

**RECORD OF DECISION  
OPERABLE UNIT TWO  
DAVENPORT AND FLAGSTAFF SMELTERS SUPERFUND SITE  
SALT LAKE COUNTY, UTAH**

The U. S. Environmental Protection Agency (EPA), with the concurrence of the Utah Department of Environmental Quality (UDEQ), presents this Record of Decision (ROD) for Operable Unit Two (OU2) of the Davenport and Flagstaff Smelters Superfund Site (Site) in Salt Lake County, Utah. The ROD is based on the Administrative Record for OU2. The ROD presents a summary of the Remedial Investigation/Focused Feasibility Study (RI/FFS), actual and potential risks to human health and the environment, and a description of the Selected Remedy. The EPA 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 the ROD. The purpose of the 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 (AR).
3. Provide information necessary for determining the conceptual engineering components, outline Remedial Action Objectives (RAOs), and select cleanup 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 cleanup 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 EPA'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 cleanup 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/FFS and other information in the Administrative Record.

**Part 1**  
**Declaration**  
**Record of Decision**  
**Davenport and Flagstaff Smelters Superfund Site**  
**Operable Unit Two**

# **DECLARATION FOR THE RECORD OF DECISION DAVENPORT AND FLAGSTAFF SMELTERS SUPERFUND SITE OPERABLE UNIT TWO**

## **Site Name and Location**

Davenport and Flagstaff Smelters Superfund Site  
Operable Unit Two (OU2)  
Salt Lake County, Utah  
CERCLIS # UTD988075719

## **Statement of Basis and Purpose**

This decision document presents the Selected Remedy for OU2 of the Davenport and Flagstaff Smelters 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 (USC) 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 the Sandy Library, located at 10100 South Petunia Way, Sandy, Utah. The Administrative Record may also be reviewed at the EPA Region 8 Records Center, located at 1595 Wynkoop St., Denver, Colorado.

The State of Utah, through 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**

Since OU2 contains both commercial and undeveloped properties, and the risks associated with these areas are different, separate remedies were selected for each type of property.

The Selected Remedy for addressing the Commercial Areas of OU2 is excavation and off-Site disposal of all soils in excess of 1,000 mg/kg lead, ex-situ treatment and off-Site disposal of principal threat waste, followed by the replacement of excavated soil with clean soil, and re-vegetation.

The Selected Remedy for the commercial area will achieve substantial long-term risk reduction through removal of contaminated soil and will allow the property to continue to be used for commercial purposes. The components of the Selected Remedy include:

- Removal of existing vegetation from the contaminated areas.
- Excavation of all surface soils with lead concentrations exceeding 1,000 mg/kg (not expected to exceed 12 inches) using a mixture of machine and hand excavation.
- Ex-situ treatment of all principal threat waste by stabilizing leachable lead in soil.
- Transportation to and disposal of all excavated soil at an appropriate landfill.
- Placement of clean topsoil and re-vegetation of excavated areas.
- Institutional Controls (ICs), such as environmental covenants under the State of Utah's Environmental Covenants Act, conservation easements and/or land use controls established through Salt Lake County Zoning Authorities, and/or notification services, to ensure the remedy remains protective.

The Selected Remedy for addressing the undeveloped areas of OU2 is the excavation and off-Site disposal of all soils in excess of 3,000 mg/kg lead and ex-situ treatment and off-Site disposal of all principal threat waste, followed by the replacement of excavated soil with clean soil and re-vegetation.

The Selected Remedy will achieve substantial long-term risk reduction through removing contaminated soil. The components of the selected remedy include:

- Removal of existing vegetation from the contaminated areas.
- Excavation of all surface soils with lead concentrations exceeding 3,000 mg/kg to an expected maximum depth of 18 inches.
- Excavation of all principal threat waste.
- Ex-situ treatment of all principal threat waste by stabilizing leachable lead in soil.
- Transportation to and disposal of all excavated soil at an appropriate landfill.
- Placement of clean topsoil and re-vegetation of excavated areas.
- Removal and restoration of access road.
- ICs, such as environmental covenants under the State of Utah's Environmental Covenants Act, conservation easements and/or land use controls established through Salt Lake County Zoning Authorities, and/or notification services, to ensure the remedy remains protective.

The Selected Remedies for OU2 address 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. Principal threat waste is defined as soils with leachable levels of lead and arsenic above 5 mg/L based on the Toxicity Characteristic Leaching Procedure (TCLP). Stabilization of principal threat waste renders leachable lead in soil non-leachable so the soils can be disposed in a RCRA Subtitle D Landfill.

Two other Operable Units have addressed smelter contamination at the Site. Operable Unit One (OU1) addressed residential properties with lead and arsenic contaminated soils located on both the north and south sides of Little Cottonwood Creek. The OU1 cleanup was conducted from 2004 to 2007. Operable Unit Three (OU3) addressed agricultural land proposed for future residential use near the Flagstaff Smelter. OU3 was cleaned up by a private entity with EPA and UDEQ oversight. Both OU1 and OU3 were completed as Removal Actions.

## **Statutory Determinations**

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) to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principle element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this 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 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 (COCs) and their respective concentrations. (Sections 7.1.1 and 7.2.1)
- 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. (Sections 6.1, 6.2 , and 6.3)
- Baseline risk represented by the contaminants of concern. (Sections 7.1.4 and 7.2.4)
- Cleanup levels established for contaminants of concern and the basis for these levels. (Section 8)
- How principal threats are addressed. (Section 11)
- Potential land use that will be available at the Site as a result of the Selected Remedy. (Section 12.1.4 and 12.2.4)
- 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. (Sections 12.1.3 and 12.2.3)
- Key factors that led to selecting the remedy. (Sections 12.1 and 12.2)

**Authorizing Signatures**

For Davenport and Flagstaff Smelters Site, Operable Unit Two, Record of Decision

**U.S. Environmental Protection Agency, Region 8**

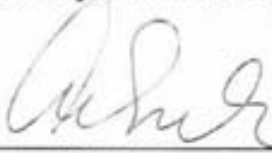
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*9/16/09*

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Date

Utah Department of Environmental Quality



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Amanda Smith  
Acting Executive Director  
Utah Department of Environmental Quality

9.14.09

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Date

**Part 2**  
**Decision Summary**  
**Record of Decision**  
**Davenport and Flagstaff Smelters Superfund Site**  
**Operable Unit Two**

**Decision Summary**  
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## **Section 1: Site Name, Location, and Brief Description**

The Davenport and Flagstaff Smelters Superfund Site (Site) (CERCLIS# UTD988075719) is located approximately 15 miles southeast of Salt Lake City, Utah, in the mouth of Little Cottonwood Canyon. (See Figure 1-1) The Davenport Smelter was located on the southern side of the canyon, near Little Cottonwood Canyon Road. The Flagstaff Smelter was located north of Little Cottonwood Creek. The land use surrounding the Site is mainly residential with some agricultural and commercial facilities. The Site consists of a mix of residential, commercial and undeveloped property.

The Site has been separated into three Operable Units. Operable Unit One (OU1) addressed residential properties with lead and arsenic contamination in surface and subsurface soils. The OU1 cleanup was conducted from 2004 to 2007. Operable Unit Three (OU3) addressed agricultural land proposed for future residential use near the Flagstaff Smelter. OU3 was cleaned up in 2006 by a private entity with EPA and UDEQ oversight. This ROD addresses Operable Unit Two (OU2). OU1, OU2 and OU3 are shown on Figure 1-2. OU2 covers approximately 29 acres and consists of a mixture of commercial and undeveloped land. The Commercial and Undeveloped areas of OU2 are shown on Figure 1-3.

The commercial area consists of a restaurant and reception center that covers approximately six acres and contains landscaped lawns and hedges as well as vineyards. The undeveloped area of OU2 is a 22.8 acre wooded and marshy area with Little Cottonwood Creek forming the northern border. Two large ponds are located in the northwest corner of the undeveloped area. A ground water seep acts as a tributary to the ponds. There are also three other seeps within the undeveloped area that appear to be the water sources for an extensive system of wetlands.

The Utah Department of Environmental Quality (UDEQ) is the lead agency for the Site with the EPA acting as the support agency.

## **Section 2: Site History and Enforcement Activities**

### **2.1 Site History**

The Davenport and Flagstaff smelters were both constructed around 1870 at the mouth of Little Cottonwood Canyon. Both of these smelters processed lead and silver ore removed from mines located near Alta, Utah. Ore was delivered to the smelters using wagons and possibly rail cars. The ore was stockpiled near the smelters until it was processed. Smelting technology of the era was relatively basic. The ore was first crushed to a reasonable size and then was placed, along with fuel (either wood or coal), into the smelter. As the fuel burned, the temperature of the ore was raised to the melting points of lead and silver. As the liquid metal drained to the bottom of the smelter a gate was opened and the molten metal was poured into ingots and then shipped to a more advanced smelter for further processing and refining. The waste ore and fuel, or slag, was usually

stockpiled somewhere out of the way. The ore crushing process likely generated dust contaminated with lead and arsenic. In addition, the flue ash from the smelter likely contained concentrated levels of these metals, which would have settled in the vicinity of the smelters. Both of the smelters were decommissioned and dismantled by 1879.

The area was mainly used for agricultural purposes until the 1970's and 1980's when it started being developed as a restaurant and as a residential community.

## **2.2 EPA and UDEQ Investigations**

In 1991, the discovery of ladle casts in the Little Cottonwood Creek, near the Flagstaff Smelter location, prompted a study of historical smelter Sites in the Salt Lake Valley. During investigations performed in 1992 by the EPA and in 1994 by UDEQ, elevated concentrations of arsenic and lead were detected in soil at both smelter locations.

A Phase I Site Assessment was conducted by the EPA Region 8, Emergency Response Branch, Technical Assistance Team (TAT) in April of 1992. During this Site assessment, elevated levels of arsenic and lead were detected in surface and subsurface soil near the Flagstaff Smelter. Based on these results, the TAT performed a Phase II Site Assessment.

During the Phase II investigation, the Davenport Smelter was discovered south of the Flagstaff Smelter. The area around the Davenport Smelter was investigated as Phase III of the Little Cottonwood Creek Smelter Sites in July of 1992. The limited sampling performed during both the Phase II and Phase III assessments revealed high levels and widespread distribution of arsenic and lead contaminated soils surrounding the former smelters.

Based on the results of the 1992 sampling efforts, a Preliminary Assessment (PA) was performed in August of 1992. Focused Site Inspections were performed for the Davenport and Flagstaff Smelters in 1994. Additional sampling activities were conducted in June 1994 near the former smelter Sites in order to determine the distribution of the soil contamination dispersed away from the source area via air, surface water, or ground water pathways. From these investigations it was determined that more investigation was warranted. The results of the Site Inspections are presented in the Analytical Results Report for each representative smelter.

A Site Characterization of the residential areas near the two smelters was performed in 1998. A total of 740 samples were collected from 32 residences near the locations of the two smelters. Surface and subsurface samples were collected in the general area of the former smelter locations in order to provide information regarding the source, nature, and extent of arsenic and lead contamination. Lead and arsenic contamination was found in surface and subsurface soils in the residential areas surrounding both of the smelters at concentrations well above risk-based screening levels established by the EPA.

The Site was placed on the Superfund National Priorities List (NPL) on April 30, 2003. The Site has been separated into three Operable Units (OUs). Operable Unit One (OU1) addressed residential properties with lead and arsenic contamination. Operable Unit Three (OU3) addressed agricultural land proposed for future residential use near the Flagstaff Smelter. Operable Unit Two (OU2) consists of commercial and undeveloped areas between the two smelters.

Cleanup activities associated with OU1 were conducted from 2004 to 2007 by the EPA Removal Program. OU3 was cleaned up by a private entity in 2006 under an agreement with EPA. EPA and UDEQ provided oversight for OU3 cleanup activities.

Extensive sampling activities took place at OU2 during the summer of 2006. The results of the sampling activities were used to develop a Remedial Investigation (RI) Report, a Human Health Risk Assessment (HHRA), an Ecological Risk Assessment (ERA), and a Focused Feasibility Study Report (FFS). During the investigation, three residential properties within the boundaries of OU2 were found to contain lead and arsenic concentrations greater than the residential cleanup levels established for OU1. These three properties were incorporated into the OU1 cleanup and were addressed during the 2007 construction activities.

Lead and arsenic have been identified as the contaminants of concern (COCs) for OU2. RI sampling results indicate that lead concentrations in soil range from 10 to 10,800 milligrams per kilogram (mg/kg), and arsenic concentrations in soil range from 1.5 mg/kg to 300 mg/kg. The elevated concentrations of lead and arsenic were found in both surface and sub-surface soils.

Based on the data collected during the RI and the HHRA cleanup levels of 1,000 mg/kg lead and 3,000 mg/kg lead were established respectively for the commercial and undeveloped areas of OU2. The OU2 RI also investigated metals concentrations in surface water and ground water and did not find a significant risk to human health or the environment related to metals in these media.

The FFS was performed in 2008 to screen different remedial technologies for the Site. The FFS investigated cleanup alternatives for both the commercial and undeveloped areas of OU2.

### **2.3 Enforcement Activities:**

EPA initiated a Potentially Responsible Party (PRP) search in 2000, focusing on the owners and operators of the smelters. However, none of the companies that owned or operated the smelters still exist, nor could they be traced to current operating entities. No general or special notice letters have been issued.

### **Section 3: Community Participation**

EPA and UDEQ have conducted the required community participation activities through the presentation of the RI, HHRA, ERA, FFS and Proposed Plan (PP), a 30 day public comment period, a public meeting, and the presentations of the Preferred Remedy in the PP. In addition, several fact sheets and other mailings were dispersed to the public. The Granite Community Council was updated about Site activities numerous times.

The Administrative Record (AR) for the Site is available for review at the Sandy City Public Library and at the EPA Superfund Records Center. A notice advertising the availability of the AR and the Proposed Plan was published in the Deseret News and The Salt Lake Tribune on February 6, 2009.

The Proposed Plan for OU2 was issued on February 6, 2009. The RI/FFS and other documents in the Administrative Record were made available to the public at this time as well. In addition, over 400 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 February 6 to March 9, 2009.

A public open house was held on February 18, 2009, in the Metropolitan Water District of Salt Lake and Sandy 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 three OUs:

- OU1 – Addressed residential properties with lead and arsenic soil contamination. The OU1 cleanup was conducted from 2004 to 2007.
- OU2 – Is the subject of this ROD and consists of contaminated soil within commercial and undeveloped areas.
- OU3 – Addressed agricultural land near the Flagstaff Smelter. OU3 was cleaned up in 2006 by a private entity with EPA and UDEQ oversight.

The ROD for OU1 was signed in September of 2002 and consisted primarily of excavation and off-Site disposal of surface and subsurface soils with lead concentrations greater than 600 mg/kg and arsenic concentrations greater than 126 mg/kg.

An Explanation of Significant Differences (ESD) was prepared for the OU1 ROD in April 2005. The ESD extended the remedy selected in OU1 to areas of the Site that were

considered non-residential at the release of the ROD but were later developed as residential properties. The newly-developed residential properties described in the ESD were designated as OU3.

The cleanups of OU1 and OU3 were Removal Actions. The OU1 cleanup was performed by the Removal Program of EPA and the OU3 cleanup was performed by a developer under an Administrative Order on Consent with EPA.

OU2 is the subject of this ROD. The cleanup of OU2 will address contaminated soil from historical smelter operations on both commercial and undeveloped land. The Remedial Action described in this ROD will not involve surface water or ground water because the RI showed that neither have been impacted by Site contaminants. OU2 is the final OU to be addressed. No further remedial action, other than the implementation of ICs as outlined in the selected remedies for OU1 and OU2, will be performed at the Site after completion of the OU2 cleanup.

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

## **Section 5: Site Characteristics**

OU2 covers approximately 29 acres and consists of a mixture of commercial property and undeveloped land. The Commercial and Undeveloped areas of OU2 are shown on Figure 1-3.

The Commercial area consists of a restaurant and reception center that covers approximately six acres and contains landscaped lawns and hedges as well as vineyards.

The undeveloped area of OU2 is a 22.8 acre wooded and marshy area with Little Cottonwood Creek forming the northern border. Two large ponds are located in the northwest corner of the undeveloped area. A ground water seep acts as a tributary to the ponds. There are three other seeps that appear to be the water source for an extensive system of wetlands.

### **5.1 Site Conceptual Models**

A HHRA and an ERA were prepared for OU2 to determine the health and ecological risks associated with the contamination at the Site. The human health exposure areas are shown on Figure 5-1.

Figure 5-2 shows the conceptual model for human exposure and presents how humans may be potentially exposed to Site contaminants. The following pathways were considered potentially complete and significant:

- Current/future adult indoor workers – ingestion of surface soil as indoor dust in the commercial areas.

- Current/future adult grounds workers – ingestion of surface soil, subsurface soil, pond water, and pond sediments; and direct contact with pond water in the commercial area.
- Current/future youth visitors – ingestion of surface soil, surface water, and sediments and direct contact with surface water in the undeveloped area.

Figure 5-3 shows the conceptual model for ecological exposure and presents how ecological receptors may be potentially exposed to Site contaminants. The following pathways were considered potentially complete and significant and were evaluated in the ERA:

- Plants - direct contact with surface and subsurface soils
- Soil Invertebrates - direct contact with surface and subsurface soils
- Herbivores - ingestion of surface soil, subsurface soil, food/prey, seep water, pond water, pond sediment, and creek water
- Invertivores (insect eating animals) - ingestion of surface soil, subsurface soil, food/prey, seep water, pond water, pond sediment, and creek water
- Carnivores - ingestion of surface soil, subsurface soil, food/prey, seep water, pond water, pond sediment, and creek water
- Benthic (sediment dwelling) Macroinvertebrates - direct contact with pond and creek sediments
- Aquatic organisms - direct contact with pond and creek water

The ERA identified herbivorous and invertivorous birds such as the American robin as the most exposed and sensitive species.

## 5.2 Physical Characteristics of the Site

The Davenport and Flagstaff Smelter Site is located in a residential area at the mouth of Little Cottonwood Canyon, approximately fifteen miles southeast of Salt Lake City, Utah, within the southwest quarter of the northwest quarter of Section 12, Township 3 south, Range 1 East, Salt Lake Base and Meridian (Figure 1-1). The Wasatch Mountains rise abruptly to the east with peaks greater than 11,000 feet above mean sea level (amsl) less than four miles from the Site. Little Cottonwood Creek flows from these mountains and forms the northern border of OU2. The boundaries of OU2 are shown in Figure 1-3.

The elevations of the Site range from approximately 5,150 feet amsl near Wasatch Boulevard to 5,230 feet amsl near the eastern boundary. Within this area the Flagstaff Smelter was located on the north side of Little Cottonwood Creek, and the Davenport Smelter was located on the opposite side of the creek, approximately ¼ mile south of the Flagstaff Smelter.

