at ARM 36.15.702(2).	
ARM 36.15.606	Flood control works are subject to ARM 36.15.606, which requires compliance with safety standards for levees, floodwalls, and riprap.	
ARM 36.15.901	ARM 36.15.901 requires electrical systems to be flood-proofed.	
	FEDERAL AND STATE ACTION SPECIFIC ERCLS	
Federal Hazardous Waste Management Regulations (Applicable)		
42 U.S.C. §§ 6901 et seq., and Montana Hazardous Waste Act, Sections 75-10-401 et seq., MCA	The Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Sections 6901 et seq., and the Montana Hazardous Waste Act, Sections 75-10-401 et seq., MCA, and regulations under these acts establish a regulatory structure for the generation, transportation, treatment, storage and disposal of hazardous wastes. These requirements are applicable to substances and actions at the site which involve the active management of hazardous wastes. Burlington Northern operated the site and generated waste through 1986-7. Therefore, in certain instances, disposal was not pre-jurisdictional and the hazardous waste requirements are applicable now. However, DEQ does not have the documentation showing the dates of individual discharges, and therefore has, for purposes of this ROD, made a determination to treat all historic waste and media containing waste as pre-jurisdictional (in accord with the NCP and EPA guidance). Therefore, under this ROD, the historic waste which is characteristic or listed becomes hazardous upon excavation (generation).	AS/SVE pilot test activities are being conducted in the area containing F-listed constituents, IDW generated during the AS/SVE pilot test will be suspected of containing F-listed constituents and will be managed as a hazardous waste unless analytical testing shows otherwise. The types of hazardous IDW expected to be generated are discussed in Section 8.0 of the AS/SVE Pilot Test Work Plan. Hazardous IDW will be managed in accordance with Section 8.0 of the AS/SVE Pilot Test Work Plan and with the Facility-Wide SAP. While DEQ has the authority to waive non-substantive permit requirements for remedial actions conducted entirely at the Facility, that authority does not extend to offsite permitted activities such as transporting and disposing of hazardous waste. Environmental samples containing RCRA-regulated constituents submitted to the analytical laboratory are exempt from RCRA; however, they become subject to RCRA again when they are disposed of by the analytical laboratory. Analytical laboratory will dispose of environmental samples in accordance with state and federal regulations.
Indentification and Listing of Hazardous Waste		
40 CFR 261 ARM 17.54.501-502	Wastes may be designated as hazardous by either of two methods: listing or demonstration of a hazardous characteristic. Listed wastes are the specific types of wastes determined by EPA to be hazardous as identified in 40 CFR Part 261, Subpart D (40 CFR 261.30 - 261.33). Listed wastes are designated hazardous by virtue of their origin or source, and must be managed as hazardous wastes regardless of the concentration of hazardous constituents. Characteristic wastes are those that by virtue of concentrations of hazardous constituents demonstrate the characteristic of ignitability, corrosivity, reactivity or toxicity, as described at 40 CFR Part 261, Subpart C. Certain of the wastes at the site demonstrate the characteristic of toxicity, and are therefore characteristic hazardous wastes upon excavation. The site also contains F001 and F002 which are listed hazardous wastes for chlorinated solvents. The various media and wastes at the site contaminated by the F001 and F002 wastes are also hazardous wastes pursuant to 40 CFR Part 261 upon excavation. The RCRA requirements specified below are applicable requirements for the treatment, storage and disposal of these wastes. See 40 CFR 261.31 (Hazardous Waste Numbers F001 and F002) and ARM 17.54.501. These ERCLs apply to remedial activities; on-going operations must comply with State and federal requirements and permits. EPA has advised EPA Regions and States that conservative, health-based levels derived from direct exposure pathways would clearly be acceptable as "contained-in" levels. [See memorandum from Sylvia K. Lowrance to Jeff Zelikson, Region IX, (January 24, 1989)]. EPA and many States specify conservative, risk-based levels calculated with standard conservative exposure assumptions (usually based on unrestricted access), or site-specific risk assessments. 61 FR at 18795 (April 29, 1996); 63 FR 28556 (May 26, 1998) [Part I of II]. For the BN Livingston Shop Complex, soils treated to below cleanup levels will be allowed to return to the site (from, for example, the electric shop) to an approved location in compliance with RCRA.	AS/SVE pilot test activities are being conducted in the area containing F-listed constituents, IDW generated during the AS/SVE pilot test(s) will be suspected of containing F-listed constituents and will be managed as a hazardous waste unless analytical testing shows otherwise. Hazardous IDW will be managed in accordance with Section 8.0 of the AS/SVE Pilot Test Work Plan and with the Facility-Wide SAP. If offsite disposal is warranted, additional testing of the IDW may be required by the disposal facility and will be performed if necessary.
40 CFR 261 ARM 17.54.501-502 (cont.)	For media which contain hazardous waste, all standards are applicable except for disposal requirements for "contained-out" soils. For all non-media wastes, the standards are applicable. However, no on-site disposal of hazardous waste is allowed under the selected remedy. Therefore, all hazardous wastes, including all media not treated to cleanup levels must be disposed off-site at a regulated subtitle C facility. These standards specifically apply to free product removed from within the solvent plume. For free product removed from outside the solvent plume 40 CFR Part 279 is applicable.	

