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May 9, 2019

Mr. Garin Schrieve, P.E.
Washington State Dept. of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

Subject: Kaiser Mead NPL – Submittal of Final Interim Action Workplan

Dear Mr. Schrieve:

On behalf of the Mead Custodial Trust, enclosed please find two paper copies of the revised Final Interim Action Workplan for the Kaiser Mead Site.

Please call me at (406) 257-4204 if you have any questions.

Sincerely,

Scott Mason

Scott Mason, LHG.
Senior Geochemist

Enclosures: Final Interim Action Workplan for the Kaiser Mead NPL Site

c: Dan Silver, Mead Custodial Trust (electronic copy only)
Bob Pender, AIG (electronic copy only)

INTERIM ACTION WORKPLAN
KAISER MEAD NPL SITE

Prepared for:

Mead Custodial Trust
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April 2019

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INTERIM ACTION WORKPLAN
KAISER MEAD NPL SITE

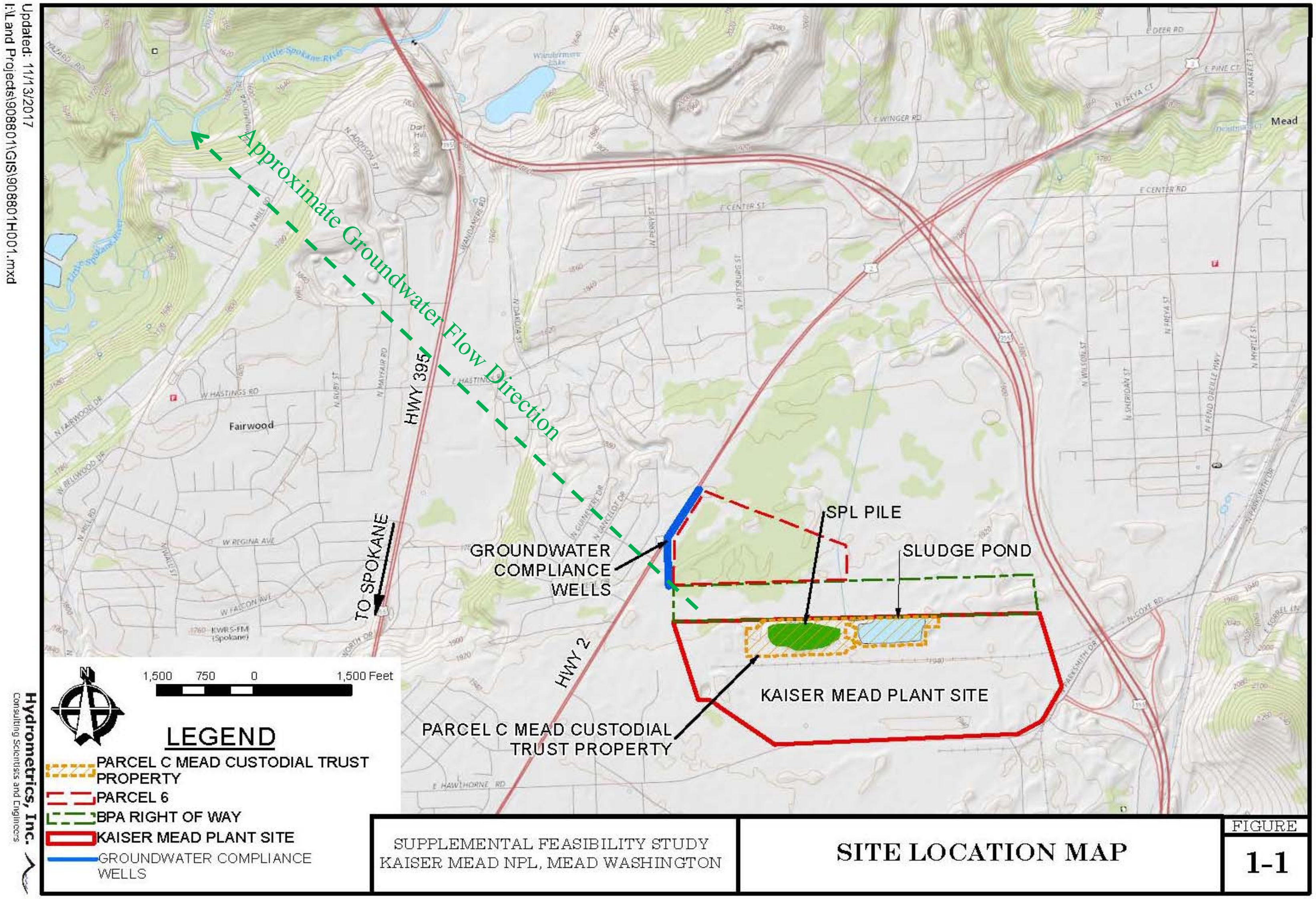
1.0 INTRODUCTION

This draft Interim Action Workplan (IAWP) describes the proposed interim action (IA) for the groundwater portion of the Kaiser Mead NPL Site (Site). The Site is located within Section 16, Township 26 North, Range 43 East, approximately 7 miles north of Spokane, Washington and 1 mile southwest of Mead, Washington (Figure 1-1). This IAWP has been prepared to meet the requirements of the Model Toxics Control Act (MTCA); Chapter 173-340 of the Washington Administrative Code (WAC) as directed by the Washington State Department of Ecology (Ecology). The IAWP would be implemented by the Mead Custodial Trust (MCT or Trust). The purpose of the interim action is to perform cleanup actions to reduce groundwater contamination by lowering the concentration and mass of cyanide and fluoride remaining in groundwater on the Site and flowing off-site towards the Little Spokane River.

The proposed interim cleanup actions include monitoring, extraction, treatment and discharge of groundwater as described in Alternative C(50) of the Final Supplemental Feasibility Study (SFS) for the Site (Hydrometrics, 2018). Cleanup actions include:

- Monitored natural attenuation of cyanide and fluoride (i.e., continuation of existing groundwater monitoring and natural attenuation processes that naturally occur on the Site);
- Capture of contaminated groundwater by pumping of groundwater from extraction wells;
- Treatment of extracted groundwater through a wetland-electrocoagulation (EC) water treatment system to destroy and/or remove cyanide and fluoride;

FIGURE 1-1. KAISER MEAD NPL SITE LOCATION MAP



- Disposal of water treatment residuals (sludge containing cyanide and fluoride removed from groundwater) in an approved landfill at an off-site location; and
- Discharge of treated groundwater in accordance with substantive permit requirements for discharge to groundwater.

The requirement for interim cleanup actions to address groundwater is based upon the failure of previous cleanup actions to attain groundwater cleanup levels, requirements for evaluation and implementation of supplemental groundwater remedial actions contained in the bankruptcy consent decree (US Bankr. Ct. Del, 2004), and a directive to the Trust from Ecology. On November 9, 2018, Ecology (2018) directed the Trust to prepare a draft IAWP for implementation of Alternative C(50)-Ex Situ Treatment (Wetland-Electrocoagulation) at a target rate of 50 gallons/minute. This directive for supplemental groundwater cleanup is pursuant to Task 5 of the Remedial Action Plan (RAP); attached to the Consent Decree Relating to Mead Aluminum Reduction Works entered in *In re Kaiser Aluminum Corporation*, Case No. 02-10429 (JKF) (US Bankr. Ct. Del.) (2004). Under Task 5 of the RAP, the Trust was to prepare an SFS if a Performance Evaluation indicated that cyanide or fluoride concentrations in groundwater did not meet MTCA and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements at the Compliance Wells bordering State Highway 2. A groundwater MTCA/ CERCLA Performance Evaluation was conducted in 2012 (Hydrometrics, 2012) and concluded that groundwater cleanup requirements were not attained. Ecology directed the Trust to conduct an SFS, which was completed in October 2018 (Hydrometrics, 2018). The 2018 SFS concluded that groundwater cleanup levels would not be attained without additional remedial actions and identified eight remedial alternatives to address groundwater contamination. The groundwater remedial alternatives were evaluated in the SFS through a disproportionate cost analysis as required by MTCA. Ecology selected Alternative C(50) based on the disproportionate cost analysis included in the SFS Report and information in Ecology's records for the site and directed the Trust to prepare this IAWP.

Ecology's goals for the interim remedial actions are to:

- Reduce ongoing sources of groundwater contamination by removing contaminant mass from the aquifer system (i.e., groundwater and aquifer sediments);
- Reduce off-Site transport of contaminants beyond the compliance wells; and
- Take actions that are supportive of future, final cleanup decisions for the Site.

2.0 REGULATORY BASIS FOR THE INTERIM ACTION

Washington Administrative Code 173-340-430(1) states that an IA is distinguished from a cleanup action in that an interim action only partially addresses the cleanup of a site. This regulation also states that an interim action is:

A. A remedial action that is technically necessary to reduce a threat to human health and the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility;
B. A remedial action that corrects a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed; or
C. A remedial action needed to provide for completion of a site hazard assessment, remedial investigation/feasibility study, or design of a cleanup action.

The IA proposed in this IAWP will substantially reduce the transport of contaminants from the Site via the groundwater pathway. Contaminant transport will be reduced by capturing contaminated groundwater with extraction wells, treating the captured groundwater to destroy cyanide and remove cyanide and fluoride, disposing the removed contaminants in an approved off-site landfill, and discharging the treated groundwater back to the groundwater system in accordance with substantive requirements of a discharge permit (discharge is exempt from the procedural requirements, but not the substantive requirements, of a State Waste Discharge Permit as detailed in Appendix A).

3.0 SITE HISTORY, DESCRIPTION AND PREVIOUS INVESTIGATIONS

3.1 SITE HISTORY

The Site is located on the former Kaiser Aluminum Chemical Corporation smelter complex. The facility was a pre-bake aluminum smelter that was constructed by the US government during WWII in 1942. The smelter complex covers approximately 240 acres and the area immediately adjacent to the smelter is zoned for industrial use. The nearest residential properties are located approximately 1,500 feet to the northwest of the smelter. The Site consists of the Trust property (approximately 50 acres) that includes approximately 25 acres located in the western portion of the smelter complex where a waste material known as potliner (aka spent potliner or SPL) was traditionally disposed and where a groundwater contamination plume containing elevated levels of cyanide and fluoride exists. The groundwater plume extends from the northwest corner of the plant for approximately two and one half miles to the Little Spokane River.

Kaiser Aluminum went bankrupt in 2004 and the MCT was established through the bankruptcy to take title to the property and manage cleanup activities. The Trust property consists of an approximately twenty-five (25) acre pile (SPL Pile) of SPL, solid waste rubble and butt tailings that Kaiser Aluminum consolidated and covered with a low permeability capping system during interim actions in 2001 (Ecology Order DE 01 TCPIS-2075) and an approximately twenty-five (25) acre wet scrubber sludge bed to the east of the SPL Pile (see Figure 1-1, Section 1.0).

During operation of the smelter, waste materials including SPL, a listed RCRA hazardous waste (designated K088) and dangerous waste under WAC 173-303-9904 that contains high concentrations of fluoride and cyanide, were disposed in the northwest corner of the smelter facility in the vicinity of the current SPL Pile. Process water from smelter operations, including fluoride- and cyanide-rich water used to soak and remove SPL from the smelting pots, and stormwater, was disposed in the waste material disposal area. Process water, stormwater, and water from leaking water pipelines area leached fluoride and cyanide from the waste materials and carried the contaminants to the underlying groundwater system where aquifer sediments interacted with groundwater and also became enriched in cyanide and fluoride. The groundwater contaminant plume from the Site historically and currently extends from the area of the SPL Pile to the northwest to the Compliance Wells and beyond toward the Little Spokane River. Site investigation and characterization activities conducted during development of the 2018 SFS identified the cyanide and fluoride-enriched aquifer sediments as the primary ongoing source of groundwater contamination, which was a different conclusion than earlier assessments.

