Kerr-McGee Chemical Corp. Soda Springs Plant Superfund Site, Proposed Plan

Soda Springs, Idaho **March 9, 2023**

U.S. Environmental Protection Agency, Region 10

Proposed Plan for Public Comment

1. Introduction

The U.S. Environmental Protection Agency (EPA) invites the public to review and comment on this Proposed Plan to amend the Record of Decision (ROD) for the cleanup of groundwater at the Kerr-McGee Chemical Corporation Soda Springs Plant Superfund Site (Site). The property is a former chemical-manufacturing facility located north of Soda Springs, Idaho (Figure 1-1)[1].

This Proposed Plan provides background information on the Site and the cleanup process for the Site, describes the cleanup alternatives that were evaluated, identifies EPA's Preferred Alternative, and explains the reasons for this preference. By issuing this Proposed Plan, EPA fulfills the statutory and regulatory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) § 117(a) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) § 300.430(f)(2). The topics covered by this Proposed Plan are shown in the inset box below.

Inside this Proposed Plan

Public Comment Period: Now through April 7, 2023

Where to review the Proposed Plan:
The Administrative Record, which contains the Proposed Plan and other documents that support the basis for the Preferred Alternative, is available for public review at the following locations:

- Soda Springs Public Library
  149 S. Main Street
  Soda Springs, ID 83276
  208-547-2606 (call for hours)
- Online: https://www.epa.gov/superfund/kerr-mcgee-soda-springs

How to Comment on the Proposed Plan:
Written comments may be submitted at any time during the public comment period (now through March 19, 2023) by U.S. mail or email to one of the following recipients:

- U.S. Mail: Zoë Lipowski, EPA Region 10, 1200 Sixth Avenue, Suite 155, M/S 12-D12-1, Seattle WA 98101
- Email: lipowski.zoe@epa.gov

Public Meeting, Wednesday, March 29, 2023:
EPA will hold a public meeting to present the information provided in this Proposed Plan, take comments from the public, and provide the public the opportunity to ask EPA questions. EPA will accept oral and written comments at the public meeting.

Wednesday, March 29, 2023
5:00 to 6:00 p.m. – Open House
6:00 p.m. – Presentation and Public Comment
Soda Springs City Hall
9 West 2nd South
Soda Springs, ID 83276

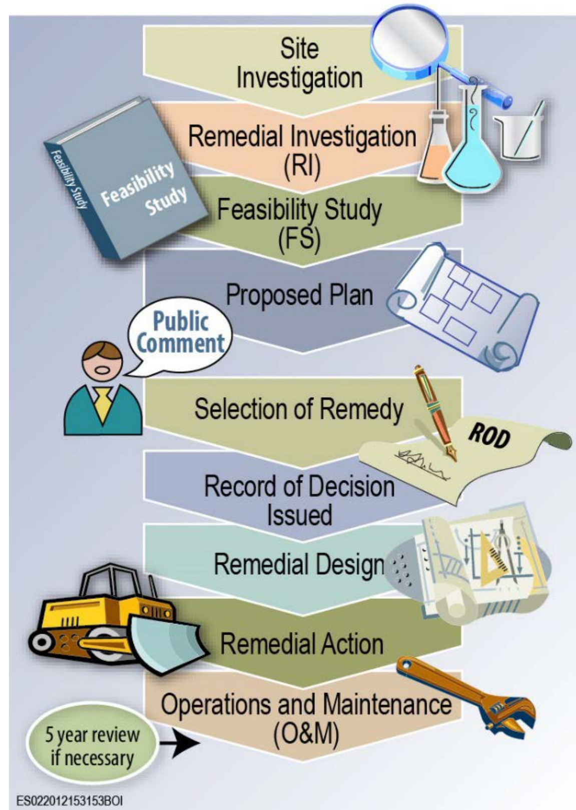
Additional meeting information will be published in the *Caribou County Sun* and *Idaho State Journal*, as well as on EPA's website.[2]

[1] Tables and figures are located at the end of this document.

[2] https://www.epa.gov/superfund/kerr-mcgee-soda-springs

EPA is the lead agency at the Kerr-McGee Site, and the Idaho Department of Environmental Quality (IDEQ) is the supporting agency. EPA, in consultation with IDEQ, will issue an amendment to the cleanup decision described in the ROD for the Site after reviewing and considering all information submitted during the 30-day public comment period. EPA may modify the Preferred Alternative or select another response action presented in this Proposed Plan based on new information or public comment. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 300.430(f)(2) of the NCP. This Proposed Plan summarizes information that can be found in greater detail in the supplemental remedial investigation (SRI), focused feasibility study (FFS), and other documents contained in the Administrative Record for this Site. EPA encourages the public to review these documents to learn more about the site and Superfund activities that have been conducted at the site.



The Superfund Process

The Superfund process, as established by CERCLA and the NCP, is structured to guide the cleanup of contaminated sites. The process includes defined steps, illustrated to the right, leading from discovery of a site, through investigation, remedy selection, and implementation of a remedy. The NCP includes procedures, expectations, and program management principles to guide the process. EPA has developed technical guidance and policies on a range of issues so that decisions are based on sound science and to ensure that cleanup actions will ultimately be protective of human health and the environment.

Summary of Preferred Alternative

EPA proposes to use a hybrid approach to address the groundwater contamination at the Site that combines in-situ groundwater treatment and groundwater capture with ex-situ treatment for the groundwater source area. Monitored natural attenuation (MNA) will be used in the portions of the plume farther from the contaminant source, downgradient of the active source area remediation. In addition to the previous source control actions and removals completed at the Site to date, and the ongoing Long-Term Monitoring (LTM) Program, a sitewide adaptive management plan will be developed and implemented to evaluate and monitor critical elements of the remedy, and determine if additional designs, design modifications, or operational changes are necessary to achieve remedial action objectives (RAOs). An Institutional Control Plan (ICP) is required in the 1995 ROD and is a planned component of the Preferred Alternative.

The Preferred Alternative provides additional flexibility for implementation because it includes pilot studies to gather additional information on the Site and sequential application of complementary elements of the remedy that can be designed and constructed in response to a more robust dataset and better Site knowledge.

The Preferred Alternative will reduce the magnitude of residual risks at the Site through passive controls and active treatment to reduce mass transport from the remaining subsurface source areas to the primary groundwater flow paths. The combination of active groundwater treatments, MNA, and ICs is expected to restore groundwater to beneficial uses within a time frame that is reasonable.

2. Site Background

The Kerr McGee property is located 1.5 miles north of Soda Springs, Idaho. Historical plant operations, including vanadium processing activities and handling of solid wastes, wastewater, and process water, have resulted in contamination of soil and groundwater on the Kerr-McGee property and off-site locations.

The Kerr-McGee property consists of approximately 547 acres located east of State Route 34 in Caribou County, north of the City of Soda Springs, Idaho, in an area zoned for industrial use. The property is bordered by agricultural land to the north and east, the former Evergreen Facility and agricultural land to the south, and the Bayer Corporation phosphate processing plant across State Route 34 to the west.

Site History

Chemical manufacturing began at the property in 1963 and continued until 2009. The facility was owned and operated by the Kerr-McGee Chemical Corporation (KMCC) to produce vanadium, although secondary by-products such as fertilizer and cathode materials for lithium-manganese batteries were also produced between 1997 and 2009.

In 2005, KMCC created Tronox Limited (Tronox), a corporate "shell" company, and transferred the Site (and hundreds of other contaminated sites) without the funds required for cleanup. KMCC then sold the most valuable oil and gas assets to Anadarko Petroleum Corporation (Anadarko). Tronox was unable to pay for cleanup of the KMCC sites and filed for bankruptcy in 2009. The U.S. Bankruptcy Court approved a Settlement Agreement in 2011 with the federal government, 22 state governments, Tronox, and others that established several trusts, including the Multistate Trust, with limited funds to address only the most pressing environmental actions. A federal lawsuit against Anadarko for fraudulent conveyance led to a court-approved settlement on January 21, 2015. Under the Anadarko Litigation Settlement, the Site received funds in 2015 and 2016 which allowed the Multistate Trust to implement several environmental actions at the Site.

Historical Releases of Contaminants

The processing plant was constructed in 1963 and produced vanadium by metallurgical refinement of ferrophosphorus ore recovered as a smelter slag by-product from the refinement of phosphate at the nearby Monsanto (now Bayer) and FMC Industries elemental phosphorus plants. The refinement process produced eight vanadium compounds, but the process liberated many other metal-bearing minerals such as arsenic, manganese, and molybdenum, and introduced liquids containing tributyl phosphate and No.1 fuel oil into the process water. Spent solids from the refinement process were discharged to one of two unlined calcine tailings repository ponds. Tailings were discharged to the West Calcine Repository from 1963-1973 and the East Calcine Repository from 1973-1999. Water management on the property evolved over time; sixteen surface water ponds, both lined and unlined, were used for settlement, storage of residual solvent extraction (S-X) liquids (also called S-X raffinate), tailings storage, product storage, and stormwater retention (**Figure 2-1**).

Decades of infiltration into the ground through unlined ponds and direct leaching from the calcine repositories caused contamination to spread into the subsurface and reach groundwater. In addition, at least three sudden containment failures were documented between 1981 and 1989, resulting in uncontrolled releases totaling 3.25 million gallons of liquid process water and wastewater to groundwater.

Previous Remedial Actions

1995 ROD

EPA issued a ROD for the Site in 1995 (EPA, 1995). The goal of the remedial action was to restore groundwater contaminated by facility sources to meet all risk-based performance standards for contaminants of concern (COCs), other than arsenic, and the Maximum Contaminant Level (MCL) for arsenic.

The RAOs for the Site include:

- Prevent the transport of COCs from facility sources to the groundwater; transport may result in COC concentrations in groundwater exceeding risk-based groundwater performance standards or MCLs for drinking water.
- Prevent ingestion by humans of groundwater containing COCs that have concentrations exceeding risk-based groundwater performance standards or MCLs.
- Prevent transport of COCs from groundwater to surface water in concentrations that may result in exceedances of risk-based groundwater

performance standards or MCLs in the receiving surface water body.

- Prevent the ingestion/direct contact with the roaster reject area material having vanadium concentrations in excess of 14,000 milligrams per kilogram (mg/kg).
- Prevent the transport of COCs from the active calcine tailings area to the surrounding soils in amounts that exceed the 95 percent upper threshold limit concentration of the background soils.

The selected remedy included the following actions:

- Elimination of uncontrolled liquid discharges from the facility by replacing unlined ponds with lined ponds;
- Excavation and reuse/recycling of buried calcine tailings (by using calcine to manufacture fertilizer on the property for an eight-year period);
- Excavation and disposal of S-X Pond and Scrubber Pond solids into lined ponds on the property and placement of solids from the ponds in a landfill on the property;
- In-place capping or excavation and disposal of windblown calcine and roaster reject material;
- Semi-annual groundwater monitoring to evaluate the effectiveness of source control measures in achieving the groundwater cleanup goals established in the ROD. These cleanup goals are named project screening levels (PSLs); and
- ICs for off-Site areas to prevent exposure to groundwater for as long as the groundwater exceeds the PSLs.

Remedial actions taken as part of the 1995 ROD led to construction of two new lined ponds (the East and West 5-Acre Ponds), a double-lined and capped landfill called the RCRA (Resource Conservation and Recovery Act) Landfill or West Waste Repository, and a double-lined pond (the 10-Acre Pond) (**Figure 2-1**).

2000 ROD Amendment

The EPA issued a ROD Amendment (RODA) in 2000 requiring KMCC to cap the calcine tailings and roaster rejects rather than continue reuse/recycling of the materials as required by the 1995 selected remedy (EPA, 2000). In-place capping was combined with ICs to restrict land use.

In 2004, the East and West 5-Acre Ponds were reclaimed and the contents, excluding liners, were placed in the 10-Acre Pond.

2018 10-Acre Pond Time-Critical Removal Action

From June 2018 to June 2019, the Multistate Trust conducted a Time-Critical Removal Action (TCRA) to excavate the 10-Acre Pond and other near-surface source materials and place them in a newly constructed on-Site waste repository (**Figure 2-2**). In all, over 350,000 cubic yards of waste were removed from near-surface sources. Removing surface source material is anticipated to eliminate the most significant source of Site-related contamination leaching to groundwater and result in significant improvement in groundwater quality.

The entire property was regraded to direct surface water runoff away from known or suspected subsurface source areas. Regrading will eliminate ponding, focused recharge to groundwater, and rapid infiltration through those source areas.

Five-Year Reviews

EPA has conducted five Five-Year Reviews at the Site in 2002, 2007, 2012, 2017, and 2022. The results of the fifth (2022) Five-Year Review concluded that the remedy is short-term protective and currently protects human health and the environment because there is no exposure to contaminated groundwater or soil. However, in order for the remedy to be protective in the long-term, the following actions were recommended: finalize the FFS and issue an additional RODA to document and implement the updated remedy and institutional controls.

3. Site Characteristics

Physical Setting

The Site is in a valley between the Soda Springs Hills and Chesterfield Range to the west and the Aspen Range to the east. The regional geology contains many north-south trending faults. The Site is underlain by a layer of silt and clay ranging from 1 to 57 feet thick, followed by approximately 230 feet of fractured basalt flows. Basalt flows are separated by interbeds of silt and clay up to 26 feet thick. Groundwater preferentially travels south/southwest along faults, fractures, and interbed zones in two recognized aquifers: (1) an upper unconfined freshwater surficial aquifer in the upper basalt flows and (2) a multi-layered carbonate-rich aquifer semi-confined by the lower basalt flows. These two aquifers are collectively called the Blackfoot Basalt aquifer.

Past volcanic activity and its lingering geothermal activity has caused numerous springs and seeps where groundwater surfaces in the Soda Springs region. As a result, groundwater flowing underneath the Site discharges to seeps, springs, and surface water bodies located within the Finch Creek, Little Springs Creek, and Big Springs Creek drainages (**Figure 3-1**).

Current and Future Site Uses

The property is currently vacant; some of the surrounding land is farmed. Site security is maintained using fencing, signage, and inspections.

The City of Soda Springs provides drinking water to residents from five Ledger Creek springs and Formation Spring, all of which are part of the Site's long-term monitoring program.

Attractive attributes for reuse of the property include its relatively large size, proximity to an active railroad line to the north and a public park to the south, accessibility of high voltage electrical transmission lines, gas, and water. The property is zoned for industrial use by Caribou County. Many community members are open to industrial development, while some prefer extending the park's trails into the property. The selection and design of additional cleanup actions for the Site take into consideration the desire to return the property to beneficial reuse. Future use of the property is currently anticipated to be industrial, however, EPA evaluated the southwestern corner of the property east of the rail spur for potential residential use, for the purpose of conservative risk-based decision-making.

Contamination in Site Media

Molybdenum, vanadium, lithium, arsenic, manganese, tributyl phosphate, and total petroleum hydrocarbons are found throughout the Site in various media, including surface soil, subsurface soil, groundwater, and surface water. COC concentrations measured at the Site are summarized in **Table 3-1**.

