# RECORD OF DECISION

# JACOBS SMELTER
# SUPERFUND SITE
# OPERABLE UNIT TWO

**STOCKTON, UTAH**
**September 2016**

# RECORD OF DECISION
# OPERABLE UNIT TWO
# JACOBS SMELTER SUPERFUND SITE
# TOOELE COUNTY, UTAH

The U. S. Environmental Protection Agency (USEPA), with the concurrence of the Utah Department of Environmental Quality (UDEQ), presents this Record of Decision (ROD) for Operable Unit Two (OU2) of the Jacobs Smelter Superfund Site (Site) in Tooele County, Utah. The ROD is based on the Administrative Record for OU2. The ROD presents a summary of the Remedial Investigation (RI) and Updated Revised Focused Feasibility Study (URFFS), actual and potential risks to human health and the environment, and a description of the Selected Remedy. The USEPA and UDEQ followed the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), and appropriate policy and guidance in preparation of this ROD. The purpose of this ROD is to:

1. Certify that the remedy selection process was carried out in accordance with the requirements of CERCLA, and to the extent practicable, the NCP.
2. Provide a summary of the technical rationale and background information contained in the Administrative Record.
3. Provide information necessary for determining the conceptual engineering components, and outline Remedial Action Objectives and the clean-up levels for the Selected Remedy.
4. Provide the public with a consolidated source of information about the history, characteristics, and risk posed by the conditions at OU2, as well as a summary of the clean-up alternatives considered, their evaluation, the rationale behind the Selected Remedy, and the Agencies consideration of, and response to comments.

The ROD is organized into three distinct sections:

1. The Declaration functions as an abstract for the key information contained in the ROD and is the section of the ROD signed by USEPA's Assistant Regional Administrator for Ecosystems Protection and Remediation and the Executive Director of the Utah Department of Environmental Quality.
2. The Decision Summary section provides an overview of the Site investigation, the clean-up alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the Selected Remedy and explains how the remedy fulfills the statutory and regulatory requirements; and
3. The Responsiveness Summary addresses public comments received on the Proposed Plan, the RI/URFS and other information in the Administrative Record.

# Part 1
# Declaration
# Record of Decision
# Jacobs Smelter Superfund Site
# Operable Unit Two

# DECLARATION FOR THE RECORD OF DECISION
# JACOBS SMELTER SUPERFUND SITE
# OPERABLE UNIT TWO

## Site Name and Location

Jacobs Smelter Superfund Site
Operable Unit Two (OU2)
Tooele County, Utah
CERCLIS # UTD0002391472

## Statement and Basis of Purpose

This decision document presents the Selected Remedy for OU2 of the Jacobs Smelter Superfund Site. The Record of Decision (ROD) has been developed in accordance with the requirements of the Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA) of 1980, 42 U.S. Code (U.S.C) 9601 *et seq*. as amended, and to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), 40 CFR Part 300.

This decision is based on the Administrative Record for OU2. The Administrative Record is available for review at Tooele City Library, located at 128 W. Vine Street, Tooele, Utah. The Administrative Record may also be reviewed by appointment at the USEPA Region 8 Records Center, located at 1595 Wynkoop St., Denver CO.

The Utah Department of Environmental Quality (UDEQ) concurs with the Selected Remedy.

## Assessment of Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Lead and arsenic contamination is present at concentrations that pose a significant risk to human health and the environment.

## Description of the Selected Remedy

The Selected Remedy for addressing contaminated areas of OU2 is excavation and off-site disposal of soils that exceed Site clean-up levels to a maximum depth of 18 inches, followed by the replacement of excavated soil with clean soil and re-vegetation.

The Selected Remedy for OU2 will achieve substantial long-term risk reduction through the removal of approximately 70,000 tons of contaminated soil from the Site and disposal at a permitted off-site disposal facility. Contaminated soil at depths greater than 18 inches will be covered with clean soil, reducing the risk of direct exposure, ingestion or inhalation. The components of the Selected Remedy include:

- Excavation of existing vegetation from contaminated areas.
- Excavation of surface soils above 500 milligrams per kilogram (mg/kg) lead and subsurface soils above 800 mg/kg lead on residential properties to a maximum depth of 18 inches.
- Excavation of surface and subsurface soils above 3,000 mg/kg lead on undeveloped properties to a maximum depth of 18 inches.
- Transportation to and disposal of all excavated soil at an appropriate off-site landfill.
- Placement of clean topsoil and revegetation of excavated areas.

The potential for contaminated soil spreading is minimized due to the permanent removal of accessible contamination and placement of clean soil over any remaining contamination.

Institutional controls (ICs), such as environmental covenants under the State of Utah's Environmental Covenants Act, or other land use controls will be established to ensure the remedy remains protective.

The Selected Remedy for OU2 addresses lead and arsenic contaminated soil associated with historical smelter activities. Surface water and ground water have been evaluated and have not been impacted by Site contamination.

The Site has been divided into six Operable Units to address the smelter contamination:

- Operable Unit One (OU1) – Addressed residential soil contamination within the Town of Stockton, attributable to the Jacobs Smelter.
- Operable Unit Two (OU2) – Consists of soil contamination outside of the Town of Stockton's 1999 boundaries (attributable to the Waterman Smelter operations)
- Operable Unit Three (OU3) – Addressed soil contamination on Union Pacific property.
- Operable Unit Four (OU4) – Addressed lead and arsenic contamination on property owned by Rio Tinto Kennecott Copper (formerly Kennecott Utah Copper LLC (KUCC)),
- Operable Unit Five (OU5) – Consists of property owned by the United States Bureau of Land Management (BLM),

- Operable Unit Six (OU6) – Contamination associated with the Chicago and Carson Buzzo Smelters. In 2014 these areas were separated from OU2 and established as OU6 due to distance from the other smelters and the town of Stockton as well as differences in land use and potential exposure pathways.

## Statutory Requirements

OU2 is the subject of this ROD. The clean-up of OU2 will address contaminated soil from historical smelter operations on both residential and undeveloped land. The Remedial Action described in the ROD will not address surface water or ground water.

The Selected Remedy for OU2 is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate (ARARs) for the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment technologies to the extent practicable. Since the contaminants of concern for the Site (lead and arsenic) pose a hazard in their elemental form and cannot be treated, the Selected Remedy does not satisfy the statutory preference for treatment.

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years, and every five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

## ROD Data Certification Checklist

The following information is included in the Decision Summary section of the ROD. Additional information can be found in the Administrative Record for this Site.

- Contaminants of Concern and their respective concentrations.
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground and surface water used in the baseline risk assessment and ROD.
- Baseline risk represented by the contaminants of concern.
- Clean-up levels established for contaminants of concern and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Potential land use that will be available at the Site as a result of the Selected Remedy.

- Estimated capital costs, annual operation and maintenance costs, total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

**Signature Page**

Martin Hestmark
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation
U.S. Environmental Protection Agency, Region 8

9/29/16
Date

**Signature Page**

Alan Matheson
Executive Director
Utah Department of Environmental Quality

29 Sept. 2016
Date

# Part 2
# Decision Summary
# Record of Decision
# Jacobs Smelter Superfund Site
# Operable Unit Two

Decision Summary

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# Section 1: Site Name, Location, and Brief Description

The Jacobs Smelter Superfund Site (Site) (CERCLIS#UT0002391472) is located within Rush Valley, Tooele County, Utah. The most significant population in the valley resides in Stockton, approximately 38 miles southwest of Salt Lake City via Interstate 80 and Utah Highway 36, and five miles southwest of the city of Tooele. The Stockton Area was the center of silver and base metal mining, milling and smelting district from the 1860s until 1970. No industries and few retail/commercial businesses currently exist in Stockton. In general, land surrounding Stockton is used for agricultural and recreational purposes.

The risks posed by the Site derive from smelting and mining activity, which occurred primarily in the 1860s and 1870s. Wastes in the form of heavy metal contaminated soil, mill tailings, and smelter waste exist at several locations within the Site boundaries.

The Site has been divided into six Operable Units to address smelter contamination:

- Operable Unit One (OU1) – Addressed residential soil contamination within the Town of Stockton, attributable to the Jacobs Smelter.
- Operable Unit Two (OU2) – Consists of soil contamination outside of the Town of Stockton's 1999 boundaries (attributable to the Waterman Smelter operations).
- Operable Unit Three (OU3) – Addressed soil contamination on Union Pacific property.
- Operable Unit Four (OU4) – Addressed lead and arsenic contamination on property owned by Rio Tinto Kennecott Copper (formerly Kennecott Utah Copper LLC (KUCC)).
- Operable Unit Five (OU5) – Consists of property owned by the United States Bureau of Land Management (BLM).
- Operable Unit Six (OU6) – Contamination associated with the Chicago and Carson Buzzo Smelters. In 2014 these areas were separated from OU2 and established as OU6 due to distance from the other smelters and the town of Stockton as well as differences in land use and potential exposure pathways.

The location of the Site and the Operable Units are shown in Figure 1-1.

This ROD addresses OU2. OU2 consists of both residential and undeveloped land that is used for agricultural purposes including grazing livestock and recreation. OU2 includes the Rawhide Ranchettes, the B&B subdivision and the area between the two subdivisions where the Waterman Smelter was located (See Figure 1-2).

The Superfund Trust Fund will be used to cover costs associated with the selected remedial action The Utah Department of Environmental Quality (UDEQ) is the lead

agency for the Site with the U.S Environmental Protection Agency (USEPA) acting as the support agency.

# Section 2: Site History and Enforcement Activities

## 2.1 Site History

In April 1864, volunteer soldiers discovered silver ore east of Stockton and organized the first mining district in the area. The area around the military reservation became the base for small-scale milling and smelting activities. The Town of Stockton was established in 1864. By 1866, the town contained over 400 inhabitants. By 1873 there were four identified smelters in Rush Valley; the H.S. Jacobs and Company, Waterman Smelting Company, Chicago Smelting Company and the Carson and Buzzo Smelter. In addition, several small smelting furnaces were built in the area, operated for a short period of time with marginal results, and then were shut down. The exact locations of these small smelters remain unknown.

The H.S. Jacobs and Company, also known as the H.S. Jacobs' Smelting Company, smelter was located on the outskirts of Stockton in the southeast corner of town. The facility, constructed in 1872, consisted of a 40 horsepower steam engine and three blast furnaces with a total daily production capacity of 60 tons. By 1880 the Jacobs Smelter was processing 100 tons of ore per day and producing approximately 80 tons of waste (tailings and slag) and about five tons of bullion a day. Once processed, the bullion was shipped by rail to the Eastern United States.

The Waterman Smelting Company works were completed in May 1871 by Isaac S. Waterman and Henry Simons of Philadelphia. The Waterman Smelter was located on the northern shore of Rush Lake, about a half mile west of Stockton. In 1871 the smelter consisted of a large roasting furnace and a 30–40 inch blast furnace. By 1872, the facility consisted of two cylindrical furnaces with a daily production capacity of 14 tons each, a 40-horsepower steam engine, and employed forty men. In 1875 the reported capacity of the Waterman furnaces was 26 tons per day, which resulted in the processing of 9 tons of bullion per day per stack. The processed bullion was shipped to New Jersey and St. Louis for refining. By 1887, production had almost ceased at the smelter and by 1894 the Waterman Smelter was no longer in operation.

The Chicago Smelting Company Smelter, was constructed on the southeastern edge of Rush Lake in August 1873. The mill consisted of two vertical blast furnaces and by 1875 was processing 15 tons of ore daily. The Chicago Smelter ceases production in 1877.

The Carson Buzzo Smelter was located about a half mile south of the Chicago Smelter, also on the southeastern shore of Rush Lake and was in operation from 1873 to 1875.

In addition to the large smelters in and around Stockton, there were numerous small smelters and stamp mills within the Rush Valley. Nearly all traces of these smelting operations have vanished. Buried timbers, stained soils, and some foundations are all of the physical evidence that remain. Homes were built upon a portion of the Jacobs Smelter location. Much of the slag was likely reprocessed at other smelters located in the Toole Valley and Salt Lake Valley.

By 1889, the older mines that had been in operation the longest in the Rush Valley Mining District began to experience problems encountering ground water at depths around 660 feet, which began to flood the mining works. Eventually the cost of pumping, along with the diminishing prices for ore, brought about the closure of many mines in the mining district. With the closure of the mines, the economic base of the area gradually shifted from mining production to agriculture.

## 2.2 USEPA and UDEQ Investigations

In 1995, the Site was added to the Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) under the name Stockton Smelters. A Preliminary Assessment and Site Investigation (PA/SI) detected lead and arsenic in the Site soils in December 1998, and the name of the Site was changed to the Jacobs Smelter Superfund Site. The USEPA conducted a removal assessment in 1998. The assessment showed lead and arsenic at concentrations that represented a significant risk to human health and the environment.

The USEPA initiated a time-critical removal action in March 1999 to clean-up 29 of the most contaminated residential properties in Stockton. The USEPA issued a Record of Decision (ROD) for OU1 on July 29, 1999. The Jacobs Smelter Superfund Site was added to the National Priorities List on February 4, 2000. In 2001, UDEQ cleaned up an additional 126 residential properties.

Remedial investigations for OU2 began in 1999. Due to the large geographic extent of OU2 and the relatively small amount of data available, UDEQ conducted a Contaminant Screening Study (CSS) to establish a geographic boundary for future study. During the CSS, elevated concentrations of heavy metals were found in the soils of a proposed subdivision within OU2, known as the Rawhide Ranchettes Subdivision.

A focused investigation of the Rawhide Ranchettes subdivision in May 2001 indicated that five of the 30 lots within the subdivision exceeded the residential lead screening levels. This resulted in a 2001 non-time critical removal clean-up of the five lots.

In order to address data gaps identified in the CSS and the Rawhide Ranchettes investigation and to focus remedial investigation activities for OU2, a Pre-Remedial Investigation study was conducted in early 2001. Additionally in 2001, the USEPA and UDEQ developed a Human Health Risk Assessment (HHRA) and an Ecological Risk

Assessment (ERA) for OU2. A land reuse assessment was finalized in 2001. The land reuse assessment looked at current land use and habitat types as well as reasonably anticipated land use.

A Remedial Investigation (RI) that characterized lead and arsenic contaminated soil was performed in 2002 by UDEQ. Based on the data collected during the RI, the results of the HHRA and the ERA, clean-up levels were established for OU2.

A Feasibility Study for OU2 was completed by UDEQ in December 2003, followed by a Revised Feasibility Study (RFS) in July 2004, also completed by UDEQ that evaluated different alternatives for cleaning up contaminated soil. USEPA and UDEQ issued a Proposed Plan in July 2004 that generated numerous public comments and concerns. As a result of the public comments and concerns none of the alternatives were pursued and a ROD was not issued.

In July 2004, KUCC conducted a soil characterization investigation of a parcel within OU2 that was located to the immediate northeast of Stockton. The results of this investigation suggested that the elevated concentrations of lead and arsenic were from up-gradient mining waste rock piles and were not associated with smelter wastes from Jacobs Smelter Superfund Site. As a result this parcel is no longer part of the Jacobs Smelter NPL Site as documented in the August 12, 2009, Administrative Settlement Agreement and Order on Consent (AOC) for Removal Action with KUCC LLC.

In order to provide more detailed analysis of contamination, potential clean-up alternatives and associated cost, UDEQ conducted additional sampling and analytical work in 2009. Elevated soil lead levels triggered a removal action to clean-up contaminated soil from four more Rawhide Ranchettes residential lots.

Clean-up activities at OU4, OU5 and the Rawhide Ranchettes, prompted UDEQ to commission an update to the RFS (URFS) in 2009. The update included collecting additional data to address community concerns regarding potential lead and arsenic contamination in residential areas.

## 2.3 Enforcement Activities

In 1999, the Union Pacific Railroad (UPRR), under agreement with the USEPA, addressed the contamination on OU3 by placing a 16-inch soil cover over the contaminated soils in the railroad right-of-way through Stockton. OU3 was partially deleted from the NPL on November 29, 2005.

The USEPA initiated a potentially Responsible Party (PRP) search in 1999. Because over 100 years have passed since the smelters have been in operations, it was considered improbable that a viable responsible party still existed. At this time none of the

companies that owned or operated the smelters exist nor could they be traced to current operating parties.

A non-time critical removal action under an Administrative Order on Consent (AOC) with Titan Development LLC for five contaminated lots within Rawhide Ranchettes, was completed in 2001. The removal action consisted of excavating six to 18 inches of contaminated soil from the contaminated lots. The excavated soil was placed within the roadbed and in a covered repository located within the subdivision which remains deeded to the subdivision's developer.

In July 2008, the USEPA entered into an AOC and issued an Action Memorandum to KUCC that required KUCC to clean-up its property located near the Stockton Railyard and east of the Rawhide Ranchettes subdivision. The parcel was designated as OU4. KUCC conducted a removal action consistent with the terms of the AOC and Action Memorandum in 2008. Soil with lead concentrations greater than 500 milligrams per kilogram (mg/kg) lead was removed from OU4 except for where contaminated soil was located underneath a large gravel hill near the railroad bed. An Environmental Covenant was placed on the parcel for this contamination.

In 2009, an AOC was signed requiring KUCC to address the Kennecott Northeast Parcel through a removal action. Based on sampling that demonstrated that there was no smelter related contamination on the parcel the Site boundaries were changed and this parcel is no longer part of the Jacobs Smelter NPL Site. KUCC addressed the concerns at the property through the removal process with USEPA and UDEQ oversight.

## Section 3: Community Participation

Sections 113 and 117 of CERCLA require public participation. USEPA and UDEQ have conducted the required community participation activities through the presentation of the RI, HHRA, ERA, URFFS and Proposed Plan, a 60 day public comment period, a public meeting, and the presentations of the Preferred Remedy in the Proposed Plan. In addition, several fact sheets and other mailings were dispersed to the public.

The Administrative Record (AR) for the Site is available for review at the Tooele City Public Library and at the USEPA Superfund Record Center. A notice advertising the availability of the AR and the Proposed Plan was published in the Tooele City Transcript on September 20, 2015.

In July 2004, the USEPA and the UDEQ issued a Proposed Plan for OU2 that identified preferred alternatives for cleaning up contaminated soil in residential and undeveloped areas. A public comment period was held to accept comments about the plan and a public meeting occurred August 4, 2004. As a result of comments received on the Proposed Plan none of the proposed alternatives were pursued and a ROD was not issued. Thereafter, the USEPA and UDEQ have been addressing comments on certain aspects of the 2004

Proposed Plan, conducting additional investigations, and working to resolve technical and legal issues to allow clean-up to proceed.

A second Proposed Plan for OU2 was issued on September 20, 2015. The RI, URFS and other documents in the AR were made available to the public at this time as well. In addition, copies of the Proposed Plan were mailed to citizens in neighborhoods within and near the Site. A public comment period on these documents was held from September 21 to November 21, 2015.

A public open house was held on October 15, 2015, in the Stockton Fire Department Conference Room to provide information regarding the Proposed Plan and the Preferred Alternatives to area residents. A court reporter was on hand to record comments received during the public open house.

A response to the comments received during the public comment period, as well as comments received during the open house, is included in the Responsiveness Summary which is part of this ROD.

## Section 4: Scope and Role of Operable Unit

As with many Superfund Sites, the problems at the Site are complex. As a result the Site has been divided into six Operable Units (OUs) to address smelter contamination:

- Operable Unit One (OU1) – Addressed residential soil contamination within the Town of Stockton, attributable to the Jacobs Smelter.
- Operable Unit Two (OU2) – Consists of soil contamination outside of the Town of Stockton's 1999 boundaries (attributable to the Waterman Smelter operations)
- Operable Unit Three (OU3) – Addressed soil contamination on Union Pacific Property.
- Operable Unit Four (OU4) – Addressed lead and arsenic contamination on property owned by Rio Tinto Kennecott Copper (formerly Kennecott Utah Copper LLC (KUCC)),
- Operable Unit Five (OU5) – Consists of property owned by the United States Bureau of Land Management (BLM),
- Operable Unit Six (OU6) – Contamination associated with the Chicago and Carson Buzzo Smelters. In 2014 these areas were separated from OU2 and established as OU6 due to distance from the other smelters and the town of Stockton as well as differences in land use and potential exposure pathways.

The ROD for OU1 was signed July 29, 1999 and identified excavation and off-site disposal of surface and subsurface contaminated soils as the selected remedy. The selected remedy involved the excavation of approximately 150,000 tons of lead and arsenic contaminated soil from contaminated properties. Excavated soils were disposed in

a suitable landfill based on classification of the soil as hazardous or non-hazardous in accordance with Subtitle C of the Resource Conservation and Recovery Act (RCRA).

In July 2004, the USEPA and the UDEQ issued a Proposed Plan for OU2 that identified preferred alternatives for cleaning up contaminated soil in residential and undeveloped areas. As a result of comments received on the Proposed Plan none of the proposed alternatives were pursued and a ROD was not issued. In response to comments submitted on the proposed plan, the USEPA and UDEQ coordinated additional characterization and clean-up activities with Kennecott Utah Copper (KUCC). This resulted in the designation of OU4 and the removal of land northeast of Stockton from the Jacobs Smelter Superfund Site.

In 2010 two additional Operable Units were created from land already within OU2: (1) OU4, which consisted of land east of the Rawhide Ranchettes, and (2) OU5 which contained land owned by the BLM. During 2009 and 2010 additional investigation was performed within the Waterman Smelter and the Rawhide Ranchettes and B&B subdivisions. The results of this investigation resulted in a second non-time critical removal of contaminated soil from residences within the Rawhide Ranchettes subdivision.

Clean-up at OU3 and OU4 was completed through removal actions and no further work is needed. UPRR performed the OU3 clean-up and OU3 was partially deleted from the NPL on November 29, 2005. KUCC performed the OU4 clean-up that includes implementation of institutional controls (ICs) through the placement of an Environmental Covenant under the Utah Uniform Environmental Covenants Act. In 2001 clean-up of several properties within the Rawhide Ranchettes was performed by Titan Development LLC, and in 2009, additional clean-up was performed by the USEPA to address surface lead contamination at four more properties. No further cleanup work is needed within Rawhide Ranchettes and the area is covered under the Town of Stockton Hazardous Soils Ordinance (#2000-04). Since this area is within the boundaries of OU2, it is also covered under this ROD.

In July 2012, the BLM conducted clean-up activities near the Waterman Smelter for part of OU5. Other investigation and remediation activities at OU5 are being conducted by BLM. Further clean-up of OU5, if needed, will be performed by the BLM.

Contamination associated with the Chicago and Carson Buzzo Smelters was originally included in OU2. Based on differences in land use, exposure scenarios, and the remote location of the smelter in relation to Stockton, the risk and exposure assumptions used for the Waterman Smelter are not applicable to the Chicago and Carson Buzzo smelters. As a result these areas were removed from OU2 in January 2014 and were established as OU6.

OU2 is the subject of this ROD. The clean-up of OU2 will address contaminated soil from historical smelter operations on both residential and undeveloped land. The Remedial Action described in this ROD will not address surface water or ground water

because the RI showed that neither had been impacted by Site contaminants. Clean-up Actions for OU1, OU3 and OU4 have already been completed.

The remedy selected by the USEPA and UDEQ and documented in this ROD is intended to mitigate or abate risks posed by the Site contamination.

## Section 5: Site Characteristics

The Jacobs Smelter Superfund Site originally consisted of three Operable Units, OU1, OU2 and OU3. At that time OU2 consisted of undeveloped and underdeveloped land surrounding the Waterman Smelter west of Stockton, the majority of the Rush Lake Valley, and the Chicago and Carson Buzzo Smelters south of the Town of Stockton.

In 2010, two additional Operable Units were created, OU4 and OU5. OU4 consists of land owned by Kennecott LLC and is located east of the Rawhide Ranchettes subdivision. OU5 consists of land owned and managed by the BLM. In addition, areas that sampling efforts had shown were not impacted by smelter related contamination were removed from the Site boundaries. The boundaries of OU2 were modified to include the Waterman Smelter, the Rawhide Ranchettes and B&B subdivisions and the Chicago and Carson Buzzo Smelters.

The Chicago and Carson Buzzo Smelter areas are used mainly for agricultural purposes. Thus, in 2013 the agencies re-examined the exposure scenarios associated with the Chicago and Carson Buzzo Smelters. Based on the differences in use and the location of the Chicago and Carson Buzzo Smelters in relation to the town of Stockton, it was determined that the risk assumptions used for the Waterman Smelter are not applicable to the Chicago and Carson Buzzo Smelters.

Therefore, the boundaries of OU2 have been changed to only address contamination associated with the Waterman Smelter. Another Operable Unit, OU6, has been created to address contamination from the Chicago and Carson Buzzo Smelters.

Currently OU2 covers approximately 85 acres and consists of the Rawhide Ranchetes residential development to the north, the B&B Subdivision to the south and the undeveloped land containing the Waterman smelter between them Figure 5-1.

The lots in the B&B subdivision range from 5 to 10 acres in size with the majority of the lots used for agricultural purposes that include the grazing of livestock. The lots in the Rawhide Ranchettes subdivision are considerably smaller, ranging from one to two acres.

The undeveloped area of OU2 is a sparsely vegetated bluff that contains the foundations of the Waterman Smelter and associated smelter debris and slag. The undeveloped area of OU2 is mainly used for recreational purposes, unrestricted all-terrain vehicle (ATV) use being chief among them.

The Waterman Smelter represents a 19th Century historic smelter with multiple features and numerous artifacts which have the potential to yield information about early smelting operations in Utah. The Waterman Smelter has been identified as potentially eligible for listing on the National Register of Historic Places. The USEPA has initiated preliminary consultation with interested parties per the National Historic Preservation Act (NHPA) regulations. The agencies will consider the effect that the remedial action will have on the historical property and will incorporate appropriate mitigation measures during construction.

## 5.1 Site Conceptual Models

A Human Health Risk Assessment (HHRA) and an Ecological Risk Assessment (ERA) were prepared for OU2 to determine the health and ecological risks associated with the contamination at the Site.

Figure 5-2 shows the Conceptual Site Model (CSM) for residential exposure and Figure 5-3 shows the CSM for exposure in the undeveloped areas of OU2. The exposure routes and exposure media that were considered for these receptors include:

- Incidental ingestion of indoor dust
- Incidental ingestion of outdoor soil
- Direct ingestion of discrete waste piles
- Inhalation of outdoor dust
- Dermal contact with surface soil
- Ingestion of surface water
- Dermal contact with surface water

## 5.2 Physical Characteristics of the Site

Jacobs Smelter OU2 is located within Rush Valley, Tooele County, Utah. The significant population in the Valley resides in the Town of Stockton, located approximately 38 miles southwest of Salt Lake City via Interstate 80 and Utah Highway 36 and 5 miles southwest of the city of Toole, the county seat. OU2 consists of both residential and undeveloped land that is used for agricultural and recreational purposes. OU2 includes the Rawhide Ranchettes, the B&B subdivision and the area between the two subdivisions containing the historic Waterman Smelter location.

The topography of OU2 is dominated by the Rush Valley floor, which is generally smooth, at an elevation of approximately 5,000 feet.

Rush Lake is a remnant of historic Lake Bonneville, which once covered most of northern Utah. Rush Valley is separated from the Tooele Valley and the Great Salt Lake

by a traverse drainage called South Mountain which is part of a geologic fold called the Ophir Anticline. Lake Bonneville left a series of shoreline bars and beaches. One remnant of the of these shoreline bars is located directly north of the Stockton town limit and has been named the Stockton Bar. The Lake Bonneville and Rush Lake lakebed deposits include well-bedded silt forming a veneer over older alluvial deposits. The primary soils underlying the Stockton area include gravelly loam and sandy loam.

The climate of the Stockton area is sub humid, with warm, dry summers, cool winters, and wetter spring and fall periods. The wettest periods of the year are March-April and October-November, with average annual precipitation at 18.5 inches. Snow is possible between late September and early June. Maximum daily temperatures average from 36.0 degrees Fahrenheit in December to 88.6 degrees in July. Minimum daily temperatures average from 18.6 degrees in December to 60.5 degrees in July. The frost-free season ranges from 100-120 days.

Rush Valley forms a closed drainage basin 36 miles long and 18 miles wide. Nearly all surface drainage in the Rush Valley is directed to Rush Lake. Rush Lake receives its inflow from eight perennial streams originating in the Oquirrh Mountains to the east and the Stansbury Mountains to the west.

The drainages in Rush Valley are generally short, high gradient streams that carry runoff only during, and immediately after, precipitation events or during the relatively brief spring snowmelt period in the surrounding mountains. Because Rush Lake is located in a closed drainage basin, its level is completely dependent on the ratio of runoff to evaporation occurring each year. The level and size of Rush Lake have dramatically fluctuated during the last 150 years. Currently, after numerous drought seasons, the lake contains virtually no water. Based on historic fluctuations, the lake level may be expected to rise and drop in the future.

Ground water in the Rush Valley is present at shallow depths and is perched on bed rock throughout the Rush Lake playa. However, the Waterman Smelter and the area encompassed by OU2 are located on a geologic bench approximately 150 feet above the playa. No investigation has been conducted to specifically determine the nature and extent of potential perched aquifers, nor is additional investigation planned for OU2.

Approximately 32 acres within OU2 contain lead and arsenic contaminated soil with lead concentrations as high as 150,000 mg/kg. Contaminated soil extends below 18 inches near the location of the Waterman smelter and other locations throughout the Site.

Surface and subsurface soil, sediment, surface water and ground water samples have been collected and analyzed during investigations performed at OU2. Sampling results did not indicate that surface water had been impacted by smelter contamination.

Sampling wells were installed up-gradient and down-gradient of the Waterman Smelter to depths of 100 feet below ground surface (bgs) and 47 feet bgs respectively, but ground water was not encountered.

## 5.3 Summary of OU2 Remedial Investigation

Jacobs Smelter OU2 has been under investigation since 1998 and has been subject to numerous sampling events culminating in a RI that was completed in July 2003. At that time, OU2 included undeveloped land associated with the Waterman Smelter west of Stockton, agricultural land associated with the Chicago and Carson Buzzo Smelters south of Stockton as well as undeveloped land north and east of Stockton. OU2 included all surface water and ground water. Due to the large geographic extent of OU2 and the relatively small amount of data a CSS was conducted in 2000 to identify general areas of contamination and to establish a boundary for future study. During the CSS, elevated concentrations of lead and arsenic prompted further investigation and a non-time critical removal in a proposed subdivision within OU2 known as the Rawhide Ranchettes.

In order to address remaining data gaps and to focus RI activities for OU2 a Pre-Remedial Investigation Study was conducted in early 2001. The sampling events that took place prior to the RI analyzed surface and subsurface soils and sediments, surface water and ground water. The results from these investigations were used to establish the boundaries of OU2 and to focus sampling efforts for the RI.

Three additional OUs have been designated since the Site was listed and divided into Operable Units. OU4, originally part of OU2, is comprised of KUCC property and includes soils west of OU3 and east of Rawhide Ranchettes. OU5, also originally part of OU2, is comprised of BLM land in the northeast corner of the Site and a small strip of land located north of the Waterman Smelter and south of Rawhide Ranchettes. OU6, which was created in 2014, is several miles south of Stockton and includes contamination associated with the Chicago and Carson Buzzo smelters.

OU2 focusses on contamination associated with the Waterman Smelter area, the Rawhide Ranchettes and the B&B subdivisions.

### 5.3.1 Remedial Investigation Sampling Strategy

The RI sampling was conducted in two phases. The first phase, which took place in April and May of 2002, covered numerous areas within the Rush Valley and included the characterization of surface water, sediment and ground water as well as surface and subsurface soils. The second phase focused on characterizing smelter related contamination on residential properties south of the Waterman Smelter.

In July 2004, the USEPA and the UDEQ issued a Proposed Plan for OU2 that identified preferred alternatives for cleaning up contaminated soil. A public comment period was

held to accept comments about the plan and a public meeting occurred August 4, 2004. Since then, the USEPA and the UDEQ have been addressing comments on certain aspects of the original Proposed Plan, conducting additional investigations, and working to resolve technical and legal issues to allow clean-up to proceed.

Phase 1 sampling efforts were focused on delineating the extent of contamination associated with the Waterman, Chicago and Carson Buzzo Smelters as well as areas to the north, northeast and east of Stockton.

Based on the sampling results of Phase 1, UDEQ and USEPA determined that additional sampling was required on a number of the residential properties included in OU2. The second phase of sampling took place in February 2003 and only included soil sampling.

Ground water samples were initially collected using direct push technology throughout the Rush Valley with inconclusive results. Additional ground water sampling activities were developed to characterize the ground water at each of the former smelter sites. One monitoring well upgradient and one downgradient of Waterman Smelter were installed to depths of 100 bgs and 42 feet bgs, respectively. Ground water was not encountered at either well. Based on the lack of ground water encountered at the Waterman Smelter, and the depth of ground water in the Rush Valley, the USEPA and UDEQ have determined that the ground water pathway is incomplete and have no plans to investigate ground water within OU2 further.

In 2009, at a Rawhide Ranchettes property owner's request, UDEQ took additional samples. Results indicated lead contamination exceeding residential action levels. This instigated a review of the sampling protocol previously implemented at the residential subdivision for the RI and resulted in additional characterization of the Rawhide Ranchettes and B&B Subdivisions.

The original scope of the additional characterization was to collect samples from the 40 residential properties within OU2 and analyze them for lead and arsenic. After sampling activities began in the residential subdivisions, the scope of the sampling effort was expanded to include additional sampling of undeveloped land surrounding the Waterman Smelter.

Different field sampling techniques were used for the residential properties than were used for the undeveloped properties. The residential properties were divided into quarter-acre decision units and samples were collected from three different depth intervals: 0-6 inches, 6-12 inches and 12-18 inches. A total of 900 samples were collected in the Rawhide Ranchettes subdivision and 832 samples in the B&B subdivision.

In the undeveloped properties, X-ray fluorescence (XRF) screening was conducted at 177 surface locations and 21 surface soil and 3 subsurface samples were collected and analyzed at a fixed base laboratory.

In August 2011, an additional sampling event was conducted within the undeveloped properties to evaluate the spatial distributions of lead and arsenic contamination. Samples were collected from each location at three different depths intervals: 0-6 inches, 6-12 inches, and 12-18 inches.

### 5.3.2 Nature and Extent of Soil Contamination

The nature of the contamination at OU2 consists mainly of lead and arsenic in surface and subsurface soils. Lead and arsenic are naturally occurring elements that are present in the sulfide ores that were processed at the Waterman Smelter. The ore was extracted from the numerous mines above the Rush Valley. The smelting process involved the crushing and melting of sulfide ore in order to concentrate the desired metals. The crushing process likely released arsenic, lead and other metals from the rock matrix in the form of dust. In addition, flue ash from the smelting process likely contained concentrated levels of these metals and would have settled across the smelter and surrounding areas. Also, slag (a byproduct of the smelting process) and smelter debris is present throughout the Site and is known to contain elevated concentrations of lead and arsenic.

Lead and arsenic have been identified as the contaminants of concern (COCs) for OU2. The RI and successive sampling results indicate the maximum lead concentration of 154,000 mg/kg is located at the historic Waterman Smelter site.

Samples collected during 2009 from four lots within the Rawhide Ranchettes subdivision exceeded residential clean-up levels. These exceedances resulted in an additional Removal Action in the Rawhide Ranchettes subdivision. The Removal Action was initiated in 2010 and was completed in the spring of 2011. Contaminated soil placed underneath roadways as well as contaminated soil placed in the repository constructed as part of the 2001 removal remains within the subdivision. Rawhide Ranchettes requires no further clean-up.

Approximately 33 acres remaining within OU2 contain lead and arsenic contaminated soil above clean-up levels. Contaminated soil extends below 18 inches near the location of the former smelter and other locations throughout the OU.

The extent of contamination at the B&B subdivision is estimated to be 5.4 acres and is shown on Figure 5-4. The majority of the contamination in the residential properties is located in the northern half of the B&B subdivision and is not near buildings or homes.

The extent of contamination within the undeveloped areas of OU2 is estimated to be 26.7 acres and is also shown in Figure 5-4. The vertical extent of contamination was investigated to a depth of 18 inches with the following results: approximately 14.6 acres of the undeveloped area contains contamination extending to a depth of 6 inches, 3.6 acres to a depth of 12 inches and 8.5 acres to a depth of 18 inches or greater.

### 5.3.3 Nature and Extent of Surface Water Contamination

Nine surface water samples were collected from Rush Lake as part of the 2002 RI sampling activities. Seven surface water samples were collected from springs and seeps located near the Rush Lake shoreline (Figure 5-4).

The surface water sampling results reported metals concentrations as either non-detect or at concentrations close to the reporting limits. Sampling results indicate that surface water has not been impacted by smelter contamination. There is no water currently in Rush Lake and there is no surface water associated with within the current boundaries of OU2.

Further assessment of surface water is anticipated as part of OU6 characterization activities.

### 5.3.4 Nature and Extent of Ground Water Contamination

Groundwater monitoring wells were installed at locations up-gradient and downgradient of the Waterman Smelter to depths of 100 feet bgs and 42 feet bgs. Groundwater was not encountered at either location Figure 5-4).

Based on the lack of ground water encountered at the Waterman Smelter and the general depth to groundwater in the Rush Valley, groundwater is not an issue at OU2.

Further assessment of groundwater is anticipated as part of OU6 characterization.

# Section 6: Current and Potential Future Land and Water Uses

This section discusses the current and reasonably, anticipated future land uses and ground and surface water uses at the Site.

## 6.1 Current and Potential Land Uses

Land use within OU2 varies. The Rawhide Ranchettes and B&B subdivisions are zoned for rural residential use. The Waterman Smelter area is undeveloped and is currently used for recreational purpose, namely off-road ATV use and target shooting.

Since Stockton is within commuting distance of both Salt Lake City and Tooele, the future use anticipated for properties near and around the town is expected to be residential with limited commercial and industrial facilities to support the growing population. Property use associated with the Waterman Smelter area is not expected to change.

## 6.2 Current and Potential Surface Water Uses

Stockton currently utilizes surface water from Soldier Creek as its primary water source. The town plans on continuing to use this as it water source into the future. The town's water intake is upstream of the Site and any known smelter contamination. The town's water supply is not currently impacted nor is it expected to be impacted by any Site related contamination. Rush Lake is not currently used for domestic water due to its low quality and quantity. It is not anticipated that Rush Lake will be used as a potable water source in the future.

## 6.3 Current and Potential Ground Water Uses

Ground water from one well within the boundaries of the Site is currently being used for domestic purposes. It is possible that domestic wells could be installed at or near the Site. However, due to the overall low quality of water in the shallow aquifer any domestic wells installed would access the deeper aquifer, which is believed to be at a depth greater than 100 feet bgs. Based on the valley geohydrology and results of Site investigation ground water monitoring activities, it is unlikely that ground water will be impacted by Site contamination in the future.

# Section 7: Summary of Site Risks

A Human Health Risk Assessment (HHRA) was prepared for OU2 based on sampling associated with the CSS and RI to characterize potential exposure to smelter related contamination for residential, industrial/commercial, and recreational users. An Ecological Risk Assessment (ERA) was also conducted to characterize potential exposure of sensitive species to smelter contamination in soil, surface water, and sediment. The ERA was based on samples collected specifically for the ERA. These assessments suggested excessive risks to both human and ecological receptors from surface soils contaminated with lead and arsenic.

Remedial action in the residential areas of OU2 will be focused on minimizing risk to human receptors. Remediation in non-residential areas will be focused on minimizing risk to avian and terrestrial wildlife as well as minimizing risk to humans under a recreation exposure scenario. While there are currently no industrial commercial uses associated with contaminated areas within OU2, an industrial/commercial use scenario was evaluated as a possible future use.

## 7.1 Human Health Risks

The HHRA was conducted to evaluate threats to human receptors from exposure to Site contaminants at Jacobs Smelter OU2. Data for samples collected from surface soil during all previous investigations (including investigations for OU1) were used in a three-phased

assessment process. Phase 1 compared measured concentrations for contaminants at the Site with USEPA Region 3 risk-based concentrations to select contaminants of concern (COCs). Phase 2 developed site-specific risk-based screening levels specific to the various media at Jacobs Smelter OU2, and compared these levels with concentrations measured at the Site. Phase 3 of the HHRA defined exposure areas within OU2, statistically determined exposure point concentrations (EPCs) for each COC, and then compared those EPCs to the Site specific screening levels developed in Phase 2.

### 7.1.1 Identification of Chemicals of Concern

The COCs for OU2 were determined by evaluating all metals and other contaminants associated with smelter activity in the affected media. The COCs identified to have the potential for human health risk in soil were antimony, arsenic, lead, manganese and mercury. All five of these contaminants are present in the undeveloped area and exclusively located near the foundation of the Waterman Smelter. While other metals are present at elevated levels near the Waterman Smelter the majority of the contamination is due to lead and arsenic. Remediation of lead and arsenic in soil would address any potential health risks associated with the other metals. Lead and arsenic were identified as the COCs for water.

The COCs identified for ecological risk included aluminum, cadmium, copper, iron. Lead, magnesium, mercury, selenium and zinc. These metals were evaluated for the different types of ecological communities observed at the Site. The COC list for ecological risk was narrowed to lead because the site risk is primarily driven by lead concentrations in the soils and the other metals were co-located with the lead.

## 7.2 Exposure Assessment

## Human Exposures

The first phase of the HHRA for OU2 provided a conceptual Site Model (CSM), identified COCs, and identified remediation goals based on screening levels for industrial/commercial and recreational land uses. While there are currently no industrial/commercial uses within OU2, an industrial/commercial land use scenario was evaluated as a possible future scenario. Due to strong similarities between Jacobs OU1 and the residential areas of OU2 (same COCs, depth of contamination and exposure scenario), remediation goals selected for residential areas in OU2 were based on the Jacobs Smelter OU1 ROD.

The HHRA illustrates the potential residential human receptors at Jacobs Smelter OU2 include current and future children and adults. The inhalation and dermal contact exposure pathways were considered minimal and the ingestion of homegrown vegetables pathway was not evaluated in the HHRA due to limited OU2 specific vegetable gardening. Since soils below 12 inches do not have an exposure point where humans can

easily contact the contaminated soil, exposure pathways associated with soil contamination below a depth of 12 inches are considered incomplete and were not evaluated. Based on the conclusions of the OU1 HHRA, contamination of drinking water is not a concern since residents of Stockton (including the residents of Rawhide Ranchettes and B&B subdivisions) are supplied with drinking water through a municipal water system.

The CSM for the second phase of the HHRA illustrates that potential non-residential human receptors include future industrial/commercial uses and children and adults participating in recreational activities. Risk to human receptors from groundwater is minimal and exposure pathways associated with contaminated groundwater are considered incomplete due to the considerable depth to groundwater.

