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Grain Handling Facility at Freeman, Freeman, Washington

Third Revised Interim Remedial Action Work Plan

January 2020

Union Pacific Railroad

Grain Handling Facility at Freeman, Freeman, Washington

Project No:	UPSRWA05
Document Title:	Third Revised Interim Remedial Action Work Plan
Document No.:	GES1129191150PDX
Date:	January 2020
Client Name:	Union Pacific Railroad
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Grain Handling Facility at Freeman
Freeman, Washington

January 2020

Prepared for:

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Attention: Sandra Treccani, P.G.

Technical Certification

This work plan has been prepared under the direction of a Registered Civil Engineer in the State of Washington.

January 9, 2020

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Acronyms and Abbreviations

µg/L	microgram(s) per liter
bgs	below ground surface
CHS	Cenex Harvest States, Inc.
CSM	conceptual site model
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FS	feasibility study
FSD	Freeman School District
GHFF	Grain Handling Facility at Freeman
gpm	gallon(s) per minute
HDPE	high density polyethylene
IDW	investigation-derived waste
IRA	interim remedial action
Jacobs	Jacobs Engineering Group Inc.
LGAC	liquid-phase granular activated carbon
O&M	operation and maintenance
Order	2015 Enforcement Order No. DE 12863
PID	photoionization detector
PVC	polyvinyl chloride
RI	remedial investigation
UPRR	Union Pacific Railroad
VGAC	vapor-phase granular active carbon
VOC	volatile organic compound
WAC	Washington Administrative Code

1. Introduction

On behalf of Union Pacific Railroad (UPRR) and in consultation with Cenex Harvest States, Inc. (CHS), Jacobs Engineering Group Inc. (Jacobs) has prepared this third revised interim remedial action (IRA) work plan for the Grain Handling Facility at Freeman (GHFF), located at 14603 Highway 27, Freeman, Washington (Site). The GHFF location is shown on Figure 1-1. For the purposes of this third revised IRA work plan, the Site is defined as the lateral and vertical extent where contamination that exceeds applicable cleanup levels has come to be located. A description of the extent of impacted environmental media is presented in the Remedial Investigation (RI) Report for the GHFF (Jacobs, 2018). This third revised IRA work plan presents the revised plan to conduct IRA activities at the Site.

The *Interim Remedial Action Work Plan* (Jacobs, 2019a) was submitted on April 15, 2019, and presented the plan to conduct an IRA consisting of additional operation at the Primary Freeman School District (FSD) Well (WS5) and treatment system, which is owned and operated by FSD to provide drinking water and irrigation for the district. The proposed IRA would have provided additional pumping to increase contaminant mass removal within the Site, downgradient of the GHFF. Since submittal of the IRA Work Plan, FSD has declined access to the Primary FSD Well (WS5) and treatment system because of concerns regarding additional fatigue to the well and treatment system. Because the Primary FSD Well (WS5) and treatment system could not be used as part of an IRA, additional IRA options were evaluated and presented in the Revised IRA Work Plan (Jacobs, 2019b). The revised IRA work plan recommended low-flow groundwater extraction (approximately 1 gallon per minute [gpm]) from a new extraction well located at the GHFF where carbon tetrachloride concentrations in groundwater are the highest. The extracted groundwater would be temporarily stored in containers for routine offsite transportation and disposal. This IRA was rejected by the Washington State Department of Ecology (Ecology) (Treccani, 2019b), because Ecology determined it would not achieve the stated IRA requirement to "…remove contaminant mass and *lessen the risk to downgradient drinking water receptors"* (Treccani, 2018). This third revised IRA work plan will supersede and replace the previously submitted IRA work plans.

1.1 Regulatory Framework

RI and other activities were conducted from May 2016 through August 2019 at the Site in accordance with the 2015 Enforcement Order No. DE 12863 (Order) issued to UPRR and CHS by Ecology (Ecology, 2015). The purpose of the 2015 Order was to require the completion of an RI and feasibility study (FS) at the GHFF where there has been a suspected historical release. Ecology identifies carbon tetrachloride and chloroform as constituents of concern. The 2015 Order required an RI to define the extent of impacted media at the GHFF.

In compliance with the Order, an RI has been conducted in accordance with the Model Toxics Control Act Cleanup Regulation (Chapter 173-340 Washington Administrative Code [WAC]). The Site was listed on the U.S. Environmental Protection Agency (EPA) National Priorities List with the EPA site identification WAN001003081 on September 30, 2015. The draft RI report was submitted to Ecology on September 1, 2018 (Jacobs, 2018). A combined updated RI/FS report was submitted to Ecology on December 13, 2019 (Jacobs, 2019c).

1.2 Purpose and Scope

On September 12, 2018, EPA provided a draft version of the Optimization Review Report (EPA, 2018). The Optimization Review Report presents an independent study funded by EPA that evaluates existing data, discusses the conceptual site model (CSM), analyzes remedy performance, and provides suggestions for improving protectiveness, reducing cost, and making progress toward site closure. One recommendation in the Optimization Review Report was to conduct an IRA consisting of full-time operation at the Primary FSD Well (WS5) and treatment system (Figure 1-2).

In response to a request (UPRR, 2018) to extend the submittal of the RI/FS report, Ecology requested that UPRR develop an IRA that could include the EPA recommendation or other IRA options “to remove contaminant mass and lessen the risk to downgradient drinking water receptors” (Ecology, 2018).

IRAs are remedial actions that partially address the cleanup of a site and that may occur at any time during the cleanup process. Regulatory approved IRAs may be conducted under the Order. The WAC 173-340-430 states that IRAs are conducted because of one or more of the following reasons:

- They are technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance.
- They correct a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed.
- They are needed to provide for completion of the RI/FS or design of the cleanup action.

The purposes of this third revised IRA work plan are as follows:

- Present an alternative IRA capable of removing contaminant mass and lessening the risk to downgradient drinking water receptors.
- Propose data quality objectives (DQOs) for the recommended IRA.
- Describe the tasks necessary to construct and operate the recommended IRA.

1.3 Report Organization

This third revised IRA work plan is organized into the following sections:

- **Section 1, Introduction,** presents the purpose and general organization of this third revised IRA work plan.
- **Section 2, Interim Remedial Action Recommendation,** describes the evaluation and results of IRA selection and recommends an alternative IRA.
- **Section 3, Data Quality Objectives,** proposes data quality objectives (DQOs) associated with the recommended IRA.
- **Section 4, Interim Remedial Action Implementation,** describes the implementation tasks associated with the recommended IRA.
- **Section 5, References,** presents the references used in preparation of this document.

1.4 Site Background

A summary of the Site background and history, geology and hydrogeology, Site characterization, and CSM is presented in the RI Report (Jacobs, 2018). An updated summary of geology and hydrogeology, Site characterization, and CSM is presented in the RI/FS report.

2. Interim Remedial Action Recommendation

RI activities were conducted through August 2019 to better understand the hydrogeologic framework and extent of carbon tetrachloride in groundwater that are critical for the refinement of the CSM and development/evaluation of remedial action solutions. The most recent investigation activities completed in August 2019 included geologic and hydrogeologic testing and monitoring well installation within boreholes generally along the centerline of the carbon tetrachloride plume. The results of these investigation activities provided the data necessary to refine the existing CSM adequate for developing a groundwater model and evaluating remedial action options for the Site. These data, combined with previous data collected at the Site and an updated, calibrated groundwater model, were used to evaluate remedial action options with the potential to achieve the stated IRA requirement to "…remove contaminant mass and lessen the risk to downgradient drinking water receptors" (Treccani, 2018). Remedial action evaluation primarily focused on hydraulic technologies (groundwater recirculation). The recommended IRA was developed based on the evaluation of multiple groundwater extraction/treatment/reinjection scenarios. The numerical groundwater model was used to optimize placement of the IRA extraction and injection wells to capture the core of the plume and more quickly reduce concentrations upgradient of impacted supply wells. Extensive technical information, including a groundwater model, is presented in the RI/FS report to support selection and implementation of the proposed extraction/injection remediation system.