The primary COCs at the Site are vanadium and molybdenum. A molybdenum groundwater plume originates on the property and discharges at Big Spring near the Bear River at concentrations above EPA's tapwater Regional Screening Level (RSL) (**Figure 3-2**). A vanadium groundwater plume also originates at the Site and extends to approximately East 1st Street North in Soda Springs at concentrations above the EPA's tapwater RSL (**Figure 3-3**). The two COCs are found above their respective tapwater RSLs at depths exceeding 150 feet below the ground surface.

How does EPA Assess Risk?

Human health and ecological risk assessments provide estimates of risks to people and ecological receptors from exposure to contaminants either now or in the future. For these studies, "risk" is defined as the possible harm to people or wildlife from exposure to chemicals. Two types of health risks for people are evaluated: (1) cancer and (2) noncancer health effects. EPA evaluates only noncancer risks to wildlife.

EPA uses the results of a risk assessment to evaluate whether the contamination at a site poses an unacceptable risk to human health or the environment under CERCLA. The CERCLA regulations provide a range of risk numbers to evaluate if cleanup of a site is necessary. EPA established an "acceptable" excess lifetime cancer risk range, from 1 in 10,000 (1×10^{-4}) to 1 in 1,000,000 (1×10^{-6}) risk of developing cancer from exposure to site contaminants at a site over a person's lifetime.

For noncancer health effects, EPA calculates a hazard quotient(HQ) or hazard index (HI) for both humans and wildlife. A hazard index is the sum of the hazard quotient for several chemicals that have the same or similar effects. The noncancer hazard index of 1 is a threshold below which EPA does not expect any noncancer health effects to occur in exposed populations. If the hazard quotient or hazard index is 1 or higher, then exposure to site contaminants could cause adverse effects to humans or wildlife.

4. Summary of Site Risks

Baseline human health and screening level ecological risk assessments were performed as part of the SRI for the Site following standard EPA and IDEQ guidance. Multiple exposure pathways by which people (human receptors) or plants and animals (ecological receptors) could be exposed to contamination at the Site were evaluated.

The Site was divided into separate and distinct exposure areas including: On-Site (Industrial area and Lower Field) and Off-Site (Former (b) (6) Property, Soda Springs (groundwater only), Big Spring Creek, Ledger Creek and Unnamed Stream) (**Figure 4-1**).

Human Health Risks

A human health conceptual site model (CSM) was developed to identify potential exposure pathways for human receptors based upon current and anticipated future land use at the Site and included:

- On-Site/Off-Site construction/utility workers
- Industrial workers
- Recreational users
- On and Off-Site residents (adult and child)

All receptors may be exposed to soils (via incidental ingestion, dermal contact, and the inhalation of fugitive dust) and to groundwater (via ingestion and dermal contact). Residential receptors were assumed to also be exposed to homegrown produce and beef that has taken up site contaminants from soil and groundwater. On and off-Site residents exposed to groundwater is considered a hypothetical scenario because all residents living in areas with groundwater contamination are connected to the City water supply. Recreational users may be exposed to surface water and sediment via incidental ingestion and dermal contact and ingestion of fish that have taken up contaminants.

A target risk level (TRL) of 1E-05 (1 in 100,000) was selected to compare against site-related cancer risks and is consistent with EPA's acceptable cancer risk range of 1E-04 to 1E-06 and IDEQ's acceptable TRL for combined exposure to all carcinogens for a receptor. For noncarcinogens, a target hazard quotient (HQ) and hazard index (HI) of 1 was chosen as an acceptable level. In cases where the cumulative HI is above 1, target organs were considered. If contaminants of potential concern (COPCs) have the same target organ and the cumulative HI is less than 1 for the target organ, adverse effects are not expected.

The results of the BHHRA are summarized below and in **Table 4-1**:

- Soil – Cancer risks for all receptors are below the acceptable TRL of 1E-05. Noncancer risks exceed the HI of 1 in limited instances:
    - For child residents in the Lower Field due to concentrations of manganese that are comparable to background levels, indicating that these concentrations are due to naturally-occurring conditions and therefore, are not Site-related.
    - Noncancer risks to child residents in the Former (b) (6) Property slightly exceeds a HI of 1 due to concentrations of TPH (HQ=1.2) in homegrown produce. This pathway used modeled produce concentrations in soil and a conservative assumption that half of all the produce consumed by the hypothetical child resident is homegrown. This is a conservative assumption due to Idaho's climate and short growing season.

    Overall, exposure to COPCs in soil does not pose unacceptable risks to receptors and no further evaluation is warranted.

- Groundwater – Cancer risk for all receptors are below the acceptable TRL of 1E-05 in each area except for hypothetical off-Site adult and child residents in Soda Springs. Cancer risk is due to the ingestion/dermal contact with arsenic in groundwater hypothetically used as tap-water.

    Noncancer risk for industrial workers from on-Site groundwater is above a HI of 1 due to dermal contact with vanadium in process water. Since concentrations of vanadium are considered Site-related and the results of the risk evaluation are also above acceptable noncancer levels, exposure to on-Site groundwater may pose a potential health concern for future industrial workers. Noncancer risk for construction workers due to on-Site/off-Site shallow groundwater exposure is below the acceptable HI of 1.

    Noncancer risk is above the acceptable HI of 1 for hypothetical future adult and child residents in the Lower Field due to ingestion/dermal contact during showering/bathing/swimming due to lithium, manganese, molybdenum, and vanadium in groundwater used as tap-water. These constituents are attributable to the Site.

    Noncancer risk is above the acceptable HI of 1 for hypothetical off-Site residents in Soda Springs due to lithium, manganese, and molybdenum in groundwater used as tap-water. The noncancer risk from ingestion/dermal contact with tap-water remains above acceptable levels.

- Surface water, sediment and fish tissue – The estimated risks from potential exposure to Site-related COPCs in Big Spring Creek, Ledger Creek and Unnamed Stream are below acceptable risk levels for both current/future adult and child recreational users. Therefore, no further consideration is warranted.
- Soil leaching to groundwater – It has been demonstrated through site-specific modeling and background comparisons that chemical concentrations in soils are not adversely impacting groundwater quality at the Site and further evaluation is not warranted.

Ecological Risks

The Site consists of terrestrial habitats in the former industrial areas, agricultural areas, and downgradient aquatic habitats. Downgradient aquatic habitats where groundwater from the Site may discharge to surface water include Ledger Creek, an Unnamed Stream within Kelly Park, and Big Spring Creek. A CSM was developed that identified important exposure pathways from the Site to ecological receptors. The maximum concentrations of all applicable surface water, sediment, surface soil and fish tissue samples were incorporated into the Screening Level Ecological Risk Assessment (SLERA) and evaluated for their impacts to specific species (avian/mammalian herbivores, insectivores, and carnivores/piscivores) and communities (terrestrial plants, benthic invertebrates, and fish).

No ecological risks associated with the Site were identified in the SLERA that require further evaluation or action.

Basis for Proposing a Remedy

EPA's judgement is that the Preferred Alternative, or one of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment. Two significant groundwater plumes of molybdenum and vanadium originate on the property and migrate off-Site. The primary objectives for taking action are to address these groundwater contaminant sources, prevent exposure to contaminants in groundwater by people, and restore groundwater to its highest beneficial use as a drinking water source within a timeframe that is reasonable.

A remedy is proposed for the ingestion of and dermal contact with groundwater for hypothetical future use as a drinking water source. In addition, a remedy is proposed for direct contact with on-Site groundwater used by industrial workers during process activities.

5. Remedial Action Objectives and Preliminary Cleanup Goals

Updated Remedial Action Objectives

In accordance with the NCP, EPA developed RAOs to describe what the cleanup is expected to accomplish to protect human health and the environment. RAOs help focus the development and evaluation of remedial alternatives and form the basis for establishing preliminary remediation goals (PRGs). Final RAOs and cleanup levels (CULs) will be included in the ROD.

Following are the new RAOs for the Site:

- Prevent unacceptable human health risk due to contact with, or ingestion of, groundwater contaminated by COCs with concentrations exceeding risk-based concentrations (RBCs) or MCLs.
- Restore groundwater to beneficial use as a drinking water source by reducing COC concentrations exceeding the naturally occurring background concentration, $RSL_{Tapwater}$, or MCL within a reasonable time frame.

Preliminary Remediation Goals

The PRGs represent the concentration thresholds for contaminants and media that are protective of human health and the environment. In developing PRGs, EPA considers applicable or relevant and appropriate requirements (ARARs), acceptable exposure levels (or RBCs), and other factors such as background levels of contaminants in various media, and other pertinent information. PRGs presented here are not yet final. The final remediation goals (or cleanup levels [CULs]) will be established in the RODA.

For human health, EPA considers acceptable exposure levels to be concentrations of carcinogens that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-4} (1 in 10,000 probability) to 10^{-6} (1 in 1,000,000 probability) or less; and concentration levels of non-carcinogens that are below toxicity reference doses protective of human health (an HQ of 1).

For ecological receptors, EPA considers acceptable exposure levels to be concentration levels that are below toxicity reference values or benchmarks protective of ecological populations. However, ecological risks are not present at the Site. Therefore, PRGs were not calculated for ecological receptors.

PRGs for groundwater are presented in **Table 5-1**.

6. Remedial Alternatives

This section summarizes and presents the potential additional actions to achieve groundwater cleanup goals within a reasonable time frame. These alternatives are evaluated in detail in the FFS. A list of all the alternatives considered and those that were retained for detailed evaluation are shown in **Table 6-1**.

- Alternative 1 – Existing Cleanup Action
- Alternative 2 – Monitored Natural Attenuation (MNA)
- Alternative 3 – In-Situ Active Groundwater Treatment, and MNA
- Alternative 4 – Groundwater Capture and Ex-Situ Treatment, and MNA
- Alternative 5 – Hybrid In-Situ and Contingent Ex-Situ Groundwater Treatment, and MNA

A comprehensive, Preferred Alternative is presented later in this Proposed Plan. This sitewide Preferred Alternative is a modified Alternative 5 (Hybrid In-Situ and Ex-situ Groundwater Treatment) and incorporates adaptive management planning and long-term monitoring.

Common Elements

The following subsections present remedial components that are common to all alternatives.

Preconstruction Activities

Preconstruction activities include developing health and safety and other work plans, mobilizing and demobilizing equipment, and developing remedial design drawings and specifications.

Future Land Use Assumptions

Future use of the property is currently anticipated to be industrial; however, EPA evaluated the Site for potential residential use in the southwestern corner of the Site east of the rail spur.

Institutional Controls (ICs)

ICs are administrative and/or legal mechanisms intended to control land use to minimize the potential for people to be exposed to contamination by limiting land or resource use, and to maintain the integrity of the engineered components of the remedy.

An ICP was required in the 1995 ROD and is a planned component of all alternatives for the Site. A conceptual Site-wide ICP was prepared in the FFS to consider a preliminary suite of ICs that could be employed in conjunction with the potential remedial alternatives. The conceptual ICP considered four general IC application “zones,” shown on **Figure 6-1**.

Operation and Maintenance (O&M)

O&M is an integral component of all alternatives and ensures the proper functioning and integrity of engineering controls such as the repository cover system or the proper functioning of treatment facilities. Each specific alternative includes a variety of O&M requirements. The specific O&M requirements vary depending on the cleanup method or technology and will be refined during remedial design.

Long-term Monitoring (LTM)

Monitoring is also an integral component of all alternatives to assess the effectiveness of the remedy. The monitoring program will include periodic inspections of engineered caps and facilities, soil cover and infiltration monitoring, and sampling and analysis of groundwater. For all alternatives, monitoring activities described above would also be conducted after significant natural events. Five-year reviews will be required for as long as there are hazardous substances, pollutants, or contaminants remaining at the Site preventing unlimited use and unrestricted exposure.

Description of Alternatives

This section presents the remedial alternatives considered to address the risks at the Site and meet the

RAOs. These alternatives were developed following the requirements established in CERCLA and the NCP.

As required by CERCLA, a "No Action Alternative" is included for comparative purposes. The No Action Alternative would include only monitoring to evaluate changes in COC concentrations over time.

The cost analysis evaluated in the feasibility study includes O&M for 30 years. The five alternatives evaluated in this Proposed Plan have estimated cleanup timeframes ranging from 21 to 120 years. The costs for the ongoing monitoring and site maintenance activities already in place at the Site were also included to provide a consistent basis for comparison of alternatives that recognizes and includes the existing costs and commitments at the Site. The O&M costs and the total estimated present-value costs were developed using a 7 percent discount rate. The durations presented in this discussion include time to develop the remedial design.

Alternative 1 – Existing Cleanup Action

Estimated Cost/Time	
Capital Costs	$860,670
Annual O&M Costs	$300,875
Net Present Value (NPV) (30-year) Costs	$4,700,000
Construction Timeframe	None
Time to Achieve RAOs	120 years

A "no action" alternative is required under the Superfund law to compare cleanup alternatives with baseline site conditions. Since remedial activities have already been completed at this site, Alternative 1 is considered a "no further action" alternative. This alternative includes plugging and abandoning groundwater monitoring wells, while continuing to monitor groundwater quality in a small number of wells until cleanup goals are achieved throughout the plume. Alternative 1 is not considered protective and does not meet ARARs or achieve RAOs in a reasonable timeframe.

Alternative 2 – Monitored Natural Attenuation

Estimated Cost/Time	
Capital Costs	$339,450
Annual O&M Costs	$728,433
NPV (30-year) Costs	$10,200,000
Construction Timeframe	None
Time to Achieve RAOs	120 years

Alternative 2 includes the following components:

- MNA to address remaining subsurface COC sources and groundwater plumes until cleanup goals are achieved throughout the plume.

EPA defines MNA as "the reliance on natural attenuation processes (within the context of a carefully controlled and monitored clean-up approach) to achieve site-specific remedial objectives within a timeframe that is reasonable compared to other methods" (EPA, 1999). Natural attenuation processes include a variety of physical, chemical, or biological processes that act without human intervention to reduce the contaminant mass, toxicity, mobility, volume, or concentrations in soil and groundwater. Biodegradation is the most important destructive attenuation mechanism, although abiotic destruction of some compounds does occur. Nondestructive attenuation mechanisms include sorption, dispersion, dilution from recharge, and volatilization.

MNA is appropriate as a remedial approach only when it can be demonstrated to be capable of achieving the RAOs within a timeframe that is reasonable compared to that offered by other methods. MNA is typically applied in conjunction with active remediation measures, or as a follow-up to active remediation measures that have already occurred. Evaluating natural attenuation usually involves both determining what natural attenuation processes are occurring and estimating future results of these processes. Therefore, if EPA selects this remedy, it will include continued monitoring and data evaluation over time to document and verify the effectiveness of these processes. The evaluation may consist of groundwater or fate-and-transport modeling to predict the effects of natural attenuation. The evaluation method may also be updated periodically to verify progress and compare groundwater analysis results to the predictions.