The final phase of the HHRA evaluated if removal of "hot spots" in surface and subsurface soils would result in an acceptable decrease of risk. This was done by identifying exposure areas and then calculating EPCs for each area. Highly contaminated areas were then removed from the data set and a new EPC was calculated and compared to the Phase 2 screening levels. This approach was used in the original Final Revised FS to determine an action level for the undeveloped areas of OU2. Based on observed increased recreational use patterns, specifically an increase in the frequency of ATV use near the Waterman Smelter, a new risk management approach was adopted. A Risk Management Memo presented by UDEQ June 17, 2010 describes the changes made in the exposure assumptions and presents a more conservative recreation exposure action level.

### Ecological Exposures

The ERA was conducted to evaluate potential threats to ecological receptors in the terrestrial aquatic systems of Rush Lake and the surrounding areas from exposure to Site contaminants. Samples of soil, surface water, sediment, terrestrial plants, aquatic plants, terrestrial invertebrates, aquatic invertebrates, fish tissue and small mammals were studied. The ERA concluded that aquatic and terrestrial biota are at risk from contaminants at OU2 but the primary threat to ecological receptors is from exposure to lead. No clean-up goals were established in the ERA. The complete ecological exposure pathways identified and evaluated in the ERA are listed in Table 7-1.

## 7.3 Toxicity Assessment

While other heavy metals are present at the Site the primary risk drivers to both human and ecological receptors are lead and arsenic.

The toxicity of lead is well documented. Lead is not an essential element for humans. There is currently not an oral reference dose (RFD) or oral slope factor (SF) for human exposure to inorganic lead. Excess exposure to lead can result in a wide variety of

adverse effects in humans. Chronic low-level exposure is usually of greater concern for young children and fetuses than older children and adults. Children are more likely to have hand to mouth activities that result in higher ingestion rates. Children are at risk of several neurological effects when exposed to lead. Elevated lead levels have been linked to reduced neurobehavioral development (decreased IQ and eye hand coordination, and shortened attention span) decreased red blood cell development and reduced body size. Fetuses have similar health effects when the mother has elevated blood lead levels. A blood lead level greater than 10 ug/dl in children is considered a health concern. Adverse health effects of lead exposure in adults include high blood pressure and the inability to absorb vitamin D.

Lead is not an essential element for birds or mammals either. Clinical signs of lead toxicity in domestic animals are manifested for different species, but the overall signs of encephalopathy and gastrointestinal malfunction. Behavioral signs of lead toxicity include anxiety, apprehension and hyper-excitability. Lead toxicity also causes locomotor disturbances that include walking with a stilted gait, swaying, and compulsive circling, pacing and running.

Like in humans, lead can interfere with the development of red blood cells in birds and mammals. Lead toxicity can lead to the accumulation of non-heme iron and protoporphyrin-IX in red blood cells. One of the characteristic cellular metabolic reactions of lead toxicity is the formation of intra-nuclear inclusion bodies in the liver and kidney. Other signs of lead toxicity in domestic animals include rapid, labored breathing, anorexia, weight loss, decreased milk production, dehydration, general weakness, paraplegia, reduced pregnancy rate, fetal death, impaired postnatal growth and resistance to infectious diseases.

Chronic exposure to arsenic can result in carcinogenic and non-carcinogenic health adverse effects in human receptors. Carcinogenic effects associated with exposure to environmental arsenic include skin cancer, bladder cancer, stomach cancer and lung cancer. Non-carcinogenic effects associated with exposure to environmental arsenic include irritation of the mucosal membranes of the mouth, throat and stomach and a thickening of the skin and the formation of corns on the palms of hands and soles of feet. Arsenic exposure can cause death at very high concentrations.

Arsenic toxicity for OU2 was assessed by using the USEPA-verified RFP for non-cancer effects and SF for cancer potency. The chronic oral RFD of 3x10-4 mg/kg-day (based on hyper-pigmentation, keratosis and possible vascular complications in humans exposed to arsenic in drinking water) was used to evaluate non-cancer effects from exposure to arsenic in surface soil.

The USEPA considers arsenic to be a known human carcinogen based on sufficient evidence from human data. The USEPA SF used for estimating cancer risks is the upper bound of the probability of an individual developing cancer as a result of a lifetime exposure to a particular level of a potential carcinogen. The USEPA's oral SF of 1.5 per

(mg/kg-day)-1 is based on sufficient evidence from human data, such as increased mortality from multiple internal organ cancers and an increased incidence of skin cancer in humans exposed to arsenic in drinking water.

## 7.4 Preliminary Remediation Goals and Action Levels.

The USEPA, in consultation with UDEQ, used results of the HHRA, ERA and observed property use patterns to establish PRGs for the Site and to develop preliminary action levels to meet these goals. Final clean-up levels will be established in this ROD.
The USEPA and UDEQ selected soil PRGS for human receptors (as shown on Table 7-2) based on the HHRA and observed recreational use patterns within OU2. Due to the similarities between Jacobs Smelter OU1 and the residential OU2 areas, the residential PRGs are based on the Jacobs Smelter OU1 ROD. The industrial commercial and undeveloped (recreational) use area RPGs of 2,200 and 3,000 mg/kg lead, respectively, represent the approximate arithmetic mean of the low and high risk ranges.

Action levels of 500 mg/kg lead and 100 mg/kg arsenic were selected for surface soils and an action level of 800 mg/kg lead was selected for sub-surface soils over an exposure area within residential areas (Appendix D). An action level of 3,000 mg/kg lead for recreational exposure was selected for surface and sub-surface soil over an exposure area within undeveloped areas of OU2 (Appendix D). While there are currently no commercial uses within OU2 an action level of 2,200 mg/kg lead over an exposure area for commercial/industrial areas for surface and subsurface soil is being established for potential commercial uses as part of this ROD. An exposure area is defined as an area with consistent land use, where receptors are exposed to contamination and across which an exposure point concentration can be calculated and compared to an action level. These action levels are presented in Table 7-3. Action levels for arsenic for commercial/industrial or recreation exposures have not been proposed because the arsenic contamination is co-located with the lead contamination and risk associated with the arsenic contamination will be addressed by the remediation of the lead contaminated soil (Appendix D).

USEPA developed ecological PRGs for OU2 based on the ERA and under the assumption that protection to ecological receptors from deleterious levels of lead will also be protective from other heavy metal contaminants. While the ERA demonstrated potential threats based on pathways from sediments and surface water, clean-up goals for both soil and sediment are based on soil concentrations due to the significant fluctuations in the water level of Rush Lake and the fact that sediment samples taken during the ERA are now well above the water level of Rush Lake and are indistinguishable from surface soils. The lowest protective lead concentration in soils was estimated terrestrial and avian wildlife receptors and lead remediation goals of 574 and 1,148 mg/kg were established based on HQs of one and two for the most sensitive species, the northern flicker, a member of the insectivorous avian community.

In 2012, USEPA used ArcGIS 10.0 software, in conjunction with soil data within OU2 to conduct a moving window analysis to evaluate remediation scenarios and identify potential exposure areas which had an average lead soil concentration above the ecological PRG for lead of 1,148 mg/kg (corresponding with an HQ=2 ). The remediation scenarios were run for three soil horizon depths (0-6, 6-12, and 12-18 inches bgs) and calculated the resultant exposures for remediation of soils with lead concentrations above 3,000, 5,000 and 10,000 mg/kg respectively for each depth horizon. A detailed explanation of the moving window analysis is included in Appendix D of this ROD.

Based on the moving window analysis, it has been determined that remediating OU2 to the recreations exposure action level of 3,000 mg/kg lead in soil over an exposure area will also be protective of ecological receptors.

# Section 8: Remedial Action Objectives

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. The risks discussed above provide the basis for USEPA's determination that the contaminated soils in OU2 present an imminent and substantial endangerment to public health and that the remedial action is warranted. The nature of these risks, coupled with the current and future land use within OU2 lead to the development of Remedial Action Objectives (RAOs). RAOs consist of medium-specific or OU-specific goals for protecting human health and the environment and describe what the response action is expected to accomplish. The RAOs that have been developed for OU2 are:

- Reduce risks from exposure to lead and arsenic-contaminated soil, such that no more than five percent (5%) of children exposed to Site contaminants will have a blood lead concentrations exceeding 10 micrograms per deciliter (ug/dL). Since the lead and arsenic contamination is co-located health risks associated with arsenic exposure will be addressed by the remediation of lead contamination. This objective can be achieved by preventing the ingestion of lead and arsenic contaminated soils above clean-up levels in residential and undeveloped areas.
- Reduce risks from exposure to lead contaminated soil such that no ecological receptor has the potential to exceed two times the toxicity exposure thresholds for non-cancer health effects. This objective can be achieved by preventing the ingestion of lead-contaminated soils by ecological receptors that would result in an average exposure in excess of 1,148 mg/kg lead.

These RAOs address contaminated soil and sediment located within OU2. Surface water and ground water located within OU2 boundaries have been investigated and it has been determined that both of the pathways are incomplete.

Institutional Controls (ICs) are required to meet the RAOs. The objectives of the ICs for OU2 are to:

- Prevent or reduce potential exposure to contaminated soil.
- Limit property use in undeveloped areas to recreational uses.
- Limit or control soil disturbance activities.

## 8.1 Remediation Goals and Clean-up Levels

The RAOs set forth above were developed to be protective of the current and reasonably anticipated future land uses at OU2. As described previously in this ROD, OU2 consists of both residential and undeveloped areas.

The residential area is comprised of two subdivisions: the Rawhide Ranchettes and the B&B subdivisions. The lots in the B&B subdivision range from 5 to 10 acres in size. The majority of these lots include agriculture uses such as livestock grazing. The lots in the Rawhide Ranchettes subdivision range from one to two acres.

The undeveloped area of OU2 is comprised of a sparsely vegetated bluff that contains the Waterman Smelter foundations, associated smelter debris, and slag. The undeveloped area of OU2 is mainly used for recreational purposes with all-terrain vehicle (ATV) use being chief among them. While there are currently no commercial uses within OU2 the clean-up level was developed for potential commercial uses.

It is not anticipated that the current uses of the residential or undeveloped areas will change in the near future. In order to achieve the RAOs that were developed to protect these current and reasonably anticipated land uses at OU2, remediation goals for Site soils were developed for both residential and undeveloped areas.

The USEPA uses a model to predict the risk for lead exposure to humans. Using this model, the USEPA's target for this OU is to limit the risk to a typical child exposed to lead in soil to no more than a 5% chance of exceeded a blood lead concentrations of 10ug/dL. This blood lead target is used to calculate lead clean-up levels.

Remediation Goals or clean-up goals were calculated for lead contamination in Site soils.

- The human health clean-up level for residential areas is 500 mg/kg lead for surface soil and 800 mg/kg lead for sub-surface soil.
- The human health clean-up level for commercial areas is 2,200 mg/kg lead.
- The human health clean-up level for undeveloped areas is 3,000 mg/kg lead.

The human health clean-up level for arsenic in residential areas is 100 mg/kg for surface soils. These residential clean-up levels are consistent with the residential clean-up levels utilized in OU1.

Arsenic contamination throughout the Site, including the undeveloped area, is co-located with lead contamination and unacceptable human and ecological health risks will be addressed by the clean-up of lead contaminated soil to the proposed clean-up goals.

Additionally, the human health clean-up level of 3,000 mg/kg lead for the undeveloped area will also address the risk of exposure to ecological receptors.

# Section 9: Description of Alternatives

This section describes the remedial alternatives developed for residential and undeveloped areas of OU2. These alternatives were arrived at through a systematic screening process applied in the Updated Revised Feasibility Study (URFS). In the URFS a number of remedial alternatives were developed and a screened for effectiveness, implementability and cost. The remedial alternatives with the most favorable composite evaluation were retained and investigated in detail.

The areas and depths within the B&B subdivision that contain contamination above clean-up levels are illustrated in Figure 9-1. The extent of contamination at the B&B subdivision is estimated to be 5.4 acres. Most of the clean-up areas within the residential properties are located in the northern half of the subdivision and are not near buildings or homes.

The areas in the undeveloped area of OU2 that contain contamination above clean-up levels are illustrated in Figure 9-2. The extent of contamination of the undeveloped area is estimated at 26.7 acres. Approximately 14.6 acres contain contaminated soil above clean-up levels to a depth of 6 inches, 3.6 acres contain contaminated soil above clean-up levels to a depth of 12 inches and 8.5 acres contain contaminated soil above clean-up levels to at least a depth of 18 inches.

The Rawhide Ranchettes subdivision was cleaned up as part of a 2010 time-critical removal action and requires no additional remedial activities.

Five remedial alternatives were identified and developed in detail. An additional remedial alternative is the “no action” alternative, which is required by the NCP.

All of the “action” alternatives will address Site contamination by either removing contaminated soil from the Site, providing a physical barrier, or by consolidating contaminated soil within an on-site repository. Additionally, all of the “action” alternatives include institutional controls (ICs) as noted below. The six remedial alternatives for OU2 are:

- Alternative 1 – No action.

- Alternative 2 – Excavate contaminated soil to a depth of 18 inches and place in an off-site landfill.
- Alternative 3 – Cover contaminated soil with clean soil.
- Alternative 4 – Excavate contaminated soil to a depth of 18 inches and place in an on-site repository with a RCRA Subtitle-C cap.
- Alternative 5 – Excavate all contaminated soil in undeveloped areas. Excavate contaminated soil to a depth of 18 inches in residential areas. Place soil in an on-site repository with a RCRA Subtitle-C cap.
- Alternative 6 – Excavate all contaminated soil in undeveloped areas. Excavate contaminated soil to a depth of 18 inches in residential areas. Place soil in an on-site repository with a soil cover.

A summary of the common elements and distinguishing features of the remedial alternatives is shown in Figure 9-3.

These proposed alternatives have been formulated according to NCP Section 300.420 (e) and meet the Remedial Action Objectives. Since concentrations of lead and arsenic greater than those required for unlimited use and unrestricted exposure will remain after clean-up activities for all the action alternatives, ICs will be implemented. ICs address potential future exposure to contaminants and ensure that the remedy remains protective of human health and the environment.

The objectives of the ICs for OU2 are to:

- Prevent or reduce potential exposure to contaminated soil above clean-up levels.
- Limit property use to recreational use only in undeveloped areas remediated to recreational standards.
- Limit or control soil disturbance activities.

Potential ICs include environmental covenants, zoning and land use controls.

With the assistance of UDEQ and USEPA, the Town of Stockton developed and implemented a Hazardous Soils Ordinance (#2000-04) in fall of 2010. Ordinance #2000-4 utilizes post construction information from previous removal and remedial activities to identify properties and areas within the town of Stockton with residual contamination. The Ordinance requires soils excavated within those areas be handled in accordance with a Soils Management Plan that provides instruction for the safe handling and disposal of contaminated soil. In addition the Town of Stockton has built a repository specifically for contaminated soil.

After the implementation of the OU2 selected remedy, USEPA and UDEQ will assist the Town of Stockton to evaluate and update Ordinance #2000-4 to incorporate post OU2 construction information so that residual contamination within OU2 is addressed through

this IC. Environmental covenants with property owners may be used to restrict property use and to limit or control soil disturbance activities.

## 9.1 Alternative 1: No action

No remedial action will be taken to address soil contamination with this alternative. This alternative does not include any remedial action, any engineering controls or any ICs on land-use, or construction activities or any other actions that would incur costs.

Regulations governing the Superfund program require that a “no-action” alternative be evaluated to establish a baseline for comparison. Under this alternative, contaminated soil will remain in place and the threat to human health and the environment will not be addressed.

## 9.2 Alternative 2: Excavate contaminated soil to a maximum depth of 18 inches and place in an off-site landfill

Alternative 2 addresses the clean-up of 5.4 acres of residential land and 26.7 acres of undeveloped land by excavating contaminated soil above clean-up levels, to a maximum depth of 18 inches. The total area to be addressed is approximately 32 acres, with approximately 70,000 tons of contaminated soil to be excavated and disposed.

Alternative 2 includes the removal of vegetation in all areas with soil concentrations exceeding:

- 3,000 mg/kg lead in undeveloped areas,
- 500 mg/kg lead and 100 mg/kg arsenic in residential surface soils, and
- 800 mg/kg lead in residential subsurface soils.

Following vegetation removal, soil with lead concentrations above 3,000 mg/kg will be excavated to a maximum depth of 18 inches and transported for disposal at either a Subtitle D or Subtitle C RCRA permitted facility. The disposal facility will depend on the leachability characteristics of the soil as established by Toxicity Characteristic Leachate Procedure (TCLP) analysis. Contaminated soils failing the TCLP test will be disposed at a RCRA Subtitle C permitted facility. Because the TCLP concentration of all soil to be excavated is unknown, the cost for disposal at a Subtitle C facility was used to prepare the Alternative 2 cost estimate.

Following the excavation work, a geo textile fabric will be placed over areas with remaining contaminated soil above clean-up levels, (i.e. areas with contamination at depths greater than the excavated 18 inches). The geo textile fabric serves as a visible marker. Clean imported backfill and topsoil will be placed in excavated areas and

machine roll compacted to approximate original grade. The covered area will be reseeded with a native grass mix.

Alternative 2 will take 12 months to implement. The present worth cost of Alternative 2 is $9,647,000.

## 9.3 Alternative 3: Cover contaminated soil with clean soil

Alternative 3 addresses contaminated soil above clean-up levels in both residential and undeveloped areas by creating a barrier of clean soil that reduces exposure to contamination. The total area to be addressed is approximately 32 acres.

Alternative 3 includes the removal of vegetation in all areas with soil concentrations exceeding:

- 3,000 mg/kg lead in undeveloped areas,
- 500 mg/kg lead and 100 mg/kg arsenic in residential surface soils, and
- 800 mg/kg lead in residential subsurface soils.

Following vegetation removal, contaminated soil above clean-up levels will be covered with a geo-textile fabric that serves as a visible marker. Clean imported backfill and topsoil will be placed over the top of the geo-textile fabric and machine roll compacted to create a barrier 12-14 inches thick. The covered area will reseeded with a native grass mix.

Alternative 3 will take 9 to 12 months to implement. The present worth cost of Alternative 3 is $5,279,000.

## 9.4 Alternative 4: Excavate contaminated soil to a depth of 18 inches and place in an on-site repository with a RCRA Subtitle C cap

Alternative 4 addresses contaminated soil in residential and undeveloped areas by excavating contaminated soil above clean-up levels to a depth of 18 inches and placing approximately 70,000 tons of excavated contaminated soil in an on-site repository with a RCRA Subtitle C cap that is designed to prevent water infiltration.

Alternative 4 includes the removal of vegetation in all areas with soil concentrations exceeding:

- 3,000 mg/kg lead in undeveloped areas,
- 500 mg/kg lead and 100 mg/kg arsenic in residential surface soils, and
- 800 mg/kg lead in residential subsurface soils.

Following vegetation removal, contaminated soil above clean-up levels will be excavated to a maximum depth of 18 inches and placed in an on-site repository.

The on-site repository will be situated on the slope of the former Waterman Smelter property and will be covered with an engineered cap that meets RCRA Subtitle C requirements. The cap design will consist of the following layers from top to bottom:

- 6 inches of gravel,
- 18 inches of common fill,
- 4-ounce geotextile fabric,
- 12 inches of drainage material,
- second layer of 4-ounce geo-textile fabric, and
- geo-synthetic clay liner.

The repository will also include a drainage ditch and a fence surrounding the repository. Two upgradient and three downgradient monitoring wells will be installed to ensure that contamination from the repository does not adversely impact ground water.

Following the excavation work, a geo textile fabric will be placed over areas with remaining contaminated soil above clean-up levels. The geo textile fabric serves as a visible marker. Clean imported backfill and topsoil will be placed in excavated areas and machine roll compacted to approximate the original grade. The covered areas will be reseeded with a native grass mix.

Alternative 4 will take 24 months to implement. The present worth cost of Alternative 4 is $8,065,000.

## 9.5 Alternative 5: Excavate all contaminated soil in undeveloped areas and to a depth of 18 inches in residential areas. Place soil in an on-site repository with a RCRA Subtitle C cap

Alternative 5 addresses contaminated soil by excavating all the contaminated soil above clean-up levels in undeveloped areas and the contaminated soil above the clean-up levels in residential areas to a depth of 18 inches. Approximately 80,000 tons of excavated contaminated soil will be placed in an on-site repository with a RCRA Subtitle C cap that is designed to prevent water infiltration.

Alternative 5 includes the removal of vegetation in all areas with soil concentrations exceeding:

- 3,000 mg/kg lead in undeveloped areas,
- 500 mg/kg lead and 100 mg/kg arsenic in residential surface soils, and
- 800 mg/kg lead in residential subsurface soils.

Following vegetation removal, all soil with lead concentrations exceeding clean-up levels will be excavated from undeveloped areas and to a maximum depth of 18 inches in residential areas. The excavated soil will be placed in an on-site repository.

The on-site repository will be placed in the same location and be designed to the same requirements as the repository described in Alternative 4.

Following the excavation work, the undeveloped areas will be regraded and contoured to retain original drainage patterns and covered with clean top-soil. Following the excavation work in residential areas, a geo textile fabric will be placed over areas with remaining contaminated soil above clean-up levels. The geo textile fabric serves as a visible marker. Clean imported backfill and topsoil will be placed in excavated areas, and machine roll compacted to the original grade. All excavated areas will be reseeded with a native grass mix.

Alternative 5 will take 24 months to implement. The present worth cost is $8,326,000.

## 9.6 Alternative 6: Excavate all contaminated soil in undeveloped areas. Excavate contaminated soil to a maximum depth of 18 inches in residential areas. Place soil in an on-site repository with a soil cover

Alternative 6 addresses contaminated soil by excavating all the contaminated soil above clean-up levels in undeveloped areas and the contaminated soil above clean-up levels in residential areas to a depth of 18 inches. The approximately 80,000 tons of excavated contaminated soil will be placed in an on-site repository with a soil cover cap.

Alternative 6 includes the removal of vegetation in all areas with soil concentrations exceeding:

- 3,000 mg/kg lead in undeveloped areas,
- 500 mg/kg lead and 100 mg/kg arsenic in residential surface soils, and
- 800 mg/kg lead in residential subsurface soils.

Following vegetation removal all soil with lead concentrations exceeding clean up levels will be excavated from undeveloped areas and to a maximum depth of 18 inches in residential areas. All excavated soil will be placed in an on-site repository.
The on-site repository will be placed in the same location as the repository described in Alternative 4. The repository will be covered with a soil cover cap that provides a physical barrier to the contaminated soil.

Following the excavation work, the undeveloped areas will be regraded and contoured to retain original drainage patterns and covered with clean top-soil. Following the excavation work in residential areas, a geo textile fabric will be placed over areas with remaining contaminated soil above clean-up levels. The geo textile fabric serves as a visible marker. Clean imported backfill and topsoil will be placed in the excavated areas and machine roll compacted to the original grade. All excavated areas will be reseeded with a native grass mix.

Alternative 6 will take 24 months to implement. The present worth cost is $7,664,000.

## Section 10: Summary of Comparative Analysis of Alternatives

To facilitate a complete and systematic comparison, each of the alternatives discussed in this ROD are evaluated against the nine criteria as set forth in the NCP. The nine criteria are:

- Overall protectiveness of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The first two criteria are considered “threshold factors” which must be met in order for the remedy to be considered. The next five criteria are considered “primary balancing

factors" and are the criteria upon which the analysis is based. Finally the last two criteria are considered modifying factors.

## 10.1 Overall Protection of Human Health and the Environment

Overall protection of human health addresses whether each alternative provides adequate protection of human health and the environment. It also describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or ICs.

All the alternatives except for Alternative 1 provide adequate protection of human health and the environment.

Alternative 1 does not remediate any areas and the risk to human health and ecological receptors will remain unchanged. Human health and ecological hazards for the areas containing soil contamination greater than the clean-up levels will not be mitigated or eliminated. Alternative 1 does not meet the threshold criterion for protection of human health and the environment.

Alternative 2 involves the excavation and off-site disposal of up to 18 inches of contaminated soil in affected areas. Removal of contaminated soil to a depth of 18 inches removes the risk of direct contact, inhalation or ingestion of contamination and eliminates human health and ecological risk for the soil removed from the Site. Off-site landfill disposal reduces the migration potential for future direct contact, ingestion or inhalation by permanently removing the majority of the contaminated soil from the Site. Contaminated soil remains on-site underneath a barrier of 18 inches of clean soil that reduces the risk of direct contact, inhalation or ingestion to residual contamination. With ICs to limit property use in undeveloped areas, prevent soil disturbances, and prevent or reduce exposure in areas where contamination remains. Alternative 2 meets the threshold criterion for protection of human health and the environment.

Alternative 3 involves placing a 12 to 14 inch soil cover over contaminated soil as a barrier to prevent exposure. All contamination remains in place and is not removed from the Site. Soil cover reduces direct contact, inhalation or ingestion of contaminated soil as long as the soil cover remains intact. Engineering controls to protect the soil cover barrier from burrowing animals and ATV use are required to prevent exposure to Site contamination. Annual monitoring and repairs to the soil cover are also required to ensure that soil cover remains intact and the remedy remains protective. With engineering controls and ICs to limit property use in undeveloped areas, prevent soil disturbances, and prevent or reduce exposure in areas where contamination remains, Alternative 3 meets the threshold criterion for protection of human health and the environment.

Alternative 4 involves the excavation of up to 18 inches of contaminated soil in affected areas and disposal of the excavated soil in an on-site repository with a RCRA Subtitle-C

cap. Removal of contaminated soil to a depth of 18 inches reduces the risk of direct contact, inhalation or ingestion of contamination by consolidating contaminated soil and placing it in an engineered repository with a cover designed to prevent water infiltration. Contaminated soil remains on-site within a repository located near residential and recreational areas, as well as underneath 18 inches of clean soil elsewhere at the Site. Engineering controls are required to protect the repository cap from burrowing animals. Annual monitoring and O&M are also required to evaluate the integrity of the repository to ensure that remedy remains protective. With engineering controls and ICs to limit property use in undeveloped areas, prevent soil disturbances, and prevent or reduce exposure in areas where contamination remains, Alternative 4 meets the threshold criterion for protection of human health and the environment.

Alternative 5 involves the excavation of all contaminated soil in undeveloped areas and contaminated soil to a depth of 18 inches in residential areas and disposal of the excavated soil at an on-site repository with a RCRA Subtitle-C cap. Removal of all contaminated soil in the undeveloped area eliminates the risk of direct contact, inhalation or ingestion of contamination. Removal of contaminated soil to a depth of 18 inches in residential areas reduces the risk of direct contact, inhalation or ingestion of contamination. Disposal of contaminated soil in an on-site repository with an impermeable cap reduces the risk of direct contact, inhalation or ingestion of contamination by consolidating contaminated soil and placing it in an engineered repository with a cover designed to prevent water infiltration. Contamination remains on-site within a repository located near residential and recreational areas and underneath 18 inches of clean fill and topsoil in some residential areas. Engineering controls are required to protect the repository cap from burrowing animals. Annual monitoring and O&M are also required to evaluate the integrity of the repository to ensure that remedy remains protective. With engineering controls and ICs to limit property use in undeveloped areas, prevent soil disturbances, and prevent or reduce exposure in areas where contamination remains, Alternative 5 meets the threshold criterion for protection of human health and the environment.

Alternative 6 involves the excavation of all contaminated soil from undeveloped areas and to a depth of 18 inches in residential areas and disposal of the excavated soil at an on-site repository with a soil cover cap. Removal of all contaminated soil in the undeveloped area eliminates the risk of direct contact, inhalation or ingestion. Removal of contaminated soil to a depth of 18 inches in residential areas reduces the risk of direct contact, inhalation or ingestion of contamination. Disposal of contaminated soil in an on-site repository with a soil cover cap reduces the risk of direct contact, inhalation or ingestion of contamination by consolidating contaminated soil and placing it in an engineered repository with a cover designed to provide a barrier to contaminated soil. Contamination remains on-site within a repository located near residential and recreational areas and underneath 18 inches of clean fill and topsoil in some residential areas. Engineering controls are required to protect the repository cap from burrowing animals. Annual monitoring and O&M are also required to evaluate the integrity of the repository to ensure that remedy remains protective With engineering controls and ICs to

limit property use in undeveloped areas, prevent soil disturbances, and prevent or reduce exposure in areas where contamination remains, Alternative 6 meets the threshold criterion for protection of human health and the environment.

## 10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Both CERCLA and the NCP require that remedial actions at CERCLA sites attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria and limitations which are collectively referred to as "ARARs." CERCLA Section 121 (d)(4) provides the conditions for which ARARs can be waived.

Applicable requirements 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. Relevant and appropriate requirements 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, while not applicable to a hazardous substance, pollutant, contaminant, remedial action or other circumstance at a CERCLA site, addresses problems or situations sufficiently similar to those encountered at the CERCLA site that there use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be applicable or relevant and appropriate

The Site's soils was contaminated with lead and arsenic during beneficiation and smelting of metal ores in and around the Site. "Primary lead processing" wastes appear on the Bevill exempt list. Thus, the lead and arsenic contaminated soil is considered to be Bevill exempt. Since these wastes are Bevill exempt, they are by definition not hazardous wastes. However, some of the Site soils may not pass the Toxic Characteristic Leachate Procedure (TCLP) parameter of less than 5 ug/l lead. For these contaminated soils many of the RCRA Subtitle C requirements are relevant and appropriate standards and may require more stringent controls during remedy implementation.

Appendix A presents a detailed analysis of ARARs and an evaluation of how ARARs will be met. This section provides a summary of how each alternative meets ARARs.

Alternative 1 involves no action to remediate contaminated soil or reduce the risk of exposure and does not comply with the risk based standards established for the Site. Under this alternative, contaminated soil remains in place and there is no reduction to exposure or to contaminant transport. Alternative 1 does not meet ARARs because no remedial action is involved. Since Alternative 1 does not meet the threshold criterion of

protectiveness of human health and the environment and compliance with ARARs, it is not evaluated further.

All of the action alternatives have common ARARS associated with construction (e.g. fugitive dust and storm water runoff controls), excavation, transport and disposal of contaminated soil.

All of the action alternatives meet the threshold criteria of compliance with ARARs.

## 10.3 Long Term Effectiveness and Permanence

Long term effectiveness and permanence refers to the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once the clean-up levels have been met. This criterion includes consideration of residual risk that remains following remediation and the adequacy and reliability of both engineering controls and ICs.

All of the action alternatives provide some degree of long-term effectiveness since contaminated soil is either removed from the Site, placed under a barrier or encapsulated in a repository. For Alternative 2, the majority of the contaminated soil is removed from the Site, and therefore the majority of the threat posed to human and ecological receptors is permanently removed from OU2.

Alternative 2 provides greater long-term effectiveness than Alternative 3 which relies on soil cover to provide a barrier between lead and arsenic contaminated soils and potential human and ecological receptors including burrowing animals and avian insectivores.

Alternative 2 also provides greater long-term effectiveness than Alternatives 4-6 which rely on a repository to prevent exposure to contaminated soils and potential human by ecological receptors including burrowing animals and avian insectivores.

Because contaminants above health based levels remain with all the alternatives and prevent unlimited use across the Site, a CERCLA five-year review is required to evaluate long-term effectiveness of these remedies.

## 10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility or volume through treatment refers to the anticipated performance of treatment technologies that may be included as part of the remedy. The Superfund law places a preference on alternatives that include physical or chemical treatment processes that reduce or eliminate the hazardous nature of material or its ability to move in the environment and/or the quantity left after treatment.

None of the alternatives evaluated meet the statutory preference for reduction of toxicity, mobility or volume through treatment.

## 10.5 Short Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until the clean-up levels are achieved.

There is no closure or relocation of any businesses anticipated during the implementation of any of the alternatives. Personal protective equipment is required for construction workers for all of the alternatives and dust suppression will be implemented during construction to prevent any environmental or human health impact.

During the remedial design, the extent of the contaminated areas will be more accurately delineated in order to determine the minimum excavation needed to meet the clean-up goals. This minimizes the number of landfill disposal truck trips, reduces fuel consumption and the impact of transporting materials off-site. The agencies will also prepare a storm water pollution prevention plan to address controlling surface water run off during construction activities.

Alternatives 2 and 3 will take approximately 12 months and Alternatives 4-6 will take approximately 24 months.

The increased soil handling involved in the construction of a soil cover as described in Alternative 3 and in the construction of an on-site repository as described in Alternatives 4-6 would result in increased noise, and dust during construction and would increase local traffic and potential damage to local roads.

Alternative 2 provides more short term effectiveness than the other action alternatives.

## 10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and material, administrative feasibility, and coordination with other governmental agencies are considered.

The excavation and disposal associated with Alternative 2 is a relatively simple process with proven procedures. It is a labor intensive process with little potential for automation. Standard clearing and grubbing as well as soil excavating, hauling, backfilling and grading techniques are used. The equipment and other services associated with

excavation and disposal are easily available. Coordination with state and local officials for disposal of contaminated soil is required. Excavation and off-site disposal has been used effectively to address similar smelter sites within Utah and throughout Region 8.

The placement of soil cover described in Alternative 3 can be easily performed. The construction equipment is available from several vendors. Grading so that drainage patterns on unaffected property are not altered may be difficult. Also, if additional earthmoving activities are required after the soil cover is complete; these activities would destroy the original soil cover remedy and require additional work. Annual monitoring of the soil cover for a potential failure is required. Soil excavated for the planting of trees and/or other landscaping activities may require testing to determine disposal requirements. These factors make Alternative 3 more difficult to implement than Alternative 2.

The design and construction of the on-site repository increases the complexity of implementing Alternatives 4, 5, and 6. Design and installation of the Subtitle-C cap in Alternatives 4 and 5 is more complicated than the soil cover cap described in Alternative 6. The re-grading and re-contouring described in Alternatives 5 and 6 may be difficult to achieve so it does not permanently alter drainage patterns. The O&M requirements for a repository as well as the challenges obtaining access to construct a repository increase the difficulty of implementing Alternatives 4, 5 and 6. These factors make Alternatives 4, 5, and 6 more difficult to implement than Alternative 2.

All of the proposed action alternatives will require the cooperation of land owners as well as Town and County officials. Town officials have expressed concern about the placement of a repository and the long term effectiveness of Alternatives 4, 5 and 6.

## 10.7 Cost

Before selecting a clean-up plan, the agencies must consider the construction and long-term operations and maintenance costs associated with each alternative:

- The present worth cost for Alternative 2 is $9,443,000.
- The present worth cost for Alternative 3 is $5,278,000.
- The present worth cost for Alternative 4 is $8,065,000.
- The present worth cost for Alternative 5 is $8,326,000.
- The present worth cost for Alternative 6 is $7,664,000.

Appendix B contains detailed cost estimates of the alternatives.

## 10.8 State Acceptance

The State of Utah through the Utah Department of Environmental Quality was actively involved in the development of the OU2 RI and URFS and concurs with Alternative 2 as the selected remedy. The State believes that Alternative 2 provides greater long term

protectiveness to both human and ecological receptors, will require significantly less O&M, and will be easier to implement than the other alternatives. The State does not believe that Alternative 1 provides adequate protection of human health and the environment.

### 10.9 Community Acceptance

During the public comment period, the community expressed concerns regarding the clean-up levels, how the remediation will be performed and whether specific properties had been impacted by smelter releases. In addition, concerns were raised about the quality of the topsoil used in the clean-up and the re-vegetation plans. Concerns were raised about exposure to contaminated dust during construction activities and whether exposure to dust from the undeveloped area would pose a threat to residences after construction. A preference for removing contamination from OU2 rather than covering in place or constructing a repository has been expressed by members of the community as well as Town and County officials. The responsiveness summary contains all of the comments received during the comment period along with the agencies responses.

## Section 11: Principal Threat Wastes

Based on determinations made in the HHRA and the URFS smelter contaminated soils at the Site with lead concentrations greater than 30,000 mg/kg-are classified as principal threat waste.

The NCP establishes an expectation that USEPA will use treatment to address the principal threats posed by a site wherever practicable (NCP 300.40. (a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile, which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threat wastes are addressed generally will determine whether the statutory preference for treatment as a principal remedy element is satisfied.

A range of treatment technologies for contaminated soils was evaluated and screened as part of the URFS as described in Section 9 of this ROD. Contaminated soil at the Site exists in large volumes and due to the soil matrix and the ability of the soil to be isolated from inhalation and ingestion exposures it is amenable to containment. Treatment technologies where evaluated within the URFS and were eliminated from further consideration in screening due to low implementability and high costs. Furthermore, treatment was determined not to be practical or viable because it added little additional benefit to the long-term effectiveness at the Site.

# Section 12: Selected Remedy

## 12.1 Summary of the Rationale for Selected Remedy

The selected remedy must provide for the overall protection of human health and the environment, be cost effective and use, to the maximum extent possible, permanent solutions employing treatment and/or resource recovery technologies. These requirements are fulfilled by selecting a remedy that:

- Satisfies the threshold criteria (overall protection of human health and the environment and compliance with ARARs),
- Provides the best balance of the five balancing criteria (long-term effectiveness, short-term effectiveness, implementability, reduction in toxicity, mobility or volume and cost), and
- Considers the preference for treatment as a principal element of the remediation with a bias against off-site land disposal of untreated waste.

The UDEQ and the USEPA have chosen Alternative 2 as the OU2 Selected Remedy at the Jacobs Smelter Superfund Site based on the above requirements and the following reasons:

- Excavation and disposal meets all ARARs and provides a high level of protectiveness for human health and the environment.
- Excavation and disposal is a well-proven technology and has been effectively utilized at other smelter sites in Utah and throughout Region 8.
- Excavation and disposal is a relatively simple process with proven procedures.
- The construction equipment, specialists, materials, technologies, services and capacities needed are available from several local vendors.
- Since the majority of the contamination is removed from the Site, Alternative 2 provides greater long term protectiveness to both human and ecological receptors.
- Alternative 2 does not require the design and construction of a repository and will be easier to implement than the other alternatives.
- Alternative 2 requires less O&M and reporting than other alternatives.
- The area requiring ICs is less than that associated with the other alternatives.
- Alternative 2 enjoys greater support from the community, local officials and from the State than the other alternatives.

### 12.1.1 Detailed Description of the Selected Remedy

Based upon the results of the systematic screening process previously described and input from the impacted community, UDEQ and the USEPA agree that Alternative 2- "Excavate contaminated soil to a maximum depth of 18 inches and place in an off-site

landfill", most completely satisfies the nine analyses criteria and is designated as the Selected Remedy for OU2. The Selected Remedy will be considered complete when the following key components, are accomplished.

- Removal of existing vegetation from the contaminated areas.
- Excavation of surface soil with lead concentrations exceeding 500 mg/kg and subsurface soil with lead concentrations exceeding 800 mg/kg to a depth of 18 inches on residential properties.
- Excavation of surface and subsurface soil with lead concentrations exceeding 3,000 mg/kg lead to a depth of 18 inches on undeveloped properties.
- Transportation and disposal of all excavated soils to an appropriate landfill.
- Placement of clean backfill and topsoil and re-vegetation of excavated areas.
- Implementation of ICs to ensure the remedy remains protective.

The RAOs are met by reducing the risk of direct contact, inhalation or ingestion of contaminated soil by: (1) excavating and disposing of contaminated soil above clean-up levels in an off-site landfill, and (2) implementing ICs to prevent potential future exposure to contaminants and ensure that the remedy remains protective of human health and the environment.

Since concentrations of lead and arsenic greater than those required for unlimited use and unrestricted exposure will remain after clean-up activities ICs are part of the Selected Remedy. ICs address potential future exposure to contaminants and ensure that the remedy remains protective of human health and the environment.

The objectives of the ICs for OU2 are to:

- Prevent or reduce potential exposure to contaminated soil above clean-up levels.
- Limit property use in undeveloped areas remediated to recreational standards.
- Limit or control soil disturbance activities.

Potential ICs include environmental covenants and land use controls.

## 12.2 Implementation of the Selected Remedy

The Selected Remedy will be implemented following remedial design (RD) activities. During the RD affected property owners will be consulted regarding the current and post-remedial property conditions. Properties will be returned to as close to original condition as possible. Physical construction will be considered complete when all the clean-up areas have been addressed and returned to satisfactory condition. The physical construction involved in the selected remedy area is expected to take approximately 12 months.

## 12.3 Summary of Estimated Remedy Costs

The selected remedy calls for the excavation and disposal of close to 70,000 tons of contaminated soil and transporting and disposing of all excavated soils at an off-site facility. Site preparation to clear and grub the area prior to excavation is $550 per acre. Commercial remediation cost estimates for excavation is $10 per ton. Transportation of excavated soil is expected to cost $12.50 per ton and disposal at a Subtitle C Facility is expected to cost $35 per ton. The cost for backfilling is $23 per ton. This price includes the purchase, transportation and placement of the imported backfill. Similarly, the cost for procuring and placing top-soil is $32 per ton. Re-vegetation with a native grass seed mixture via a broadcast and harrow method is approximately $300 per acre.

As indicated in Table 12-1, capital costs are $9,442,938 for Alternative 2. The annual O&M cost for Alternative 2 is estimated at $16,622 (Table 12-2). O&M cost includes annual inspection of the remediated areas and the generation of an annual report by the O&M contractor. The annual report documents the annual inspection and maintenance activities, as well as the effectiveness of ICs for the site. The capital and O&M costs combine for a net present worth for the selected remedy of $9,647,000.

The information in the cost estimate and in the summary tables is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost estimate are likely to occur as a result of new information and data collected during the design of the remedial alternative. Changes may be documented in the form of a memorandum in the Administrative Record file, Explanation of Significant Difference (ESD), or a ROD amendment. This is an order of magnitude engineering cost estimate that is expected to be within +50 to - 30 percent of the actual project cost. More detailed cost estimate summaries for the selected remedy can be found in Tables 12-1 through 12-3.

## 12.4 Expected Outcome of the Remedy

Implementation of the Selected Remedy for OU2 will achieve the stated RAOs and allow continued residential use in the residential areas. The Selected Remedy will achieve substantial risk reduction by removing contaminated surface and subsurface soils from the Site. The Selected Remedy will reduce the risk associated with the Site contaminants in a reasonable time frame (12 months) and will provide long-term protectiveness by permanently removing contaminated soil from the Site.

# Section 13: Statutory Determinations

Under CERCLA 121 and the NCP, the USEPA must select remedies that are protective of human health and the environment, comply with ARARs (unless statutory waivers are justified), are cost effective, and utilize permanent solutions and alternative treatment

technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment which permanently and significantly reduces the volume, toxicity, and mobility of hazardous waste. The following sections discuss how the Selected Remedy meets these statutory requirements.

## 13.1 Protection of Human Health and the Environment

The need for action at OU2 is driven by risks to human health and the environment which will be significantly reduced by the performance of the Selected Remedy.

Excavation and off-site disposal of contaminated soil is a well proven technology and decreases human health and ecological risks at OU2. Off-site disposal reduces human health and ecological risks by removing the majority of contaminated soil from OU2. While residual contamination will remain after the implementation of the selected remedy there will be considerably less than with the other alternatives. A barrier of clean soil will reduce exposure to the residual contamination beneath the excavation depth of 18 inches.