The Site is situated near a traditional boundary between the bedrock of the mountains and unconsolidated valley fill. The consolidated rocks of the Wasatch Mountain Range above the Site consist of Precambrian quartzite and shale, and tertiary quartz monzonite. Glacial moraines, talus and lacustrine deposits are present along the valley margin. The

Site is situated within a zone of complex surface faulting associated with the Wasatch Fault.

Native soils within the Site are typically granular, ranging from fine to coarse sand with gravel and cobbles; however, on residential and commercial properties, a large amount of topsoil has been imported for landscaping purposes.

The climate of the foothills of the Wasatch Mountain Range (including the Site area) varies according to the time of year. Summer months are usually hot and dry with limited precipitation. Based on measurements collected near the mouth of Big Cottonwood Canyon (approximately three miles north of the Site at an elevation of 4960 feet amsl the average maximum temperature for July is 92 degrees Fahrenheit, while the average minimum temperature for January is 24 degrees Fahrenheit. The greatest amount of precipitation usually occurs during the spring months. The annual average precipitation is 24.30 inches per year. Snow usually falls during the months of November through April, with a monthly average of 18.5 inches for December and 14.8 inches for January.

The primary surface water feature near the Site is Little Cottonwood Creek. Little Cottonwood Creek is a perennial stream beginning near the resort town of Alta at the head of the Little Cottonwood Canyon. The Creek flows west through the length of the canyon and eventually discharges in the Jordan River in the Salt Lake Valley. Little Cottonwood Creek enters the east end of the Site near the mouth of Little Cottonwood Canyon and proceeds through the length of the Site, exiting at the west end, and forms the northern border of OU2 as shown on Figure 1-3. There are also several manmade ponds present on the La Caille property (commercial property) as well as adjacent to the entrance road to the La Caille restaurant. Several natural springs discharge from the hillside directly west of Quail Ridge Road and south of La Caille restaurant. A number of these springs originate in the back yards of residences that were cleaned up as part of OU1. The springs flow to the northwest and create a wetland area near the entrance road of the La Caille restaurant before they drain into Little Cottonwood Creek.

Ground water in the Salt Lake Valley area is in fractured bedrock and in unconsolidated materials underlying the valley and canyon floors. Within the Salt Lake Valley, ground water generally occurs in a shallow unconfined aquifer and deeper confined aquifers. The deeper aquifers serve as a source of drinking water for much of the Salt Lake area. Confining beds consisting of clay, silt and fine sand separate the shallow aquifer from the deeper aquifers. These confining beds pinch out near the base of the mountains resulting in a deep unconfined aquifer in areas along the valley margin, where the Site is located. Ground water in the deep aquifer is recharged in this area from the infiltration of precipitation, and the inflow of water from the fractured bedrock. Depth to the deep aquifer in the area of the Site is unknown, but believed to be greater than 100 feet based on Site location and on records from two local municipal wells. In the lower elevations of the Site, such as along the Little Cottonwood Creek and in the wetland areas, depth to the unconfined aquifer is likely much less. Surface water springs, discussed above, are likely associated with a shallow perched aquifer or aquifers that may exist in this area.

However, no investigation has been conducted to specifically determine the nature and extent of potential perched aquifers in the study area, nor is additional investigation planned.

### **5.3 Summary of OU2 Remedial Investigation**

In 2006, a Remedial Investigation was performed on OU2 to characterize contamination at the Site. Sampling of soil, ground water, surface water, and sediment was conducted from July 31, 2006, to September 20, 2006. Soil samples obtained from the commercial and residential areas were analyzed for lead and arsenic to support the HHRA.

Additionally, a subset of these samples was analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) to support waste characterization for purposes of the FFS. Soil samples from the undeveloped area and background locations, as well as sediment samples, were analyzed for priority pollutant list (PPL) metals to support both the ERA and the HHRA. A subset of these samples was also analyzed using TCLP. Ground water and surface water samples were analyzed for PPL metals as well as hexavalent chromium, calcium, and magnesium. All field work was performed in accordance with a sampling and analysis plan that had been approved by both EPA and UDEQ.

#### **5.3.1 Remedial Investigation Sampling Strategy**

A total of 265 soil samples were collected from 35 zones in the commercial area, 12 zones in the residential area, 35 zones in the undeveloped area and seven background locations (See Figures 5.3-1 and 5.3-2).

Soil samples from each zone in the commercial and residential areas were comprised of a surface composite sample collected from 0-2 inches below ground surface (bgs) from ten randomly located aliquots and three subsurface grab samples collected from 0-6, 6-12 and 12-18 inches bgs at the pre-determined center point of each zone.

Soil samples from each zone in the undeveloped area were comprised of one 10-point surface composite sample collected from 0-2 inches bgs and one 10-point subsurface composite sample collected from 2-18 inches bgs. A total of 40 samples were collected for lead and arsenic analysis using TCLP.

A total of 18 co-located surface water and sediment samples were collected from locations within, up-gradient, and down-gradient of OU2. Eight samples were collected from Little Cottonwood Creek, four samples were collected from the manmade ponds on the La Caille property, two samples were collected from naturally occurring ponds adjacent to the entrance of La Caille, one sample was collected from the stream that feeds these ponds, and three samples were collected from springs located in the undeveloped area (See Figure 5.3-3).

Direct push technology for temporary ground water monitoring was attempted at eight locations within and around OU2. Ground water was located at four of these locations at depths of 3 feet, 5 feet, 7.5 feet and 22 feet bgs.

### **5.3.2 Nature and Extent of Soil Contamination**

The main source of contamination within OU2 is smelter-related waste and emissions from the Davenport and Flagstaff Smelters. It is presumed that slag and tailings were reprocessed at one of the other larger smelters within the Salt Lake Valley. However, documentation to support this presumption has not been found.

The nature of contamination at OU2 consists mainly of lead and arsenic in Site soils. Lead and arsenic are naturally occurring elements that are present in the ores that were processed at the Davenport and Flagstaff Smelters. The smelting process involved the crushing and melting of the ore in order to concentrate the desired metals, generally lead and silver. This crushing process likely released dust containing lead and arsenic. In addition, flue ash containing concentrated levels of lead and arsenic would have been produced and distributed throughout the Site. Also, slag (a byproduct of the smelting process) is present throughout the Site and is known to contain elevated concentrations of lead and arsenic as well.

Lead and arsenic have been identified as the contaminants of concern (COCs) for OU2. RI sampling results indicate maximum lead concentrations of 10,800 mg/kg and maximum arsenic concentrations of 300 mg/kg. The majority of the samples had lead concentrations below 600 mg/kg and arsenic concentrations below 20 mg/kg. Elevated concentrations of lead and arsenic were found in surface and sub-surface soils. Lead concentrations greater than the cleanup levels established for OU1 were found on the residential portion of OU2. Surface and Subsurface lead and arsenic concentrations are shown on Figures 5.3-4 and 5.3-5.

Of the 40 samples analyzed using TCLP, two samples exceeded the characteristic hazardous waste TCLP value for lead (5 milligrams per Liter (mg/L)). These two samples were collected from the 0-2 inch and 2-18 inch interval of Zone U2 in the undeveloped area and had TCLP results of 15.9 mg/L and 12.8 mg/L, respectively. The associated soil lead results were 3,670 mg/kg and 2,630 mg/kg, respectively. The TCLP results from Zone U2 are expected to be representative of the majority of soils that require remediation in the undeveloped area. No TCLP arsenic results exceeded the arsenic characteristic hazardous waste value (5 mg/L).

Within the Commercial Area, there are three zones C-4, C-5 and C-24 that contain lead concentrations high enough to warrant remedial action.

Undeveloped Zones U2, U3, U4 and U34 contain lead concentrations at levels high enough to warrant remedial action.

Approximately 6,000 tons of lead and arsenic contaminated soils exceeding cleanup levels are located within OU2. This contaminated soil will require remediation. It is expected that a majority of the soil requiring remediation within the undeveloped area will exhibit a characteristic of hazardous waste based on TCLP testing and will require

treatment prior to disposal. Some of the soil within the commercial area may require treatment prior to disposal as well.

### **5.3.3 Nature and Extent of Surface Water Contamination**

Eighteen co-located surface water and sediment samples were collected and analyzed for total and dissolved PPL metals. The maximum detected value of lead and arsenic for total metals (unfiltered) is 39 µg/L (micrograms per Liter) and 4 µg/L, respectively. The maximum detected concentration for dissolved (filtered) lead in surface water is 0.8 µg/L. The maximum concentrations of lead and arsenic detected in sediments is 263 mg/kg and 30 mg/kg respectively.

Based on surface water results, all samples were less than the associated maximum contaminant level (MCL) for arsenic. With the exception of one sample, results for lead were below the drinking water action level (15 µg/L) (referred to as a MCL in this ROD). The sample that exceeded the MCL for lead was collected at SW6 from a nearly inaccessible seep within the Undeveloped Area and had a total lead concentration of 39 µg/L. Although the lead concentration was above the associated MCL, the dissolved (filtered) lead concentration from the same sample location was less than the detection limit. This indicates that there may have been lead-bearing sediment in the unfiltered surface water sample. MCLs are based on dissolved (filtered) contaminant levels. All concentrations of lead and arsenic in sediment were below the residential screening levels for soil.

Based on the comparison of surface water sampling results and MCLs, and the lack of dissolved Site related contaminants in surface water above MCLs, Site related metals contamination in surface water or sediment is not considered to be an issue at the Site.

### **5.3.4 Nature and Extent of Ground Water Contamination**

Based on the Site's location within the foothills of the Salt Lake Valley as well as the geologic and hydrogeologic features described in the RI, it is suspected that there are a number of perched aquifers associated with the Site. Depth to the deep unconfined aquifer is unknown but estimated to be greater than 100 feet bgs based on the depth to ground water at two nearby municipal wells. These wells are owned by the city of Sandy and are located approximately one mile up gradient of the Site. As part of the municipal water supply the wells are required to meet Safe Drinking Water Act standards, and are monitored for heavy metals as well as other contaminants on a regular basis. Although ground water has been investigated, due to the findings in the RI, no investigation has been conducted to specifically determine the nature and extent of potential perched aquifers in the study area.

Ground water sampling was conducted for the OU2 RI during the summer of 2006. Ground water sampling was attempted at eight locations within, or near the Site using direct push methodology. Ground water was found at four of the sample locations, providing some confirmation of the discontinuous nature of ground water associated with

the Site. The ground water sample locations are shown on Figure 5.3-3. Table 5-1 lists the ground water sampling results.

A comparison of MCLs to unfiltered (total) and filtered (dissolved) sample concentrations was conducted in the RI. The comparison showed lead concentrations in unfiltered samples above the MCL in samples GW 02, GW 03, and GW 04, and arsenic concentrations in unfiltered samples above the MCL in all of the samples. Only GW 01 and GW 02 had filtered sample concentrations above the MCL for arsenic. The concentrations detected in these two samples were slightly above the arsenic MCL of .01 mg/L. None of the filtered sample concentrations exceeded the MCL for lead.

The detection of contaminants in the unfiltered samples could be a result of entrained soil particles that may have had lead or arsenic containing material in them due to the sampling methodology and the fact that the samples were unfiltered. MCLs are based on filtered samples.

The two sample locations where filtered (dissolved) arsenic exceeded the MCL (GW01 and GW02) are located near the northwest corner of OU2, near the Little Cottonwood Creek, and are a considerable distance away from the former smelter locations. In contrast dissolved arsenic was not detected at sample locations near the smelters (GW03 and GW04) where Site related contamination was expected. This indicates that the dissolved arsenic is associated with naturally occurring arsenic-bearing material, possibly from arsenic bearing rock formations or sediments in the vicinity of Little Cottonwood Creek and is not related to the smelters at the Site.

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

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

### **6.1 Current and Potential Land Uses**

OU2 consists of a mixture of commercial and undeveloped land. Three residences within the boundaries of OU2 were investigated during the RI and were addressed as part of the OU1 cleanup. The commercial portion of OU2 encompasses the La Caille restaurant, and the surrounding grounds and vineyards associated with the restaurant. The undeveloped area consists of: property owned by Salt Lake City as part of their watershed protection program; the right of way for Wasatch Boulevard owned by Salt Lake County; a parcel owned by the City of Sandy; and a parcel near the Little Cottonwood Creek that is part of the La Caille property. The land use surrounding the Site is primarily residential.

The La Caille restaurant is one of the valley's premier restaurants. The grounds are groomed and well-maintained and are often used to host weddings and other receptions.

In addition to being a watershed protection area (as designated by Salt Lake City), the undeveloped area is used for recreational purposes as well. Area residents have been observed using the property for hiking and walking dogs, and have expressed interest in continuing this use. Other recreational uses have not been observed.

Based on conversations with Salt Lake City and Salt Lake County, the future use of the portions of OU2 owned by Salt Lake City, Salt Lake County and Sandy City is unlikely to change from the observed present use as a watershed protection area, with occasional recreational use.

Due to the proximity to the mouth of Little Cottonwood Canyon and the Salt Lake Valley, along with the recent development of neighboring properties for residential use, it is possible that the portion of OU2 owned by La Caille will be eventually developed for residential use.

## **6.2 Current and Potential Surface Water Uses**

The Little Cottonwood Creek is a perennial stream that flows west through the Site and eventually discharges to the Jordan River in the Salt Lake Valley. In addition to the Creek, there are a number of man-made and naturally occurring ponds as well as an extensive wetlands system fed by naturally occurring springs. The current use of surface water within the Site itself is recreational with some agricultural use. However, the Metropolitan Water District of Salt Lake and Sandy Little Cottonwood Treatment Plant is located approximately 0.5 miles down stream of the Site and treats and supplies drinking water to approximately 500,000 people. Based on conversations with current property owners and the water district the use of surface water associated with the Site is not anticipated to change.

## **6.3 Current and Potential Ground Water Uses**

There is no current use of ground water and no direct human exposure to ground water at the Site. Due to the limited extent and discontinuous nature of the perched aquifer ground water at the Site is an unlikely source of drinking water.

The agencies have not performed an investigation to specifically determine the extent of the perched aquifer; however, since ground water was not encountered at four of the eight locations attempted, it appears that the perched aquifer is discontinuous. The presence of a discontinuous perched aquifer is compatible with the geologic and hydrogeologic features described in the RI.

Based on the fact that the contamination in the perched aquifer was just slightly above the MCL and the depth to the deeper aquifer is greater than 100 ft bgs, the contamination observed is at such low levels that the perched ground water in this area is not expected to adversely impact the deeper drinking water aquifer that underlies the entire Salt Lake Valley, nor is it expected to represent any threat to surface water in the Little Cottonwood Creek.

The deep aquifer that runs below the Site is not being used or anticipated to be used at the Site and is not expected to be impacted by contamination from the Site. Based on the limited extent and discontinuous nature of the perched aquifer no future use of the perched ground water is anticipated.

## **Section 7: Summary of Site Risks**

### **7.1 Human Health Risks**

A Human Health Risk Assessment (HHRA) was performed on OU2 to determine whether smelter contamination posed an unacceptable threat to human health. Analytical results for surface soil, subsurface soil, ground water, surface water and sediments were used to identify areas, media and chemicals of concern.

A baseline HHRA estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes results of the HHRA for this Site.

#### **7.1.1 Identification of Chemicals of Concern**

The contaminants of concern (COCs) were determined by evaluating all metals and other contaminants in the soil (surface and sub-surface) and water (surface and ground water) associated with the smelter activity. After evaluating all of the contaminants in all the media, the only COCs identified to have potential for human health risk for the Davenport and Flagstaff Smelters Site are lead and arsenic in the soil (surface and sub-surface). The range of lead in the soil at this Site (surface and sub-surface) was 82 mg/kg to 10,800 mg/kg. The range of arsenic in the soil at this Site was 4.5 mg/kg to 300 mg/kg. Arsenic and lead were detected in 100% of surface soil samples used in the quantitative risk assessment. Arsenic and lead were also detected in 100% of subsurface soil and sediment samples.

#### **7.1.2 Exposure Assessment**

A Site conceptual model (SCM) (see Figure 5-2) was developed to determine complete exposure pathways. Exposure Scenarios that were considered were: Residential, Grounds Workers; Commercial Indoor Workers; Restaurant Patrons; and Adult, Youth, and Child Visitors. The exposure routes and exposure media that were considered for these receptors include inhalation of dust associated with the Site, ingestion of the soil and water at the Site, and dermal contact with the soil and water at the Site. A complete exposure pathway (which represents potential risk) is noted in the SCM when a receptor has contact with the contaminate media through an exposure route. At the Flagstaff/Davenport Site, the exposure pathways that were complete included an exposure to contaminated soil by the Residential scenario, Grounds Workers scenario, Commercial Workers scenario and Youth Visitors scenario. Exposure pathways that are

not complete include any exposure to dust and water. Additionally, the Restaurant Patron scenario and Adult and Young Child Visitor exposure to contaminated soil are not complete.

Exposure point concentrations (EPCs) for arsenic and lead in surface soil were either the 95% upper confidence limit (UCL) of the mean concentration (as determined using ProUCL) or the maximum detected concentration in each exposure area, whichever was lower. Table 7-1 provides the surface soil EPCs and summary statistics used to calculate the EPCs. EPCs for arsenic and lead in indoor dust were estimated from EPCs in surface soil, using regression equations derived for OUI. Calculated EPCs in the commercial exposure area are 24 mg/g for arsenic in indoor dust and 222 mg/kg for lead in indoor dust.

### **7.1.3 Toxicity Assessment**

After evaluating all of the chemicals associated with the smelting activity at the Davenport and Flagstaff Site, two contaminants of concern emerge as potential risk. These two contaminants, lead and arsenic, are at concentrations that may cause toxic effects if a receptor (human or animal) were exposed.

The toxicity of lead has been studied for centuries. Inorganic lead does not currently have an oral reference dose (RfD) or oral slope factor (SF). The potential hazard from environmental exposure to lead is estimated based on the blood lead levels of adults, children and fetuses. Children and fetuses are the group of individuals that are the most sensitive to exposure to environmental lead. This is due to the fact that children are growing and are more likely to have hand to mouth activities. A child who has a blood lead level exceeding 10 µg/dL would be considered a health concern. Numerous health effects are associated with elevated blood lead. These include neurobehavioral development (decreased IQ and hand-eye coordination, along with shortened attention spans), red blood cell development, decreased gestational age and birth rate, and reduced size at ages 7-8. Fetuses have similar health effects as stated above when the mother has elevated blood lead levels. Adverse health effects of exposure to lead in adults can include high blood pressure and inability to absorb vitamin D.