In addition to modeling, the use of natural attenuation as part of the remedial plan will require that a long-term monitoring program be instituted. Since groundwater monitoring is ongoing, Alternative 2 would require no additional steps to implement. The existing monitoring well network would be used to monitor groundwater COC concentrations, breakdown products, geochemical conditions, and natural attenuation parameters, including dissolved oxygen, oxidative-reductive potential, turbidity, pH, and conductivity. COC concentrations are expected to decrease in all areas on- and off-Site in response to the already completed actions, including the TCRA. Groundwater cleanup goals are expected to be achieved throughout the plume in up to 120 years, which is not a reasonable timeframe for reaching RAOs. **Figure 6-2** provides an overview of Alternative 2.

Alternative 3 – In-Situ Active Groundwater Treatment

Estimated Cost/Time	
Capital Costs	$4,404,747
Annual O&M Costs	$1,395,201
NPV (30-year) Costs	$22,000,000
Construction Timeframe	1-2 years with annual injections
Time to Achieve RAOs	50 years

Alternative 3 includes the following components:

- Includes all elements of Alternative 2.
- Includes active groundwater extraction, pumping, mixing amendment and reinjection via a series of recovery and injection trenches and /or wells.
- Pilot testing of the in-situ treatment amendment mixture.
- The treatment area would be limited to the plume cores south of the Former Industrial Area Boundary (FIAB) Transect.

Alternative 3 includes an in-situ treatment process to reduce the mobility of source materials and address the groundwater plume by promoting the microbial reduction of molybdenum and vanadium. Groundwater would be pumped from the plume cores, mixed with amendment to enhance the anaerobic microbial community, and reinjected to introduce a chemical reagent to alter redox conditions in the plume cores, which is expected to reduce the mobility of molybdenum and vanadium through precipitation of metal sulfides at the source areas. New on-Site wells could be used as either extraction or injection wells as needed to facilitate controlled amendment injection locations and in-situ treatment rates to optimize flushing and attenuation of the subsurface sources of molybdenum and vanadium.

The above-ground amendment addition system components would include portable tanks and pumping systems to blend and mix the amendments above ground prior to reinjection. Initially the treatment process would be portable to allow for flexibility in design optimization. Once pilot testing is optimized, a more permanent above-ground system could be considered. Alternative 3 is expected to generate only a minimal amount of wastewater but would require equipment storage during off-season periods. A warehouse building is available on-Site which could be used for this purpose. **Figure 6-3** provides an overview of Alternative 3.

Alternative 4 – Groundwater Capture and Ex-Situ Treatment

Estimated Cost/Time	
Capital Costs	$13,863,729
Annual O&M Costs	$1,968,073
NPV (30-year) Costs	$37,500,000
Construction Timeframe	1-2 years
Time to Achieve RAOs	120 years

Alternative 4 would include the following components:

- Includes all elements of Alternative 2.
- Includes groundwater extraction, pumping, and treating in an on-Site water treatment plant via a series of recovery wells.
- Multiple water treatment options were considered and are available.
- Treatment area would be limited to the groundwater plume cores south of the FIAB well transect.
- Includes reinjection of treated groundwater downgradient of the source areas to control groundwater flow and enhance groundwater capture.

Alternative 4 would use active hydraulic containment and ex-situ treatment processes. This alternative would extract groundwater from the plume cores with ex-situ treatment to remove dissolved vanadium and molybdenum from the extracted water prior to reinjection. This alternative would gradually extract contaminant mass from subsurface source materials over time as they desorb from the solid phases to the dissolved phase in the groundwater. Alternative 4 would also reduce contaminant mass discharge from source zones and plume cores and is expected to enhance downgradient vanadium attenuation speed and the flushing of molybdenum downgradient of the property.

Extraction wells would be located in the plume cores to capture contaminated groundwater that would be treated in an on-Site water treatment plant. Treated water would be reinjected into selected areas to enhance flushing toward the contaminated water extraction wells or reinjected at the downgradient edge of the plume for hydraulic gradient control. Due to the costs, anticipated treatment effectiveness, and absence of a liquid waste stream, co-precipitation followed by absorptive media filtration is the anticipated water treatment method, however, the exact treatment method will be pilot tested prior to full-scale implementation. Other treatment options that will be considered include ion exchange, high density sludge, reverse osmosis, and microfiltration/ultrafiltration. The co-precipitation treatment option could be designed with a media backwash recirculation system to eliminate liquid waste but would still require sludge dewatering and disposal.

Figure 6-4 provides an overview of Alternative 4. Alternative 4 is expected to reach cleanup goals within 120 years, which is not a reasonable time frame.

Alternative 5 – Hybrid In-Situ and Contingent Ex-Situ Groundwater Treatment

Estimated Cost/Time	
Capital Costs (Ex-situ + in-situ)	$10,242,107
Annual O&M Costs	$3,050,544
NPV (30-year) Costs	$45,200,000
Construction Timeframe	2-4 years without contingency; 3-5 years with contingency
Time to Achieve RAOs	50 years

Alternative 5 includes the following components:

- Includes all elements of Alternatives 3 and 4.
- Treats subsurface source material through active groundwater pumping, mixing amendment and reinjection.
- Full Scale Pilot testing with the ability to add additional elements as contingencies.
- The ex-situ treatment component includes active groundwater extraction, pumping via permanent pipelines, treating in an on-Site water treatment plant, and reinjection of treated groundwater downgradient of the source areas to control groundwater flow and enhance groundwater capture.
- Utilizes adaptive management to scale the in-situ treatment and ex-situ groundwater treatment components as needed.
- Multiple water treatment options were considered and are available.
- Relies primarily on MNA to address existing groundwater plumes downgradient of the FIAB.

Alternative 5 provides for a hybrid design that combines elements of Alternatives 3 and 4. Alternative 5 combines a phased pilot study and sequential implementation of in-situ groundwater treatment in various subsurface source areas, with the potential addition of targeted ex-situ treatment, contingent on remedy performance. Alternative 5 would be implemented initially as a large-scale in-situ treatment pilot study focusing on the plume core associated with AOC-3 and the former S-X Pond. If successful, in-situ treatment would be expanded sequentially to full-scale implementation. If in-situ treatment is ineffective as a standalone treatment, or monitoring and modeling indicates that groundwater capture and additional treatment is necessary, a scaled-down ex-situ treatment component could be sequentially implemented to increase the effectiveness of treating, controlling, and reducing COC loading from the plume. This ex-situ treatment component is envisioned to be a smaller scale and more focused approach than as described in Alternative 4.

If ex-situ treatment is deemed necessary, this alternative would use adaptive management techniques to combine the in-situ groundwater treatment methods with an ex-situ groundwater treatment system to address the inaccessible source materials that are present below the groundwater table. The treatment system layouts would be adjusted to focus initially on the large-scale pilot study with the ability to transition into a full-scale system.

Alternative 5 would also include the flexibility to include pumping groundwater upstream of the Site and reinjection of the clean, treated water south of the FIAB Transect to provide hydraulic controls and reduce gradients across the treatment zone. **Figure 6-5** provides an overview of Alternative 5.

7. Comparison of Alternatives

This section summarizes the comparative analysis of alternatives using the threshold and balancing criteria listed previously. More detailed analyses can be found in the FFS report.

Overall Protection of Human Health and the Environment

All alternatives would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls.

All alternatives would provide protection by preventing direct contact exposure to contaminated soils and prevent leaking of these contaminated source materials to the ground water by consolidation in on-Site repositories; however, long-term maintenance and monitoring would be required to ensure that the repositories remained protective.

With the exception of Alternatives 1 and 2 (monitored natural attenuation), all ground water alternatives would eliminate human and environmental risks from direct contact with contaminated ground water through treatment. Although all alternatives do not prevent migration of contaminants to downgradient surface water, there is no evidence that potential discharges to surface water have or are resulting in concentrations greater than surface water quality standards.

Current fencing and future land-use controls provide protection from contamination in the repositories. Future groundwater use controls will ensure protection of human health until cleanup goals are achieved.

Compliance with Applicable or Relevant and Appropriate Requirements

Preliminary ARARs are discussed in detail in the FFS Report (Pioneer, 2022). Key ARARs include the Federal Safe Drinking Water Act and Idaho Groundwater Quality Rule. Identifying ARARs is an iterative process, which will continue until final ARAR determinations are made by EPA during preparation of the ROD Amendment.

Each of the five alternatives are expected to comply over time with the chemical-specific ARARs. Alternatives 1 and 2 require an extended period of time to meet chemical-specific ARARs. Alternatives 3, 4, and 5 use active treatment and would achieve remediation objectives sooner than Alternatives 1 and 2. However, only Alternatives 3 and 5 are expected to comply with ARARs in a reasonable timeframe.

Overall, Alternatives 2, 3, 4, and 5 would comply with the location- and action-specific ARARs and TBCs. Because no remedial activities would be conducted under Alternative 1, the location- and action-specific ARARs and TBCs are not applicable.

Long-term Effectiveness and Permanence

All alternatives require ongoing containment of the source materials and achievement of cleanup goals in groundwater throughout the plume. Therefore, all alternatives are equally effective and achieve the same permanence in the long-term. Long-term O&M of the waste repositories will be necessary to ensure the effectiveness and permanence of the remedy.

All groundwater alternatives would be effective in the long term by reducing contaminant concentrations in groundwater. The adequacy and reliability of the pump and treatment technologies have been well proven for the contaminants of concern. However, reinjection systems (Alternatives 4 and 5) may have extensive

Nine Superfund Evaluation Criteria:

In accordance with CERCLA and Section 300.430(f)(5)(i) of the NCP, EPA evaluates remedial alternatives using the following nine criteria:

- **Threshold Criteria** – These criteria specify what an alternative must meet to be eligible for selection as a remedial action:
  - **Overall protection of human health and the environment** – Determines whether a remedial action eliminates, reduces, or controls threats to public health and the environment through treatment, engineering controls (such as fencing), or institutional controls (such as deed restrictions).
  - **Compliance with ARARs** – In addition to ensuring that human and ecological receptors are protected, remedial actions to cleanup a site must attain legally applicable, or relevant and appropriate federal, and state standards and requirements unless such ARARs are waived under CERCLA Section 121(d)(4).
- **Balancing Criteria** – These criteria represent technical considerations upon which the detailed analysis is based:
  - **Long-term effectiveness and permanence** – Considers the ability of a remedial alternative to maintain protection of human health and the environment over time and the reliability of such protection.
  - **Reduction of toxicity, mobility, and volume through treatment** – Evaluates using treatment to reduce the harmful effects of contaminants and the ability of contaminants to move in the environment. More specific considerations include the amount of hazardous substances that would be destroyed, treated, or recycled; the degree to which treatment is irreversible; and the degree to which treatment reduces the inherent hazards posed by principal threat waste.
  - **Short-term effectiveness** – Considers both the length of time required to implement a remedial alternative and the risk that constructing and maintaining the remedy would pose to workers, residents, and the environment until cleanup levels are achieved.
  - **Implementability** – Considers the technical and administrative feasibility of implementing a remedial alternative, such as relative availability of goods and services. This criterion also considers whether the technology has been used successfully at other similar sites.
  - **Cost** – Considers both estimated capital costs and long-term operations and maintenance costs. Costs are expected to be accurate within a range of +50 and -30 percent.
- **Modifying Criteria** – These criteria are evaluated at the end of the public review and comment period; they are not discussed in this Proposed Plan:
  - **State and Tribal acceptance** – Considers whether the state and tribes support EPA's analyses and recommendations of the FFS report and the Proposed Plan.
  - **Community acceptance** – Considers whether the local community agrees with EPA's analyses and recommendations of the FFS report and the Proposed Plan.

maintenance problems and as such may not be considered reliable. For all the alternatives, there is some uncertainty associated with natural attenuation and the time required to reach the final cleanup levels.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Active treatment under Alternatives 3 and 5 provides reduction in toxicity, mobility, and volume through treatment and removal of COCs in groundwater, with Alternative 5 providing a slightly greater reduction because of the additional ex-situ treatment component. Alternative 4 would provide some reduction in mobility, but minimal reduction in toxicity or volume. Alternatives 1 and 2 uses natural processes to achieve the same goals.

Short-term Effectiveness

Alternatives 1 and 2 present no increased short-term risks because no construction-related activities would be implemented that would create additional risks to workers or the community.

Alternatives 3 and 4 have equal short-term risks for worker exposure, including the mobilization of equipment, construction and installation of the treatment system, well drilling, and operation of the groundwater treatment systems. Alternative 5 has the same short-term risks as Alternatives 3 and 4, but because it has the longest construction timeframe, short-term risks are the greatest for Alternative 5.

Overall, Alternatives 3 and 5 are estimated to meet groundwater cleanup levels 70 years sooner than Alternatives 1, 2, and 4. Considering the similar time frames to achieve cleanup goals, Alternatives 3 and 5 are expected to be equivalent in short-term effectiveness and are more effective in the short-term than alternatives 1, 2, or 4.

Implementability

Alternatives 3 through 5 require installation of treatment systems, O&M of these systems, installation of additional wells, long-term monitoring, and implementation of ICs. These groundwater treatment options are equally implementable without construction difficulties, although Alternative 5 is the most complicated to design, construct and operate. Extraction and ex-situ treatment is a proven technology and can remove contamination in groundwater. There are potential problems associated with reinjecting the large volume of water into the aquifer as under Alternatives 3 through 5.

The available performance data for use of an in-situ amendment do not fully support that sequestration of molybdenum and vanadium is sustainable or stable. Alternative 3 does not address these technical issues whereas Alternative 5 includes a remedial design developed with the capacity for hydraulic control and ex-situ treatment as an integral component of the approach to introduce amendments into the aquifer.

O&M requirements for Alternative 5 are more complex than for Alternatives 3 and 4. All three alternatives can also be readily expanded, adjusted, and reliably monitored. Even though Alternative 5 represents the most complicated system, it provides additional flexibility because it can be designed and constructed of complementary elements. At full-scale implementation, Alternative 5 would require multiple treatment systems, the most construction equipment to complete, specialized services offered by a limited number of contractors, requires on-Site water treatment, and requires off-Site disposal of residual treatment wastes.

Cost

Costs for each alternative are presented in **Table 7-1**. The estimated present worth cost of Alternative 1 is less than that of Alternative 2. The estimated present worth cost of Alternative 2 is less than Alternatives 3, 4 and 5.

8. Preferred Alternative

The Preferred Alternative is a modified Alternative 5 (Hybrid In-Situ and Contingent Ex-Situ Treatment), described in more detail in the FFS. It includes modifications and clarifications related to sequencing of implementation, adaptive management planning, and long-term monitoring, described further below. **Figure 8-1** provides an overview of the Preferred Alternative.

The Preferred Alternative consists of the implementation of a bench and field scale pilot study to test the performance of amendments to select the most effective treatment and amendment delivery methods. It will combine in-situ treatment in the subsurface source with targeted groundwater capture and ex-situ groundwater treatment. Groundwater capture and ex-situ treatment would be required downgradient of in-situ treatment, instead of being a contingency. The pilot study will build upon previously completed small-scale pilot tests and optimize amendment delivery methods, and groundwater capture will protect against potential re-mobilization of contaminants into the distal plume. If the pilot study is successful, treatment would be expanded to other areas of the Site as needed and as appropriate.