The recommended IRA consists of groundwater recirculation (extraction, treatment, and reinjection), with the following components:

- Groundwater extraction at one new well in the core of plume in the vicinity of well MW-19D and well cluster MW-27 through MW-31
- Treatment of extracted groundwater aboveground using air stripping and/or liquid phase granular activated carbon (LGAC) at a treatment plant at the GHFF
- Injection (recirculation) of treated groundwater at up to 4 four new wells installed up- and cross-gradient of the plume

A plan view layout of the extraction/injection network is presented in on Figure 2-1, and a cross-section view is shown in on Figure 2-2. The proposed IRA provides good hydraulic capture of the core of impacted groundwater and provides effective clean water flushing through the aquifer. The proposed extraction well location was selected because it is within a relatively high concentration area just upgradient of water supply wells, and is within a fairly uniform fractured basalt unit that will facilitate effective contaminant mass removal. The proposed injection wells are at the up- and cross-gradient margins just outside of the existing carbon tetrachloride plume and will enhance aquifer restoration efforts by directing clean water flushing toward the extraction well (Figure 2-1). The injections are also intended to mitigate potential aquifer dewatering from groundwater extraction alone. The upgradient injection wells at the GHFF are intended to provide flushing of the upper unconsolidated zone while the cross-gradient injection wells east and west of the extraction well will provide flushing of the underlying fractured basalt. Air stripping and/or LGAC will be used to remove carbon tetrachloride from extracted groundwater before groundwater is reinjected into the aquifer zones identified above.

The extraction/injection remediation system will be initially implemented as an IRA. As presented in the RI/FS report, the remediation system will be integrated into the final remedy proposed for the Site.

3. Data Quality Objectives

Ecology required an IRA "to remove contaminant mass and lessen the risk to downgradient drinking water receptors" (Ecology, 2018). It is expected that the proposed IRA will achieve these goals. The DQOs for the proposed IRA include the following:

- Remove contaminant mass from the core of plume, thereby reducing contaminant concentrations in groundwater and lessening the risk to downgradient drinking water receptors.
- Document and evaluate hydraulic and hydrogeochemical effects of the IRA on the local groundwater aquifers, the existing contaminant plume, and the domestic water supply wells to support final remedy design.

Groundwater carbon tetrachloride concentrations close to the proposed extraction well and at the GHFF are in the range of 400 to 500 micrograms per liter (µg/L). The extraction rate that will be applied during the IRA will be determined during field testing. However, it is anticipated that it could range from 30 to 60 gpm. (Note: the IRA operational flow rate will be balanced based on the ability to inject treated water, the desire to not dewater the existing water supply wells, and to optimize mass removal). The proposed IRA is projected to remove a significant mass of carbon tetrachloride from the Site and will reduce concentrations over time to meet the first DQO. The second DQO will be met as the IRA is operated and optimized over time.

4. Interim Remedial Action Implementation

This section presents the construction and operation of the components of the proposed IRA, as well as permitting, monitoring, and reporting requirements. The FSD and GHFF lessee (CHS) will be coordinated with before any construction or operation of the IRA occur.

4.1 Access and Permitting

Anticipated permits include the following:

- State well permits will be obtained by the driller for the new extraction and injection wells installed as part of the IRA.
- Access agreements will be obtained from FSD for construction on FSD property.
- An easement, or similar document, will be obtained from Washington State Department of Transportation for conducting construction activities adjacent to and across State Highway 27.
- A state permit will be obtained under the Underground Injection Control program for regulating the discharge (reinjection) of treated water within injection wells.
- A notice of construction and any other required permits will be obtained from Spokane Regional Clean Air Agency for regulating emissions from the treatment system.

4.2 Field Preparation Activities

Anticipated field preparation activities include the following:

- Procuring contractors
- Ordering equipment and materials
- Preparing project instructions and conducting operation readiness review meetings
- Updating the health and safety plan
- Performing utility clearances prior to subsurface work.
- Providing monthly status updates to Ecology prior to and during construction activities

4.3 Extraction Well Installation

A new groundwater extraction well will be drilled and installed at a location adjacent to monitoring well MW-19D, where carbon tetrachloride concentrations in groundwater have historically been relatively higher than in other areas of the Site (Figure 2-1). The new extraction well is anticipated to be screened to capture groundwater from the base of the unconsolidated overburden aquifer and through the underlying fractured basalt aquifer. Borehole geophysics and hydrophysical/packer testing will be conducted within a separate, adjacent pilot-testing borehole to support the final well construction and screen interval design.

A pilot-testing borehole will be drilled and installed using an air-rotary drilling rig with nominal 6-inch-diameter drive casing. The 6-inch-diameter drive casing will be advanced continuously to, and seated within, the top of the basalt (anticipated depth of 90 to 100 feet below ground surface [bgs]) to seal off and support the borehole within the unconsolidated overburden portion of the aquifer. Air-rotary drilling would then continue as 4-inch-diameter open borehole through the fractured basalt to a depth of approximately 5 feet below the top of the basement granitic gneiss.

Upon reaching the target depth and ensuring a stable pilot-testing borehole, downhole geophysical and hydrophysical logging will be deployed to evaluate the extraction capacity of the borehole and identify preferential flow intervals. Downhole logging may include, but not be limited to, flow logging using impeller and heat flow probes, fluid resistivity and temperature logging, video logging, and caliper logging. Borehole hydrophysical testing is anticipated to be conducted under both ambient and pumping conditions and will be performed by a contractor specializing in this work. Preferential flow zones identified during logging will be isolated using packers and collected analytical samples. Each targeted packer-sampling interval will be purged (developed) for 1 hour to remove any drilling fluids from the isolated fracture zone, with purge water monitored for temperature, pH, and specific conductivity using a field water- quality instrument and a flow-through cell. A groundwater sample will be collected following purging and will be submitted under chain of custody to a Washington-certified laboratory for analysis of volatile organic compounds (VOCs), dissolved metals (target analyte list plus iron and manganese), total organic carbon, and geochemical parameters.[1] Following sample collection, pumping within the packer interval will be increased to evaluate the potential maximum achievable pumping within the isolated zone; pressure transducers will be deployed within the packed zone and below/above the packed zone to evaluate potential packer leakage. Cumulative packer interval pumping rates will be used to estimate the achievable pumping rate for the overall borehole and to identify specific target well screen intervals for well construction.

Following completion of the various borehole logs and tests, the pilot-testing borehole will be abandoned by grouting and an adjacent borehole will be drilled for installation of the extraction well. The well-construction borehole will be drilled with the same rig using nominal 10-inch-diameter drive casing advanced continuously to, and seated within, the top of the basalt (anticipated depth of 90 to 100 feet bgs) to seal off and support the borehole within the unconsolidated overburden aquifer. Air-rotary drilling will then continue as 10-inch open borehole through the fractured basalt to approximately 5 feet below the selected extraction well screened interval design depth, and the extraction well will be assembled and installed within the open borehole. The extraction well will consist of 6-inch-diameter Schedule 80 polyvinyl chloride (PVC) casing and 6-inch-diameter stainless steel continuous wire-wrap well screen with 0.060-inch screen openings. Depending on the testing results, the extraction well may be constructed with either a single screen or multiple screened sections to target the high flow and/or high concentration intervals. The new extraction well will incorporate a threaded bottom cap and 5-foot-long PVC sump, the selected well screen length or specific screened intervals, blank casing to the ground surface, and well centralizers with spacing no greater than at the top, middle, and bottom of the well screen and at the midpoint and top of the upper blank casing. The well will be freely hung inside the borehole so that the bottom cap is 4 to 6 inches above the bottom of the borehole.