Arsenic has two types of hazardous effects: carcinogenic and non-carcinogenic. Carcinogenic effects associated with exposure to environmental arsenic include skin cancer, bladder cancer, stomach cancer, and lung cancer. Non-carcinogenic effects, when exposed to environmental arsenic, include a thickening of the skin and the formation of corns on the palms on the hands and soles of the feet. Arsenic also causes death at very high concentrations and at lower levels is an irritant of the mucosal membrane of the mouth, throat, and stomach.

Arsenic toxicity was assessed by using the EPA-verified (RfD) for noncancer effects and (SF) for cancer potency. The chronic oral RfD of  $3 \times 10^{-04}$  mg/kg-day based on hyperpigmentation, keratosis, and possible vascular complications in humans exposed to

arsenic in drinking water (from EPA's Integrated Risk Information System) was used to evaluate non-cancer effects from exposure to arsenic in surface soil.

EPA considers arsenic to be a known human carcinogen based on sufficient evidence from human data. EPA SFs used for estimating cancer risks are upper 95th percentile confidence limits of the probability of response per unit intake of contaminant over a lifetime. EPA's oral SF of 1.5 per  $(\text{mg}/\text{kg}\text{-day})^{-1}$  based on skin cancer in humans exposed to arsenic in drinking water (from EPA's Integrated Risk Information System 2007 online data base) was used to estimate cancer risks from exposure to arsenic in surface soil. An adjustment for ingestion of chemicals in soil is necessary when data clearly show a difference between absorption from soil as compared to the exposure medium from which the oral toxicity value was derived. A relative bioavailability factor of 0.51 was used for arsenic in surface soil in OU2, derived in the risk assessment for OU1.

#### **7.1.4 Risk Characterization**

Risks were characterized based on current and future land use scenarios. Residential exposure scenarios at OU2 were cleaned up under the OU1 remedial action.

EPA's Adult Lead Exposure Model (ALEM) was used to predict blood lead levels (BLLs) in fetuses of indoor workers, grounds workers, and adult visitors (used as surrogates for the youth visitor scenario). The probability that fetuses of adult receptors exposed at OU2 would have a BLL exceeding 10  $\mu\text{g}/\text{dL}$  is determined in the ALEM. EPA's target for women of child-bearing age is to limit the risk to a typical developing fetus to no more than 5% chance of exceeding 10  $\mu\text{g}/\text{dL}$ ; this target was adopted for OU2.

The predicted BLLs for receptors exposed to surface soil in OU2 were calculated for the commercial and undeveloped areas. The probability that fetuses of adult receptors exposed at OU2 would have BLLs exceeding 10  $\mu\text{g}/\text{dL}$  was less than 1.2% for the adult indoor workers and adult grounds workers in the commercial exposure area and adult visitors in part of the undeveloped area (much of wetland area). This value is below EPA's target for women of child-bearing age. However, although the lead concentration in soil appears to be uniform at depth in most locations, contamination hot spots exist. A calculation of preliminary remediation goals (PRGs) as shown in Table 7-2, indicates that several commercial areas (Figure 8-1), have soil lead levels the might result in unacceptable blood lead levels.

In the rest of the undeveloped area, the BLLs ranged from 1.9 – 8.0%. The high end of the range of BLLs predicted for adult visitors in the undeveloped area exceeded EPA's target, indicating that lead in much of the undeveloped area might pose an unacceptable risk to human health. These areas are shown in Figure 8-1.

Hazard indices (HIs) and cancer risks were used to identify the potential for arsenic noncarcinogenic effects and carcinogenic effects, respectively. Hazard indices for the central tendency exposure (CT) and the reasonable maximum exposure (RME) were well

below 1.0 for all scenarios, indicating that arsenic at the site does not pose a threat of non-cancer effects to indoor workers, grounds workers, or youth visitors.

The CT and RME arsenic cancer risks were well below  $10^{-4}$  for all scenarios. CT and RME cancer risks were less than or equal to  $10^{-6}$  for all scenarios except youth visitors in part of the undeveloped area where CT cancer risk was  $3 \times 10^{-6}$ . This cancer risk level is within EPA's target cancer risk range of  $10^{-6}$  to  $10^{-4}$ . RME cancer risk ranged from  $2 \times 10^{-6}$  to  $10^{-5}$  for indoor workers in the commercial exposure area and youth visitors in the undeveloped area. These cancer risk levels are within EPA's target cancer risk range of  $10^{-6}$  to  $10^{-4}$ . Cancer risks for other scenarios were equal to or less than EPA's point of departure of  $10^{-6}$  indicating that no further evaluation of these cancer arsenic related risks is required.

The three exposure scenarios that have current or future risks are represented in the Table 7-2. Cleanup goals were calculated to be protective of receptors that may come in contact with the contamination.

### **7.1.5 Human Health Risk Uncertainty**

There is uncertainty associated with the sampling and analysis, exposure assessment, toxicity assessment, and risk characterization steps in the HHRA. A number of assumptions were made in the HHRA that introduce uncertainty into the risk characterization results. For instance, the 95% UCLs or maximum detected concentrations, whichever were smaller, were used as exposure point concentrations. Therefore, the exposure point concentrations used in the risk assessment probably contributed to an overestimation of hazard, cancer risk, and BLLs. However, in one undeveloped exposure area, the maximum value was used as the exposure point concentration per guidance. If the 95% UCL had been used, it would have resulted in slightly higher blood lead values. Thus, the risk assessment could underestimate risk slightly in this area. Another example of uncertainty relates to exposure factor values. When available, standard EPA default values were used for exposure factor parameter values. Most of these exposure factor values are reasonable high-end estimates of exposure.

Overall, while uncertainties could lead to an underestimation of risk, the numerous conservative assumptions in the risk assessment have likely resulted in a net overestimation of potential non-cancer hazards, cancer risk and impact on blood lead levels.

## **7.2 Ecological Risk Assessment**

The undeveloped area of OU2 evaluated in the Ecological Risk Assessment (ERA) is a 22.8 acre wooded and marshy area with Little Cottonwood Creek forming the northern border of the area. Two large ponds are located in the northwest corner of the undeveloped area. The undeveloped area also contains an extensive system of wetlands. Lush growths of cat tails, cottonwoods, willows and other vegetation indicative of

wetlands have been observed and are documented in the ERA. These habitats support a variety of animals and are consistent with anecdotal observations of wildlife on-Site. Taxonomic groups to be protected include plants, soil invertebrates, aquatic (i.e., water column) organisms, benthic macroinvertebrates, and wildlife (herbivores, invertivores, and carnivores).

### **7.2.1 Identification of Chemicals of Concern**

The strategy to evaluate ecological risks in the ERA incorporates the screening of detected metals to identify contaminants of potential ecological concern (COPECs), and then the assessment of these metals to identify chemicals of ecological concern (COECs). A metal is considered a COPEC in an exposure medium (soil, surface water, or sediment) if the maximum concentration of a detected metal exceeds its conservative ecological screening level (ESL) and exceeds background. COPECs and media identified for the undeveloped area of OU2 include: Antimony, Arsenic, Cadmium, Copper, Lead, Mercury, Selenium, Silver, and Zinc. These metals were found in three types of media; soil (surface and sub-surface), sediment (creek and pond) and the surface water (creek and pond). Statistical data relating to the COPECs are listed in Table 7-3.

### **7.2.2 Exposure Assessment**

To refine the COPEC list to the COEC list a SCM for ecological receptors was developed (Figure 5-3). This further refined which receptors were at the greatest risk when exposed to the Site's different types of media. The ERA identified the following types of ecological receptors that would be representative of different feeding guilds. The representative species at OU2 include: Herbivores (horned lark, meadow vole, mule deer, and wood duck), Invertivores (American robin, masked shrew, and lesser scaup) and Carnivores (American kestrel, red fox, and mink). The ERA assumed that the plant and terrestrial wildlife was exposed to surface soil, subsurface soil and surface water. Aquatic and terrestrial wildlife associated with the ponds and tributaries was exposed to surface water and sediments but not to soils. The ERA evaluated risk to ecological receptors through direct contact, ingestion of food or prey, and incidental ingestion of soil or sediment while feeding or drinking water. The EPCs for ecological receptors are listed in Table 7-3.

### **7.2.3 Ecological Effects Assessment**

The effects of chemicals on ecological receptors at this Site are based on two types of exposure to different contaminated media. These types of effects occur when a receptor (plant, insect, bird, mammal, etc.) comes in direct contact with contaminated media or ingestion of the contaminated media. Comparisons of screening values (i.e., toxicological reference values (TRVs)) with measured concentrations of contaminated media are used to determine risk. The ecological effects associated with the exposure to the contaminated media are identified as toxicological endpoints including survival, reproduction, development, and/or growth.

Table 7-4 contains a summary of COECs for each exposure medium and receptor in the undeveloped area of OU2. Letters represent the ecological receptors for which the metal is determined to be a COEC.

Monitoring or modeling data and assumptions used to characterize exposure point concentrations can be found on Table 7-5.

#### **7.2.4 Ecological Risk Characterization**

Risk characterization is the interpretation of potential ecological effects related to the assessment endpoints and consists of risk estimation, uncertainty discussion, and risk description. Hazard Quotients (HQs) for plants, soil invertebrates, benthic macroinvertebrates, aquatic organisms or wildlife are the ratios of contaminant concentration/TRVs. HQs greater than 1.0 suggest risk, but the uncertainties associated with HQ calculations must be considered. Consequently, although the HQ is not a definitive measure, it can be used to estimate the potential level at which the measured or predicted exposure relates to levels where adverse effects have been observed in toxicological studies.

Table 7-4 shows a summary of metals with HQs exceeding 1.0. These metals are considered to be COECs for each exposure medium and receptor in the undeveloped area of OU2. Letters represent the ecological receptors for which the metal is determined to be a COEC. Soils (surface and subsurface) have eight metals identified as COECs. This is more COECs than in any of the other exposure media in the undeveloped area of OU2. Lead in soils has the potential to affect the greatest number of ecological receptors. Pond/tributary and creek sediments have one COEC each, while creek and pond/tributary surface waters have no COECs.

The ranges of lead concentrations in samples collected from the undeveloped area are between 138 - 4,930 mg/kg in surface soil and 82 - 10,800 mg/kg in subsurface soil. The highest lead concentrations in soils were found immediately south of the former Flagstaff Smelter and west of the former Davenport Smelter. Measured lead concentrations are all higher than the maximum background concentration of 51 mg/kg found in deep soils (greater than 3 feet bgs).

Lead in surface and subsurface soil is the only COEC with HQs of 40 or greater for selected wildlife receptors (herbivorous and invertivorous birds). Most other birds and all mammals have HQs an order of magnitude lower, and many are lower than 1.0 (indicative of no Site-related risk). Even if consideration is given to the conservative nature of the risk assessment, herbivorous birds, represented by the horned lark, and invertivorous birds, represented by the American robin, are potentially at risk from lead in soils.

Soil concentrations of lead would have to be lowered to less than 29 mg/kg in order to achieve HQs lower than 1.0 for the most exposed and sensitive wildlife receptors (horned lark and American robin).

From an engineering perspective a cleanup of this level could cause significant damage (especially, since background lead levels at the Site are at 51 mg/kg) to the wetlands in the undeveloped area and could result in unintended short and/or long-term negative consequences such as erosion and transport of Site contaminants. Despite the conservative nature of the cleanup standards, there are areas within OU2 that contain lead contamination at concentrations that are of real concern to ecological receptors. Nevertheless, the Selected Remedy will significantly reduce exposure and ecological risk at the Site while avoiding significant damage to ecological habitat.

The response action selected in the ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

## **Section 8: Remedial Action Objectives**

Remedial Action Objectives (RAOs) consist of medium-specific or operable unit-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:

- Reducing risks from exposure to lead-contaminated soil such that no developing fetus of an adult visitor (used as a surrogate for the youth visitor scenario) has more than a 5 percent chance of exceeding a blood lead level (BLL) of 10 micrograms per decaliter ( $\mu\text{g/dL}$ );
- Reducing the risks from exposure to arsenic-contaminated soil such that no person has greater than a 1 in 10,000 increased risk of contracting cancer;
- Preventing the occurrence and spread of windblown contamination; and
- Addressing the bulk of the source material that is driving the risk to ecological receptors, while minimizing the damage that the undeveloped area would sustain through more extensive construction activities.

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 a Commercial Area and an Undeveloped Area. The Commercial Area is comprised of a restaurant and reception center, covers approximately six acres, and contains landscaped lawns and hedges as well as vineyards. The restaurant and reception center is frequented by the facility's customers, along with workers that support the establishment (e.g., groundskeepers). The Undeveloped Area is made up of a 22.8 acre wooded and marshy area with two large ponds located in the northwest corner of the area and Little Cottonwood Creek forming the northern border. The Undeveloped Area serves primarily as a watershed protection area for the surrounding and nearby local governmental entities, but is also used for recreational purposes such as hiking and walking dogs. It is not anticipated that the current uses of the Commercial and 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, clean-up goals for lead and arsenic were developed for the Commercial and Undeveloped Areas.

EPA uses a model to predict risk for lead exposure to humans. Using this model, the target for OU2 is to limit the risk to a typical developing fetus of a pregnant woman exposed to lead in soil to no more than a 5% chance of exceeding a blood lead level of 10 µg/dL. This blood lead target was used to calculate lead cleanup levels for the commercial and undeveloped areas. Arsenic cleanup levels were calculated so that no person will have a greater than one in ten thousand chance of increased risk of cancer due to exposure to arsenic in soil and no increased risk of non-cancer related illness.

- The human health cleanup goal for lead in the commercial area of OU2 is 1,000 mg/kg.
- The human health cleanup goal for lead in the undeveloped area of OU2 is 3,000 mg/kg.
- The human health cleanup goal for arsenic throughout all of OU2 is 1,000 mg/kg.

Commercial Zones C-4, C-5, and C-24 (as shown in Figure 8-1) contain lead concentrations in surface and subsurface soils that need to be addressed. Undeveloped Zones U2, U3, U4 and U34 contain lead concentrations in surface and subsurface soils that need to be addressed as well. There are no commercial or undeveloped zones that contain arsenic concentrations above the arsenic cleanup level. Cleanup of soils containing greater than 3,000 mg/kg lead will address the bulk of the source material that is driving the risk to ecological receptors, while minimizing the damage that the undeveloped area would sustain through more aggressive construction activities. The risk to herbivorous and invertivorous birds will be reduced significantly when this material has been addressed.

## **Section 9: Description of Alternatives**

This section describes the remedial alternatives developed for both commercial and undeveloped areas of OU2. These alternatives were arrived at through a systematic screening process applied in the FFS. In the FFS a number of remedial alternatives were developed and screened for effectiveness, implementability and cost. Those with the most favorable composite evaluation were retained and investigated in detail.

Three remedial alternatives were developed to address the commercial areas of OU2 and four remedial alternatives were developed to address the undeveloped areas. One remedial alternative for both the commercial and undeveloped areas is the “no action” alternative, which is required by the NCP. All of the alternatives, with the exception of the “no action” alternatives, include Institutional Controls (ICs) to control future exposure to contaminants and to ensure that the remedy remains protective of human health and the environment.

The three remedial alternatives for the commercial areas of OU2 are:

- Alternative C1- No action.
- Alternative C2- Excavate and dispose of all soils in excess of 1,000 mg/kg lead, backfill and revegetate.
- Alternative C3 – Excavation and disposal of soil from contaminated areas with non-native vegetation, and soil cover around native vegetation.

The four remedial alternatives for the undeveloped area are:

- Alternative U1- No action.
- Alternative U2 - In-situ treatment followed by excavation, off-Site disposal and restoration and revegetation.
- Alternative U3 – Excavation followed by ex-situ treatment, off-Site disposal and restoration and revegetation.
- Alternative U4 – Soil cover.

These proposed alternatives have been formulated according to NCP Section 300.430 (e) and are intended to meet the Remedial Action Objectives. Since concentrations of lead and arsenic greater than those required for unlimited use will remain after cleanup activities for all the action alternatives, ICs such as environmental covenants, conservation easements or land use zoning will be implemented to control future exposure to contaminants and to ensure that the remedy remains protective of human health and the environment. In addition, five-year reviews will be required.

## **9.1 Remedial Alternatives for Commercial Areas**

Three remedial alternatives have been evaluated for the commercial areas of OU2. Both of the action alternatives will address Site contamination by either removing contaminated soil from the Site or by providing a physical barrier to the contamination. All excavated soil will be disposed of at a municipal landfill or equivalent solid waste landfill following treatment, as necessary. Both of the action alternatives include re-vegetation and restoration of the contaminated areas. Five-year reviews will be required for all of the alternatives evaluated including the no action alternative. The cost for each alternative is detailed in Appendix A.

### **Alternative C1: No Action**

Commercial alternative C1 provides no remedial actions to address soil contamination associated with the commercial portions of the Site. The “no action” alternative does not include any ICs on land use, any 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 leaving the threat to human health and the environment unchanged.

**Alternative C2: Excavate and Dispose of all Soils in Excess of 1,000 mg/kg Lead, Backfill and Re-vegetate.**

Alternative C2 addresses soil within the commercial area that has lead concentrations exceeding 1,000 mg/kg. It includes the clearing and grubbing of the contaminated areas followed by a mixture of machine and hand excavation. It is anticipated that lead contaminated soils exceeding 1,000 mg/kg reside in only the upper 12 inches. Based on TCLP analysis performed during the RI, it is anticipated that excavated soils within the commercial area will not be principal threat waste. However, any principal threat wastes encountered during remedial activities will be treated and stabilized prior to disposal as described in Alternative U3. An estimated 1,317 tons of contaminated soil will be transported to and disposed of at a municipal or equivalent solid waste landfill.

Clean, imported backfill and topsoil will be used to fill the excavated areas and the excavated areas will be re-vegetated and restored. Large tree replacement may be required in the commercial zone C-4.

Excavation and disposal of contaminated soil from the commercial area, along with backfill, reduces the risk of direct contact, inhalation, or ingestion of the contaminated soil through removal of the contaminated surface media and, therefore, reduces both human health and ecological risk. Landfill disposal further reduces the migration potential and the potential for future direct contact, ingestion, and inhalation of contaminated soil. The excavation and off-site disposal provide long-term liability for Alternative C2.

Alternative C2 meets all the chemical-specific ARARs and avoids impact to historic properties so location-specific ARARs will be met. Action-specific ARARs including CAMU regulations if principal threat wastes are encountered, and fugitive dust controls will also be met

Assuming control of fugitive dust is maintained during excavation, Alternative C2 meets all the chemical-specific ARARs. Alternative C2 avoids impact to historic properties, will not require a hazardous waste facility so the location-specific ARARs will be met. By incorporating fugitive dust controls and by not generating a hazardous waste, Alternative C2 meets all action-specific ARARs.