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[a] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
ARM 17.53.111 and 112, MCA	Because of the presence of listed and characteristic hazardous waste, the permit requirements specified in ARM 17.53.112 are applicable. However, DEQ is exempting remedial actions involving hazardous waste from RCRA permit requirements pursuant to 75-10-721(3), MCA (1993) as long as substantive requirements are met. This does not, however, affect the requirement to comply with ARM 17.53.111, Registration and EPA Identification Numbers for Generators and Transporters. Workplans will require detailed information on compliance with all procedural and substantive standards (as well as all ERCLs). Set out below are the hazardous waste requirements that are applicable for the types of waste management units or the waste management practices anticipated in the remedial actions at the site.	BNSF has obtained a hazardous waste identification number for the Livingston railyard (EPA ID No. MTT310010087).
Standards for Transporters of Hazardous Waste		
40 CFR Part 263	The RCRA regulations at 40 CFR Part 263, establish standards that apply to transporters of hazardous waste. These standards include requirements for immediate action for hazardous waste discharges. These standards are applicable for any on-site transportation. These standards are independently applicable (see Other Laws section) for any off-site transportation.	DEQ has determined that a hazardous waste transporter is not required to transport hazardous waste from a work area to the centralized storage area, provided transportation remains within the Facility. If hazardous waste needs to be transported outside the Facility, the waste will be manifested and a hazardous waste transporter will be used as discussed in Section 8.4.4 of the Facility-Wide SAP.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities		
40 CFR 264, Subpart B	General Facility Standards The regulations at 40 CFR 264, Subpart B, establish general facility requirements. These standards include requirements for general waste analysis, security and location standards.	Hazardous IDW will be managed in accordance with the Facility-Wide SAP.
40 CFR 264, Subpart F	Releases from Solid Waste Management Units The regulations at 40 CFR 264, Subpart F, establish requirements for groundwater protection for RCRA-regulated solid waste management units (i.e., waste piles, surface impoundments, land treatment units, and landfills). The regulations at Subpart F establish monitoring requirements for RCRA-regulated solid waste management units (i.e., waste piles, surface impoundments, land treatment units, and landfills). Subpart F provides for three general types of groundwater monitoring: detection monitoring (40 CFR 264.98); compliance monitoring (40 CFR 264.99); and corrective action monitoring (40 CFR 264.100). Monitoring wells must be cased according to 264.97(c). Monitoring is required during the active life of a hazardous waste management unit. If hazardous waste remains, monitoring is required for a period necessary to protect human health and the environment.	Hazardous IDW will be managed in accordance with the Facility-Wide SAP.
40 CFR Part 264, Subpart G	Closure and Post-Closure Monitoring and Maintenance of Waste Management or Disposal Facilities 40 CFR Part 264, Subpart G, establishes that hazardous waste management facilities must be closed in such a manner as to (a) minimize the need for further maintenance and (b) control, minimize or eliminate, to the extent necessary to protect public health and the environment, post-closure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff or hazardous waste decomposition products to the ground or surface waters or to the atmosphere. Requirements for facilities requiring post-closure care include the following: the facilities must undertake appropriate monitoring and maintenance actions, control public access, and control postclosure use of the property to ensure that the integrity of the final cover, liner, or containment system is not disturbed. In addition, all contaminated equipment, structures and soil must be properly disposed of or decontaminated unless exempt and free liquids must be removed or solidified, the wastes stabilized, and the waste management unit covered.	
40 CFR Part 264, Subparts I and J 40 CFR 261.7	Waste Containers and Tanks 40 CFR Part 264, Subparts I and J apply to owners and operators of facilities that store hazardous waste in containers, and store or treat hazardous waste in tanks, respectively. These regulations are applicable to any storage or treatment in these units at the site. The related provisions of 40 CFR 261.7, residues of hazardous waste in empty containers, are also applicable.	Hazardous IDW and IDW suspected to be hazardous generated during implementation of the AS/SVE pilot test(s) will be stored in drums, tanks, or other appropriate containers and managed as outlined in the Facility-Wide SAP.