Annular extraction well materials will be placed within the lower open borehole through the fractured basalt aquifer and then continue as the outer drive casing is extracted. From the bottom of the borehole upwards, these materials will consist of bentonite chips or coated pellets from the bottom of the borehole to the mid-point of the bottom sump, 6x12 mesh clean quartz filter pack sand to 3 feet above the top of the well screen, 1 foot of fine transition sand, a 5-feet- thick hydrated bentonite seal, and bentonite grout to approximately 12 to 18 inches bgs. The extraction wellhead will be completed within a flush-mounted well vault set within a concrete pad, facilitating a belowground connection of the extraction piping and electrical supply.

The new extraction well will be developed no sooner than 24 hours following completion using a combination of surging, bailing, and pumping techniques. Portable field instruments (pH, temperature conductivity, turbidity, and dissolved oxygen) will be used with a flow-through cell to monitor extracted groundwater during the pumping phase of development, which will continue until field parameters stabilize.

[1] Geochemical parameters consist of alkalinity, anions (chloride, sulfate, and nitrate), major cations (sodium, potassium, calcium, magnesium), chemical oxygen demand, nitrate plus nitrite, sulfide, and total dissolved solids.

The new extraction well will be equipped with a nominal 4-inch-diameter submersible pump incorporating a check-valve and using 2-inch-diameter Schedule 80 PVC drop piping to place the pump inlet at approximately the middle of the final selected screen interval. A water level transducer will be installed in the well. The extraction wellhead will include fittings and valves, allowing the well to be isolated from the rest of the distribution and treatment system. A data logging flow-rate and volume-totalizing meter will be installed either at the wellhead or at the treatment plant.

4.4 Injection Well Installation

Two injection wells will be installed upgradient (north) of the extraction well at the GHFF and two cross-gradient injection wells will be installed east and west of the extraction well at the margins of impacted groundwater (Figure 2-1). The upgradient injection wells will provide flushing of the upper unconsolidated zone at the GHFF while the cross-gradient injection wells will provide flushing of the underlying fractured basalt. The two injection wells at the GHFF will be installed using air rotary techniques to advance a 10-inch- diameter drive casing through the upper unconsolidated zone to the top of the fractured basalt. Once the top of the basalt has been identified, the borehole will be grouted to approximately 3 feet above the top of the basalt and then the GHFF injection wells will be assembled and installed within the drive casing. Each injection well will consist of 6-inch-diameter Schedule 80 PVC casing and 6-inch-diameter stainless steel continuous wire-wrap well screen with 0.020-inch screen openings. The GHFF injection wells will incorporate a threaded bottom cap and 2-foot-long Schedule 80 PVC sump, an anticipated well screen length extending to approximately 20 feet bgs, blank casing to the ground surface, and well centralizers with spacing no greater than at the top, middle, and bottom of the well screen and at the midpoint and top of the upper blank casing. Each injection well will be freely hung inside the drive casing so that the bottom cap is 4 to 6 inches above the bottom of the borehole. The final GHFF injection wells will be screened within the upper unconsolidated zone at depths from approximately 20 feet bgs to approximately 3 to 5 feet above the top of the basalt, which is anticipated at a depth of approximately 45 feet bgs based on nearby existing soil borings and wells. This construction is intended to force injected water at the GHFF through the unconsolidated zone materials rather than facilitating preferential flow through the higher-permeability interface with the underlying fractured basalt.

The cross-gradient injection wells at the plume margins east and west of the proposed extraction well (Figure 2-1) will be drilled in the same manner as the extraction well and include the same borehole testing program to identify the dominant permeable zones, determine the injection capacity at the selected locations, and determine the final well construction design. Open screen intervals within these two injection wells are anticipated to be within the range of 100 to 200 feet bgs (within fractured basalt). These injection wells will use the same construction materials as those specified for the extraction well, with the exception of using a 2-foot-long sump.

Annular injection well materials will be placed as the drive casing is extracted, and within the lower open borehole through the fractured basalt aquifer for the cross-gradient injection wells, and then continue as the drive casing is extracted. From the bottom of the borehole upwards, these materials will consist of bentonite chips or coated pellets from the base of the borehole to mid-way up the bottom sump, 6x12 mesh (8x16 mesh for the GHFF injection wells) clean quartz filter pack sand to 3 feet above the top of the well screen, 1 foot of fine transition sand, a 5-foot-thick hydrated bentonite seal, and bentonite grout to approximately 12 to 18 inches bgs. The injection wellheads will be completed within a flush-mounted well vault set within a concrete pad, facilitating a belowground connection of the injection piping and any electrical supply.

The new injection wells will be developed no sooner than 24 hours following completion using a combination of surging, bailing, and pumping techniques. Portable field instruments (pH, temperature conductivity, turbidity, and dissolved oxygen) will be used with a flow-through cell to monitor extracted groundwater during the pumping phase of development, which will continue until field parameters stabilize.

The injection wellheads will include fittings and valves, allowing each injection well to be isolated from the rest of the distribution and treatment system and accommodating any required injection-distribution piping, such as a drop pipe. A water level transducer will be installed in each well at a depth near the top of the well screen. A separate data logging rate and volume-totalizing meter will be installed for each injection well at either the wellhead or the treatment plant.

4.5 Treatment Plant and Equipment Installation

The proposed IRA extracts groundwater from a mid-plume location, conveys this water to a new groundwater treatment plant at the GHFF, and then conveys and recirculates treated water through the local aquifer via four injection wells (Figure 2-1). The proposed IRA provides treatment of VOCs in groundwater using either LGAC alone or air stripping combined with potential off-gas treatment using vapor-phase granular active carbon (VGAC). If an air stripper is used, the need for VGAC emission controls will be confirmed following permitting with the Spokane Regional Clean Air Agency. This subsection describes the various components associated with the groundwater conveyance and treatment systems.

4.5.1 Groundwater Conveyance and Electrical System

A network of piping will convey groundwater from the new extraction well to the treatment plant and distribute treated water to the four new injection wells. New double-containment water conveyance pipelines, anticipated to be 4-inch high density polyethylene (HDPE) interior piping and 6-inch HDPE outer containment piping, will be installed within trenches in accordance with local and state requirements (anticipated to be 24-inches bgs, embedded in sand or fine gravel, with backfill of excavated native materials and surface finish matching surrounding materials. The anticipated locations of the wells and conveyance pipelines are shown on Figure 2-1. Final locations and alignment will be based on Site access, permits, and pre-mobilization field consultation with FSD and installation subcontractors to identify accessible locations that minimize disruption to FSD operations and the surrounding community.

Electrical power and process control wiring for the extraction well pump and any powered components at the injection wells will be provided by routing wiring within the groundwater conveyance trench network before backfilling. Electrical power to the well locations will be tied into the new treatment plant that will incorporate a new power drop from the CHS facility. The new power drop will be constructed in coordination with the local power company and CHS. Connections to existing power infrastructure may be either overhead or buried similar to conveyance trenching.