Like C3, alternative C2 will take six months to implement. The present worth cost of C2 is \$766,000. The expected outcome of both Alternatives C2 and C3 is continued use as a commercial property.

### **Alternative C3: Excavation and Disposal of Soil from Contaminated Areas with Non-Native Vegetation, and Soil Cover around Native Vegetation, Large Trees and Boulders.**

Alternative C3 addresses the same affected areas as Alternative C2. Contaminated areas containing lead concentrations greater than 1,000 mg/kg that have non-native vegetation will be machine excavated to an approximate depth of 12 inches. A six-inch soil cover will be placed over a geo-textile fabric in areas that contain native vegetation, large/mature trees and large boulders. The geo-textile fabric will act as a visible marker between clean soil and contaminated soil underneath. Since contaminated soil will remain in these areas and may be exposed through erosion or excavation Alternative C3 offers less long-term reliability of remedy than Alternative C2. Excavated soil will be transported and disposed of at a municipal landfill or equivalent solid waste landfill. Any principal threat waste will be treated and stabilized prior to disposal as described in Alternative U3.

Annual monitoring of soil cover thickness will be needed to ensure the soil cover's integrity and to maintain compliance with ICs. Like C2, alternative C3 will take six months to implement. The present worth cost of C3 is \$781,000.

Like Alternative C2, excavation and disposal of contaminated soil from the commercial area, along with backfill, reduces the risk of direct contact, inhalation, or ingestion of the contaminated soil through removal of the contaminated surface media and, therefore, reduces both human health and ecological risk. Landfill disposal further reduces the migration potential and the potential for future direct contact, ingestion, and inhalation of contaminated soil.

Placing a soil cover over contaminated soils reduces the risk of direct contact, inhalation, or ingestion of the contaminated soil and, therefore, reduces human health and ecological risk by providing a barrier to accessible contamination. The clean soil cover and the vegetation layer also reduce the spread of contamination into the environment through wind and water erosion of the contamination left in place providing long term reliability of Alternative C3.

If appropriate ICs are implemented, Alternative C3 will meet all action-specific, chemical-specific, and location-specific ARARs.

## **9.2 Remedial Alternatives for Undeveloped Areas**

Four remedial alternatives were evaluated for the OU2 undeveloped areas.

All of the action alternatives will address Site contamination by either removing contaminated soil from the Site or by providing a physical barrier to the contamination. All of the excavated contaminated soil will be disposed of at a municipal landfill or equivalent solid waste landfill. All of the action alternatives include re-vegetation and restoration of the contaminated areas.

Since concentrations of lead and arsenic are greater than those required for unlimited use will remain with each alternative, five-year reviews will be required for all of the alternatives.

Removal and restoration of a gravel road that was built through the undeveloped area to facilitate completion of the OU1 cleanup will occur following the OU2 cleanup. The road removal and restoration will be conducted as an OU1 activity so there are no associated OU2 capital costs. The cost for each alternative is detailed in Appendix A.

### **Alternative U1: No Action**

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

Regulations governing the Superfund Program required that a no action alternative be evaluated to establish a baseline for comparison. Under this alternative contaminated soil will remain in place leaving the threat to human health and the environment unchanged.

### **Alternative U2: In-Situ Treatment, Excavation and Disposal of all Soils in Excess of 3,000 mg/kg Lead, Backfill and Re-Vegetate.**

Alternative U2 involves the cleanup of four undeveloped areas that contain lead concentration in excess of 3,000 mg/kg (U2, U3, U4 and U34) as shown in Figure 8.1 to an estimated depth of 18 inches. The total area to be addressed is approximately 2.45 acres, with approximately 5,000 tons of contaminated soil to be treated and disposed. Alternative U2 includes the clearing and grubbing of all affected areas. Principal threat wastes (contaminated soil that fails TCLP), will be treated with a chemical reagent and stabilized in place (in-situ) rendering the leachable lead non-leachable. It is assumed that all of the contaminated soils will require treatment. The treated and stabilized soils will be machine excavated and disposed of off-Site at a municipal or equivalent solid waste landfill. Clean imported soil backfill and topsoil will be placed in excavated areas and reseeded with a native grass mix. In addition to re-vegetation, large tree replacement may be required in affected areas.

In-situ stabilization of principal threat waste will be performed in- place and will not generate a hazardous waste according to RCRA regulations, because no excavation will take place before treatment. In areas where access is limited due to rocks, slopes or other geographical features in-situ stabilization may not be as effective as ex-situ stabilization due to incomplete mixing.

Excavation and disposal of the contaminated soil followed by placement of clean backfill reduces the risk of direct contact, inhalation, or ingestion of the contaminated soil and, therefore, reduces the migration potential and the potential for future direct contact, ingestion, and inhalation of the contaminated soil. Treatment of the principal threat

waste renders it non-hazardous and permits it to be disposed in a Subtitle D landfill. The excavation, treatment and off-site disposal provide long-term reliability for Alternative U2.

Alternative U2 meets all the chemical-specific ARARs and avoids impact to historic properties so location-specific ARARs will be met. By not generating a hazardous waste through in-situ treatment and by controlling fugitive dust Alternative U2 meets all action-specific ARARs.

Like U3 and U4, Alternative U2 will take six months to implement. The present worth cost of U2 is \$1,435,000.

### **Alternative U3: Excavation, Ex-Situ Treatment and Disposal of all Soils in Excess of 3,000 mg/kg Lead, Backfill and Re-Vegetate.**

Alternative U3 involves the same areas as Alternative U2. Alternative U3 is the same as Alternative U2 except that contaminated soil that is considered principal threat waste will be excavated prior to treatment with a chemical reagent and stabilization to render the leachable lead in the soil non-leachable.

Ex-situ stabilization, while still performed on-Site, will take place after the contaminated soil has been excavated and stockpiled at the Site. Excavation and ex-situ treatment of principal threat waste will be performed in a storage and treatment Corrective Action Management Unit (CAMU) is not created. Creation of a CAMU under 40 CFR 264.552 will allow for the excavated principal threat waste to be mixed and stabilized more effectively and efficiently than the in-situ treatment described in Alternative C2.

Like Alternative U2, excavation and disposal of the contaminated soil followed by placement of clean backfill reduces the risk of direct contact, inhalation, or ingestion of the contaminated soil and, therefore, reduces the migration potential and the potential for future direct contact, ingestion, and inhalation of the contaminated soil. Treatment of the principal threat waste renders it non-hazardous and permits it to be disposed in a Subtitle D landfill. The excavation, treatment and off-site disposal provide long-term reliability for alternative U3.

A CAMU can be designated by the EPA or an authorized state (which includes Utah) to manage CAMU-eligible wastes, which are all solid and hazardous wastes managed for implementing cleanup. The principal threat waste found at OU2 is considered to be a CAMU-eligible waste. A CAMU must be located within the contiguous area where the wastes to be managed in the CAMU originated, which would be satisfied by all or part of OU2. CAMUs used for treatment and storage only are subject to requirements found in 40 CFR 264.552:

Alternative U3 meets all the chemical-specific ARARs and avoids impact to historic properties so location-specific ARARs will be met. Action-specific ARARs including CAMU regulations, and fugitive dust controls will also be met.

U3 will take six months to implement. The present worth cost of U3 is the same as U2, \$1,435,000.

#### **Alternative U4: Soil Cover**

Alternative U4 covers the same areas as alternatives U2 and U3. It consists of placing a 6-inch thick lift of compacted soil over a geo-textile material placed on the prepared ground surfaces. The geo-textile material acts as a visible marker that indicates contaminated soil and also serves as a baseline so that cover thickness can be measured during operation and maintenance activities. The affected areas will be re-seeded with a native grass mix.

Soil cover of contaminated soils reduces the risk of direct contact, inhalation, or ingestion of the contaminated soil and, therefore reduces human health risk by providing a barrier to accessible contamination. The clean backfill, topsoil, and vegetation layer also reduces the spread of contamination into the environment through wind and water erosion of contaminated soil and provides long-term reliability for Alternative U4.

The OU2 location-specific ARARs will be met and all federal and state action-specific ARARs will be met by Alternative U4. However, the soil remaining below the cover and possible breach of the soil cover require the imposition of more stringent ICs than Alternatives U2 and U3.

Like U2 and U3, alternative U4 will take six months to implement. The present worth cost of U4 is \$1,249,000.

### **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

Of these nine criteria, the first two are considered “threshold factors” that must be satisfactorily met in order for the remedy to be considered for implementation. The next five criteria are considered “primary balancing factors” and are the primary criteria upon which the analysis is based. Finally, the last two criteria are considered modifying factors.

## **10.1 Commercial Alternatives**

### **10.1.1 Overall Protection of Human Health and the Environment**

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and 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 C1 are protective of human health and the environment.

Alternative C1 does not remediate any areas and the risk to human health and ecological receptors will remain unchanged. Human health and ecological hazards for the area containing soil contamination greater than the cleanup levels will not be mitigated or eliminated. Alternative C1 does not meet the threshold criterion for protection of human health and the environment.

Alternative C2 involves the excavation and disposal of contaminated soil from affected areas. Excavation and disposal reduces the potential of direct contact, inhalation, or ingestion of the contaminated soil and therefore reduces the risk to human health and the environment. Treatment, as necessary, and landfill disposal further reduces the migration potential for future exposure. The clean backfill, topsoil and vegetation will also reduce the spread of any remaining contaminated soil into the environment. Alternative C2 meets the threshold criterion for protection of human health and the environment.

Alternative C3 Involves the excavation and disposal of contaminated soil in some areas and placing a soil cover in other areas. As in Alternative C2, the excavation and disposal reduces the potential of direct contact, inhalation, or ingestion of the contaminated soil and therefore, reduces human health and ecological risk. Treatment, as necessary, and landfill disposal of the excavated soil further reduces the migration potential for future exposure. Placing a soil cover over contaminated soils also reduces the risk of direct contact, inhalation or ingestion of contaminated soil and reduces human health and ecological risk by providing a barrier to accessible contamination. However, any breach in the cap would potentially expose individuals to existing levels of contamination. Alternative C3 meets the threshold criterion for protection of human health and the environment.

Both Alternatives C2 and C3 rely on ICs to address contaminants that may remain after cleanup. Since more contaminated material will remain after cleanup associated with Alternative C3, it is more dependant on ICs than Alternative C2.

### **10.1.2 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 limitation which are collectively referred to as “ARARs,” unless such ARARs are waived under CERCLA Section 121(d)(4).

Applicable requirements are those cleanup 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 cleanup 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, address problems or situations sufficiently similar to those encountered at the CERCLA Site that their 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 relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of Federal and State environmental statutes or provide a basis for invoking a waiver. Appendix B presents a detailed analysis of ARARs.

Alternative C1 takes 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. Since Alternative C1 does not satisfy the threshold criteria of protectiveness of human health and the environment and compliance with ARARs, it is not evaluated further.

The excavation and disposal proposed in Alternative C2 reduces the risk of direct contact and protects grounds workers from ingesting contaminated soil. By incorporating ICs to address any contamination remaining beneath the excavation depth that prevents unlimited use of the property, Alternative C2 meets risk-based standards and therefore, will comply with ARARs.

With the soil cover proposed in Alternative C3, there is a possibility of opening an exposure pathway if the cover is removed or the geo-textile is damaged. Special ICs to govern the use of the remediated properties along with annual inspection will be required to avoid exposure. By implementing intuitional controls and imposing annual inspections, Alternative C3 also meets risk based standards.

Alternatives C2 and C3 have common ARARs associated with construction (e.g. fugitive dust and storm water runoff controls), excavation, transport and disposal of contaminated soil, and both alternatives meet Corrective Action Management Unit Requirements for storage and treatment of any soil exhibiting a characteristic of hazardous waste. Both also require ICs to ensure that the remedy remains protective. However, Alternative C3 requires more controls than Alternative C2 since more contaminated soil will remain at the Site.

Alternatives C2 and C3 both meet the threshold criteria of compliance with ARARs.

### **10.1.3 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 cleanup levels have been met. This criterion includes consideration of residual risk that will remain on-Site following remediation and the adequacy and reliability of controls.

Both Alternatives C2 and C3 provide some degree of long-term protection since some contaminated soil is removed. For Alternative C2, contaminated soil, with lead concentrations greater than 1,000 mg/kg, will be removed from the Site, and therefore the threat posed by this soil will be permanently removed from OU2. Alternative C2 provides greater long-term protection than Alternative C3, which relies on soil cover in some commercial areas to provide a barrier between lead and arsenic contaminated soils and potential receptors.

Both Alternatives C2 and C3 rely on ICs to address contaminants that may remain after cleanup. Since more contaminated material will remain after cleanup associated with Alternative C3, Alternative C2 provides a greater degree of long-term effectiveness and permanence with the removal of contaminants from the Site.

Because contaminants above health-based levels for unregulated use would remain with both alternatives C2 and C3, a CERCLA five-year review will be required to evaluate long-term effectiveness of these remedies.

### **10.1.4 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.

Alternative C2 significantly reduces the mobility of contaminants by removing the soil and placing it in an approved landfill, which is managed to minimize contaminant transportation via erosion and infiltration of precipitation. Any excavated soils with concentrations of extractable lead greater than 5 mg/L (e.g. those failing TCLP testing) encountered during construction will be treated to render them non-hazardous prior to disposal. Treatment will reduce both the mobility and toxicity of contaminants in the excavated soil. Only soils failing TCLP will be treated prior to disposal. Since the majority of the contaminated soil is expected to pass the TCLP test, it will not need treatment and the preference for treatment will not be met. However, the mobility of the contaminants will be reduced by disposal in an appropriate disposal facility.

Alternative C3 uses no treatment in areas of native vegetation and boulders, therefore, the composition of the contaminated soil would not be altered. Soil cover provides no reduction of either toxicity or volume, but it does reduce the mobility of the contaminants via wind and water erosion. Alternative C3 also proposes that the area of non-native vegetation be excavated and disposed. The excavation and disposal of contaminated soil in the non-native vegetation areas will provide the same reduction of toxicity and mobility as discussed in Alternative C2.

Therefore, Alternative C2 may provide a greater reduction in toxicity and mobility through treatment.

### **10.1.5 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 cleanup levels are achieved.

There will be no closure or relocation of any businesses required during the implementation of any of the alternatives. Personal protective equipment will be required for construction workers. Dust suppression will be implemented during construction to prevent any environmental or human health impact. The time required to complete either of the action alternatives is approximately six months.

The agencies will prepare a storm water pollution prevention plan as part of the Remedial Design. The plan will address controlling runoff during construction activities in order to prevent any contaminated from entering Little Cottonwood Creek.

The agencies will also delineate the extent of contaminated areas more accurately during the remedial design in order to determine the minimum extent to which excavation is required, thus reducing the number of trips to the landfill and reduce fuel consumption. In addition, haul routes and trip times will be identified that will address the project's impact on area traffic, thus addressing Salt Lake and Sandy City's concerns expressed during the public comment period regarding risks posed by increased traffic from cleanup activities.

The short-term effectiveness for all of the action alternatives is equivalent.

### **10.1.6 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 also considered.

The excavation and disposal associated with both Alternatives C2 and C3 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 readily available from local vendors. Coordination with state and local officials for disposal of contaminated soil will be required.

The placement of soil cover in the areas of native vegetation and boulders described in Alternative C3 can be easily performed. The construction equipment is readily available from several local vendors. Grading and/or retention of the soil cover so as not to permanently alter unaffected property may be difficult. Also, if additional earth/moving activities are required after implementation of the soil cover is complete; these activities would destroy the original soil cover remedy. Annual monitoring of the soil cover would be required to give notice of any remedy failure. Soil excavated for the planting of trees and/or other landscaping activities may require testing to determine disposal requirements. These factors make Alternative C3 a little more difficult to implement than Alternative C2.

ICs for Alternatives C2 and C3 will require cooperation of land owners as well as City and County officials. Discussions to date with City and County officials indicate that ICs should be implementable for both Alternatives C2 and C3.

### **10.1.7 Cost**

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

The present worth cost for Alternative C2 is \$776,000 and the present worth cost for Alternative C3 is \$781,000.

### **10.1.8 State Acceptance**

The State of Utah through the Utah Department of Environmental Quality has been the lead agency in the development of the RI/FFS for OU2 and concurs with the selection of Alternative C2 as the selected remedy. The State does not believe that Alternative C1 provides adequate protection of human health and the environment.

### **10.1.9 Community Acceptance**

During the public comment period, the community expressed concerns regarding how the cleanup levels were calculated and why they were different than the OU1 levels, how the remediation will be performed and whether specific residential properties near the Site had been impacted by smelter releases. Two property owners, the City of Salt Lake and the City of Sandy, expressed concerns about remedial activities affecting a down-stream water intake, increased vehicular traffic due to the transport of contaminated soil, and the impact of construction vehicle emissions on air quality. The Metropolitan Water District of Salt Lake echoed the Cities' concerns regarding the down-stream water intake. Salt Lake City challenged many of the assumptions made in both the Human Health and Ecological Risk Assessments and argued for a "no action" remedy. The responsiveness summary contains all of the comments received during the comment period along with the agencies' responses. Several community members expressed support for the Selected Remedy.

## **10.2 Undeveloped Alternatives**

### **10.2.1 Overall Protection of Human Health and the Environment**

With Alternative U1 (the no-action alternative), no cleanup occurs and the risk to human health and ecological receptors will remain unchanged. Alternative U1 does not meet the threshold criteria for protection of human health and the environment. All the other alternatives are protective of human health and the environment.

Alternatives U2 and U3 both involve the excavation and regulated disposal of all areas containing contaminated soil above the cleanup level and thus, reduces the risk of direct contact, inhalation or ingestion of contaminated soil and therefore reduces human health and ecological risk. In-situ and ex-situ soil stabilization and landfill disposal further reduce the migration potential and the potential for future direct contact. Clean backfill, topsoil and a vegetation layer also reduce the spread of contamination into the environment through wind and water erosion of any contaminated soil remaining at depth after construction. Alternatives U2 and U3 meet the threshold criteria for protection of human health and the environment and are equally protective.

Alternative U4 is less protective as it relies on a soil cover over contaminated soils to reduce the risk of direct contact, inhalation, or ingestion of the contaminated soil. The contaminated soil under the soil cover is left in place and may become exposed if the cover is breached through excavation, erosion, or construction below the cover layer.

Alternatives U2, U3 and U4 all rely on ICs to address contaminants that may remain after construction.

## **10.2.2 Compliance with ARARS**

Alternative U1 takes no action to remediate the contaminated soil or reduce risk of exposure and does not comply with the risk based standards established for the Site. Alternative U1 does not meet the threshold criteria of compliance with ARARS.