3.2 SITE DESCRIPTION

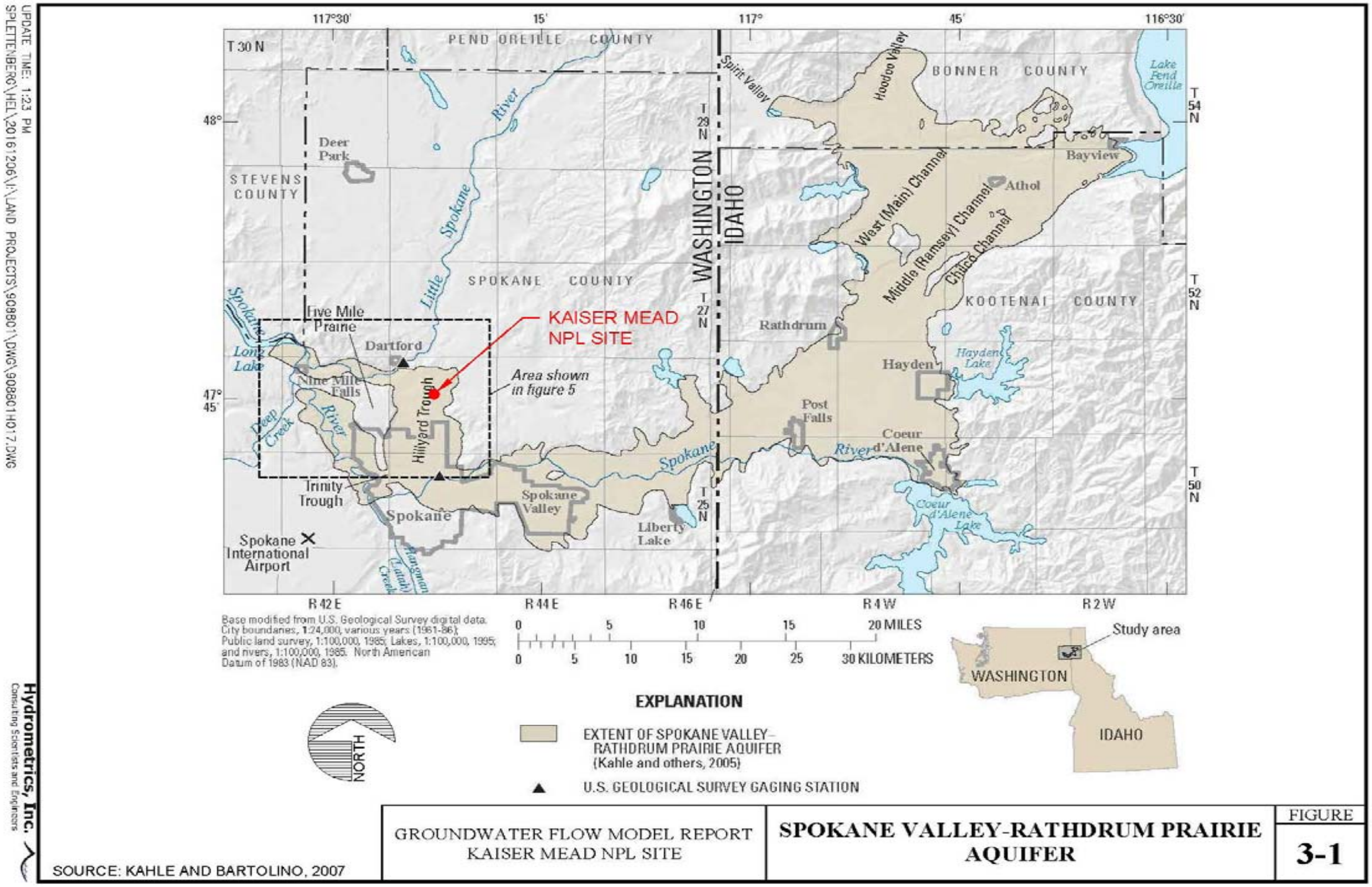
3.2.1 Geologic Setting

The Site overlies the western end of the Spokane Valley-Rathdrum Prairie (SVRP) aquifer near the northern end of the Hillyard Trough (Figure 3-1). The SVRP aquifer is known as one of the most productive aquifers in the United States and is considered a “Sole Source Aquifer” as it is the only significant source of quality water supply in the Spokane Valley (Kahle et al., 2005). The aquifer was formed from deposition of sand, gravel, cobble, and boulder-sized material from a series of catastrophic glacial flood deposits associated with Glacial Lake Missoula which occupied portions of western Montana approximately 15,000 years ago. The Site is located on the surface of the Hillyard Trough, which is a unique part of the SVRP aquifer. The deposition in the Hillyard Trough is generally finer and typically consists of sands and fine gravels with layers of finer grained silts and clay that act as confining/semi-confining units. The SVRP in the Hillyard Trough is reported to be approximately 255 to 280 feet thick (Kahle and Bartolino, 2007).

3.2.2 Groundwater Hydrology

Beneath the Site, groundwater occurs at a depth of approximately 140 to 150 feet below ground surface (bgs) in an aquifer composed predominantly of fine to coarse-grained sand with intervening layers of thin and discontinuous silt and clay. A thick (140 to 150 feet) unsaturated zone above the aquifer consists of fine to coarse grained sands and thin layers of sandy gravels and silt/clay lenses. A discontinuous silt/clay lens is present at approximately 50 to 60 feet bgs along the northern and eastern portion of the SPL Pile.

FIGURE 3-1. SPOKANE VALLEY-RATHDRUM PRAIRIE AQUIFER

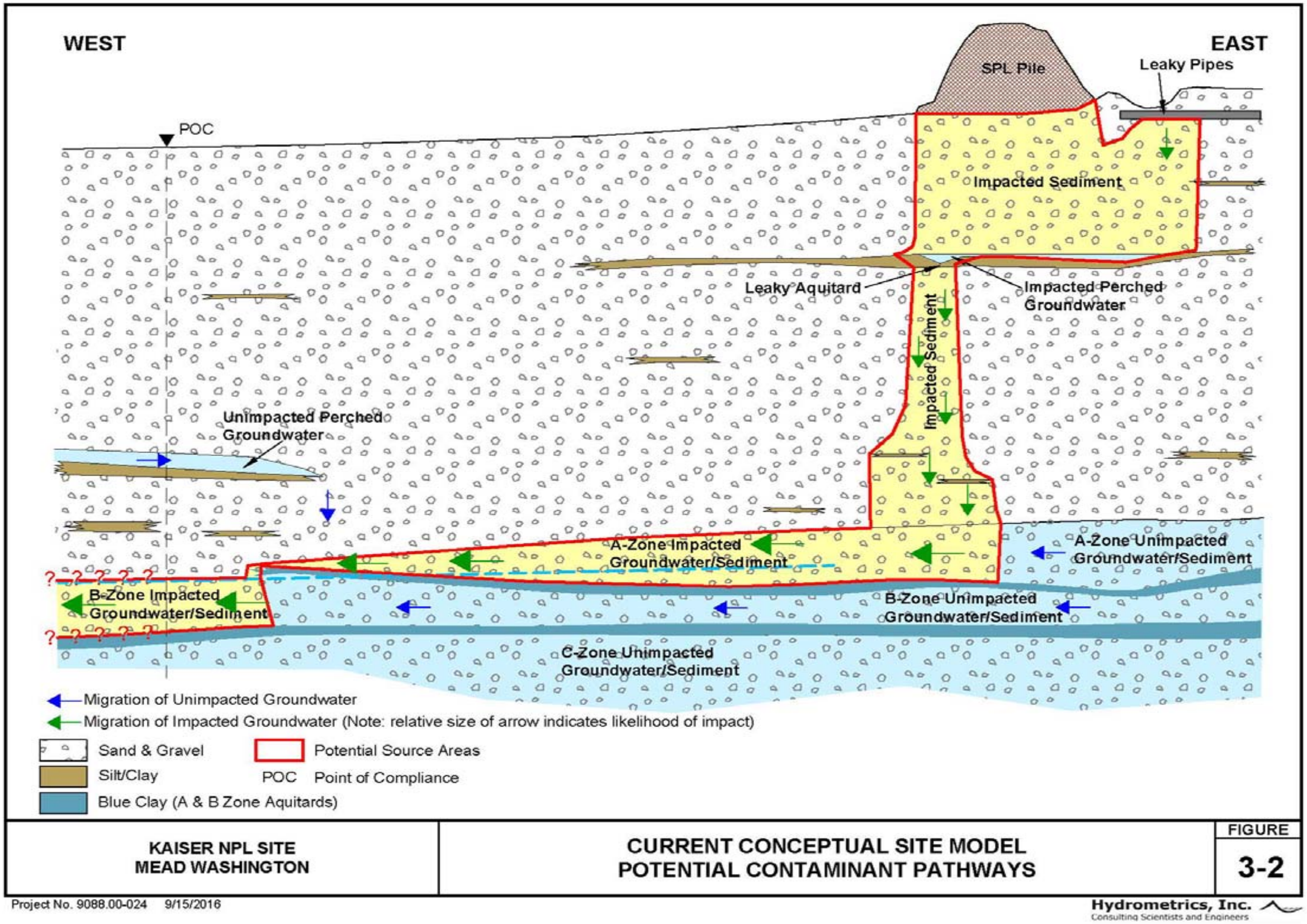


The aquifer stratigraphy is divided into three permeable zones (A, B and C from shallowest to deepest) that exhibit different levels of contamination and are separated by relatively impermeable aquitards (Figure 3-2). Beneath the Trust property, the uppermost A-Zone is contaminated while the deeper B-zone and C-zones are uncontaminated. The A-Zone is composed of fine to coarse sand with discrete zones of silt and very fine sand. The saturated portion of the A-Zone is generally 10 to 20 feet thick and underlain by a silt and clay layer that is laterally discontinuous to the west. Approximately 500 feet east and upgradient of the Compliance Wells, the A-Zone aquifer and the aquitard separating the A-Zone aquifer are absent and the B-Zone aquifer, in which the Compliance Wells are completed, is contaminated. The B-Zone consists of fine to coarse sand, sometimes silty or with silt layers (MFG, 2000). B-Zone saturated thickness reported in boring logs ranges from 6 to 24 feet and is underlain by a silt/clay layer. The C-Zone underlies the B-Zone and is uncontaminated.

3.3 PREVIOUS INVESTIGATIONS

The Washington Department of Ecology became aware of the cyanide and fluoride groundwater contamination found at the Mead Works in late 1978. Kaiser initiated a groundwater investigation that showed contamination was present in domestic wells northwest of the smelter. The findings were reported to the Spokane County Health Department and a more extensive sampling program was conducted in the affected area northwest of the Mead Works. The suspected source of the cyanide and fluoride contamination was SPL wastes from aluminum production. Kaiser arranged for alternative potable water supplies to be provided to persons whose residential wells were contaminated with cyanide. Kaiser offered residents with contaminated wells options of a permanent hook up to public water, a deionizer to treat water from their existing well or a newly constructed well. One new well was drilled and 25 individuals were hooked up to the public water system.