4.5.2 Groundwater Treatment Plant

A new groundwater treatment system will be constructed within a pre-engineered building anticipated to be placed just east of the grain silos at the GHFF. The building size is anticipated to be in the range of 1,200 square feet and the final location and orientation of the building will be determined in consultation with CHS. The proposed groundwater treatment technologies will either be LGAC and/or air stripping to remove volatile contaminants from the groundwater. If an air striper is used, off-gas from the air stripper may be treated by VGAC, if necessary, based on permitting requirements. The treatment system will be designed to allow for a wide range of potential influent flow rates ranging from only a few gpm to the maximum proposed system design flow of 60 gpm. However, the actual flow rate will be based on borehole testing, additional groundwater modeling, and observations made during operation of the system. The treatment system capacity design is further based on the range of recently-measured carbon tetrachloride (up to approximately 500 µg/L, which includes a 25 percent factor of safety) and chloroform (up to approximately 28 µg/L, which includes a 25 percent factor of safety) concentrations in the vicinity of the proposed extraction well, corrected to the 95 percent confidence interval, and considering a 50 percent excess multiplier allowing for fluctuation of concentrations. Given these assumptions, the design criterion of the treatment plant is to treat up to 60 gpm influent at carbon tetrachloride and chloroform concentrations of 730 and 40 µg/L, respectively. While the system is designed to accommodate current contaminant concentrations in groundwater, the influent concentrations are anticipated to decrease markedly over time. As part of the permitting process for reinjection of treated water, applicable water quality criteria will be established. It is anticipated that water must be treated in accordance with WAC 173-200-040, which establishes water quality criteria for carbon tetrachloride and chloroform as 0.3 and 7.0 µg/L. Therefore, the treatment system will be designed to take these discharge limits into consideration.

As shown in the general process diagram in (Figure 4-1), the proposed process consists of (1) the extraction well and conveyance to the treatment plant, (2) an influent tank, (3) a feed pump, (4) a pre-treatment bag filter, (5) groundwater treatment using options of either direct LGAC or an air stripper with VGAC off-gas treatment, (6) an effluent tank, (7) an injection pump, (8) a pre-injection bag filter, and (9) the injection wells. If LGAC is selected as the treatment technology in the final design, the air stripper and VGAC units will be eliminated.

The injection wells used at any given time during the IRA may vary based on observations. For example, one to all four of the wells may be used for injection based on observed water levels and aquifer concentration trends. System operations will be adaptive to optimize remedial performance and aquifer restoration while limiting impacts to local domestic water users. The treatment plant will include instrumentation and controls necessary to allow variation in the groundwater extraction rate, automate removal of contaminants of concern, and allow customizable distribution of treated water to the injection well network.

4.6 Waste Management

Soil investigation-derived waste (IDW) from drilling and trenching activities will be managed in accordance with protocols provided in the RI/FS Work Plan (CH2M, 2016). Water IDW pumped during testing and development of the extraction and injection wells will be contained at the Site and transported offsite for disposal.

4.7 Operations, Maintenance, and Monitoring

Following construction, the new IRA groundwater extraction, treatment, and recirculation system will undergo system startup and shakedown testing to ensure all components are operational and control systems function as designed. An operation and maintenance (O&M) plan will be prepared, and made available to Ecology if requested, that describes the methodology to operate and maintain the system. The O&M plan will contain information regarding start-up, normal, and emergency operating procedures; descriptions of equipment and facilities; stakeholder responsibilities; names, addresses, and phone numbers of all key personnel; all contractors and suppliers; and state and local officials. The O&M Plan will become a training manual to provide personnel with a source reference while they learn to operate the facilities. The O&M Plan will be used by experienced operating personnel to monitor normal procedures for changes or emergency conditions; as a source for names and phone numbers when emergency notification is required; and as a check of proper maintenance procedures.

Once the system is fully operational, system monitoring will be conducted to evaluate and document system operation, perform routine system inspections and maintenance, track groundwater extraction concentrations and volume, and evaluate system performance against the objectives of the IRA. The data obtained during operation of the IRA will also be used to support final remedial action design, as appropriate. The IRA is intended to operate until a final remedy has been implemented or until it is no longer determined to be effective.

In support of the weekly, monthly, and quarterly monitoring programs, the following wells (identified as the IRA monitoring network), at a minimum, will be equipped with data-logging water level transducers:

- The extraction well and four injection wells
- Monitoring wells adjacent to the extraction well including MW-19D and well cluster MW-27, MW-28, MW-29, and MW-30.
- Local domestic well surrogates MW-10S, MW-11S, MW-13S, and MW-14D; MW-30 will also be considered as a domestic well surrogate
- GHFF monitoring wells MW-9D, MW-9S, and MW-9U

- Downgradient monitoring wells MW-4D, and MW-17D, and well cluster MW-26, MW-35, and MW-36

Sampling conducted in support of system monitoring activities will be performed in accordance with the sampling and analysis plan and quality assurance project plan presented in the RI/FS Work Plan (CH2M, 2016).

4.7.1 System Startup, Shakedown, and Initial Operation

System startup and shakedown testing will be conducted on individual components as they are installed and for the full system once construction is complete. The testing will confirm that (1) all major system components are operating as designed, (2) there are no leaks within the system; , (3) all valves, gauges, meters, and control systems function properly, (4) the LGAC or air-stripper and VGAC off-gas treatment systems are removing constituents of concern and achieving groundwater injection and atmospheric effluent discharge requirements, (5) groundwater extraction and treated water distribution among the four injection wells can be adjusted and controlled,; and (6) measured extraction flows match the measured injection flows. The shakedown process is anticipated to occur over the first 2 to 4 weeks of system operation.

After successful testing of all system components, initial system operation will occur at low extraction rates in the range of 5 to 10 gpm. Incremental increases in the extraction rate (on the order of 5 gpm) will be made at intervals no less than weekly during the first 8 weeks of system operation. This will allow the impact of pumping on surrounding monitoring and domestic wells (via selected surrogates) to be evaluated based on findings from the weekly monitoring program described in Section 4.6.2. Potential further increases in the extraction rate will be evaluated as part of longer-term performance monitoring and optimization (Section 4.6.5) using data collected during the subsequent monthly and ongoing quarterly monitoring program.

4.7.2 Weekly/Monthly Monitoring Program

The IRA system will be inspected weekly for 8 weeks to evaluate and document system operation, including the following:

- Inspect new extraction and injection wellheads, in-vault piping/fitting connections, and totalizing flow meters
- Inspect aboveground extraction and injection piping and fittings, including the sampling port and connections to the treatment system
- Record current flow rate and cumulative extracted and injected groundwater volume from each totalizing flow meter
- Inspect the treatment system including piping, fittings, pumps, blowers, stripper, carbon vessels, instrumentation, control systems, and power supply
- Record readings from all treatment system flow and pressure gauges
- Download depth-to-water transducer data for the new extraction well and each injection well
- Download depth-to-water transducer data from the IRA monitoring network
- Measure and record total VOCs within post-air-stripper off-gas (if this is used as the groundwater treatment technology) using a photoionization detector (PID) at points before the lead VGAC vessel, between the lead and lag VGAC vessels, and after the lag VGAC vessel
- Collect influent and treated effluent water samples at the treatment plant, from sampling ports installed before and after the air-stripper or LGAC treatment processes. These more-frequent early samples will be used to evaluate any changes in influent concentrations because of possible weekly changes in the extraction flow rate and confirm effective treatment during the startup and shakedown process.

After the first 8 weeks, the above monitoring and sampling will be performed on a monthly basis for the first year. After the first year, treatment system monitoring will continue monthly as above with the exception of downloading transducer data from monitoring wells, which will revert to match the routine quarterly groundwater monitoring program for the Site.