With appropriate ICs, Alternatives U2, U3 and U4 meet all the chemical specific, action specific and location specific ARARs, including risk-based standards and meet the threshold criteria of compliance with ARARS.

The excavation and disposal proposed in Alternatives U2 and U3 reduce the risk of direct contact and protect recreational users from ingesting contaminated soil and meet risk based standards. Alternatives U2 and U3 meet all the chemical specific, action specific and location specific ARARs. Alternative U3 will meet Corrective Action Management Unit requirements for storage and treatment of principal threat wastes.

With the soil cover proposed in Alternative U4, there is a possibility of opening an exposure pathway if the cover is removed or the geo-textile fabric is damaged. Regular inspection, monitoring and soil cover repair will be needed in addition to the ICs that will be required for Alternatives U2 and U3.

Alternatives U2, U3 and U4 have common ARARs associated with construction (e.g. fugitive dust and storm water runoff controls).

## **10.2.3 Long-term Effectiveness and Permanence**

Each alternative except for Alternative U1 provides some degree of long-term protection.

Alternative U1 would not reduce any of the risk to human health or the environment and does not provide any control over the existing contamination. Alternative U1 is not evaluated further because it does not meet the threshold criteria.

The excavation and off-Site disposal that is described in Alternatives U2 and U3 are well-proven technologies. Contaminated soil, up to a depth of 18 inches, and principal threat waste at depths greater than 18 inches, are removed from the Site. Therefore, the threat posed by this soil will be permanently removed.

In Alternative U4, a soil cover and a geotextile fabric or erosion control material is used to provide a barrier between potential receptors and the existing contaminated soil. However, the contaminated soil still remains in place and the soil cover could be breached by water and wind erosion or construction activities related to a change in land use. This alternative does not provide as high a level of long-term effectiveness or permanence as U2 and U3.

Because contaminants above health based levels for unregulated use would remain with all three of the action alternatives, a CERCLA five-year review will be required to evaluate long-term effectiveness for all remedies.

#### **10.2.4 Reduction of Toxicity, Mobility or Volume through Treatment**

Alternatives U2 and U3 significantly reduce the mobility of contaminants by removing the contaminated soil and placing it in an approved landfill, which is managed to minimize contaminant transportation via erosion and infiltration. Additionally stabilization and treatment of principal threat waste will reduce both the mobility and toxicity of the contaminants in the excavated soil.

Alternative U4 utilizes no treatment process; therefore, the composition of the contaminated soil is not altered. Since a soil cover is used the contaminated soil remains on-Site albeit the mobility of the soil is reduced. A soil cover provides no reduction of either toxicity or volume.

#### **10.2.5 Short-Term Effectiveness**

There will be no closure or relocation of any businesses required during the implementation of any of the alternatives. Personal protective equipment will be required for construction workers. Dust suppression will be implemented during construction to prevent any environmental or human health impact. The time required to complete either of the action alternatives is approximately six months.

The agencies will prepare a storm water pollution prevention plan as part of the Remedial Design that will address controlling runoff during construction activities in order to prevent the introduction of contaminated soil into Little Cottonwood Creek.

The agencies will also delineate the extent of contaminated areas more accurately during the remedial design in order to determine the minimum extent to which excavation is required, thus reducing the number of trips to the landfill and reduce fuel consumption. In addition, haul routes and trip times will be identified that will address the project's impact on area traffic, thus addressing Salt Lake and Sandy City's concerns expressed during the public comment period regarding risks posed by increased traffic from cleanup activities.

The short-term effectiveness for all of the action alternatives is equivalent.

#### **10.2.6 Implementability**

The excavation and disposal associated with both alternatives U2 and U3 is a relatively simple process with proven procedures. It is a labor intensive procedure with little potential for automation. Standard clearing and grubbing as well as soil excavating,

hauling, backfilling and grading techniques are used. Equipment and other services associated with excavation and disposal are easily available.

In-situ stabilization of material that contains greater than 5 mg/L of extractable lead, as described in alternative U2 will not generate hazardous waste, because the hazardous characteristics of the soil will be treated and mitigated prior to excavation. In areas where access is limited, in-situ stabilization may be difficult to achieve and may not be as effective as ex-situ stabilization, due to incomplete mixing.

Ex-situ stabilization, as described in alternative U3, while still performed on-Site, will take place after contaminated soil has been excavated. Ex-situ stabilization will provide the same treatment as Alternative U2, but offers the advantage of greater mixing potential in hard-to-access areas and therefore, is easier to implement than Alternative U2. Minor coordination between state and federal agencies will be required to assure land disposal restrictions are followed, but this will not be difficult and should not impact implementability.

Coordination with state and local officials for disposal of contaminated soil will be required for both Alternatives U2 and U3.

The placement of a soil cover over the contaminated areas as described in Alternative U4 can be easily performed. The construction equipment, specialists, material, technologies, and services are readily available from several local vendors. Grading and/or retention of soil cover so as not to permanently alter unaffected property may be difficult. If additional remediation were required after construction of alternative U4 is complete, it would destroy the original soil cover remedy. Additionally, soil excavated for the planting of trees and /or other landscaping activities may require testing and special handling requirements. These activities may make Alternative U4 more difficult to implement.

Comprehensive coordination with local agencies will be required to attain the necessary ICs for all of the undeveloped area alternatives.

### **10.2.7 Cost**

The present worth cost for Alternatives U2 and U3 is \$1,435,000.

The present worth cost for Alternative U4 is \$1,249,000.

### **10.2.8 State Acceptance**

The State of Utah through the Utah Department of Environmental Quality has been the lead agency in the development of the RI/FFS for OU2 and concurs with the selection of Alternative U3 as the selected remedy. The State does not believe that Alternative U1 provides adequate protection of human health and the environment.

## **10.2.9 Community Acceptance**

During the public comment period, the community expressed concerns regarding how the cleanup levels were calculated and why they were different than the OU1 levels, how the remediation will be performed and whether specific residential properties near the Site had been impacted by smelter releases. Two property owners, the City of Salt Lake and the City of Sandy, expressed concerns about remedial activities affecting a down-stream water intake, increased vehicular traffic due to the transport of contaminated soil, and the impact of construction vehicle emissions on air quality. The Metropolitan Water District of Salt Lake echoed Cities' concerns regarding the down-stream water intake. Salt Lake City challenged many of the assumptions made in both the Human Health and Ecological Risk Assessments and argued for a "no action" remedy. The responsiveness summary contains all of the comments received during the comment period along with the agencies' responses. Several community members expressed support for the Selected Remedy.

## **Section 11: Principal Threat Wastes**

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a Site wherever practicable (NCP 300.430. (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 can not 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 element of a remedy is satisfied.

While it has been determined that ground water is currently unaffected by Site-related contamination, the potential of contaminants leaching to ground water will still exist if the leachable material is not removed from the Site.

Soils with leachable levels of lead and arsenic above 5 mg/L based on the TCLP are considered to be both highly toxic as well as highly mobile and are considered a principal threat waste. Principal threat wastes will be treated and stabilized with a chemical reagent to render the leachable lead non-leachable prior to disposal off-Site at a Subtitle D landfill. Treatment of principal threat wastes will satisfy the statutory preference for treatment.

## **Section 12: Selected Remedies**

UDEQ and EPA have chosen Alternative C2, excavation and off-Site disposal of all soils exceeding 1,000 mg/kg lead (approximately 12 inches) as the Selected Remedy for the commercial areas of OU2 and Alternative U3, excavation and ex-situ treatment of all soils failing TCLP testing for lead, and off-Site disposal of soils in excess of 3,000 mg/kg lead, to a depth of 18 inches, for the undeveloped areas of OU2.

## **12.1 Summary of the Rationale for the Commercial Area 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 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.

Based on these requirements, UDEQ and EPA have chosen Alternative C2 as the Selected Remedy for the commercial area of the Davenport and Flagstaff Smelters Superfund Site for the following reasons:

- Excavation and disposal will satisfy all ARARs as well as provide a high level of protectiveness for human health and the environment.
- Excavation and disposal is a well-proven technology. The threat posed by the excavated soil will be permanently eliminated.
- The preference for treatment will be met for principal threat waste, but will not be met for contaminated soil that is not considered a principal threat waste.
- The mobility of untreated excavated soil will be greatly reduced by placing it in an approved landfill facility.
- 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. The soil cover described in Alternative C3 may be more difficult to implement.

Excavation and disposal will require less inspection and reporting than Alternative C3 and will permanently remove contaminated soil from the Site. The potential of Site related contaminants leaching into ground water will be removed for soils that fail TCLP (principal threat waste). The impact of ICs will be less than those associated with Alternative C3.

### **12.1.1 Detailed Description of the Commercial Area Selected Remedy**

Based upon the results of the systematic screening process described previously, and input from the impacted community, UDEQ and EPA agree that Alternative C2, Excavation and Disposal of all Soils in Excess of 1,000 mg/kg, most completely satisfies the analyses criteria and is designated as the Selected Remedy for the Commercial

portion of OU2. Excavation and disposal has been used successfully at a number of similar lead Sites in Utah and throughout EPA Region 8.

The Selected Remedy involves a remedial action to meet ARARS for soils and decrease human health risks at the Site. The zones that require action are C4-C5, and C24. The Selected Remedy involves clearing and grubbing the affected areas (grubbing involves the removal of all plants, including roots, stems and trunks), machine excavation, limited hand excavation around boulders and some large trees, and transportation to and disposal of all excavated soils at a Subtitle D landfill. Principal threat waste, if encountered during excavation will be addressed using the methods used for principal threat waste in the Undeveloped Area. Machine excavation will occur in the accessible areas of C2 and C24. Hand excavation will occur in the inaccessible areas and around large trees and boulders. The depth for excavation for both machine and hand excavation needed in order to remove soil with lead above 1,000 mg/kg lead is expected to be 6 inches in C4 and C24, and 12 inches in C5.

In order to retain the current surface grade and elevation at the property, clean, imported soil backfill and topsoil will be compacted to a height equal to the depth excavated. The affected areas will revegetated.

ICs in the form of environmental covenants, conservation easements or, land use zoning will be required to ensure that future land use is consistent with the cleanup levels and that the remedy remains protective.

The Selected Remedy will be considered complete when the following key components, are accomplished:

- Removal of existing vegetation from the contaminated areas.
- Excavation of all surface soils with lead concentrations exceeding 1,000 mg/kg (not expected to exceed 12 inches) using a mixture of machine and hand excavation.
- Ex-situ treatment of all principal threat waste by stabilizing leachable lead in soil.
- Transportation to and disposal of all excavated soil at an appropriate (Subtitle D) landfill.
- Placement of clean topsoil and re-vegetation of excavated areas.
- Institutional Controls (ICs), such as environmental covenants under the State of Utah's Environmental Covenants Act, conservation easements and/or land use controls established through Salt Lake County Zoning Authorities, to ensure the remedy remains protective.

These performance standards will ensure that the RAOs are met by reducing the risk of direct contact, inhalation or ingestion of contaminated soil by excavating and disposing of contaminated soil within the commercial areas of OU2, and providing controls to protect against exposure to contaminated soil above levels allowing unregulated (residential) use that remain after excavation.

### **12.1.2 Implementation of the Commercial Area Selected Remedy**

The selected remedy will be implemented following remedial design (RD) activities. During design, affected property owners will be consulted regarding the current and post-remedial condition of the property. Physical construction will be considered complete when all the areas identified for remediation have been addressed as described in the RD. Property owners will receive an assurance that construction and vegetation are warranted for one year. The physical construction involved in the selected remedy for the commercial area is expected to take approximately six months.

ICs are part of the Selected Remedy and are desirable to ensure the protectiveness of the remedy. The objectives of the ICs for the commercial area of OU2 are to:

- Restrict the development of residential uses without proper assessment of risk to human health and the environment.
- Ensure that contaminated soil, above unregulated use levels, remaining after cleanup is characterized and disposed of appropriately if encountered during any future redevelopment activities.
- Provide information regarding the nature of cleanup activities and contamination left in place to future property owners.

These objectives will be achieved by coordinating the development of zoning ordinances and environmental covenants with local governmental agencies, property owners and/or notification services.

It is anticipated that Salt Lake County would be instrumental in the development of zoning ordinances or some type of overlay district that would restrict unregulated use of the Commercial and Undeveloped Areas of the Site and also ensure that contaminated soil encountered during future development is appropriately characterized and disposed. The agencies have participated in several conversations with the county regarding ICs but a program that defines and enacts them has not been established at this time.

The agencies anticipate easements or environmental covenants with property owners would be used to restrict development, ensure that contaminated soil encountered in future development is handled appropriately, and provide information regarding cleanup activities and contamination left in place to future property owners.

### **12.1.3 Summary of Commercial Area Estimated Remedy Costs**

The selected remedy calls for the excavation and disposal of 1,317 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 costs \$6,395 per acre. Commercial remediation cost estimates for machine excavation and hand excavation are \$15 and \$200 per ton, respectively. Assuming the excavated material will pass TCLP testing as is expected based on the comparison of OU2 sampling results with OU1 total lead to TCLP correlations, excavated soils can be disposed in a less expensive Subtitle D

Landfill for \$22 per ton. The cost for backfilling is \$30 and \$200 per ton for machine and hand placement, respectively. These prices include the purchase, transportation and placement of imported backfill. Similarly, the cost for procuring and placing topsoil is \$40 and \$224 per ton for machine and hand placement, respectively. Re-vegetation with a native grass seed mixture via a broadcast and harrow method is approximately \$0.40 per square foot. Replacement of large trees (less than 4 inch diameter) is estimated at approximately \$200 per tree.

As indicated in Table 12-1, capital costs are \$607,065 for Alternative C2. The Annual Operation and Maintenance (O&M) cost for Alternative C2 is estimated at \$9,000 (Table 12-2). O&M costs include an 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 for the commercial area of \$776,000 (Table 12-3).

The information in this cost estimate and in the summary tables (Tables 12-1 to 12-3) 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 RD. Major changes may be documented in the form of a memorandum in the Administrative Record file and 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 Appendix B.

#### **12.1.4 Expected Outcome of the Remedy**

Implementation of the Selected Remedy will achieve the stated Remedial Action Objectives. Future health risks associated with lead and arsenic in the commercial area will be reduced to levels acceptable for commercial uses, namely those associated with a grounds worker. Cleanup of contaminated soil with concentrations of lead exceeding 1,000 mg/kg lead and 3,000 mg/kg arsenic will allow for continued commercial use of the property.

### **12.2 Summary of the Rationale for the Undeveloped Area 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 and 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.

Based on these requirements, UDEQ and EPA have chosen Alternative U3 as the Selected Remedy for the undeveloped area of the Davenport and Flagstaff Smelters Superfund Site for the following reasons:

- Excavation and disposal will satisfy all ARARs as well as provide a high level of protectiveness for human health and the environment.
- Excavation and disposal is a well-proven technology. The threat posed by the excavated soil will be permanently eliminated.
- The preference for treatment will be met for principal threat wastes, but will not be met for contaminated soil that is not a principal threat.
- The mobility of untreated excavated soil will be greatly reduced by placing it in an approved landfill facility.
- 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. The soil cover described in Alternative U4 may be more difficult to implement.
- Disposal of the contaminated material at an off-Site facility permanently removes the contaminated soil from the Site and decreases the amount of operation and maintenance that will be required after construction. This is an important factor for state acceptance of the Selected Remedy.
- Cleanup to a level of 3,000 mg/kg allows the material that poses both a human health risk and an ecological risk to be removed from the Site without destroying wetlands located at the Site and their associated wildlife habitat.
- Ex-situ treatment of principal threat wastes will allow more efficient mixing and will be easier to implement in heavily vegetated areas and on slopes than in-situ treatment.

### **12.2.1 Detailed Description of Undeveloped Area Selected Remedy**

Based on the results of the systematic screening process described previously and input from the impacted community, UDEQ and EPA agree that Alternative U3, excavation and ex-situ treatment of all soils failing TCLP testing for lead, and off-Site disposal of soils in excess of 3,000 mg/kg lead, most completely satisfies the analysis criteria and is designated as the Selected Remedy for the undeveloped area of the Davenport and Flagstaff Smelters Superfund Site for OU2. Excavation and disposal have been used successfully at a number of similar lead contaminated Sites in Utah and throughout EPA Region 8.

The Selected Remedy involves a remedial action to meet ARARs for soils and decrease human health and ecological risks at the Site. The zones that require action are U2, U3, U4 and U34. The Selected Remedy involves clearing and grubbing the affected areas, machine excavation to an expected 6 inch depth for zones U2, U3, and U34 and machine excavation to an expected depth of 18 inches for zone U4.

The Selected Remedy also calls for the ex-situ treatment of principal threat waste in a storage and treatment Corrective Action Management Unit (CAMU), and transportation and disposal of all excavated and stabilized soils at a Subtitle D Class I landfill. The Selected Remedy also includes the removal of the access road constructed during cleanup activities associated with OU1 and restoration and re-vegetation of all affected areas.

Principal threat waste will be stockpiled and treated and stabilized, ex-situ, with a chemical reagent that decreases the leachability of the lead in the soil rendering it non-leachable. As described in Section 10, ex-situ treatment and stabilization of principal threat waste will generate a hazardous waste and trigger Land Disposal Restrictions if a CAMU is not created

In order to retain the current surface grade and elevation at the property, clean, imported soil backfill and topsoil will be compacted to a height equal to the depth excavated. The affected areas will be re-seeded with a native grass mix. In addition to the re-seeding some large tree replacement may be required in forested areas.

ICs in the form of environmental covenants, conservation easements or land use zoning will be required to ensure that future land use is consistent with the cleanup levels and that the remedy remains protective.

The remedy will be considered complete when the following key components are accomplished:

- Removal of existing vegetation from the contaminated areas.
- Excavation of all surface soils with lead concentrations exceeding 3,000 mg/kg to an expected maximum depth of 18 inches.
- Excavation of all principal threat waste.
- Ex-situ treatment of all principal threat waste by stabilizing leachable lead in soil.
- Transportation to and disposal of all excavated soil at an appropriate (Subtitle D) landfill.
- Placement of clean topsoil and re-vegetation of excavated areas.
- Removal and restoration of access road.
- ICs, such as environmental covenants under the State of Utah's Environmental Covenants Act, conservation easements and/or land use controls established through Salt Lake County Zoning Authorities, to ensure the remedy remains protective.

These performance standards will ensure that the RAOs are met by reducing the risk of direct contact, inhalation or ingestion of contaminated soil by excavating and disposing of contaminated soil within the undeveloped area of OU2, and providing controls to protect against exposure to contaminated soil remaining after excavation.

### **12.2.2 Implementation of the Undeveloped Area Selected Remedy**

The Selected Remedy will be implemented following RD activities. During design affected property owners will be consulted regarding the current and post-remedial condition of the property. Physical construction will be considered complete when all of the properties in areas identified for remediation have been addressed and returned to satisfactory condition.