FIGURE 3-2. CURRENT CONCEPTUAL SITE MODEL POTENTIAL CONTAMINANT PATHWAYS



Site conditions were characterized in detail by Hart Crowser for Kaiser in 1988 (Hart Crowser, 1988) and their work (and work by others previously) was the basis for selection of the source control (waste capping and pipe repairs) and groundwater pump and treat as the remedial alternatives of choice by RETEC in the 1993 Feasibility Study (RETEC, 1993). Site characterization identified the waste material in the northwest plant Site area, primarily SPL, as the primary source of fluoride and cyanide to groundwater. Leaching of fluoride and cyanide from the waste material to groundwater was exacerbated by exposure of the waste material to rainfall, stormwater, and leaking water lines. Remedial alternatives in the 1993 Feasibility Study (RETEC, 1993) included technologies to control the leaching of the fluoride and cyanide source materials (waste consolidation and capping and pipeline repair, monitoring, and maintenance) and groundwater pumping and treatment with release of treated water to groundwater.

The cleanup alternative selected by Ecology in the 2002 Cleanup Action Plan (CAP) (Ecology, 2002) included waste capping, pipe repairs, groundwater pump and treat, institutional controls, and long-term monitoring and cap maintenance. Additional work by MFG, Inc. concluded that completion of source control remedial actions without groundwater pump and treat would result in attainment of cleanup levels at the Compliance Wells in a five-year time frame (MFG, 2004). The 2004 Consent Decree did not require groundwater pump and treat, but retained the option for supplemental groundwater remedial action if MTCA/CERCLA requirements were not met (Task 5 of the RAP).

3.4 PREVIOUS CLEANUP ACTIONS

Since the discovery of groundwater contamination associated with SPL management practices in 1978, a number of actions have been taken to address the sources and condition contributing to the migration of identified contaminants. Table 3-1 below lists the actions taken to date.

As a result of these actions, transport of contaminants by process waters has been eliminated and leaching of waste materials within the SPL Pile by rainfall/snowmelt and stormwater is believed to be greatly reduced, if not eliminated, by the engineered, low permeability SPL

Pile cap. The plant water pipe systems have been replaced and/or lined and pressure and gravity-line transported waters are believed to be contained within the vicinity of waste storage and impacted sediments.

TABLE 3-1. REMEDIAL ACTIONS COMPLETED AT KAISER MEAD

Date	Action
1978	Use of sludge bed, pot soaking operations, discharge of sewage effluent to sludge bed ceased.
1979	SPL material covered with asphalt cap.
1979	Pot cleaning activities conducted on asphalt pad.
1981	SPL handling and storage activities moved into SPL building.
1981	Unlined wastewater settling basin (aka Tharp Lake), northwest of sludge bed abandoned.
1983	Pipe leak repaired.
1986	Pot cleaning activities moved to building.
1986	Area 2, immediately east of SPL pile, capped with asphalt.
2001	Interim Action Agreed Order DE 01 TCPIS-2075 resulted in waste materials (butt pile, rubble pile, asphalt covered SPL Pile) consolidated into the current SPL Pile and capped with synthetic liner.
2002	Cured-in-place liners installed in stormwater and sanitary sewer lines.
2005	Semi-annual inspections of SPL and asphalt cap areas and surface water drainage features.
2005	Compliance monitoring well network installed.
2006	Pressure main water supply pipelines replaced and sanitary sewer line break repaired above shallow aquitard.
2005 - Present	Ongoing groundwater and surface water monitoring and inspection and maintenance of source controls.
2012	Groundwater performance evaluation completed.
2018	Supplemental Feasibility Study completed.

As a result of these cleanup actions, the current contaminant migration pathways differ from the historic (pre-actions) pathways as 1) there is no longer any process water being infiltrated to the groundwater system; 2) waste material has been substantially isolated from infiltration of rain and snowmelt by the SPL Pile cap; and 3) there is less water from plant water and piping systems being infiltrated to the groundwater system from the SPL Pile area. The primary migration pathway currently is leaching of contaminated aquifer sediments (beneath the SPL Pile and extending to the Compliance Wells and likely beyond) by groundwater. The leaching of contaminated aquifer sediments was identified by supplemental Site characterization activities (described in Section 3.5, below) as a secondary contaminant source (i.e., a contaminant source separated in space or location from the area where the contaminant was initially released).

The CAP (Ecology, 2002) selected institutional controls consisting of a covenant to ensure that no groundwater is removed for domestic purposes from the contaminant plume, to prevent property owners or operators from taking actions that interfere with the integrity of the SPL Pile cap, and to control exposure of future site workers to the Site contaminants. This covenant was specified in the Task 6 of 2004 Consent Decree Scope of Work and subsequently executed as an Easement Agreement between Kaiser Aluminum Properties, Inc. and MCT for the property upgradient (southeast) of Highway 2 and the Compliance Wells. No institutional controls for properties downgradient of the Compliance Wells were included in the CAP or Consent Decree. Ecology (2016) reviewed the status of off-Site institutional controls and identified State and Spokane County restrictions on groundwater use and concluded that sufficient protective measures are in place to protect human health and the environment from exposure to contaminated groundwater from the Kaiser Mead facility. These identified measures include State Department of Health regulation of public water supply systems and Spokane County final plat dedications regarding provision of public water supply systems and prohibition of the use of private wells.

3.5 SUPPLEMENTAL SITE CHARACTERIZATION, PILOT TESTING AND TREATABILITY STUDIES

A Groundwater MTCA/CERCLA Performance Evaluation was conducted in 2012 (Hydrometrics, 2012) pursuant to Task 4 of the RAP for the Kaiser Mead Site. The RAP is attached to the Consent Decree Relating to Mead Aluminum Reduction Works entered in *In re Kaiser Aluminum Corporation,* Case No. 02-10429 (JKF) (US Bankr. Ct. Del.) (2004). The Performance Evaluation concluded that after the requisite five-year groundwater monitoring period following completion of certain remedial actions at the Kaiser Mead facility, the groundwater cleanup requirements at the Compliance Wells had not yet been attained. Under Task 5 of the RAP, the MCT or Trust was to prepare a SFS if the Performance Evaluation indicated that cyanide or fluoride concentrations in groundwater did not meet MTCA and CERCLA requirements at the Compliance Wells. On November 9, 2012, Ecology directed the Trust to perform the SFS to evaluate additional groundwater remedial actions at the Site. The purpose of the SFS was to develop and evaluate groundwater remedial action alternatives for the Site. The Final SFS for the Site was completed on October 18, 2018 and was formally accepted by Ecology on November 9, 2018.

As part of the SFS, additional site characterization was performed, the conceptual site model (CSM) was refined, groundwater bench-scale treatability studies were conducted, and potential remedial technologies were tested at the pilot scale. This work was conducted during 2013 through 2016 and included:

- Additional borings and aquifer testing to further characterize site hydrogeology;
- Laboratory testing of aquifer sediment to characterize the cyanide and fluoride content and potential for sediment to continue to contribute contaminants to groundwater;
- Development of groundwater flow and sediment:groundwater partitioning models to evaluate contaminant transport and predict future groundwater contaminant concentrations;
- Laboratory testing of a variety of treatment methods for removing cyanide and fluoride from groundwater; and
- Field pilot-scale testing of the construction of a grout wall containment system.

3.6 GROUNDWATER POINT OF COMPLIANCE AND CLEANUP LEVELS

Applicable or relevant and appropriate requirements (ARARs) for the Site based on federal and State laws were identified in the 1993 Feasibility Study (RETEC, 1993) and the 2002 CAP (Ecology, 2002). Ecology determined in the CAP that the groundwater cleanup levels for the Site were based on the drinking water maximum contaminant level (MCL). These levels were adopted by Ecology and are listed in the 2002 CAP as 4 mg/L fluoride and 0.2 mg/L cyanide (free).

A component of the MTCA/CERCLA Performance Evaluation (Hydrometrics, 2012) was to determine MTCA/CERCLA requirements (cleanup standards) for the Site applicable at the time. The Performance Evaluation review of MTCA/CERCLA requirements revealed that requirements had not changed and that the 2002 groundwater cleanup levels were still appropriate for the Site as MCL values for fluoride and cyanide have not changed.

The cleanup levels for groundwater at the Compliance Wells are:

- 4 mg/L fluoride; and
- 0.2 mg/L cyanide (free).

The Consent Decree governing this cleanup action (Task 5 of the RAP) established the location where compliance with applicable groundwater standards would be measured as a line of wells (aka the Compliance Wells) located at the downgradient western border of Parcel 6, currently owned by Kaiser Aluminum Properties, Inc. (area that borders State Highway 2, see Figure 1-1 in Section 1.0).

The goals for this interim action are to reduce ongoing sources of groundwater contamination by removing contaminant mass from the aquifer; reduce off-site transport of contaminants beyond the compliance line; and take actions that will support future final cleanup decisions for the Site. For this interim action, the short-term success of control of off-site transport of contamination will be measured by comparing concentrations of free cyanide and fluoride measured at the compliance wells to the cleanup levels described above. The long-term future success of control of off-site transport of contamination will be measured by the amount of contaminant mass removed from the aquifer.

3.7 SOIL CLEANUP LEVELS

Although no soil cleanup is planned to occur as part of this IA, it is expected that some soil disturbance will occur during implementation of the groundwater remedial action. To the extent practical, all excavations will be designed to achieve a neutral material balance where no fill material is imported or exported from the Site. Consistent with previous cleanup actions on-Site, any soil or fill material imported to the Site must meet appropriate soil cleanup levels. Ecology determined in the CAP that the soil cleanup levels for the Site were based on MTCA Method B standards that are protective of groundwater rather than a direct contact unrestricted land use value. The standards derived to protect groundwater are much more stringent than the unrestricted MTCA Method B soil standards for cyanide and fluoride (1,600 mg/kg cyanide; 4,800 mg/kg fluoride).

The cleanup levels for soil on Site are:

- 2,884 mg/kg fluoride; and
- 1 mg/kg cyanide (free).

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 CHEMICALS OF CONCERN

Cyanide and fluoride are the only two chemicals of concern found at the Site (Ecology, 2002). Cleanup actions discussed in this IAWP address only cyanide and fluoride contamination in groundwater, although it is likely that other contaminants such as nitrogen compounds (i.e., nitrate, nitrite and ammonia) will also be removed from groundwater by the cleanup action. Cyanide and fluoride are found in SPL waste (contained with the engineered waste repository), soils and groundwater at the Site.

4.2 GROUNDWATER CONTAMINATION

Cyanide and fluoride are found in groundwater beneath the SPL Pile and in a groundwater plume that extends from the SPL Pile to the northwest toward the Little Spokane River. Concentrations of cyanide and fluoride in groundwater at the Site are shown in Figures 4-1 and 4-2. Concentrations of cyanide and fluoride in groundwater have generally declined over time but remain significantly above cleanup levels throughout the plume and at the Compliance Wells. Aquifer sediments within the groundwater contaminant plume are also enriched in cyanide and fluoride.

The groundwater plume extends beyond the Compliance Wells to springs along the Little Spokane River as shown on Figure 4-3. Delineation of the plume between the Compliance Wells and the springs is based on groundwater data collected in the mid-1980s described in Hart Crowser (1988). The springs along the Little Spokane River are monitored four times per year by the Trust. The most recent data (shown on Figure 4-3) indicates that concentrations of free cyanide and fluoride in the spring waters are lower (better) than groundwater cleanup levels of 0.2 mg/L free cyanide and 4 mg/L fluoride.