The implementation of ICs will ensure that the Selected Remedy will remain protective after construction has been completed. The implementation of the Selected Remedy will not pose any unacceptable short-term risks. The time required to complete the remedial action is 12 months. The Selected Remedy will be more protective and require less O&M than the other alternatives. The area covered by ICs will be less than the other alternatives evaluated.

## 13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy will comply with Federal and State ARARS that have been identified. No waiver of any ARAR is being sought for the selected remedy. Only the State ARAR is identified when a situation occurs in which the State ARAR is more stringent than the corresponding Federal ARAR, or where requirements from the State program have been federally authorized. The ARARs for the Selected Remedy are identified in Tables 13-1 through 13-3.

## 13.3 Cost Effectiveness

In the USEPA's and UDEQ's judgement the Selected Remedy is cost effective and represents a reasonable value for the money to be spent. In making this determination the following definition was used: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied

the threshold criterion (were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing criterion in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the Selected Remedy was determined to be proportional to the cost and hence, the Selected Remedy represents a reasonable value for the money to be spent.

Table 13-5 shows the present worth costs of the alternatives, including the Selected Remedy. The estimated present worth cost of the Selected Remedy is $9,647,000. Although other alternatives are less expensive, more contaminated soil will remain at the Site and will be subject to ICs and therefore, the Selected Remedy is more cost effective. The agencies believe that the Selected Remedy's additional cost for off-site disposal of lead contaminated soil provides a significant increase in protection of human health and the environment and is cost effective.

## 13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

Alternative treatment technologies was evaluated and screened as part of the URFS and were eliminated from further consideration due to low implementability and high costs. None of the alternatives evaluated utilized alternative treatment technologies. The UDEQ and USEPA determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Site.

Of those alternatives that are protective of human health and the environment and comply with ARARS, the UDEQ and USEPA determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria and considering State and community acceptance.

The Selected Remedy satisfies the criteria for long-term effectiveness by permanently removing the threat posed by the excavated soil from the Site. The Selected Remedy takes less time and involves less soil handling and construction traffic than the other alternatives and presents fewer long term and short term risks than the other alternatives. The Selected Remedy calls for less O&M, ICs over less area, enjoys greater community support and is easier implemented than the other alternatives.

## 13.5 Preference for Treatment as a Principal Element

None of the alternatives evaluated meet the statutory preference for reduction of toxicity, mobility or volume through treatment. Contaminated soil at the Site exists in large volumes and due to the soil matrix and the ability of the soil to be isolated from inhalation and ingestion exposures it is amenable to containment. Treatment technologies where evaluated within the URFS and were eliminated from further consideration in screening due to low implementability and high cost. Furthermore, treatment was determined not to be practical or viable because it added little additional benefit to the long-term effectiveness at the Site.

## 13.6 Five-Year Review Requirements

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after the initiation of remedial action. The five-year review ensures that the remedy remains protective of human health and the environment.

# Section 14: Documentation of Significant Changes

A Proposed Plan was initially release for public comment in July 2004. It identified a mixture of excavation and off-site disposal and soil cover as the Preferred Remedy. During the public comment period the community expressed concerns regarding the Preferred Remedy and as a result a ROD was not pursued. Since then, the USEPA and the UDEQ have been addressing comments on certain aspects of the original Proposed Plan, conducting additional investigations, and working to resolve technical and legal issues to allow clean-up to proceed.

An updated Proposed Plan was released for public comment in September of 2015. It identified Alternative 2 as the Preferred Remedy for OU2. During the public comment period the community expressed concerns regarding the effectiveness of Alternative 2, how the clean-up will be performed, dust control during construction, and the quality of topsoil to be used during construction. The agencies reviewed all written and verbal comments submitted in the public comment period. It was determined that no significant changes to the remedy, were necessary or appropriate.

# List of Acronyms

| | |
|---|---|
| AOC: | Administrative Order on Consent |
| AR: | Administrative Record |
| ATV: | All-Terrain Vehicle |
| ARARS: | Applicable or Relevant and Appropriate Regulations |
| bgs: | Below Ground Surface |
| BLM: | Bureau of Land Management |
| CERCLA: | Comprehensive Environmental Response Compensation and Liability Act |
| CERCLIS: | Comprehensive Environmental Response Compensation and Liability Information System |
| CSM: | Conceptual Site Model |
| CSS: | Contaminant Screening Study |
| COCs: | Contaminants of Concern |
| CLP: | Contract Lab Program |
| ERA: | Ecological Risk Assessment |
| ESD: | Explanation of Significant Difference |
| HHRA: | Human Health Risk Assessment |
| ICs: | Institutional Controls |
| KUCC: | Riot Tinto Kennecott Copper (formerly Kennecott Utah Copper LLC) |
| mg/kg: | Milligrams per Kilogram |
| NCP: | National Oil and Hazardous Substance Pollution Contingency Plan |
| OU1: | Operable Unit One |
| OU2: | Operable Unit Two |
| OU3: | Operable Unit Three |
| OU4: | Operable Unit Four |
| OU5: | Operable Unit Five |
| OU6: | Operable Unit Six |
| PA/SI: | Preliminary Assessment and Site Investigation |
| PRGs: | Preliminary Remediation Goals |
| PRP: | Potentially Responsible Party |
| RAOs: | Remedial Action Objectives |
| RCRA: | Resource Conservation and Recovery Act |
| RD: | Remedial Design |
| RfD: | Reference Dose |
| RFS: | Revised Feasibility Study |
| RI: | Remedial Investigation |
| ROD: | Record of Decision |
| SF: | Slope Factor |
| Site: | Jacobs Smelter Superfund Site |
| TCLP: | Toxicity Characteristic Leachate Procedure |
| UDEQ: | Utah Department of Environmental Quality |
| USEPA: | U.S. Environmental Protection Agency |
| ug/dL: | Micrograms per Deciliter |

| | |
|---|---|
| URFS: | Update Revised Feasibility Study |
| UPRR: | Union Pacific Railroad |
| U.S.C | United States Code |
| XRF: | X-ray Fluorescence |

# FIGURES

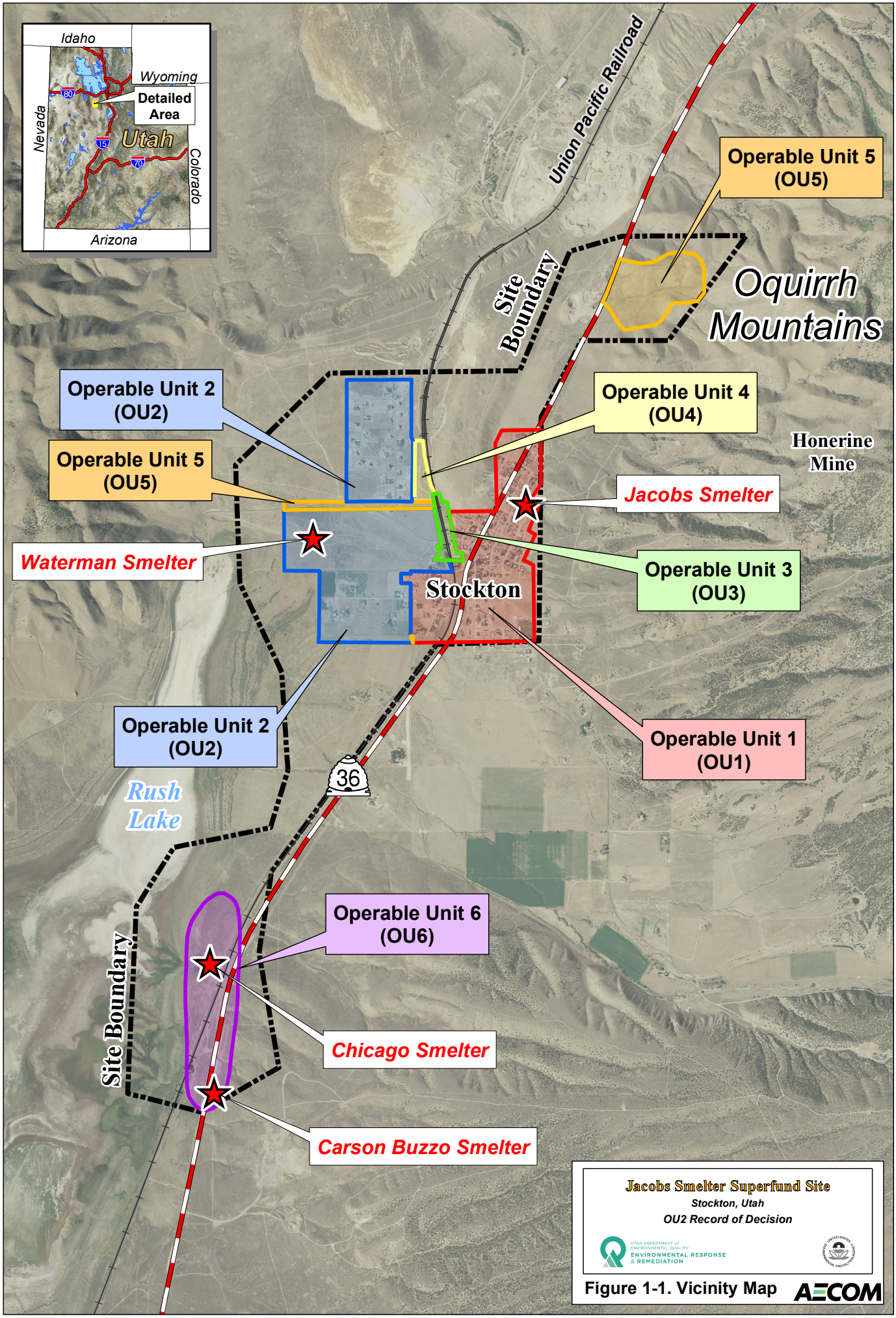



Figure 1-1. Vicinity Map

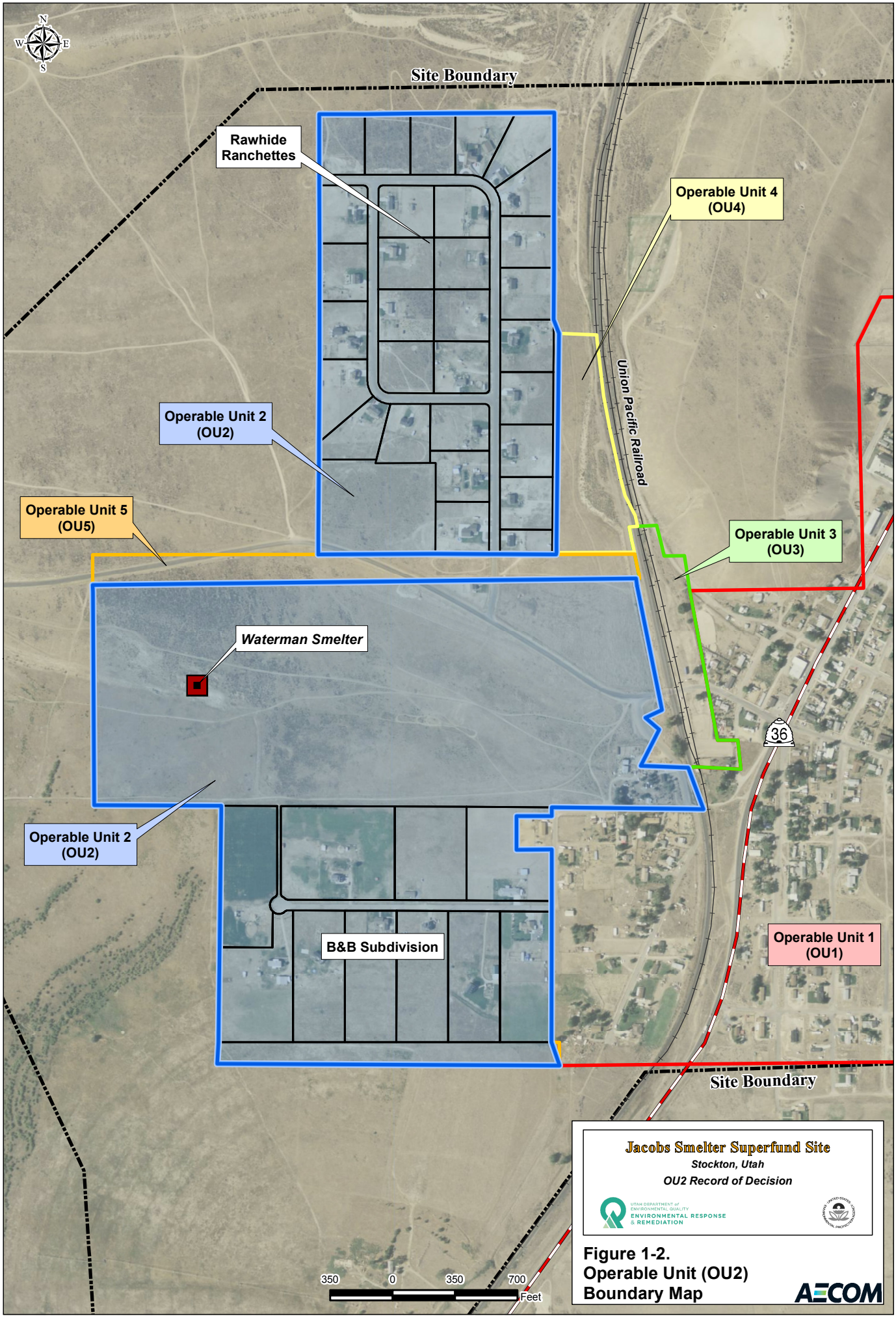



Figure 1-2.
Operable Unit (OU2)
Boundary Map

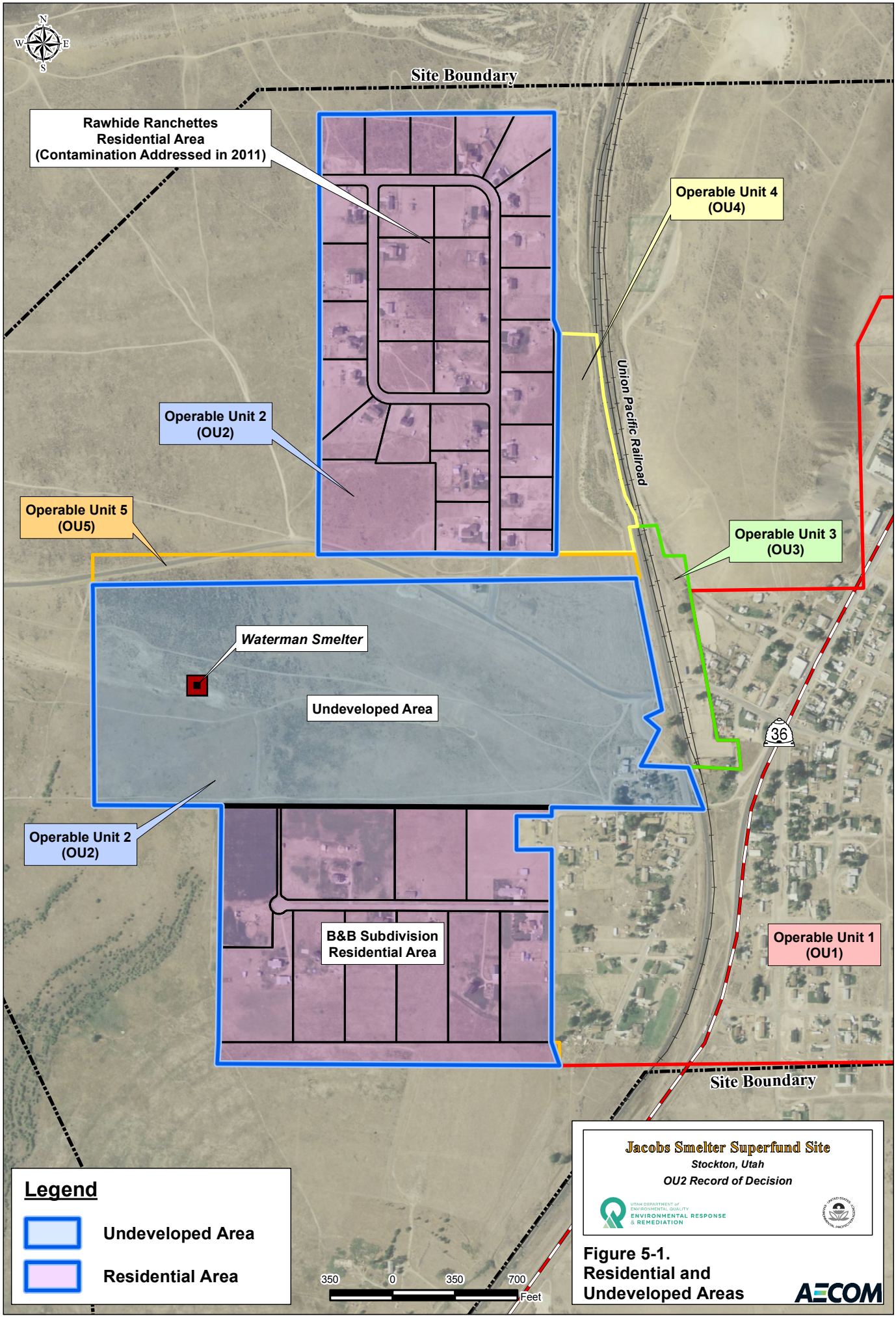
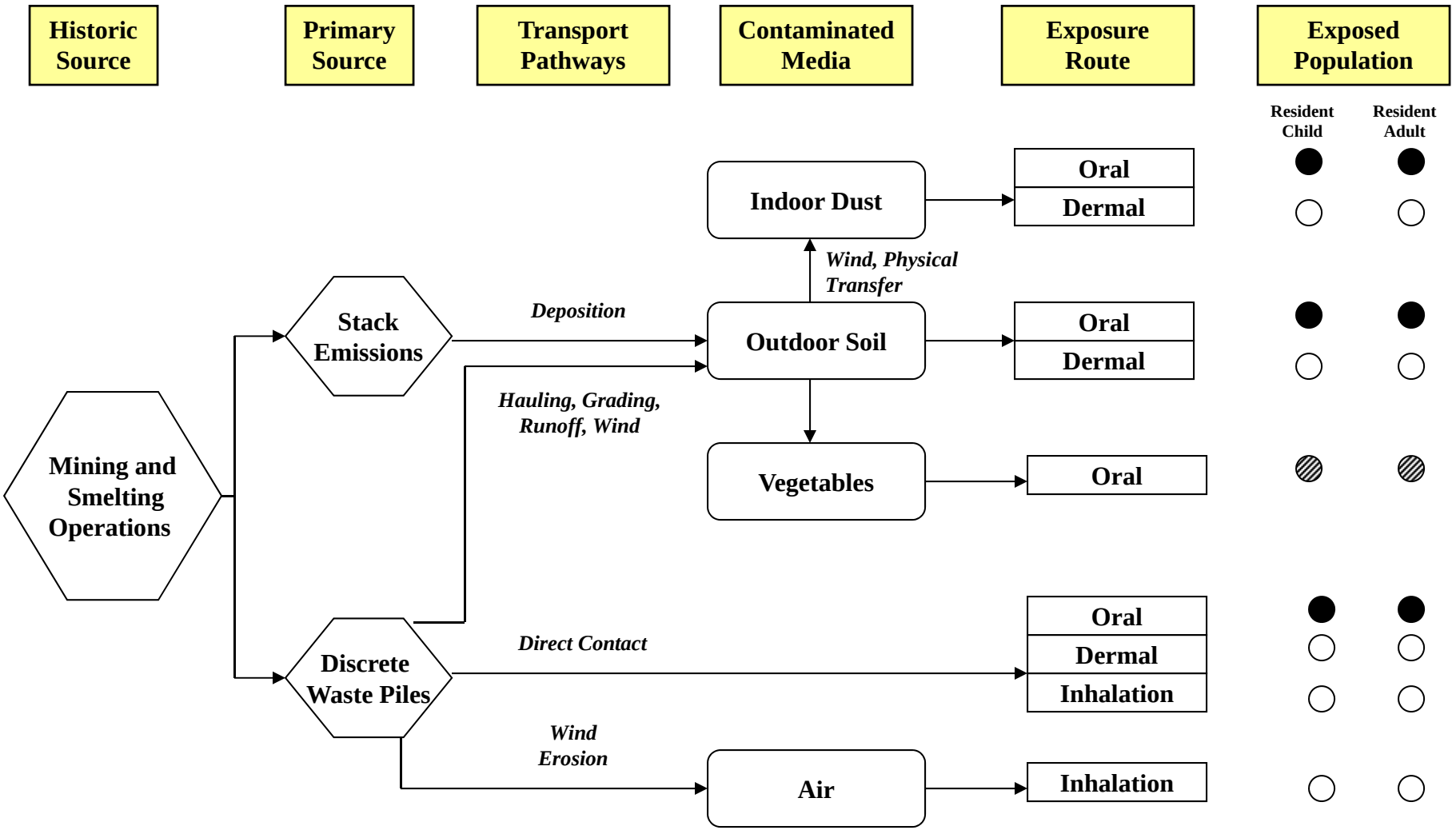



Figure 5-1.
Residential and
Undeveloped Areas




○ Pathway is not complete; No evaluation necessary.

◍ Pathway is or may be complete; however, risk is low or data are lacking; qualitative evaluation only.

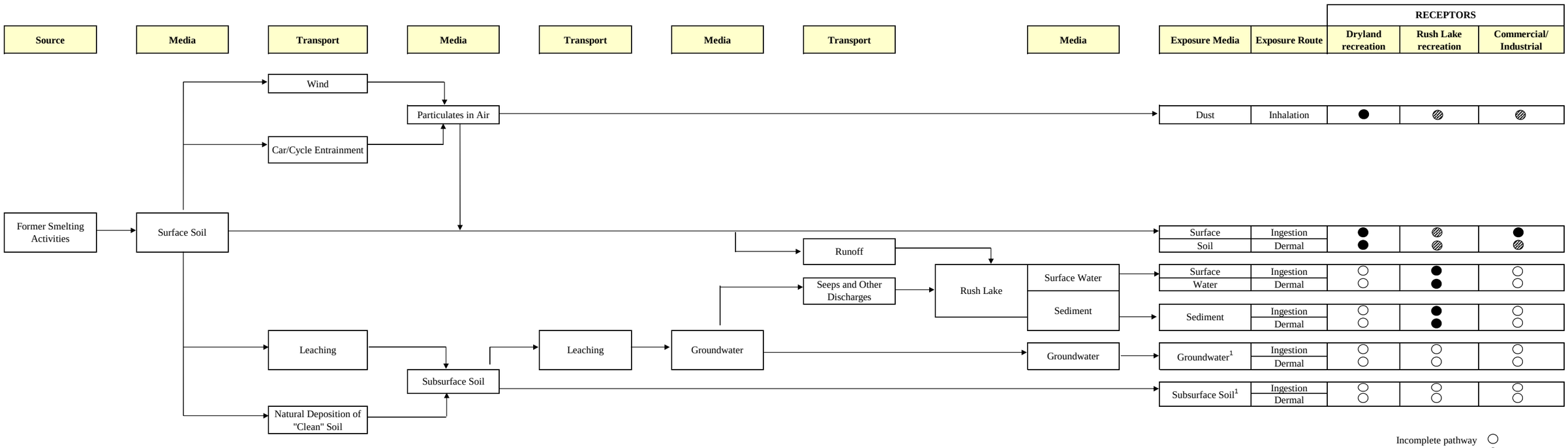
● Pathway is or may be complete and may be significant; quantitative evaluation.

**Jacobs Smelter Superfund Site**
*Stockton, Utah*
*OU2 Record of Decision*

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL RESPONSE & REMEDIATION

**Figure 5-2.**
**Conceptual Site Model for Residential Exposure**

AECOM




Note 1: This CSM is based on current conditions. There may be potential for future exposure to these media that could require updating of this CSM.

**Jacobs Smelter Superfund Site**

*Stockton, Utah*

***OU 2 Record of Decision***

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL RESPONSE & REMEDIATION

**Figure 5-3.**
**Conceptual Site Model for Undeveloped Exposure**

AECOM

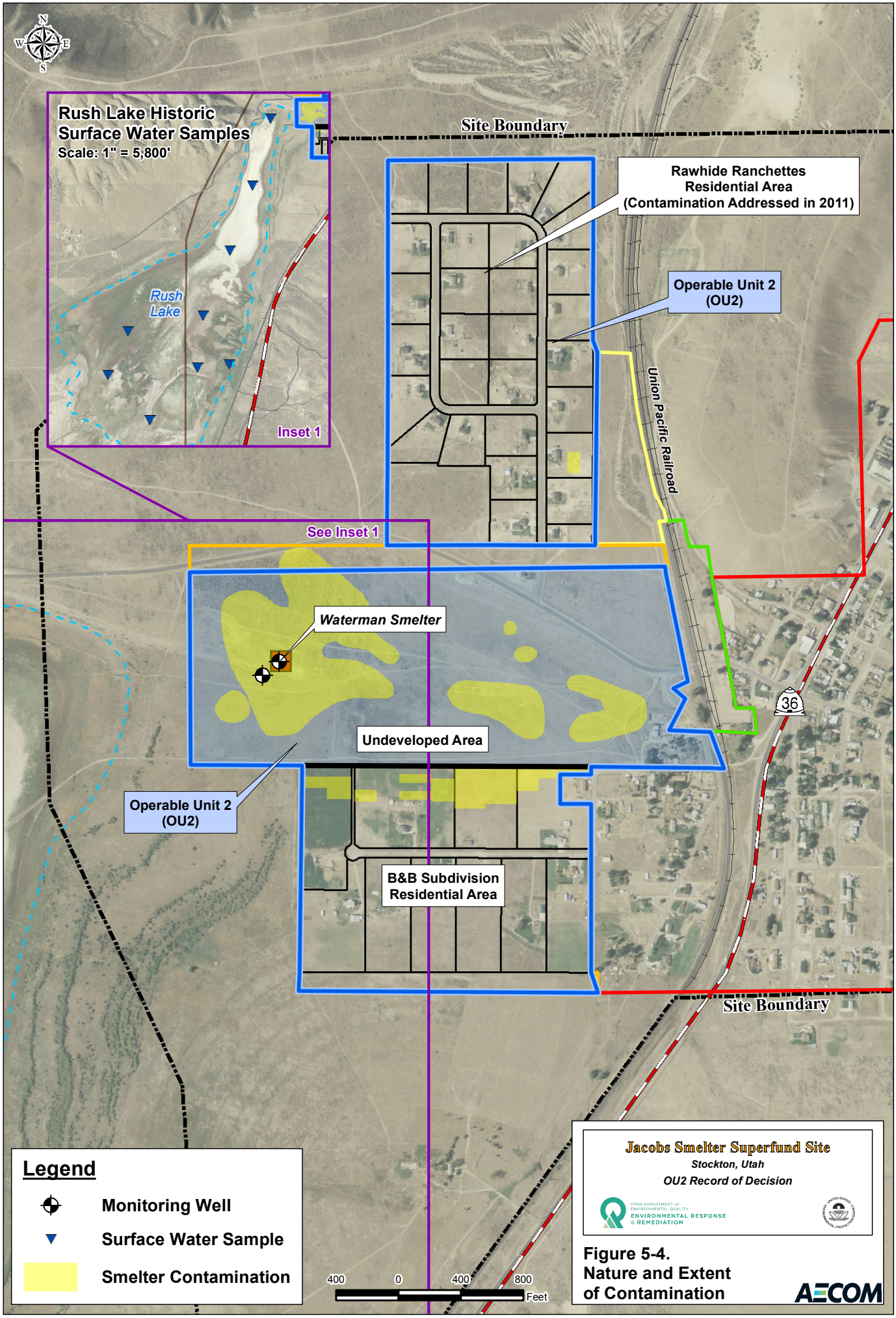
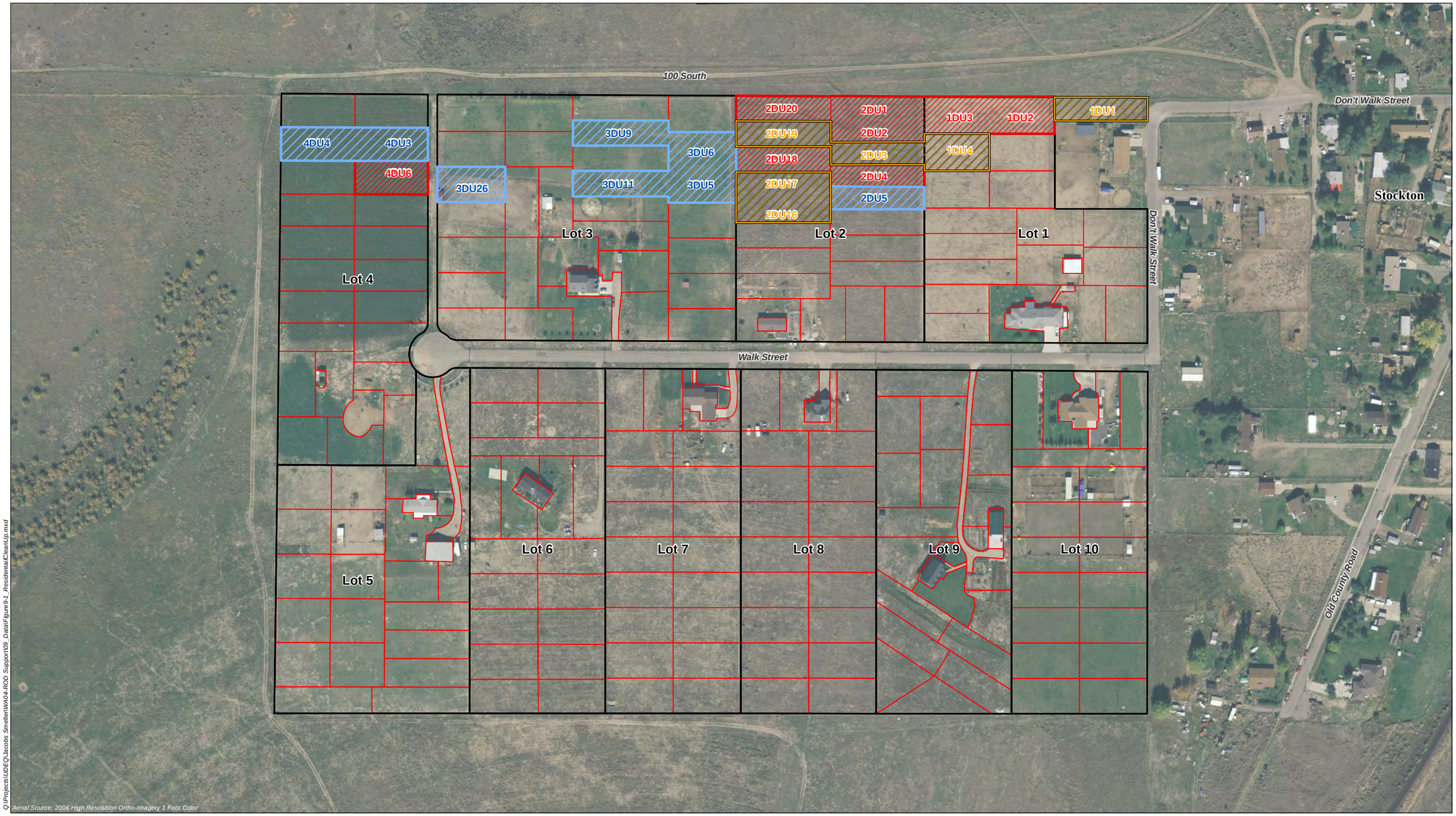



Figure 5-4.
Nature and Extent
of Contamination




# LEGEND

**Excavation Areas (Excavation Depth)**

- *0-6" bgs (Surface) - 2.0 acres*
- *0-12" bgs (Shallow Subsurface) - 1.5 acres*
- *0-18" bgs (Deep Subsurface) - 1.9 acres*

- **Decision Unit**
- **Lot Boundary**

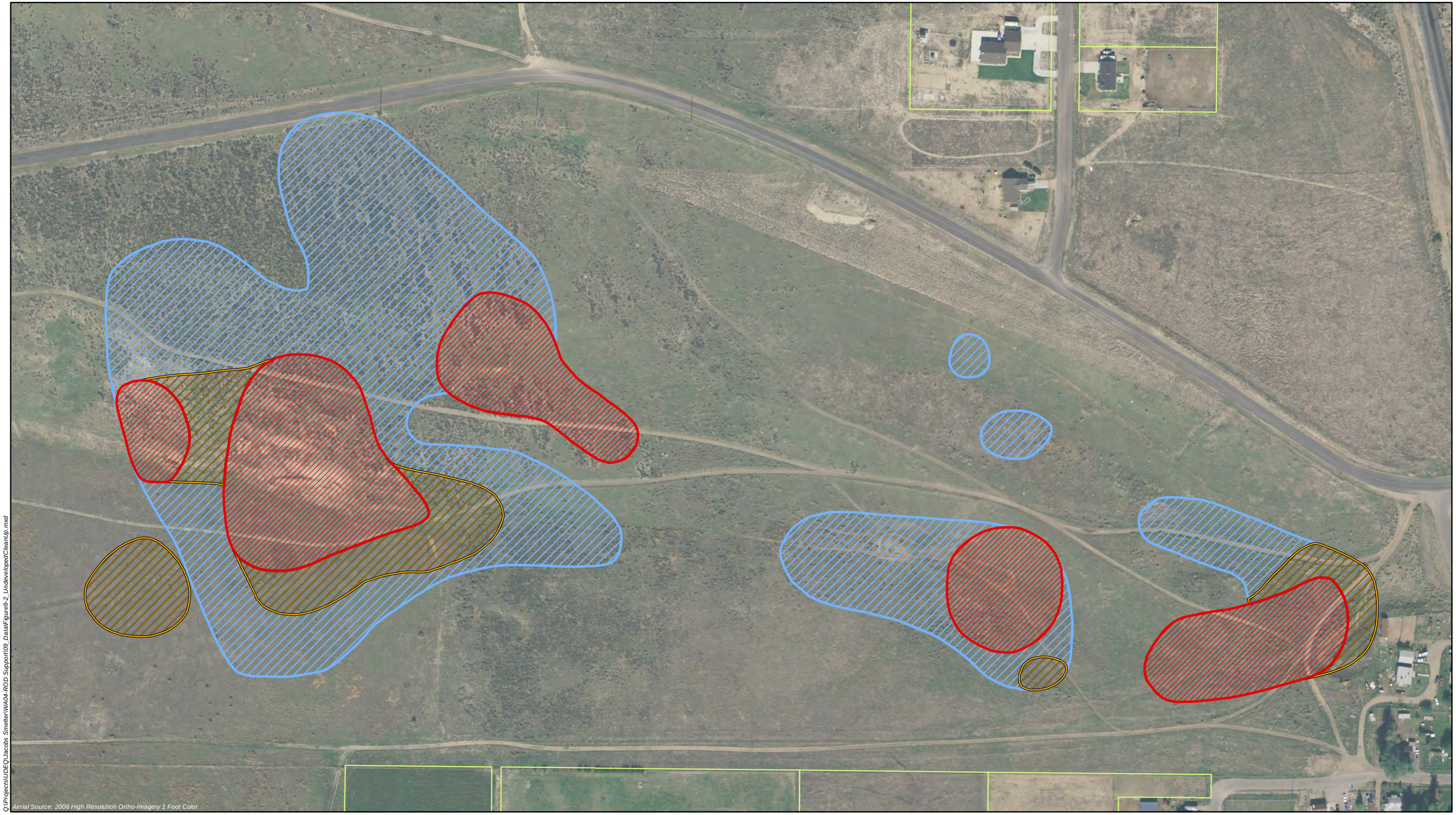
N W E S

0 100 200 300 Feet

**Jacobs Smelter Superfund Site**
*Stockton, Utah*
*OU2 Record of Decision*

**Figure 9-1.**
**Residential Extent of Cleanup**

AECOM




Q:\Projects\UDEQ\Jacobs Smelter\WA04-ROD Support\09_Data\Figure9-2_UndevelopedCleanUp.mxd

# LEGEND

**Excavation Areas (Excavation Depth)**

- ***0-6" bgs (Surface)* - 14.6 acres**
- ***0-12" bgs (Shallow Subsurface)* - 3.6 acres**
- ***0-18" bgs (Deep Subsurface)* - 8.5 acres**

**Subdivision Lots**

**Notes:**
**1) bgs = below ground surface**
**2) Excavation areas based on contours shown in Figure 3-5, 3-6, and 3-7.**

N W E S

0 100 200 300 Feet

**Jacobs Smelter Superfund Site**
***Stockton, Utah***
***OU2 Record of Decision***

**Figure 9-2.**
**Undeveloped Extent of Cleanup**

AECOM

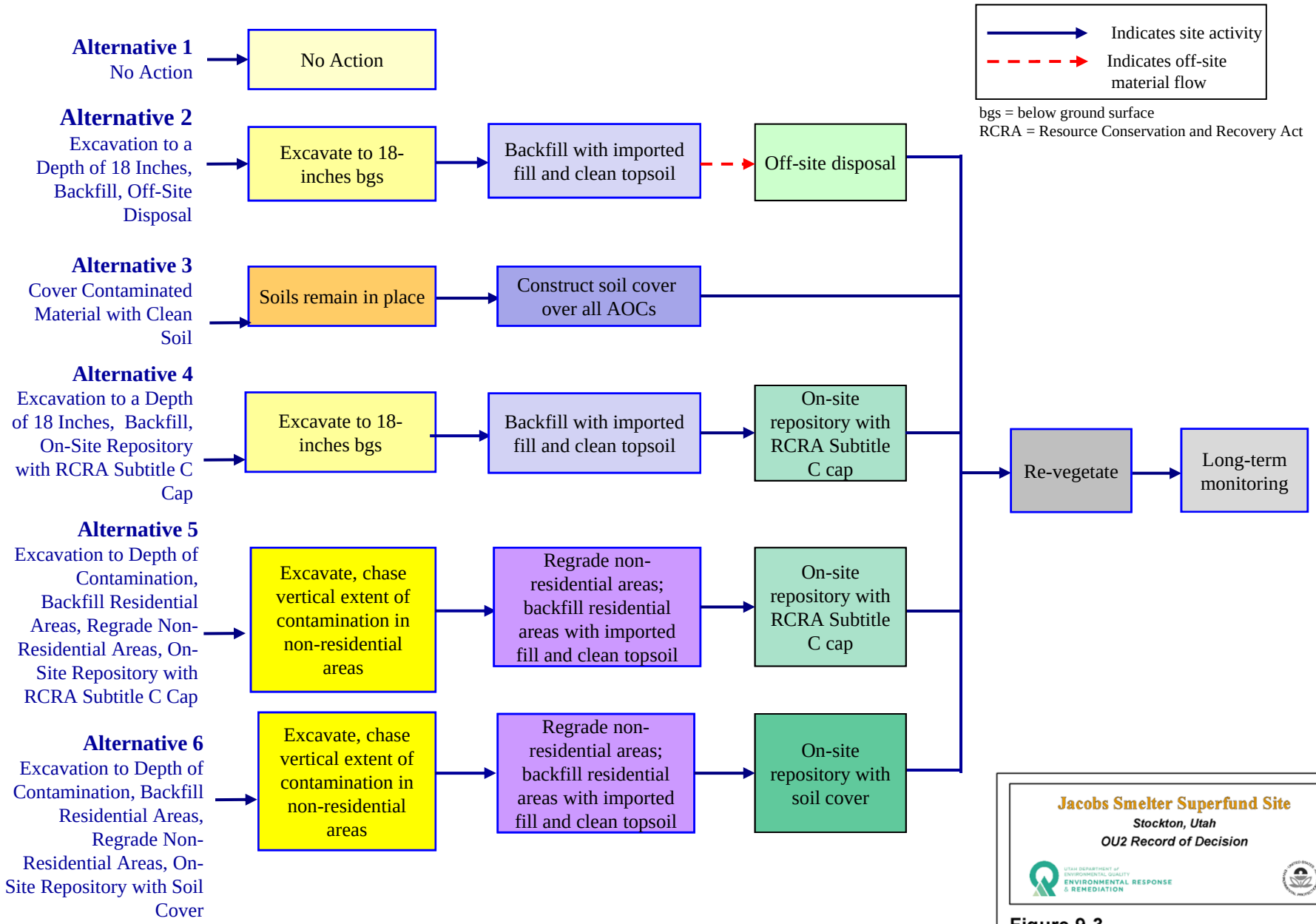



**Figure 9-3.**
**Summary of Remedial Alternatives**

# TABLES

**Table 7-1**
**Complete Exposure Pathways for Ecological Receptors**

| Endpoint | Pathway |
|---|---|
| I. Terrestrial Plant Community | Direct contact with soil<br>Direct contact with surface water |
| II. Benthic Invertebrates | Direct contact with interstitial water<br>Direct contact with surface water<br>Direct contact with sediment<br>Ingestion of sediment |
| III. Herbivorous Birds | Ingestion of surface water<br>Incidental ingestion of soil<br>Incidental ingestion of sediment<br>Ingestion of terrestrial or aquatic vegetation |
| IV. Insectivorous Birds | Ingestion of surface water<br>Incidental ingestion of soil<br>Ingestion of terrestrial invertebrates |
| V. Aquatic Invertebrate Eating Birds | Ingestion of surface water<br>Incidental ingestion of sediment<br>Ingestion of aquatic invertebrates |
| VI. Omnivorous Birds | Ingestion of surface water<br>Incidental ingestion of soil<br>Incidental ingestion of sediment<br>Ingestion of aquatic plants<br>Ingestion of aquatic invertebrates |
| VII. Piscivorous Birds | Ingestion of surface water<br>Incidental ingestion of sediment<br>Ingestion of aquatic vertebrates |
| VIII. Carnivorous Birds | Ingestion of surface water<br>Incidental ingestion of soil<br>Ingestion of small mammals |
| IX. Herbivorous Mammals | Ingestion of surface water<br>Incidental ingestion of soil<br>Ingestion of terrestrial vegetation |
| X. Insectivorous Mammals | Ingestion of surface water<br>Incidental ingestion of soil<br>Ingestion of terrestrial insects |
| XI. Omnivorous Mammals | Ingestion of surface water<br>Incidental ingestion of soil<br>Ingestion of terrestrial insects<br>Ingestion of terrestrial vegetation |
| XII. Carnivorous Mammals | Ingestion of surface water<br>Incidental ingestion of soil<br>Ingestion of small mammals |

**Table 7-2**
**Preliminary Soil Remediation Goals for Human Receptors for Jacobs Smelter OU2**

| | Lead (mg/kg) | | |
|---|---|---|---|
| | **Low** | **High** | **Selected** |
| Residential (Surface, 0-2 in. bgs) | 500 | 500 | 500 |
| Residential (Subsurface, 2-12 in. bgs) | 800 | 800 | 800 |
| Commercial/Industrial | 1,671 | 2,632 | 2,200 |
| Recreational | 2,408 | 3,792 | 3000 |

bgs – below ground surface
in – inches
mg/kg – milligrams per kilogram
Range calculated from regional blood lead levels

**Table 7-3**
**Preliminary Soil Action Levels for Human Receptors within Jacobs Smelter OU2 (UDEQ, 2010)**

| Preliminary Action Level for Soil | Lead (mg/kg) |
|---|---|
| Residential Areas (Surface, 0-2 in. bgs) | 500 |
| Residential Areas (Subsurface, 2-12 in. bgs) | 800 |
| Commercial/Industrial | 2,200[a] |
| Recreational | 3,000 |

UDEQ, 2010. Utah Department of Environmental Quality. *Memorandum: Risk management proposal regarding clean up levels based on human health risk for Operable Unit Two of the Jacobs Smelter Superfund Site*. June 17, 2010.

a – this value was not included in the memorandum referenced above, but has been selected by UDEQ/EPA as a part of this FS process.
bgs – below ground surface
in – inches
mg/kg – milligrams per kilogram

**Table 12-1**
**Capital Cost Estimate for Selected Remedy**
**Jacobs Smelters OU2 Record of Decision - July 2016**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Truck Scale | Each | 1 | $45,000 | 1 | $45,000 |
| 2 | Clear and Grub Brush | Acres | 32.1 | $550 | 1 | $17,655 |
| 3 | Water Truck - Dust Suppression | Month | 12 | $15,000 | 1 | $180,000 |
| 4 | Excavation | Ton | 69,558 | $10 | 7 | $695,585 |
| 5 | Backfill - material, haul, and place | Ton | 44,555 | $23 | 2 | $1,024,767 |
| 6 | Topsoil - material, haul, and place | Ton | 52,419 | $32 | 2 | $1,677,408 |
| 7 | Geotextile Fabric 4 oz. | Sq yd | 50,534 | $0.98 | 3 | $49,524 |
| 8 | Revegetation | Acres | 32.1 | $300 | 1 | $9,630 |
| 9 | Erosion Control Blankets | Acres | 32.1 | $10,890 | 6 | $349,569 |
| 9 | Transport Bevill Exempt Waste to Subtitle C Hazardous Waste Landfill | Ton | 69,558 | $12.50 | 1 | $869,481 |
| 10 | Disposal of Bevill Exempt Waste at Subtitle C Hazardous Waste Landfill | Ton | 69,558 | $35 | 4 | $2,434,546 |
| 11 | Health & Safety Ambient Air Monitoring | Lump Sum | 1 | $55,950 | 5 | $55,950 |
| 12 | Final Site Wide Clean-up | Each | 1 | $10,000 | 1 | $10,000 |
| | | Total Cost | | | | $7,419,115 |
| | | Mobilization | | | | $300,000 |
| | | Demobilization | | | | $150,000 |
| | | Subtotal | | | | $7,869,115 |
| | | Unidentified Construction Cost (10%) | | | | $786,911 |
| | | Construction Management (10%) | | | | $786,911 |
| | | **TOTAL** | | | | **$9,442,938** |

Assumptions:
a) TCLP testing will not be required by regulation based on the Bevill Exemption; however, a particular commercial facility may require TCLP tests based on policy or permit conditions.
b) Geotextile will only installed in the areas excavated to a depth of 18 inches below ground surface.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) Quote from Steve Simpson with Clean Harbors on 8/8/13.
5) See Table A-23.
6) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.

7) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

oz = ounces
sq yd = square yard
TCLP = Toxic Characteristic Leachability Procedure

**Table 12-2. Operation and Maintenance (O&M) Costs for Preferred Alternative (Excavate to a depth of 18 inches, backfill, off-site disposal)**

| Alternative 2 | | |
|---|---|---|
| **Soil Cover** | - | acres |
| **Excavation & Backfill** | 32.1 | acres |
| **On-Site Repository Area** | - | acres |
| **Total Acreages** | 32.1 | acres |

**Annual Maintenance**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Repair Supplies | Lump Sum | 1 | 1 | $1,000 | $1,000 | Engineer estimate | Drums, clean soil, seeds, hand tools, etc. |
| Repair Equipment, Rental | Lump Sum | 1 | 1 | $1,200 | $1,200 | Engineer estimate | Bobcat loader, fertilizer spreader, etc. |
| Travel (Round Trip) | Miles | 100 | 1 | $0.56 | $56 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$2,256** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 1 | $120 | $360 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 32 | 1 | $65 | $2,080 | URS | Assume ~one hour per acre; field technician labor rate. |
| Onsite Supervision | Hour | 32 | 1 | $85 | $2,720 | URS | Assume ~one hour per acre; geologist/engineer labor rate. |
| Offsite Support | Hour | 3 | 1 | $55 | $165 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$5,325** | | |
| Contingency Allowance | | 10% | | $7,581 | **$758** | | |
| Annual Cost | | | | | **$8,339** | | |

Notes:
a) Maintenance is estimated to occur annually after the first year.
b) Maintenance will include clean soil replacement, erosion control, and reseeding if necessary.

**Monitoring Summary Reports - Annual**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Reproduction | Page | 300 | 1 | $0.10 | $30 | URS | 10 copies, 30 pages per copy |
| Postage / Packaging | Package | 3 | 1 | $20 | $60 | FedEx | Express Mail / FedEx |
| ODC Subtotal | | | | | **$90** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 12 | 1 | $120 | $1,440 | URS | Project manager labor rate. |
| Offsite Labor | Hour | 48 | 1 | $85 | $4,080 | URS | Geologist / engineer labor rate. |
| Offsite Drafting/Graphics | Hour | 16 | 1 | $65 | $1,040 | URS | CADD /GIS technician labor rate. |
| Offsite Support | Hour | 16 | 1 | $55 | $880 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$7,440** | | |
| Contingency Allowance | | 10% | | $7,530 | **$753** | | |
| Annual Cost | | | | | **$8,283** | | |

Notes:
CADD = Computer-Aided Design Drafting
GIS = Geographical Information System
ODC = Other Direct Charges

| **Total Annual O&M Cost:** | **$16,622** |
|---|---|

**Table 12-3**
**Present Worth Cost Estimate for Selected Remedy**
**Jacobs Smelter OU2 Record of Decision July 2016**

| Year | Capital Cost | Annual O&M Cost | Subtotal Annual Expenditures | Discount Factor [1] 7% | Present Worth[2] |
|---|---|---|---|---|---|
| 0 | $9,442,938 | | $9,442,938 | 1.000 | $9,442,938 |
| 1 | | $16,622 | $16,622 | 0.935 | $15,534 |
| 2 | | $16,622 | $16,622 | 0.873 | $14,518 |
| 3 | | $16,622 | $16,622 | 0.816 | $13,568 |
| 4 | | $16,622 | $16,622 | 0.763 | $12,681 |
| 5 | | $16,622 | $16,622 | 0.713 | $11,851 |
| 6 | | $16,622 | $16,622 | 0.666 | $11,076 |
| 7 | | $16,622 | $16,622 | 0.623 | $10,351 |
| 8 | | $16,622 | $16,622 | 0.582 | $9,674 |
| 9 | | $16,622 | $16,622 | 0.544 | $9,041 |
| 10 | | $16,622 | $16,622 | 0.508 | $8,450 |
| 11 | | $16,622 | $16,622 | 0.475 | $7,897 |
| 12 | | $16,622 | $16,622 | 0.444 | $7,380 |
| 13 | | $16,622 | $16,622 | 0.415 | $6,897 |
| 14 | | $16,622 | $16,622 | 0.388 | $6,446 |
| 15 | | $16,622 | $16,622 | 0.362 | $6,024 |
| 16 | | $16,622 | $16,622 | 0.339 | $5,630 |
| 17 | | $16,622 | $16,622 | 0.317 | $5,262 |
| 18 | | $16,622 | $16,622 | 0.296 | $4,918 |
| 19 | | $16,622 | $16,622 | 0.277 | $4,596 |
| 20 | | $16,622 | $16,622 | 0.258 | $4,295 |
| 21 | | $16,622 | $16,622 | 0.242 | $4,014 |
| 22 | | $16,622 | $16,622 | 0.226 | $3,752 |
| 23 | | $16,622 | $16,622 | 0.211 | $3,506 |
| 24 | | $16,622 | $16,622 | 0.197 | $3,277 |
| 25 | | $16,622 | $16,622 | 0.184 | $3,063 |
| 26 | | $16,622 | $16,622 | 0.172 | $2,862 |
| 27 | | $16,622 | $16,622 | 0.161 | $2,675 |
| 28 | | $16,622 | $16,622 | 0.150 | $2,500 |
| 29 | | $16,622 | $16,622 | 0.141 | $2,336 |
| Present Worth of Capital Cost | | | | | $9,443,000 |
| Present Worth of O&M Cost | | | | | $204,000 |
| Total Present Worth (30 Years) | | | | | $9,647,000 |

Notes:

1) Discount rate of 7% and inflation rate of 0% were based on guidance from Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", (USEPA. 2000). Discount factor = $1/(1+\text{Discount Rate}^{\text{Year}})$.

2) Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

a) Present worth values rounded to the nearest $1000.

b) Assume that Year 0 is the year 2014.

**TABLE 13-1**
**Chemical-Specific ARARs**
**For Selected Remedy**

| Requirement | Citation | ARAR | Comment |
|---|---|---|---|
| **FEDERAL: NA** | | | |
| **STATE: NA** | | | |

**TABLE 13-2**
**Preliminary Action-Specific ARARs**
**For Selected Remedy**

| Action | Citation | ARAR | Comment |
|---|---|---|---|
| **FEDERAL:** | | | |
| National Ambient Air Quality Standards (NAAQS) | 40 CFR Part 50 | Applicable | Selected Remedy must meet the emission standards of this regulation. |
| Criteria for Classification of Solid Waste Disposal and Practices | 40 CFR 257.3 | Applicable | Since the Selected Remedy involves the generation and on-site disposal of solid wastes must comply with these requirements. |
| Criteria for Identification and Listing of Hazardous Waste | 40 CFR Part 261 | Relevant and Appropriate | Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. Wastes at this site were created from beneficiation and smelting of metal ores and are not hazardous waste per 40 CFR 261.4(b)(7)(ii)(B) and 40 CFR 261.4(b)(7)(i). However, because some of the wastes are similar to hazardous waste, certain RCRA hazardous waste requirements are considered relevant and appropriate. |
| Bevill Exempt Status of Mining Wastes | 40 CFR 261.4(b)(7) | Applicable | Any solid waste generated as a result of the extraction, benefication, or processing of ores and minerals are not considered hazardous wastes and are not subject to RCRA Subtitle C regulations. |
| Generation of Hazardous Waste | 40 CFR Part 262 | Relevant and Appropriate | Standards are relevant and appropriate to alternatives that generate remediation wastes that are similar to hazardous waste. |
| Closure and Post Closure | 40 CFR 264 Subpart G | Relevant and Appropriate | The requirements are relevant and appropriate to site closure activities due to the presence of contaminated wastes that are similar to hazardous waste. This is not triggered when soils are moved within an Area of Contamination (AOC). |
| Construction Quality Assurance (CQA) Program | 40 CFR 264.19 | Relevant and Appropriate | A CQA program is required for most surface impoundment, waste pile, and landfill units. Alternatives leaving contaminated soil in place and covering with soil or alternatives using staging piles may need a CQA. |
| Landfill Closure and Post Closure | 40 CFR 264.310 | Relevant and Appropriate | The requirements are relevant and appropriate to alternatives that involve the placement of a cover over contaminated materials. Post-closure care of such covers is necessary. |
| Surface Water Control | 40 CFR 264.554(d) | Relevant and Appropriate | All remedial alternatives using staging piles must operate run-on/run-off controls |

| Action | Citation | ARAR | Comment |
|---|---|---|---|
| | | | to protect human health and the environment. |
| Staging Piles | 40 CFR 264.554 | Relevant and Appropriate | All remedial alternatives using staging piles must address temporary storage of remediation wastes in piles during remedial activities. |
| **STATE:** | | | |
| Air Pollutant Emissions | UAC R307-102-1 | Applicable | All alternatives must prevent emissions of air contaminants in significant quantities. All alternatives must meet applicable emission requirements of R307 and the Utah State Implementation Plan. |
| Emission Standards: Visible Emissions | UAC R307-201-3(1) | Applicable | Emissions from the excavation and disposal operations must meet the standards of this regulation. Remedial actions are not expected to cause significant visible emissions. |
| Production of Fugitive Emissions and/or Fugitive Dust | UAC R307-205 | Applicable | All alternatives must be designed to minimize fugitive dust and emissions. |
| Non-Attainment and Maintenance Areas for PM 10 and PM2.5: Fugitive Dust and Fugitive Emissions | UAC-R307-309 | Applicable | All alternative must be designed to minimize fugitive dust and emissions. |
| Corrective Action Cleanup | UAC R311-211 | Applicable | The remedial alternatives must employ appropriate measures to control or remove contaminant sources and must utilize soil cleanup standards that are protective of public health and the environment. |
| Cleanup Action and Risk Based Closure Standards | UAC R315-101 | Applicable | The standards establish requirements for managing sites contaminated with hazardous waste or hazardous constituents where cleanup to background will not be achieved. Site management depends on risks identified for the site and may include corrective action, post-closure care, monitoring, and institutional controls. |
| Identification and Listing of Hazardous Waste | UAC R315-2 | Relevant and Appropriate | Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. Wastes at this site were created from beneficiation and smelting of metal ores and are not hazardous wastes per UAC R315-2-4(b)(7). However, because some of the wastes are similar to hazardous waste, certain RCRA hazardous waste requirements are considered relevant and appropriate. |
| Hazardous Waste Generator | UAC R315-5 | Relevant and Appropriate | Standards are relevant and appropriate to alternatives that generate remediation wastes that are similar to hazardous waste. |
| Closure and Post Closure | UAC R315-8-7 | Relevant and Appropriate | The requirements are relevant and appropriate to site closure activities due to the presence of contaminated wastes that are similar to hazardous waste. This is not triggered by movement of material within an AOC. |
| Surface Water Control | UAC R315-8-14.2 (g), (h), & (i) | Relevant and Appropriate | All alternatives leaving contaminated soil in place and covering with soil must maintain run-on and run-off systems to protect soil from water associated with a 24-hour 25-year storm. |
| Landfill Closure and Post Closure | UAC R315-8-14.5 | Relevant and Appropriate | The requirements are relevant and appropriate to alternatives that involve the placement of a cover over contaminated materials. Post-closure care of such covers is necessary. |

| Action | Citation | ARAR | Comment |
|---|---|---|---|
| Cleanup Action and Risk Based Closure Standards | UAC R315-101 | Applicable | The standards establish requirements for managing sites contaminated with hazardous waste or hazardous constituents where cleanup to background will not be achieved. Site management depends on risks identified for the site and may include corrective action, post-closure care, monitoring, and institutional controls. |
| Owner Responsibility for Solid Waste | UAC R315-301-3 | Applicable | Solid wastes generated during the remedial activities will be managed and disposed in accordance with the Utah Solid Waste Permitting and Management Rules and the Utah Solid and Hazardous Waste Act. |
| Piles Used for Storage and Treatment | UAC R315-314 | Applicable | All remedial alternatives that store remediation wastes in piles more than 90 days must comply with the applicable requirements of this standard. |
| Run-On/Run-Off Controls | UAC R317-2 | Applicable | All alternatives must comply with storm water runoff requirements to protect surface water bodies, including Rush Lake. |
| Run-on/Run-off Control | UAC R317-8 | Applicable | Since construction area exceeds an acre, all alternatives must comply with storm water runoff requirements.. |

**TABLE 13-3**
**Preliminary Location-Specific ARARs**
**For Selected Remedy**

| Location | Citation | ARAR | Comment |
|---|---|---|---|
| **FEDERAL:** | | | |
| Effect on historic properties within project area | National Historical Preservation Act (NHPA)<br>36 CFR Part 800<br>16 USC 470 | Applicable | Requires federal agency to consider the effect of the project on properties eligible for inclusion on the National Register of Historic Places. |
| **Location** | **Citation** | **ARAR** | **Comment** |
| Area inhabited by endangered species or migratory birds. | 16 USC 1531 et seq.;<br>40 CFR 6.302(h)<br>Migratory Bird Treaty Act (16 USC §§ 703 et seq.) | Applicable | Applicable to all alternatives, if endangered species or migratory birds are present at the site. |
| **STATE:** | | | |
| Location standards for disposal facility | UAC R315-302-1 | Applicable | These standards are applicable to alternatives involving the generation and on-site disposal of solid waste. They are relevant and appropriate to alternatives that involve in-place closure of contaminated soil. |

# APPENDIX A

# APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS

**TABLE 1**
**Preliminary Chemical-Specific ARARs**

| Requirement | Citation | ARAR | Comment |
|---|---|---|---|
| **FEDERAL:** | | | |
| National Ambient Air Quality Standards (NAAQS) | 40 CFR Part 50 | Applicable | All alternatives must meet the emission standards of this regulation. |
| Criteria for Identification and Listing of Hazardous Waste | 40 CFR Part 261 | Relevant and Appropriate | Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. Wastes at this site were created from beneficiation and smelting of metal ores and are not hazardous waste per 40 CFR 261.4(b)(7)(ii)(B) and 40 CFR 261.4(b)(7)(i). However, because some of the wastes are similar to hazardous waste, certain RCRA hazardous waste requirements are considered relevant and appropriate. |
| **STATE:** | | | |
| Emission Standards: Visible Emissions | UAC R307-201-1(1) | Applicable | Emissions from the excavation and disposal operations must meet the standards of this regulation. Remedial actions are not expected to cause significant visible emissions. |
| Emission Standards: Fugitive Emissions and Fugitive Dust | UAC R307-309 | Applicable | Fugitive dust must be controlled during ground disturbing activities such as excavation, disposal, and soil covering. |
| Corrective Action Cleanup | UAC R311-211 | Applicable | The remedial alternatives must employ appropriate measures to control or remove contaminant sources and must utilize soil cleanup standards that are protective of public health and the environment. |
| Identification and Listing of Hazardous Waste | UAC R315-2 | Relevant and Appropriate | Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. Wastes at this site were created from beneficiation and smelting of metal ores and are not hazardous wastes per UAC R315-2-4(b)(7). However, because some of the wastes are similar to hazardous waste, certain RCRA hazardous waste requirements are considered relevant and appropriate. |
| Cleanup Action and Risk Based Closure Standards | UAC R315-101 | Applicable | The standards establish requirements for managing sites contaminated with hazardous waste or hazardous constituents where cleanup to background will not be achieved. Site management depends on risks identified for the site and may include corrective action, post-closure care, monitoring, and institutional controls. |
| Run-On/Run-Off Controls | UAC R317-2 | Applicable | All alternatives must comply with storm water runoff requirements to protect surface water bodies, including Rush Lake. |

**TABLE 2**
**Preliminary Action-Specific ARARs**

| Action | Citation | ARAR | Comment |
|---|---|---|---|
| **FEDERAL:** | | | |
| Criteria for Classification of Solid Waste Disposal and Practices | 40 CFR 257.3 | Applicable | Alternatives which involve the generation and on-site disposal of solid wastes must comply with these requirements. |
| Bevill Exempt Status of Mining Wastes | 40 CFR 261.4(b)(7) | Applicable | Any solid waste generated as a result of the extraction, benefication, or processing of ores and minerals are not considered hazardous wastes and are not subject to RCRA Subtitle C regulations. |
| Generation of Hazardous Waste | 40 CFR Part 262 | Relevant and Appropriate | Standards are relevant and appropriate to alternatives that generate remediation wastes that are similar to hazardous waste. |
| Closure and Post Closure | 40 CFR 264 Subpart G | Relevant and Appropriate | The requirements are relevant and appropriate to site closure activities due to the presence of contaminated wastes that are similar to hazardous waste. This is not triggered when soils are moved within an Area of Contamination (AOC). |
| Construction Quality Assurance (CQA) Program | 40 CFR 264.19 | Relevant and Appropriate | A CQA program is required for most surface impoundment, waste pile, and landfill units. Alternatives leaving contaminated soil in place and covering with soil or alternatives using staging piles may need a CQA. |
| Landfill Closure and Post Closure | 40 CFR 264.310 | Relevant and Appropriate | The requirements are relevant and appropriate to alternatives that involve the placement of a cover over contaminated materials. Post-closure care of such covers is necessary. |
| Surface Water Control | 40 CFR 264.554(d) | Relevant and Appropriate | All remedial alternatives using staging piles must operate run-on/run-off controls to protect human health and the environment. |
| Staging Piles | 40 CFR 264.554 | Relevant and Appropriate | All remedial alternatives using staging piles must address temporary storage of remediation wastes in piles during remedial activities. |
| **STATE:** | | | |
| Air Pollutant Emissions | UAC R307-102-1 | Applicable | All alternatives must prevent emissions of air contaminants in significant quantities. All alternatives must meet applicable emission requirements of R307 and the Utah State Implementation Plan. |
| Production of Fugitive Emissions and/or Fugitive Dust | UAC R307-205 | Applicable | All alternatives must be designed to minimize fugitive dust and emissions. |
| Non-Attainment and Maintenance Areas for PM 10 and PM2.5: Fugitive Dust and Fugitive Emissions | UAC-R307-309 | Applicable | All alternative must be designed to minimize fugitive dust and emissions. |
| Corrective Action Cleanup | UAC R311-211 | Applicable | The remedial alternatives must employ appropriate measures to control or remove contaminant sources and must utilize soil cleanup standards that are protective of public health and the environment. |
| Hazardous Waste Generator | UAC R315-5 | Relevant and Appropriate | Standards are relevant and appropriate to alternatives that generate remediation wastes that are similar to hazardous waste. |

| Action | Citation | ARAR | Comment |
|---|---|---|---|
| Closure and Post Closure | UAC R315-8-7 | Relevant and Appropriate | The requirements are relevant and appropriate to site closure activities due to the presence of contaminated wastes that are similar to hazardous waste. This is not triggered by movement of material within an AOC. |
| Surface Water Control | UAC R315-8-14.2 (g), (h), & (i) | Relevant and Appropriate | All alternatives leaving contaminated soil in place and covering with soil must maintain run-on and run-off systems to protect soil from water associated with a 24-hour 25-year storm. |
| Landfill Closure and Post Closure | UAC R315-8-14.5 | Relevant and Appropriate | The requirements are relevant and appropriate to alternatives that involve the placement of a cover over contaminated materials. Post-closure care of such covers is necessary. |
| Cleanup Action and Risk Based Closure Standards | UAC R315-101 | Applicable | The standards establish requirements for managing sites contaminated with hazardous waste or hazardous constituents where cleanup to background will not be achieved. Site management depends on risks identified for the site and may include corrective action, post-closure care, monitoring, and institutional controls. |
| Owner Responsibility for Solid Waste | UAC R315-301-3 | Applicable | Solid wastes generated during the remedial activities will be managed and disposed in accordance with the Utah Solid Waste Permitting and Management Rules and the Utah Solid and Hazardous Waste Act. |
| Closure and Post-Closure | UAC R315-302-3 | Applicable | These standards are applicable to alternatives that involve the generation of solid waste and the disposal of that waste in an on-site repository. They are relevant and appropriate to alternatives that involve placement of a cover over contaminated soil that remains in-place. Closure will be performed to minimize maintenance and threats to human health and the environment. |
| Corrective Action Management Units | UAC R315-8-21 | Relevant and Appropriate | A CAMU will be designated if the remedial action involves excavation of contaminated soil followed by on-site storage. |
| Industrial Solid Waste Facility Requirements and Landfilling Standards | UAC R315-303<br>UAC R315-304 | Applicable | Alternatives that involve the generation of solid waste and the disposal of that waste in an on-site repository must comply with the Class IIIa industrial waste landfill requirements. |
| Ground Water Monitoring Requirements | UAC R315-308 | Applicable | While applicable due to the on-site repository alternatives, ground water monitoring requirements may be waived if it is demonstrated that there is no potential for migration of hazardous constituents to the groundwater. |
| Piles Used for Storage and Treatment | UAC R315-314 | Applicable | All remedial alternatives that store remediation wastes in piles more than 90 days must comply with the applicable requirements of this standard. |
| | | | |
| Run-on/Run-off Control | UAC R317-8 | Applicable | Since construction area exceeds an acre, all alternatives must comply with storm water runoff requirements.. |

**TABLE 3**
**Preliminary Location-Specific ARARs**

| Location | Citation | ARAR | Comment |
|---|---|---|---|
| **FEDERAL:** | | | |
| Effect on historic properties within project area | National Historical Preservation Act (NHPA)<br>36 CFR Part 800<br>16 USC 470 | Applicable | Requires federal agency to consider the effect of the project on properties eligible for inclusion on the National Register of Historic Places. |
| **Location** | **Citation** | **ARAR** | **Comment** |
| Area inhabited by endangered species or migratory birds. | 16 USC 1531 et seq.;<br>40 CFR 6.302(h)<br>Migratory Bird Treaty Act (16 USC §§ 703 et seq.) | Applicable | Applicable to all alternatives, if endangered species or migratory birds are present at the site. |
| **STATE:** | | | |
| Location standards for disposal facility | UAC R315-302-1 | Applicable | These standards are applicable to alternatives involving the generation and on-site disposal of solid waste. They are relevant and appropriate to alternatives that involve in-place closure of contaminated soil. |

**TABLE 4**
**Summary of To Be Considered (TBC) Material**

| Material | Citation | Comment |
|---|---|---|
| Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities | OSWER Directive #9200.4-27P August 1998 | Office of Solid Waste and Emergency Response (OSWER) recommends that the integrated exposure uptake and biokinetic (IEUBK) model be used as the primary tool to generate risk-based soil cleanup levels at lead sites for current or future residential land use. In selecting management strategies, it is OSWER's preference to seek early risk reduction with a combination of engineering controls (actions which permanently remove or treat contaminants, or create reliable barriers to mitigate the risk of exposure) and non-engineering response actions (such as education and health intervention programs). As a given project progresses, OSWER recognizes the National Oil and Hazardous Substances Contingency Plan (NCP) preference for permanent remedies and emphasizes selection of engineering over non-engineering remedies for long-term response actions. |
| Centers for Disease Control and Prevention (CDC) guidance for determining soil lead action levels | "Preventing Lead Poisoning in Young Children: A Statement by the Centers for Disease Control", October 1991 | CDC recommends that there should be no more than a 5 percent chance that children aged 1 to 3 have blood levels higher than 10 micrograms per deciliter (μg/dL). |

# APPENDIX B

# DETAILED COST ESTIMATES

**Table B-1**
**Jacobs Smelter OU2 Cost Summary**

| | Capital | Present Worth O&M | Present Worth | Brief Description of Alternative |
|---|---|---|---|---|
| Alternative 1 | $0 | $0 | $0 | No action |
| Alternative 2 | $9,443,000 | $204,000 | $9,647,000 | Excavate material in excess of site action levels to a depth of 18 inches, backfill with clean soil, and dispose of excavated materials **off-site**. |
| Alternative 3 | $5,056,000 | $222,000 | $5,278,000 | Cover material in excess of site action levels with clean soil. |
| Alternative 4 | $7,647,000 | $417,000 | $8,065,000 | Excavate material in excess of site action levels to a depth of 18 inches, backfill all areas with clean soil, and dispose of excavated materials in an **on-site repository with a RCRA Subtitle C cap**. |
| Alternative 5 | $7,956,000 | $371,000 | $8,326,000 | Excavate all material in excess of site action levels to the depth of contamination, backfill residential areas with clean soil, regrade non-residential areas, and dispose of excavated materials in an **on-site repository with a RCRA Subtitle C cap.** |
| Alternative 6 | $7,293,000 | $371,000 | $7,664,000 | Excavate all material in excess of site action levels to the depth of contamination, backfill residential areas with clean soil, regrade non-residential areas, and dispose of excavated materials in an **on-site repository with a soil cover.** |

Notes:
O&M = Operations and Maintenance

a) Residential O&M costs for Alternatives 2 through 6 are negligible due to the size of the residential areas compared to the non-residential areas. The O&M for the residential areas will be conducted at the same time as the O&M for the non-residential areas and are therefore reflected in the non-residential O&M costs.
b) All numbers are rounded to the nearest $1000.

**Table B-2**
**Jacobs Smelter OU2 Remedial Quantities**

| AREA OF CONTAMINATION | AREA (acres) | VOLUME (cu.yd.) | WEIGHT (tons) |
|---|---|---|---|
| **RESIDENTIAL PROPERTIES** | | | |
| **SURFACE AND SUBSURFACE LEAD CONTAMINATION** | | | |
| B&B Subdivision | 5.4 | 8,631 | 12,818 |
| Sub-Total | **5.4** | **8,631** | **12,818** |
| **NON-RESIDENTIAL AREAS** | | | |
| **SURFACE AND SUBSURFACE LEAD CONTAMINATION** | | | |
| Waterman Smelter | 19.5 | 27,045 | 40,162 |
| ATV Area | 7.2 | 11,164 | 16,579 |
| Sub-Total | 26.7 | 38,209 | 56,741 |
| **TOTAL FOR ALL AREAS** | **32.1** | **46,841** | **69,558** |

Notes:
a) The above acreages are preliminary.
b) See Table A-3 for detailed remedial quantities.
c) Residential contamination defined as >500 mg/kg lead in surface (0-2 inches bgs) and >800 mg/kg lead in subsurface (2-12 inches bgs)
d) Non-residential contamination defined as >3,000 mg/kg lead in surface (0-6 inches bgs), shallow subsurface (6-12 inches bgs), and deep subsurface (12-18 inches bgs)
e) Acreages in non-residential areas estimated from countours primarily based on results from the 2011 sample event. Contours were adjusted, where necessary, based on previous sample data.

bgs = below ground surface
cu.yd. = cubic yard
mg/kg = milligrams per kilogram

**Table B-3**
**Material Requirements and Waste Generation**
**Jacobs Smelter OU2**

| AREA OF CONTAMINATION | AREA[1] (acres) | Excavate DEPTH (inches) | Excavate VOLUME (Cu yd) | Excavate WEIGHT (tons) | Geotextile Fabric[2] AREA (Sq yd) | Backfill[3,4] DEPTH (inches) | Backfill[3,4] WEIGHT (tons) | Topsoil[4] DEPTH (inches) | Topsoil[4] WEIGHT (tons) | Vegetation AREA (acres) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Alternatives 2 - Excavate Material in Excess of Site Action Levels to a Depth of 18 Inches; Backfill with Clean Soil; and Dispose of Excavated Materials Off-Site** | | | | | | | | | | |
| B&B Subdivision | | | | | | | | | | |
| 6 in bgs excavation depth | 2.0 | 6 | 1,608 | 2,387 | - | -- | -- | 9 | 3,256 | 2.0 |
| 12 in bgs excavation depth | 1.5 | 12 | 2,355 | 3,498 | - | 9 | 2,504 | 9 | 2,385 | 1.5 |
| 18 in bgs excavation depth | 1.9 | 18 | 4,668 | 6,932 | 9,336 | 18 | 6,617 | 9 | 3,151 | 1.9 |
| *Subtotal* | *5.4* | | *8,631* | *12,818* | *9,336* | | *9,121* | | *8,791* | *5.4* |
| Waterman Smelter | | | | | | | | | | |
| 6 in bgs excavation depth | 11.1 | 6 | 8,924 | 13,252 | - | -- | -- | 9 | 18,071 | 11.1 |
| 12 in bgs excavation depth | 2.9 | 12 | 4,704 | 6,986 | - | 9 | 5,001 | 9 | 4,763 | 2.9 |
| 18 in bgs excavation depth | 5.5 | 18 | 13,416 | 19,923 | 26,833 | 18 | 19,018 | 9 | 9,056 | 5.5 |
| *Subtotal* | *19.5* | | *27,045* | *40,162* | *26,833* | | *24,019* | | *31,891* | *19.5* |
| ATV Area | | | | | | | | | | |
| 6 in bgs excavation depth | 3.5 | 6 | 2,822 | 4,190 | - | -- | -- | 9 | 5,714 | 3.5 |
| 12 in bgs excavation depth | 0.7 | 12 | 1,160 | 1,723 | - | 9 | 1,233 | 9 | 1,174 | 0.7 |
| 18 in bgs excavation depth | 3.0 | 18 | 7,183 | 10,666 | 14,365 | 18 | 10,181 | 9 | 4,848 | 3.0 |
| *Subtotal* | *7.2* | | *11,164* | *16,579* | *14,365* | | *11,414* | | *11,737* | *7.2* |
| **Total** | **32.1** | | **46,841** | **69,558** | **50,534** | | **44,555** | | **52,419** | **32.1** |
| **Alternative 3 - Cover Material in Excess of Site Action Levels with Clean Soil** | | | | | | | | | | |
| B&B Subdivision | 5.4 | - | - | - | 26,049 | 9 | 9,231 | 9 | 8,791 | 5.4 |
| Waterman Smelter | 19.5 | - | - | - | 94,491 | 9 | 33,485 | 9 | 31,891 | 19.5 |
| ATV Area | 7.2 | - | - | - | 34,775 | 9 | 12,324 | 9 | 11,737 | 7.2 |
| **Total** | **32.1** | | | | **155,316** | | **55,040** | | **52,419** | **32.1** |

Notes:
1) The above acreages are preliminary.
2) Geotextile will only be placed in the areas excavated to 18 inches bgs.
3) Backfill and topsoil depths/volumes are based on uncompacted volumes. It is estimated that a 33% reduction in volume will occur during compaction.
4) A 33% compaction factor was estimated for bringing the fill material to grade. Therefore, the areas where soil is excavated to 6 inches will be filled with 9 inches of clean topsoil; the areas where soil is excavated to 12 inches will be filled with 9 inches of un-contaminated backfill followed by 9 inches of clean topsoil; and the areas where soil was excavated to 18 inches will be filled with 18 inches of un-contaminated backfill followed by 9 inches of clean topsoil.
5) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B. In summary, the area of the the on-site repository is 2.0 acres for Alternative 4, 2.4 acres for Alternative 5, and 2.3 acres for Alternative 6.
6) The repository RCRA Subtitle C cap consists of the following layers from top to bottom: 6 inches of gravel armor, 18 inches of common backfill, 4-ounce geotextile fabric, 12 inches of drainage material, 4-ounce geotextile fabric, and a geosynthetic clay liner.
7) The repository soil cover consists of the following layers from top to bottom: 6 inches of uncompacted topsoil, 12 inches of uncompacted backfill, a 4-ounce geotextile fabric.

Conversion Factors:

Average Density of In-Place Material = 110 $lb/ft^3$ (typical value taken from literature for similar soils)
Average Density of Uncompacted Backfill Material = 105 $lb/ft^3$
Average Density of Uncompacted Topsoil Material = 100 $lb/ft^3$
1 acre = 4,840 sq yd
1 acre = 43,560 sq ft
1 cu yd = 27 cu ft

bgs = below ground surface
in = inches
Cu ft = cubic feet
$lb/ft^3$ = pounds per cubic feet
Cu yd = cubic yard
Sq yd = square yard

**Table B-3 (cont'd)**
**Material Requirements and Waste Generation**
**Jacobs Smelter OU2**

| AREA OF CONTAMINATION | AREA[1] (acres) | Excavate DEPTH (inches) | Excavate VOLUME (Cu yd) | Excavate WEIGHT (tons) | Geotextile Fabric[2] AREA (Sq yd) | Backfill[3,4] DEPTH (inches) | Backfill[3,4] WEIGHT (tons) | Topsoil[4] DEPTH (inches) | Topsoil[4] WEIGHT (tons) | Vegetation AREA (acres) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Alternative 4 - Excavate Material in Excess of Site Action Levels to a Depth of 18 Inches; Backfill All Areas with Clean Soil; and Dispose of Excavated Materials in an On-Site Repository with a RCRA Subtitle C Cap** | | | | | | | | | | |
| B&B Subdivision | | | | | | | | | | |
| 6 in bgs excavation depth | 2.0 | 6 | 1,608 | 2,387 | - | -- | -- | 9 | 3,256 | 2.0 |
| 12 in bgs excavation depth | 1.5 | 12 | 2,355 | 3,498 | - | 9 | 2,504 | 9 | 2,385 | 1.5 |
| 18 in bgs excavation depth | 1.9 | 18 | 4,668 | 6,932 | 9,336 | 18 | 6,617 | 9 | 3,151 | 1.9 |
| *Subtotal* | *5.4* | | *8,631* | *12,818* | *9,336* | | *9,121* | | *8,791* | *5.4* |
| Waterman Smelter (Area of on-site repository subtracted)[5,6] | | | | | | | | | | |
| 6 in bgs excavation depth | 11.0 | 6 | 8,853 | 13,146 | - | -- | -- | 9 | 17,926 | 11.0 |
| 12 in bgs excavation depth | 2.5 | 12 | 4,049 | 6,013 | - | 9 | 4,305 | 9 | 4,100 | 2.5 |
| 18 in bgs excavation depth | 4.0 | 18 | 9,772 | 14,511 | 19,544 | 18 | 13,852 | 9 | 6,596 | 4.0 |
| *Subtotal* | *17.5* | | *22,674* | *33,671* | *19,544* | | *18,157* | | *28,623* | *17.5* |
| ATV Area | | | | | | | | | | |
| 6 in bgs excavation depth | 3.5 | 6 | 2,822 | 4,190 | - | -- | -- | 9 | 5,714 | 3.5 |
| 12 in bgs excavation depth | 0.7 | 12 | 1,160 | 1,723 | - | 9 | 1,233 | 9 | 1,174 | 0.7 |
| 18 in bgs excavation depth | 3.0 | 18 | 7,183 | 10,666 | 14,365 | 18 | 10,181 | 9 | 4,848 | 3.0 |
| *Subtotal* | *7.2* | | *11,164* | *16,579* | *14,365* | | *11,414* | | *11,737* | *7.2* |
| **Total** | **30.1** | | **42,470** | **63,067** | **43,245** | | **38,693** | | **49,151** | **30.1** |

Notes:
1) The above acreages are preliminary.
2) Geotextile will only be placed in the areas excavated to 18 inches bgs.
3) Backfill and topsoil depths/volumes are based on uncompacted volumes. It is estimated that a 33% reduction in volume will occur during compaction.
4) A 33% compaction factor was estimated for bringing the fill material to grade. Therefore, the areas where soil is excavated to 6 inches will be filled with 9 inches of clean topsoil; the areas where soil is excavated to 12 inches will be filled with 9 inches of un-contaminated backfill followed by 9 inches of clean topsoil; and the areas where soil was excavated to 18 inches will be filled with 18 inches of un-contaminated backfill followed by 9 inches of clean topsoil.
5) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B. In summary, the area of the the on-site repository is 2.0 acres for Alternative 4, 2.4 acres for Alternative 5, and 2.3 acres for Alternative 6.
6) The repository RCRA Subtitle C cap consists of the following layers from top to bottom: 6 inches of gravel armor, 18 inches of common backfill, 4-ounce geotextile fabric, 12 inches of drainage material, 4-ounce geotextile fabric, and a geosynthetic clay liner.
7) The repository soil cover consists of the following layers from top to bottom: 6 inches of uncompacted topsoil, 12 inches of uncompacted backfill, a 4-ounce geotextile fabric.

Conversion Factors:

Average Density of In-Place Material = 110 $lb/ft^3$ (typical value taken from literature for similar soils)
Average Density of Uncompacted Backfill Material = 105 $lb/ft^3$
Average Density of Uncompacted Topsoil Material = 100 $lb/ft^3$
1 acre = 4,840 sq yd
1 acre = 43,560 sq ft
1 cu yd = 27 cu ft

bgs = below ground surface
in = inches
Cu ft = cubic feet
$lb/ft^3$ = pounds per cubic feet
Cu yd = cubic yard
Sq yd = square yard

**Table B-3 (cont'd)**
**Material Requirements and Waste Generation**
**Jacobs Smelter OU2**

| | | Excavate | | | Geotextile Fabric[2] | Backfill[3,4] | | Topsoil[4] | | Vegetation |
|---|---|---|---|---|---|---|---|---|---|---|
| **AREA OF CONTAMINATION** | AREA[1] (acres) | DEPTH (inches) | VOLUME (Cu yd) | WEIGHT (tons) | AREA (Sq yd) | DEPTH (inches) | WEIGHT (tons) | DEPTH (inches) | WEIGHT (tons) | AREA (acres) |
| **Alternative 5 – Excavate All Material in Excess of Site Action Levels to the Depth of Contamination; Backfill Residential Areas with Clean Soil, Regrade Non-Residential Areas, Dispose of Excavated Material in On-Site Repository with a RCRA Subtitle C cap** | | | | | | | | | | |
| B&B Subdivision | | | | | | | | | | |
| 6 in bgs excavation depth | 2.0 | 6 | 1,608 | 2,387 | - | -- | -- | 9 | 3,256 | 2.0 |
| 12 in bgs excavation depth | 1.5 | 12 | 2,355 | 3,498 | - | 9 | 2,504 | 9 | 2,385 | 1.5 |
| 18 in bgs excavation depth | 1.9 | 18 | 4,668 | 6,932 | 9,336 | 18 | 6,617 | 9 | 3,151 | 1.9 |
| *Subtotal* | *5.4* | | *8,631* | *12,818* | *9,336* | | *9,121* | | *8,791* | *5.4* |
| Waterman Smelter (Area of on-site repository subtracted)[5,6] | | | | | | | | | | |
| 6 in bgs excavation depth | 10.8 | 6 | 8,737 | 12,974 | - | - | - | 9 | 17,692 | 10.8 |
| 12 in bgs excavation depth | 2.4 | 12 | 3,870 | 5,748 | - | - | - | 9 | 3,919 | 2.4 |
| 18 in bgs excavation depth | 3.8 | 18 | 9,310 | 13,825 | - | - | - | 9 | 6,284 | 3.8 |
| *Subtotal* | *17.1* | | *21,917* | *32,547* | *0* | | - | | *27,895* | *17.1* |
| ATV Area | | | | | | | | | | |
| 6 in bgs excavation depth | 3.5 | 6 | 2,822 | 4,190 | - | - | - | 9 | 5,714 | 3.5 |
| 12 in bgs excavation depth | 0.7 | 12 | 1,160 | 1,723 | - | - | - | 9 | 1,174 | 0.7 |
| 18 in bgs excavation depth | 3.0 | 18 | 7,183 | 10,666 | - | - | - | 9 | 4,848 | 3.0 |
| *Subtotal* | *7.2* | | *11,164* | *16,579* | *0* | | - | | *11,737* | *7.2* |
| **Subtotal (0 to 18 inches bgs)** | **29.7** | | **41,713** | **61,943** | **9,336** | | **9,121** | | **48,423** | **29.7** |
| Quantities for Chasing Contamination (Assuming an additional 12 inches of contamination in areas of 18-inch excavation depth) | | | | | | | | | | |
| Additional 12 in under 18 in bgs excavation areas | 6.8 | 12 | 10,995 | 16,327 | - | - | - | - | - | - |
| **Total** | | | **52,708** | **78,271** | **9,336** | | **9,121** | | **48,423** | **29.7** |

Notes:
1) The above acreages are preliminary.
2) Geotextile will only be placed in the areas excavated to 18 inches bgs.
3) Backfill and topsoil depths/volumes are based on uncompacted volumes. It is estimated that a 33% reduction in volume will occur during compaction.
4) A 33% compaction factor was estimated for bringing the fill material to grade. Therefore, the areas where soil is excavated to 6 inches will be filled with 9 inches of clean topsoil; the areas where soil is excavated to 12 inches will be filled with 9 inches of un-contaminated backfill followed by 9 inches of clean topsoil; and the areas where soil was excavated to 18 inches will be filled with 18 inches of un-contaminated backfill followed by 9 inches of clean topsoil.
5) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B. In summary, the area of the the on-site repository is 2.0 acres for Alternative 4, 2.4 acres for Alternative 5, and 2.3 acres for Alternative 6.
6) The repository RCRA Subtitle C cap consists of the following layers from top to bottom: 6 inches of gravel armor, 18 inches of common backfill, 4-ounce geotextile fabric, 12 inches of drainage material, 4-ounce geotextile fabric, and a geosynthetic clay liner.
7) The repository soil cover consists of the following layers from top to bottom: 6 inches of uncompacted topsoil, 12 inches of uncompacted backfill, a 4-ounce geotextile fabric.