40 CFR Part 264, Subpart L	Waste Piles 40 CFR Part 264, Subpart L, applies to owners and operators of facilities that store or treat hazardous waste in piles. The regulations include requirements for the use of run-on and run-off control systems and collection and holding systems to prevent the release of contaminants from waste piles. These regulations are applicable to any storage in waste piles at the site.	IDW generated during implementation of the AS/SVE pilot test(s) will not be stored in waste piles. IDW (soil, water, non-indigenous) generated during the AS/SVE pilot test(s) will be stored in drums, tank(s) or other appropriate containers as described in Section 8.4 of the Facility-Wide SAP.
40 CFR 264.554	Staging Piles 40 CFR 264.554 sets forth a new storage unit called the staging pile. A staging pile must be located within the contiguous property under the control of the owner/operator where the wastes to be managed in the staging pile originated. The staging pile must be designed so as to prevent or minimize releases of hazardous wastes and hazardous constituents into the environment, and minimize or adequately control cross-media transfer, as necessary to protect human health and the environment (for example, through the use of liners, covers, run-off/run-on controls, as appropriate). The staging pile must not operate for more than two years and cannot be used for treatment.	IDW generated during implementation of the AS/SVE pilot test(s) will not be stored in staging piles. IDW (soil, water, non-indigenous) generated during the AS/SVE pilot test(s) will be stored in drums, tank(s) or other appropriate containers as described in Section 8.4 of the Facility-Wide SAP.
40 CFR Part 268 HWIR Media Rule (63 Fed. Reg. 65874)	RCRA Land Disposal Restrictions Since the wastes to be treated are listed and characteristic wastes, the RCRA Land Disposal Restrictions (LDRs) treatment levels set forth in 40 CFR Part 268 are applicable requirements including the treatment levels for F001 and F002 listed wastes for the disposal of hazardous wastes generated at the site. With the exception of treated soils, hazardous wastes are prohibited from disposal on-site. The HWIR Media Rule, promulgated at 63 Fed. Reg. 65874 (November 30, 1998) allows listed waste treated to levels protective of human health and the environment to be disposed on-site without triggering land ban or minimum technology requirements for these disposal requirements. Treated soils containing hazardous waste will need to meet cleanup levels to avoid triggering land ban or minimum technology requirements for these disposal requirements.	If investigation-derived soil or water is proposed for landspreading, documentation showing that concentrations are below LDR standards will be included in the request for a no-longer contained-in determination from DEQ as discussed in the Facility-Wide SAP.
40 CFR 268.45	Hazardous debris Since on-site disposal of solid and hazardous wastes is prohibited at the site, any hazardous debris remaining on-site must comply with 40 CFR 268.45 prior to off-site disposal as a solid waste (all off-site disposal must also comply with LDR certification requirements, which apply to these wastes). If the debris does not fully comply with 40 CFR 268.45, it must be disposed off-site at a regulated subtitle C facility.	It is not anticipated that hazardous debris will be generated during AS/SVE pilot test activities; if any hazardous debris is generated, it will be managed as a hazardous waste along with hazardous IDW as outlined in the Facility-Wide SAP.
40 CFR Part 270	Substantive Permit Requirements 40 CFR Part 270 sets forth the hazardous waste permit program. The substantive requirements set forth in 40 CFR Part 270, Subpart C (permit conditions), including the requirement to properly operate and maintain all facilities and systems of treatment and control are applicable requirements.	The substantive permit requirements that pertain to the management of hazardous waste (including generation, storage, and disposal) are included in the Facility-Wide SAP.
40 CFR Part 279	Used Oil 40 CFR Part 279 sets forth the standards for the management of used oil. For product removed from outside the solvent plume, 40 CFR Part 279 is applicable.	AS/SVE pilot test activities will not result in the generation of used oil.