FIGURE 4-1. FREE CYANIDE CONCENTRATION IN GROUNDWATER

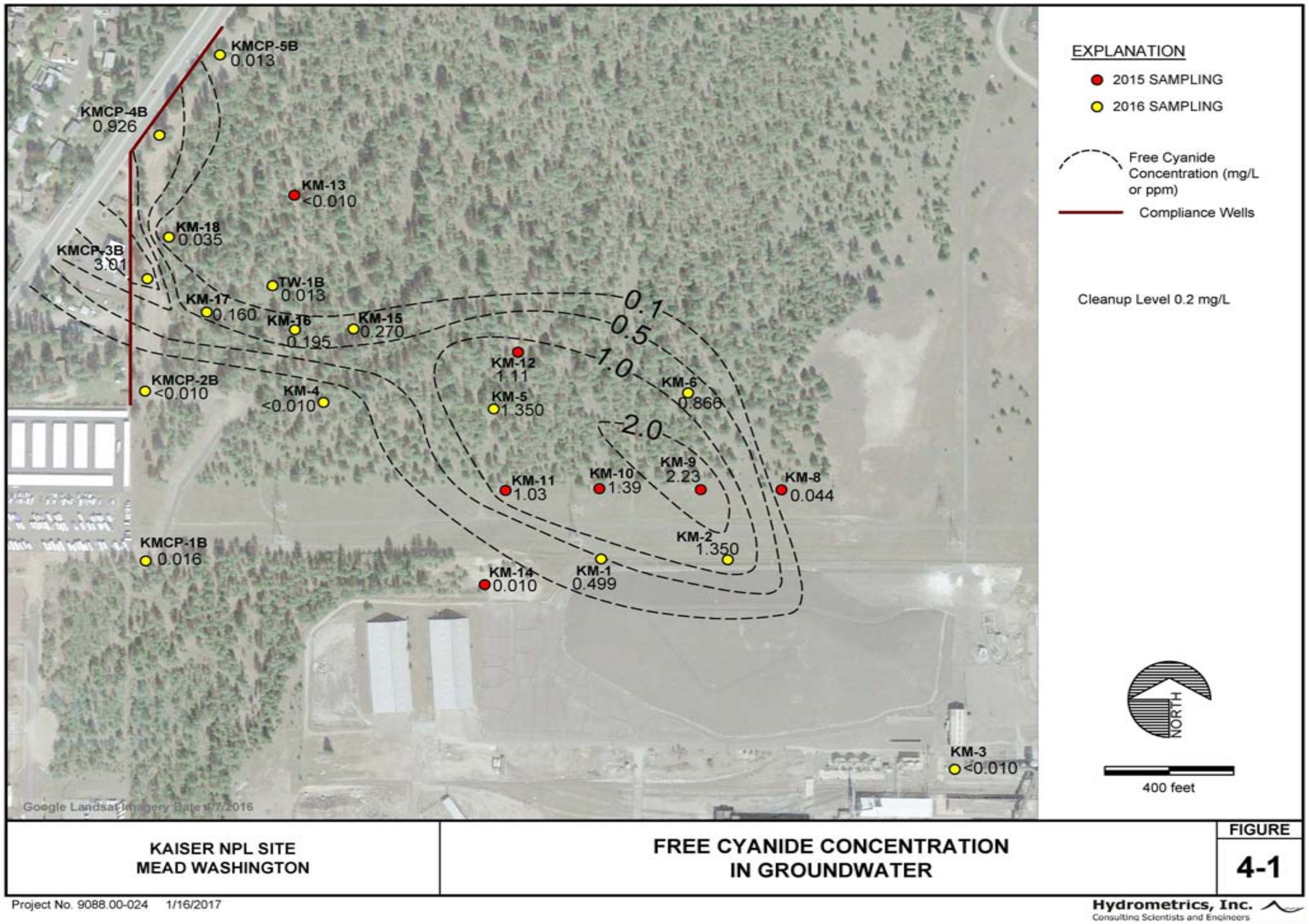
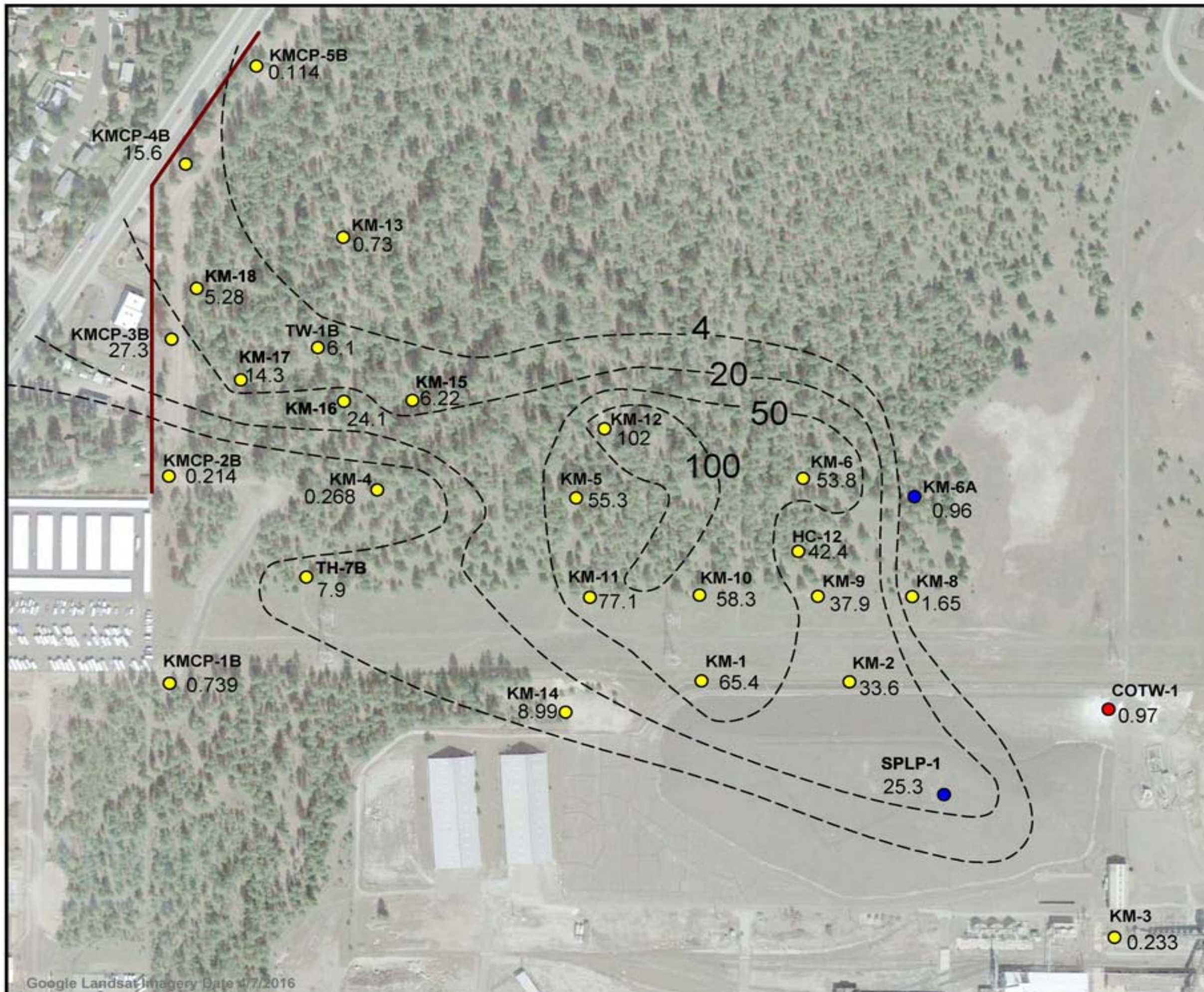


FIGURE 4-2. FLUORIDE CONCENTRATION IN GROUNDWATER



KAISER NPL SITE MEAD WASHINGTON	FLUORIDE CONCENTRATION IN GROUNDWATER	FIGURE 4-2

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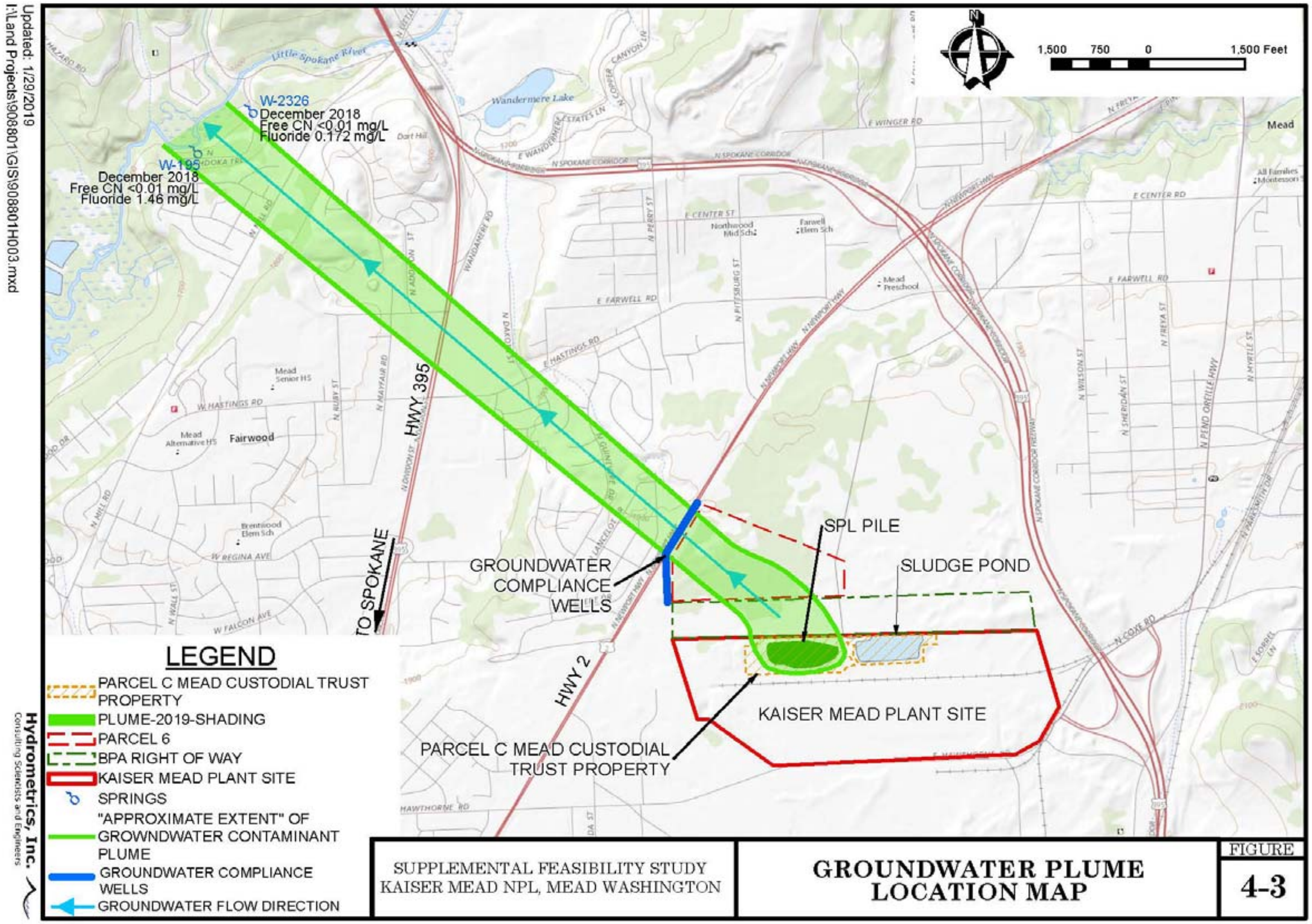
FIGURE 4-3. APPROXIMATE EXTENT OF GROUNDWATER CONTAMINANT PLUME



4.3 CONCEPTUAL SITE MODEL

A graphical representation of the current CSM is shown in Figure 3-2 in Section 3.0. Currently, cyanide and fluoride can potentially migrate to groundwater by three mechanisms:

1. Leaching of impacted sediments in the unsaturated zone beneath the SPL Pile by an unidentified water source (i.e., leaching of sediments by zones of saturated flow within the otherwise unsaturated zone above the regional water table, such as could occur above a shallow aquitard or adjacent a leaky pipe);
2. Leaching of cyanide- and fluoride-enriched sediments within the saturated zone of the A Zone aquifer and downgradient B Zone aquifer by groundwater; and
3. Contaminant release from unsaturated sediments due to unsaturated flow of soil moisture through the vadose zone.