Conversion Factors:

Average Density of In-Place Material = 110 $lb/ft^3$ (typical value taken from literature for similar soils)
Average Density of Uncompacted Backfill Material = 105 $lb/ft^3$
Average Density of Uncompacted Topsoil Material = 100 $lb/ft^3$
1 acre = 4,840 sq yd
1 acre = 43,560 sq ft
1 cu yd = 27 cu ft

bgs = below ground surface
in = inches
Cu ft = cubic feet
$lb/ft^3$ = pounds per cubic feet
Cu yd = cubic yard
Sq yd = square yard

**Table B-3 (cont'd)**
**Material Requirements and Waste Generation**
**Jacobs Smelter OU2**

| AREA OF CONTAMINATION | AREA[1] (acres) | Excavate DEPTH (inches) | Excavate VOLUME (Cu yd) | Excavate WEIGHT (tons) | Geotextile Fabric[2] AREA (Sq yd) | Backfill[3,4] DEPTH (inches) | Backfill[3,4] WEIGHT (tons) | Topsoil[4] DEPTH (inches) | Topsoil[4] WEIGHT (tons) | Vegetation AREA (acres) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Alternative 6 – Excavate All Material in Excess of Site Action Levels to the Depth of Contamination; Backfill Residential Areas with Clean Soil, Regrade Non-Residential Areas, Dispose of Excavated Material in an On-Site Repository with a Soil Cover** | | | | | | | | | | |
| B&B Subdivision | | | | | | | | | | |
| 6 in bgs excavation depth | 2.0 | 6 | 1,608 | 2,387 | - | -- | -- | 9 | 3,256 | 2.0 |
| 12 in bgs excavation depth | 1.5 | 12 | 2,355 | 3,498 | - | 9 | 2,504 | 9 | 2,385 | 1.5 |
| 18 in bgs excavation depth | 1.9 | 18 | 4,668 | 6,932 | 9,336 | 18 | 6,617 | 9 | 3,151 | 1.9 |
| *Subtotal* | *5.4* | | *8,631* | *12,818* | *9,336* | | *9,121* | | *8,791* | *5.4* |
| Waterman Smelter (Area of on-site repository subtracted)[5,7] | | | | | | | | | | |
| 6 in bgs excavation depth | 10.9 | 6 | 8,763 | 13,013 | - | - | - | 9 | 17,745 | 10.9 |
| 12 in bgs excavation depth | 2.4 | 12 | 3,898 | 5,788 | - | - | - | 9 | 3,947 | 2.4 |
| 18 in bgs excavation depth | 3.9 | 18 | 9,544 | 14,174 | - | - | - | 9 | 6,443 | 3.9 |
| *Subtotal* | *17.2* | | *22,205* | *32,975* | *0* | | - | | *28,134* | *17.2* |
| ATV Area | | | | | | | | | | |
| 6 in bgs excavation depth | 3.5 | 6 | 2,822 | 4,190 | - | - | - | 9 | 5,714 | 3.5 |
| 12 in bgs excavation depth | 0.7 | 12 | 1,160 | 1,723 | - | - | - | 9 | 1,174 | 0.7 |
| 18 in bgs excavation depth | 3.0 | 18 | 7,183 | 10,666 | - | - | - | 9 | 4,848 | 3.0 |
| *Subtotal* | *7.2* | | *11,164* | *16,579* | *0* | | - | | *11,737* | *7.2* |
| **Subtotal (0 to 18 inches bgs)** | **29.8** | | **42,001** | **62,371** | **9,336** | | **9,121** | | **48,662** | **29.8** |
| Quantities for Chasing Contamination (Assuming an additional 12 inches of contamination in areas of 18-inch excavation depth) | | | | | | | | | | |
| Additional 12 in under 18 in bgs excavation areas | 6.9 | 12 | 11,151 | 16,560 | - | - | - | - | - | - |
| **Total** | | | **53,152** | **78,931** | **9,336** | | **9,121** | | **48,662** | **29.8** |

Notes:
1) The above acreages are preliminary.
2) Geotextile will only be placed in the areas excavated to 18 inches bgs.
3) Backfill and topsoil depths/volumes are based on uncompacted volumes. It is estimated that a 33% reduction in volume will occur during compaction.
4) A 33% compaction factor was estimated for bringing the fill material to grade. Therefore, the areas where soil is excavated to 6 inches will be filled with 9 inches of clean topsoil; the areas where soil is excavated to 12 inches will be filled with 9 inches of un-contaminated backfill followed by 9 inches of clean topsoil; and the areas where soil was excavated to 18 inches will be filled with 18 inches of un-contaminated backfill followed by 9 inches of clean topsoil.
5) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B. In summary, the area of the the on-site repository is 2.0 acres for Alternative 4, 2.4 acres for Alternative 5, and 2.3 acres for Alternative 6.
6) The repository RCRA Subtitle C cap consists of the following layers from top to bottom: 6 inches of gravel armor, 18 inches of common backfill, 4-ounce geotextile fabric, 12 inches of drainage material, 4-ounce geotextile fabric, and a geosynthetic clay liner.
7) The repository soil cover consists of the following layers from top to bottom: 6 inches of uncompacted topsoil, 12 inches of uncompacted backfill, a 4-ounce geotextile fabric.

Conversion Factors:

Average Density of In-Place Material = 110 $lb/ft^3$ (typical value taken from literature for similar soils)
Average Density of Uncompacted Backfill Material = 105 $lb/ft^3$
Average Density of Uncompacted Topsoil Material = 100 $lb/ft^3$
1 acre = 4,840 sq yd
1 acre = 43,560 sq ft
1 cu yd = 27 cu ft

bgs = below ground surface
in = inches
Cu ft = cubic feet
$lb/ft^3$ = pounds per cubic feet
Cu yd = cubic yard
Sq yd = square yard

**Table B-4**
**Alternative 2 (Excavate to a depth of 18 inches, backfill, off-site disposal) - Capital Cost Estimate**
**Jacobs Smelters OU2 Residential and Non-Residential Zone**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Truck Scale | Each | 1 | $45,000 | 1 | $45,000 |
| 2 | Clear and Grub Brush | Acres | 32.1 | $550 | 1 | $17,655 |
| 3 | Water Truck - Dust Suppression | Month | 12 | $15,000 | 1 | $180,000 |
| 4 | Excavation | Ton | 69,558 | $10 | 7 | $695,585 |
| 5 | Backfill - material, haul, and place | Ton | 44,555 | $23 | 2 | $1,024,767 |
| 6 | Topsoil - material, haul, and place | Ton | 52,419 | $32 | 2 | $1,677,408 |
| 7 | Geotextile Fabric 4 oz. | Sq yd | 50,534 | $0.98 | 3 | $49,524 |
| 8 | Revegetation | Acres | 32.1 | $300 | 1 | $9,630 |
| 9 | Erosion Control Blankets | Acres | 32.1 | $10,890 | 6 | $349,569 |
| 9 | Transport Bevill Exempt Waste to Subtitle C Hazardous Waste Landfill | Ton | 69,558 | $12.50 | 1 | $869,481 |
| 10 | Disposal of Bevill Exempt Waste at Subtitle C Hazardous Waste Landfill | Ton | 69,558 | $35 | 4 | $2,434,546 |
| 11 | Health & Safety Ambient Air Monitoring | Lump Sum | 1 | $55,950 | 5 | $55,950 |
| 12 | Final Site Wide Clean-up | Each | 1 | $10,000 | 1 | $10,000 |
| | | Total Cost | | | | $7,419,115 |
| | | Mobilization | | | | $300,000 |
| | | Demobilization | | | | $150,000 |
| | | Subtotal | | | | $7,869,115 |
| | | Unidentified Construction Cost (10%) | | | | $786,911 |
| | | Construction Management (10%) | | | | $786,911 |
| | | **TOTAL** | | | | **$9,442,938** |

Assumptions:
a) TCLP testing will not be required by regulation based on the Bevill Exemption; however, a particular commercial facility may require TCLP tests based on policy or permit conditions.
b) Geotextile will only installed in the areas excavated to a depth of 18 inches below ground surface.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) Quote from Steve Simpson with Clean Harbors on 8/8/13.
5) See Table A-23.
6) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.

7) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

oz = ounces
sq yd = square yard
TCLP = Toxic Characteristic Leachability Procedure

**Table B-5**
**Alternative 3 (Cover impacted material with clean soil) - Capital Cost Estimate**
**Jacobs Smelters OU2 Residential and Non-Residential Zone**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Truck Scale | Each | 1 | $45,000 | 1 | $45,000 |
| 2 | Clear and Grub Brush | Acres | 32.1 | $550 | 1 | $17,655 |
| 3 | Water Truck - Dust Suppression | Month | 12 | $15,000 | 1 | $180,000 |
| 4 | Backfill - material, haul, and place | Ton | 55,040 | $23 | 2 | $1,265,919 |
| 5 | Topsoil - material, haul, and place | Ton | 52,419 | $32 | 2 | $1,677,408 |
| 6 | Geotextile Fabric 4 oz. | Sq yd | 155,316 | $0.98 | 3 | $152,209 |
| 7 | Revegetation | Acres | 32.1 | $300 | 1 | $9,630 |
| 8 | Erosion Control Blankets | Acres | 32.1 | $10,890 | 5 | $349,569 |
| 9 | Health & Safety Ambient Air Monitoring | Lump Sum | 1 | $55,950 | 4 | $55,950 |
| 10 | Final Site Wide Clean-up | Each | 1 | $10,000 | 1 | $10,000 |

| | |
|---|---|
| Total Cost | $3,763,341 |
| Mobilization | $300,000 |
| Demobilization | $150,000 |
| Subtotal | $4,213,341 |
| Unidentified Construction Cost (10%) | $421,334 |
| Construction Management (10%) | $421,334 |
| **TOTAL** | **$5,056,009** |

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) See Table A-23.
5) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.

oz = ounces
Sq yd = square yard

**Table B-6**
**Alternative 4 (Excavate to a depth of 18 inches, backfill, disposal at on-site repository with RCRA Subtitle C cap) - Capital Cost Estimate**

**Jacobs Smelters OU2 Residential and Non-Residential Zone**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Truck Scale | Each | 1 | $45,000 | 1 | $45,000 |
| 2 | Clear and Grub Brush | Acres | 30.1 | $550 | 1 | $16,555 |
| 3 | Water Truck - Dust Suppression | Month | 24 | $15,000 | 1 | $360,000 |
| 4 | Excavation of Contaminated Soils | Ton | 63,067 | $10 | 7 | $630,673 |
| 5 | Backfill - material, haul, and place | Ton | 38,693 | $23 | 2 | $889,931 |
| 6 | Topsoil - material, haul, and place | Ton | 49,151 | $32 | 2 | $1,572,823 |
| 7 | Geotextile Fabric 4 oz. | Sq yd | 43,245 | $0.98 | 3 | $42,380 |
| 8 | Revegetation | Acres | 30.1 | $300 | 1 | $9,030 |
| 9 | Erosion Control Blankets | Acres | 30.1 | $10,890 | 6 | $327,789 |
| 10 | On-Site Repository Generation | Each | 1 | $1,698,450 | 4 | $1,698,450 |
| 11 | Transport Contaminated Soil to On-Site Repository | Ton | 63,067 | $4 | 1 | $252,269 |
| 12 | Health & Safety Ambient Air Monitoring | Lump Sum | 1 | $67,950 | 5 | $67,950 |
| 13 | Final Site Wide Clean-up | Each | 1 | $10,000 | 1 | $10,000 |
| | | Total Cost | | | | $5,922,850 |
| | | Mobilization | | | | $300,000 |
| | | Demobilization | | | | $150,000 |
| | | Subtotal | | | | $6,372,850 |
| | | Unidentified Construction Cost (10%) | | | | $637,285 |
| | | Construction Management (10%) | | | | $637,285 |
| | | **TOTAL** | | | | **$7,647,420** |

Assumptions:
a) Quantities based on the areas of contamination located within the proposed area for the on-site repository are not included in the estimates for excavation, backfilling, geotextile, and revegetation.
b) Geotextile will only be installed in the areas excavated to a depth of 18 inches below ground surface.
c) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B.
d) The volume of material excavated from the repository, with the exception of the top 18 inches, is of suitable quality and does not have elevated lead concentrations. Therefore, it can be used as clean backfill for the project.
e) For cost estimating purposes, it is assumed that the clean soil generated as part of the on-site repository excavation will not be used to backfill the remedial excavation.
f) Blasting will not be required to develop the on-site repository.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) See Table A-20.
5) See Table A-23.
6) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.
7) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

oz = ounces
Sq yd = square yard

**Table B-7**
**Alternative 5 (Excavate to depth of contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with RCRA Subtitle C cap) - Capital Cost Estimate**
**Jacobs Smelters OU2 Residential and Non-Residential Zone**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Truck Scale | Each | 1 | $45,000 | 1 | $45,000 |
| 2 | Clear and Grub Brush | Acres | 29.7 | $550 | 1 | $16,335 |
| 3 | Water Truck - Dust Suppression | Month | 24 | $15,000 | 1 | $360,000 |
| 4 | Excavation of Contaminated Soils | Ton | 61,943 | $10 | 7 | $619,434 |
| 5 | Excavation for Chasing Contamination | Ton | 16,327 | $10 | 7 | $163,274 |
| 6 | Regrade Excavated Areas | Sq yd | 143,748 | $3 | 1 | $431,244 |
| 7 | Backfill - material, haul, and place | Ton | 9,121 | $23 | 2 | $209,790 |
| 8 | Topsoil - material, haul, and place | Ton | 48,423 | $32 | 2 | $1,549,551 |
| 9 | Geotextile Fabric 4 oz. | Sq yd | 9,336 | $0.98 | 3 | $9,150 |
| 10 | Revegetation | Acres | 29.7 | $300 | 1 | $8,910 |
| 11 | Erosion Control Blankets | Acres | 29.7 | $10,890 | 6 | $323,433 |
| 12 | On-Site Repository Generation | Each | 1 | $2,052,466 | 4 | $2,052,466 |
| 13 | Transport Contaminated Soil to On-Site Repository | Ton | 78,271 | $4 | 1 | $313,083 |
| 14 | Health & Safety Ambient Air Monitoring | Lump Sum | 1 | $67,950 | 5 | $67,950 |
| 15 | Final Site Wide Clean-up | Each | 1 | $10,000 | 1 | $10,000 |
| | | Total Cost | | | | $6,179,619 |
| | | Mobilization | | | | $300,000 |
| | | Demobilization | | | | $150,000 |
| | | Subtotal | | | | $6,629,619 |
| | | Unidentified Construction Cost (10%) | | | | $662,962 |
| | | Construction Management (10%) | | | | $662,962 |
| | | **TOTAL** | | | | **$7,955,543** |

Assumptions:
a) Geotextile will only be installed in the areas excavated to a depth of 18 inches below ground surface in residential areas.
b) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B.
c) The volume of material excavated from the repository, with the exception of the top 18 inches, is of suitable quality and does not have elevated lead concentrations. Therefore, it can be used as clean backfill for the project.
d) For cost estimating purposes, it is assumed that the clean soil generated as part of the on-site repository excavation will not be used to backfill the remedial excavation.
e) Blasting will not be required to develop the on-site repository.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) See Table A-20.
5) See Table A-23.
6) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.
7) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

oz = ounces
Sq yd = square yard

**Table B-8**
**Alternative 6 (Excavate to depth of contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with soil cover) - Capital Cost Estimate**
**Jacobs Smelters OU2 Residential and Non-Residential Zone**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Truck Scale | Each | 1 | $45,000 | 1 | $45,000 |
| 2 | Clear and Grub Brush | Acres | 29.8 | $550 | 1 | $16,390 |
| 3 | Water Truck - Dust Suppression | Month | 21 | $15,000 | 1 | $315,000 |
| 4 | Excavation of Contaminated Soils | Ton | 62,371 | $10 | 7 | $623,711 |
| 5 | Excavation for Chasing Contamination | Ton | 16,560 | $10 | 7 | $165,598 |
| 6 | Regrade Excavated Areas | Sq yd | 144,232 | $3 | 1 | $432,696 |
| 7 | Backfill - material, haul, and place | Ton | 9,121 | $23 | 2 | $209,790 |
| 8 | Topsoil - material, haul, and place | Ton | 48,662 | $32 | 2 | $1,557,183 |
| 9 | Geotextile Fabric 4 oz. | Sq yd | 9,336 | $0.98 | 3 | $9,150 |
| 10 | Revegetation | Acres | 29.8 | $300 | 1 | $8,940 |
| 11 | Erosion Control Blankets | Acres | 29.8 | $10,890 | 6 | $324,522 |
| 12 | On-Site Repository Generation | Each | 1 | $1,532,022 | 4 | $1,532,022 |
| 13 | Transport Contaminated Soil to On-Site Repository | Ton | 78,931 | $4 | 1 | $315,723 |
| 14 | Health & Safety Ambient Air Monitoring | Lump Sum | 1 | $61,950 | 5 | $61,950 |
| 15 | Final Site Wide Clean-up | Each | 1 | $10,000 | 1 | $10,000 |
| | | Total Cost | | | | $5,627,674 |
| | | Mobilization | | | | $300,000 |
| | | Demobilization | | | | $150,000 |
| | | Subtotal | | | | $6,077,674 |
| | | Unidentified Construction Cost (10%) | | | | $607,767 |
| | | Construction Management (10%) | | | | $607,767 |
| | | **TOTAL** | | | | **$7,293,209** |

Assumptions:
a) Geotextile will only be installed in the areas excavated to a depth of 18 inches below ground surface in residential areas.
b) The size of the on-site repository was estimated based on the volume of contaminated soil excavated and the selected cover design for each alternative. The material requirements and waste generation associated with the on-site repository are described in Appendix B.
c) The volume of material excavated from the repository, with the exception of the top 18 inches, is of suitable quality and does not have elevated lead concentrations. Therefore, it can be used as clean backfill for the project.
d) For cost estimating purposes, it is assumed that the clean soil generated as part of the on-site repository excavation will not be used to backfill the remedial excavation.
e) Blasting will not be required to develop the on-site repository.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) See Table A-20.
5) See Table A-23.
6) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.
7) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

oz = ounces
Sq yd = square yard

**Table B-9**
**Alternative 2 (Excavate to a depth of 18 inches, backfill, off-site disposal) - Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

| Alternative 2 | | |
|---|---|---|
| **Soil Cover** | - | acres |
| **Excavation & Backfill** | 32.1 | acres |
| **On-Site Repository Area** | - | acres |
| **Total Acreages** | 32.1 | acres |

**Annual Maintenance**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Repair Supplies | Lump Sum | 1 | 1 | $1,000 | $1,000 | Engineer estimate | Drums, clean soil, seeds, hand tools, etc. |
| Repair Equipment, Rental | Lump Sum | 1 | 1 | $1,200 | $1,200 | Engineer estimate | Bobcat loader, fertilizer spreader, etc. |
| Travel (Round Trip) | Miles | 100 | 1 | $0.56 | $56 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$2,256** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 1 | $120 | $360 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 32 | 1 | $65 | $2,080 | URS | Assume ~one hour per acre; field technician labor rate. |
| Onsite Supervision | Hour | 32 | 1 | $85 | $2,720 | URS | Assume ~one hour per acre; geologist/engineer labor rate. |
| Offsite Support | Hour | 3 | 1 | $55 | $165 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$5,325** | | |
| Contingency Allowance | | 10% | | $7,581 | **$758** | | |
| Annual Cost | | | | | **$8,339** | | |

Notes:
a) Maintenance is estimated to occur annually after the first year.
b) Maintenance will include clean soil replacement, erosion control, and reseeding if necessary.

**Monitoring Summary Reports - Annual**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Reproduction | Page | 300 | 1 | $0.10 | $30 | URS | 10 copies, 30 pages per copy |
| Postage / Packaging | Package | 3 | 1 | $20 | $60 | FedEx | Express Mail / FedEx |
| ODC Subtotal | | | | | **$90** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 12 | 1 | $120 | $1,440 | URS | Project manager labor rate. |
| Offsite Labor | Hour | 48 | 1 | $85 | $4,080 | URS | Geologist / engineer labor rate. |
| Offsite Drafting/Graphics | Hour | 16 | 1 | $65 | $1,040 | URS | CADD /GIS technician labor rate. |
| Offsite Support | Hour | 16 | 1 | $55 | $880 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$7,440** | | |
| Contingency Allowance | | 10% | | $7,530 | **$753** | | |
| Annual Cost | | | | | **$8,283** | | |

Notes:
CADD = Computer-Aided Design Drafting
GIS = Geographical Information System
ODC = Other Direct Charges

| **Total Annual O&M Cost:** | **$16,622** |
|---|---|

**Table B-10**
**Alternative 3 (Cover impacted material with clean soil) - Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

| Alternative 3 | | |
|---|---|---|
| **Soil Cover** | 32.1 | acres |
| **Excavation & Backfill** | - | acres |
| **On-Site Repository Area** | - | acres |
| **Total Acreages** | 32.1 | acres |

**Annual Maintenance**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Repair Supplies | Lump Sum | 1 | 1 | $1,500 | $1,500 | Engineer estimate | Drums, clean soil, seeds, hand tools, etc. |
| Repair Equipment, Rental | Lump Sum | 1 | 1 | $2,000 | $2,000 | Engineer estimate | Bobcat loader, fertilizer spreader, etc. |
| Travel (Round Trip) | Miles | 100 | 1 | $0.56 | $56 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$3,556** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 1 | $120 | $360 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 32 | 1 | $65 | $2,080 | URS | Assume ~one hour per acre; field technician labor rate. |
| Onsite Supervision | Hour | 32 | 1 | $85 | $2,720 | URS | Assume ~one hour per acre; geologist/engineer labor rate. |
| Offsite Support | Hour | 3 | 1 | $55 | $165 | URS | Office clerical staff labor rate |
| Labor Subtotal | | | | | **$5,325** | | |
| Contingency Allowance | | 10% | | $8,881 | **$888** | | |
| Annual Cost | | | | | **$9,769** | | |

Notes:
a) Maintenance is estimated to occur annually after the first year.
b) Maintenance will include clean soil replacement, erosion control, and reseeding if necessary.

**Monitoring Summary Reports - Annual**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Reproduction | Page | 300 | 1 | $0.10 | $30 | URS | 10 copies, 30 pages per copy |
| Postage / Packaging | Package | 3 | 1 | $20 | $60 | FedEx | Express Mail / FedEx |
| ODC Subtotal | | | | | **$90** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 12 | 1 | $120 | $1,440 | URS | Project manager labor rate. |
| Offsite Labor | Hour | 48 | 1 | $85 | $4,080 | URS | Geologist / engineer labor rate. |
| Offsite Drafting/Graphics | Hour | 16 | 1 | $65 | $1,040 | URS | CADD /GIS technician labor rate. |
| Offsite Support | Hour | 16 | 1 | $55 | $880 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$7,440** | | |
| Contingency Allowance | | 10% | | $7,530 | **$753** | | |
| Annual Cost | | | | | **$8,283** | | |

Notes:
CADD = Computer-Aided Design Drafting
GIS = Geographical Information System
ODC = Other Direct Charges

| **Total Annual O&M Cost:** | **$18,052** |
|---|---|

**Table B-11**
**Alternative 4 (Excavate to a depth of 18 inches, backfill, disposal at on-site repository with RCRA Subtitle C cap) - Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

| Alternative 4 | | |
|---|---|---|
| **Soil Cover** | - | acres |
| **Excavation & Backfill (residential)** | 5.4 | acres |
| **On-Site Repository Area** | 2 | acres |
| **Total Acreages** | 7.4 | acres |

**Annual Maintenance**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Repair Supplies | Lump Sum | 1 | 1 | $2,000 | $2,000 | Engineer estimate | Drums, clean soil, seeds, hand tools, etc. |
| Repair Equipment, Rental | Lump Sum | 1 | 1 | $2,400 | $2,400 | Engineer estimate | Bobcat loader, fertilizer spreader, etc. |
| Travel (Round Trip) | Miles | 100 | 1 | $0.56 | $56 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$4,456** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 1 | 1 | $120 | $120 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 7 | 1 | $65 | $455 | URS | Assume ~one hour per acre; field technician labor rate. |
| Onsite Supervision | Hour | 7 | 1 | $85 | $595 | URS | Assume ~one hour per acre; geologist/engineer labor rate. |
| Offsite Support | Hour | 1 | 1 | $55 | $55 | URS | Office clerical staff labor rate |
| Labor Subtotal | | | | | **$1,225** | | |
| Contingency Allowance | | 10% | | $5,681 | **$568** | | |
| Annual Cost | | | | | **$6,249** | | |

Notes:
a) Maintenance is estimated to occur annually after the first year.
b) Maintenance will include clean soil replacement, erosion control, and reseeding if necessary.

**Monitoring Summary Reports - Annual**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Reproduction | Page | 700 | 1 | $0.10 | $70 | URS | 10 copies, 70 pages per copy |
| Postage / Packaging | Package | 3 | 1 | $20 | $60 | FedEx | Express Mail / FedEx |
| ODC Subtotal | | | | | **$130** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 12 | 1 | $120 | $1,440 | URS | Project manager labor rate. |
| Offsite Labor | Hour | 24 | 1 | $85 | $2,040 | URS | Chemist labor rate. |
| Offsite Labor | Hour | 80 | 1 | $85 | $6,800 | URS | Geologist / engineer labor rate. |
| Offsite Drafting/Graphics | Hour | 16 | 1 | $65 | $1,040 | URS | CADD /GIS technician labor rate. |
| Offsite Support | Hour | 20 | 1 | $55 | $1,100 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$12,420** | | |
| Contingency Allowance | | 10% | | $12,550 | **$1,255** | | |
| Annual Cost | | | | | **$13,805** | | |

Notes:
CADD = Computer-Aided Design Drafting
GIS = Geographical Information System
ODC = Other Direct Charges

**Table B-11 (cont.)**
**Alternative 4 (Excavate to a depth of 18 inches, backfill, disposal at on-site repository with RCRA Subtitle C cap) - Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

**First Year of Groundwater Monitoring**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Dedicated Pumps and Tubing | Each | 5 | 1 | $1,200 | $6,000 | Engineer estimate | One Grundfos 3" pump with dedicated tubing for the two upgradient wells and the three downgradient wells, for a total of five pumps with dedicated tubing. |
| Generator Rental | Days | 3 | 8 | $125 | $3,000 | Engineer estimate | Rental of generator for sampling effort. |
| Upgradient Analytical Costs | Each | 3 | 8 | $40 | $960 | AWAL | One sample from the two upgradient wells with one duplicate sample eight times the first year. Analysis of lead and arsenic only. Analytical costs from America West Analytical Laboratories (AWAL). |
| Downgradient Analytical Costs | Each | 3 | 4 | $40 | $480 | AWAL | One sample from the three downgradient wells four times the first year. Analysis of lead and arsenic only. Analytical costs from AWAL. |
| Sampling ODCs | Lump Sum | 1 | 8 | $250 | $2,000 | Engineer estimate | Gloves, bottles, drums, rags, etc. |
| Travel (Round Trip) | Miles | 100 | 8 | $0.56 | $444 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$12,884** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 8 | $120 | $2,880 | URS | Project manager labor rate |
| Onsite Labor | Hour | 24 | 8 | $65 | $12,480 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Field technician labor rate. |
| Onsite Supervision | Hour | 24 | 8 | $85 | $16,320 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Engineer or geologist labor rate. |
| Offsite Support | Hour | 2 | 8 | $55 | $880 | URS | Office clerical staff rate to support field efforts and order supplies. |
| Labor Subtotal | | | | | **$32,560** | | |
| Contingency Allowance | | 10% | | $45,444 | **$4,544** | | |
| Cost for First Year of Monitoring | | | | | **$49,988** | | |

Notes:
a) The first year of groundwater monitoring will consist of sampling the two upgradient wells on eight separate events and the three downgradient wells on four separate events, as per UDEQ UAC R315-308-2(5)(a). Since a quality assurance/quality control (QA/QC) sample is required, it is assumed that three upgradient samples are required and one will be used for QA/QC purposes.
b) A dedicated pump and dedicated tubing for each well is included.
c) It is assumed that each sample event will last three days.

**Table B-11 (cont.)**
**Alternative 4 (Excavate to a depth of 18 inches, backfill, disposal at on-site repository with RCRA Subtitle C cap) - Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

**Groundwater Monitoring After the First Year**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Generator Rental | Days | 3 | 2 | $125 | $750 | Engineer estimate | Rental of generator for sampling effort. |
| Upgradient and Downgradient Sampling Costs | Each | 6 | 2 | $40 | $480 | AWAL | One sample from the two upgradient wells and the three downgradient wells with one duplicate sample two times per year after the first year. Analysis of lead and arsenic only. Analytical costs from AWAL. |
| Sampling ODCs | Lump Sum | 1 | 2 | $250 | $500 | Engineer estimate | Gloves, bottles, drums, rags, etc. |
| Travel (Round Trip) | Miles | 100 | 2 | $0.56 | $111 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$1,841** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 2 | $120 | $720 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 24 | 2 | $65 | $3,120 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Field technician labor rate. |
| Onsite Supervision | Hour | 24 | 2 | $85 | $4,080 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Engineer or geologist labor rate. |
| Offsite Support | Hour | 2 | 2 | $55 | $220 | URS | Office clerical staff labor rate to support field efforts and order supplies. |
| Labor Subtotal | | | | | **$8,140** | | |
| Contingency Allowance | | 10% | | $9,981 | **$998** | | |
| Cost for Groundwater Monitoring After the First Year | | | | | **$10,979** | | |

Notes:
a) Groundwater monitoring after the first year will consist of sampling the two upgradient wells and three downgradient wells on a semi-annual basis as per UDEQ UAC R315-308-2(5)(b). Since a quality assurance/quality control (QA/QC) sample is required, it is assumed that a total of six samples are required per sampling event and one will be used for QA/QC purposes.
b) It is assumed that each sample event will last three days.
c) Redevelopment of the wells is not included in the annual costs because it is not likely needed on an annual basis. Redevelopment of the wells will likely be required every 5-10 years at an approximate cost of $1,500 per well.

| | |
|---|---|
| **O&M Cost for First Year:** | **$70,042** |
| **O&M Cost after First Year:** | **$31,033** |

**Table B-12**
**Alternative 5 (Excavate to depth contamination, backfill residential areas, regrade non-residential areas; and disposal at on-site repository with RCRA Subtitle C cap)**
**Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

| Alternative 5 | | |
|---|---|---|
| **Soil Cover** | - | acres |
| **Excavation & Backfill (residential)** | 5.4 | acres |
| **On-Site Repository Area** | 2.4 | acres |
| **Total Acreages** | 7.8 | acres |

**Annual Maintenance**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Repair Supplies | Lump Sum | 1 | 1 | $500 | $500 | Engineer estimate | Fertilizer spreader, clean soil, seeds, hand tools, etc. |
| Travel (Round Trip) | Miles | 100 | 1 | $0.56 | $56 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$556** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 1 | $120 | $360 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 8 | 1 | $65 | $520 | URS | Assume ~1 hour per acre; field technician labor rate. |
| Onsite Supervision | Hour | 8 | 1 | $85 | $680 | URS | Assume ~1 hour per acre; geologist/engineer labor rate. |
| Offsite Support | Hour | 2 | 1 | $55 | $110 | URS | Office clerical staff labor rate |
| Labor Subtotal | | | | | **$1,670** | | |
| Contingency Allowance | | 10% | | $2,226 | **$223** | | |
| Annual Cost | | | | | **$2,448** | | |

Notes:
a) Maintenance is estimated to occur annually after the first year.
b) Maintenance will include clean soil replacement, erosion control, and reseeding if necessary.

**Monitoring Summary Reports - Annual**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Reproduction | Page | 700 | 1 | $0.10 | $70 | URS | 10 copies, 70 pages per copy |
| Postage / Packaging | Package | 3 | 1 | $20 | $60 | FedEx | Express Mail / FedEx |
| ODC Subtotal | | | | | **$130** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 12 | 1 | $120 | $1,440 | URS | Project manager labor rate. |
| Offsite Labor | Hour | 24 | 1 | $85 | $2,040 | URS | Chemist labor rate. |
| Offsite Labor | Hour | 80 | 1 | $85 | $6,800 | URS | Geologist / engineer labor rate. |
| Offsite Drafting/Graphics | Hour | 16 | 1 | $65 | $1,040 | URS | CADD /GIS technician labor rate. |
| Offsite Support | Hour | 20 | 1 | $55 | $1,100 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$12,420** | | |
| Contingency Allowance | | 10% | | $12,550 | **$1,255** | | |
| Annual Cost | | | | | **$13,805** | | |

Notes:
CADD = Computer-Aided Design Drafting
GIS = Geographical Information System
ODC = Other Direct Charges

**Table B-12 (cont.)**
**Alternative 5 (Excavate to depth contamination, backfill residential areas, regrade non-residential areas; and disposal at on-site repository with RCRA Subtitle C cap)**
**Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

**First Year of Groundwater Monitoring**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Dedicated Pumps and Tubing | Each | 5 | 1 | $1,200 | $6,000 | Engineer estimate | One Grundfos 3" pump with dedicated tubing for the two upgradient wells and the three downgradient wells, for a total of five pumps with dedicated tubing. |
| Generator Rental | Days | 3 | 8 | $125 | $3,000 | Engineer estimate | Rental of generator for sampling effort. |
| Upgradient Analytical Costs | Each | 3 | 8 | $40 | $960 | AWAL | One sample from the two upgradient wells with one duplicate sample eight times the first year. Analysis of lead and arsenic only. Analytical costs from America West Analytical Laboratories (AWAL). |
| Downgradient Analytical Costs | Each | 3 | 4 | $40 | $480 | AWAL | One sample from the three downgradient wells four times the first year. Analysis of lead and arsenic only. Analytical costs from AWAL. |
| Sampling ODCs | Lump Sum | 1 | 8 | $250 | $2,000 | Engineer estimate | Gloves, bottles, drums, rags, etc. |
| Travel (Round Trip) | Miles | 100 | 8 | $0.56 | $444 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$12,884** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 8 | $120 | $2,880 | URS | Project Manager labor rate |
| Onsite Labor | Hour | 24 | 8 | $65 | $12,480 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Field technician rate. |
| Onsite Supervision | Hour | 24 | 8 | $85 | $16,320 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Engineer or geologist labor rate. |
| Offsite Support | Hour | 2 | 8 | $55 | $880 | URS | Office clerical staff rate to support field efforts and order supplies. |
| Labor Subtotal | | | | | **$32,560** | | |
| Contingency Allowance | | 10% | | $45,444 | **$4,544** | | |
| Cost for First Year of Monitoring | | | | | **$49,988** | | |

Notes:
a) The first year of groundwater monitoring will consist of sampling the two upgradient wells on eight separate events and the three downgradient wells on four separate events, as per UDEQ UAC R315-308-2(5)(a). Since a quality assurance/quality control (QA/QC) sample is required, it is assumed that three upgradient samples are required and one will be used for QA/QC purposes.

b) A dedicated pump and dedicated tubing for each well is included.
c) It is assumed that each sample event will last three days.

**Table B-12 (cont.)**
**Alternative 5 (Excavate to depth contamination, backfill residential areas, regrade non-residential areas; and disposal at on-site repository with RCRA Subtitle C cap)**
**Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

**Groundwater Monitoring After the First Year**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Generator Rental | Days | 3 | 2 | $125 | $750 | Engineer estimate | Rental of generator for sampling effort. |
| Upgradient and Downgradient Sampling Costs | Each | 6 | 2 | $40 | $480 | AWAL | One sample from the two upgradient wells and the three downgradient wells with one duplicate sample two times per year after the first year. Analysis of lead and arsenic only. Analytical costs from AWAL. |
| Sampling ODCs | Lump Sum | 1 | 2 | $250 | $500 | Engineer estimate | Gloves, bottles, drums, rags, etc. |
| Travel (Round Trip) | Miles | 100 | 2 | $0.56 | $111 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$1,841** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 2 | $120 | $720 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 24 | 2 | $65 | $3,120 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Field technician labor rate. |
| Onsite Supervision | Hour | 24 | 2 | $85 | $4,080 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Engineer or geologist labor rate. |
| Offsite Support | Hour | 2 | 2 | $55 | $220 | URS | Office clerical staff labor rate to support field efforts and order supplies. |
| Labor Subtotal | | | | | **$8,140** | | |
| Contingency Allowance | | 10% | | $9,981 | **$998** | | |
| Cost for Groundwater Monitoring After the First Year | | | | | **$10,979** | | |

Notes:
a) Groundwater monitoring after the first year will consist of sampling the two upgradient wells and three downgradient wells on a semi-annual basis as per UDEQ UAC R315-308-2(5)(b). Since a quality assurance/quality control (QA/QC) sample is required, it is assumed that a total of six samples are required per sampling event and one will be used for QA/QC purposes.

b) It is assumed that each sample event will last three days.
c) Redevelopment of the wells is not included in the annual costs because it is not likely needed on an annual basis. Redevelopment of the wells will likely be required every 5-10 years at an approximate cost of $1,500 per well.

| | |
|---|---|
| **O&M Cost for First Year:** | **$66,241** |
| **O&M Cost after First Year:** | **$27,232** |

**Table B-13**
**Alternative 6 (Excavate to depth contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with soil cover)**
**Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

| Alternative 5 | | |
|---|---|---|
| **Soil Cover** | - | acres |
| **Excavation & Backfill (residential)** | 5.4 | acres |
| **On-Site Repository Area** | 2.3 | acres |
| **Total Acreages** | 7.7 | acres |

**Annual Maintenance**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Repair Supplies | Lump Sum | 1 | 1 | $500 | $500 | Engineer estimate | Fertilizer spreader, clean soil, seeds, hand tools, etc. |
| Travel (Round Trip) | Miles | 100 | 1 | $0.56 | $56 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$556** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 1 | $120 | $360 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 8 | 1 | $65 | $520 | URS | Assume ~1 hour per acre; field technician labor rate. |
| Onsite Supervision | Hour | 8 | 1 | $85 | $680 | URS | Assume ~1 hour per acre; geologist/engineer labor rate. |
| Offsite Support | Hour | 2 | 1 | $55 | $110 | URS | Office clerical staff labor rate |
| Labor Subtotal | | | | | **$1,670** | | |
| Contingency Allowance | | 10% | | $2,226 | **$223** | | |
| Annual Cost | | | | | **$2,448** | | |

Notes:
a) Maintenance is estimated to occur annually after the first year.
b) Maintenance will include clean soil replacement, erosion control, and reseeding if necessary.

**Monitoring Summary Reports - Annual**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Reproduction | Page | 700 | 1 | $0.10 | $70 | URS | 10 copies, 70 pages per copy |
| Postage / Packaging | Package | 3 | 1 | $20 | $60 | FedEx | Express Mail / FedEx |
| ODC Subtotal | | | | | **$130** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 12 | 1 | $120 | $1,440 | URS | Project manager labor rate. |
| Offsite Labor | Hour | 24 | 1 | $85 | $2,040 | URS | Chemist labor rate. |
| Offsite Labor | Hour | 80 | 1 | $85 | $6,800 | URS | Geologist / engineer labor rate. |
| Offsite Drafting/Graphics | Hour | 16 | 1 | $65 | $1,040 | URS | CADD /GIS technician labor rate. |
| Offsite Support | Hour | 20 | 1 | $55 | $1,100 | URS | Office clerical staff labor rate. |
| Labor Subtotal | | | | | **$12,420** | | |
| Contingency Allowance | | 10% | | $12,550 | **$1,255** | | |
| Annual Cost | | | | | **$13,805** | | |

Notes:
CADD = Computer-Aided Design Drafting
GIS = Geographical Information System
ODC = Other Direct Charges

**Table B-13 (cont.)**
**Alternative 6 (Excavate to depth contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with soil cover)**
**Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

**First Year of Groundwater Monitoring**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Dedicated Pumps and Tubing | Each | 5 | 1 | $1,200 | $6,000 | Engineer estimate | One Grundfos 3" pump with dedicated tubing for the two upgradient wells and the three downgradient wells, for a total of five pumps with dedicated tubing. |
| Generator Rental | Days | 3 | 8 | $125 | $3,000 | Engineer estimate | Rental of generator for sampling effort. |
| Upgradient Analytical Costs | Each | 3 | 8 | $40 | $960 | AWAL | One sample from the two upgradient wells with one duplicate sample eight times the first year. Analysis of lead and arsenic only. Analytical costs from America West Analytical Laboratories (AWAL). |
| Downgradient Analytical Costs | Each | 3 | 4 | $40 | $480 | AWAL | One sample from the three downgradient wells four times the first year. Analysis of lead and arsenic only. Analytical costs from AWAL. |
| Sampling ODCs | Lump Sum | 1 | 8 | $250 | $2,000 | Engineer estimate | Gloves, bottles, drums, rags, etc. |
| Travel (Round Trip) | Miles | 100 | 8 | $0.56 | $444 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$12,884** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 8 | $120 | $2,880 | URS | Project Manager labor rate |
| Onsite Labor | Hour | 24 | 8 | $65 | $12,480 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Field technician rate. |
| Onsite Supervision | Hour | 24 | 8 | $85 | $16,320 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Engineer or geologist labor rate. |
| Offsite Support | Hour | 2 | 8 | $55 | $880 | URS | Office clerical staff rate to support field efforts and order supplies. |
| Labor Subtotal | | | | | **$32,560** | | |
| Contingency Allowance | | 10% | | $45,444 | **$4,544** | | |
| Cost for First Year of Monitoring | | | | | **$49,988** | | |

Notes:
a) The first year of groundwater monitoring will consist of sampling the two upgradient wells on eight separate events and the three downgradient wells on four separate events, as per UDEQ UAC R315-308-2(5)(a). Since a quality assurance/quality control (QA/QC) sample is required, it is assumed that three upgradient samples are required and one will be used for QA/QC purposes.
b) A dedicated pump and dedicated tubing for each well is included.
c) It is assumed that each sample event will last three days.