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Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
State Hazardous Waste Management Regulations (Applicable)		
Sections 75-10-401 et seq., MCA	The Montana Hazardous Waste Act, Sections 75-10-401 et seq., MCA, and regulations under this act establishes a regulatory structure for the generation, transportation, treatment, storage and disposal of hazardous wastes. These requirements are applicable to substances and actions at the site which involve listed and characteristic hazardous wastes.	AS/SVE pilot test activities are being conducted in an area containing F-listed constituents, IDW generated during the AS/SVE pilot test(s) will be suspected of containing F-listed constituents and will be managed as a hazardous waste unless analytical testing shows otherwise. Hazardous IDW will be managed in accordance with Section 8.0 of the AS/SVE Pilot Test Work Plan and with the Facility-Wide SAP.
ARM 17.53.501-502	ARM 17.53.501-502 adopts the equivalent of RCRA regulations at 40 CFR Part 261, establishing standards for the identification and listing of hazardous wastes, including standards for recyclable materials and standards for empty containers, with certain State exceptions and additions.	
ARM 17.53.601-604	ARM 17.53.601-604, adopts the equivalent to RCRA regulations at 40 CFR Part 262, establishing standards that apply to generators of hazardous waste, including standards pertaining to the accumulation of hazardous wastes, with certain State exceptions and additions.	
ARM 17.53.701-708	ARM 17.53.701-708, adopts the equivalent to RCRA regulations at 40 CFR Part 263, establishing standards that apply to transporters of hazardous waste, with certain State exceptions and additions.	
ARM 17.53.801-803	ARM 17.53.801-803, adopts the equivalent to RCRA regulations at 40 CFR Part 264, establishing standards that apply to hazardous waste treatment, storage and disposal facilities, with certain State exceptions and additions.	
ARM 17.53.1101-1102	ARM 17.53.1101-1102, adopts the equivalent to RCRA regulations at 40 CFR Part 268, establishing land disposal restrictions, with certain State exceptions and additions.	
Section 75-10-422 MCA	Section 75-10-422 MCA prohibits the unlawful disposal of hazardous wastes.	
ARM 17.53.1101-1102	ARM 17.53.1101-1102, adopts the equivalent to RCRA regulations at 40 CFR Part 270, which establish standards for permitted facilities, with certain State exceptions and additions.	
ARM 17.53.1401	ARM 17.53.1401, adopts the equivalent of RCRA regulations at 40 CFR Part 279 which set forth the standards for the management of used oil.	AS/SVE pilot test activities will not result in the generation of used oil.
National Emission Standards for Hazardous Air Pollutants (NESHAPs)		
ARM 17.8.341 (Incorporates by reference 40 CFR Part 61)	Asbestos (Well-Suited) The federal Clean Air Act requires the EPA to set emission standards for hazardous air pollutants. 42 U.S.C Section 7412. Implementation and enforcement of these standards in Montana has been delegated to the State. See 40 CFR 61.04(b)(BB). Federal standards for hazardous air pollutants (NESHAPs) at 40 CFR Part 61, are incorporated by reference by ARM 17.8.341. The NESHAPs for asbestos are well-suited to the cinder pile and are discussed in the Asbestos section below; however, the solid waste requirements are the more stringent of the ERCLs that must be complied with with respect to covering of the cinder pile.	AS/SVE pilot test activities will not result in air emissions of asbestos.
40 CFR 61.145	40 CFR 61.145. (well-suited). Standard for demolition and renovation. This section contains standards for demolition or renovation of a facility. The standards are designed to reduce or eliminate asbestos emissions from such operations, and include provisions for notification regarding intended project, wetting of asbestos materials, use of exhaust systems, careful movement of asbestos materials, and presence on site of a trained asbestos removal person. This section applies to any demolition or renovation of a structure, installation, building, or waste disposal area at the site containing asbestos materials.	
40 CFR 61.151	40 CFR 61.151. (well-suited). Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. There must either be no discharge of visible emissions from the site to the outside air, or the specified covering or treatment methods must be followed. Warning signs must be posted and prior notice must be given to EPA or the State before the waste material is excavated or disturbed.	
40 CFR Part 61, Subpart F	Vinyl Chloride (Applicable) 40 CFR Part 61, Subpart F contains the national emission standard for vinyl chloride. 40 CFR 61.64(b) requires concentrations from vinyl chloride in each exhaust gas stream from each stripper not exceed 10 ppm.	AS/SVE pilot test activities will not result in air emissions of vinyl chloride.
National Pollutant Discharge Elimination System (NPDES) and the Montana Pollutant Discharge Elimination System (MPDES) (Applicable)		
40 CFR Part 122, Subpart C and ARM 17.30.1342 - .1344	40 CFR Part 122, Subpart C and ARM 17.30.1342-1344 set forth the substantive requirements applicable to all MPDES and NPDES permits. Permits must be obtained for all surface and groundwater systems that are part of remedial actions, including proper operation and maintenance of all facilities and systems of treatment and control.	Investigation-derived water will be treated to the groundwater cleanup levels presented in the ROD and will meet all applicable permit requirements as specified in Petroleum Cleanup General Permit MTG7900013 before discharge to the Yellowstone River.
Technology-Based Treatment (Applicable)		
40 CFR Part 125 and ARM 17.30.1344	40 CFR Part 125 and ARM 17.30.1344 set forth criteria and standards for dischargers. Based on the source, the technology-based treatment standards include the best practicable control technology (BPT), best conventional pollutant control technology (BCT), or Best Available Technology Economically Achievable (BAT).	To ensure state waters are not degraded/polluted, investigation-derived water will be treated to the groundwater cleanup levels presented in the ROD and will meet all applicable permit requirements as specified in Petroleum Cleanup General Permit MTG7900013 before discharge to the Yellowstone River.
Underground Injection Control Program (Well-Suited)		
40 CFR 146	The Underground Injection Control Program set forth at 40 CFR 146, sets forth the standards and criteria for the injection of substances into aquifers. Wells are classified as Class I through V, depending on the location and the type of substance injected. For all classes, no owner may construct, operate or maintain an injection well in a manner that results in the contamination of an underground source of drinking water at levels that violate MCLs or otherwise adversely affect the health of persons. Each classification may also contain further specific standards, depending on the classification.	AS/SVE pilot test activities will involve the construction of wells for injection of air as part of environmental remediation. These are not subject to underground injection control (UIC) permitting and will be most likely rule-permitted. However, if requested by U.S. Environmental Protection Agency (EPA), information required and any mitigation measures will be provided for discussion.