Of these three potential mechanisms, leaching of impacted aquifer sediments by groundwater (bullet 2) is believed to be dominant. Although plausible, leaching of sediment above the A Zone aquifer as described in bullets 1 and 3 is believed to be minor due to the lack of a significant documented water source.

Once in the groundwater system, cyanide and fluoride migrate with groundwater flow and are transported through the A Zone aquifer to the northwest, toward the Compliance Wells and ultimately toward the Little Spokane River. The A Zone aquitard is discontinuous in the vicinity of monitoring well KM-4, allowing contaminated groundwater within the A Zone to commingle with the underlying B Zone aquifer upgradient of the Compliance Wells. The B Zone aquifer transports cyanide and fluoride to the downgradient Compliance Wells and beyond. Within the groundwater system, the transport of cyanide and fluoride is controlled by the aquifer properties. Average linear velocity of groundwater flow is approximately 3 to 5 ft/day and estimated groundwater travel time from the SPL Pile to the Compliance Wells (a distance of approximately 2,000 feet) is approximately one to two years.

During groundwater transport, cyanide and fluoride in groundwater are subject to dilution by mixing and dispersion and react with the aquifer sediments through the chemical processes of mineral dissolution, mineral precipitation, adsorption/desorption, and ion-exchange. These physical and chemical processes cause cyanide and fluoride transport to be retarded (or slowed) relative to groundwater transport velocity. These chemical processes also resulted in the formation of secondary contaminant sources within the aquifer sediment beneath and downgradient of the SPL Pile area.

4.4 INTERIM ACTION AREA

The IA is intended to address groundwater and aquifer contamination within the groundwater contaminant plume (shown in Figures 4-1 and 4-2).

5.0 SUMMARY OF INTERIM ACTION SELECTION PROCESS

As part of the IA remedy selection process, a SFS was conducted by MCT (Hydrometrics, 2018). The purpose of the SFS was to evaluate potential groundwater remedial actions for the Site. As part of the SFS, additional site characterization was performed, the CSM was refined, groundwater treatability studies were conducted, and potential remedial technologies were pilot tested. This work was conducted during 2013 through 2016 and included:

- Additional borings and aquifer testing to further characterize site hydrogeology (Hydrometrics, 2017);
- Laboratory testing of aquifer sediment to characterize the cyanide and fluoride content and potential for sediment to continue to contribute contaminants to groundwater (Hydrometrics, 2017 and Appendix F of the SFS);
- Development of groundwater flow and sediment:groundwater partitioning models to evaluate contaminant transport and predict future groundwater contaminant concentrations (described in Appendices A and F of the SFS);
- Laboratory testing of a variety of treatment methods for removing cyanide and fluoride from groundwater (described in Appendices B, C and D of the SFS); and
- Field pilot-scale testing of construction of a grout wall containment system (described in Appendix G of the SFS).

The SFS considered a variety of remedial technologies and combined feasible technologies into the following eight remedial alternatives:

- Alternative A – Monitored Natural Attenuation (MNA).
- Alternative B – Hydraulic Control by Grout Wall plus MNA.
- Alternative C – Groundwater Pumping and Treatment by Wetland-Electrocoagulation plus MNA at various rates:
    - Alternative C(25) – Pumping and treatment at nominal rate of 25 gpm;
    - Alternative C(50) – Pumping and treatment at nominal rate of 50 gpm; and
    - Alternative C(100) – Pumping and treatment at nominal rate of 100 gpm.

- Alternative D – Groundwater Pumping and Treatment by Iron precipitation-Electrocoagulation plus MNA at various rates:
    - Alternative D(25) – Pumping and treatment at nominal rate of 25 gpm;
    - Alternative D(50) – Pumping and treatment at nominal rate of 50 gpm; and
    - Alternative D(100) – Pumping and treatment at nominal rate of 100 gpm.

The SFS evaluated the alternatives in accordance with MTCA requirements including a disproportionate cost analysis. Alternative C(100) ranked the highest in terms of environmental benefit but had very high cost, second in cost only to Alternative D(100). Alternative A ranked the lowest in terms of environmental benefit and had the lowest cost. A detailed evaluation of the alternatives may be found in the SFS (Hydrometrics, 2018). Ecology selected Alternative C(50) based on the disproportionate cost analysis included in the SFS Report and information in Ecology's records for the site. A more detailed description of the alternatives considered is provided in following Sections 5.1 through 5.4.

5.1 ALTERNATIVE A – MONITORED NATURAL ATTENUATION

Under Alternative A, Site groundwater would continue to be monitored and to cleanup by natural processes. Over time, all fluoride and cyanide remaining in groundwater and aquifer sediments would be leached and transported beyond the Compliance Wells to the Little Spokane River. This alternative would provide no additional control of groundwater contamination than currently provided.

5.2 ALTERNATIVE B – HYDRAULIC CONTROL BY GROUT WALL PLUS MNA

Under Alternative B, a low permeability cement grout wall would be installed to isolate the most highly contaminated aquifer sediment from groundwater and groundwater would continue to be monitored and to cleanup by natural processes. A pilot test of this technology was conducted at the Site in 2016 as described in Appendix G of the SFS. Based on the pilot test, it was concluded that implementation of this Alternative is possible, but some defects or flaws in the wall would be likely to occur. These defects would lessen the effectiveness of the grout wall but a moderate degree of hydraulic control would be attained.

5.3 ALTERNATIVE C – GROUNDWATER PUMPING AND TREATMENT BY WETLAND-ELECTROCOAGULATION PLUS MNA

Under Alternative C, for all pumping and treatment rates (25, 50 and 100 gpm), groundwater would be extracted by pumping and treated to remove cyanide in a constructed wetland treatment system. After wetland treatment, water would be further treated to remove residual cyanide and fluoride in an EC system. Treated water that meets applicable water quality standards would be discharged to groundwater via an infiltration pond or to the Little Spokane River via the Spokane municipal sewer. The Alternative C wetland treatment system would result in destruction of cyanide versus capture and landfilling of the contaminant as would occur with the iron precipitation treatment of cyanide in Alternative D. This resulted in a higher benefit score for the Alternative C wetland technology over the iron precipitation technology in Alternative D. Although Alternative C included the option for discharge to the municipal sewer, discharge to groundwater is considered to be more implementable. Thus, the Alternative C discharge method included in this proposed interim action is discharge to groundwater.

5.4 ALTERNATIVE D - GROUNDWATER PUMPING AND TREATMENT BY IRON PRECIPITATION-ELECTROCOAGULATION PLUS MNA

The sole difference between Alternatives C and D is the method of removal of cyanide from groundwater; a constructed treatment wetland is used in Alternative C while iron precipitation (a process where cyanide is stabilized as a solid iron compound) is done in Alternative D. Under Alternative D, for all pumping and treatment rates (25, 50 and 100 gpm), groundwater would be extracted (pumped) and treated to remove cyanide in a water treatment plant by a two-step process. Cyanide would be treated by iron precipitation followed by removal of residual cyanide and fluoride in an EC system, identical to that included in Alternative C. Treated water that meets applicable water quality standards would be discharged to groundwater via an infiltration pond or to the Little Spokane River via the Spokane municipal sewer.

6.0 INTERIM ACTION DESCRIPTION, DESIGN AND IMPLEMENTATION

This Section describes the purpose, goals and conceptual design of the IA and describes how elements of the IA will be refined during the remedial design (RD) process. RD will be done in phases by a Contractor that will be hired by the Trust. All elements of RD will undergo review, modification (if necessary) and approval by the Trust and Ecology prior to implementation of the IA. Ecology will be the final decision maker on interim action design and implementation. This Section is organized as follows.

- Purpose and goals of the groundwater interim action are described in Section 6.1.
- The overall RD process is described in Section 6.2.
- Sections 6.3 through 6.8 detail the current conceptual designs for major elements of the IA (e.g., groundwater extraction, treatment, and discharge, etc.). To the extent possible at this phase, design elements, conditions or criteria that are known to require further refinement are identified. If known, potential actions to refine IA design are also described.
- To the extent possible at this phase of design, Sections 6.9 through 6.15 describe elements, such as permits and plans that will be required for safe, legal, and successful implementation of the interim action. Additional permits and plans may be identified and developed during the RD process.

6.1 PURPOSE AND GOALS

The purpose of the groundwater IA is to address legacy groundwater contamination caused by Kaiser's historic waste management practices that occurred over almost 60 years of operation as an aluminum smelter. The goals for this Interim Action are to:

- Reduce ongoing sources of groundwater contamination by removing contaminant mass from the aquifer system;
- Reduce off-site transport of contaminants beyond the compliance line; and
- Take actions that will support future, final cleanup decisions for the Site.

Based on the interim action alternative selected and direction provided by Ecology, the completed project must meet the following requirements:

1. Design and construct a groundwater capture and treatment system nominally capable of handling 50 gallons per minute (gpm) at a wetland hydraulic retention time of approximately seven days.
2. Ecology expects the Trust and its contractors to optimize the system over time to seek maximum benefit toward the project goals per unit cost. During and following implementation of IA, the extraction and treatment system will be optimized and operated/managed to yield the highest cyanide and fluoride mass load removal with the lowest cost. Optimization may require extraction and treatment of higher or lower rates than the nominal 50 gpm design flow; variable or seasonal rates; intermittent operation; adjustment of hydraulic retention times or other modifications.
3. To treat captured groundwater to concentrations lower (better) than cleanup levels, 4 mg/L fluoride and 0.2 mg/L cyanide (free).
4. If needed to meet discharge permit requirements, treat captured groundwater for additional chemical parameters such as nitrate.
5. To discharge and return treated groundwater to the groundwater system via an infiltration pond.
6. To handle water treatment residuals (cyanide- and fluoride-bearing sludge) in accordance with all local, State, and Federal requirements.
7. To comply with the need to apply All Known Available and Reasonable Treatment (AKART).

To achieve the project goals and meet the above requirements, Ecology and the Trust envision an extraction and treatment system that is designed to be flexible and adaptable to conditions at the Site over time.

6.2 INTERIM ACTION DESIGN AND PROJECT DELIVERY PROCESS

The basis for this IA work plan is the conceptual design for Alternative C(50) as described in the Final SFS consisting of extraction wells and wetland treatment followed by EC treatment.

The conceptual design (described in Sections 6.3 through 6.8, below) incorporates design parameters based on hydraulic parameters observed in existing monitoring wells and treatment parameters observed in laboratory testing of the wetland and EC system.

6.2.1 Design-Build Delivery Process

Final design and implementation of the IA will follow a Design-Build-Operate process. A design-build process is a method of project delivery in which one entity, the Design-Build-Operate team (Contractor and sub-consultants and sub-contractors), works under a single contract with the project owner (in this case, the Trust). This IAWP will serve as a document that the Trust will use to procure the Design-Build-Operate Contractor who will complete RD and implement the IA. The Trust has identified interested and qualified contractors by issuing a Request for Qualifications. Qualified contractors will be asked to provide proposals for design, construction and initial operation of the interim action system. Based on the proposals, the Trust will select the qualified contractor that the Trust determines to be best suited to design, build and in the short-term, operate the interim action.