**Table B-13 (cont.)**
**Alternative 6 (Excavate to depth contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with soil cover)**
**Operation and Maintenance Cost Estimate**
**Jacobs Smelters OU2**

**Groundwater Monitoring After the First Year**

| Description | Unit | Quantity per Event | Frequency (Events per Year) | Unit Cost | Total | Source | Notes |
|---|---|---|---|---|---|---|---|
| Other Direct Charges | | | | | | | |
| Generator Rental | Days | 3 | 2 | $125 | $750 | Engineer estimate | Rental of generator for sampling effort. |
| Upgradient and Downgradient Sampling Costs | Each | 6 | 2 | $40 | $480 | AWAL | One sample from the two upgradient wells and the three downgradient wells with one duplicate sample two times per year after the first year. Analysis of lead and arsenic only. Analytical costs from AWAL. |
| Sampling ODCs | Lump Sum | 1 | 2 | $250 | $500 | Engineer estimate | Gloves, bottles, drums, rags, etc. |
| Travel (Round Trip) | Miles | 100 | 2 | $0.56 | $111 | URS | Based on a 100-mile round trip |
| ODC Subtotal | | | | | **$1,841** | | |
| Labor Charges | | | | | | | |
| Project Management | Hour | 3 | 2 | $120 | $720 | URS | Project manager labor rate. |
| Onsite Labor | Hour | 24 | 2 | $65 | $3,120 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Field technician labor rate. |
| Onsite Supervision | Hour | 24 | 2 | $85 | $4,080 | URS | Assume 24 hours per sampling event to travel to site, pick up supplies and generator, sample, pack and ship cooler, return generator, etc. Engineer or geologist labor rate. |
| Offsite Support | Hour | 2 | 2 | $55 | $220 | URS | Office clerical staff labor rate to support field efforts and order supplies. |
| Labor Subtotal | | | | | **$8,140** | | |
| Contingency Allowance | | 10% | | $9,981 | **$998** | | |
| Cost for Groundwater Monitoring After the First Year | | | | | **$10,979** | | |

Notes:
a) Groundwater monitoring after the first year will consist of sampling the two upgradient wells and three downgradient wells on a semi-annual basis as per UDEQ UAC R315-308-2(5)(b). Since a quality assurance/quality control (QA/QC) sample is required, it is assumed that a total of six samples are required per sampling event and one will be used for QA/QC purposes.

b) It is assumed that each sample event will last three days.
c) Redevelopment of the wells is not included in the annual costs because it is not likely needed on an annual basis. Redevelopment of the wells will likely be required every 5-10 years at an approximate cost of $1,500 per well.

| | |
|---|---|
| **O&M Cost for First Year:** | **$66,241** |
| **O&M Cost after First Year:** | **$27,232** |

**Table B-14**
**Alternative 2 (Excavate to a depth of 18 inches, backfill, off-site disposal)**
**Present Cost of Construction, Operation, Maintenance, and Monitoring**

| Year | Capital Cost | Annual O&M Cost | Subtotal Annual Expenditures | Discount Factor [1] 7% | Present Worth[2] |
|---|---|---|---|---|---|
| 0 | $9,442,938 | | $9,442,938 | 1.000 | $9,442,938 |
| 1 | | $16,622 | $16,622 | 0.935 | $15,534 |
| 2 | | $16,622 | $16,622 | 0.873 | $14,518 |
| 3 | | $16,622 | $16,622 | 0.816 | $13,568 |
| 4 | | $16,622 | $16,622 | 0.763 | $12,681 |
| 5 | | $16,622 | $16,622 | 0.713 | $11,851 |
| 6 | | $16,622 | $16,622 | 0.666 | $11,076 |
| 7 | | $16,622 | $16,622 | 0.623 | $10,351 |
| 8 | | $16,622 | $16,622 | 0.582 | $9,674 |
| 9 | | $16,622 | $16,622 | 0.544 | $9,041 |
| 10 | | $16,622 | $16,622 | 0.508 | $8,450 |
| 11 | | $16,622 | $16,622 | 0.475 | $7,897 |
| 12 | | $16,622 | $16,622 | 0.444 | $7,380 |
| 13 | | $16,622 | $16,622 | 0.415 | $6,897 |
| 14 | | $16,622 | $16,622 | 0.388 | $6,446 |
| 15 | | $16,622 | $16,622 | 0.362 | $6,024 |
| 16 | | $16,622 | $16,622 | 0.339 | $5,630 |
| 17 | | $16,622 | $16,622 | 0.317 | $5,262 |
| 18 | | $16,622 | $16,622 | 0.296 | $4,918 |
| 19 | | $16,622 | $16,622 | 0.277 | $4,596 |
| 20 | | $16,622 | $16,622 | 0.258 | $4,295 |
| 21 | | $16,622 | $16,622 | 0.242 | $4,014 |
| 22 | | $16,622 | $16,622 | 0.226 | $3,752 |
| 23 | | $16,622 | $16,622 | 0.211 | $3,506 |
| 24 | | $16,622 | $16,622 | 0.197 | $3,277 |
| 25 | | $16,622 | $16,622 | 0.184 | $3,063 |
| 26 | | $16,622 | $16,622 | 0.172 | $2,862 |
| 27 | | $16,622 | $16,622 | 0.161 | $2,675 |
| 28 | | $16,622 | $16,622 | 0.150 | $2,500 |
| 29 | | $16,622 | $16,622 | 0.141 | $2,336 |
| Present Worth of Capital Cost | | | | | $9,443,000 |
| Present Worth of O&M Cost | | | | | $204,000 |
| Total Present Worth (30 Years) | | | | | $9,647,000 |

Notes:
1) Discount rate of 7% and inflation rate of 0% were based on guidance from Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", (USEPA. 2000). Discount factor = $1/(1+\text{Discount Rate}^{\text{Year}})$.
2) Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

a) Present worth values rounded to the nearest $1000.
b) Assume that Year 0 is the year 2014.

**Table B-15**
**Alternative 3 (Cover impacted material with clean soil)**
**Present Cost of Construction, Operation, Maintenance, and Monitoring**

| Year | Capital Cost | Annual O&M Cost | Subtotal Annual Expenditures | Discount Factor [1] 7% | Present Worth[2] |
|---|---|---|---|---|---|
| 0 | $5,056,009 | | $5,056,009 | 1.000 | $5,056,009 |
| 1 | | $18,052 | $18,052 | 0.935 | $16,871 |
| 2 | | $18,052 | $18,052 | 0.873 | $15,767 |
| 3 | | $18,052 | $18,052 | 0.816 | $14,735 |
| 4 | | $18,052 | $18,052 | 0.763 | $13,771 |
| 5 | | $18,052 | $18,052 | 0.713 | $12,871 |
| 6 | | $18,052 | $18,052 | 0.666 | $12,029 |
| 7 | | $18,052 | $18,052 | 0.623 | $11,242 |
| 8 | | $18,052 | $18,052 | 0.582 | $10,506 |
| 9 | | $18,052 | $18,052 | 0.544 | $9,819 |
| 10 | | $18,052 | $18,052 | 0.508 | $9,176 |
| 11 | | $18,052 | $18,052 | 0.475 | $8,576 |
| 12 | | $18,052 | $18,052 | 0.444 | $8,015 |
| 13 | | $18,052 | $18,052 | 0.415 | $7,491 |
| 14 | | $18,052 | $18,052 | 0.388 | $7,001 |
| 15 | | $18,052 | $18,052 | 0.362 | $6,543 |
| 16 | | $18,052 | $18,052 | 0.339 | $6,115 |
| 17 | | $18,052 | $18,052 | 0.317 | $5,715 |
| 18 | | $18,052 | $18,052 | 0.296 | $5,341 |
| 19 | | $18,052 | $18,052 | 0.277 | $4,991 |
| 20 | | $18,052 | $18,052 | 0.258 | $4,665 |
| 21 | | $18,052 | $18,052 | 0.242 | $4,360 |
| 22 | | $18,052 | $18,052 | 0.226 | $4,074 |
| 23 | | $18,052 | $18,052 | 0.211 | $3,808 |
| 24 | | $18,052 | $18,052 | 0.197 | $3,559 |
| 25 | | $18,052 | $18,052 | 0.184 | $3,326 |
| 26 | | $18,052 | $18,052 | 0.172 | $3,108 |
| 27 | | $18,052 | $18,052 | 0.161 | $2,905 |
| 28 | | $18,052 | $18,052 | 0.150 | $2,715 |
| 29 | | $18,052 | $18,052 | 0.141 | $2,537 |

| | |
|---|---|
| Present Worth of Capital Cost | $5,056,000 |
| Present Worth of O&M Cost | $222,000 |
| Total Present Worth (30 Years) | $5,278,000 |

Notes:

1) Discount rate of 7% and inflation rate of 0% were based on guidance from Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", (USEPA. 2000). Discount factor = $1/(1+\text{Discount Rate}^{\text{Year}})$.

2) Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

a) Present worth values rounded to the nearest $1000.

b) Assume that Year 0 is the year 2014.

**Table B-16**
**Alternative 4 (Excavate to a depth of 18 inches, backfill, disposal at on-site repository with RCRA Subtitle C cap)**
**Present Cost of Construction, Operation, Maintenance, and Monitoring**

| Year | Capital Cost | Annual O&M Cost | Subtotal Annual Expenditures | Discount Factor [1] 7% | Present Worth[2] |
|---|---|---|---|---|---|
| 0 | $7,647,420 | | $7,647,420 | 1.000 | $7,647,420 |
| 1 | | $70,042 | $70,042 | 0.935 | $65,460 |
| 2 | | $31,033 | $31,033 | 0.873 | $27,105 |
| 3 | | $31,033 | $31,033 | 0.816 | $25,332 |
| 4 | | $31,033 | $31,033 | 0.763 | $23,675 |
| 5 | | $31,033 | $31,033 | 0.713 | $22,126 |
| 6 | | $31,033 | $31,033 | 0.666 | $20,678 |
| 7 | | $31,033 | $31,033 | 0.623 | $19,326 |
| 8 | | $31,033 | $31,033 | 0.582 | $18,061 |
| 9 | | $31,033 | $31,033 | 0.544 | $16,880 |
| 10 | | $31,033 | $31,033 | 0.508 | $15,775 |
| 11 | | $31,033 | $31,033 | 0.475 | $14,743 |
| 12 | | $31,033 | $31,033 | 0.444 | $13,779 |
| 13 | | $31,033 | $31,033 | 0.415 | $12,877 |
| 14 | | $31,033 | $31,033 | 0.388 | $12,035 |
| 15 | | $31,033 | $31,033 | 0.362 | $11,248 |
| 16 | | $31,033 | $31,033 | 0.339 | $10,512 |
| 17 | | $31,033 | $31,033 | 0.317 | $9,824 |
| 18 | | $31,033 | $31,033 | 0.296 | $9,181 |
| 19 | | $31,033 | $31,033 | 0.277 | $8,581 |
| 20 | | $31,033 | $31,033 | 0.258 | $8,019 |
| 21 | | $31,033 | $31,033 | 0.242 | $7,495 |
| 22 | | $31,033 | $31,033 | 0.226 | $7,004 |
| 23 | | $31,033 | $31,033 | 0.211 | $6,546 |
| 24 | | $31,033 | $31,033 | 0.197 | $6,118 |
| 25 | | $31,033 | $31,033 | 0.184 | $5,718 |
| 26 | | $31,033 | $31,033 | 0.172 | $5,344 |
| 27 | | $31,033 | $31,033 | 0.161 | $4,994 |
| 28 | | $31,033 | $31,033 | 0.150 | $4,667 |
| 29 | | $31,033 | $31,033 | 0.141 | $4,362 |
| Present Worth of Capital Cost | | | | | $7,647,000 |
| Present Worth of O&M Cost | | | | | $417,000 |
| Total Present Worth (30 Years) | | | | | $8,065,000 |

Notes:
1) Discount rate of 7% and inflation rate of 0% were based on guidance from Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", (USEPA. 2000). Discount factor = $1/(1+\text{Discount Rate}^{\text{Year}})$.
2) Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

a) Present worth values rounded to the nearest $1000.
b) Assume that Year 0 is the year 2014.

**Table B-17**
**Alternative 5 (Excavate to depth of contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with RCRA Subtitle C cap)**
**Present Cost of Construction, Operation, Maintenance, and Monitoring**

| Year | Capital Cost | Annual O&M Cost | Subtotal Annual Expenditures | Discount Factor [1] 7% | Present Worth[2] |
|---|---|---|---|---|---|
| 0 | $7,955,543 | | $7,955,543 | 1.000 | $7,955,543 |
| 1 | | $66,241 | $66,241 | 0.935 | $61,908 |
| 2 | | $27,232 | $27,232 | 0.873 | $23,786 |
| 3 | | $27,232 | $27,232 | 0.816 | $22,230 |
| 4 | | $27,232 | $27,232 | 0.763 | $20,775 |
| 5 | | $27,232 | $27,232 | 0.713 | $19,416 |
| 6 | | $27,232 | $27,232 | 0.666 | $18,146 |
| 7 | | $27,232 | $27,232 | 0.623 | $16,959 |
| 8 | | $27,232 | $27,232 | 0.582 | $15,849 |
| 9 | | $27,232 | $27,232 | 0.544 | $14,812 |
| 10 | | $27,232 | $27,232 | 0.508 | $13,843 |
| 11 | | $27,232 | $27,232 | 0.475 | $12,938 |
| 12 | | $27,232 | $27,232 | 0.444 | $12,091 |
| 13 | | $27,232 | $27,232 | 0.415 | $11,300 |
| 14 | | $27,232 | $27,232 | 0.388 | $10,561 |
| 15 | | $27,232 | $27,232 | 0.362 | $9,870 |
| 16 | | $27,232 | $27,232 | 0.339 | $9,224 |
| 17 | | $27,232 | $27,232 | 0.317 | $8,621 |
| 18 | | $27,232 | $27,232 | 0.296 | $8,057 |
| 19 | | $27,232 | $27,232 | 0.277 | $7,530 |
| 20 | | $27,232 | $27,232 | 0.258 | $7,037 |
| 21 | | $27,232 | $27,232 | 0.242 | $6,577 |
| 22 | | $27,232 | $27,232 | 0.226 | $6,147 |
| 23 | | $27,232 | $27,232 | 0.211 | $5,745 |
| 24 | | $27,232 | $27,232 | 0.197 | $5,369 |
| 25 | | $27,232 | $27,232 | 0.184 | $5,018 |
| 26 | | $27,232 | $27,232 | 0.172 | $4,689 |
| 27 | | $27,232 | $27,232 | 0.161 | $4,382 |
| 28 | | $27,232 | $27,232 | 0.150 | $4,096 |
| 29 | | $27,232 | $27,232 | 0.141 | $3,828 |

| | |
|---|---|
| Present Worth of Capital Cost | $7,956,000 |
| Present Worth of O&M Cost | $371,000 |
| Total Present Worth (30 Years) | $8,326,000 |

Notes:
1) Discount rate of 7% and inflation rate of 0% were based on guidance from Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", (USEPA. 2000). Discount factor = $1/(1+\text{Discount Rate}^{\text{Year}})$.
2) Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

a) Present worth values rounded to the nearest $1000.
b) Assume that Year 0 is the year 2014.

**Table B-18**
**Alternative 6 (Excavate to depth of contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with soil cover)**
**Present Cost of Construction, Operation, Maintenance, and Monitoring**

| Year | Capital Cost | Annual O&M Cost | Subtotal Annual Expenditures | Discount Factor [1] 7% | Present Worth[2] |
|---|---|---|---|---|---|
| 0 | $7,293,209 | | $7,293,209 | 1.000 | $7,293,209 |
| 1 | | $66,241 | $66,241 | 0.935 | $61,908 |
| 2 | | $27,232 | $27,232 | 0.873 | $23,786 |
| 3 | | $27,232 | $27,232 | 0.816 | $22,230 |
| 4 | | $27,232 | $27,232 | 0.763 | $20,775 |
| 5 | | $27,232 | $27,232 | 0.713 | $19,416 |
| 6 | | $27,232 | $27,232 | 0.666 | $18,146 |
| 7 | | $27,232 | $27,232 | 0.623 | $16,959 |
| 8 | | $27,232 | $27,232 | 0.582 | $15,849 |
| 9 | | $27,232 | $27,232 | 0.544 | $14,812 |
| 10 | | $27,232 | $27,232 | 0.508 | $13,843 |
| 11 | | $27,232 | $27,232 | 0.475 | $12,938 |
| 12 | | $27,232 | $27,232 | 0.444 | $12,091 |
| 13 | | $27,232 | $27,232 | 0.415 | $11,300 |
| 14 | | $27,232 | $27,232 | 0.388 | $10,561 |
| 15 | | $27,232 | $27,232 | 0.362 | $9,870 |
| 16 | | $27,232 | $27,232 | 0.339 | $9,224 |
| 17 | | $27,232 | $27,232 | 0.317 | $8,621 |
| 18 | | $27,232 | $27,232 | 0.296 | $8,057 |
| 19 | | $27,232 | $27,232 | 0.277 | $7,530 |
| 20 | | $27,232 | $27,232 | 0.258 | $7,037 |
| 21 | | $27,232 | $27,232 | 0.242 | $6,577 |
| 22 | | $27,232 | $27,232 | 0.226 | $6,147 |
| 23 | | $27,232 | $27,232 | 0.211 | $5,745 |
| 24 | | $27,232 | $27,232 | 0.197 | $5,369 |
| 25 | | $27,232 | $27,232 | 0.184 | $5,018 |
| 26 | | $27,232 | $27,232 | 0.172 | $4,689 |
| 27 | | $27,232 | $27,232 | 0.161 | $4,382 |
| 28 | | $27,232 | $27,232 | 0.150 | $4,096 |
| 29 | | $27,232 | $27,232 | 0.141 | $3,828 |

| | |
|---|---|
| Present Worth of Capital Cost | $7,293,000 |
| Present Worth of O&M Cost | $371,000 |
| Total Present Worth (30 Years) | $7,664,000 |

Notes:
1) Discount rate of 7% and inflation rate of 0% were based on guidance from Section 4.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", (USEPA. 2000). Discount factor = $1/(1+\text{Discount Rate}^{\text{Year}})$.
2) Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

a) Present worth values rounded to the nearest $1000.
b) Assume that Year 0 is the year 2014.

**Table B-19**
**Alternatives 4, 5, & 6 - On-Site Repository Quantities**

| | | Excavate | | | Cover Material | | | | Geotextile Fabric | Fencing[3] | Drainage Ditch[3] | Vegetation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **AREA (acres)** | DEPTH (inches) | VOLUME (cu.yd.) | WEIGHT (tons) | AREA (sq.yd.) | DEPTH (inches) | VOLUME (cu.yd.) | WEIGHT (tons) | AREA (sq.yd.) | LENGTH (ft) | LENGTH (ft) | AREA (acres) |
| **Alternative 4** | | | | | | | | | | | | |
| Excavation of On-Site Repository (See Appendix B for sizing calculations)[1] | 2.0 | - | 47,188 | 70,074 | -- | -- | -- | -- | -- | 1,171 | 1,171 | -- |
| Excavated Material from Residential and Undeveloped Areas | 30.1 | -- | 42,470 | 63,067 | -- | -- | -- | -- | -- | -- | -- | -- |
| Work Area[4] | 2.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.0 |
| RCRA Subtitle C cap Material | | | | | | | | | | | | |
| Top Layer - 6 in gravel armor[2] | 2.0 | -- | -- | -- | 9,525 | 6 | 1,588 | 2,381 | -- | -- | -- | -- |
| Top Layer - 18 in backfill | 2.0 | -- | -- | -- | 9,525 | 18 | 4,763 | 6,751 | -- | -- | -- | -- |
| Drainage Layer - 12 in sand or gravel[2] | 2.0 | -- | -- | -- | 9,525 | 12 | 3,175 | 4,763 | 9,525 | -- | -- | -- |
| Impermeable layer - Geosynthetic Clay Liner | 2.0 | -- | -- | -- | 9,525 | -- | -- | -- | 9,525 | -- | -- | -- |
| **TOTAL** | | | | | **38,100** | **36** | **9,525** | **13,895** | **19,050** | **1,171** | **1,171** | **2.0** |
| **Alternative 5** | | | | | | | | | | | | |
| Excavation of On-Site Repository (See Appendix B for sizing calculations)[1] | 2.4 | - | 58,564 | 86,968 | -- | -- | -- | -- | -- | 1,305 | 1,305 | -- |
| Excavated Material from Residential and Undeveloped Areas | 29.7 | -- | 52,708 | 78,271 | -- | -- | -- | -- | -- | -- | -- | -- |
| Work Area[4] | 2.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.0 |
| RCRA Subtitle C cap Material | | | | | | | | | | | | |
| Top Layer - 6 in gravel armor[2] | 2.4 | -- | -- | -- | 11,821 | 6 | 1,970 | 2,955 | -- | -- | -- | -- |
| Top Layer - 18 in backfill | 2.4 | -- | -- | -- | 11,821 | 18 | 5,911 | 8,378 | -- | -- | -- | -- |
| Drainage Layer - 12 in sand or gravel[2] | 2.4 | -- | -- | -- | 11,821 | 12 | 3,940 | 5,911 | 11,821 | -- | -- | -- |
| Impermeable layer - Geosynthetic Clay Liner | 2.4 | -- | -- | -- | 11,821 | -- | -- | -- | 11,821 | -- | -- | -- |
| **TOTAL** | | | | | **47,285** | **36** | **11,821** | **17,244** | **23,643** | **1,305** | **1,305** | **2.0** |
| **Alternative 6** | | | | | | | | | | | | |
| Excavation of On-Site Repository (See Appendix B for sizing calculations)[1] | 2.3 | - | 54,985 | 81,653 | -- | -- | -- | -- | -- | 1,264 | 1,264 | -- |
| Excavated Material from Residential and Undeveloped Areas | 29.8 | -- | 53,152 | 78,931 | -- | -- | -- | -- | -- | -- | -- | -- |
| Work Area[4] | 2.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.0 |
| Soil Cover Material | | | | | | | | | | | | |
| Topsoil Layer | 2.3 | -- | -- | -- | 11,099 | 9 | 2,775 | 3,746 | -- | -- | -- | 2.3 |
| Backfill Layer | 2.3 | -- | -- | -- | 11,099 | 9 | 2,775 | 4,120 | 11,099 | -- | -- | -- |
| **TOTAL** | | | | | **22,198** | **18** | **5,549** | **7,866** | **11,099** | **1,264** | **1,264** | **4.3** |

Conversion Factors:

Average Density of In-Place Material = 110 $lb/ft^3$ (typical value taken from literature for similar soils)

Average Density of Uncompacted Backfill Material = 105 $lb/ft^3$

Average Density of Uncompacted Topsoil Material = 100 $lb/ft^3$

1 acre = 4,840 sq yd

1 acre = 43,560 sq ft

1 cu yd = 27 cu ft

1) The provided on-site repository acreage is preliminary and does not include any additional excavation that may be required to maintain slope stability. Acreage was estimated based the volume of excavation required to accommodate contaminated soil, a RCRA Subtitle C cap for Alternatives 4 and 5, and a soil cover for Alternative 6. See Appendix B for volume calculations.

2) Based on estimates from Staker Parson Tooele, the calculated weight for these materials was calculated as: Volume (cu.yd.)*1.5 = Weight (tons)

3) The drainage ditch and fence length is based on the perimeter of the repository.

4) Work area includes area around the repository as well as the area needed to stockpile soil from the repository.

Notes:
Cu yd = cubic yard
ft = foot
in = inch
Sq yd = square yard

**Table B-20**
**Alternative 4 (Excavate to a depth of 18 inches, backfill, disposal at on-site repository with RCRA Subtitle C cap)**
**On-Site Repository Cost Summary**
**Jacobs Smelter OU2 FS**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Clear and Grub Brush | Acres | 4 | $550 | 1 | $2,182 |
| 2 | Grade Road to Repository | Sq yd | 3,333 | $3.00 | 1 | $10,000 |
| 3 | Excavation of Repository | Ton | 70,074 | $10.00 | 8 | $700,741 |
| **Top Layer** | | | | | | |
| 4 | Gravel Armour (D50 3/4") - material and haul | Ton | 2,381 | $35.00 | 1 | $83,344 |
| 5 | Backfill - material, haul, and place | Ton | 6,751 | $0.00 | 6 | $0 |
| **Drainage Layer** | | | | | | |
| 6 | Geotextile Fabric - 4 oz. | Sq yd | 9,525 | $0.98 | 2 | $9,335 |
| 7 | Drainage Layer (Graded material 3/8" minus) - material and haul | Ton | 4,763 | $35.00 | 1 | $166,688 |
| **Low Permeability Layer** | | | | | | |
| 8 | Geotextile Fabric - 4 oz. | Sq yd | 9,525 | $0.98 | 2 | $9,335 |
| 9 | Geosynthetic Clay Liner | Sq yd | 9,525 | $4.50 | 1 | $42,863 |
| 10 | Installation of Geosynthetic Clay Liner | Sq yd | 9,525 | $2.25 | 1 | $21,431 |
| **Installation and Other** | | | | | | |
| 11 | Compaction of Contaminated Soil | Cu yd | 42,470 | $4.00 | 1 | $169,878 |
| 12 | Spread RCRA Subtitle C cap Material with Front End Loader and Bulldozer | Cu yd | 9,525 | $5.00 | 1 | $47,625 |
| 13 | Grade Four Cap Layers | Sq yd | 38,100 | $3.00 | 1 | $114,300 |
| 14 | Monitoring Well Installation and Development | Each | 5 | $30,000 | 3 | $150,000 |
| 15 | Drainage Ditch Around Repository | Linear Foot | 1,171 | $1.50 | 1 | $1,757 |
| 16 | Rock for Drainage Trenches | Cu yd | 260 | $50.00 | 1 | $13,013 |
| 17 | Install Fencing | Linear Foot | 1,171 | $45.00 | 4 | $52,702 |
| 18 | Site Revegetation | Acres | 2 | $300.00 | 1 | $600 |
| 19 | Erosion Control Blankets | Acres | 2 | $10,890 | 7 | $21,780 |
| | | Subtotal | | | | $1,617,572 |
| | | On-Site Repository Design Cost (5%) | | | | $80,879 |
| | | **TOTAL** | | | | **$1,698,450** |
| | | **Total per ton of soil** | | | | **$26.93** |

Assumptions:
a) Five groundwater monitoring wells (2 upgradient and 3 downgradient of the repository) drilled to a depth of 200 feet will be required for the on-site repository.

b) The on-site repository will be capped with multilayered, composite system to meet the requirements of a RCRA Subtitle C Cap and includes the following layers (from top to bottom): 6-inch gravel armor; 18-inch common fill; 4 oz. geotextile; 12-inch drainage layer; 4 oz. geotextile; geosynthetic clay liner (GCL). Details on the on-site repository are found in Appendix B.
c) Clean excavated material will be used for the 18-inch common fill layer.
d) Blasting will not be required to develop the on-site repository.
e) Drainange ditch will be approximately six feet wide and one foot deep.
f) Site revegetation will only be required for the 2 acre work area.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
3) Engineer's estimate.
4) RSMeans Heavy Construction Data 2010; *32 31 23.10 0320* , 6 ft high privacy vinyl fence.
5) See Table A-23.
6) Excess clean material from the construction of the on-site repository will be used as backfill in the top layer of the RCRA Subtitle C cap. Therefore, the material cost for backfill is not included. The costs for compacting and spreading backfill are included in items #11 and 12, respectively.
7) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.

8) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

Cu yd = cubic yard
Sq yd = square yard
oz = ounces

**Table B-21**
**Alternative 5 (Excavate to depth of contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with RCRA Subtitle C cap)**
**On-Site Repository Cost Summary**
**Jacobs Smelter OU2 FS**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Clear and Grub Brush | Acres | 4 | $550 | 1 | $2,443 |
| 2 | Grade Road to Repository | Sq yd | 3,333 | $3.00 | 1 | $10,000 |
| 3 | Excavation of Repository | Ton | 86,968 | $10.00 | 8 | $869,675 |
| **Top Layer** | | | | | | |
| 4 | Gravel Armour (D50 3/4") - material and haul | Ton | 2,955 | $35.00 | 1 | $103,436 |
| 5 | Backfill - material, haul, and place | Ton | 8,378 | $0.00 | 6 | $0 |
| **Drainage Layer** | | | | | | |
| 6 | Geotextile Fabric - 4 oz. | Sq yd | 11,821 | $0.98 | 2 | $11,585 |
| 7 | Drainage Layer (Graded material 3/8" minus) - material and haul | Ton | 5,911 | $35.00 | 1 | $206,873 |
| **Low Permeability Layer** | | | | | | |
| 8 | Geotextile Fabric - 4 oz. | Sq yd | 11,821 | $0.98 | 2 | $11,585 |
| 9 | Geosynthetic Clay Liner | Sq yd | 11,821 | $4.50 | 1 | $53,196 |
| 10 | Installation of Geosynthetic Clay Liner | Sq yd | 11,821 | $2.25 | 1 | $26,598 |
| **Installation and Other** | | | | | | |
| 11 | Compaction of Contaminated Soil | Cu yd | 52,708 | $4.00 | 1 | $210,830 |
| 12 | Spread RCRA Subtitle C cap Material with Front End Loader and Bulldozer | Cu yd | 11,821 | $5.00 | 1 | $59,106 |
| 13 | Grade Four Cap Layers | Sq yd | 47,285 | $3.00 | 1 | $141,855 |
| 14 | Monitoring Well Installation and Development | Each | 5 | $30,000 | 3 | $150,000 |
| 15 | Drainage Ditch Around Repository | Linear Foot | 1,305 | $1.50 | 1 | $1,957 |
| 16 | Rock for Drainage Trenches | Cu yd | 290 | $50.00 | 1 | $14,497 |
| 17 | Install Fencing | Linear Foot | 1,305 | $45.00 | 4 | $58,712 |
| 18 | Site Revegetation | Acres | 2 | $300 | 1 | $600 |
| 19 | Erosion Control Blankets | Acres | 2 | $10,890 | 7 | $21,780 |
| | | Subtotal | | | | $1,954,729 |
| | | On-Site Repository Design Cost (5%) | | | | $97,736 |
| | | **TOTAL** | | | | **$2,052,466** |
| | | **Total per ton of soil** | | | | **$26.22** |

Assumptions:
a) Five groundwater monitoring wells (2 upgradient and 3 downgradient of the repository) drilled to a depth of 200 feet will be required for the on-site repository.

b) The on-site repository will be capped with multilayered, composite system to meet the requirements of a RCRA Subtitle C Cap and includes the following layers (from top to bottom): 6-inch gravel armor; 18-inch common fill; 4 oz. geotextile; 12-inch drainage layer; 4 oz. geotextile; geosynthetic clay liner (GCL). Details on the on-site repository are found in Appendix B.
c) Clean excavated material will be used for the 18-inch common fill layer.
d) Blasting will not be required to develop the on-site repository.
e) Drainange ditch will be approximately six feet wide and one foot deep.
f) Site revegetation will only be required for the 2 acre work area.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
3) Engineer's estimate.
4) RSMeans Heavy Construction Data 2010; *32 31 23.10 0320* , 6 ft high privacy vinyl fence.
5) See Table A-23.
6) Excess clean material from the construction of the on-site repository will be used as backfill in the top layer of the RCRA Subtitle C cap. Therefore, the material cost for backfill is not included. The costs for compacting and spreading backfill are included in items #11 and 12, respectively.
7) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.
8) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

Cu yd = cubic yard
Sq yd = square yard
oz = ounces

**Table B-22**
**Alternative 6 (Excavate to depth of contamination, backfill residential areas, regrade non-residential areas, and disposal at on-site repository with soil cover)**
**On-Site Repository Cost Summary**
**Jacobs Smelter OU2 FS**

| Item# | Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|---|
| 1 | Clear and Grub Brush | Acres | 4 | $550 | 1 | $2,361 |
| 2 | Grade Road to Repository | Sq yd | 3,333 | $3.00 | 1 | $10,000 |
| 3 | Excavation of Repository | Ton | 81,653 | $10.00 | 9 | $816,526 |
| **Soil Cover** | | | | | | |
| 4 | Backfill - material, haul, and place | Ton | 4,120 | $0.00 | 7 | $0 |
| 5 | Topsoil - material, haul, and place | Ton | 3,746 | $32.00 | 2 | $119,867 |
| 6 | Erosion control mat - material and place | Sq ft | 99,890 | $0.35 | 8 | $34,961 |
| 7 | Geotextile Fabric - 4 oz. | Sq yd | 11,099 | $0.98 | 3 | $10,877 |
| **Installation and Other** | | | | | | |
| 8 | Compaction of Contaminated Soil | Cu yd | 53,152 | $4.00 | 1 | $212,608 |
| 9 | Spread Material with Front End Loader and Bulldozer | Cu yd | 5,549 | $5.00 | 1 | $27,747 |
| 10 | Monitoring Well Installation and Development | Each | 5 | $30,000 | 4 | $150,000 |
| 11 | Drainage Ditch Around Repository | Linear Foot | 1,264 | $1.50 | 1 | $1,896 |
| 12 | Rock for Drainage Trenches | Cu yd | 281 | $50.00 | 1 | $14,047 |
| 13 | Install Fencing | Linear Foot | 1,264 | $45.00 | 5 | $56,890 |
| 14 | Site Revegetation | Acres | 4 | $300.00 | 1 | $1,288 |
| 15 | Erosion Control Blankets | Acres | 4 | $10,890 | 7 | $46,752 |
| | | Subtotal | | | | $1,459,069 |
| | | On-Site Repository Design Cost (5%) | | | | $72,953 |
| | | **TOTAL** | | | | **$1,532,022** |
| | | **Total per ton of soil** | | | | **$19.41** |

Assumptions:
a) Five groundwater monitoring wells (2 upgradient and 3 downgradient of the repository) drilled to a depth of 200 feet will be required for the on-site repository.

b) The on-site repository will be capped with 12 inches of uncompacted backfill; 6 inches of uncompacted topsoil; and 4-oz geotextile fabric. The soil cover will be compacted to a 12-inch soil cover. Details on the on-site repository are found in Appendix B.
c) Blasting will not be required to develop the on-site repository.
d) Clean excavated material will be used for the 12-inch backfill layer.
e) Drainange ditch will be approximately six feet wide and one foot deep.
f) Site revegetation will be required for the 2 acre work area and the on-site repository.

Notes:
1) Quote received from Environmental Remediation, LLC on 3/20/13.
2) Quote received from AET Environmental on 3/21/13.
3) Quote received from Geodynamics on 3/21/13. Typar non-woven fabric, price includes material and labor.
4) Engineer's estimate.
5) RSMeans Heavy Construction Data 2010; *32 31 23.10 0320* , 6 ft high privacy vinyl fence
6) See Table A-23.
7) Excess clean material from the construction of the on-site repository will be used as backfill in the soil cover. Therefore, the material cost for backfill is not included. The costs for compacting and spreading backfill are included in items #8 and #9, respectively.
8) Quote received from Direct Push Services LLC on 10/25/11 for the Davenport Flagstaff site and includes installation and materials for coconut straw erosion control blankets.
9) Excavation cost based on the quote received from Environmental Remediaion, LLC on 3/20/13 and range of costs in 2014 RS Means.

Cu yd = cubic yard
Sq ft = square feet
Sq yd = square yard
oz = ounces

**Table B-23**
**Health & Safety Ambient Air Monitoring**
**Jacobs Smelters OU2**

**Health & Safety Ambient Air Sampling Costs for 3 Months**

| Description | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|
| Data Ram | Per Month | 3 | $1,000 | 1 | $3,000 |
| Air Pump | Per Day | 90 | $80 | 2 | $7,200 |
| Analysis | Per Sample | 370 | $90 | 3 | $33,300 |
| Air Pump Calibrators | Per Month | 3 | $150 | | $450 |
| | | | | **Total for 3 Months of Monitoring** | **$43,950** |

**Health & Safety Ambient Air Monitoring (Data Ram) Costs for Project Duration**

| Alternative | Units | Quantity | Unit Cost | Notes | Cost |
|---|---|---|---|---|---|
| Data Ram for Alternative 2 (12 months) | Per Month | 12 | $1,000 | 4 | $12,000 |
| Data Ram for Alternative 3 (9-12 months) | Per Month | 12 | $1,000 | 4 | $12,000 |
| Data Ram for Alternative 4 (21-24 months) | Per Month | 24 | $1,000 | 4 | $24,000 |
| Data Ram for Alternative 5 (24 months) | Per Month | 24 | $1,000 | 4 | $24,000 |
| Data Ram for Alternative 6 (18-21 months) | Per Month | 18 | $1,000 | 4 | $18,000 |

**Health & Safety Ambient Air Monitoring Total Costs**

| Alternative | Cost |
|---|---|
| Alternative 2 | $55,950 |
| Alternative 3 | $55,950 |
| Alternative 4 | $67,950 |
| Alternative 5 | $67,950 |
| Alternative 6 | $61,950 |

1) Two Data Ram stations (one upwind and one downwind) at $500 per unit for the duration of the project.
2) Minimum of two air pumps (one upwind and one downwind) at $40 per unit per day for 90 days.
3) Assume four samples will be collected per day (one upwind sample, one downwind sample, one trip blank, and one field duplicate) for three months. Additionally, 10 samples from workers will be collected.
4) The longest project duration is used for cost estimating purposes.

# APPENDIX C

# RESPONSIVENESS SUMMARY

**Comments:**

Public Comments and Agency Responses

Commenter: Thomas Karjola

1. Comment: *What type of soil will replace the soil being removed?*

   Response: The removed soil will be replaced with a mixture of top soil and clean fill. Clean fill will be placed in areas that require excavation deeper than 6 inches and machine roll compacted. Clean top soil will be placed over all areas that require excavation. The Remedial Design will provide specifications governing granular size and organic content for both the fill and top soil that will be utilized during construction. The source of any fill material will be inspected and approved by UDEQ prior to placement.

2. Comment: What happens in the future if somebody excavates deeper than 18 inches?

   Response: With the assistance of UDEQ and EPA, the Town of Stockton developed and implemented a Hazardous Soils Ordinance (#2000-04) in fall of 2010. This ordinance identifies areas within the town of Stockton with residual contamination and requires soils excavated within those areas be handled in accordance with a Soils Management Plan that provides instruction for the safe handling and disposal of contaminated soil. In addition the Town of Stockton has built a repository specifically for contaminated soil. Following the excavation of OU2 properties, a geo textile fabric will be placed over areas with remaining contaminated soil to serve as a visible marker to warn workers if excavation takes place in the future. After construction UDEQ and EPA and the Town of Stockton will update the Hazardous Soils Ordinance to include properties addressed during the OU2 clean-up.

3. Comment: How will dust be mitigated during clean up?

   Response: There is always the possibility of dust generation during construction activities. UDEQ and EPA have been involved in several residential cleanups within the State. Both UDEQ and EPA require intensive dust control restriction during construction activities to minimize exposure and recontamination due to dust dispersion. The cleanup contractor will be required to submit a dust control plan that will be implemented to mitigate visible emissions, including fugitive dust. For similar construction projects within the state fugitive dust has been controlled through extensive use of watering trucks. In addition air monitors will be placed up-wind and down-wind of construction areas to ensure that the community is not exposed to hazardous materials.

4. Comment: Due to the proximity of the Waterman Smelter to houses, clean up should be to residential levels to prevent exposure.

   Response: EPA's policy is to, where possible; implement remedies that achieve the reasonably anticipated land uses that are determined during the site investigation and alternative development. Clean-up levels are calculated for exposure scenarios that are based on the reasonably anticipated land uses. Based on observed use of the undeveloped OU2 area, the exposure scenario of "recreational ATV use" was selected. The clean-up levels calculated for this exposure scenario are based on conservative assumptions regarding frequency of use and ingestion rates due to inhalation and ingestion of contaminated dust and soil.

   Additionally, UDEQ and EPA recognize that there exists some uncertainty regarding exposure of residents in the Rawhide Ranchettes and B&B Subdivisions to dust from the undeveloped area. After the clean-up is complete, there will be some undeveloped areas where lead concentrations will be between the residential and undeveloped cleanup levels. To address this uncertainty, UDEQ and EPA will incorporate dust monitoring near the residential areas during Remedial Design activities. The results of this dust monitoring will be used to evaluate exposure to residential areas and help determine design criteria that assure the remedy is protective for both the undeveloped land use and nearby residential areas.

5. Comment: What can be done to compel Nathan Broadbank to repair the repository fence?

   Response: EPA Enforcement is examining various options for how best to address the recurring damage to the repository fence. The contaminated material within the repository is effectively contained under an impermeable cap and 18 inches of clean cover and does not pose a health risk.

6. Can air monitors be placed near homes after the remediation to ensure that there is no exposure to "hazardous" dust?

   Response: As stated in the response to Comment 3, air monitors will be placed in up-wind and down-wind locations during construction activities to ensure that there is no exposure during construction activities. In addition UDEQ and EPA will incorporate dust monitoring near the residential areas into Remedial Design activities to evaluate if there will be exposure risk to residential areas after clean-up.

Commenter: Jay Carley

1. Comment: There should be a secondary confinement to prevent livestock from damaging the respository fence so that it is not the original developer's responsibility.

   Response: EPA Enforcement is examining various options for how best to address the recurring damage to the repository fence. The contaminated material within the repository is effectively contained under an impermeable cap and 18 inches of clean cover and does not pose a health risk.

Commenter: Melinda Viereg

1. Comment: What effect will lead contaminated soil (below residential clean up levels) have on dogs?

   Response: It is highly unlikely that soil containing lead below the residential cleanup level will result in lead poisoning in dogs. The cleanup levels are designed to be protective of young children less than 7 years of age who may inadvertently ingest 200 mg of soil every single day for 7 years. Based on veterinarian case histories, the primary risk to dogs is not the ingestion of lead in soil, but the ingestion of lead containing items such as lead based paint, car batteries, plumbing materials, solder, food or water in ceramic bowls, golf balls, etc.

2. Comment: What are the effects of lead and arsenic (currently) on dogs?

   Response: The symptoms for lead poisoning mostly relate to gastrointestinal (GI) distress and central nervous system effects. GI distress is typically observed with chronic and low level exposures. Symptoms include vomiting, diarrhea, poor appetite or abdominal pain. Central nervous systems effects are more common in acute exposures in young animals. Symptoms include lethargy, anxiety and seizures. Ingestion of lead-based paints is the most commonly identified source of lead poisoning in dogs. Other common sources includes car batteries, solder, plumbing materials, golf balls, and improperly glazed ceramic food or water bowls.

   Acute exposures to arsenic are associated with GI distress such as vomiting, diarrhea, and abdominal pain. Other symptoms may include lethargy, cold extremities, and fresh blood in the feces. Chronic exposure to arsenic may result in poor appetite and weight loss. The most common causes of arsenic poisoning in dogs are ingestion of arsenic containing herbicides, insecticides, and wood treating preservatives. Overdoses of arsenic containing drug formulas for treating heartworm parasites are also a common cause of arsenic poisoning.