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Federal or State ERCL Citation	Description	Compliance
Solid Waste Management Regulation (Applicable and Well-Suited)		
ARM 17.50.505	ARM 17.50.505(2) specifies standards for solid waste management facilities, including the requirements that: 1. Class II landfills must confine solid waste and leachate to the disposal facility. If there is the potential for leachate migration, it must be demonstrated that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters; 2. adequate separation of group II wastes from underlying or adjacent water must be provided; and 3. no new disposal units or lateral expansions may be located in wetlands. ARM 17.50.505 also specifies general soil and hydrogeological requirements pertaining to the location of any solid waste management facility.	AS/SVE pilot test activities do not involve siting, construction, operation/maintenance, and closure of a solid waste management facility.
ARM 17.50.511	ARM 17.50.511 sets forth general operational and maintenance and design requirements for solid waste facilities using landfilling methods. Specific operational requirements, specified in ARM 17.14.511 are run-on and run-off control systems requirements, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements.	
ARM 17.50.530	ARM 17.50.530 sets forth the closure requirements for landfills. Class II landfills must meet the following criteria: 1. install a final cover that is designed to minimize infiltration and erosion. 2. design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less; 3. minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth and protecting the infiltration layer from frost effects and rooting damage; 4. revegetate the final cover with native plant growth within one year of placement of the final cover.[5]	
ARM 17.50.531	ARM 17.50.531 sets forth post closure care requirements for Class II landfills. Post closure care must be conducted for a period sufficient to protect human health and the environment. Post closure care requires maintenance of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 17, chapter 14, subchapter 7.	
Transportation of Solid Waste (Applicable)		
Section 75-10-212	For solid wastes, Section 75-10-212 prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted.	Non-hazardous IDW [including non-indigenous waste (i.e., PPE) and IDW determined through analytical testing to be non-hazardous] generated during implementation of the AS/SVE pilot test(s) will be contained in 55-gallon drums or other appropriate containers and temporarily stored in a centralized storage area pending characterization and final disposition. If investigation-derived soil and water cannot landspread at the Livingston railyard, it will be disposed offsite along with other non-hazardous IDW as discussed in the Facility-Wide SAP. Any other solid waste generated (i.e., tape removed from boxes, plastic bags and/or boxes containing supplies that are not reused, etc.) will be contained in a plastic garbage bag (if necessary) and placed in a garbage can for collection and appropriate disposal as solid waste. Solid waste generated during implementation of the AS/SVE pilot test(s) will be transported in a manner to prevent discharge, dumping, spilling, and leaking.
ARM 17.50.523	ARM 17.50.523 requires that such waste must be transported in such a manner as to prevent its discharge, dumping, spilling, or leaking from the transport vehicle.	
Underground Storage Tank (USTs) Regulations (Applicable)		
	These standards are applicable. To the extent certain UST systems were removed prior to the effective date of the regulations, diesel is found separate and distinct from an UST system, or UST regulations are not applicable, the UST requirements remain well-suited since they address situations or problems sufficiently similar to those at the site.	AS/SVE pilot test activities do not involve USTs.
40 CFR Part 280, Subpart F	40 CFR Part 280, Subpart F sets forth requirements for Release Response and Corrective Action for UST Systems Containing Petroleum or Hazardous Substances. These include initial response, initial abatement measures, site characterization, free product removal, and investigations for soil and groundwater cleanup.	
40 CFR 280.64	40 CFR 280.64 provides that where investigations in connection with leaking underground storage tanks reveal the presence of free product, owners and operators must remove free product to the maximum extent practicable as determined by the implementing agency. This regulation also requires that the free product removal be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site, and that properly treats, discharges or disposes of recovery byproducts in compliance with applicable local, State and Federal regulations. 40 CFR 280.64 provides that abatement of free product migration is a minimum objective for the design of the free product removal system provides that any flammable products must be handled in a safe and competent manner to prevent fires or explosions.	
40 CFR Part 280, Subpart D	40 CFR Part 280, Subpart D sets forth requirements for release detection.	
40 CFR 280.43	40 CFR 280.43 (well-suited) specifies groundwater monitoring requirements for underground storage tanks and requires continuous monitoring devices or manual methods used to detect the presence of at least 1/8 of an inch of free product on top of the groundwater in the monitoring wells.	
Title 17, Chapter 56, Sub-Chapter 4	The Montana regulations regarding underground storage tanks include similar requirements. Title 17, Chapter 56, Sub-Chapter 4 specifies release detection.	
ARM 17.56.407	ARM 17.56.407 specifies groundwater monitoring requirements for underground storage tanks and requires continuous monitoring devices or manual methods used to detect the presence of at least 1/8 of an inch of free product on top of the groundwater in the monitoring wells.	
Title 17, Chapter 56, Sub-Chapter 6	Title 17, Chapter 56, Sub-Chapter 6 specifies release response and corrective action for tanks containing petroleum or hazardous substances.	
ARM 17.56.602 - 605	ARM 17.56.602 through 605 requires certain mitigation measures including removal of as much of the regulated substance from the system as is necessary to prevent further release into the environment and prevention of further migration of the released substance into surrounding soil and groundwater.	