4.7.3 Monthly/Quarterly Sampling Program

A groundwater sample will be collected monthly from the new extraction well, using an inline sampling port installed on the extraction pipeline within the treatment plant. If LGAC treatment is the selected treatment technology, water samples will also be collected monthly from sampling ports installed between the lead and lag LGAC vessels and after the lag LGAC vessel. These samples will be used to evaluate the LGAC vessel change-out schedule and confirm treated effluent meets permit requirements before injection. If air stripping and off-gas treatment using VGAC is the selected treatment technology, a treated-effluent water sample will be collected monthly from a sampling port installed after the treatment plant air stripper. Water samples will be handled consistent with the existing UPRR quarterly groundwater monitoring program and will be submitted to a Washington-certified laboratory for analysis of VOCs.

If an air stripper will be used to treat extracted groundwater, vapor samples of the air-stripper off-gas may be necessary to comply with emissions standards or regulations, and the nature and frequency of any such sampling program will be developed in consultation with the Spokane Regional Clean Air Agency. If such samples are required, they are anticipated to be collected using Summa canisters and submitted to a Washington-certified laboratory for analysis of VOCs. The monthly PID readings before and between the VGAC vessels, (described in Section 4.6.2), will be used to determine when to perform a VGAC vessel exchange, which will occur when the influent and effluent vapor concentrations are approximately equal for the lead VGAC vessel. At this point, the lead VGAC vessel will be removed and sent for carbon regeneration, the lag vessel will be placed in the lead position, and a new vessel will be placed in the lag position. A similar vessel exchange process, based on results of monthly water samples between the lead and lag vessels and after the lag vessel, will apply under the LGAC groundwater treatment option.

The existing UPRR quarterly groundwater sampling and monitoring program will continue during the IRA and includes monitoring water levels and collecting groundwater samples from monitoring wells surrounding the new extraction well. Data will be downloaded quarterly from wells equipped with water level transducers, and water levels at other wells will be monitored using standard electronic water level meters.

4.7.4 Injection Well Maintenance

Observations from the above weekly and monthly monitoring events will be used to evaluate the degree of potential injection screen fouling because of biological growth or mineral/chemical scaling. Such fouling or scaling is anticipated to increase injection well pressures versus the initial condition, at the same injection flow rate. Observations of decreased injection efficiency will trigger redevelopment of the affected injection well. Redevelopment may use numerous techniques including brushing, swabbing, jetting, air-lifting, chemical treatment, and pumping, in accordance with the Underground Injection Control program for regulating the discharge (reinjection) of treated water within injection wells. Video logging may also be conducted at this time to evaluate the severity of any scaling or fouling, evaluate the effectiveness of different development techniques, and support an evaluation of any potential routine injection well redevelopment schedule. A specific routine redevelopment schedule may not be necessary for each or all injection wells, and redevelopment may continue on an as-needed basis subject to observations of injection efficiency.

IDW water generated during well redevelopment will be containerized, handled, and disposed of as described in Section 4.5.

4.7.5 Performance Monitoring and Optimization

As described in Section 4.6.1, early operation of the treatment system during shakedown testing and through the first 8 weeks will be at relatively low extraction rates, with incremental flow increases made on a weekly or longer basis subject to evaluation of system and aquifer monitoring results. The conservative incremental increases in extraction rates are intended to be protective of local domestic water users by ensuring there are no significant adverse impacts to water levels within aquifer zones tapped by domestic water wells. Increased extraction rates will only be considered when monitoring data, particularly water levels within the domestic well surrogates MW-10S, MW-11S, MW-13S, MW-14D, and MW-30, do not indicate significant dewatering or decrease in potentiometric head because of operation of the IRA (separate from potential seasonal variation in water levels).

Given the conservative approach to extraction rate increases, it is anticipated that extraction flow rates may be in the range of 20 to 30 gpm by the end of the first 8 weeks. Monitoring over longer time periods will be required to provide sufficient observational data regarding the capture zone for the new extraction well and to gain confidence that new long-term extraction does not adversely impact local domestic water supplies. The reinjection of treated water at the plume margins is anticipated to replenish extracted groundwater and prevent broad declines in aquifer water levels. Similarly, longer-term monitoring is anticipated as necessary to understand alternate injection distribution that may enhance treatment effectiveness or better mitigate potential declines in water levels within isolated portions of the aquifer. The monthly and sitewide routine quarterly monitoring program, in combination with treatment system monitoring data such as total extraction volume, will provide documentation of contaminant mass removal meeting the objective of “to remove contaminant mass and lessen the risk to downgradient drinking water receptors” (Ecology, 2018).

Extraction flow rates in the upper range of the system design criteria (that is, 30 to 60 gpm) will be considered after many months or several quarters of operational data are available to support such a decision. Contaminant concentration and water level trends within various wells will be reviewed in conjunction with extraction/injection flow rates and mass removal data to optimize system performance. Longer-term observations considered favorable during the ongoing optimization process include:

- Maintaining adequate water levels near supply wells. For instance, moderate extraction well pumping may indicate a very localized water level depression at the extraction well and adjacent monitoring well MW-30, while limited water level declines indicative of hydraulic capture and effective groundwater recirculation, but not of dewatering, are present at domestic well surrogates slightly farther away, such as MW-10S and MW-11S (and potentially MW-36). Aggressive pumping that leads to significant water level declines in these domestic well surrogates would not be favorable.
- Decreasing concentration trends at monitoring wells between the injection wells and the extraction well. Such wells may include MW-9D, MW-9S, MW-9U, MW-10S, Out-of-use FSD well W26, and local domestic wells.
- Decreasing concentration trends at plume core monitoring wells including MW-19D, MW-28, MW-29, and MW-30. The rate of concentration decline within these core wells will provide indication of the potential residual mass within the plume and help assess the estimated 17-year remedial timeframe presented in the RI/FS.

4.8 Estimated Project Schedule

It is anticipated that the selected IRA will be implemented approximately 8 months following approval of this third revised IRA work plan. This provides time to design the system, obtain access from property owners, obtain the permits to operate the system, contract drillers/constructors, and construct the system. A summary of the schedule is presented in Table 4-1.

4.9 Reporting

Within 3 months of completion of construction activities associated with the proposed IRA, an IRA construction completion report will be submitted to Ecology in accordance with WAC 173-340-430(7), including the design and construction requirements of WAC 173-340-400. The IRA construction completion report will include a narrative of the construction activities and provide field documentation and as-built drawings (that is, boring and testing logs, well completion diagrams, waste disposal records, sampling and analytical data reports, final piping/electrical alignments, and treatment system as-built drawings).

Routine IRA performance status updates will be submitted to Ecology during IRA operation. Updates are anticipated to be submitted biweekly for the first 3 months of system operation and then quarterly, in conjunction with the quarterly monitoring program status updates. The status updates will primarily provide data summaries and routine field documentation. Limited status update narratives will focus on significant disruptions to routine system operation. The regular status updates will highlight the following:

- Description of any significant disruption to the continuous IRA system operation, such as system troubleshooting, equipment malfunction and replacement, or major power loss
- Adverse findings of routine system inspections and the associated resolution
- A table documenting, and a figure illustrating, time-series data for the measured weekly flow rates and average weekly extraction volume. The table will document the cumulative extraction volume over the duration of the IRA
- Laboratory analytical reports and summary data table for monthly samples from the new extraction well
- Treatment effectiveness in terms of mass removal and concentration reduction. As stated in the RI/FS report, designated cleanup levels for carbon tetrachloride and chloroform are not expected to be achieved at a conditional point of compliance until the remediation system has been operating for 17 years.
- Field documentation

5. References

CH2M HILL, Inc. (CH2M). 2016. *Remedial Investigation/Feasibility Study Work Plan, Grain Handling Facility at Freeman, Freeman, Washington*. April.