ICs are part of the Selected Remedy and are desirable to ensure the protectiveness of the remedy. The objectives of the ICs for the undeveloped area of OU2 are to:

- Restrict the development of residential uses without proper assessment of risk to human health and the environment.
- Ensure that contaminated soil, above unregulated use levels, remaining after cleanup is characterized and disposed of appropriately if encountered during any future redevelopment activities.
- Provide information regarding the nature of cleanup activities and contamination left in place to future property owners.

These objectives will be achieved by coordinating the development of zoning ordinances and environmental covenants with local governmental agencies, property owners and/or notification services.

It is anticipated that Salt Lake County would be instrumental in the development of zoning ordinances or some type of overlay district that would restrict unregulated use of the Commercial and Undeveloped Areas of the Site and also ensure that contaminated soil encountered during future development is appropriately characterized and disposed. The agencies have participated in several conversations with the county regarding ICs but a program that defines and enacts them has not been established at this time.

The agencies anticipate easements or environmental covenants with property owners would be used to restrict development, ensure that contaminated soil encountered in future development is handled appropriately, and provide information regarding cleanup activities and contamination left in place to future property owners.

### **12.2.3 Summary of Undeveloped Area Estimated Remedy Costs**

The Selected Remedy for the undeveloped area calls for the excavation of 4,747 tons of contaminated soil and treating, transporting and disposing of all excavated soil at an off-Site facility. Site preparation to clear and grub the area prior to excavation is \$6,395 per acre. Unit cost estimates for the excavation is \$15 per ton. It is assumed that all of the excavated material will fail TCLP testing for lead and is therefore considered a principal threat waste and will require treatment prior to disposal. Treatment of lead contaminated soil is estimated at \$80 per ton. The costs for imported, clean backfill material and topsoil, including transportation and placement are \$30 and \$40 per ton respectively. Re-vegetation with a native grass seed mixture via a broadcast and harrow method is

approximately \$0.40 per square foot. Protection of the brick road, which will be used to access part of the undeveloped area, is estimated to cost \$1,000. The access road across the undeveloped areas will be removed and the native vegetation will be restored for an estimated cost of \$35,500.

As indicated in Table 12-4, capital costs are \$1,265,837 for Alternative U3. The annual O&M costs for the Selected Remedy are estimated at \$8,592 (Table 12-5). O&M costs include 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 for the undeveloped areas of \$1,435,000 (Table 12-6).

The information in this cost estimate and in the summary tables (Tables 12-4 to 12-6) 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 RD. Major changes may be documented in the form of a memorandum in the Administrative Record file and 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 Appendix B.

#### **12.2.4 Expected Outcome of the Remedy**

Implementation of the Selected Remedy for the undeveloped area will achieve the stated Remedial Action Objectives and allow the continued recreational use of the undeveloped area. 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 Site contaminants in a reasonable time frame (six months) and will provide long-term protectiveness by permanently removing contaminated soil from the Site. ICs, such as environmental covenants, conservation easements or land-use zoning, will be implemented to control future exposure to contaminants and to ensure that the remedy remains protective of human health and the environment. Future health risks associated with lead and arsenic in the undeveloped area will be reduced to levels acceptable for recreational uses by performing a cleanup to levels of 3,000 mg/kg lead and 3,000 mg/kg arsenic.

### **Section 13: Statutory Determinations**

Under CERCLA 121 and the NCP, the lead agency 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 that permanently and significantly reduces the volume, toxicity, and mobility of hazardous wastes as a principal element and a bias against off-Site disposal of untreated

wastes. The following sections discuss how the Selected Remedies for both the Commercial and Undeveloped Areas meet 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 which when implemented will significantly reduce the exposure of ecological receptors to soil contamination.

The Selected Remedies, excavation and removal of contaminated soils and treatment of principal threat waste, are a well proven technology. The threat posed by the excavated soil will be permanently removed from the Site. Treatment and landfill disposal will reduce the migration potential of the principal threat waste along with the potential for human exposure to it.

It is believed that cleanup to levels protective of human health will address the bulk of the source material that is driving risk to ecological receptors, while also minimizing the damage that the undeveloped area would sustain through more intrusive and aggressive construction activities. The exposure of herbivorous and invertivorous birds to material that pose an ecological risk will be reduced by the Selected Remedies but will not be quantifiable.

The development of ICs will ensure that the Selected Remedies will remain protective after construction has been completed. The implementation of these remedies will not pose any unacceptable short-term risks. The time required to complete the remedial action is six months. The Selected Remedies will be more protective and require less reporting and monitoring and the impact of ICs will be much 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 below.

**Identification and Listing of Hazardous Waste, UAC R315-2.** This standard establishes state requirements for identifying waste generated during the Selected Remedy as a hazardous waste as appropriate. This includes soil excavated for off-site disposal. This standard is applicable.

**Land Disposal Restrictions, UAC R315-13.** This standard establishes state management requirements for hazardous wastes generated during the Selected Remedy.

Since treatment of principal threat waste is necessary prior to land disposal this standard is applicable.

**State Rule Requiring Compliance with NAAQS, UAC R307-101-1.** Emissions from excavation operations performed as part of the Selected Remedy must meet the requirements set forth in this standard. This standard is applicable.

**Emissions Standards – Visible Emissions, UAC R307-201-3.** Emissions from construction activities performed as part of the Selected Remedy must meet the requirements set forth in this standard. The Selected Remedy is not expected to cause significant visible emissions. This standard is applicable.

**Non-Attainment Area for PM10 Fugitive Emission and Fugitive Dust; UAC R307-309.** Fugitive dust must be controlled during ground disturbing activities associated with the Selected Remedy. This standard is applicable.

**Air Pollution Prohibited, UAC R307-102-1.** Emission of air contaminants in sufficient quantities to cause air pollution is prohibited. This standard is applicable.

**Corrective Action Cleanup Standard Policy - UST and CERCLA Sites, UAC R311-211.** The Selected Remedy eliminates the source of contamination through removal and utilizes risk based cleanup standards for soil. This standard is applicable.

**Hazardous Waste Generator Requirements, UAC R315-5.** All activities that generate hazardous waste must meet the substantive provisions of these requirements. This standard is applicable.

**Closure and Post-Closure, UAC R315-8-7.** The closure standards of 40 CFR 264.552(f) are applicable to closure of the treatment and storage CAMU designated by the Record of Decision. The requirements of UAC R315-8-7 are relevant and appropriate to closure of any contaminated soil that is not excavated during the implementation of the Selected Remedy and remains in place.

**Landfills, UAC R315-8-14.** Requirements for landfill closure are relevant and appropriate to the Selected Remedy. A soil cover will be placed over contaminated materials that are not excavated during the remedial action to address any direct contact threat. This constitutes a hybrid landfill closure.

**Corrective Action for Solid Waste Management Units, UAC R315-8-21.** This rule incorporates 40 CFR 264.552 by reference. This Record of Decision designates a storage and treatment CAMU in areas of the Site requiring remediation (see Figure 8-1). The requirements of 40 CFR 264.552(f) are applicable to management of remediation wastes within the CAMU. Creation of a CAMU will allow for ex-situ treatment of principal threat waste. By designating the area requiring remediation as a storage and treatment CAMU, principal threat waste can be rendered non-hazardous and then disposed of at a municipal landfill.

**Cleanup and Risk Based Closure Standard, UAC R315-101.** Allows closure of facilities to risk based standards. Appropriate site management, such as corrective action, post closure care, and institutional controls, is required based on identified levels of risk.

**Utah Pollutant Discharge Elimination System (UPDES), UAC R317-8.** The storm water pollution prevention requirements of UAC R317-8 are applicable to construction activities at the Site.

**Remediation Waste Management Sites, UAC R315-8-1(g).** The substantive requirements of UAC R315-8(g) are applicable to management of remediation wastes within the storage and treatment CAMU.

**Emergency Control Requirements, UACR315-9.** In the event of an on-Site spill of hazardous wastes substantive requirements for immediate actions and cleanup will be met. This standard is applicable.

**National Historic Preservation Act, 36 CFR Part 800, 40 CFR Part 6.301(b), 16 USC Section 470.** The Selected Remedy will include determining whether any portion or portions of the Site are listed or eligible for listing on the National Register of Historic Places and will comply with these requirements where applicable.

**Archeological and Historic Preservation Act, 40 CFR Part 6.301(c), 16 USC Section 469.** If the Selected Remedy will cause irreparable loss or destruction of significant cultural resources, data recovery and preservation activities may be conducted in accordance with these standards. These standards are applicable.

**Migratory Bird Treat Act 50 CFR Part 10.** This standard prevents the taking of migratory birds, their nests or eggs without special permits. This standard is applicable

**Community Culture and History, UAC R212-6.** State standards regarding cultural resources are applicable.

**General Facility Standards – Location Standards, UAC R315-8-2.9.** State standards regarding the location of hazardous waste management units are relevant and appropriate to any hybrid landfill closure of unexcavated contaminated soil left in place.

### **13.3 Cost-Effectiveness**

In the lead agency's judgment the Selected Remedies are cost effective and represent 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 criteria (were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing

criteria 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 these remedial alternatives was determined to be proportional to their costs and hence these alternatives represent a reasonable value for the money to be spent.

Table 13-1 shows the present worth costs of the alternatives, including the selected remedies. The estimated present worth cost of the Selected Remedy for the Commercial Area (Alternative C2) is \$776,000 and costs slightly less than the cost for Alternative C3.

The estimated present worth cost of the Selected Remedy for the Undeveloped Area (Alternative U3) is \$1,435,000. Although Alternative U4 is slightly less expensive (\$1,249,000) principal threat waste will still remain at the Site, and therefore the Selected Remedy is more cost-effective. The agencies believe that the Selected Remedy's additional cost for ex-situ treatment of principal threat waste and 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.**

The agencies have 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 agencies have determined that the Selected Remedies provide the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-Site treatment and disposal and considering State and community acceptance.

The Selected Remedy for the Commercial Area satisfies the criteria for long-term effectiveness by permanently removing the threat posed by the excavated soil from the Site. Any principal threat waste encountered during construction will be treated prior to disposal. The Selected Remedy for the Commercial Area does not present short-term risks different from the other alternatives. There are no special implementability issues that set the Selected Remedy apart from any of the other alternatives evaluated.

The Selected Remedy for the Undeveloped Area satisfies the criteria for long-term effectiveness by permanently removing the threat posed by the excavated soil from the Site. The treatment of principal threat waste will reduce both the toxicity and mobility of the contaminants in the excavated soil. The Selected Remedy for the Undeveloped Area does not present short-term risk different from the other alternatives. There are no special implementability issues that set the Selected Remedy apart from any of the other alternatives evaluated.

### **13.5 Preference for Treatment as a Principal Element**

The Selected Remedy for the Commercial Area satisfies the preference for treatment as a principal element for any principal threat waste encountered during construction. The preference for treatment will not be met for the majority of the excavated soils in the Commercial Area. However, the mobility of the contaminants will be greatly reduced by disposal in an appropriate disposal facility.

The Selected Remedy for the Undeveloped area calls for all soil with a TCLP greater than 5 mg/L (principal threat waste) to be stabilized prior to off-Site disposal. The stabilization will reduce both the mobility and the toxicity of the contaminants in the excavated soil. The preference for treatment will be met for those soils that will require treatment prior to disposal. The selected remedy may also include the excavation and disposal of soils that do not require treatment prior to disposal. The preference for treatment will not be met for these soils. However, the mobility of the contaminants will be reduced by disposal in an appropriate disposal facility. Disposal of contaminated soils in an appropriate landfill reduces the mobility of contaminants more than the soil cover contained in the other alternatives.

### **13.6 Five-Year Review Requirements**

Because the Selected Remedies at the commercial and undeveloped areas 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 to ensure that the remedies are, or will be, protective of human health and the environment.

### **14.0 Documentation of Significant Changes**

The Proposed Plan was released for public comment in February of 2009. It identified Alternative C2 as the Preferred Remedy for the commercial areas and Alternative U3 as the Preferred Remedy for the Undeveloped Areas. During the public comment period, the community expressed concerns regarding how the cleanup levels were calculated and why they were different than the OU1 levels, how the remediation will be performed and whether specific residential properties near the Site had been impacted by smelter releases. Two property owners, the City of Salt Lake and the City of Sandy, expressed concerns about remedial activities affecting a down-stream water intake, increased vehicular traffic due to the transport of contaminated soil, and the impact of construction vehicle emissions on air quality. The Metropolitan Water District of Salt Lake and Sandy echoed the cities concerns regarding the down-stream water intake. Salt Lake City challenged many of the assumptions made in both the Human Health and Ecological Risk Assessments and argued for a “no action” remedy. The agencies reviewed all written and verbal comments submitted in the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

## Tables

<b>Table 5-1</b>	<b>Groundwater Sampling Results</b>
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**Table 5-1**  
**Groundwater Sampling Results**  
**Davenport and Flagstaff Smelter OU2**

		Lead MCL = .015 mg/L	Arsenic MCL = .01 mg/L
GW 01	Total	<b>.011</b>	<b>.012</b>
	Dissolved	ND	<b>.011</b>
GW 02	Total	<b>4.07</b>	<b>.38</b>
	Dissolved	.0085	<b>.014</b>
GW 03	Total	<b>.025</b>	<b>.003</b>
	Dissolved	ND	ND
GW 04	Total	<b>.82</b>	<b>.098</b>
	Dissolved	ND	ND

mg/L=milligrams per liter

Table 7-1  
**Surface Soil Summary Statistics and EPC Results**  
 O2 Davenport and Flagstaff Smelters

Group	Analyte	Unit	No. of Samples	Detection Rate	Summary Statistics				Detected Values		Goodness-of-Fit Test	Upper Confidence Limit (UCL)		EPC
					Mean	Std Dev	Min	Max	Min Detected	Max Detected		Distribution	Method of UCL Calculation	
(1) Commercial Soils - All	ARSENIC	mg/kg	25	100%	15.3	6.5	7	40	7	40	Gamma	95% Approximate Gamma UCL	17.5	17.5
(1) Commercial Soils - All	LEAD	mg/kg	25	100%	236	209	115	1190	115	1190	Non-Parametric	95% Student's-t UCL	308	308
(2) Undeveloped Soils - U1-U7, U10	ARSENIC	mg/kg	8	100%	69.8	28.8	36	125	36	125	Normal	95% Student's-t UCL	89.0	89.0
(2) Undeveloped Soils - U1-U7, U10	LEAD	mg/kg	8	100%	2709	1191	1520	4930	1520	4930	Normal	95% Student's-t UCL	3507	3507
(3) Undeveloped Soils - U31-U34	ARSENIC	mg/kg	4	100%	100	80	37	211	37	211	Normal	95% Student's-t UCL	194	194
(3) Undeveloped Soils - U31-U34	LEAD	mg/kg	4	100%	2107	1394	796	3680	796	3680	Normal	95% Student's-t UCL	3747	3680
(4) Undeveloped Soils - U8, U9, U11-U30	ARSENIC	mg/kg	22	100%	22.8	8.9	8.9	38	8.9	38	Normal	95% Student's-t UCL	26.0	26.0
(4) Undeveloped Soils - U8, U9, U11-U30	LEAD	mg/kg	22	100%	478	211	138	924	138	924	Normal	95% Student's-t UCL	555	555

Notes:

(1) Goodness-of-Fit Test at 5% significance level is used to test for distributional assumption.

(2) The distributional assumption from (1) is used to select the appropriate UCL calculation method. For normal distribution, the UCL is based on the t-statistics. For lognormal distribution, gamma distribution, and non-parametric assumption, the UCL is based on the recommendations from EPA (2002) and Singh et al. (2004).

(3) References:

Singh, A., Singh, A. K., and Maichle, R. (2004). ProUCL Version 3.0 User Guide. Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R04/079.

U.S. Environmental Protection Agency (EPA). 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Report No. OSWER 9285.6-10.

EPC = exposure point concentration

max = maximum

mg/kg = milligrams per kilogram

min = minimum

Std Dev = standard deviation

**Table 7-2**  
**Preliminary Remediation Goals (PRGs) for the Three Exposure Scenarios**  
**That Have Current or Future Risks**

<b>Chemical</b>		<b>Commercial Worker PRG (mg/kg)</b>	<b>Grounds Worker PRG (mg/kg)</b>	<b>Youth Visitor PRG (mg/kg)</b>
Arsenic	Cancer Risk = 1E-04	1,300	1,250	1,600
	Cancer Risk = 1E-05	130	125	160
	Cancer Risk = 1E-06	13	12.5	16
	Non-Cancer HQ=1	2,090	2,000	1030
Lead	ALM (GSD=1.69)	2,430	700	2,920
	ALM (GSD=1.53)	3,830	1,100	4,600

**Table 7-3**  
**Soil and Sediment Summary Statistics and EPC Results**  
**Soil and Sediment Ecological Risk Assessment EPC Results**  
**OU2 Davenport and Flagstaff Smelters**  
**Ecological Risk Assessment**

Group	Analyte	No. of Samples	Detection Rate	Summary Statistics				Detected Values		Goodness-of-Fit Test	Upper Confidence Limit (UCL)		EPC
				Mean	Sd	Min	Max	Min Detected	Max Detected		Distribution	Method of 95% UCL Calculation	
Undeveloped Soils - Surface (0-2 inches)	ANTIMONY	35	69%	16.1	23.1	2.5	109	5	109	Non-Parametric	99% Chebyshev (Mean, Sd) UCL	55.0	55.0
	ARSENIC	35	100%	42.4	40.1	8.9	211	8.9	211	Lognormal	95% H-UCL	53.7	53.7
	CADMIUM	35	100%	3.16	1.72	1.1	7	1.1	7	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	4.43	4.43
	COPPER	35	100%	63.6	45.0	19	237	19	237	Gamma	95% Approximate Gamma UCL	76.5	76.5
	LEAD	35	100%	1172	1216	138	4930	138	4930	Lognormal	95% H-UCL	1700	1700
	MERCURY	35	77%	0.449	0.503	0.05	2.5	0.1	2.5	Gamma	95% Approximate Gamma UCL	0.607	0.607
	SELENIUM	35	46%	0.481	0.347	0.25	1.9	0.5	1.9	Non-Parametric	95% Chebyshev (Mean, Sd) UCL	0.737	0.737
	SILVER	35	80%	3.56	3.86	0.5	18	1	18	Non-Parametric	99% Chebyshev (Mean, Sd) UCL	10.1	10.1
ZINC	35	100%	275	206	86	1010	86	1010	Gamma	95% Approximate Gamma UCL	335	335	
Undeveloped Soils - Subsurface (2-18 inches)	ANTIMONY	35	54%	17.0	43.0	2.5	254	5	254	Non-Parametric	99% Chebyshev (Mean, Sd) UCL	89.3	89.3
	ARSENIC	35	100%	35.3	50.7	4.5	300	4.5	300	Lognormal	95% H-UCL	44.1	44.1
	CADMIUM	35	97%	2.25	2.25	0.25	13	0.7	13	Lognormal	95% H-UCL	2.89	2.89
	COPPER	35	100%	66.7	101.4	10	601	10	601	Lognormal	95% H-UCL	81.4	81.4
	LEAD	35	100%	903	1808	82	10800	82	10800	Lognormal	95% H-UCL	1144	1144
	MERCURY	35	63%	0.384	0.479	0.05	2.1	0.1	2.1	Non-Parametric	99% Chebyshev (Mean, Sd) UCL	1.19	1.19
	SELENIUM	35	14%	0.360	0.328	0.25	1.9	0.6	1.9	Non-Parametric	95% Student's-t UCL	0.454	0.454
	SILVER	35	69%	3.30	7.15	0.5	43	1	43	Non-Parametric	99% Chebyshev (Mean, Sd) UCL	15.3	15.3
ZINC	35	100%	242	257	57	1320	57	1320	Gamma	95% Approximate Gamma UCL	309	309	
Creek - Sediment	ARSENIC	5	100%	18.4	9.1	6.8	30	6.8	30	Normal	95% Student's-t UCL	27.1	27.1
	CADMIUM	5	100%	0.940	0.167	0.8	1.2	0.8	1.2	Normal	95% Student's-t UCL	1.10	1.10
	COPPER	5	100%	64.6	27.0	32	95	32	95	Normal	95% Student's-t UCL	90.4	90.4
	LEAD	5	100%	137	74	80	263	80	263	Normal	95% Student's-t UCL	207	207
	ZINC	5	100%	283	97	162	410	162	410	Normal	95% Student's-t UCL	376	376

Notes:

(1) Goodness-of-Fit Test at 5% significance level is used to test for distributional assumption.