The full-scale design will treat source areas with in-situ amendments and contain downgradient flow with groundwater capture and ex-situ groundwater treatment. MNA will be implemented off-Site, downgradient of the active treatment areas.

The ICP would be implemented, and the full existing LTM program would continue until cleanup goals are achieved. A structured process for measuring remedy progress will be implemented, as will the use of adaptive management strategies to achieve RAOs within a reasonable timeframe.

Rationale for Selection of Preferred Alternative

The Preferred Alternative was selected over other alternatives or combinations of alternatives using the findings of the nine criteria evaluations in the FFS and summarized in this document. The Preferred Alternative is expected to restore groundwater to beneficial uses within a time frame that is reasonable.

The Preferred Alternative provides protection by eliminating human and environmental risks from direct contact with contaminated groundwater. While it costs the most of the alternatives evaluated, it provides the greatest reduction of toxicity, mobility, or volume through treatment of the alternatives considered and is more effective in the long term than Alternatives 1, 2, and 4. In the short term, Alternatives 3, 4, and 5 are equally effective, more so than Alternatives 1 and 2. Alternative 5 is readily implementable, albeit the most complicated to design, construct, and operate, and has the most O&M requirements; however, it provides the greatest flexibility of the alternatives because it can be designed and constructed with complementary elements and incorporates an adaptive management plan to scale the system as needed.

Alternative 3 has the potential to provide a permanent remedy through in-situ stabilization of COCs; however, there are unresolved technical issues of an in-situ remedy. Alternative 5 provides a permanent remedy through the hybrid in-situ and ex-situ design and inclusion of additional bench and field pilot studies to assess the effectiveness of the technologies. As such, the reliability and permanence of Alternative 5 outweigh the assumed effectiveness and potential cost-savings of Alternative 3.

Adaptive management is a structured, iterative process for making decisions on complex projects where there is uncertainty about the effectiveness of cleanup methods or technologies. The Preferred Alternative includes groundwater treatment technologies that are untested for remediation of inorganic contaminants, especially in such a complex hydrogeologic system. Incorporation of adaptive management for the Kerr-McGee Site will create a structured process for measuring and/or monitoring elements of the remedy, and determine if additional design, design modifications, or operational changes are necessary to achieve RAOs. An Adaptive Management Plan will be developed for the selected combined remedy during remedial design. None of these anticipated modifications would constitute a significant or fundamental change to the proposed remedy.

The Preferred Alternative provides additional flexibility because it includes additional pilot study testing to gather additional information on the Site and sequential application of complementary elements that can be designed and constructed in response to a more robust dataset and better site knowledge.

This Preferred Alternative would reduce the magnitude of residual risks at the Site through passive controls and active treatment to reduce mass transport from the remaining subsurface source areas to the primary groundwater flow paths. The primary mechanisms for reducing concentrations of molybdenum in groundwater are dilution and dispersion. As noted in EPA guidance on MNA of inorganic contaminants, dilution and dispersion generally are not appropriate as primary MNA mechanisms but may be elements of an MNA response action for inorganic contaminants and may be appropriate for distal portions of a plume when an active remedy is or has been used at a site, source control is complete, and appropriate land use and groundwater use controls are in place. MNA may be appropriate when source control is used to mitigate highly contaminated areas, and MNA is applied in the lower concentration portions of the plume (EPA, 2015). At this site, MNA will be used in the distal portions of the plume, downgradient of the active source remediation area.

9. References

EPA, 1995. Record of Decision Kerr-McGee Superfund Site. U.S. Environmental Protection Agency. September 1995.

EPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. April 21, 1999.

EPA, 2000. Record of Decision Amendment: Kerr-McGee Chemical Corp. Soda Springs Plant. U.S. Environmental Protection Agency. July 13, 2000.

Haley & Aldrich, 2019a. Results of Supplemental Data Collection in Support of Focused Feasibility Study, Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Haley & Aldrich, Inc. October 31, 2019.

Haley & Aldrich, 2019b. Supplemental Remedial Investigation Report, Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Haley & Aldrich, Inc. November 2019.

Haley & Aldrich, 2021. Evaluation of Anticipated Impacts of 10-Acre Pond Time Critical Removal Action, Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Haley & Aldrich, Inc. July 23, 2021.

Hydrometrics, 2020a. Screening-Level Ecological Risk Assessment. Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Hydrometrics, Inc. and TRC, March 2020.

Hydrometrics, 2020b. Baseline Human Health Risk Assessment, Volumes 1 and 2. Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Hydrometrics, Inc. and TRC, June 2020.

Hydrometrics, 2021. Monitored Natural Attenuation Technical Memorandum, Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Hydrometrics, Inc. July 23, 2021.

Pioneer, 2019a. 10-Acre Pond Time-Critical Removal Action (TCRA) Final After Action Report (AAR). Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Pioneer Technical Services, Inc. April 9, 2019.

Pioneer, 2019b. 10-Acre Pond Time-Critical Removal Action (TCRA) Final After Action Report (AAR) Addendum. Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Pioneer Technical Services, Inc. October 21, 2019.

Pioneer, 2022. Focused Feasibility Study, Revision 1. Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Pioneer Technical Services, Inc. July 13, 2022.

EPA, 2012. Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites. U.S. Environmental Protection Agency. OSWER Directive 9355.0-89. December 2012.

EPA, 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. U.S Environmental Protection Agency. OSWER Directive 9283.1-36. August 2015.

Abbreviations and Acronyms

AAR After Action Report

AMP Adaptive Management Plan

ARAR Applicable or relevant and appropriate requirements

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CUL(s) Cleanup level(s)

COC Contaminant of Concern

COPC Contaminant of Potential Concern

CSM Conceptual Site Model

EPA United States Environmental Protection Agency

FFS Focused Feasibility Study

FIAB Former Industrial Area Boundary

HI Hazard Index

HQ Hazard Quotient

IC(s) Institutional Control(s)

IDEQ Idaho Department of Environmental Quality

KMCC Kerr-McGee Chemical Company

LTM Long-Term Monitoring

MNA Monitored Natural Attenuation

NCP National Oil and Hazardous Substance Pollution Contingency Plan

NFA No Further Action

NPV Net Present Value

O&M Operations and Monitoring

PRG Preliminary Remediation Goal

PSL Project Screening Level

RAO Remedial Action Objective

RBC Risk-based concentration

RODA Record of Decision Amendment

ROD Record of Decision

§ Section

S-X Solvent Extraction

Site Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site

SLERA Screening-Level Ecological Risk Assessment

SRI Supplemental Remedial Investigation

TBC To Be Considered

TCRA Time Critical Removal Action

TRL Target Risk Level

Glossary of Terms

Applicable or Relevant and Appropriate Requirements (ARARs): *Applicable requirements*, as defined in 40 CFR § 300.5, are those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements, as defined in 40 CFR § 300.5, means those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

Contaminants of Concern (COCs): Site-specific chemicals/contaminants that are identified for evaluation in the site assessment process that pose unacceptable human health or ecological risks.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law, commonly referred to as the "Superfund" Program. CERCLA provides for clean-up and emergency response in connection with existing inactive hazardous waste disposal sites that endanger public health and safety or the environment.

Exposure pathway: The pathway for a chemical from the source of contamination to the exposed individual or receptor, such as dermal contact, ingestion, or inhalation.

Feasibility Study (FS): A comprehensive process to screen, develop, and evaluate potential alternatives for remediating contamination.

Groundwater: Subsurface water that occurs in fully saturated soil and geologic formations.

Hazard Index (HI): Summation of the noncancer risks to which an individual is exposed. An HI value of 1.0 or less indicates that noncancer adverse human health effects are unlikely to occur.

Human Health Risk Assessment: An assessment of the risks posed to human health through potential contaminant exposures, based on site-specific exposure scenarios.

Institutional Controls: Non-engineered controls, such as administrative and legal controls, that help minimize human exposure to contamination and/or protect the integrity of the remedy.

Operation and Maintenance (O&M): Activities conducted after the remedial action to maintain the effectiveness of the response action.

Proposed Plan: A plan for site remedial action or other action that is available to the public for comment.

Record of Decision (ROD): A legal document that describes the clean-up action or alternative selected for a site, the basis for choosing that alternative, and public comments on the selected alternative.

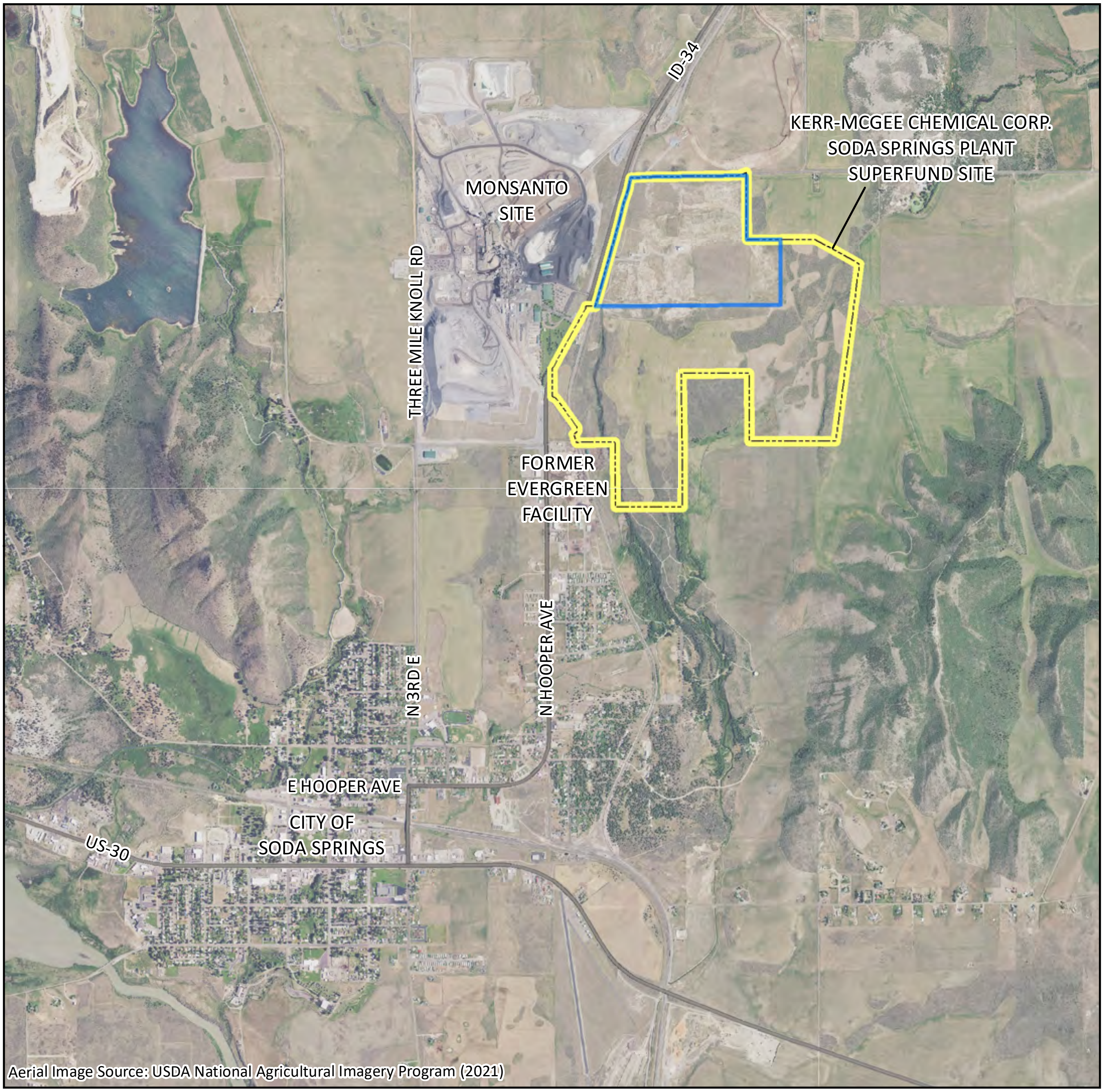
Remedial Action Objectives (RAOs): Specific goals for protecting human health and the environment. RAOs are developed by evaluating ARARs protective of human health and the environment and the results of remedial investigations and risk assessments.

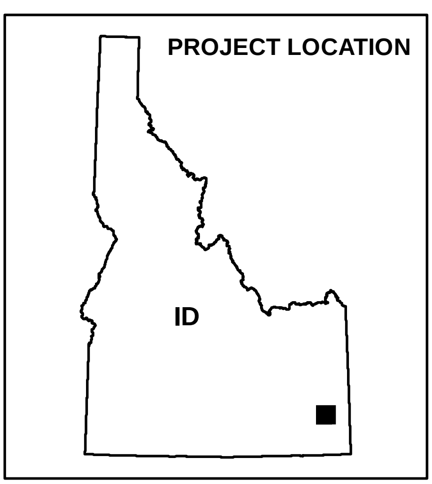
Preliminary Remediation Goals (PRGs): Clean-up goals developed during the cleanup planning process based on the ARARs. They also are used during analysis of remedial alternatives in the remedial investigation/feasibility study (RI/FS).

Remedial Investigation (RI): Extensive technical study conducted to characterize the nature and extent of contamination and the risks posed by contaminants present at a site.

Residual Risk: Hazards which remain on site after a remedial action has been completed.

U.S. Environmental Protection Agency (EPA): The federal agency responsible for administration and enforcement of CERCLA (and other environmental statutes and regulations), and with final approval authority for the selected remedial alternative.