3. What are short and long term effects of lead exposure to a small dog? (Pre and post clean up)

   Response: It is highly unlikely that soil containing lead at the Jacobs Smelter OU 2 site post cleanup will result in lead poisoning in dogs. See response to question 1 above. The potential for adverse effects prior

to cleanup will depend on the levels of lead in the soil (e.g., lead>5,000 ppm) and the habits of the dog. If the owner is concerned about lead poisoning they should contact their veterinarian for a complete physical examination and blood testing.

Commenter: Rosey Roberts:

Rosey Roberts is a Stockton property owner within the boundaries of Jacobs Smelter who contacted UDEQ during the public comment period regarding a sick horse undergoing chelation therapy. Roberts'submitted soil samples to the Tooele County Health Department in October 2015 from an area on her property where her horse was kept. DERR spoke to Roberts in January 2016 regarding the sampling results and were told the soil samples did not indicate elevated lead or arsenic. Roberts said her horse was getting better and would contact DERR with any concerns or issues.

Although the soil samples did not indicate soil contamination, Roberts requested her property be sampled as part of any cleanup activities for the Jacobs Smelter Superfund Site. Roberts' property was addressed during the OU-1 cleanup of 2000.

1. Comment: I Would like my property tested again to determine if lead contamination from the property is contributing to the heavy metal "poisoning" of her horses (she has lost two)?

   Response: Review of sampling data associated with the owners property showed that the property had been sampled as part of the OU1 response and lead contamination was not found at levels that posed a risk to human health. There are no plans to resample the property.

2. Comment: Is dust carried by wind from the contaminated area contributing to exposure?

   Response: Our current Site model does not show that there is an exposure risk to contaminated dust in residential areas. However, UDEQ and EPA recognize that there exists some uncertainty regarding exposure of residents to dust during the cleanup of the undeveloped area. In order to address this uncertainty, UDEQ and EPA will incorporate dust monitoring near the residential areas into Remedial Design activities. The results from the dust monitoring will be evaluated for potential exposures to residential areas and if needed, the clean-up work will be stopped and corrective actions taken to prevent any exposures. Dust monitoring will also be performed during construction activities to ensure that the community is not exposed to contaminated dust.

3. Comment: Is dust carried by wind from the gravel pit contributing to exposure?

   Response: There are actually a number of gravel extraction operations in the vicinity of Stockton, however, it appears that the gravel pit you are concerned about is the AltaView Concrete gravel pit just north of Stockton.

   AltaView Concrete was sent a reasonable steps letter by EPA on March 7, 2007, for a proposed gravel extraction facility to be located north of the town of Stockton and within the boundaries of the Jacobs Smelter Superfund Site. The letter identified lead clean-up levels for both residential and commercial/industrial property uses. In addition, the letter also identified the following appropriate reasonable steps:

   - Appropriately manage all soils on the property to prevent release or potential threat of release (now and in the future) of all soils determined to be above unacceptable human health or ecological risk levels.
   - Survey, and record the survey report in the county recorder's office, all areas of the property where contaminated soil above the clean-up levels are located, including areas constructed as repositories or where contamination was capped in place.
   - Maintain any caps or vegetation to prevent exposure to contaminated soils left on the property.

The area that AltaView Concrete proposed for gravel extraction is located on a portion of the Stockton bar that had been sampled. The samples indicated no lead or arsenic in concentrations greater than residential clean up levels established for the Site.

4. Comment: Could dust from the smelter and other places be what is making the horses sick?

   Response: DERR spoke to Ms. Roberts in January 2016 regarding the sampling results and was told by Roberts that the soil samples did not indicate elevated lead or arsenic. Roberts said her horse was getting better and would contact DERR with any concerns or issues.

Dave Allison from UDEQ coordinated the review of the sampling results with Ms. Roberts

Commenter: Karl Rhoades

*(The following comments were submitted by Mr. Rhoades September 27, 2015.)*

*Tom,*

*It is imperative that the areas in and around Stockton be cleaned to provide safe living environments for the residents as well as visitors to the area. This initiative should not only consider cost but also both the short & **long term** effects of the alternative decided upon.*

*I live in Rawhide Ranchettes and have been here for 13 years. I saw the **second** attempt to "clean up" our neighborhood after inadequate removal by the original developer and insufficient monitoring/testing by the state.*

*For this reason, I am opposed to the proposed plan of Alternative 2 for the following reasons:*

1. *This is only a short term remediation plan and does not prevent future exposure.*
2. *Stockton city/EPA/UDEQ does not monitor excavation projects and risk to re-exposure is imminent.*
3. *Simply planting a tree could take you below the recommended 18" depth and expose contaminated material. What happens a few years later when an old tree stump is removed that has penetrated the geo-textile fabric?*
4. *Alternative 2 does not address the re-use of the open/residential land for ATV travel which will eventually remove the new 18" soil cover and re-expose contaminated materials. Currently, Lot 2 (or maybe 3) already has a small motorcycle/ATV track present. If only 18" is removed and this activity allowed to continue, it is only a matter of time before it is re-exposed. Residents should not be limited or restricted with what they want to do with their own land due to insufficient clean up methodologies/efforts.*

*I'm not sure why there is no option to remove **ALL** contaminated soil to restore the ground as it was prior to mining activities. I feel all proposed solutions are only a short term remedy (and are cost driven approaches not public health and safety). By only removing 18" of material allows contaminated soils to remain and subject to re-exposure in the years that follow. Once this occurs, more money will need to be spent and soils disturbed to conduct a secondary cleanup as was the case in Rawhide Ranchettes. This secondary attempt is not only costly but submits the resident to even more airborne issues and concerns. Having different contractors involved with additional HazMat training lends itself to additional risks due to potential inexperience and inconsistency in contaminated material's handling practices.*

*Fencing or closure of the area (as Rio Tinto has done is only a short term (and low cost $) solution. The contamination still exists and has potential for migration to other areas outside the fenced area. With water and wind erosion (of which we get **LOTS** of wind erosion in Stockton), that soil will not stay behind a fence for long. Contamination knows no fenced boundaries.*

*On site vaults just leave the material still present in the soil (even though in a vault) just at a different depth. It does eliminate airborne concerns but could also eventually get re-exposed. Disposal of soils in a proper holding facility with strict controls is the only way to ensure safety and eliminate re-exposure. I am appalled the developer was allowed to place the initial contaminated soil under the road surface & in an "authorized vault" in one of the resident's backyard. I'm sure this was thought to be a permanent solution until Stockton decided to install a sewer system. Then, a new contractor was introduced, training had to be provided which cost the town more money to ensure they were properly qualified to handle soils to complete the project. The resident's ended up eating this cost because the state allowed this "low cost" alternative to be permitted.and an alternative that was acceptable to the state. Once again, the residents were re-exposed to the contaminants previously thought to be remediated and paid for it (both monetarily and via health risks).*

*Do it right the **first time** and get **all** contaminated soils removed. Alleviate any questions or concerns that**re-exposure can occur**. Take the cost factor out of the equation and perform the remediation correctly & thoroughly the first time with short/long term health factors being the primary consideration not initial cost. I'm not sure you can put a price tag on our family's health.*

*Sincerely,*

*Karl Rhoads*
*164 North Rodeo Drive*
*Stockton, Utah 84071*

*(In order to address Mr. Rhoades concerns DERR and EPA have summarized the key issues that were represented and have responded to them.)*

1. Comment: There should be an option that removes ALL contaminated soil:

a) All proposed solutions are only a short term remedy and do not prevent future exposure.

Response: UDEQ and EPA disagree that the proposed remedies are short term remedies and do not prevent future exposure. Long-term effectiveness and permanence is one of nine criteria considered and evaluated for each of the Alternatives. The selected remedy "Excavate contaminated soil to a depth of 18 inches and place in an off-site landfill" was selected over the other proposed alternatives specifically due to the superior long-term effectiveness it provides. Removal of contaminated soil to a depth of 18 inches removes the risk of direct contact, inhalation and ingestion of contamination and eliminates the human health and ecological risk for the soil removed from the Site. Off-site landfill disposal reduces the migration potential for future direct contact, ingestion or inhalation by permanently removing the majority of the contaminated soil form the Site. Contaminated soil that remains after construction will be underneath of 18 inches of clean soil which will provide a permanent barrier to exposure as long as the soil cover remains intact. To this end, institutional controls.

b) Stockton City/EPA/UDEQ do not monitor excavation projects and there is a risk of re-exposure.

Response: With the assistance of UDEQ and EPA, the Town of Stockton developed and implemented a Hazardous Soils Ordinance (#2000-04) in fall of 2010. Ordinance #2000-4 identifies areas within the town of Stockton with residual contamination and requires soils excavated within those areas be handled in accordance with a Soils Management Plan that provides instruction for the safe handling and disposal of contaminated soil. In addition the Town of Stockton has built a repository specifically for contaminated soil.

Since contamination remains above unrestricted use levels throughout the Jacobs Smelter Superfund Site a statutory review is conducted every five years. The effectiveness of Ordinance #2000-4 along with other environmental covenants and institutional controls associated with the Jacobs Smelter Superfund Site are evaluated during the Five-Year reviews. A Five-Year Review was conducted in 2105 and review of the institutional controls found that the Town of Stockton has been adequately enforcing Ordinance #2000-4

c) Simply planting a tree could expose contaminated material.

Response: Planting of trees could potentially result in exposure to residual contamination. To this end, after excavation to 18 inches, a geo textile fabric will be placed over areas with remaining contaminated soil to serve as a visible marker to warn property owners if excavation takes place in the future. Since contamination will remain at depths greater than 18 inches, institutional controls to address potential future exposures will be implemented to ensure that the remedy remains protective of human health and the environment. Potential institutional controls include environmental covenants, conservation easements land use zoning as well as community education and outreach. UDEQ and EPA will be working with property owners and local government officials in the design and implementation of effective institutional controls.

d) Alternative 2 does not address re-use of the open land for ATV travel which will eventually remove the 18" soil cover and re-expose contaminated material.

Response: UDEQ and EPA recognize that ATV use may damage the selected remedy. During the Remedial Design different engineering controls that will protect the remedy will be investigated.

e) Residents should not be limited or restricted with what they want to do with their own land due to insufficient clean-up.

Response: UDEQ and EPA disagree that the cleanup described in the Slelected Remedy is insufficient. Excavation to 18 inches will remove all of the contamination over most of the residential properties. Every attempt possible will be made during the Remedial Design and the cleanup to minimize the impact of institutional controls that may contain contaminated soil at depths greater than 18 inches. Institutional controls would not prevent property owners from completing construction work, but there may be requirements dictating how work is done and the excavated soil managed. Such projects must also comply with existing town building permit requirements.

2. Comment: Fencing or closure of the area (Rio Tinto) is only a short term solution. With water and wind erosion the soil (contaminated) will not stay behind the fence for long.

Response: UDEQ and EPA agree that fencing or closure of an area is a short term solution. Construction activities at OU4 (performed by KUCC "Rio Tinto") consisted of the excavation and removal of soil with lead concentrations greater 500 mg/kg except for where contaminated soil was located underneath a large gravel hill near the railroad bed that could not be accessed without impacting the railroad. We expect that KUCC installed the fence to make sure the reseeding was successful. There may be other reasons the KUCC maintains the fence around their property.

3. Comment: On-site Vaults leave the material still present in the soil just at a different depth. I am appalled that the developer (Brockbank?) was allowed to place the initial contaminated soil under the road surface and in an "authorized vault" in one of the resident's back yard.

Response: The on-site vault or repository is not located in a resident's back yard it is located on a separate parcel located behind the residential lot that the developer retains title to. In addition, the soils and material placed in the repository were capped with a 60-millimeter HDPE flexible membrane liner to prevent excavation as well as water infiltration and then covered with 24 inches of uncontaminated soil followed by topsoil that has been seeded with native grasses and wildflowers. The HDPE liner along with the 24 inch cap provide a more than adequate barrier to the contamination contained within the repository and is protective of human health and the environment.

Placement of contaminated soil underneath road surfaces is a common and widely accepted method for preventing exposure to non-hazardous materials. For the Rawhide Ranchettes cleanup non-hazardous contaminated soil was placed underneath sections of roadway within the subdivision. The contaminated material was covered with 18 inches of clean fill, 8 inches of road base and 2.5 inches of asphalt thus

providing an impermeable cover that prevents exposure to the contamination for the life of the road. The location of the contaminated soil was recorded and excavation activities within the roadway are regulated under the Stockton Hazardous Soils Ordinance (Ordinance #2000-4) enforced by the Town of Stockton.

4. Remove all contamination and take the cost factor out of the equation.

   Response: The remedy selection process and the ROD were developed in accordance with the requirements of CERCLA and the NCP. To provide a systematic comparison, each of the alternatives discussed in the proposed plan were evaluated against the nine criteria set forth in the NCP which include overall protectiveness, long-term effectiveness and permanence as well as cost. The Selected Remedy removes the bulk of contaminated soil from the Site and places it in an off-site landfill, permanently removing the soil as well as the risk to exposure associated with it. The residual contamination that will remain at the Site will be covered with 18 inches of clean soil and will be vegetated providing an effective barrier to human exposure and will also prevent erosion. Removal of contaminated material deeper than 18 inches will not significantly increase the protectiveness of the remedy.

# APPENDIX D

# SITE MEMOS

to AR 12113106

K. Bradford

Katherine Bradford
03/23/2004 08:17 AM

To: Joshua Knight/EPR/R8/USEPA/US@EPA
cc:
Subject: Jacob's Smelter and Bevill issues

Per our discussions with the State of Utah and their request for an EPA Bevill determination, please be advised that I consider this site to be Bevill exempt as to the heavy metal wastes/hazardous substances.

The great majority of the waste from these smelters is from primary lead smelting. For the twenty year period from 1870 to 1890 alone, 378 million pounds of lead were produced in this Jacob's Smelter area. This far exceeded any other metal produced.

The lead wastes involved at the Site were created during a process of beneficiation and smelting of the metal ores extracted in and around the Site. The lead ores in their natural form were intermingled with silver, gold, copper and zinc. The smelting (production) of lead at this Site far exceeded production of any other metal for the entire production life of the Site. The beneficiation and smelting processes which created these ores was a simultaneous process for all of the metals, each metal was not created separately. Thus the silver, gold, copper and zinc wastes, both slag from processing and tailings from beneficiation were incidental wastes created during the process/beneficiation of the lead ores.

"Primary lead processing" wastes appear on the Bevill exempt list. These lead smelter wastes are all considered to be Bevill exempt since the primary process of lead smelting generated the slag wastes and the beneficiation of the ore created the tailings. Pursuant to the regulations the resulting slag and tailings wastes are exempt. (See 40 CFR 261.4 (b)(7)(ii)(B)) and 40 CFR 261(b)(7)(i)).

Since these wastes are Bevill exempt, they are by definition not hazardous wastes and legally you may proceed to the extent permitted by the regulations without RCRA Subtitle C compliance in the remediation of this smelting site. However, some of the wastes at the site fail TCLP(Toxic Characteristic Leachate Procedure). Thus, many of the RCRA Subtitle C requirements are relevant and appropriate standards for the Site response action.

Katherine Letson Bradford
Enforcement Attorney
Legal Enforcement Program
U.S. EPA, Region VIII
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Denver, CO 80202
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State of Utah

GARY R. HERBERT
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GREG BELL
*Lieutenant Governor*

Department of
Environmental Quality

Amanda Smith
*Executive Director*

DIVISION OF ENVIRONMENTAL
RESPONSE AND REMEDIATION

Brent H. Everett
*Director*

ERRC-125-10

# MEMORANDUM

**TO:** Lisa Lloyd, Project Manager
U.S. EPA Region 8

Administrative Record File for
Jacobs Smelter Superfund Site Operable Unit Two

**FROM:** Thomas D. Daniels, Project Manager
Utah Department of Environmental Quality

**DATE:** June 17, 2010

**SUBJECT:** Risk management proposal regarding clean up levels based on human health risk for Operable Unit Two of the Jacobs Smelter Superfund Site.

The Jacobs Smelter Site is located in and around the Town of Stockton, Utah. Approximately 25 miles southwest of Salt Lake City, Utah and five miles south of Tooele, Utah. Lead and arsenic contamination from historic smelter operations has been identified in site soils. Operable Unit Two (OU2) includes underdeveloped and undeveloped land outside of the general town limits, the Rawhide Ranchettes and B&B Subdivisions, the area between the two subdivisions that contains elevated lead and arsenic concentrations related to the Waterman Smelter and a small area east of the Town of Stockton, as well as the areas surrounding the Chicago and Carson/Buzzo smelters south of Stockton.

The Preliminary Remediation Goals (PRGs) that were developed in 2001 evaluated risks associated with occasional recreational All Terrain Vehicle (ATV) use of the area around Stockton. Recently Project Managers noticed physical evidence that there had been an increase in ATV use near the Waterman Smelter area. On April 8, 2010, representatives of the Environmental Protection Agency (EPA) and the Utah Department of Environmental Quality (UDEQ) asked residents of the Rawhide Ranchettes and B&B Subdivisions about recreational ATV use by town residents throughout the year.

Based on the observed increased ATV use of the Waterman Smelter area as well as the information regarding frequency and duration of use from residents, it is clear that the exposure frequency parameters utilized in the calculation of the 2001 PRGs required adjustment to appropriately reflect observed use patterns and frequencies.

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The Utah Department of Environmental Quality, Division of Environmental Response and Remediation (DERR) recalculated the exposure parameters and documented the results in a May 26, 2010 memorandum (attached). The "safe" range calculated using these adjustments is 2,408 mg/kg – 3,792 mg/kg lead in surface soils.

The clean up level proposed for recreational use at OU2 of the Jacobs Smelter Superfund Site is 3,000 mg/kg lead.

This clean up level is within the range specified in the May 26, 2010 memorandum and is protective of human health.

The 3,000 mg/kg clean up level would be applied to the area located between the Rawhide Ranchettes and B&B Subdivisions.

The lead clean up levels for residential properties utilized in OU1 (500 mg/kg in surface soils and 800 mg/kg subsurface soils) proposed in the 2004 Proposed Plan have not been changed and are still protective of human health. The residential clean up level would be applied to the lots within the Rawhide Ranchettes and B&B Subdivisions.

Both the recreational and residential use clean up levels will be proposed to the public in a revised Proposed Plan.

Since arsenic contamination is co-located with the lead contamination and will be addressed by clean up of the lead contaminated soils, an arsenic clean up level is not necessary and is not being proposed.

State of Utah

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*Lieutenant Governor*

Department of
Environmental Quality

Amanda Smith
*Executive Director*

DIVISION OF ENVIRONMENTAL
RESPONSE AND REMEDIATION

Brent H. Everett
*Director*

ERRA-32-10

# MEMORANDUM

**TO:** Thomas Daniels, Project Manager
Utah Department of Environmental Quality

Lisa Lloyd, Project Manager
U.S. Environmental Protection Agency, Region VIII

**THROUGH:** Susan Griffin, Regional Toxicologist
U.S. Environmental Protection Agency, Region VIII

**FROM:** Scott Everett, Toxicologist
Utah Department of Environmental Quality SDE

**DATE:** May 26, 2010

**SUBJECT:** Revised Preliminary Remediation Goals for Recreation Use in Waterman Smelter Area

On April 8, 2010, representatives of the Environmental Protection Agency (EPA) and the Utah Department of Environmental Quality (UDEQ) held a meeting at the Stockton Town Council meeting room in the township of Stockton, Utah. At this meeting, the EPA and the UDEQ Project Managers presented residents with results from a recent sampling effort. Representatives from the UDEQ and the EPA questioned those in attendance about recreational All Terrain Vehicle (ATV) use during the year. Most responded that there was ATV use by residents throughout the year, even during the colder, wetter months. Residents indicated that they enjoyed the times riding through the area when there was standing water and mud.

The recreational Preliminary Remediation Goals (PRGs) that were developed in 2001, ["Preliminary Remediation Goals for Recreational Land Use at Jacobs Smelter Site (OU2), 22 May 2001] was with an estimate of ". . . teens ride approximately 3 days a week in June, July, and August, and approximately 1 day per week in April, May, September, and October for a total of 56 days a year." This estimate of an exposure frequency was acceptable at the time.

Recently, Project Managers noticed physical evidence that there had been an increase of ATV use at the site, due to formation of an off-road figure 8 track. With this evidence and the anecdotal information from the residents, it is clear the exposure frequency parameter of the lead risk model should be adjusted. This adjustment includes the assumption that residents spend an additional 1 day a week in the months of January, February, March, November, and December, which equals a total of 76 days a year. Using the same methodology as found in the 2001 memorandum, the range of PRGs for recreational exposure to lead in the soil are 3,792 - 2,408 mg/kg.

Table 1: Summary of Parameter Values

| Parameter | Value | Comment |
|---|---|---|
| Goal for the 95th percentile blood lead concentration in fetuses – $PbB_{fetal,\ 0.95\ goal}$ | 10 ug/dl | Default assumption |
| Geometric standard Deviation – $GSD_{i,\ audit}$ | 1.53<br>1.69 | Site-specific $GSD_i$ derived from the Bingham Creek and Sandy City, Utah blood lead studies (U.S. EPA, 1996c) |
| Ratio of fetal to maternal blood lead levels – $R_{fetal/maternal}$ | 0.9 | Default assumption |
| Baseline Blood Lead Concentration – $PbB_{adult,\ 0}$ | 1.3<br>2.28 | Site-specific geometric mean blood lead levels from the Bingham Creek and Sandy City, Utah blood lead studies |
| Biokinetic Slope Factor – BKSF | 0.4 ug/dl per ug/day | Default assumption |
| Soil Ingestion rate – $IR_s$ | 0.1 grams/day | Recreational dirt bike scenario – Anaconda, MT risk assessment (U.S. EPA, 1996b) |
| Exposure Frequency – EF | 76 days/year | Site-specific observation (2010) |
| Absorption Fraction – AF | 0.12 | Default assumption |

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 8**
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

May 14, 2013

**MEMORANDUM**

SUBJECT: Reevaluation of Exposure Estimates and Clean-up Goals for Waterman Smelter Soils at the Jacobs Smelter Site.

FROM: Dan Wall
Toxicologist
USEPA Region 8

TO: Lisa, Lloyd
Remedial Project Manager
USEPA Region 8

---

This memo describes the technical approach used to estimate exposures and illustrate remediation scenarios for the Waterman Smelter area of the Jacobs Smelter Superfund Site in Stockton, Utah. It was determined that because of new data and the more limited exposure area that the exposure estimates needed to be refined. Additionally, it was determined that the refined exposure model would be useful for evaluating potential remediation scenarios.

## *Background*

In 2003, EPA completed an ecological risk assessment (Lockheed Martin, REAC, 2003) which encompassed the east and northeast portion of Rush Lake to the southwest edge of the town of Stockton. This included the Chicago, Carson-Buzzo and Waterman smelters and potentially contaminated areas between the smelters.

Clean-up goals were derived for sediments and soils from data collected for the ecological risk assessment but for the purposes of this memo, the re-assessment of exposures will focus solely on Waterman Smelter soils (Hoff, 2003). Risks were primarily driven by lead concentrations in soil and food items although, other metals were co-located with the lead. Concentrations of lead in ants collected from the Jacobs Smelter NPL site ranged from 2.1-143.5 ppm with an average bioaccumulation factor (BAF) of 0.055 and an upper 95$^{th}$ percentile of 0.122.

Using the 95$^{th}$ percentile BAF for lead, clean-up goals for terrestrial wildlife receptors were developed. Predicted risks were greatest to insectivorous birds (represented by the Northern Flicker) and therefore, protection of this species will protect all other species. The resulting conservative and representative clean up goals equated to 574 and 1148 ppm average concentration of lead over the home range of the Northern Flicker, respectively.

Estimating exposures for the Northern Flicker was detailed in the 2003 Dale Hoff memo and is excerpted below.

*All species do not occupy single points through time, but rather forage across the site within a home-range. A moving window analysis (ArcGIS Desktop Help, Calculating Neighborhood Statistics, ESRI, 2002), utilizing ARC-View software, was employed to identify any potential areas across the site which had an average lead soil concentration above the lead clean-up goal. These concentrations were rounded down to 500 and 1000 ppm dw for ease in interpretation and model calculation. Prior to actually running the moving window model, extrapolation of point data was completed using ordinary kriging. Briefly, the moving window model then systematically moves a 55 hectare circle (home range size of the flicker) in 100 foot increments both laterally and longitudinally across the entire site. Every potential 55 hectare circle that had average soil concentrations ranging from 500 ppm to 1000 ppm (HQ = 1) were identified in Figure 4 as a pink color; while those areas with average concentrations greater than 1000 (HQ = 2) were identified in red.*

### *Reevaluation of Exposure at Waterman Smelter*

In an effort to refine soil concentrations in the vicinity of Waterman Smelter, the state of Utah has collected additional surficial soil data and EPA collected additional soil data in 2011. In light of the additional data and the smaller exposure unit, EPA was uncertain if the existing exposure estimate was still valid. To address this uncertainty and to establish a tool for evaluation of remediation scenarios, EPA reconstructed the exposure model in 2012.

In 2012 a moving window analysis was again employed using ArcGIS 10.0 software to identify any potential areas across the Waterman Smelter portion of the site which had an average lead soil concentration above the lead clean-up goal. The same general approach that was used in 2003 was used in 2012 with the following exceptions:

1) The analysis was conducted using data within the area of interest from different sampling events and soil horizons (horizon 1 = 0”, 0”-2”, 0”-6”, 2”-6”; horizon 2 = 2”-12’, 6”-12”; and horizon 3 = 12”-18”). Point data are presented in Figures 1-3.
2) Prior to running the moving window analysis extrapolation of point data was completed for each soil horizon group using the natural neighbor interpolation method instead of the kriging method. An output grid cell size of 50 feet was chosen instead of 100 feet. The resulting lead concentration surfaces and approximate volumes are presented in Figures 4-6.
3) A moving window analysis using neighborhood statistics was conducted for each soil horizon by moving a 55 hectare circle (home range size of the flicker) in 50 foot increments both laterally and longitudinally across the entire site. The results were categorized to illustrate areas where average concentrations of lead exceed 1148 ppm over the 55 hectare home range. Figures 7-9 illustrate theses results for each soil horizon.
4) Three remediation scenarios were run for each soil horizon. The scenarios assumed that all soils with concentrations of lead above 3,000, 5,000 and 10,000 ppm were removed and replaced with soils containing 3,000 ppm lead. This should result in a total of 9 maps of potential residual risk however only the 0-6 inch soil horizon under the 3,000, 5,000 and

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10,000 ppm lead removal scenarios resulted in residual risk. Those results are presented in Figures 10-12.

### *Results*

Risks to avian insectivores as represented by the Northern Flicker are currently at unacceptable levels in the Waterman Smelter area at all sample depths. Evaluation of Figures 10-12 indicates that remediation of soils greater than 5000 ppm is sufficient to reduce risks to avian insectivores to acceptable levels in the 0-6 inch soil horizon. Because significant exposure can potentially occur via ingestion of soil invertebrates (ants), concentrations of lead at depths of at least 18 inches are of concern. However, the reassessment of exposures indicate that remediation of subsurface soils (6-18 inches below ground surface) to 5,000 ppm is overly conservative and remediation of soils to 10,000 ppm will be protective by reducing the average exposures to below the 1,148 ppm "representative" effect level. The 6-12" remediation scenario (10,000 ppm) is presented in Figure 13. The 12-18" remediation scenario had no residual risk and does not have an accompanying figure.

### *Uncertainty*

Much effort was made to reduce uncertainties of this analysis however uncertainties do exist.

- Ant colonies may burrow significantly deeper than 18 inches however data were only available for the first 18 inches. There is a potential that this data gap may lead to an underestimation of risks.
- The original ecological risk assessment was conducted for the entire Jacobs Smelter NPL site which encompasses many habitats not seen in the Waterman Smelter area. The Northern Flicker was used to represent the avian insectivore feeding guild and was applied to Waterman Smelter. The habitat of the Waterman Smelter area is however, not ideal for a Northern Flicker. It is uncertain how much the risk estimates would be altered if a bird species more suited to the Waterman Smelter habitat were used to represent the avian insectivore feeding guild.
- The estimate of the geographic extent of clean-up relied on creating a surface from point data by extrapolating concentrations between points. Interpolation methods are more reliable where there are higher densities of equally spaced data. Areas or soil horizons that do not have high densities of data are more likely to have interpolation errors. This is most likely to be seen in the subsurface data sets.

Hoff, Dale. "Development of Ecological Clean-up Goals for the Jacobs Smelter Site in Stockton UT". USEPA, Region 8. April 25, 2003.

Lockheed Martin REAC. 2003. Ecological Risk Assessment: Jacobs Smelter Site Stockton, Utah. Prepared for USEPA.

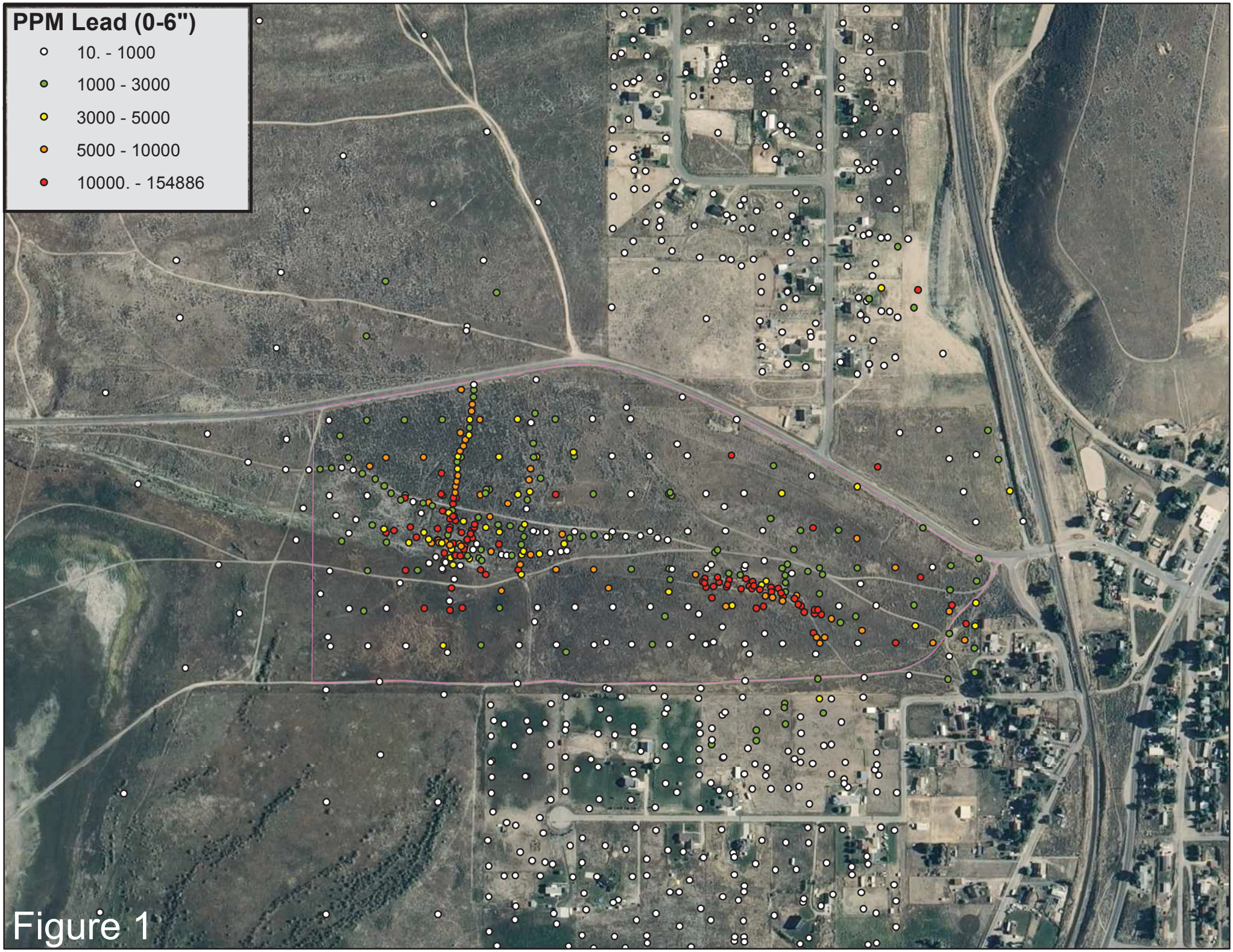

PPM Lead (0-6")
10. - 1000
1000 - 3000
3000 - 5000
5000 - 10000
10000. - 154886

Figure 1

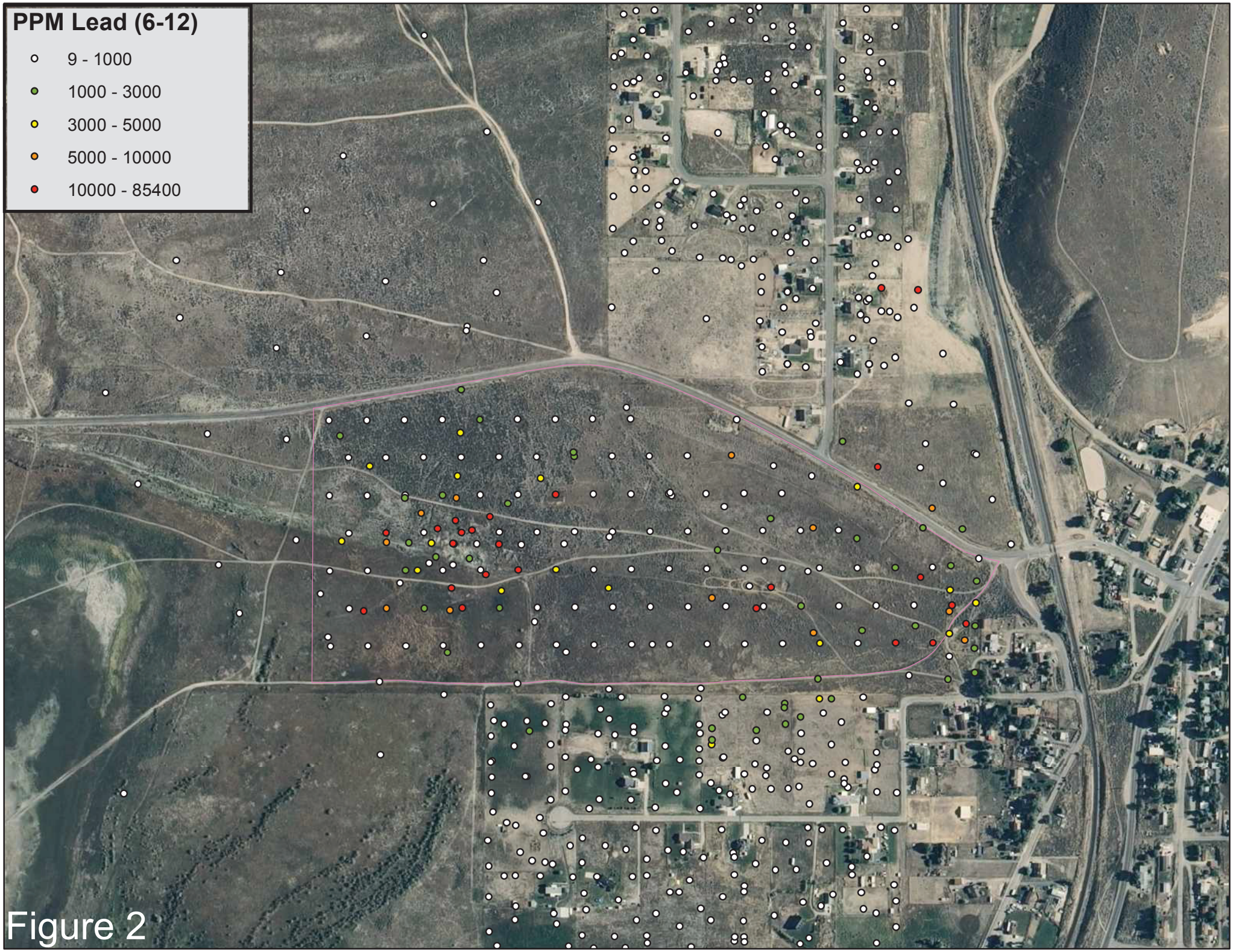

PPM Lead (6-12)
9 - 1000
1000 - 3000
3000 - 5000
5000 - 10000
10000 - 85400

Figure 2

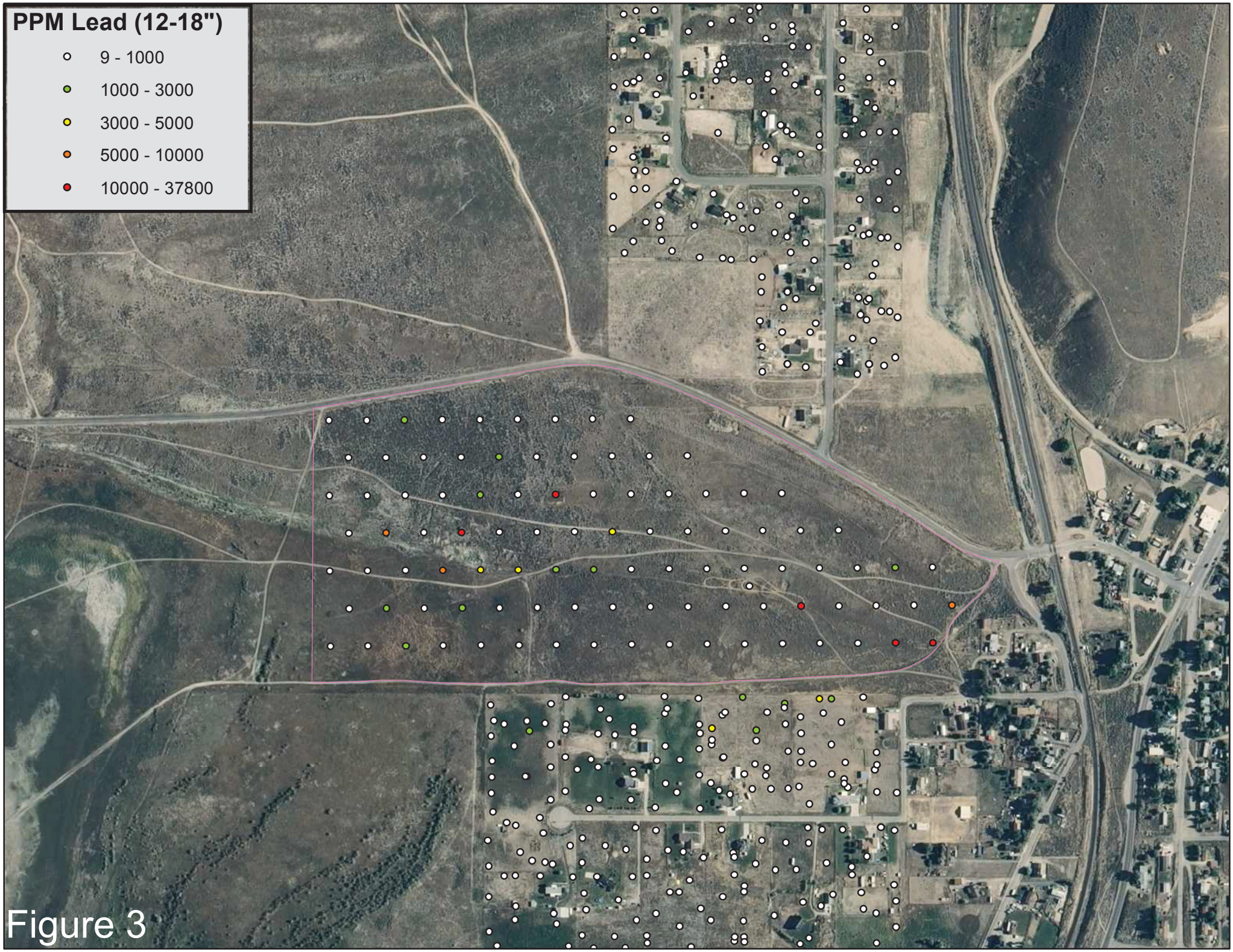
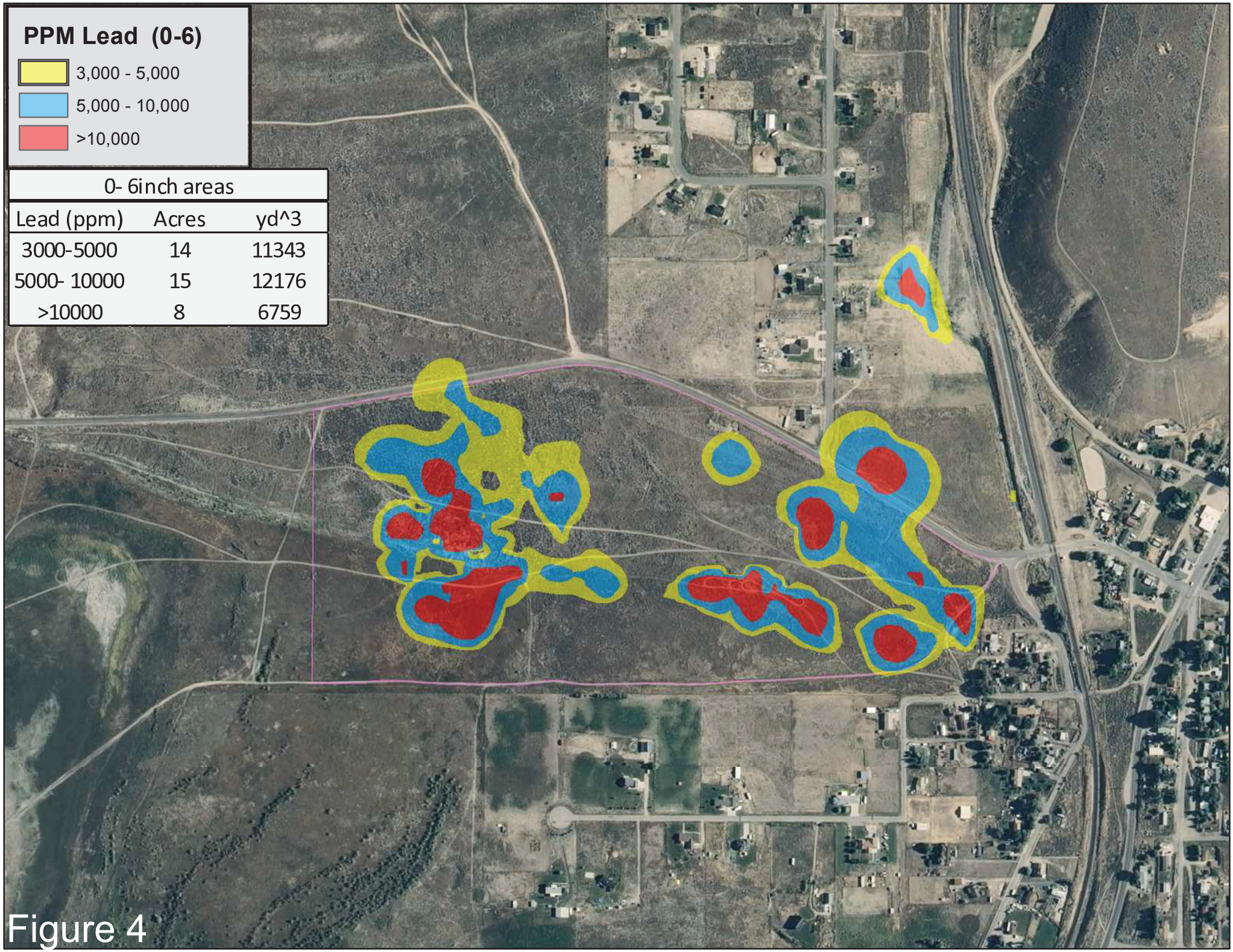
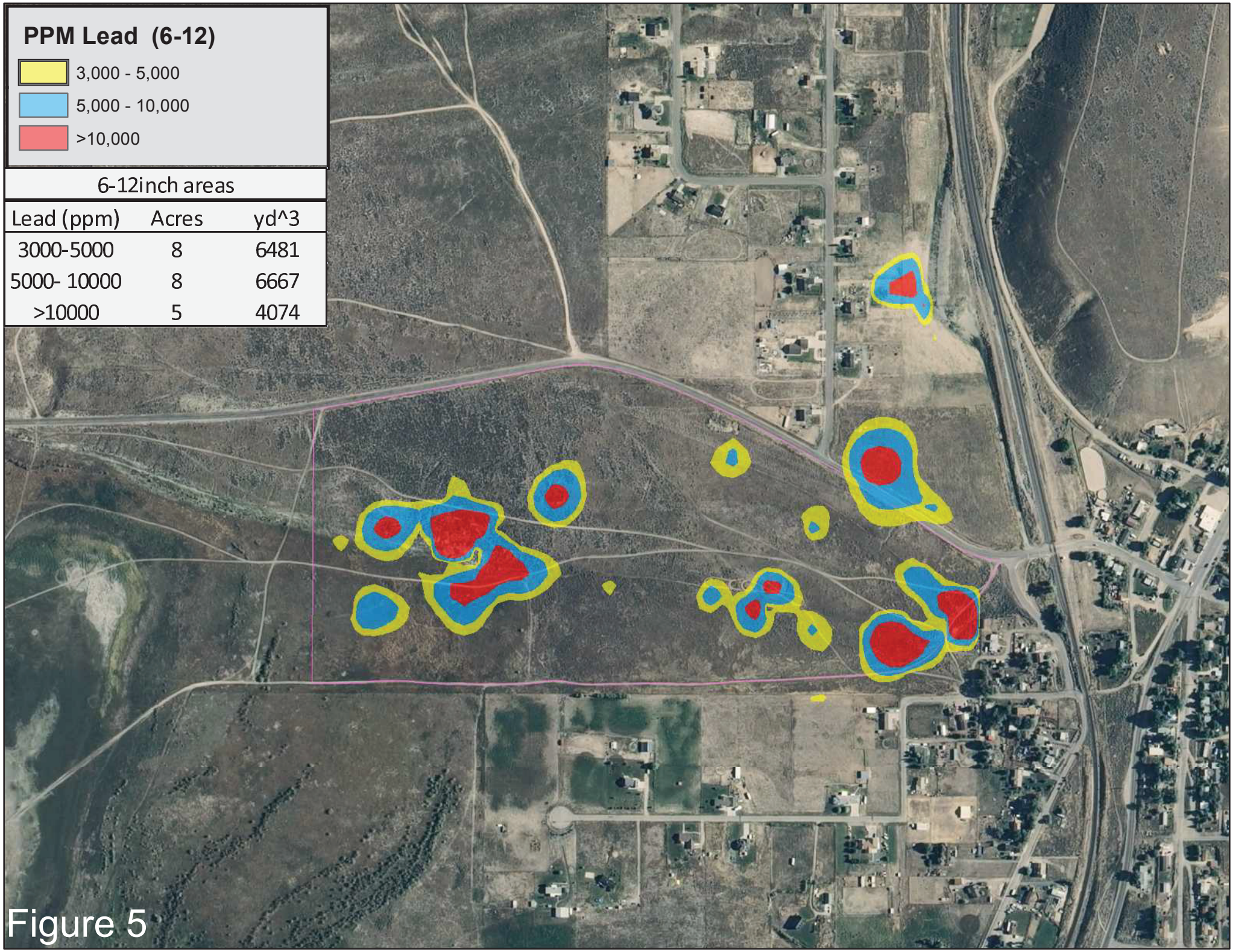