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Federal or State ERCL Citation	Description	Compliance
Asbestos Regulation in Building Construction and Demolition (Well-Suited)		
Sections 50-64-101, et seq., MCA 50-64-104, MCA	Sections 50-64-101 et seq., MCA, regulate construction and demolition of structures that contain asbestos. Section 50-64-104, MCA. provides for various safeguards to prevent release of asbestos into the air. The prescribed safeguards include notification of the local fire department, posting of warning signs, wetting of surfaces, dust emission control, covering and wetting during transport, and deposition at a landfill where materials are unlikely to be disturbed and where signs warn that asbestos-containing material is buried in the landfill. The listed safeguards are well-suited to the covering of the cinder pile.	AS/SVE pilot test activities do not involve construction or demolition of any asbestos-containing structures.
Well Drilling (Applicable)		
Section 85-2-505, MCA	Section 85-2-505, MCA, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.	AS/SVE pilot test activities involve the installation of wells. Wells will be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater. Wells will be constructed and sampled in accordance with Standard Operating Guidelines (SOGs) presented in Appendix A of the Facility-Wide SAP. Drillers will be required to file a well log report with the Montana Bureau of Mines and Geology within 60 days after completion of the well.
Section 85-2-516, MCA	Section 85-2-516, MCA states that within 60 days after any well is completed a well log report must be filed by the driller with the Montana Department of Natural Resources and Conservation and the appropriate county clerk and recorder.	
ARM 17.30.641	ARM 17.30.641 provides standards for sampling and analysis of water to determine quality.	
ARM 17.30.646	ARM 17.30.646 requires that bioassay tolerance concentrations be determined in a specified manner.	
ARM 36.21.670-678 and 810	ARM 36.21.670-678 and 810 specifies certain requirements that must be fulfilled when abandoning monitoring wells.	If wells are to be abandoned following completion of the AS/SVE pilot tests, they will be abandoned in accordance with SOG-20 (presented in Appendix A of the Facility-Wide SAP), which complies with these regulations.
Reclamation Requirements (Well-Suited)		
	Certain portions of the Montana Strip and Underground Mining Reclamation Act and Montana Metal Mining Act are well-suited requirements for certain revegetation and construction activities at the site.	AS/SVE pilot test activities do not involve any major land disturbances, which trigger these requirements.
Section 82-4-231, MCA	Section 82-4-231, MCA: Requires operators to reclaim and revegetate affected lands using most modern technology available.	
Section 82-4-233, MCA	Section 82-4-233, MCA: Operators must plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration.	
Section 82-4-336, MCA	Section 82-4-336, MCA: Disturbed areas must be reclaimed to utility and stability comparable to areas adjacent.	
ARM 17.24.501	ARM 17.24.501: Provides general backfilling and grading requirements.	
ARM 17.24.519	ARM 17.24.519: Pertinent areas where excavation will occur will be regraded to minimize settlement.	
ARM 17.24.631	ARM 17.24.631: Disturbances to the prevailing hydrologic balance will be minimized. Changes in water quality and quantity, in the depth to groundwater and in the location of surface water drainage channels will be minimized, to the extent consistent with the selected response alternatives. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, mulching, and control of toxic-forming waste materials.	
ARM 17.24.633	ARM 17.24.633: Surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.	
ARM 17.24.634	ARM 17.24.634: Disturbed drainages will be restored to the approximate pre-disturbance configuration, to the extent consistent with the selected response alternatives.	
ARM 17.24.638	ARM 17.24.638: Sediment control measures must be implemented during operations.	
ARM 17.24.639	ARM 17.24.639: Sets forth requirements for construction and maintenance of sedimentation ponds.	
ARM 17.24.640	ARM 17.24.640: Discharges from sedimentation ponds, permanent and temporary impoundments, must be controlled to reduce erosion and enlargement of stream channels, and to minimize disturbance of the hydrologic balance.	
ARM 17.24.643 - 646	ARM 17.24.643 through 17.24.646: Provisions for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.	
ARM 17.24.701 and 702	ARM 17.24.701 and 702: Requirements for redistributing and stockpiling of soil for reclamation. Also outline practices to prevent compaction, slippage, erosion, and deterioration of biological properties of soil will be employed.	
ARM 17.24.711	ARM 17.24.711: Requires that a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected must be established. This provision would not be well-suited in certain instances, for example, where there is dedicated development.	
ARM 17.24.713	ARM 17.24.713: Seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed.	
ARM 17.24.714	ARM 17.24.714: Mulch or cover crop or both must be used until adequate permanent cover can be established.	
ARM 17.24.716	ARM 17.24.716: Establishes method of revegetation.	
ARM 17.24.718	ARM 17.24.718: Requires soil amendments, irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.	
ARM 17.24.723	ARM 17.24.723: States that operators shall conduct approved periodic measurements of vegetation, soils, and water.	
ARM 17.24.724	ARM 17.24.724: Specifies that revegetation success must be measured by approved unmined reference areas. Required management for these reference areas is set forth.	
ARM 17.24.726	ARM 17.24.726: Sets the required methods for measuring productivity.	
ARM 17.24.728	ARM 17.24.728: Sets requirements for measurements of the composition of vegetation on reclaimed areas.	
ARM 17.24.761	ARM 17.24.761: This specifies fugitive dust control measures which will be employed during excavation and construction activities to minimize the emission of fugitive dust.	