LEGEND

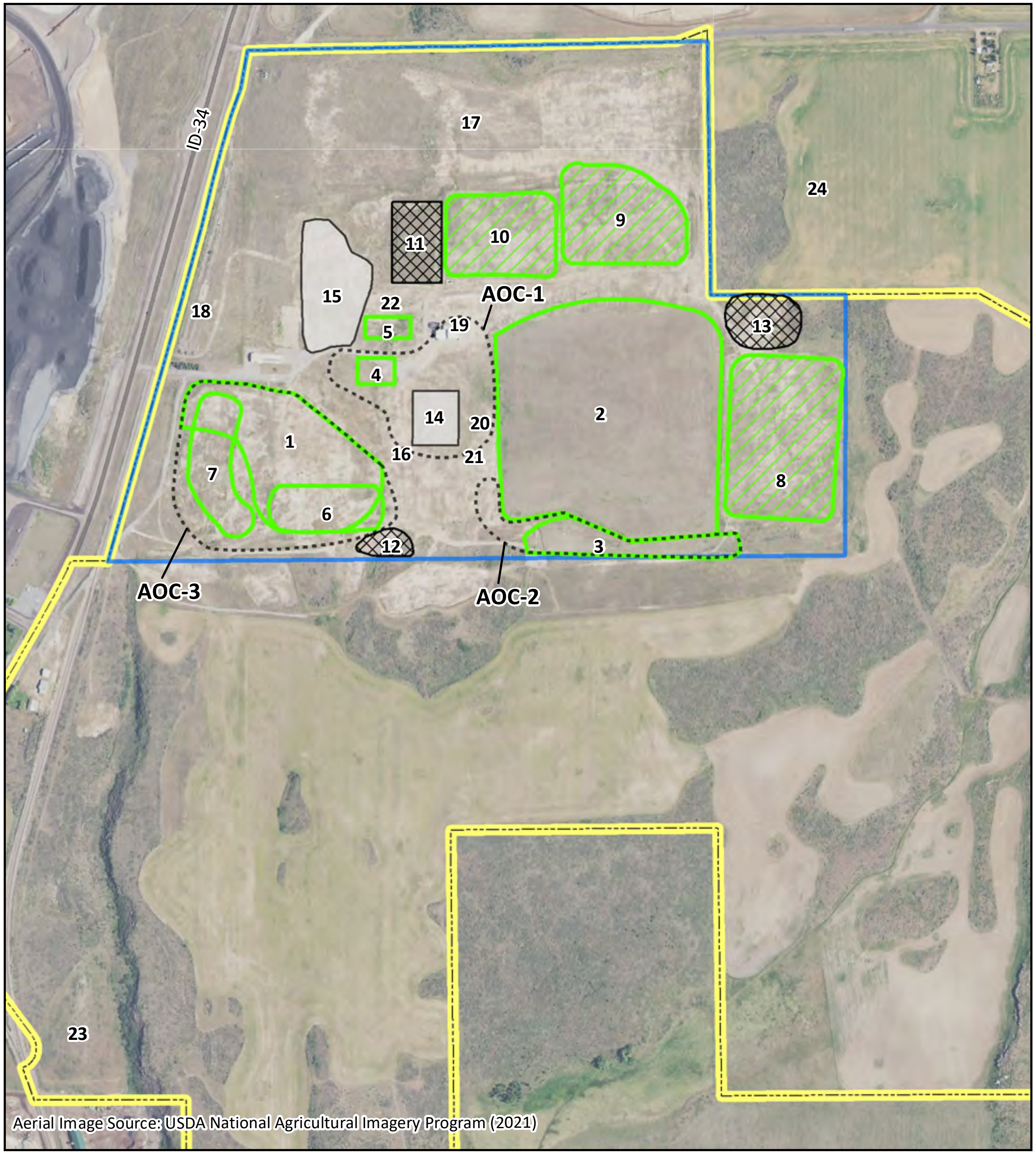
Property Boundary

Former Industrial Plant Boundary

0 1,500 3,000 6,000 Feet

N

Figure 1-1
Site Location Map
Proposed Plan for the
Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho



SITE FEATURE	NAME
1	West Calcine Repository (Reclaimed)
2	East Calcine Repository
3	Scrubber Pond (Reclaimed)
4	Boiler Blowdown Pond (Reclaimed)
5	MAP Ponds (Reclaimed)
6	Limestone Settling and Stormwater Ponds (Reclaimed)
7	S-X Pond (Reclaimed)
8	10-Acre Pond (Reclaimed)
9	East 5-Acre Pond (Reclaimed)
10	West 5-Acre Pond (Reclaimed)
11	West Waste Repository
12	South Industrial Landfill Area (Reclaimed)
13	North Industrial Landfill (Reclaimed)
14	Vanadium Plant (Dismantled)
15	Fertilizer Plant (Dismantled)
16	Water Supply Well (Abandoned)
17	Cropland (Soil Borrow Area)
18	Rail Spur Area
19	Fugitive Calcine and Roaster Reject Area (Reclaimed)
20	Limestone Stockpile (Removed)
21	Ferrophosphorus Ore Storage Area (Reclaimed)
22	Chemical Storage Building/Calcine Dewatering Building
23	Lower Field
24	Former (b) (6) Property (now owned by Monsanto)

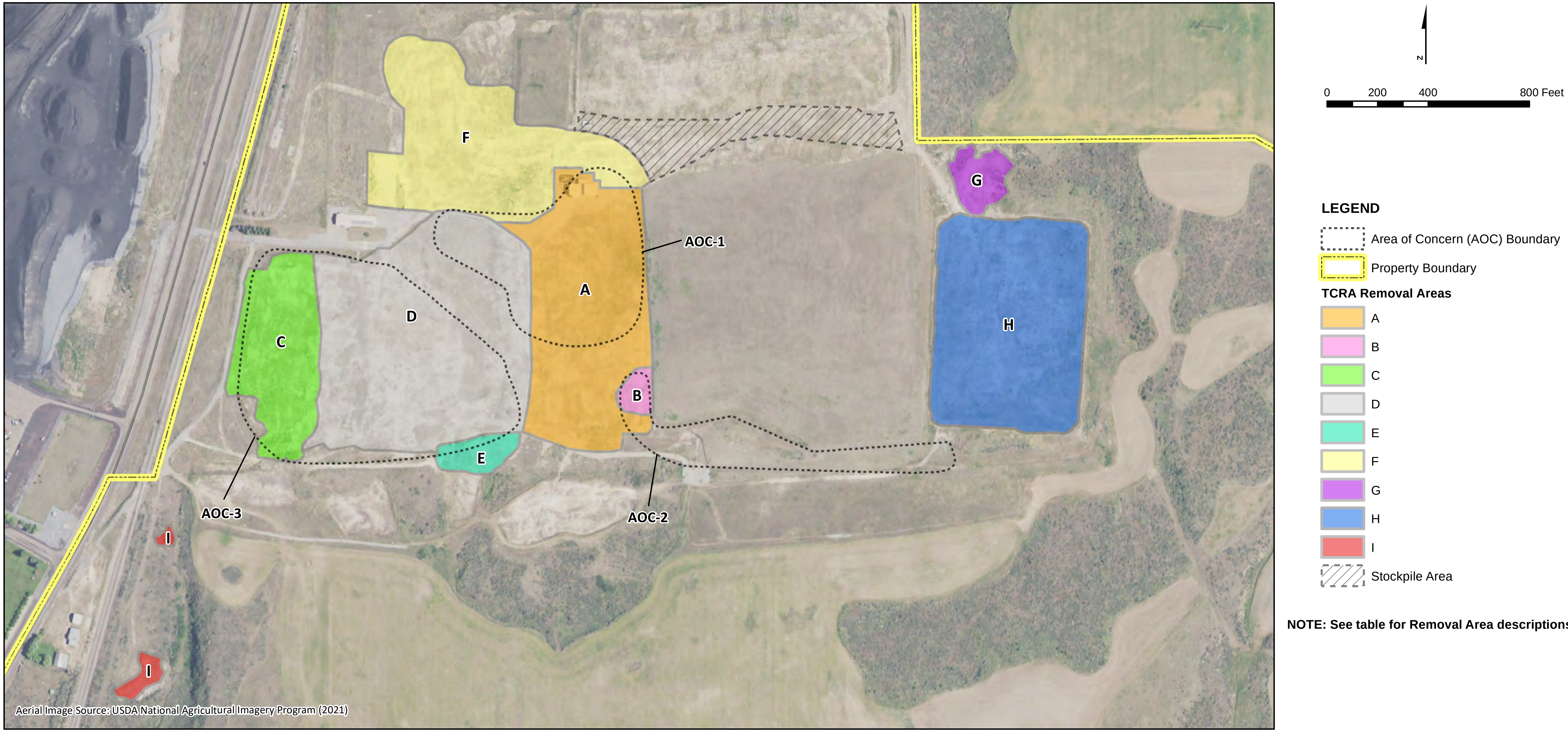
LEGEND

- Landfill
- Former Industrial Plant
- Lined Pond
- Unlined Pond
- Area of Concern (AOC) Boundary
- Former Industrial Plant Boundary
- Property Boundary

0 400 800 1,600 Feet

N

Figure 2-1
Site Features and
Historic Source Areas of Concern
Proposed Plan for the
Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho



NOTE: See table for Removal Area descriptions.

TCRA Removal Areas and Volume Summary Table

Removal Area	Description	Area of Concern	Area in Square Feet (ft^2)	Calculated Removal Volume in Cubic Yards (yd^3)
A	Vanadium Plant (VP)/AOC-1	AOC-1	464,698	13,214
B	Calcine material (CM) located outside the East Calcine Repository/AOC-2	AOC-2	21,809	2,086
C	S-X Pond (S-XP)/AOC-3	AOC-3	227,396	68,847
D	West Calcine Repository (WCR)/Limestone Settling & Stormwater Ponds (LSSP)	AOC-3	698,525	188,780
E	South Industrial Landfill Area (SILA)		39,636	1,290
F	Fertilizer Plant (FP)		430,308	12,770
G	North Industrial Landfill (NIL)		49,687	6,800
H	10-Acre Pond (10-AP)		495,483	52,844
I	South Scrap Area		23,106	3,472
		Total Removed	**2,450,648**	**350,103**

Figure 2-2
TCRA Removal Boundaries and Removal Volumes
Proposed Plan for the
Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho

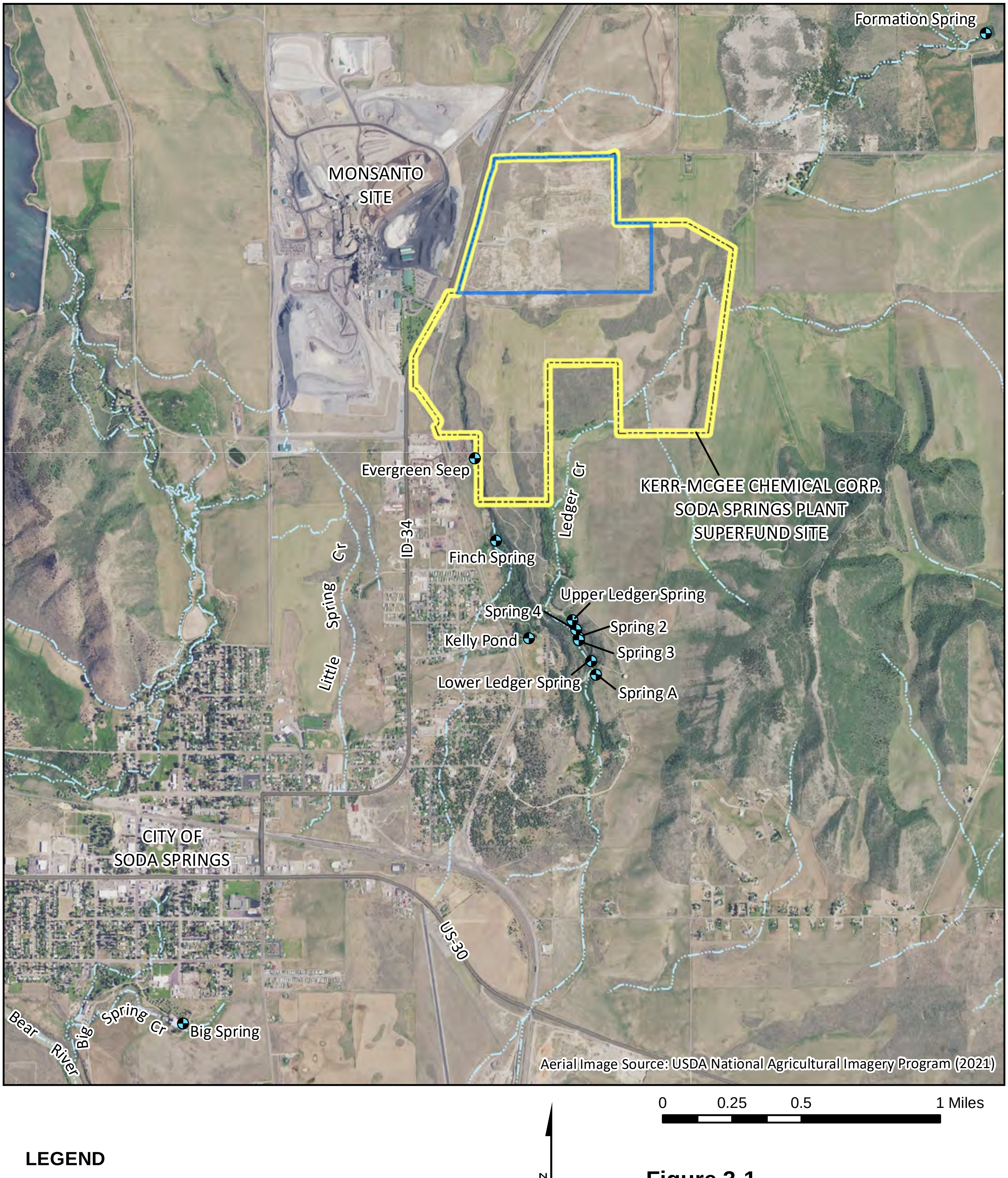
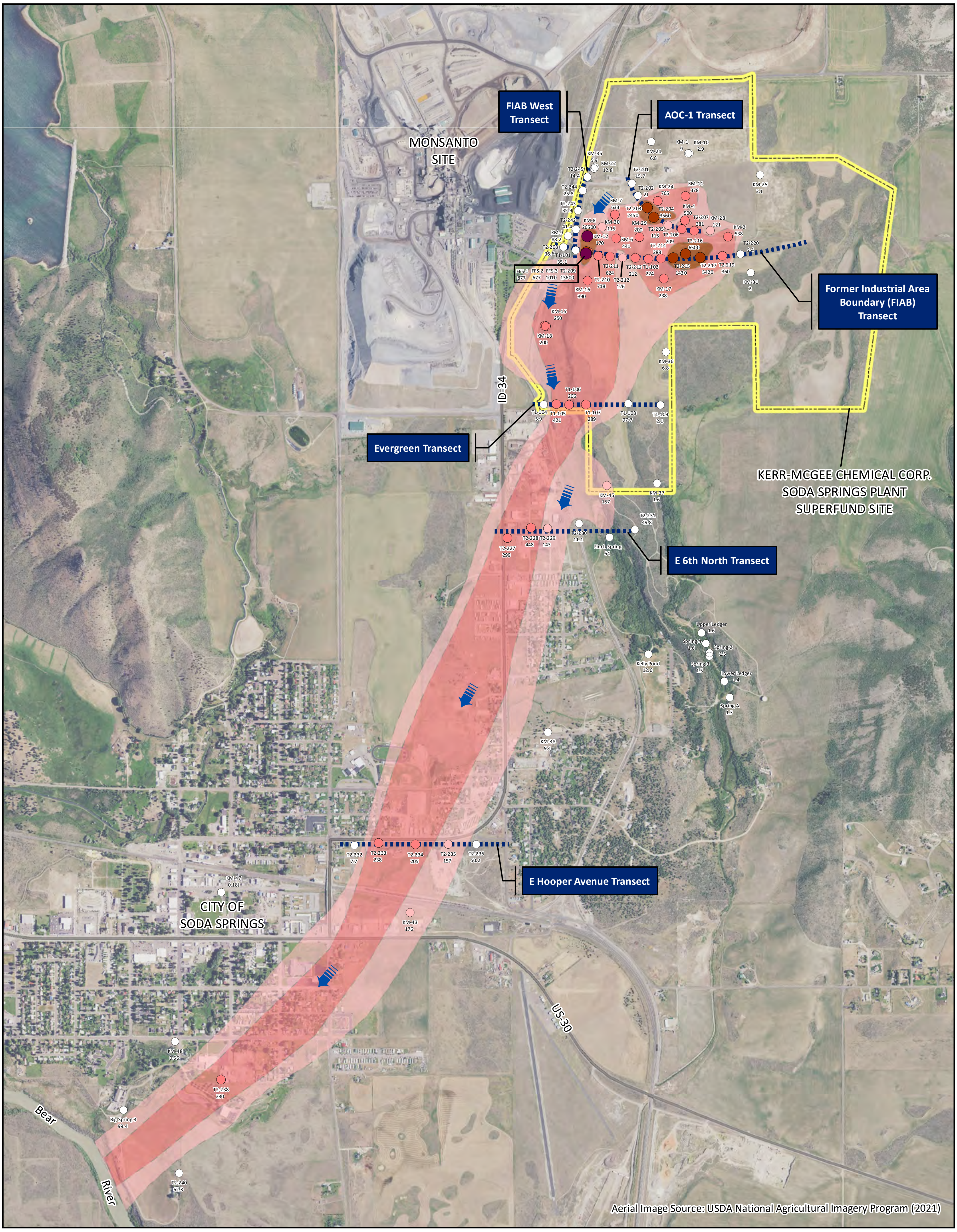