Jacobs Engineering Group Inc. (Jacobs). 2018. *Remedial Investigation Report, Grain Handling Facility at Freeman, Freeman, Washington*. September 1.

Jacobs Engineering Group Inc. (Jacobs). 2019a. *Interim Remedial Action Work Plan, Grain Handling Facility at Freeman, Freeman, Washington*. April 15.

Jacobs Engineering Group Inc. (Jacobs). 2019b. *Revised Interim Remedial Action Work Plan, Grain Handling Facility at Freeman, Freeman, Washington*. September 13.

Jacobs Engineering Group Inc. (Jacobs). 2019c. *Remedial Investigation/Feasibility Study Report, Grain Handling Facility at Freeman, Freeman, Washington*. Draft. December 13.

Treccani, Sandra, Washington State Department of Ecology. 2019a. Personal communication (email) with Anne Walsh, Union Pacific Railroad. Regarding GHFF meeting summary from July 25. July 30.

Treccani, Sandra, Washington State Department of Ecology. 2019b. Personal communication (email) with Anne Walsh, Union Pacific Railroad. Regarding GHFF: Revised Interim Remedial Action Work Plan, Grain Handling Facility at Freeman, Freeman, Washington. September 18.

Union Pacific Railroad. 2018. Enforcement Order No. 12863 - Request for Extension of Schedule. September 17.

U.S. Environmental Protection Agency (EPA). 2018. *Optimization Review Report, Remedial Investigation Optimization Study, Grain Handling Facility at Freeman*. Freeman, Spokane County, Washington. EPA Region 10. Draft. September 12.

Washington State Department of Ecology (Ecology). 2015. Enforcement Order DE 12863. November 12.

Washington State Department of Ecology (Ecology). 2018. Grain Handling Facility at Freeman Site – Response to Feasibility Study Schedule Extension Request. October 19.

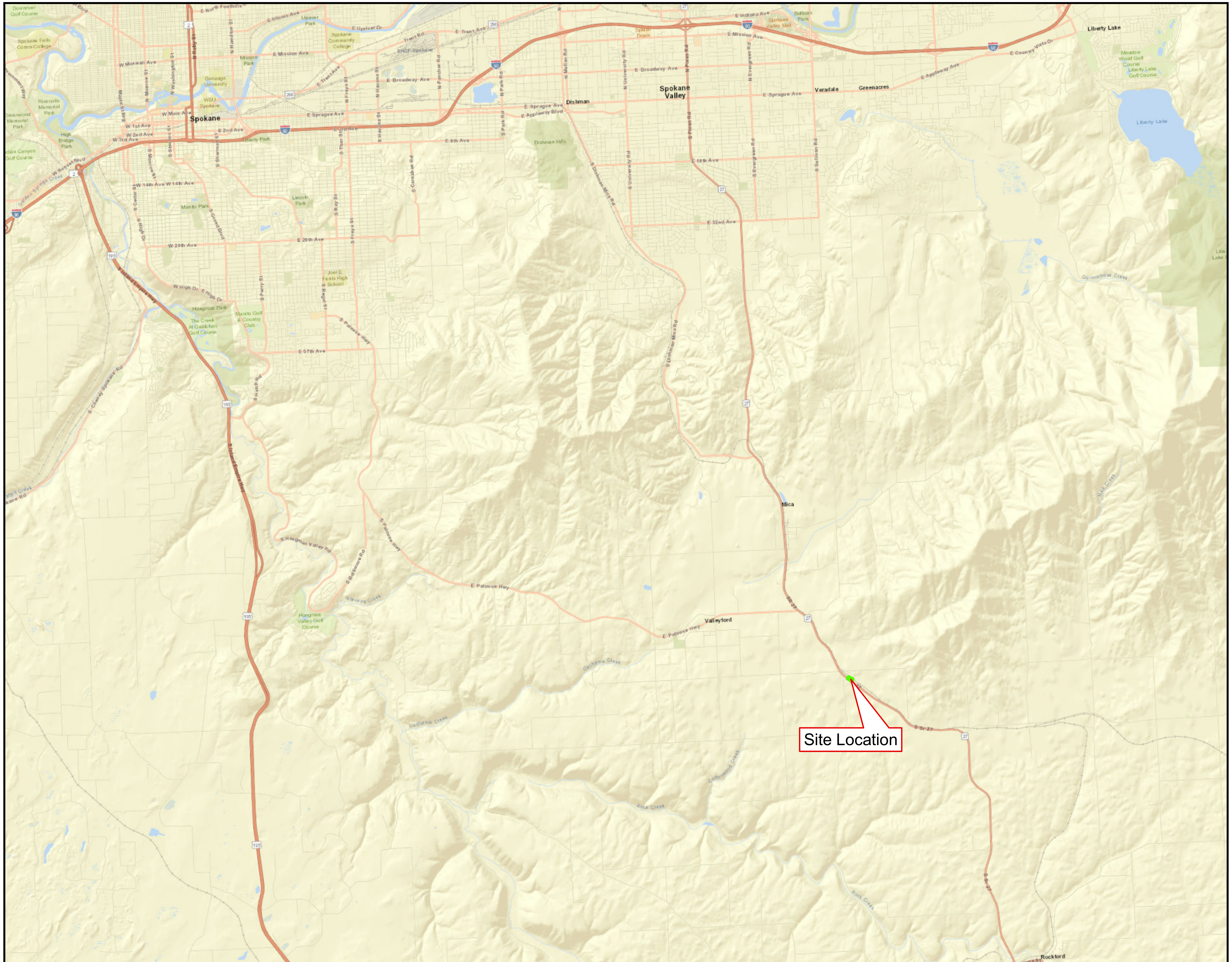
Table

Table 4-1. Estimated Project Schedule

Activity	Tentative Schedule
Submittal of Third Revised Interim Remedial Action (IRA) Work Plan	January 2020
Regulatory review and approval of Third Revised IRA Work Plan, including public participation	January 2020– February 2020 (2 months)
Remedial design	November 2019 – January 2020 (3 months)
Contractor procurement	February 2020 (1 month)
Permit procurement and preconstruction preparation	March – May 2020 (3 month)
Remedial action construction	June – July 2020 (2 months)
Remedial action initiation	August 2020

Note:
Some tasks may be initiated prior to completing the proceeding task

Figures



LEGEND

Grain Handling Facility at Freeman

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

N

0 5,000 10,000 20,000 Feet

Figure 1-1
Site Location
Third Revised Interim Remedial Action Work Plan
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS

LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Freeman School District
- Stream

Service Layer Credits:
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 200 400 800 Feet

Figure 1-2
Site and Surrounding Features
Third Revised Interim Remedial Action Work Plan
Grain Handling Facility at Freeman,
Freeman, Washington

\\BROOKSIDEFILES\GIS_SHARE\ENBG\00_PROJ\U\UPRR\UPRR_FREEMAN\MAPS\REPORT\2019\REVIRAWP\FIG1-2_SITE_FEATURES.MXD GMOON 10/30/2019 11:56:26 AM