6.2.2 Remedial Design Plan

The Design Build Contractor will develop a RD Work Plan that will detail the elements, deliverables and schedule for RD. It is anticipated that RD will follow a progression from preliminary design to pre-final design to final design. All design deliverables (e.g., design reports and various plans and specifications) will be reviewed and modified or approved as appropriate by the Trust and Ecology prior to design progression and implementation. It is anticipated that construction of some IA elements may occur prior to final design.

6.2.3 Preliminary Design

Preliminary Design will be developed by the Contractor and will describe conceptual design and technical design parameters that will serve as basis for development of Pre-Final Design. It is expected that approximately 30 percent of the design will be completed during Preliminary Design. Preliminary Design will identify and describe plans to refine design parameters for IA components including extraction wells, piping systems, wetland and EC water treatment systems, and the infiltration pond. The purpose of the Preliminary Design

Report is to provide the Trust and Ecology with sufficient information to determine that the Contractor is correctly interpreting the IA goals and requirements into site-specific engineering parameters and to confirm that the conceptual design basis can be constructed and implemented.

The Preliminary Design Report will detail elements described in Sections 6.3 through 6.8, below, and identify permits, plans and requirements to implement the IA. The Report will also include:

1. Preliminary drawings and specifications;
2. Preliminary IA implementation schedule;
3. Preliminary capital and operation and maintenance (O&M) cost estimates;
4. Preliminary process flow diagrams for treatment processes;
5. Identification of O&M provisions that will have a significant influence on design approach (e.g., unattended operation, remote instrumentation and communication, etc.);
6. Permits plan identifying how requirements for all permits needed to implement the IA will be obtained and satisfied;
7. Identification of easement and access requirements and plan to procure;
8. Confirmation that siting and location of IA elements are appropriate;
9. Description of how the design incorporates the goals of flexibility, adaptability and optimization over time; and
10. Summary and detailed justification of design assumptions.

6.2.4 Pre-Final and Final Design

The Pre-Final Design is a draft version of the complete RD, including all drawings, specification, reports and attachments, and O&M plan. If a major modification to the design is identified during Pre-Final Design, the Preliminary Design Report also will be revised to incorporate and describe the design modification, revised capital cost estimate, and revised O&M requirements and cost. The Trust and Ecology will review and approve all Pre-Final Design documents prior to requesting the Final Design from the Contractor. After incorporation of Trust and Ecology comments, Contractor will submit Final Design. The Final Design will be fully signed and stamped by licensed professional engineers involved in preparing and certifying the final engineering package. Ecology will be the final decision-maker on acceptance of the Final Design.

6.3 GROUNDWATER MONITORING

Groundwater monitoring to document groundwater concentrations would continue at a subset of monitoring wells at select locations throughout the groundwater plume and at the Compliance Wells (KMCP-1B, KMCP-2B, KMCP-3B, KMCP-4B and KMCP-5B). Extraction wells installed to pump groundwater would also be monitored as needed to properly operate the water treatment system.

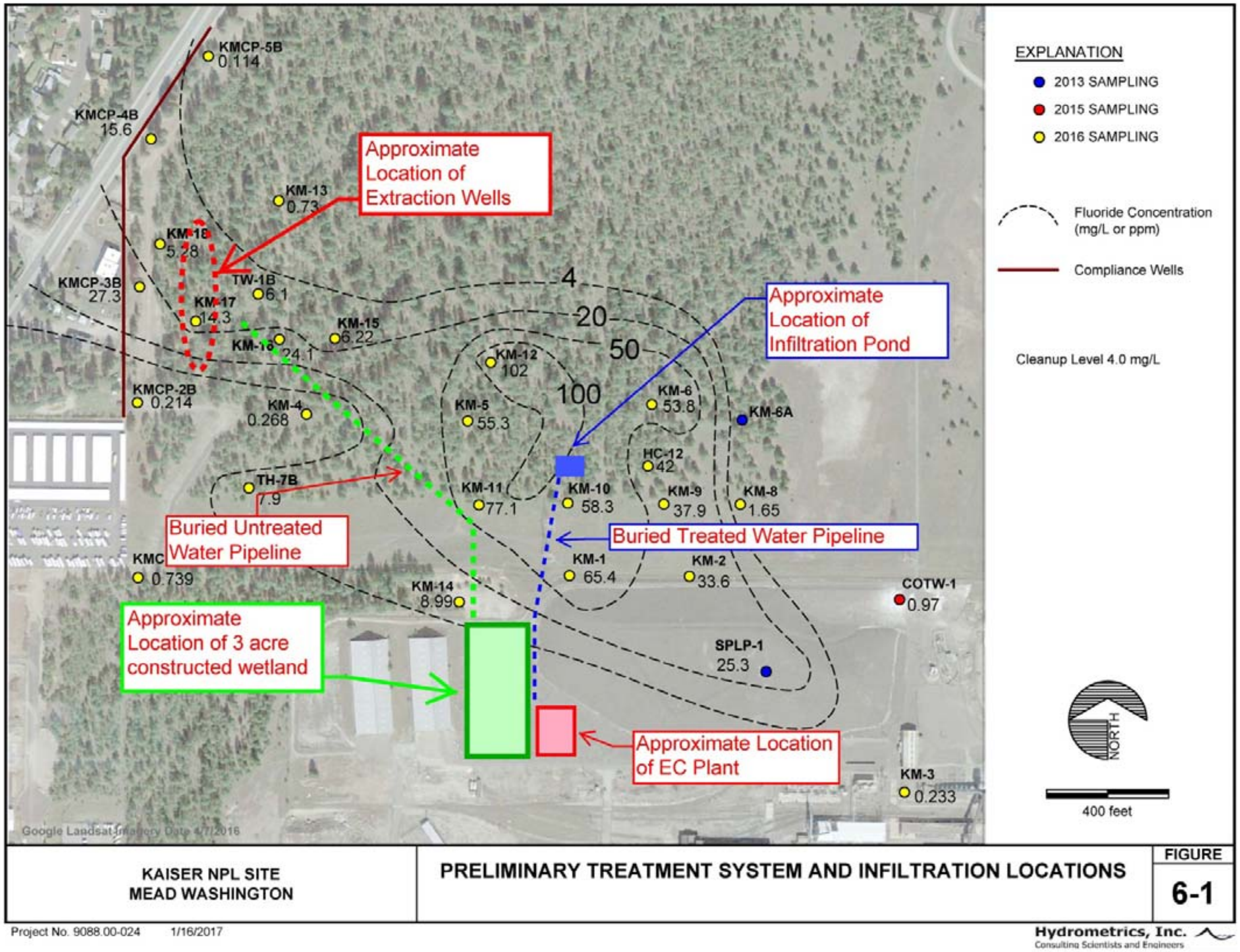
During pre-Final Design, an updated groundwater monitoring plan will be prepared by the Trust and Contractor for Ecology review and approval. The updated plan will provide for ongoing characterization of groundwater conditions and optimization of the groundwater extraction and treatment system. In particular, the plan shall characterize groundwater response to the extraction/treatment system installation and operation and include:

- Characterization of groundwater elevations with updated potentiometric surface maps;
- Characterization of groundwater quality and contaminant concentrations with updated trend analysis and maps of concentration isopleths; and
- Extraction well pumping rates, specific capacities, contaminant concentrations, and capture zone analysis.

6.4 GROUNDWATER EXTRACTION SYSTEM

The conceptual design of the groundwater extraction system consists of approximately four water wells (with associated pumps, piping and controls) constructed in a line perpendicular to groundwater flow direction across the groundwater contaminant plume approximately 200 to 300 feet upgradient of the Compliance Wells (Figure 6-1). Wells would be completed in

FIGURE 6-1. PRELIMINARY WELL, TREATMENT SYSTEM AND INFILTRATION LOCATIONS



the B Zone aquifer at a depth of approximately 150 feet. Water from the wells would be conveyed to the wetland treatment system via a buried piping system.

6.4.1 Siting and Location

During RD, specific well locations and well construction details (e.g., drilling method, well casing and screen specifications) will be identified. It is anticipated that up to eight new wells may be installed; but that not all wells may be included in the final extraction system and some wells may be used for monitoring purposes only. Use of existing monitoring wells for extraction wells is also possible.

One of the uncertainties in determining the optimal pumping and treatment rates arises from uncertainty and variations in groundwater concentrations in the proposed extraction well locations and uncertainty about how Compliance Well concentrations will respond to groundwater extraction. As illustrated by Figure 6-1, fluoride concentrations (and similarly cyanide concentration) are quite variable near the Compliance Wells and the exact contaminant concentrations in the specific extraction well locations are not fully known. It is also possible that pumping of water from wells in the plume center area may be desirable to optimize treatment plant operation and contaminant removal. These uncertainties would be addressed during RD through testing of groundwater from the extraction wells and during IA through optimization of extraction well pumping.

6.4.2 Optimization

A portion of the extraction wells will be completed during early phases of engineering design and/or construction of the IA and will be tested (i.e., water quality monitoring and short-term aquifer tests) to refine the understanding of the relationship between Compliance Well concentrations and upgradient concentrations and to refine estimates of the effects of pumping on contaminant mass removal. Refinements may include updates to the conceptual site model, hydrogeologic cross-sections, partitioning and mass balance model, and numeric groundwater model.

6.4.3 Flexibility and Adaptability

The potential need to operate the pump and treat systems at higher or lower rates than the nominal design rate will be considered in engineering design and incorporated to the extent that it is practical (i.e., flexibility in rates will be designed and built into the system where it is possible to do so without incurring excessive cost). For extraction wells, it is anticipated that flows will be varied through varying the number of wells actively pumped and/or varying pumping rates and schedules from individual wells.

6.5 WETLAND TREATMENT SYSTEM

Wetland treatment is the first step in the two-step water treatment process. The purpose of wetland treatment is to remove most of the cyanide from the water so that the water can be safely and effectively treated for residual cyanide and fluoride by EC treatment. During laboratory testing (see Appendix C of the SFS, Hydrometrics, 2018), approximately 80 to 90 percent of the total cyanide in groundwater was removed in the wetland system resulting in a wetland effluent concentration of less than 0.2 mg/L free cyanide.

The conceptual design of the constructed wetland treatment system is as follows:

- Approximately 3-acre open water surface wetland to treat a flow of 50 gpm with a hydraulic retention time of seven days;
- Wetland Length: Width ratio = 3:1 to promote uniform hydraulic mixing and prevent flow channeling;
- Surface water depth = 6-8 inches;
- Wetland system would be lined with a low permeability liner (e.g., geocomposite liner) and would have a total water depth of approximately 1 foot with planted and volunteer emergent and submergent plant species;
- Organic-rich soil with total organic carbon content at least 4% to be used as soil substrate (6-8 inches);
- Recommended wetland flora: Emergent species such as cattails plugs and pondweed, submergent and floating-leaned species (coontail) as cuttings;

- Inlet perforated pipe spanning across the width of the wetland at the entrance and exit portion of the wetland for fluid conveyance; and
- About 15% of the entire wetland length to be kept free of vegetation at the entrance section to allow maximum sunlight and photo-dissociation of total cyanide compounds (iron cyanide complexes).

This conceptual design is based on a laboratory pilot-scale test (8.75 sq. ft wetland area treating 0.002 to 0.006 gpm) conducted with Site groundwater in 2016 (described in Appendix C of the Final SFS) and a full-scale system (200 gpm flow) currently operating at ALCOA's Tennessee Site (Dzombak et al., 2006 and Ghosh, pers. comm.).

The wetland system will consist of two (or more) sections or cells. The entrance section will be kept free of vegetation to allow sunlight to degrade iron cyanide complexes (the dominant form of cyanide in contaminated groundwater) by photolysis to the more bioavailable free cyanide. The remainder of the wetland will contain soil, vegetation and microbial communities that will remove cyanide by aerobic microbial metabolism.