Figure 3-1
Seeps, Springs, and Surface Water Features
Proposed Plan for the Kerr-McGee Chemical Corporation Soda Springs Plant Superfund Site Soda Springs, Idaho



0 800 1,600 3,200 Feet

N

LEGEND

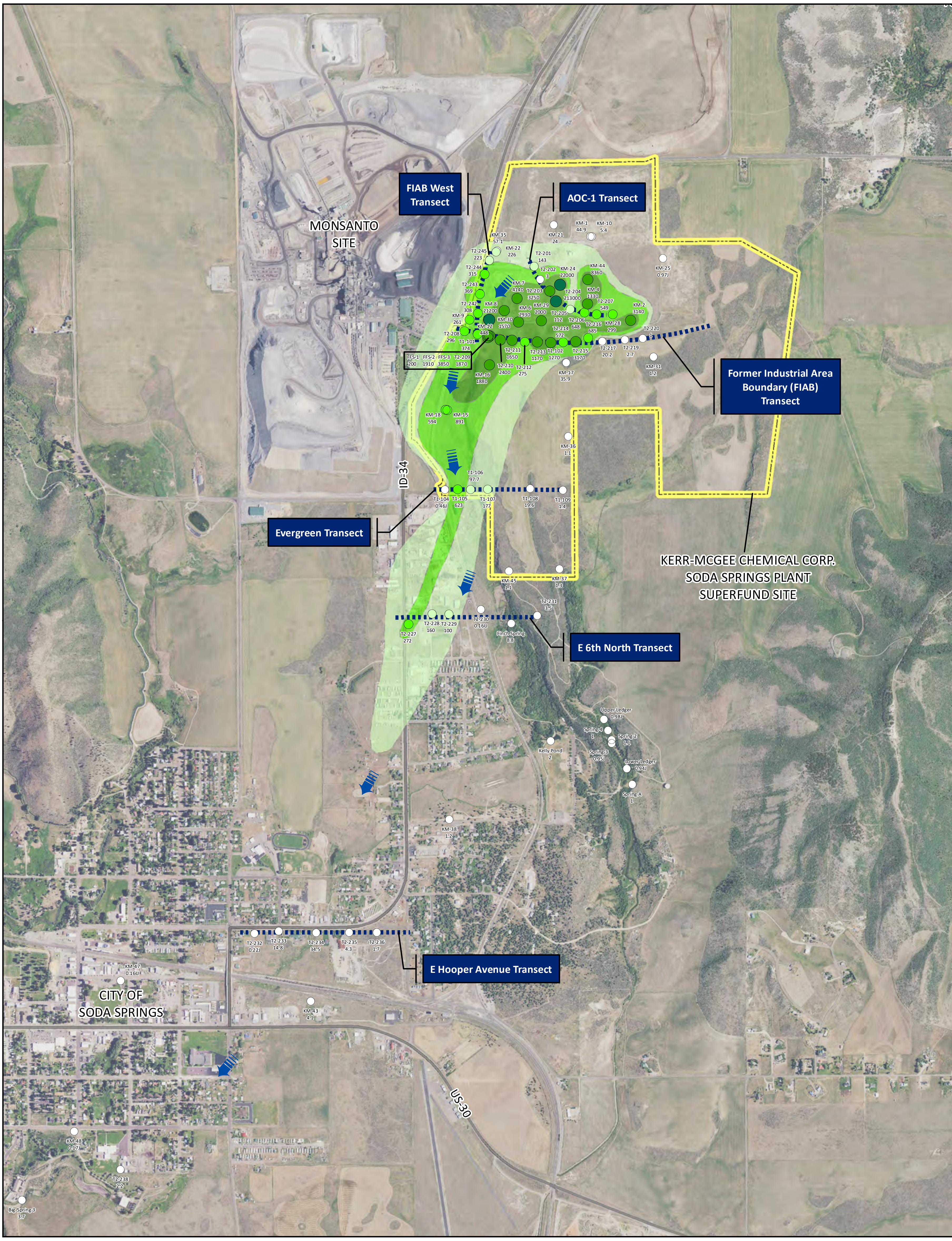
Molybdenum Concentrations (µg/L)

- < 100 (EPA Tapwater RSL)
- 100 (EPA Tapwater RSL) to 180 (ROD PSL)
- 180 (ROD PSL) to 1,000
- 1,000 to 10,000
- > 10,000

Molybdenum Isocontours (µg/L)

- 100 (EPA Tapwater RSL) to 180 (ROD PSL)
- 180 (ROD PSL) to 1,000
- > 1,000
- 2018 SRI Well Transects
- Estimated Groundwater Flow Direction
- Property Boundary

Figure 3-2
Groundwater Molybdenum Plume
October 2021
Proposed Plan for the
Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho



0 800 1,600 3,200 Feet

N

LEGEND

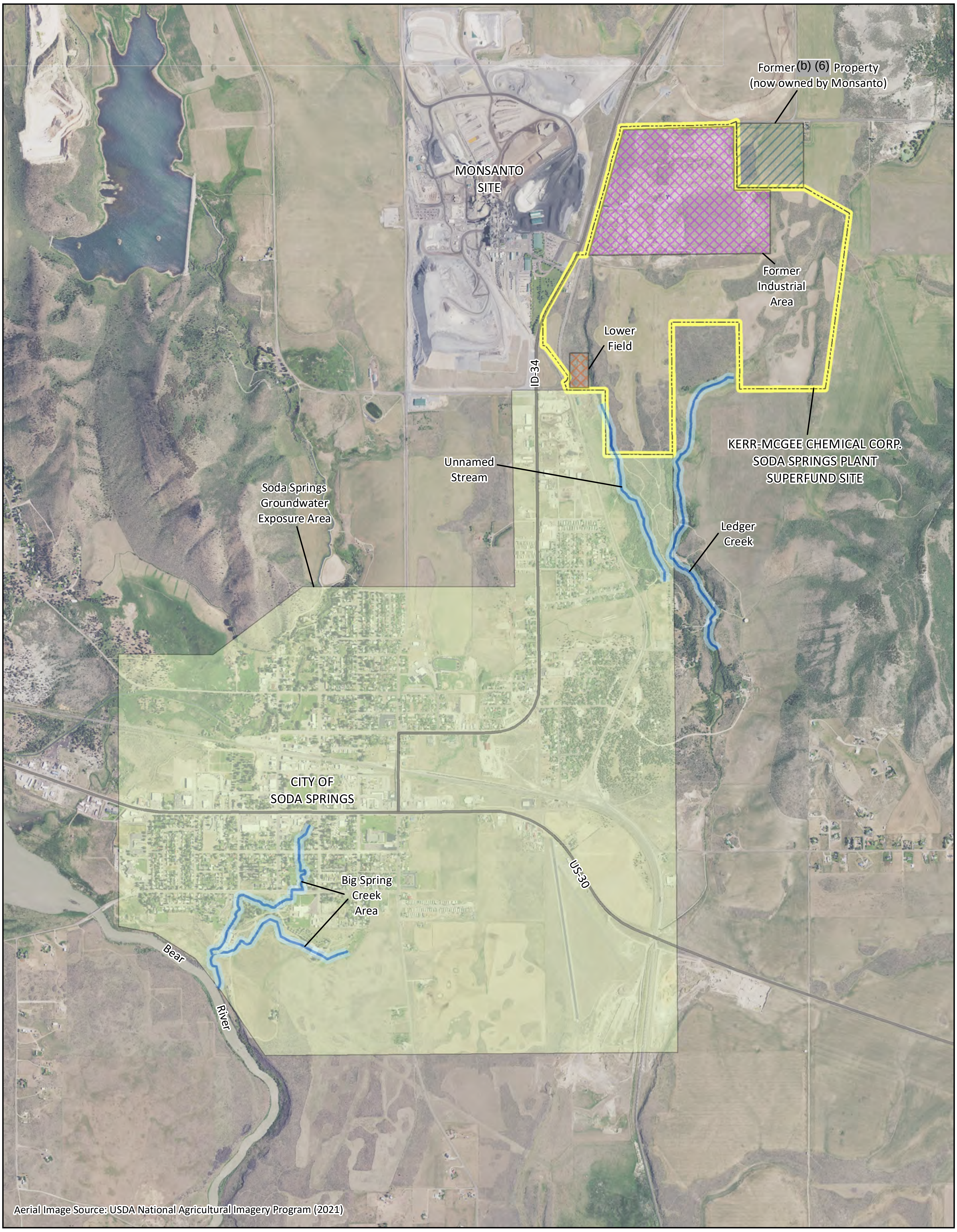
Vanadium Concentration (µg/L)

- < 86 (EPA Tapwater RSL)
- 86 (EPA Tapwater RSL) to 260 (ROD PSL)
- 260 (ROD PSL) to 1,000
- 1,000 to 10,000
- > 10,000

Vanadium Isocontours (µg/L)

- 86 (EPA Tapwater RSL) to 260 (ROD PSL)
- 260 (ROD PSL) to 1,000
- > 1,000
- 2018 SRI Well Transects
- Estimated Groundwater Flow Direction
- Property Boundary

Figure 3-3
Groundwater Vanadium Plume
October 2021
Proposed Plan for the
Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho



0 1,000 2,000 4,000 Feet

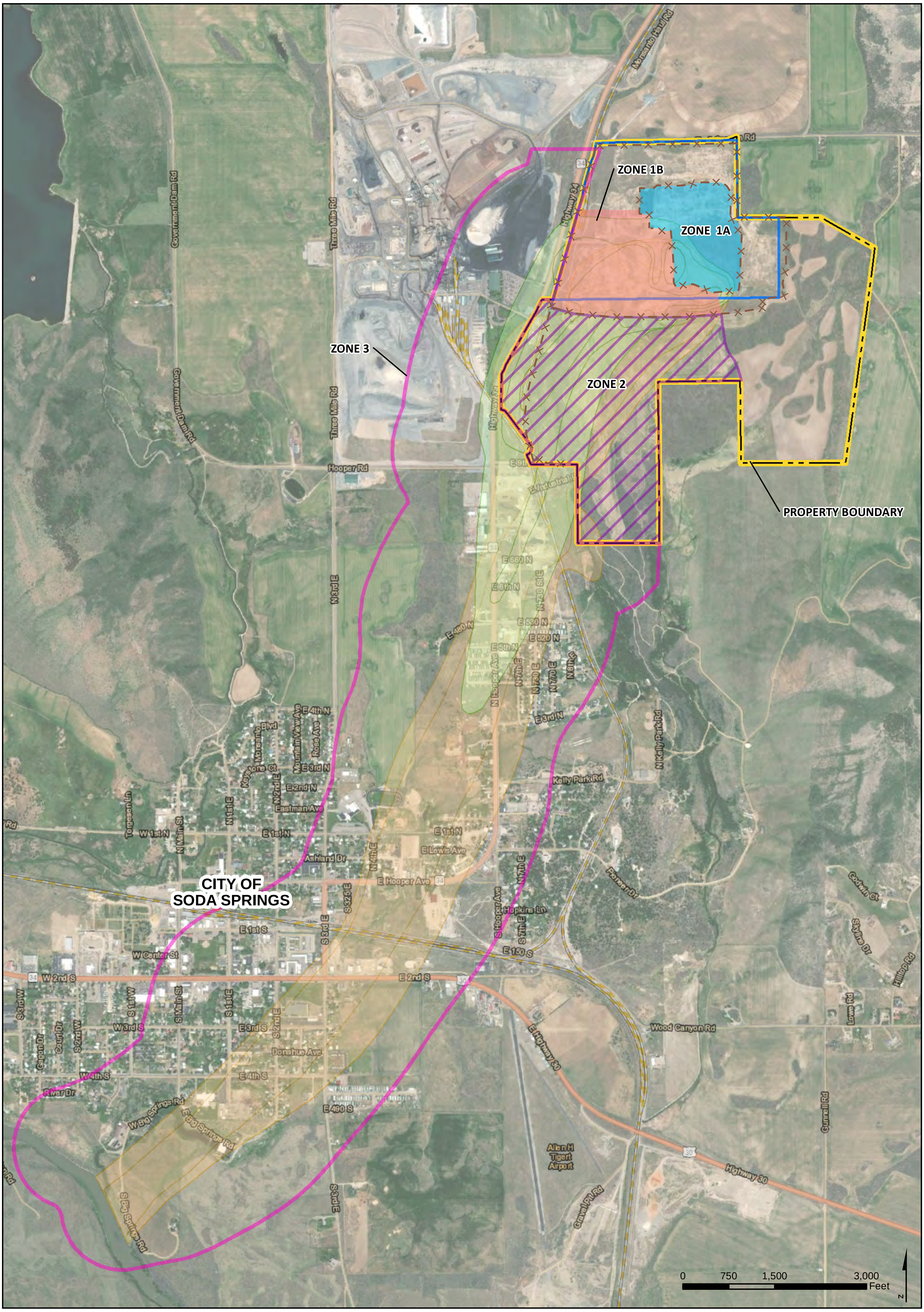
N

LEGEND

Exposure Evaluation Areas

- Former Industrial Area (On-Site)
- Lower Field (On-Site)
- Former (b) (6) Property (now owned by Monsanto) (Off-Site)
- Soda Springs (Groundwater Only)
- Surface Water/Spring Evaluation Areas
- Property Boundary