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[a] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
Noxious Weeds (Applicable)		
ARM 4.5.201 through .204 Section 7-22-2109(2)(b) Section 7-22-2152 Section 7-22-2101(7)(a), MCA	§ 7-22-2101(7)(a), MCA defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department; or (ii) as a district noxious weed by a board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM 4.5.201 through 4.5.204 and must be managed consistent with weed management criteria developed under MCA § 7-22-2109(2)(b). Notification and plan must occur as set forth in § 7-22-2152, MCA, as amended.	AS/SVE pilot test activities do not involve the introduction or planting of plants, nor will significant land disturbance occur which would trigger these requirements.
	OTHER LAWS	
	These laws are laws which are independently applicable rather than ERCLs for the site.	
Section 85-2-101, MCA	Surface Water and Groundwater Act Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.	AS/SVE pilot test activities will not require any surface water or groundwater to be appropriated.
Parts 3 and 4 of Title 85, Chapter 2, MCA	Groundwater and Surface Water Appropriation Parts 3 and 4 of Title 85, Chapter 2, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state.	AS/SVE pilot test activities will not require any water rights to be obtained.
Section 85-2-507, MCA Section 85-2-506, MCA	Controlled Ground Water Area Pursuant to Section 85-2-507 MCA, the Department of Natural Resources and Conservation may grant either a permanent or a temporary controlled ground water area. The maximum allowable time for a temporary area is four years.[6] Pursuant to 85-2-506 MCA, designation of a controlled groundwater area may be proposed if (a) that ground water withdrawals are in excess of recharge to the aquifer or aquifers within the ground water area; (b) that excessive ground water withdrawals are very likely to occur in the near future because of consistent and significant increases in withdrawals from within the ground water area; (c) that significant disputes regarding priority of rights, amounts of ground water in use by appropriators, or priority of type of use are in progress within the ground water area; (d) that ground water levels or pressures in the area in question are declining or have declined excessively; (e) that excessive ground water withdrawals would cause contaminant migration; (f) that ground water withdrawals adversely affecting ground water quality within the ground water area are occurring or are likely to occur; or (g) that water quality within the ground water area is not suited for a specific beneficial use defined by 85-2-102(2)(a).	AS/SVE pilot test activities will not require a controlled groundwater area.
29 CFR ☐Part 1910	Occupational Safety and Health Act The federal Occupational Safety and Health Act regulations found at 29 CFR 1910 are applicable to worker protection during conduct of RI/FS or remedial activities.	Field activities associated with the AS/SVE pilot test(s) will be conducted in accordance with the Facility-Wide Health and Safety Plan (HASP) and the task-specific HASP addenda.
ARM 17.74.101 ARM 17.74.102	Montana Occupational Health Act ARM Section 17.74.101, along with the similar federal standard in 29 CFR 1910.95, addresses occupational noise. ARM Section 17.74.102, along with the similar federal standard in 29 CFR 1910.1000 addresses occupational air contaminants.	
Sections 50-71-201, 202, and 203, MCA	Montana Safety Act Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe.	Water & Environmental Technologies has a comprehensive Injury and Illness Prevention Program designed to help ensure the health and safety of its employees and provide a safe and healthful work environment. In addition, Water & Environmental Technologies has a Corporate Health and Safety Program and Hazardous Communication Program.
Section 50-78-201, 202, and 204, MCA	Employee and Community Hazardous Chemical Information Act Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.	
40 CFR Part 262 and ARM 17.53.601-604	Standards for Generators of Hazardous Waste The RCRA regulations at 40 CFR Part 262 and ARM 17.53.601-604 establish standards that apply to generators of hazardous waste. These standards include requirements for obtaining an EPA identification number and maintaining certain records and filing certain reports. These standards are applicable for any waste which will transported off-site.	Hazardous IDW generated during implementation of the AS/SVE pilot test(s) will be managed in accordance with Section 8.4 of the Facility-Wide SAP and will comply with these regulations.
40 CFR Part 263 and ARM 17.53.701-708	Standards for Transporters of Hazardous Waste The RCRA regulations at 40 CFR Part 263 and ARM 17.53.701-708 establish standards that apply to transporters of hazardous waste. These standards include requirements for immediate action for hazardous waste discharges. These standards are applicable for any off-site transportation.	
40 CFR 268 and ARM 17.53.1101-1102	RCRA Land Disposal Restrictions Since the wastes to be treated are listed and characteristic wastes, the RCRA Land Disposal Restrictions (LDRs) treatment levels set forth in 40 CFR Part 268 and ARM 17.53.1101-1102 are applicable requirements including the treatment levels for F001 and F002 listed wastes for the disposal of hazardous wastes generated at the site.	
49 CFR Chapter I, Subchapters B and C and ARM 23.5.101	Oil Transportation 49 CFR Chapter I, Subchapter B (Oil Transportation) and Subchapter C (Hazardous Materials) and ARM. 23.5.101 apply to transporters of oil and hazardous materials. These standards are applicable for any off-site transportation of oil meeting the quantity requirements set forth in Subchapter B or for the transportation of hazardous materials such as the transportation of asbestos-containing waste material.	AS/SVE pilot test activities do not involve the use of oil and will not generate used oil.