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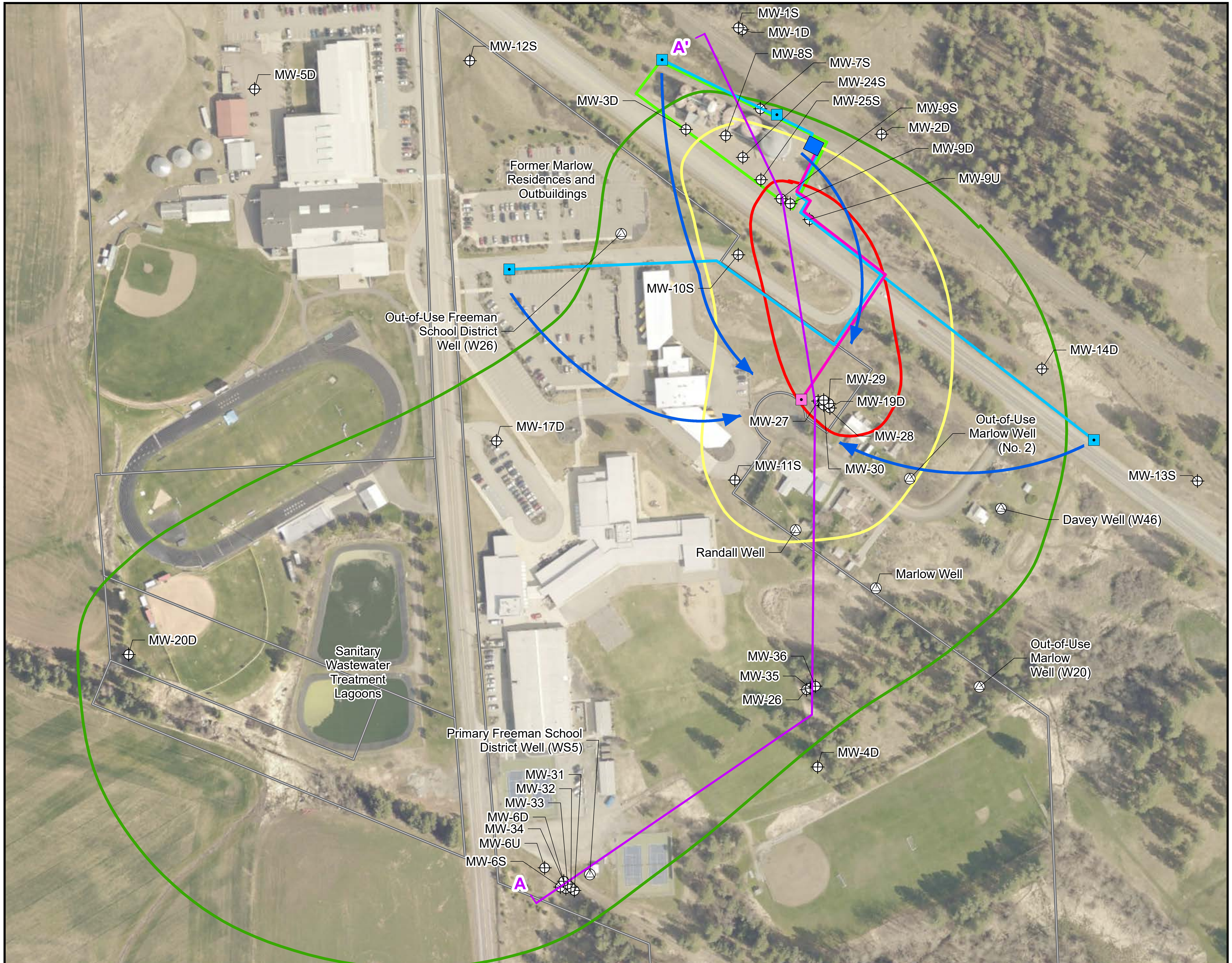

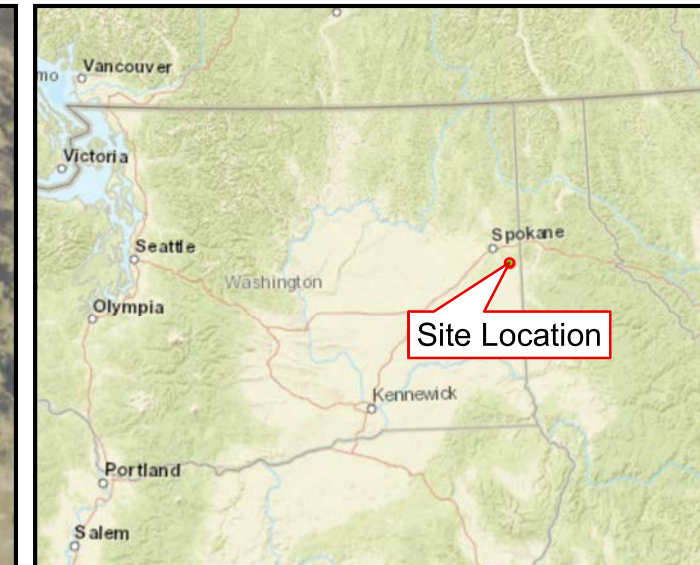

LEGEND

- Monitoring Well
- Domestic Well
- Grain Handling Facility at Freeman
- Freeman School District
- Proposed Treatment Plant
- Proposed Injection Well
- Proposed Extraction Well
- Proposed Injection Pipeline
- Proposed Extraction Pipeline
- Cross Section Alignment (See Figure 2-2)
- Typical Groundwater Recirculation Flow Lines

Carbon Tetrachloride Concentration (Basalt Aquifer)

- 10 ug/L
- 100 ug/L
- 400 ug/L

Note:
The final location and alignment of interim remedial action infrastructure will be determined as part of final system design, and in consultation with the Freeman School District, and Cenex Harvest States, Inc.

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 120 240 480 Feet

Figure 2-1
Interim Remedial Action Site Features and Proposed Infrastructure
Third Revised Interim Remedial Action Work Plan
Grain Handling Facility at Freeman,
Freeman, Washington