(2) The distributional assumption from (1) is used to select the appropriate 95% UCL calculation method. For normal distribution, the UCL is based on the t-statistics. For lognormal distribution, gamma distribution, and non-parametric assumption, the UCL is based on the recommendations from USEPA (2002) and Singh (2004).

(3) References:

Singh, A., A.K. Singh and R. Maichle. 2004. ProUCL Version 3.0 User Guide. Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R04/079.

U.S. Environmental Protection Agency (USEPA). 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*. Office of Emergency and Remedial Response. Report No. OSWER 9285.6-10.

(4) All units are milligrams per kilogram (mg/kg).

EPC = exposure point concentration

Sd = standard deviation

UCL = upper confidence limit

**Table 7-4**  
**COECs for Each Exposure Medium and Receptor**

COEC	Soils		Sediment			Surface Water	
	Surface Soil	Subsurface Soil	Creek (Benthos)	Ponds* (Benthos)	Ponds* (Wildlife)	Creek	Ponds*
Antimony	M, P	M, P					
Arsenic	M, SI	M, SI					
Cadmium	B, M	B, M			M		
Lead	B, M, P	B, M, P	BI				
Mercury	B, SI	B, SI					
Selenium	P						
Silver	P	P					
Zinc	P	P					

\*Two ponds and tributary

Receptors: B – birds; BI – benthic (macro)invertebrates; M – mammals; P – plants; SI – soil invertebrates

**Table 7-5  
Exposure Factors for Wildlife Receptors  
OU2 – Davenport and Flagstaff Smelters**

Food-web classification	Representative Species		Body Weight (bw)		Food Ingestion Rate (IR <sub>f</sub> )			Composition of Diet (%)				Soil Ingestion Rate (IR <sub>s</sub> )			Water Ingestion Rate (IR <sub>w</sub> )			Home Range			
	Common Name	Scientific Name	kg	Comment	Reference	kg/day ww	Comment	Reference	Plants	Invertebrates	Flesh	Notes; Reference	kg/day dw	Comment	Reference	L/day	Comment	Reference	Acres	Comment	Reference
Carnivore	American kestrel	<i>Falco sparverius</i>	0.119	Average of male and female means; Utah	USEPA 1993	0.02142	Based on 0.18 g ww/g bw/day; California	USEPA 1993	0%	33%	67%	Average of all diets; USEPA 1993	0.0	Negligible. Assumed same as red-tailed hawk	Eftoymsom et al. 1997	0.0137	0.115 g/g-day average of adult males and females	USEPA 1993	668	Based on range of 100-1,235 acres in Wyoming grasslands	USEPA 1993
Insectivore/ Invertivore	American robin	<i>Turdus migratorius</i>	0.077	Average of males and females	USEPA 1993	0.069	Based on 0.89 g ww/g bw/day; California	USEPA 1993	45%	55%	0%	Average of all diets; USEPA 1993	0.00206	10% of diet (dw) Based on average of soil ingestion rates for wild turkey and American woodcock	Beyer et al. 1994	0.0108	Mean, 0.14 g/g-day	USEPA 1993	0.61	Average of mean territory sizes of adult males and females	USEPA 1993
Herbivore	Horned lark	<i>Eremophila alpestris</i>	0.041		Schoener 1968	0.043	0.398*bw*0.850 (g) = dw IRf for passerines	USEPA 1993	50%	50%	0%	Mainly insects (summer), seeds (winter); DeGraaf and Rudis 1983	0.00093	10% of diet (dw) Based on average of soil ingestion rates for wild turkey and American woodcock	Beyer et al. 1994	0.0057	Assumed same as robin - mean, 0.14 g/g-day	USEPA 1993	7	Based on breeding territory acreages	Verner and Boss 1980
Insectivore/ Invertivore	Lesser scaup	<i>Aythya affinis</i>	0.815	Average of adult male and female means; U.S.	USEPA 1993	0.172	0.301*bw*0.751 (g) = dw IRf for non-passerines	USEPA 1993	28%	72%	0%	Average of all diets; USEPA 1993	0.00092	<2% of diet (dw); Based on ring-necked duck	USEPA 1993	0.051	Average of adult male and female means, 0.063 g/g-day	USEPA 1993	220	Mean breeding in Manitoba; 89 hectares	USEPA 1993
Insectivore/ Invertivore	Masked shrew	<i>Sorex cinereus</i>	0.0045	Median of adult weights (3-6 g)	USEPA 1993	0.0045	Eats its own weight daily	NatureServe 2007	10%	80%	10%	Primarily insects, also small mammals and seeds; NatureServe 2007	0.000039	Assumed same as meadow vole (2.4% of dw diet)	USEPA 1993	0.00076	0.099*bw*0.90 (kg) = WI (L/day) for all mammals	USEPA 1993	0.1	0.04 hectare	DeGraaf and Rudis 1983
Herbivore	Meadow vole	<i>Microtus pennsylvanicus</i>	0.0372	Average male and female all year; south Indiana	USEPA 1993	0.013	Based on 0.35 g ww/g bw/day; Russia	USEPA 1993	99%	1%	0%	Average of all diets; USEPA 1993	0.0000469	2.4% of diet (dw)	USEPA 1993	0.006		Sample et al. 1996	0.1	Range of 0.09-0.21 acre for males and females	USEPA 1993
Carnivore	Mink	<i>Mustela vison</i>	0.852	Average male and female adults, summer and fall; Montana	USEPA 1993	0.119	Average male and female winter 0.14 g ww/g bw/day; Michigan	USEPA 1993	17%	12%	71%	Average of all diets; USEPA 1993	0.0	Negligible	USEPA 1993	0.099		Sample et al. 1996	789	Mean of range of 640-940 acres in North Dakota	USEPA 1993
Herbivore	Mule deer	<i>Odocoileus hemionus</i>	70	Average weight in Colorado	Fitzgerald et al. 1994	10	Based on average of 22 g dw/kg bw/day	Sample et al. 1997	100%	0%	0%	Diet consists entirely of vegetation; Sample et al. 1997	0.016	North Central Colorado	Sample et al. 1997	4.5	0.099*bw*0.90 (kg) = WI (L/day) for all mammals	USEPA 1993	705	Mean annual home range	Sample et al. 1997
Carnivore	Red fox	<i>Vulpes vulpes</i>	4.5		Sample et al. 1996	0.45		Sample et al. 1996	2%	5%	93%	Average of all diets; USEPA 1993	0.004	2.8% of dw diet	Beyer et al. 1994	0.380		Sample et al. 1996	1727	Adult female mean territory, Minnesota, woods, fields, swamp	USEPA 1993
Herbivore	Wood duck	<i>Aix sponsa</i>	0.863	Average male and female	Dunning 1993	0.248	0.301*bw*0.751 (g) = dw IRf for non-passerines	USEPA 1993	90%	10%	0%	USDA-NRCS 2007	0.00079	<2% of diet (dw); Based on ring-necked duck	USEPA 1993	0.045	0.059*bw*0.67 (kg) = WI (L/day) for birds	USEPA 1993	1.26E+06	Average feeding radius 25 to 30 miles daily	NC Cooperative Extension Service undated

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Flesh = small mammals or birds

Percent solids: 15% plants; 39% soil invertebrates; and 32% small birds/mammals (USEPA 1993)

ww = wet weight

dw = dry weight

bw = body weight

kg = kilogram

g = gram

L = liter

**Table 12-1**  
**Capital Cost Estimate for Selected Remedy for Commercial Area**  
**Davenport and Flagstaff Smelter Superfund Site OU2**

Item#	Description	Units	Quantity	Unit Cost	Cost
1	Clear and grub brush	Acres	0.5	\$6,395	\$3,280
2	Move, Stage, and Replace Debris	Lump Sum	1	\$4,000	\$4,000
3	Water Truck - Dust Suppression	Months	3	\$8,000	\$24,000
4	Excavation	Ton	614	\$15	\$9,217
5	Hand Excavation	Ton	703	\$200	\$140,595
6	Analytical Cost - TCLP	Sample	2	\$150	\$300
7	Transport non-hazardous Waste to Salt Lake County Landfill.	Ton	1,317	\$6	\$7,905
8	Disposal of Non-Hazardous Waste at Salt Lake County Landfill.	Ton	1,317	\$22	\$28,984
9	Backfill - material, haul, and machine placement	Ton	307	\$30	\$9,217
10	Top Soil - material, haul, and machine placement	Ton	307	\$40	\$12,290
11	Backfill - material, haul, and hand placement	Ton	351	\$200	\$70,297
12	Top Soil - material, haul, and hand placement	Ton	351	\$224	\$78,733
13	Revegetation	Sq ft	22,345	\$0.4	\$8,938
14	Large Tree Replacement	Each	15	\$200	\$3,000
15	Health & Safety Ambient Air Monitoring	Lump Sum	1	\$36,930	\$36,930
16	Final Site Wide Cleanup	Lump Sum	1	\$56,300	\$10,000
				Total Cost	\$447,688
				Mobilization (10%)	\$44,769
				Demobilization (3%)	\$13,431
				Subtotal	\$505,887
				Unidentified Construction Cost (10%)	\$50,589
				Construction Management (10%)	\$50,589
				<b>TOTAL</b>	<b>\$607,065</b>

**Table 12-2**  
**Operation and Maintenance Cost Estimate for Selected Remedy for Commercial Area**  
**Davenport and Flagstaff Smelter Superfund Site OU2**

Activity	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total
Site Visit (Round Trip)	Visit	1	1	\$150	\$150
Reproduction	Page	250	1	\$0.15	\$38
Postage / Packaging	Package	3	1	\$20	\$60
ODC Subtotal					<b>\$248</b>
Project Management (PM)	Hour	12	1	\$100	\$1,200
On-Site Labor	Hour	16	1	\$90	\$1,440
Off-Site Labor	Hour	40	1	\$90	\$3,600
Drafting/Graphics	Hour	16	1	\$65	\$1,040
Clerical Support	Hour	16	1	\$65	\$1,040
Labor Subtotal					<b>\$8,320</b>
Contingency Allowance		10%		\$248	<b>\$25</b>
Annual Cost					<b>\$8,592</b>

**Table 12-3**  
**Present Worth Cost of Construction, Operation, Maintenance and Monitoring**  
**Selected Remedy for Commercial Area**  
**Davenport and Flagstaff Smelters Superfund Site OU2**

Year	Cost	O&M Cost	Annual Expenditures	Factor <sup>a</sup>	Worth <sup>b</sup>
0	\$607,065		\$607,065	1.000	\$607,065
1		\$8,592	\$8,592	0.973	\$8,358
2		\$8,592	\$8,592	0.946	\$8,131
3		\$8,592	\$8,592	0.920	\$7,909
4		\$8,592	\$8,592	0.895	\$7,694
5		\$8,592	\$8,592	0.871	\$7,484
6		\$8,592	\$8,592	0.847	\$7,280
7		\$8,592	\$8,592	0.824	\$7,082
8		\$8,592	\$8,592	0.802	\$6,889
9		\$8,592	\$8,592	0.780	\$6,701
10		\$8,592	\$8,592	0.759	\$6,519
11		\$8,592	\$8,592	0.738	\$6,341
12		\$8,592	\$8,592	0.718	\$6,169
13		\$8,592	\$8,592	0.698	\$6,001
14		\$8,592	\$8,592	0.679	\$5,837
15		\$8,592	\$8,592	0.661	\$5,678
16		\$8,592	\$8,592	0.643	\$5,524
17		\$8,592	\$8,592	0.625	\$5,373
18		\$8,592	\$8,592	0.608	\$5,227
19		\$8,592	\$8,592	0.592	\$5,084
20		\$8,592	\$8,592	0.576	\$4,946
21		\$8,592	\$8,592	0.560	\$4,811
22		\$8,592	\$8,592	0.545	\$4,680
23		\$8,592	\$8,592	0.530	\$4,553
24		\$8,592	\$8,592	0.515	\$4,429
25		\$8,592	\$8,592	0.501	\$4,308
26		\$8,592	\$8,592	0.488	\$4,191
27		\$8,592	\$8,592	0.474	\$4,077
28		\$8,592	\$8,592	0.462	\$3,966
29		\$8,592	\$8,592	0.449	\$3,858
Present Worth of Capital Cost					\$607,000
Present Worth of O&M Cost					\$169,000
Total Present Worth (30 Years)					<b>\$776,000</b>

**Table 12-4  
Capital Cost Estimate for Selected Remedy for Undeveloped Areas  
Of Davenport and Flagstaff Smelter Superfund Site OU2**

<b>Item#</b>	<b>Description</b>	<b>Units</b>	<b>Quantity</b>	<b>Unit Cost</b>	<b>Cost</b>
1	Clear and grub brush	Acres	2.45	\$6,395	\$15,671
2	Brick Road Protection	Lump Sum	1	\$1,000	\$1,000
3	Access Road Restoration	Lump Sum	1	\$35,544	\$35,544
4	Water Truck - Dust Suppression	Months	3	\$9,820	\$29,460
5	Excavation	Ton	4,747	\$15	\$71,201
6	Analytical Cost - TCLP	Sample	5	\$150	\$750
7	Stabilization	Ton	4,747	\$80	\$379,738
8	Transport Non-hazardous Waste to Salt Lake County Landfill.	Ton	4,747	\$6	\$28,480
9	Disposal of Non-hazardous Waste at Salt Lake County Landfill.	Ton	4,747	\$22	\$104,428
10	Backfill - material, haul, and machine placement	Ton	2,826	\$30	\$84,785
11	Top Soil - material, haul, and machine placement	Ton	1,921	\$40	\$76,822
12	Revegetation	Sq ft	106,745	\$0.4	\$42,698
13	Large Tree Replacement	Each	80	\$200	\$16,000
14	Health & Safety Ambient Air Monitoring	Lump Sum	1	\$36,930	\$36,930
15	Final Site Wide Cleanup	Lump Sum	1	\$56,300	\$10,000
Total Cost					\$933,508
Mobilization (10%)					\$93,351
Demobilization (3%)					\$28,005
Subtotal					\$1,054,864
Unidentified Construction Cost (10%)					\$105,486
Construction Management (10%)					\$105,486
<b>TOTAL</b>					<b>\$1,265,837</b>

**Table 12-5**  
**Operation and Maintenance Cost Estimate for Selected Remedy**  
**for Undeveloped Areas of**  
**Davenport and Flagstaff Smelter Superfund Site OU2**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total
<b>Other Direct Charges</b>					
Site Visit (Round Trip)	Visit	1	1	\$150	\$150
Reproduction	Page	250	1	\$0.15	\$38
Postage / Packaging	Package	3	1	\$20	\$60
ODC Subtotal					<b>\$248</b>
<b>Labor Charges</b>					
Project Management (PM)	Hour	12	1	\$100	\$1,200
On-Site Labor	Hour	16	1	\$90	\$1,440
Off-Site Labor	Hour	40	1	\$90	\$3,600
Drafting/Graphics	Hour	16	1	\$65	\$1,040
Clerical Support	Hour	16	1	\$65	\$1,040
Labor Subtotal					<b>\$8,320</b>
Contingency Allowance		10%		\$248	\$25
Annual Cost					<b>\$8,592</b>