ANALYSIS OF ENVIRONMENTAL REQUIREMENTS, CRITERIA, AND LIMITATIONS (ERCLS)[(a)] FOR AIR SPARGE / SOIL VAPOR EXTRACTION PILOT TEST WORK PLAN
Burlington Northern Livingston Shop Complex

Federal or State ERCL Citation	Description	Compliance
Sections 75-2-501 et seq., M	Montana Asbestos Control Act The Montana Asbestos Control Act, Sections 75-2-501 et seq., MCA, and implementing rules establish standards and procedures for accreditation of asbestos-related occupations and control of the work performed by persons in asbestos-related occupations.	AS/SVE pilot test activities do not involve asbestos work.
Sections 75-2-502(4) and -511, MCA, and ARM 17.74.302(3)	A permit from DEQ is required before any person can conduct an asbestos project. The definition of "asbestos project" includes the encapsulation, enclosure, removal, transportation, or disposal of asbestos-containing waste. Section 75-2-502(4), MCA; ARM 17.74.302(3). In addition, a person who inspects, plans, designs, supervises, contracts for or works on an asbestos project must meet DEQ training and accreditation requirements. See also Section 75-2-511, MCA.	
ARM 17.74.314	ARM 17.74.314 states that no person may engage in an asbestos-type occupation unless accredited in that occupation or may employ or subcontract with nonaccredited individuals or contractors. No person may conduct an asbestos abatement project without a permit.	
ARM 17.74.335 29 CFR 1926.58 40 CFR 763.120-121 40 CFR Part 61, Subpart M	ARM 17.74.335 states that asbestos abatement projects require a DEQ permit. The permit conditions include but are not limited to: a. a requirement that all work performed be in accordance with 29 CFR 1926.58 (asbestos standards for the construction industry); and 40 CFR 763.120, 121 (requirements for asbestos abatement projects); b. a requirement that all asbestos be properly disposed in an approved asbestos disposal facility. "Approved asbestos disposal facility" is defined at ARM 17.54.302(1) as a properly operated and licensed class II landfill as described in ARM 17.50.504; c. a requirement that asbestos be disposed in accordance with 40 CFR Part 61, Subpart M. (National Emission Standard for Asbestos). See discussion above on National Emission Standard for Asbestos.	
ARM 17.74.338	ARM 17.74.338 requires an accredited asbestos abatement supervisor be physically present at all times at the work-site where a permitted asbestos abatement project is being performed and must be accessible to all workers. On-site air monitoring must be conducted by an accredited asbestos contractor/supervisor, an engineer or industrial hygienist.	
ARM 17.74.341	ARM 17.74.341 requires records of each asbestos abatement project be retained for a minimum of 30 years and must be made available to DEQ at any reasonable time. This section provides a noninclusive list of the records to be retained.	
40 CFR Part 92	Locomotive Emissions 40 CFR Part 92 establishes control of air pollution from locomotives and locomotive engines.	AS/SVE pilot test activities do not involve the use of locomotives.

Notes:

(a) These ERCLs were developed by the Montana Department of Environmental Quality and were included in Appendix A of the *Record of Decision* (ROD) (DEQ 2001).
ERCLs pertinent to Air Sparge/Soil Vapor Extraction Pilot Test Work Plan are shaded in yellow.

[1] *Montana Maximum Contaminant Levels:*
Pursuant to the Public Water Safety Act, 75-6-101 et. seq., MCA and ARM 17.38.204, the MCLs specified in 40 CFR Part 141 (Primary Drinking Water Standards) are incorporated.

[2] *Montana Department of Environmental Quality, Planning, Prevention and Assistance Division, Circular WQB-7, Montana Numeric Water Quality Standards (September, 1999).*

[3] *For vinyl chloride, the WQB-7 standard was 0.15 ug/l; the MCL is 2 ug/l.*

[4] *Each of the ambient air quality standards includes in its terms specific requirements and methodologies for monitoring and determining levels. Such requirements are also applicable requirements. In addition, ARM 17.8.204 and 17.8.206, Ambient Air Monitoring; Methods and Data, respectively (Applicable), require that all ambient air monitoring, sampling and data collection, recording, analysis and transmittal shall be in compliance with the Montana Quality Assurance Manual except when more stringent requirements are determined by DEQ to be necessary.*

[5] *ARM 17.50.530(1)(b) allows the department to approve an alternative final cover design if it achieves the reduction in infiltration and protection from erosion to a level at least as equivalent as the stated criteria.*

[6] *If a temporary controlled ground water area is granted, the statute requires DNRC to commence studies to determine the designation or modification of a permanent controlled ground water area.*