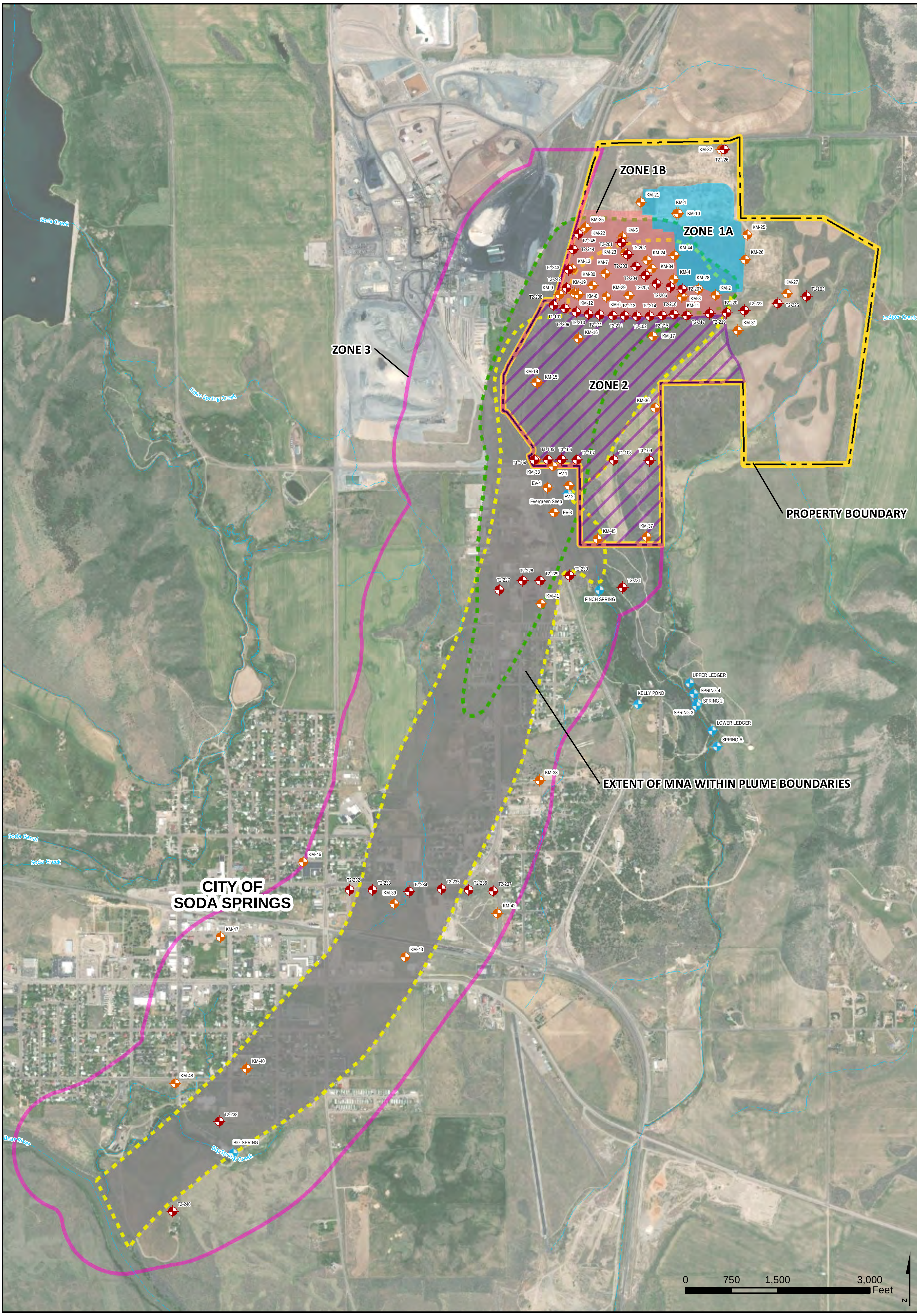
Figure 4-1
Human Health Risk Assessment Exposure Evaluation Areas
Proposed Plan for the Kerr-McGee Chemical Corporation Soda Springs Plant Superfund Site Soda Springs, Idaho



LEGEND

- Zone 1a
- Zone 1b
- Zone 2
- Zone 3
- As-Built Fence
- Former Industrial Area Boundary
- Property Boundary
- Vanadium Groundwater Plume >86 µg/L RSL
- Molybdenum Groundwater Plume >100 µg/L RSL

Figure 6-1
Conceptual Institutional Control Zone Boundaries
Proposed Plan for the Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho



LEGEND

- CMT Multilevel Wells
- KMCC Wells
- Surface Water Monitoring Location
- Property Boundary
- MNA Extent
- Zone 1a
- Zone 1b
- Zone 2
- Zone 3
- Vanadium Groundwater Plume >86 µg/L RSL
- Molybdenum Groundwater Plume >100 µg/L RSL

Figure 6-2
Alternative 2 Conceptual Monitored Natural Attenuation and Institutional Control Zone Boundaries
Proposed Plan for the Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho

LEGEND

- Conceptual In-Situ Wells
- Type 1 - CMT Multilevel Well
- Type 2 - CMT Multilevel Well
- Groundwater Well
- Groundwater Well with Transducer
- Direction of Mobilization
- CMT Multilevel Well Transect
- As-Built Fence
- Industrial Boundary
- Area of Concern (AOC) Boundary
- Property Boundary
- Groundwater Plume Core Mobilizing Off-site
- MNA Downgradient of Active Treatment Area
- Vanadium Groundwater Plume >86 µg/L RSL
- Molybdenum Groundwater Plume >100 µg/L RSL

Notes:
Institutional Control boundaries proposed in Figure 6-1 are not shown but are included in this alternative.

Figure 6-3
Alternative 3 Conceptual In-Situ Groundwater Treatment Layout
Proposed Plan for the Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho

LEGEND

- Conceptual Extraction Well
- Conceptual Injection Well
- Type 1 - CMT Multilevel Well
- Type 2 - CMT Multilevel Well
- Groundwater Well
- Groundwater Well with Transducer
- Conceptual Extraction Piping
- Conceptual Injection Piping
- Direction of Mobilization
- CMT Multilevel Well Transect
- As-Built Fence
- Conceptual Ex-Situ Treatment Plant Building
- Industrial Boundary
- Area of Concern (AOC) Boundary
- Property Boundary
- Groundwater Plume Core Mobilizing Off-site
- Vanadium Groundwater Plume >86 µg/L RSL
- Molybdenum Groundwater Plume >100 µg/L RSL
- MNA Downgradient of Active Treatment Area

Notes:
Institutional Control boundaries proposed in Figure 6-1 are not shown but are included in this alternative.

Figure 6-4
Alternative 4 Conceptual Groundwater Capture and Ex-Situ Treatment Layout
Proposed Plan for the Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho

Notes: Institutional Control boundaries proposed in Figure 6-1 are not shown but are included in this alternative.

LEGEND

- Proposed In-Situ Wells
- Potential Future In-Situ Wells
- Potential Pilot Ex-Situ Extraction Wells
- Potential Pilot Ex-Situ Injection Well
- Contingent Extraction Wells
- Contingent Injection Wells
- Type 1 - CMT Multilevel Well
- Type 2 - CMT Multilevel Well
- Groundwater Well
- Groundwater Well with Transducer
- Contingent Extraction Piping
- Contingent Injection Piping
- Direction of Mobilization
- CMT Multilevel Well Transect
- As-Built Fence
- Ex-Situ Treatment Plant Building
- Industrial Boundary
- Area of Concern (AOC) Boundary
- Property Boundary
- Groundwater Plume Core Mobilizing Off-site
- Vanadium Groundwater Plume >86 µg/L RSL
- Molybdenum Groundwater Plume >100 µg/L RSL
- MNA Downgradient of Active Treatment Area

Figure 6-5
Alternative 5 Conceptual Hybrid Alternative Layout
Proposed Plan for the Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho

LEGEND

- Pilot In-Situ Wells
- Potential Future In-Situ Wells
- Potential Future Ex-Situ Extraction Wells
- Extraction Wells
- Injection Wells
- Type 1 - CMT Multilevel Well
- Type 2 - CMT Multilevel Well
- Groundwater Well
- Groundwater Well with Transducer
- Extraction Piping
- Injection Piping
- Potential Future Extraction Piping
- Direction of Mobilization
- CMT Multilevel Well Transect
- As-Built Fence
- Ex-Situ Treatment Plant Building
- Industrial Boundary
- Area of Concern (AOC) Boundary
- Property Boundary
- Groundwater Plume Core Mobilizing Off-site
- Vanadium Groundwater Plume >86 µg/L RSL
- Molybdenum Groundwater Plume >100 µg/L RSL
- MNA Downgradient of Active Treatment Area

Notes: Institutional Control boundaries proposed in Figure 6-1 are not shown but are included in this alternative.

Figure 8-1
Preferred Alternative Conceptual Hybrid Layout
Proposed Plan for the Kerr-McGee Chemical Corporation
Soda Springs Plant Superfund Site
Soda Springs, Idaho

TABLE 3-1: Contaminant Concentrations in Site Media
Proposed Plan for the Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

Constituent	Sample Medium	Standard Compared	Total Number of Samples[1]	Range of Detections	% Exceedances of Standard Compared[4]
Arsenic	Background Soil	Residential RSL (0.68 mg/kg) / PGW (0.0015 mg/kg)	20	1.8 - 7.6	100 / 100
Manganese		Residential RSL (1,800 mg/kg) / PGW (28 mg/kg)	20	259 - 685	0 / 100
Molybdenum		Residential RSL (390 mg/kg) / PGW (2 mg/kg)	20	0.32 - 4.8	0 / 20
Vanadium		Residential RSL (390 mg/kg) / PGW (86 mg/kg)	20	11.6 - 252	0 / 25
Total Petroleum Hydrocarbons		Residential RSL (96 mg/kg) / PGW (1.5 mg/kg)	NA	NA	NA
Tributyl Phosphate		Residential RSL (60 mg/kg) / PGW (0.025 mg/kg)	NA	NA	NA
Lithium		Residential RSL (160 mg/kg) / PGW (12 mg/kg)	NA	NA	NA
Arsenic	Pre-TCRA Surface Soils Within the Former Industrial Plant Boundary	Industrial RSL (3 mg/kg) / PGW (0.0015 mg/kg)	99	1.7 - 20.4	100 / 96
Manganese		Industrial RSL (26,000 mg/kg) / PGW (28 mg/kg)	99	138 - 2890	100 / 0
Molybdenum		Industrial RSL (5,800 mg/kg) / PGW (2 mg/kg)	99	0.67 - 541	79 / 0
Vanadium		Industrial RSL (5,800 mg/kg) / PGW (86 mg/kg)	99	39.1 - 3940	81 / 0
Total Petroleum Hydrocarbons		Industrial RSL (440 mg/kg) / PGW (1.5 mg/kg)	NA	NA	NA
Tributyl Phosphate		Industrial RSL (260 mg/kg) / PGW (0.025 mg/kg)	NA	NA	NA
Lithium		Industrial RSL (2,300 mg/kg) / PGW (12 mg/kg)	NA	NA	NA
Arsenic	Post-TCRA Surface Soils Within the Former Industrial Plant Boundary [2]	Industrial RSL (3 mg/kg) / PGW (0.0015 mg/kg)	116	1.8 - 8.2	100 / 97
Manganese		Industrial RSL (26,000 mg/kg) / PGW (28 mg/kg)	116	50.6 - 862	100 / 0
Molybdenum		Industrial RSL (5,800 mg/kg) / PGW (2 mg/kg)	116	0.58 - 342	84 / 0
Vanadium		Industrial RSL (5,800 mg/kg) / PGW (86 mg/kg)	116	19.4 - 3610	73 / 0
Total Petroleum Hydrocarbons		Industrial RSL (440 mg/kg) / PGW (1.5 mg/kg)	116	2.1 - 774	59 / 10
Tributyl Phosphate		Industrial RSL (260 mg/kg) / PGW (0.025 mg/kg)	96	0.01 - 54	55 / 0
Lithium		Industrial RSL (2,300 mg/kg) / PGW (12 mg/kg)	116	1.4 - 40.6	72 / 0
Arsenic	Surface Soils Outside the Former Industrial Plant Boundary	Residential RSL (0.68 mg/kg) / PGW (0.0015 mg/kg)	48	3.8 - 8.6	100 / 100
Manganese		Residential RSL (1,800 mg/kg) / PGW (28 mg/kg)	48	438 - 847	100 / 0
Molybdenum		Residential RSL (390 mg/kg) / PGW (2 mg/kg)	48	0.55 - 4.6	15 / 0
Vanadium		Residential RSL (390 mg/kg) / PGW (86 mg/kg)	48	38 - 222	19 / 0
Total Petroleum Hydrocarbons		Residential RSL (96 mg/kg) / PGW (1.5 mg/kg)	48	2 - 2	6 / 0
Tributyl Phosphate		Residential RSL (60 mg/kg) / PGW (0.025 mg/kg)	48	NA	0 / 0
Lithium		Residential RSL (160 mg/kg) / PGW (12 mg/kg)	48	9.2 - 30.9	94 / 0
Arsenic	Pre-TCRA Subsurface Soils	PGW (0.0015 mg/kg)	270	0.24 - 15.9	100
Manganese		PGW (28 mg/kg)	270	27.7 - 6800	100
Molybdenum		PGW (2 mg/kg)	270	0.075 - 1320	63
Vanadium		PGW (86 mg/kg)	270	0.57 - 29100	59
Total Petroleum Hydrocarbons		PGW (1.5 mg/kg)	106	2.8 - 23100	100
Tributyl Phosphate		PGW (0.025 mg/kg)	78	0.015 - 220	95
Lithium		PGW (12 mg/kg)	121	0.41 - 40.9	64
Arsenic	Post-TCRA Subsurface Soils [2]	PGW (12 mg/kg)	99	0.24 - 15.9	100
Manganese		PGW (0.0015 mg/kg)	99	27.7 - 2800	99
Molybdenum		PGW (28 mg/kg)	99	0.17 - 254	65
Vanadium		PGW (2 mg/kg)	99	3.3 - 4240	38
Total Petroleum Hydrocarbons		PGW (86 mg/kg)	34	3.9 - 6.7	41
Tributyl Phosphate		PGW (1.5 mg/kg)	2	NA	100
Lithium		PGW (0.025 mg/kg)	99	0.94 - 40.9	80

TABLE 3-1: Contaminant Concentrations in Site Media
Proposed Plan for the Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