PPM Lead (12-18")
9 - 1000
1000 - 3000
3000 - 5000
5000 - 10000
10000 - 37800

Figure 3



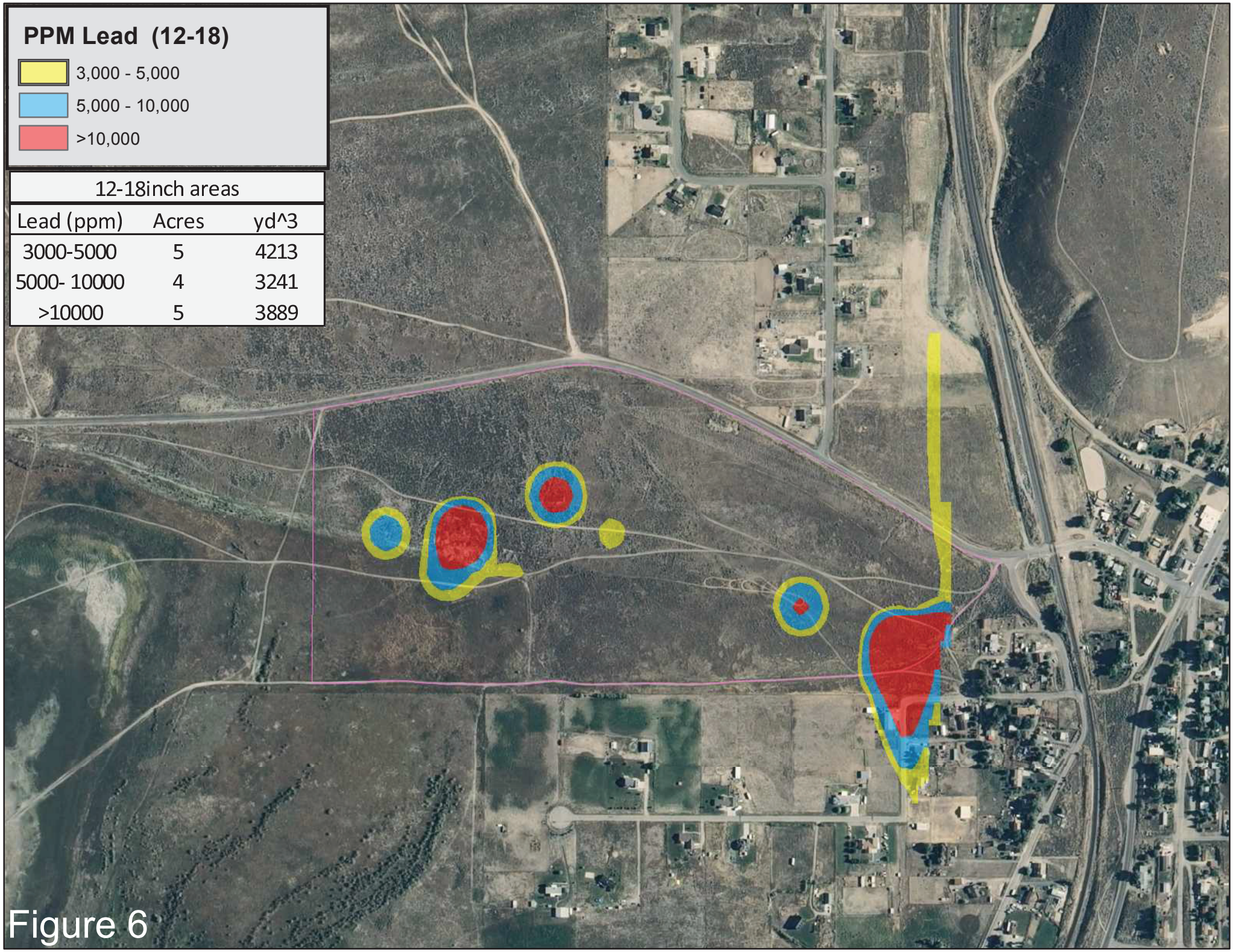

| 0- 6inch areas | | |
|---|---|---|
| Lead (ppm) | Acres | yd^3 |
| 3000-5000 | 14 | 11343 |
| 5000- 10000 | 15 | 12176 |
| >10000 | 8 | 6759 |

Figure 4




| 6-12inch areas | | |
|---|---|---|
| Lead (ppm) | Acres | yd^3 |
| 3000-5000 | 8 | 6481 |
| 5000- 10000 | 8 | 6667 |
| >10000 | 5 | 4074 |

Figure 5




| 12-18inch areas | | |
|---|---|---|
| Lead (ppm) | Acres | yd^3 |
| 3000-5000 | 5 | 4213 |
| 5000- 10000 | 4 | 3241 |
| >10000 | 5 | 3889 |

Figure 6

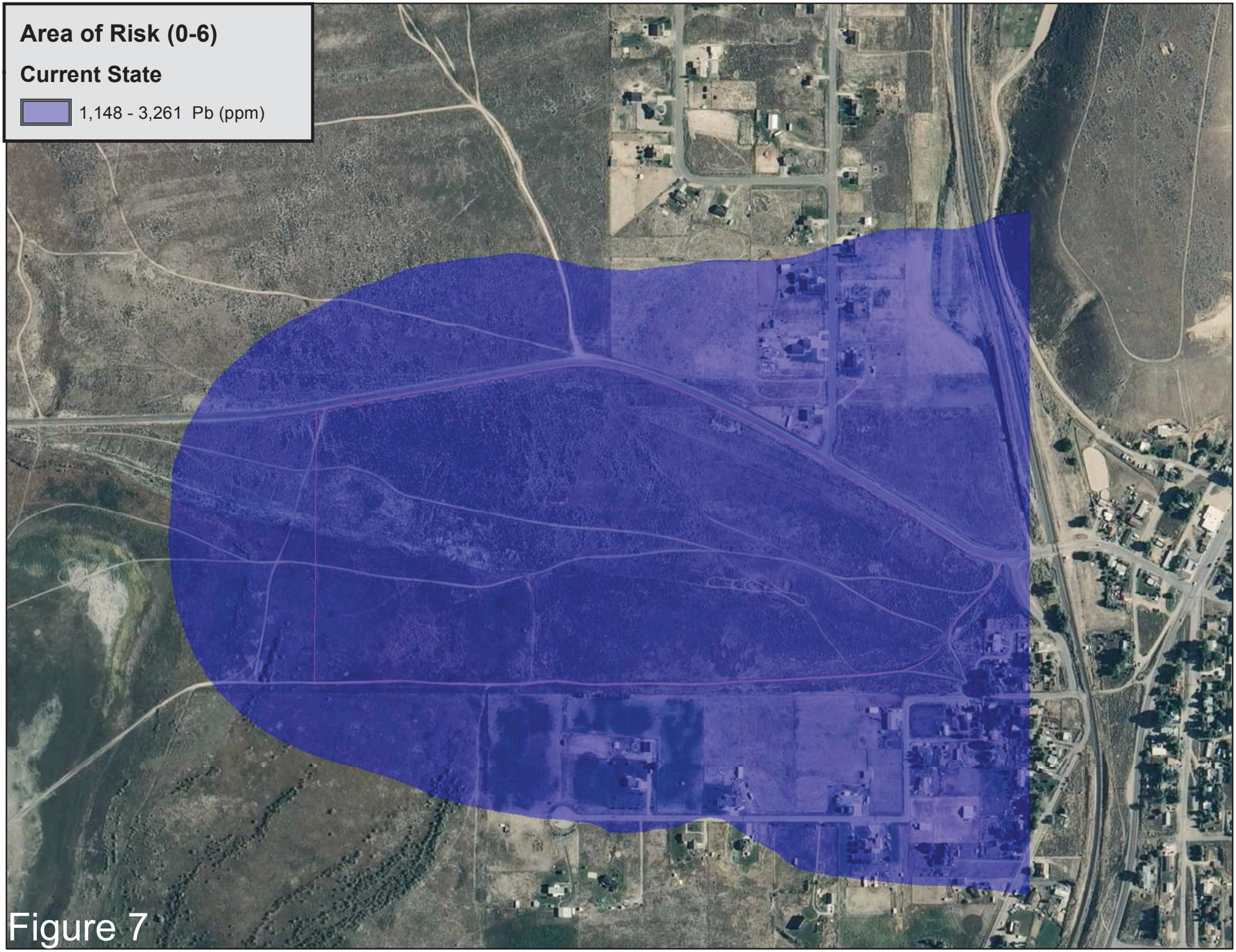



Figure 7

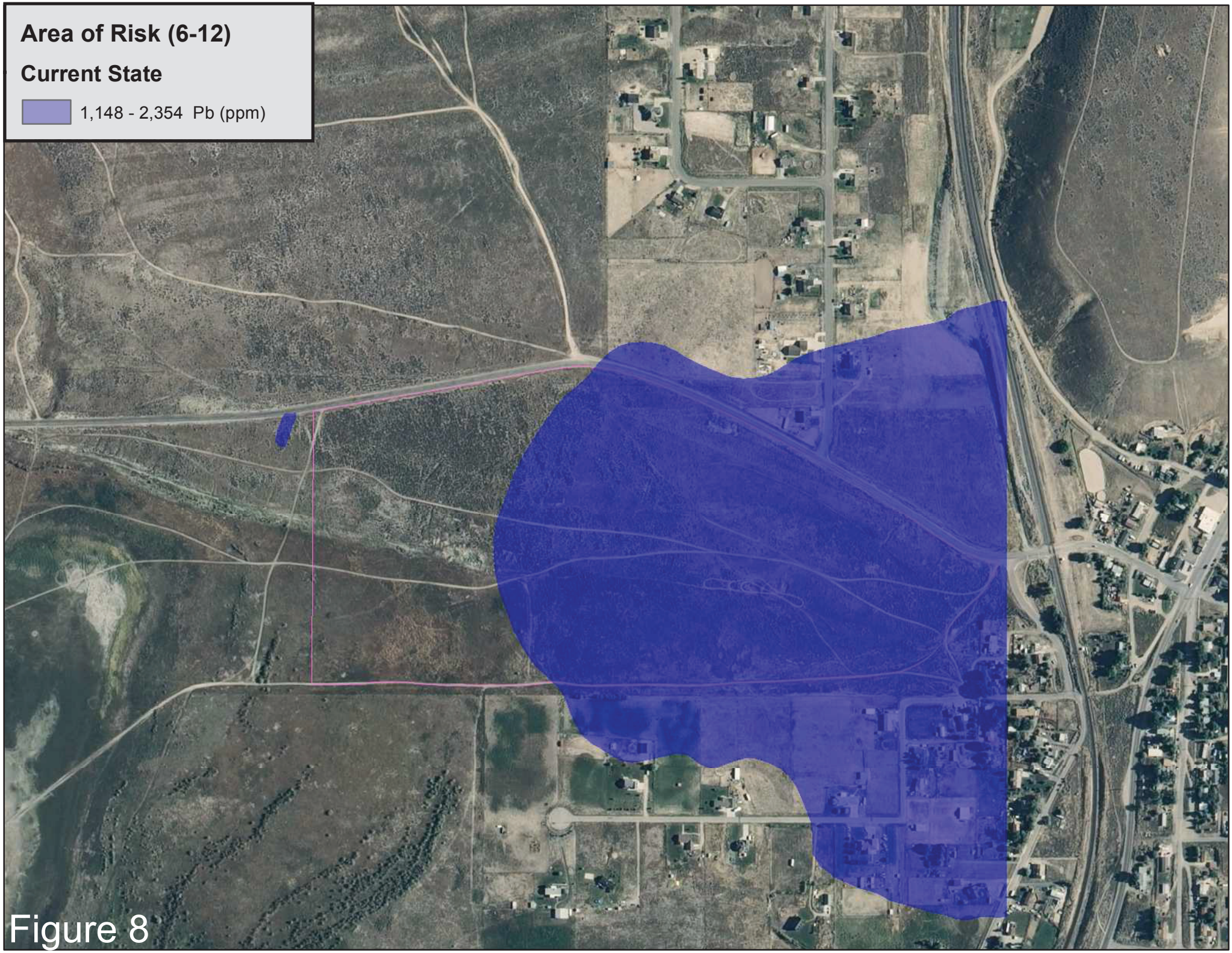



Figure 8

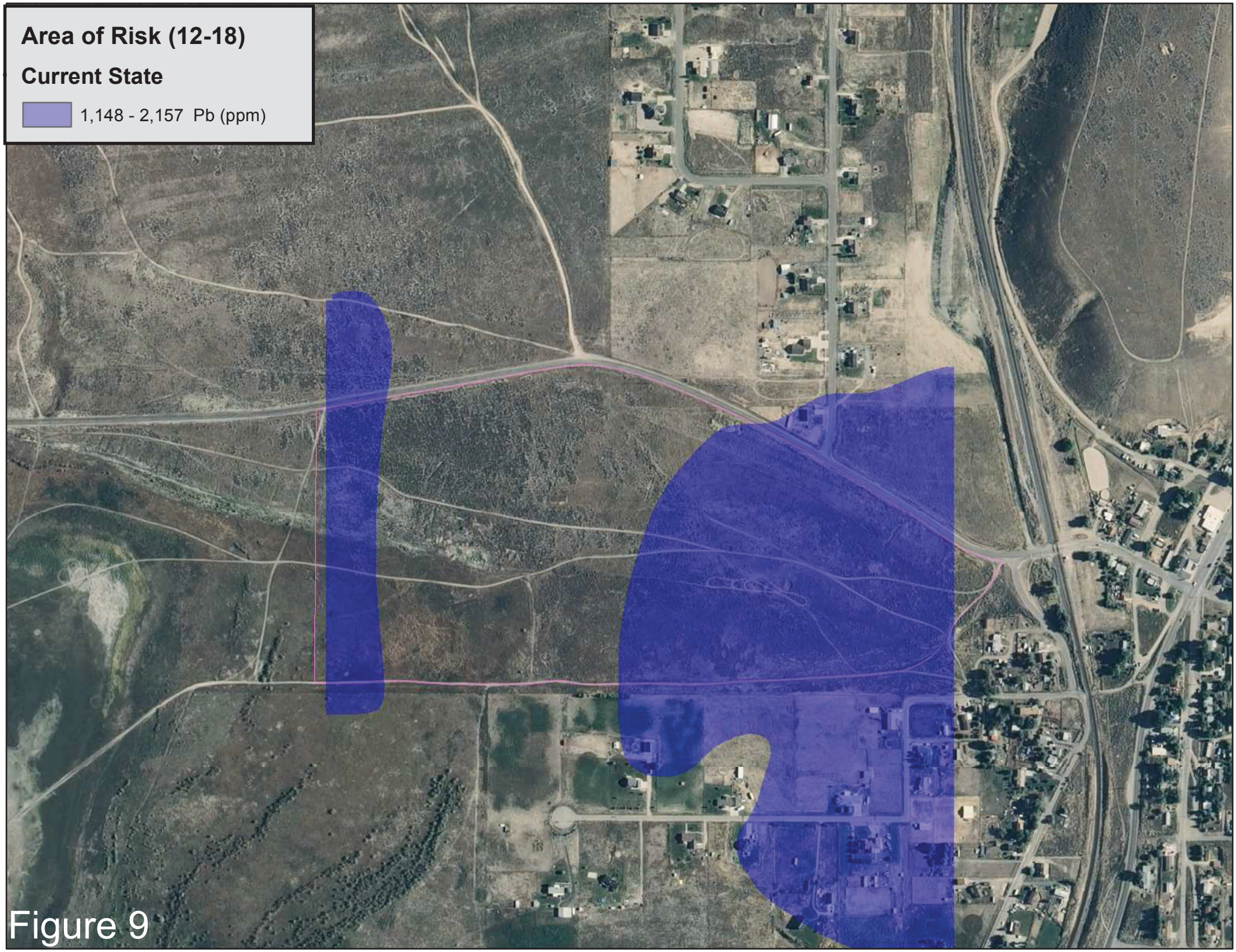



Figure 9

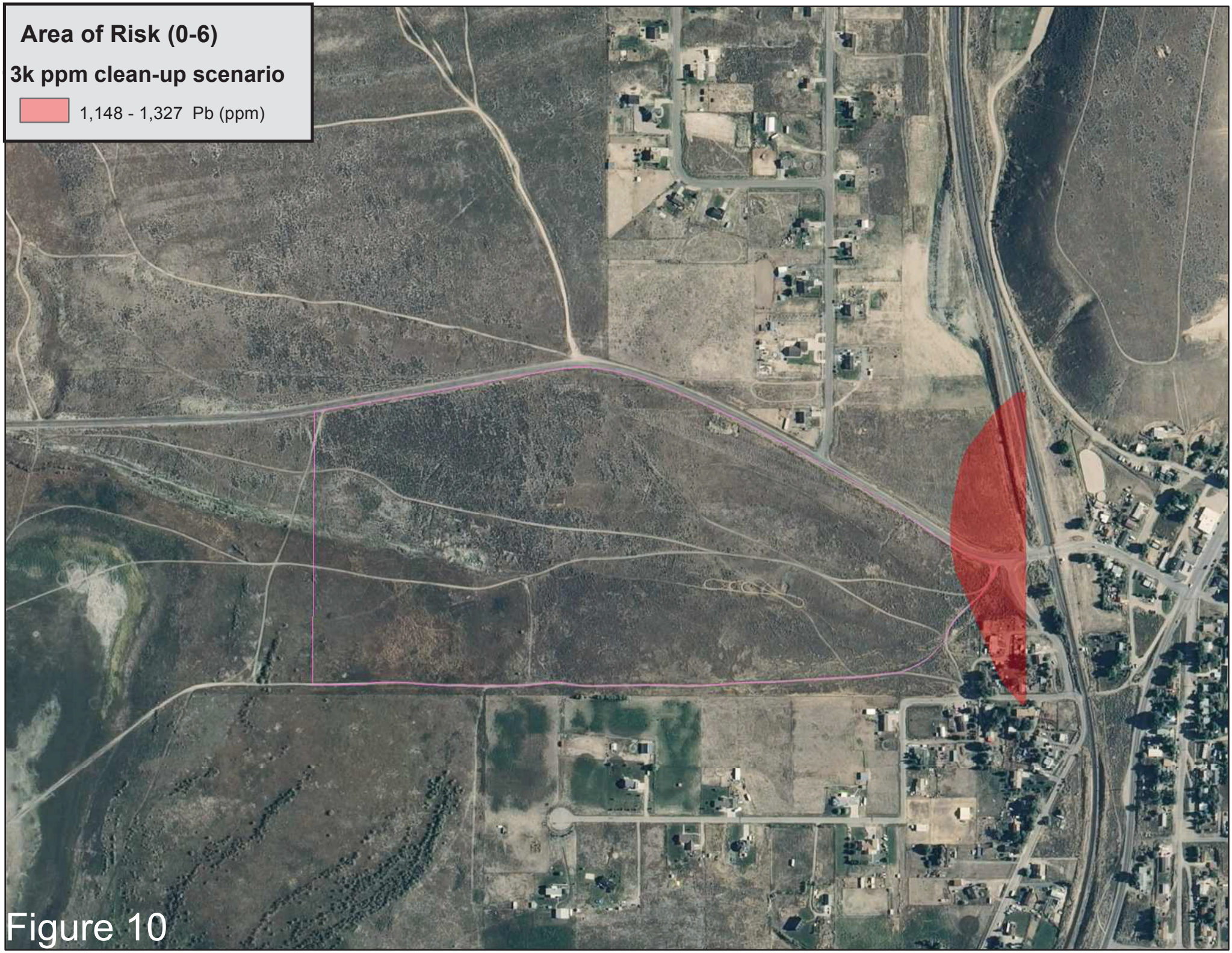



Figure 10

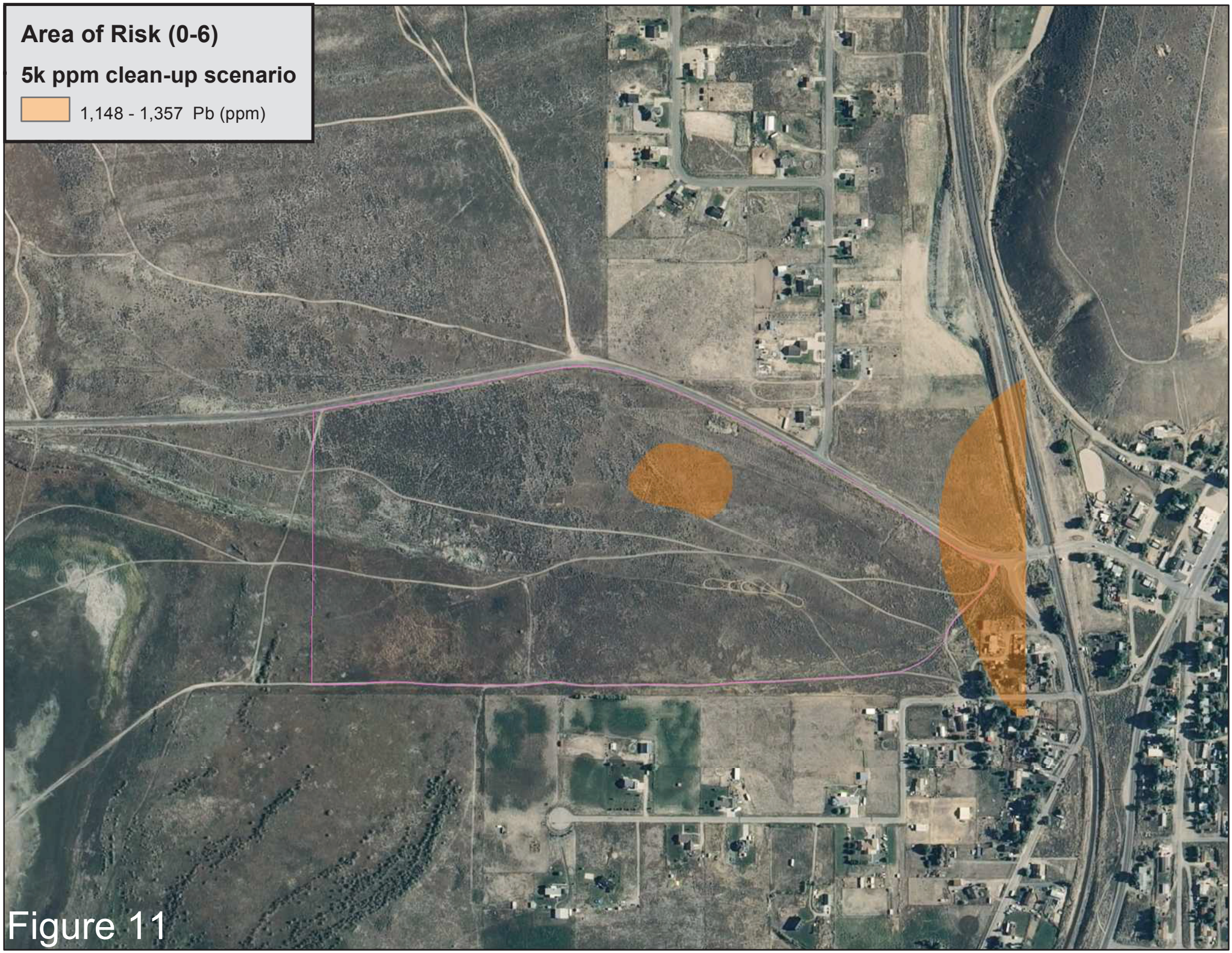



Figure 11

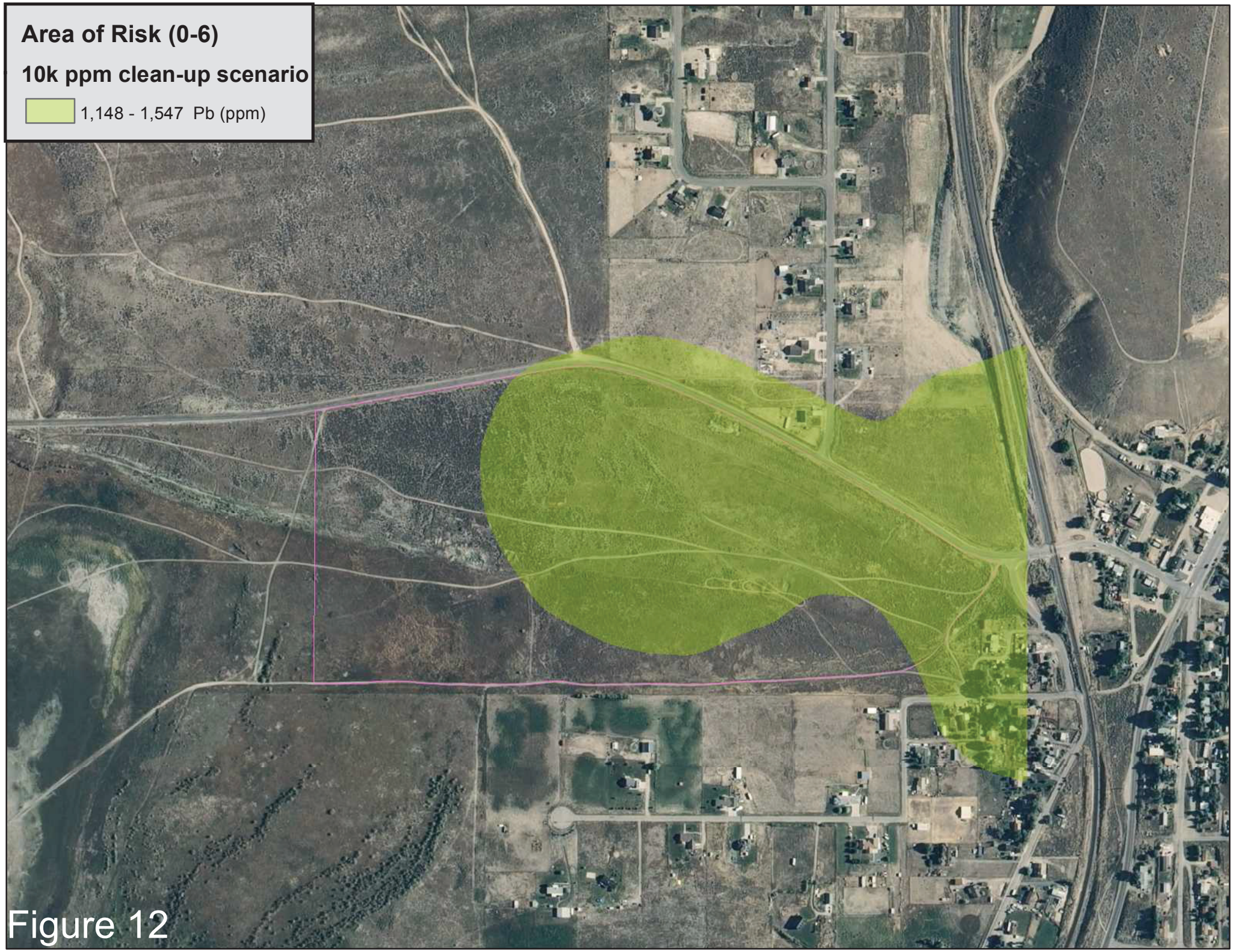



Figure 12

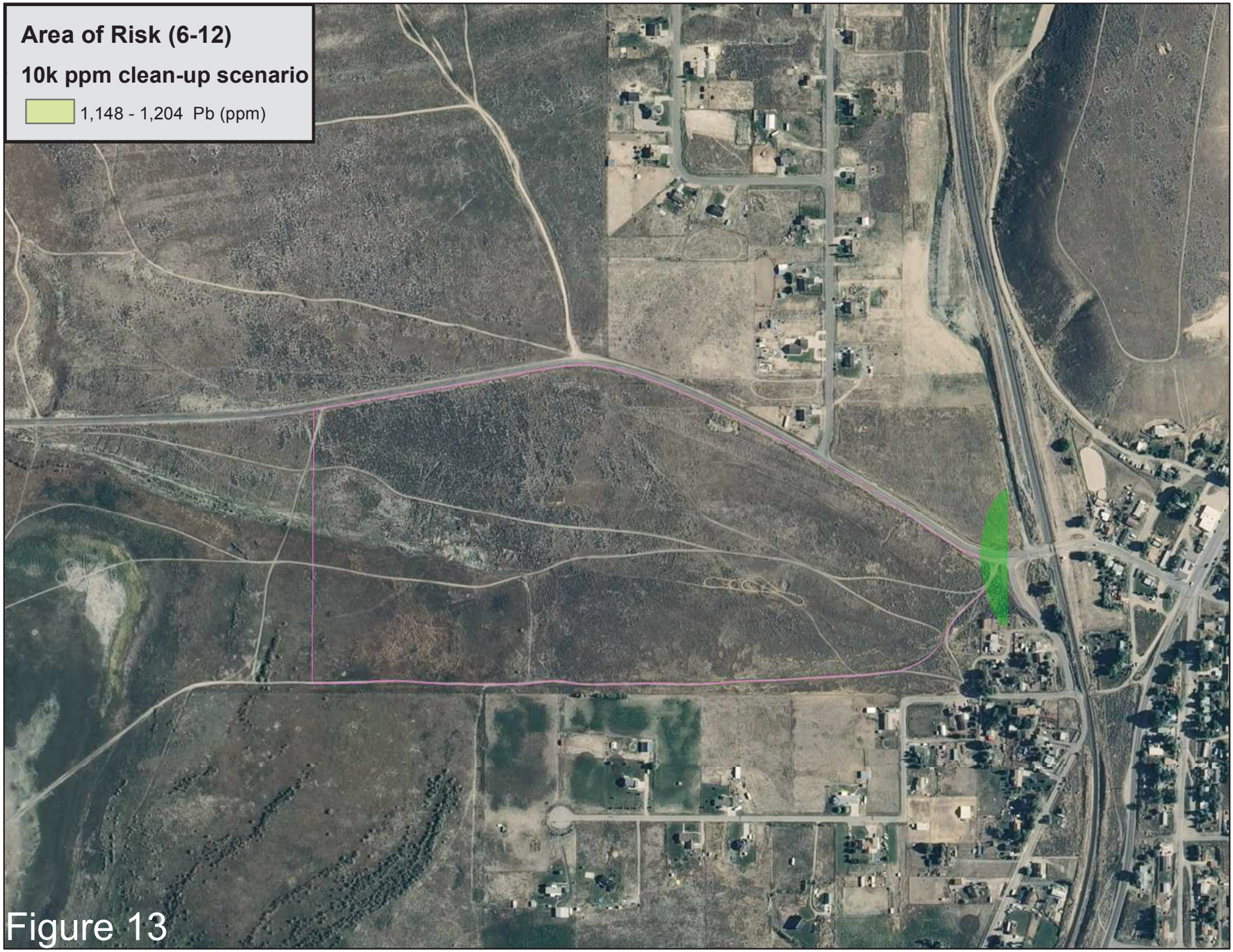



Figure 13

State of Utah

GARY R. HERBERT
*Governor*

SPENCER J. COX
*Lieutenant Governor*

Department of
Environmental Quality

Amanda Smith
*Executive Director*

DIVISION OF ENVIRONMENTAL
RESPONSE AND REMEDIATION

Brent H. Everett
*Director*

ERRC-004-14

# MEMORANDUM

TO: Jacobs Smelter Site File

THROUGH: Lisa Lloyd, Remedial Project Manager, Region 8, U.S. EPA

FROM: TDD Thomas D. Daniels, Environmental Engineer, Division of Environmental Response and Remediation, Utah Department of Environmental Quality

DATE: January 14, 2014

REGARDING: Site Summary and Creation of Operable Unit 6 for Jacobs Smelter Superfund Site

The Jacobs Smelter Superfund Site was discovered in 1996. In 1998, the Site was divided into three Operable Units, OU1, OU2 and OU3. OU1 consisted of residential properties within the town limits of Stockton, Utah, which were cleaned up in 1999. At that time, OU2 included underdeveloped and undeveloped land associated with the Waterman Smelter, west of Stockton, and the Chicago and Carson Buzzo Smelters south of Stockton. OU3 included contaminated soil within the Union Pacific railroad right of way, which was cleaned up by Union Pacific in 1999. This memo documents the decision to modify OU2 to address the contamination associated solely with the Waterman Smelter, including the Rawhide Ranchettes and B&B Subdivision. It also creates an additional Operable Unit, OU6, which will address the area around the Chicago and Carson Buzzo Smelters.

During 2010, a memo to the file was issued by the Utah Department of Environmental Quality in conjunction with Region 8 of the Environmental Protection Agency that documented modifications to the boundaries of the Site. Areas, shown through sampling efforts, to not be impacted by smelter –related contamination were no longer part of the Site and the boundaries were changed to reflect that. The 2010 memo documented the creation of two additional Operable Units, OU 4, which consisted of land east of the Rawhide Ranchettes and OU 5, land owned by the Bureau of Land Management. The memo also modified the boundary of OU2 to include the Waterman Smelter, Rawhide Ranchettes, B&B subdivisions, as well as the area surrounding the Chicago and Carson Buzzo Smelters, located south of Stockton (Site Boundary and designation of additional Operable Units for Jacobs Smelter Superfund Site, May 17, 2010).

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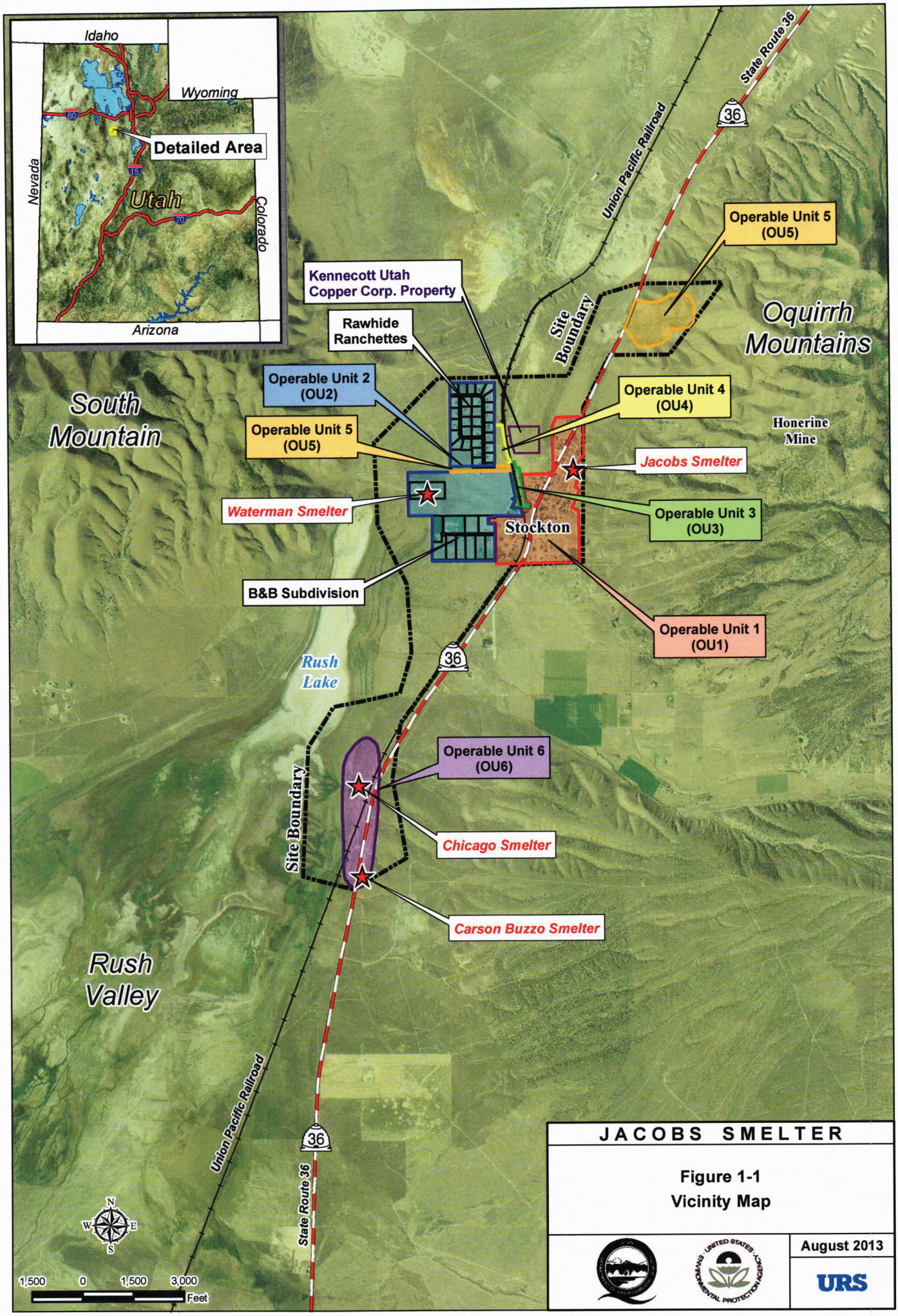
In order to address concerns regarding lead and arsenic contaminated soil associated with the Waterman Smelter and to revisit the remedial alternatives and associated cost estimates in the Revised Feasibility Study (RFS) soil samples were collected and analyzed during 2009 and 2010 from within the Waterman Smelter and two subdivisions (Rawhide Ranchettes and B&B Subdivision). The results of this sampling endeavor resulted in a non-time critical removal of contaminated soil from residences within the Rawhide Ranchettes Subdivision (performed in 2010 and 2011). Smelter related contamination that remains within the vicinity of the Waterman Smelter and at residential properties within the B&B Subdivision, will be addressed in future remedial actions.

The Chicago and Carson Buzzo Smelters are located approximately two miles south of the Town of Stockton and are much more remote than the Waterman Smelter. The area is mainly used for agricultural purposes and represents a different exposure scenario than the Waterman Smelter. The risk associated with contamination related to the Waterman Smelter was calculated using residential and recreational use exposure scenarios. Based on the difference in uses, differences in exposure scenarios, and the remote location of the Chicago and Carson Buzzo Smelters in relation to the town of Stockton, the risk and exposure assumptions used for the Waterman Smelter are not applicable to the Chicago and Carson Buzzo Smelters.

This memorandum modifies OU2 to address contamination associated solely with the Waterman Smelter including the Rawhide Ranchettes and B&B Subdivisions. In addition, the area surrounding the Chicago and Carson Buzzo Smelters is now designated as OU 6. The new boundaries for OUs 2 and 6 are depicted in the attached Figure. Additional investigations, including risk assessments will be performed for OU 6. OUs 1, 3, 4, and 5 remain unchanged.




JACOBS SMELTER

Figure 1-1
Vicinity Map

August 2013

URS