6.5.1 Siting and Location

The wetland will occupy approximately 3 acres. Preliminary location of the wetland is on Trust property west of the SPL Pile as shown on Figure 6-1. During RD, the sizing and location of the wetland will be optimized to fit the available Trust property. Additional Trust property that is likely suitable is available to the northeast of the SPL Pile. If needed to optimize the fit on Trust property, the wetland could be constructed using two non-adjacent cells (for instance, an open water cell northeast of the SPL Pile and the vegetated cell west of the SPL Pile).

6.5.2 Additional Treatment Parameters

Groundwater in well KMCP-3B in the vicinity of the proposed extraction well locations contains approximately 36 mg/L nitrate (as N) and 0.5 mg/L ammonia (as N). This nitrate concentration is higher than the Washington groundwater quality standard of 10 mg/L and thus removal of nitrate by the wetland treatment system is desirable and is required to comply with discharge requirements (Appendix A) and AKART. Wetlands are known (EPA, 2000; Kadlec and Wallace, 2009) to treat and remove nitrogen compounds. The wetland will be designed and operated to remove nitrate as well as cyanide.

6.5.3 Control of Exposure of Humans and Wildlife

The wetland has the potential to be an "attractive nuisance" and pose a risk to people or wildlife (particularly waterfowl or other birds) who may contact untreated or partially treated water in the wetland system. To reduce this potential risk, the wetland will be fenced, signed and secured to prevent ingress of unauthorized people. The wetland will provide potential habitat for aquatic species, waterfowl, and other wildlife and steps will be taken during RD and implementation to confirm that cyanide and fluoride concentrations in the wetland do not cause risk to ecological receptors. If required, waterfowl could be excluded through the use of bird netting as is commonly employed for industrial and waste water treatment ponds. The need for bird netting would be further evaluated during RD based on the actual concentrations of contaminants in the extracted groundwater and wetland system and available toxicity data for cyanide and fluoride.

6.5.4 Flexibility and Adaptability

The wetland system will be designed to allow flexibility and adaptability in operation. Anticipated operational variables include variations in flow rates and hydraulic retention times, intermittent or seasonal operation and other variables that are identified during RD.

6.6 ELECTROCOAGULATION (EC) TREATMENT SYSTEM

The fluoride removal system will consist of EC after treatment of cyanide in the wetland system. In the EC defluoridation system, the contaminated groundwater will flow through an electrolytic cell containing aluminum or iron/aluminum anodes. As electrical current is applied to the cell, the aluminum electrodes release aluminum ions (Al^{3+}) that react with hydroxide and fluoride to form solid aluminum-fluoride-hydroxide flocs (aggregation of suspended particles) that are separated from water by coagulation and settling. The EC process will generate fluoride-bearing aluminum hydroxide sludge (treatment residual) that likely will not have hazardous waste characteristics, but that likely will be classified as hazardous due to derivation from a listed waste (K088). The EC system would require a building to house the system, utility service, piping, pumps, reaction tanks and storage tanks; as well as personnel to operate and maintain the system.

6.6.1 Siting and Location

Preliminary location of the EC treatment is adjacent to the wetland treatment system as shown on Figure 6-1. Similar to the wetland system, the sizing and location of the EC system will be optimized to fit the available Trust property during RD. Additional Trust property that is likely suitable is available to the northeast of the SPL Pile. If needed to optimize the fit on Trust property, the EC system could be located distal from the wetland system.

Certain reagents (e.g., sodium hydroxide, calcium chloride, sulfuric acid, anionic or cationic polymers) that might be employed during water treatment may be harmful if mishandled or spilled. Proper engineering controls and standard operating procedures will be developed for storage, handling and use of potentially harmful chemicals.

6.6.2 Flexibility and Adaptability

The EC system will be designed to allow flexibility and adaptability in operation. Anticipated operational variables include variations in flow rates and hydraulic retention times, intermittent or seasonal operation, chemical reagents, electrodes and other variables that are identified during RD.

6.7 MANAGEMENT OF WATER TREATMENT RESIDUALS

Water treatment residuals include sludge from the EC process that is generated continuously during operation of the treatment system and wetland material (soil and vegetation) that will remain at the end of the operational life of the wetland.

6.7.1 Electrocoagulation Residuals

The EC process will generate fluoride-bearing aluminum hydroxide sludge (treatment residual) that likely will exhibit non-hazardous characteristics but that may be classified or handled as hazardous due to the presence of contaminants derived from a listed hazardous waste (i.e., K088 SPL) or due to high liquid content. The conceptual design includes a sludge thickener and filter press configured to allow the sludge to be emptied into a sludge hopper for transfer into 4’x4’x4’ Supersacks for handling, storage, transport and disposal. Based on the conceptual design for a 50 gpm system, it is estimated that approximately 1,000 tons of EC sludge will be generated annually. During RD, a sludge handling, characterization and disposal plan will be developed that will detail how sludge will be characterized to determine if it is hazardous and how sludge will be handled, stored and transported for disposal. The final determination of whether sludge is a hazardous or dangerous waste will be made by Ecology. If sludge is determined to be non-hazardous, disposal at a local solid waste landfill may be possible. If sludge is determined to be hazardous, disposal at a hazardous waste landfill will be required.

6.7.2 Wetland Residuals

During its operational life, the wetland would not generate any water treatment residuals. At the end of its operational life, the soil and vegetative matter remaining in the wetland system will be tested to determine appropriate storage, handling, and disposal. Based on the conceptual design for a 50 gpm system, it is estimated that approximately 3,000 tons of wetland material will remain. The decision for final disposition of this material will be made based on characterization of the wetland material at the end of the system life. It is anticipated that the waste associated with decommissioning of the wetland will not be considered to be a hazardous waste.

6.8 TREATED WATER DISCHARGE

The treated water discharge system would consist of an unlined infiltration pond excavated into the native sandy soil materials in the area (Figure 6-1). Discharge to groundwater through the infiltration pond will be authorized through a MTCA permit exemption to the State Waste Discharge permit as outlined in Appendix A. A comparison of expected treated water quality from the treatment system with potentially applicable water quality standards and effluent limits is provided in Table 6-1. Based on predicted treatment effectiveness, it is expected that the treated water quality is appropriate for discharge to groundwater via an infiltration pond.

TABLE 6-1. COMPARISON OF EXPECTED TREATED WATER QUALITY WITH POTENTIAL DISCHARGE LIMITS

Parameter	Potential Groundwater Discharge Limit (MTCA Method B or SCL) (1)	Expected Treated Water Quality (mg/L)	Basis for Estimate of Expected Effluent Quality
Total Cyanide	None	<0.5	A
Free Cyanide	0.2*	<0.2	A
Fluoride	4*	<4	A
pH std. units	6 to 9*	6 to 8	A
Temperature	None	35 to 80 F	A
Nitrate	10*	<10 to 30	F
Ammonia	None	<0.5	C
TDS	(500)	2,000	C
Spec. Conductivity (umhos/cm)	None	3,500	C
Sulfate	(250)	<300	C
Chloride	(250)	<40	C
TPH	(2)	Believed absent	D, E
BTEX (sum)	(2)	Believed absent	D, E
Arsenic	0.01	<0.02	A
Barium	1.0	<0.02	A
Cadmium	0.008	<0.01	A
Chromium	0.1	<0.02	A
Copper	0.64	0.3	A
Iron	(0.3)	<0.2	A
Lead	0.015	<0.02	A
Manganese	(0.05)	<0.05	A
Mercury	0.002	<0.0002	B
Molybdenum	0.08	<0.02	A
Nickel	0.32	<0.02	A
Selenium	0.05	<0.02	A
Silver	0.08	<0.01	A
Zinc	0.48	<0.05	A
Bis(2-ethylhexyl)phthalate	6	<0.5 to 1.2	E

Notes:

1 – CLARC Data Table – July 2015 https://fortress.wa.gov/ecy/clarc/CLARCDataTables.aspx. If no MTCA B value exists, values in parentheses are secondary contaminant limits in Table 1 WAC 173-200-040. Values with asterisk are from Ecology's Proposed Substantive Permit Requirements described in Appendix A.
2 – Limits for individual petroleum components.
A – Laboratory testing of wetland-EC system (see Appendix F).
B – Concentration in groundwater at plume center well KM-6 (October 2006).
C – Concentration in groundwater at Compliance Wells KMCP-3B and -4B (May 2013).
D – Petroleum hydrocarbons (fuels or wastes) were not identified as waste materials in the Site Characterization Analysis (Hart Crowser, 1988) or Feasibility Study (RETEC, 1993).
E – Results of analysis of groundwater samples collected from wells KMCP-3B, KMCP-4B, KM-16 and KM-5 on September 24, 2018.
F – Wetland performance based on literature reports. See discussion in Section 4.2.3 of the Final Supplemental Feasibility Study (Hydrometrics, 2018).

6.8.1 Infiltration Pond

Because of the relatively high infiltration rate of the native sand, a relatively small infiltration pond system (approximately 0.25 acres) would be required to accommodate 50 gpm. Final size of the pond would depend on the actual operational rate of groundwater extraction and treatment. The infiltration pond could be located in a variety of areas. Preliminary location of the infiltration pond is north of the SPL Pile within the footprint of the groundwater contaminant plume (Figure 6-1) to minimize potential deleterious effects of the release of treated water to un-impacted groundwater (treated water is anticipated to have high total dissolved solids concentrations that could reduce the suitability of groundwater for drinking water use). This preliminary pond location is in an area where infiltrated water would not contact contaminated soils in the unsaturated zone during percolation to groundwater. If an alternative location were desired, similar attributes (location above or upgradient of groundwater plume but not above contaminated unsaturated soils) would be preferred. The conceptual design for the infiltration pond is for a relatively shallow depth with relatively large surface are and no subsurface distribution system such that an Underground Injection Control (UIC) permit will not be required.

6.9 REQUIRED PERMITS AND APPROVALS

A summary of all currently known required permits and approvals is provided in Table 6-2. Additional requirements may be identified during RD and will be described in RD reports.

6.9.1 Extraction Wells

All extraction wells would be constructed in accordance with WAC 173-160 Minimum Standards for Construction and Maintenance of Wells by a licensed driller. Water extracted from the wells will not be put to beneficial use, therefore, a water right and drilling permit is not required. Prior to well construction, a Notice of Intent to construct the wells will be filed with Ecology and Spokane County.

TABLE 6-2. POTENTIAL OR ANTICIPATED PERMITS AND APPROVALS

Interim Action Element	Potentially Required Permit, Plan or Approval	Issuing or Approving Agency or Entity
Extraction Wells	Notice of Intent to install dewatering/resource protection well.	WA Department of Ecology and Spokane County
Pipelines	Access agreements with adjacent property owners and work permit for BPA powerline.	Property Owners; BPA
Discharge of treated water to ground	Compliance with substantive permit requirements in Appendix A.	WA Department of Ecology
Construction and Operation	Building Permit Erosion and Sediment Control Critical and Hazardous Materials List/Hazardous Material Management Plan Septic System Permit	Spokane County
	Electric Permit	WA Labor and Industries

6.9.2 Infiltration Pond Discharge to Groundwater

Under WAC 173-340-710(9)(b) infiltration of treated water to groundwater may be exempted from the administrative and procedural requirements of the State Waste Discharge Permit program. The project must still comply with the substantive requirements of the permit. Ecology has provided the proposed substantive requirements for the discharge of treated water to ground (Ecology, 2019) and those are described in Appendix A. The proposed requirements include compliance with discharge limitations and regular monitoring and reporting of treatment system performance.

6.9.3 Stormwater

Construction of the IA is expected to result in disturbance of greater than 1 acre of land; however no discharge of stormwater to surface waters of the State is expected. Therefore, a Construction Stormwater General Permit is not anticipated to be required.