Constituent	Sample Medium	Standard Compared	Total Number of Samples[1]	Range of Detections	% Exceedances of Standard Compared[4]
Arsenic	Basalt Rock	PGW (0.0015 mg/kg)	59	0.48 - 35.8	100
Manganese		PGW (28 mg/kg)	59	256 - 41600	100
Molybdenum		PGW (2 mg/kg)	59	0.11 - 29.8	46
Vanadium		PGW (86 mg/kg)	59	11.8 - 5840	34
Total Petroleum Hydrocarbons		PGW (1.5 mg/kg)	9	288 - 288	100
Tributyl Phosphate		PGW (0.025 mg/kg)	9	0.75 - 0.75	100
Lithium		PGW (12 mg/kg)	37	3 - 27.6	30
Arsenic	Interbedded	PGW (0.0015 mg/kg)	198	0.38 - 42.3	100
Manganese		PGW (28 mg/kg)	198	84.1 - 6920	100
Molybdenum		PGW (2 mg/kg)	198	0.14- 29.3	30
Vanadium		PGW (86 mg/kg)	198	3.5 - 410	10
Total Petroleum Hydrocarbons		PGW (1.5 mg/kg)	2	NA	100
Tributyl Phosphate		PGW (0.025 mg/kg)	2	NA	100
Lithium		PGW (12 mg/kg)	188	1.9 - 38.4	56
Arsenic	Salt Lake Formation	PGW (0.0015 mg/kg)	14	1.4 - 54.9	100
Manganese		PGW (28 mg/kg)	14	203 - 3100	100
Molybdenum		PGW (2 mg/kg)	14	0.16 - 2.2	7
Vanadium		PGW (86 mg/kg)	14	8.3 - 38.7	0
Total Petroleum Hydrocarbons		PGW (1.5 mg/kg)	NA	NA	NA
Tributyl Phosphate		PGW (0.025 mg/kg)	NA	NA	NA
Lithium		PGW (12 mg/kg)	14	5.1 - 97.7	93
Arsenic	Sediment	PGW (0.0015 mg/kg)	6	0.32 - 3.3	50
Manganese		PGW (28 mg/kg)	6	30.2 - 312	0
Molybdenum		PGW (2 mg/kg)	6	0.27 - 35.4	0
Vanadium		PGW (86 mg/kg)	6	6.4 - 27.6	0
Total Petroleum Hydrocarbons		PGW (1.5 mg/kg)	NA	NA	NA
Tributyl Phosphate		PGW (0.025 mg/kg)	NA	NA	NA
Lithium		PGW (12 mg/kg)	NA	NA	NA
Arsenic	Groundwater (Background Locations[3])	MCL (10 µg/L) / PSL (50 µg/L)	173	0.11 - 56.7	12 / 1
Manganese		Tapwater RSL (430 µg/L) / PSL (180 µg/L)	177	0.1 - 7720	22 / 33
Molybdenum		Tapwater RSL (100 µg/L) / PSL (180 µg/L)	173	0.15 - 81	0 / 0
Vanadium		Tapwater RSL (86 µg/L) / PSL (260 µg/L)	173	0.29 - 202	2 / 0
Total Petroleum Hydrocarbons		Tapwater RSL (100 µg/L) / PSL (730 µg/L)	NA	NA	NA
Tributyl Phosphate		Tapwater RSL (5.2 µg/L) / PSL (180 µg/L)	85	NA	0 / 0
Lithium		PSL (40 µg/L)	150	6.3 - 224	26
Arsenic	Surface Water (includes Springs / Seeps)	MCL (10 µg/L) / PSL (50 µg/L)	56	0.11 - 416	7 / 5
Manganese		Tapwater RSL (430 µg/L) / PSL (180 µg/L)	56	0.13 - 10900	7 / 11
Molybdenum		Tapwater RSL (100 µg/L) / PSL (180 µg/L)	62	0.79 - 528000	18 / 6
Vanadium		Tapwater RSL (86 µg/L) / PSL (260 µg/L)	62	0.38 - 48300	2 / 2
Total Petroleum Hydrocarbons		Tapwater RSL (100 µg/L) /PSL (730 µg/L)	21	13 - 6600	5 / 5
Tributyl Phosphate		Tapwater RSL (5.2 µg/L) / PSL (180 µg/L)	21	147 - 147	5 / 0
Lithium		PSL (40 µg/L)	23	6.2 - 269000	4

TABLE 3-1: Contaminant Concentrations in Site Media
Proposed Plan for the Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

Constituent	Sample Medium	Standard Compared	Total Number of Samples[1]	Range of Detections	% Exceedances of Standard Compared[4]
Arsenic	Groundwater	MCL (10 µg/L) / PSL (50 µg/L)	373	0.12 - 153	5 / 1
Manganese		Tapwater RSL (430 µg/L) / PSL (180 µg/L)	386	0.1 - 3060	19 / 41
Molybdenum		Tapwater RSL (100 µg/L) / PSL (180 µg/L)	373	0.15 - 27800	43 / 30
Vanadium		Tapwater RSL (86 µg/L) / PSL (260 µg/L)	373	0.35 - 138000	39 / 26
Total Petroleum Hydrocarbons		Tapwater RSL (100 µg/L) / PSL (730 µg/L)	394	12 - 1500	16 / 1
Tributyl Phosphate		Tapwater RSL (5.2 µg/L) / PSL (180 µg/L)	394	0.38 - 55.8	2 / 0
Lithium		PSL (40 µg/L)	373	6.3 - 1550	20 / 0

NOTES AND ABBREVIATIONS:

[1] Sample counts do not include QA/QC samples (i.e., equipment blank, field duplicate, MS/MSD samples). Where field duplicate samples were collected, the higher of either the primary or duplicate results were selected for summary information purposes.

[2] Samples indicated post-TCRA includes 10-Acre Pond TCRA samples and 2018 Surface Soil SAP samples.

[3] Includes all samples results from the background locations available at the time of the SRI. The values in this table do not reflect removal of outliers in the Background Screening Level Concentration analysis performed in the Evaluation of Anticipated Impacts of 10-Acre Pond TCRA (Haley & Aldrich, July 2).

[4] Includes samples with non-detect results where the reporting limit exceeds the Standard Compared.

µg/L = micrograms per liter
MCL = Maximum Contaminant Level
mg/kg = milligrams per kilogram
NA = not applicable
PGW = Protected Groundwater
PSL = Project Screening Levels
RSL = Regional Screening Levels
TCRA = Time-Critical Removal Action

Table 4-1: Summary of Risk and Hazard Estimates for Human Exposure Scenarios

Proposed Plan for the Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

Receptor Population	**Total Cancer Risk**	**Total Non-Cancer HI**	**Exposure Pathway Driving Cancer Risk >1E-05 Non-Cancer HI >1E+00**	**Constituent Driving Risk/Hazard**
Future On-Site Industrial Worker				
Groundwater	1E-06	**12.8**	Dermal exposure to process water (12.8)	Vanadium (12.2)
Total	1E-06	**12.8**		
Future On-Site Adult Resident - Lower Field				
Surface Soils - 0-9"	0E+00	0.01	None	
Groundwater	NA	**9.6**	Total domestic water use (9.5)	Manganese (1.4); Molybdenum (2.7), Vanadium (4.5), Kidney (1, DRO + lithium)
Total	0E+00	**9.6**		Nervous System (2.2, lithium + manganese)
Future On-Site Child Resident - Lower Field				
Surface Soils - 0-9"	NA	0.06	None	None
Groundwater	NA	**15.3**	Total domestic water use (15)	Lithium (1.4); Manganese (2.26), Molybdenum (4.6), Vanadium (6.8)
Total	**NA**	**15.3**		Kidney (1.7, DRO + lithium), Nervous System (3.5, lithium + manganese),
Current/Future Hypothetical Off-Site Adult Resident - Soda Springs				Arsenic (1E-04), Lithium (1.2), Molybdenum (1.2); Kidney (1.2, DRO + lithium)
Groundwater	**1E-04**	**4.8**	Total domestic water use (1E-04/4.7)	Cardiovascular System (2.1, arsenic + lithium); Nervous system (2, lithium
Total	**1E-04**	**4.8**		+ manganese)
Current/Future Hypothetical Off-Site Child Resident - Soda Springs				Arsenic (6E-05/1.6); Lithium (2.2); Manganese (1.3); Molybdenum (2)
Groundwater	**6E-05**	**7.8**	Total domestic water use (6E-05/7.6)	Kidney (2.3, DRO + lithium), Cardiovascular System (3.8, arsenic + lithium)
Total	**6E-05**	**7.8**		Nervous System (3.5, lithium + manganese)
Future Off-Site Adult Resident - Former (b) (6) Property				
Surface Soils - 0-9"	0E+00	0.62	None	None
Total	0E+00	0.62		
Future Off-Site Child Resident - Former (b) (6) Property - Total				
Surface Soils - 0-9"	0E+00	**1.5**	Ingestion home-grown produce (1.5)	TPH Aromatic C11-C22 - medium (1.2)
Total	0E+00	**1.5**		

Notes: A 0E+00 risk indicates that the background cancer risk was higher than Site risk. Additionally, when background constituent HQs were higher than Site constituent HQs, a value of 0 was used in the calculation of the HI.

Bold = 'Cancer Risk >1E-05 or HI >1E+00

(a) Assumed groundwater as source of domestic water. Total domestic water use = ingestion and dermal contact (while bathing/showering and swimming in pool).

DRO = Diesel Range Organics

HI = Hazard Index

HQ = Hazard Quotient

NA = Not Applicable

TPH = Total Petroleum Hydrocarbons

TABLE 5-1: Preliminary Groundwater Remediation Goals

Proposed Plan for the Former Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

COC	ON-SITE INDUSTRIAL WORKER RATL[1] (µg/L)	LOWER FIELD RESIDENT[2] RATL (µg/L)	OFF-SITE SODA SPRINGS RESIDENT[2] RATL (µg/L)	PRELIMINARY LOWER FIELD AND OFF-SITE RESIDENTIAL GROUNDWATER CLEANUP LEVEL (µg/L)	BACKGROUND SCREENING LEVEL CONCENTRATION[3] (µg/L)
Arsenic	NA	NA	10*	10*	**24.2**
Lithium	NA	39	39	40**	**131**
Manganese	NA	380	380	430**	**954**
Molybdenum	NA	92	88	**100****	37.8
Vanadium	**930**	74	NA	**86****	10

NOTES AND ABBREVIATIONS:

[1]Remedial Action Target Level (RATL) based on a cancer target risk level (TRL) of 1x10-5 and noncancer hazard quotient (HQ) of 1, and the lesser of the cancer and non-cancer value where applicable (Baseline Human Health Risk Assessment, Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site. Hydrometrics Inc. and TRC, June 2020).

[2]Lower Field and Off-Site Soda Springs Resident RATL based on child receptor.

[3] From Table 11 Evaluation of Anticipated Impacts of 10-Acre Pond Time Critical Removal Action, Haley and Aldrich, 2021.

*Arsenic Cleanup Level is the Maximum Contaminant Level (MCL).

**Based on the EPA Regional Screening Level (RSL) Generic Resident Tapwater Table (TR = 1x10-6, HQ = 1) November 2021 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).

COC = Contaminant of Concern; µg /L = micrograms per Liter; CUL = Cleanup Level; NA = not applicable

Shaded cells = selected Preliminary Groundwater Remediation Goal

TABLE 6-1: Remedial Technologies Used in the Retained Alternatives

Proposed Plan for the Former Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS	APPLICABLE ALTERNATIVES	COMMENTS
No Further Action	No Further Action (NFA)	No Action	1	Considered separately as Alternative 1. Currently does not meet the Remedial Action Objectives (RAOs) of the existing plan due to the long timeframe to reach RAOs. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that No Action be used as a comparison remedy, NFA is used in this analysis because primary source removal actions have already been completed at the Site.
Natural Attenuation	Monitored Natural Attenuation (MNA)	Groundwater MNA	2-5	Considered separately as Alternative 2 and as an element common to Alternatives 3-5 in the distal plumes. A component of the current overall Site groundwater remedy. Not sufficient as a remedy alone but is applicable when used together with other remedial process options. The Site-specific sorption study indicated that vanadium may undergo significant retardation during transport. Proper control of the vanadium mass discharge from source zones and/or plume cores is expected to help enhance vanadium attenuation downgradient significantly.
Institutional Controls	Groundwater Use Restrictions	Access Restrictions to Site and Contaminated Groundwater	2-5	Common element to Alternatives 2-5. Used as a component of overall Site risk management. Notices to deed/restrictive covenant/restrictive zoning/well drilling restriction/conservation easement are needed for groundwater use restrictions in the impacted areas of the Site. Some Institutional Controls (ICs) have already been implemented and the need for additional ICs will be determined in the future as needed.
Active Containment	Groundwater Hydraulic Control	Groundwater Extraction and/or Injection	3-5	Retained in conjunction with other in-situ and ex-situ treatments technologies. This is a proven technology. Characterization of aquifer hydraulic properties has shown that highly permeable zones are present in the vicinity of T2-209 and the Western Graben Features. Groundwater flow velocities in the Western Graben Area may be over 150 feet per day and the flow may primarily be controlled by fractures. A thoughtful and adaptive design and implementation process is needed to achieve desired outcomes.

TABLE 6-1: Remedial Technologies Used in the Retained Alternatives

Proposed Plan for the Former Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS	APPLICABLE ALTERNATIVES	COMMENTS
In-Situ Treatment	In-Situ Physical Treatment	Water Flushing	3 & 5	Retained as a component for enhanced removal of molybdenum and vanadium at potential source zones. If an ex-situ treatment or amendment step is used, treated or amended water may be used for water flushing.
	In-Situ Chemical and Biological Treatment	Chemical and Biological Redox Manipulation Processes	3 & 5	Laboratory and pilot testing verified the capability to stabilize molybdenum and vanadium, and field pilot testing validates its potential to treat a plume core. Some re-mobilization of molybdenum and vanadium will occur when groundwater is oxic. However, the release is expected to result in an aqueous concentration significantly lower than the concentrations observed at the plume cores near the areas of concern.
Ex-Situ Treatment	Ex-Situ Physical/Chemical Treatment	Ion Exchange	4 & 5	Retained for molybdenum and vanadium ex-situ treatment. Of the ex-situ treatment alternatives considered, co-precipitation followed by absorptive media filtration is expected to be the most cost-effective solution, could be designed without a liquid waste stream, and is capable of meeting the preliminary remediation goals for the Site.
		Chemical Co-Precipitation	4 & 5	Retained as a demonstrated technology that combined with Ion Exchange is capable of meeting the preliminary remediation goals for the Site. Sludge disposal would be required.

TABLE 7-1: Alternative Cost Estimate Summary

Proposed Plan for the Former Kerr-McGee Chemical Corp. Soda Springs Idaho Plant Superfund Site

Alternative	Remedial Design and Construction	Operations and Maintenance (1) Using 7.0 Percent Discount Rate (2)	Total Net Present Value Using 7.0 Percent Discount Rate	Accuracy Range (-30%)	Accuracy Range (+50%)
1	$900,000	$3,800,000	$4,700,000	$3,300,000	$7,050,000
2	$300,000	$9,900,000	$10,200,000	$7,100,000	$15,300,000
3	$4,400,000	$17,600,000	$22,000,000	$15,400,000	$33,000,000
4	$13,900,000	$23,600,000	$37,500,000	$26,300,000	$56,300,000
5	$10,200,000	$35,000,000	$45,200,000	$31,600,000	$67,800,000

NOTES AND ABBREVIATIONS:

[1] Operations and Maintenance Includes cost of implementing and maintaining the Institutional Controls Plan.

[2] For estimating operations and maintenance cost, the cost estimate assumed operations and maintenance would be conducted for 30 years.