JACOBS

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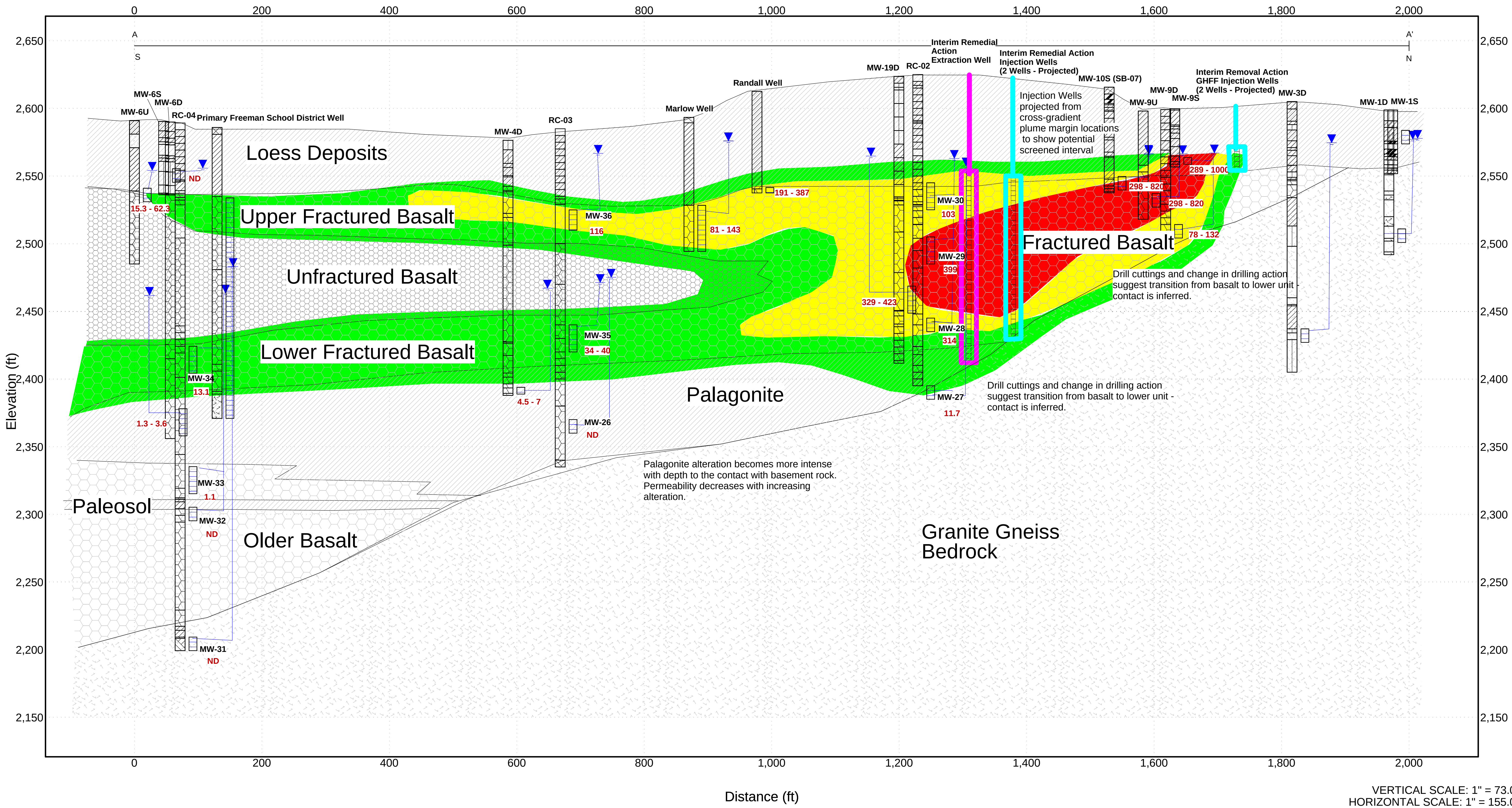

11X17 STICK LOG WITH LEGEND; DRAFT CH2M GEOTECH_12.GLB; FREEMAN LOGS_7-26-19.GPJ; CH2M GEOTECH_12.GDT; 11/8/19

JACOBS

LITHOLOGY GRAPHICS

Organic Clay or Silt · BR-Lean Clay · Well-Graded Sand · Basalt · Silt · Fat Clay · Well-Graded Sand with Silt · Poorly Graded Sand with Silt · BR-Lean Clay · Clayey Sand · Clayey Gravel · Poorly Graded Sand · Bedrock

LEGEND

— — — — — Inferred Geologic Contact

Note:
Ground surface shown is connected between boring logs and does not represent actual surface topography on the section line; refer to Figures 3-1 and 3-2 for surface topography.

NM Not Measured

1.1 Carbon Tetrachloride sampling results in ug/L

Carbon Tetrachloride Concentration

- >400 ug/L
- 100 - 400 ug/L
- 10 - 100 ug/L

BOREHOLE LEGEND

B-1 — BOREHOLE OR WELL NUMBER

WELL SCREEN INTERVAL

LITHOLOGY GRAPHIC COLUMN

GROUNDWATER LEVEL (Sep. 2019)

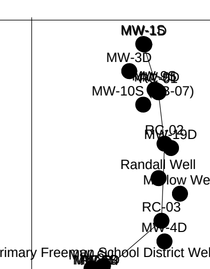

Figure 2-2
Interim Remedial Action Cross Section
Third Revised Interim Remedial Action Work Plan
Grain Handling Facility at Freeman
Freeman, Washington

Project Number: 661508

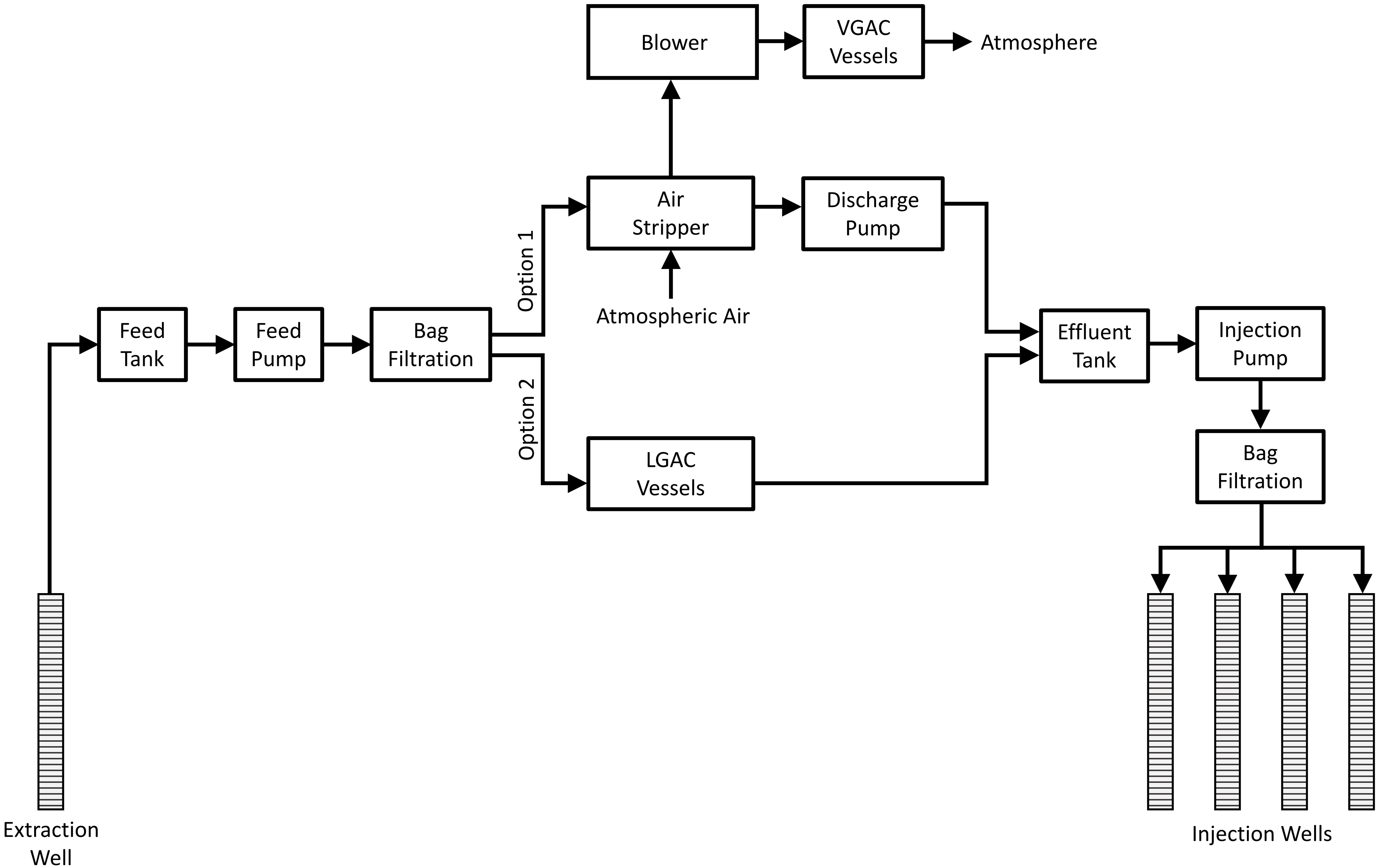

Figure 4-1
General Process Flow Diagram
Third Revised Interim Remedial Action Work Plan
Grain Handling Facility at Freeman
Freeman, Washington