6.9.4 Air Quality

Interim Actions are not expected to generate significant quantities of air pollution and thus no air quality permits are anticipated.

6.9.5 Construction and Operation Permits

Various permits, plans or approvals for construction and building are potentially required from Spokane County including, but not limited to:

- Building Permit;
- Erosion and Sediment Control;
- Critical and Hazardous Materials List/Hazardous Material Management Plan; and
- Septic System Permit.

During the design process and prior to construction, the Trust and/or Contractor will have a pre-application conference with Spokane County to identify requirements for local plans, approvals, and permits. Permits and inspections for electrical service will be required from Washington Labor and Industries.

6.9.6 Access Agreements with Adjacent Landowners

The IA will potentially require access to property owned by Kaiser Real Estate (Parcel 6), Bonneville Power Administration (BPA) (powerline), and Spokane Recycling Company. A work permit or authorization to perform work under the powerline will be required from BPA.

6.10 MOBILIZATION AND SITE PREPARATION

Mobilization and site preparation consists of transporting the necessary construction materials and equipment to the Site and constructing any temporary controls and facilities prior to commencement of interim action activities. These preliminary activities may include:

- Site access control;
- Installing temporary facilities such as a construction trailer, sanitation and decontamination facilities;
- Installing erosion control measures;
- Establishing equipment staging and laydown areas; and
- Pre-construction surveying.

Work will be performed only during hours allowed by the Spokane County municipal code.

6.11 HEALTH AND SAFETY/SITE ACCESS CONTROL

The contractor that is hired by MCT will be responsible for preparing a Project and Work Site-specific Health and Safety Plan (HASP) for the IA. The Contractor shall submit the plan to Ecology a minimum of two weeks prior to commencing excavation work at the Site.

6.11.1 Excavation and Construction

Site excavation work could generate airborne dust. Engineering controls will be used (such as misting/watering exposed soil in traffic areas and covering stockpiles) as necessary to meet Ecology best management practices (BMPs) and to prevent airborne dust emissions.

Construction noise will be generated by a variety of construction equipment such as truck engines, generators and other small engines, and earthmoving equipment. Construction noise will be limited to daytime hours and is not expected to create adverse impacts. Construction activities will be carried out in a manner consistent with Spokane County municipal code and State environmental noise standards.

The Contractor will be responsible for placing temporary perimeter fences around the work area. This fencing will be maintained during work to limit public access to the work area. The Site shall be entered and exited from a defined location that includes BMPs to minimize the tracking of soil off-Site. BMPs will be implemented consistent with the State Department of Ecology Stormwater Management Manual for Eastern Washington (Ecology, 2004).

6.11.2 Well Construction and Groundwater Monitoring

Installation and monitoring of groundwater extraction wells will expose workers to sediment and water containing cyanide and fluoride. Workers would also be exposed to purge water from well monitoring activities. During these activities, worker exposure would be limited by the use of proper personal protective equipment (PPE). Purge water with concentrations exceeding cleanup levels has been classified as hazardous and will be sent off-Site for proper disposal at a permitted facility.

6.11.3 Water Treatment

Certain reagents (e.g., sodium hydroxide, calcium chloride, sulfuric acid, anionic or cationic polymers) that might be employed during water treatment may be harmful if mishandled or spilled. Proper engineering controls, PPE and standard operating procedures will be developed for storage, handling and use of potentially harmful chemicals.

6.12 STORMWATER POLLUTION PREVENTION AND EROSION CONTROL

As described in Section 6.9.4, no discharge of stormwater to surface waters of the State is expected and a Construction Stormwater General Permit is not anticipated to be required. To ensure no discharges to surface water and to prevent other off-site impacts, the Contractor will develop a stormwater pollution prevention program and implement BMPs consistent with the State Department of Ecology Stormwater Management Manual for Eastern Washington (Ecology, 2004).

6.13 SOIL EXCAVATION, TESTING AND DISPOSAL

Soil excavation will occur and be associated with pipeline installation, construction of the wetland treatment system, and construction of the building to house the EC treatment system. To the extent possible, design and construction will balance cut and fill to attain a neutral material balance and avoid the necessity of handling and disposal of excess fill.

Soil on the Trust property was sampled and tested extensively during Site remediation in 2001 and all soil failing Site cleanup levels was excavated and disposed in the capped SPL repository. Thus, soils currently present on the Site that might be disturbed by construction activities are expected to be better than Site soil cleanup levels. As previously described in Section 3.7, the cleanup levels for soil on Site are:

- 2,884 mg/kg fluoride; and
- 1 mg/kg cyanide (free).

6.14 INTERIM ACTION COMPLETION REPORT

A completion report will be prepared by Contractor following completion and successful operation of IA. Completion report will include as-built drawings and an O&M Manual.

6.15 OPERATION AND MAINTENANCE

Interim Action elements that will require ongoing O&M will include extraction wells and pumps, pipelines, wetland treatment system, EC treatment system, infiltration pond, and associated systems. Operation and maintenance of IA elements will be the responsibility of MCT. MCT may perform O&M or may subcontract.

6.15.1 Optimization and Adaptation

Ecology expects the Trust and its contractors to optimize the system over time to seek maximum benefit toward the project goals per unit cost. During and following implementation of IA, the extraction and treatment system will be optimized and operated/ managed to yield the highest cyanide and fluoride mass load removal with the lowest cost. Optimization may require extraction and treatment of higher or lower rates than the nominal 50 gpm design flow; variable or seasonal rates; intermittent operation; adjustment of hydraulic retention times or other modifications. The Trust will explore contractual arrangements and incentives with the Contractor for optimization that may include the following:

1. Requiring the Contractor to be responsible for operations the first year, to assure that the system works as designed. After that, the Trust may explore other operational arrangements, including changing operators for performance or cost purposes.
2. To optimize and adapt, the Contractor and MCT will develop a set of performance metrics that will be used to identify how well the facility is operating. The Trust and Ecology will confer monthly using these performance metrics as a focal point for adjusting and adapting.

7.0 SCHEDULE

Schedule for the IA will be developed in consultation with Ecology and with the selected Interim Action Contractor. The preliminary schedule is for remedial design, construction and start-up of the water treatment system in 2019 with full-scale operation of the treatment system in 2020. An updated schedule for RD and implementation of IA will be presented in the Preliminary Design Report as described in Section 6.2.3.

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APPENDIX A

PROPOSED SUBSTANTIVE PERMIT REQUIREMENTS FOR DISCHARGE OF TREATED WATER TO GROUND (WA ECOLOGY, JANUARY 10, 2019)

APPENDIX A

Proposed Substantive Permit Requirements for Discharge of Treated Water to Ground

Kaiser Mead NPL Groundwater Interim Action

Under WAC 173-340-710(9), this interim action is exempt from the procedural requirements of the State Waste Discharge Permit program for discharge of treated water to ground. However, the Trust must comply with relevant substantive requirements of such a permit. These substantive requirements are outlined below. Ecology will review these requirements no less than every five years to determine if adjustments are needed based on new information, applicable requirements or agency policy.

Effluent Limitations

The discharge of treated water to ground is authorized subject to the following discharge limitations. The location of the discharge shall be as specified in the approved Remedial Design.

Parameter	Limit	Units	Averaging Period
Free cyanide	0.2[a]	mg/l	Calendar month average
Fluoride	4.0[a]	mg/l	Calendar month average
Nitrate	10[b]	mg/l as N	Rolling annual average
pH	6 to 9[c]	standard units	None—see footnote c)

a) Calendar month average shall be calculated as the arithmetic average of the values for all effluent samples collected for the calendar month.

b) Rolling annual average shall be calculated as the average of the preceding twelve calendar month averages. Compliance with the limit shall be evaluated monthly beginning at the end of the twelfth calendar month following system start-up.

c) If effluent pH is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 are not considered violations if no single excursion exceeds 60 minutes in length and total excursions do not exceed 7 hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations, regardless of duration.

Application of All Known Available and Reasonable Methods of Treatment

Chapter 90.48 RCW requires that all known, available and reasonable methods of control, prevention and treatment (AKART) be applied prior to discharging pollutants to waters of the state. Based on the information contained in and referenced by the Supplemental Feasibility Study for the Kaiser Mead NPL Site, Ecology has determined that the wetland/electrocoagulation treatment methods constitute AKART for the pollutants of concern in groundwater at the site. Ecology may refine the technology-based performance expectations for the treatment system based on the demonstrated performance of the system following completion of construction, start-up and an initial period of operation.

The Trust shall submit a treatment system performance report with the 8th quarterly monitoring report. The report shall summarize operation data and evaluate pollutant removal efficiencies (for fluoride, total and free cyanide, and nitrate) for the system under the operating conditions observed. The report shall also analyze system performance trends as a function of seasonal parameters, operational adjustments, influent pollutant concentrations and flow.

Monitoring Requirements

As part of the pre-Final Design, the Trust shall prepare a Monitoring Plan for Ecology review and approval. The Monitoring Plan shall propose the specific monitoring frequencies, parameters, laboratory methods, method detection limits, sample types (grab, time/flow weighted composite, continuous recording, etc.), sample locations, and operational parameters to be established/monitored for the proposed design to ensure proper system operation, and compliance with the effluent limitations and to provide the data needed to optimize system performance with respect to the project goals. The Monitoring Plan shall meet the requirements of WAC 173-340-820 and address each of the system components:

- Extraction system;
- Wetland treatment unit;
- Electrocoagulation treatment unit;
- Infiltration system; and
- Groundwater/subsurface response monitoring.

The Monitoring Plan shall include provisions for:

- Continuous flow, temperature and pH recording as appropriate;
- Monitoring of free and total cyanide, fluoride, nitrate, temperature and pH across the treatment system, and calculation of removal efficiencies and contaminant mass removal for free and total cyanide, fluoride and nitrate;
- Tracking of extraction rates, specific capacities and contaminant concentrations for each extraction well;
- Recording of operational parameters and treatment plant downtime;
- Identification and description of exceedances of the discharge limits; and
- Groundwater/subsurface response monitoring including updated plume data/maps, potentiometric data/maps, trend analysis and capture zone analysis.

The Monitoring Plan shall also consider specific data needs during system start-up which may include: defining the start-up period, more frequent performance sampling, additional parameters, additional monitoring of internal sampling points (e.g. different locations within the wetland), and development of operational performance parameters and acceptable ranges for system components.

Once approved, the Trust shall comply with the terms of the approved plan. The Monitoring Plan may be modified upon review and approval by Ecology.

Reporting and Record Keeping Requirements

The Trust must submit quarterly monitoring reports to Ecology's cleanup project manager in a format approved by the Department. The first monitoring report shall be due 30 days following completion of the quarter in which system start-up occurs. The report shall summarize the data generated for the quarter in accordance with the approved Monitoring Plan.

All groundwater sampling data shall be submitted to Ecology in both printed and electronic formats in accordance with WAC 173-340-840(5) and Ecology Toxics Cleanup Program Policy 840: Data Submittal Requirements. More information on submitting this data electronically through Ecology's Environmental Information Management database can be found at: https://ecology.wa.gov/Regulations-Permits/Reporting-requirements/Data-submittal-requirements-for-cleanup-sites

The Trust must report any noncompliance that may endanger health or the environment immediately to Ecology's Regional Office 24-hour number listed below:

- Eastern Regional Office 509-329-3400

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and WAC 173-303-145.

The Trust must also notify the Ecology Industrial Section cleanup project manager by telephone for any of the above situations. Outside of normal working hours, a voice mail notification to the Industrial Section project manager or their designated backup will meet this requirement.

The Trust must retain records of all monitoring information for a minimum of five years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this authorization, and records of all data.