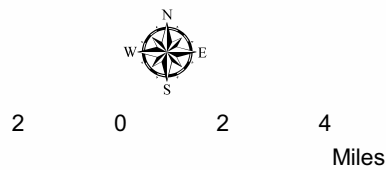
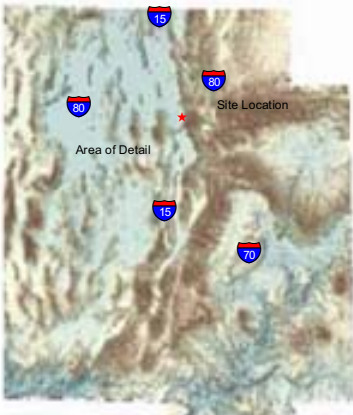
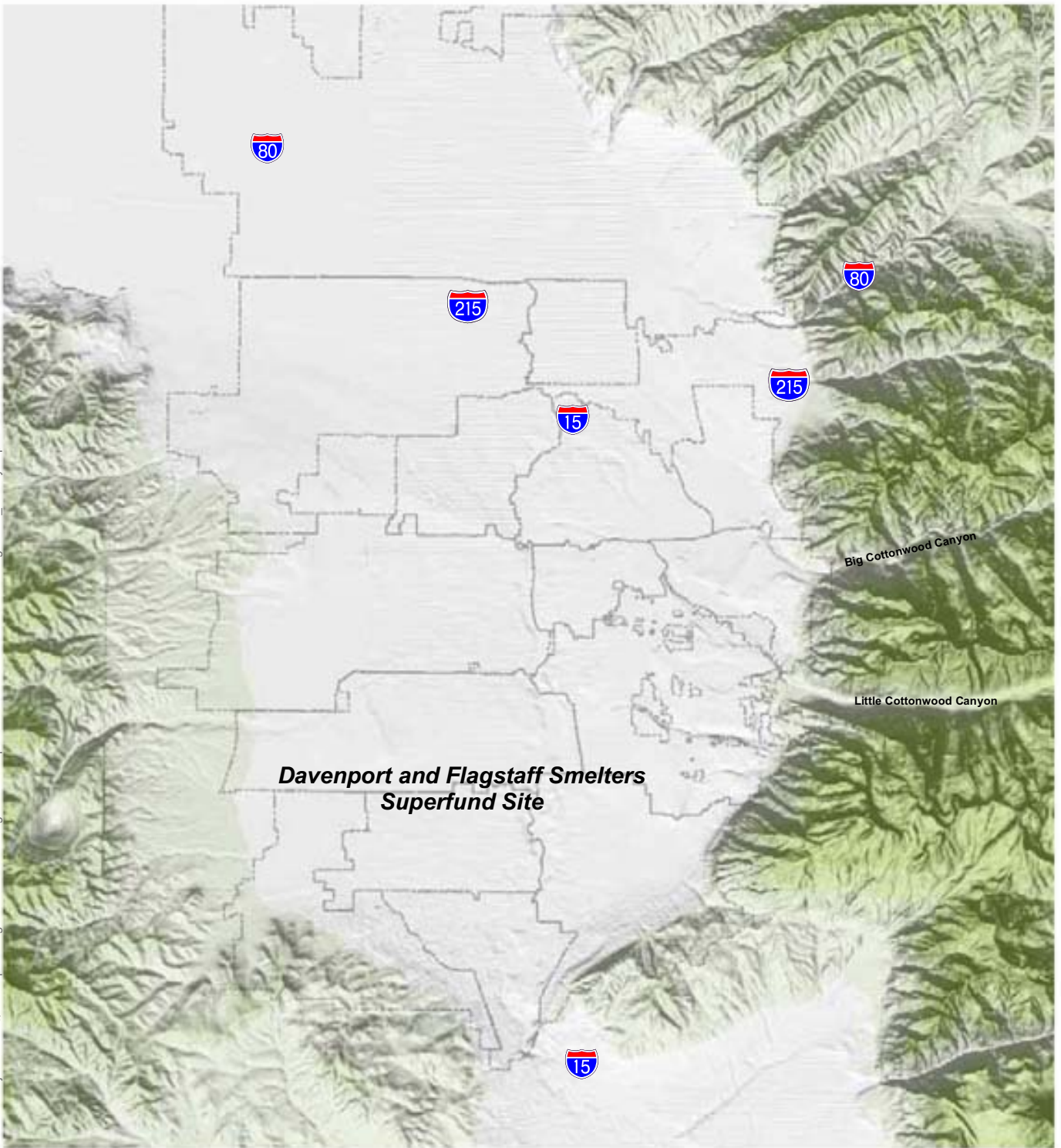
**Table 12-6**  
**Present Worth Cost of Construction, Operation, Maintenance and Monitoring**  
**Selected Remedy for Undeveloped Areas**  
**Davenport and Flagstaff Smelters Superfund Site OU2**

Year	Capital Cost	Annual O&M Cost	Subtotal Annual Expenditures	Discount Factor <sup>a</sup>	Present Worth <sup>b</sup>
0	\$1,265,837		\$1,265,837	1.000	\$1,265,837
1		\$8,592	\$8,592	0.973	\$8,358
2		\$8,592	\$8,592	0.946	\$8,131
3		\$8,592	\$8,592	0.920	\$7,909
4		\$8,592	\$8,592	0.895	\$7,694
5		\$8,592	\$8,592	0.871	\$7,484
6		\$8,592	\$8,592	0.847	\$7,280
7		\$8,592	\$8,592	0.824	\$7,082
8		\$8,592	\$8,592	0.802	\$6,889
9		\$8,592	\$8,592	0.780	\$6,701
10		\$8,592	\$8,592	0.759	\$6,519
11		\$8,592	\$8,592	0.738	\$6,341
12		\$8,592	\$8,592	0.718	\$6,169
13		\$8,592	\$8,592	0.698	\$6,001
14		\$8,592	\$8,592	0.679	\$5,837
15		\$8,592	\$8,592	0.661	\$5,678
16		\$8,592	\$8,592	0.643	\$5,524
17		\$8,592	\$8,592	0.625	\$5,373
18		\$8,592	\$8,592	0.608	\$5,227
19		\$8,592	\$8,592	0.592	\$5,084
20		\$8,592	\$8,592	0.576	\$4,946
21		\$8,592	\$8,592	0.560	\$4,811
22		\$8,592	\$8,592	0.545	\$4,680
23		\$8,592	\$8,592	0.530	\$4,553
24		\$8,592	\$8,592	0.515	\$4,429
25		\$8,592	\$8,592	0.501	\$4,308
26		\$8,592	\$8,592	0.488	\$4,191
27		\$8,592	\$8,592	0.474	\$4,077
28		\$8,592	\$8,592	0.462	\$3,966
29		\$8,592	\$8,592	0.449	\$3,858
Present Worth of Capital Cost					\$1,266,000
Present Worth of O&M Cost					<u>\$169,000</u>
Total Present Worth (30 Years)					<b>\$1,435,000</b>

**Table 13-1  
Present Worth Costs of Alternatives**

Commercial Areas	Present Worth Cost
C1: No Action	\$0
C2: Excavation and disposal of all soils in excess of 1,000 mg/kg	\$776,000
C3: Excavation and disposal of soil in non-native areas and soil cover around native vegetation	\$781,000
Undeveloped Areas	
U1: No Action	\$0
U2: In-situ treatment followed by excavation, off-Site disposal and restoration and revegetation	\$1,435,000
U3: Excavation followed by ex-situ treatment, off-Site disposal and restoration and revegetation	\$1,435,000
U4: Soil Cover	\$1,249,000

File: X:\Projects\UDEQ\Davenport+Flagstaff\2009\OU2 Flagstaff Davenport GIS\OU2 Record of Decision\Figure 1-1\_VicinityMap.mxd



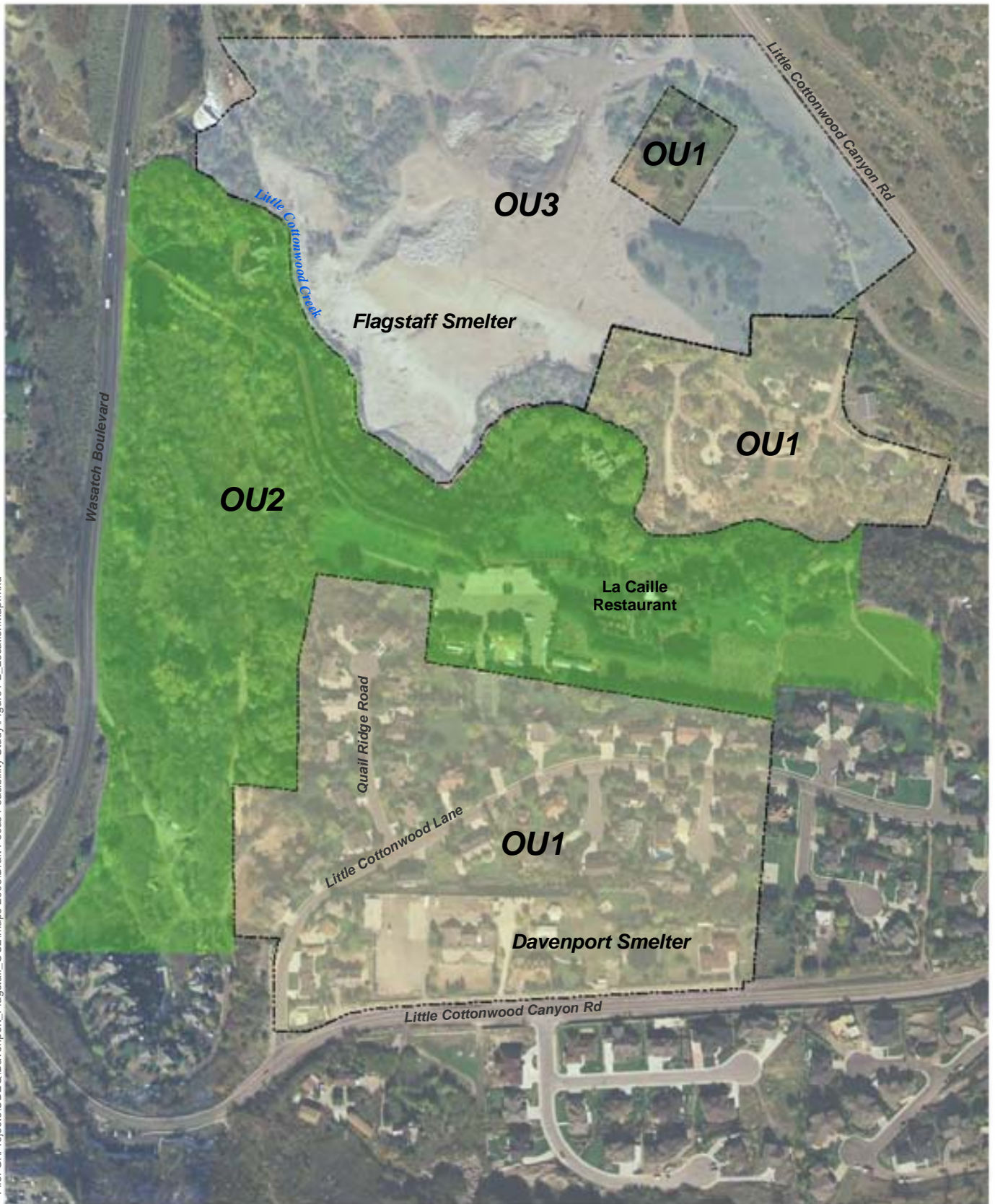
Salt Lake County, Utah  
OU 2 Record of Decision  
June 2009



**Figure 1-1. Vicinity Map**



File: G:\Projects\UDEQ\Davenport\_Flagstaff\_OU2\maps\2006\Draft Focus Feasibility Study\Figure1-2\_LocationMap.mxd



Residential Operable Unit 1 (OU1)

Operable Unit 2 (OU2)

Operable Unit 3 (OU3)

175    0    175    350  
Feet



Salt Lake County, Utah  
OU2 Final Focused Feasibility Study

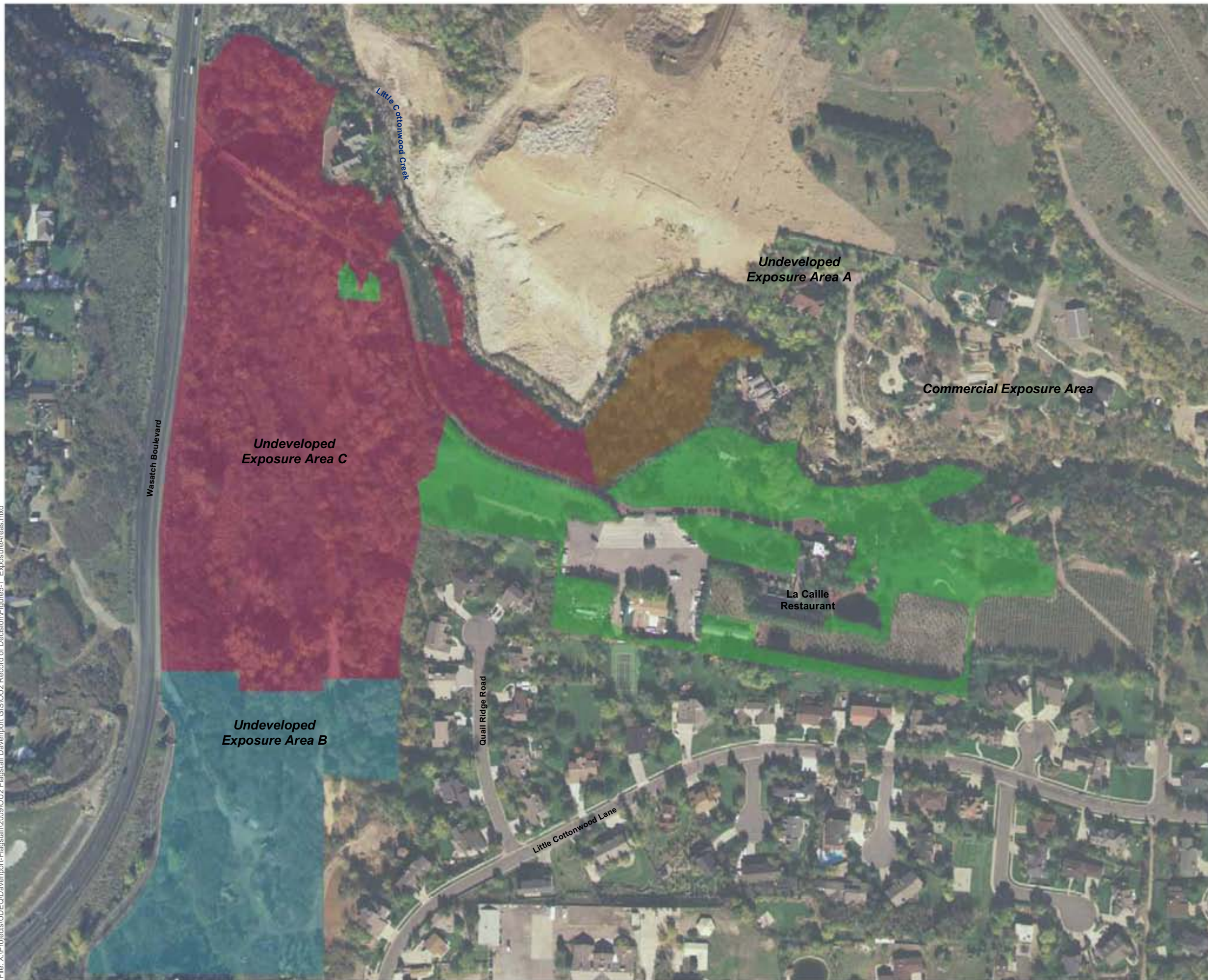


Figure 1-2. Location Map





File: X:\Projects\UDEQ\Davenport-Flagstaff\2009\OU2 Flagstaff Davenport GIS\OU2 Record of Decision\Figure5-1 ExposureAreas.mxd



OU2 Boundary

Commercial Exposure Area

Undeveloped Exposure Area A

Undeveloped Exposure Area B

Undeveloped Exposure Area C



100 0 100 200

Feet

Projection: UTM NAD83 Zone 12N



Salt Lake County, Utah  
Final OU2 Record of Decision  
June 2009



Figure 5-1.  
Human Health  
Exposure Areas



**Human Receptors**

Sources	Release Mechanism	Media	Transport Mechanism	Media	Transport Mechanism	Media	Transport Mechanism	Exposure Media	Exposure Route	Human Receptors												
										Residents <sup>(1)</sup>	Grounds Workers <sup>(2)</sup>	Commercial (Indoor) Workers <sup>(2)</sup>	Restaurant Patrons <sup>(2)</sup>	Youth Visitors <sup>(3)</sup>	Adult/Young Child Visitors <sup>(3)</sup>							
Davenport and Flagstaff Smelters	Stack Emissions (Dust and Flue Ash) and Wind Blown Dust	Surface Soil	Dust Generation	Air	P	Air	P	Air	Inhalation	N	N	N	N	N	N							
									Surface Soil	Uptake	Homegrown produce	Homegrown produce	Ingestion	C	C	C	N	C	N			
													Direct contact	N	N	N	N	N	N			
									Surface Soil	Uptake	Grapes in the Vineyard	Wine	Wine	Ingestion	I	I	I	N	I	I		
														Direct Contact	C	C	I	I	I	I		
		Subsurface Soil	Leaching, Infiltration	Groundwater	Leaching, Infiltration	Groundwater	Pond/Seep Water <sup>(5)</sup>	Pond/Seeps	Partitioning	Pond/Seep Sediment <sup>(5)</sup>	Ingestion	C	C	I	I	C	N					
											Direct Contact	N	N	I	I	I	I					
											Creek Water	Creek	Partitioning	Creek Sediment	Creek Fish	Ingestion	I	I	I	I	C	N
																Direct Contact	I	I	I	I	C	N
											Creek Sediment	Creek	Partitioning	Creek Sediment	Creek Fish	Ingestion	I	I	I	I	C	N
Direct Contact	I	I	I	I	N	N																
Creek Fish	Creek	Partitioning	Creek Fish	Creek Fish	Ingestion	I	I	I	I	N	N											
					Direct Contact	I	I	I	I	N	N											

Exposure pathway complete C -Exposure pathway potentially Complete, quantifiable.  
 I - Exposure pathway Incomplete, not quantified.  
 Exposure pathway incomplete or not significant N -Exposure pathway potentially Complete, but Negligible (pathway evaluated qualitatively in the uncertainty section).

(1) Receptors assumed to be exposed in the residential exposure area. Not addressed quantitatively in this risk assessment. To be addressed through the risk management process, using previously-developed (ISSI 1999) residential cleanup levels for lead and arsenic.  
 (2) Receptors assumed to be exposed in the commercial area.  
 (3) Receptors assumed to be exposed in the undeveloped area.  
 (4) Subsurface soil was not evaluated in the risk assessment because analysis of subsurface soil samples indicated that contamination is fairly uniform to a depth of 18 inches. If subsurface soil was excavated and brought to the surface, risks would be similar to that for surface soil. Because the concentrations of arsenic and lead in subsurface soil are elevated and there is possible risk, subsurface soils may be evaluated further in the risk management phase of the project.  
 (5) Includes ponds/seeps in the undeveloped area and ponds in the commercial area.



**Figure 5-2.**  
**Human Health Conceptual Site Model**



Sources	Release Mechanism	Media	Transport Mechanism	Media	Transport Mechanism	Media	Transport Mechanism	Exposure Media	Exposure Route	Ecological Receptors									
										Plants	Soil Invertebrates	Herbivores	Invertebrates	Carnivores	Benthic Macroinvertebrates	Aquatic Organisms			
										Terrestrial			Aquatic						
Davenport and Flagstaff Smelters	Stack Emissions (Dust and Flue Ash) and Wind Blown Dust	Surface Soil	Dust Generation	Air				Air	Inhalation	NA	NQ	NQ	NQ	NQ	NA	NA			
								Surface Soil	Ingestion Direct Contact	NA C	NQ C	C NQ	C NQ	C NQ	I I	I I			
				Uptake	Food/Prey	Food/Prey	Ingestion	NA	NQ	C	C	C	I	I					
			Leaching, Infiltration	Subsurface Soil						Subsurface Soil	Ingestion Direct Contact	NA C	NQ C	C NQ	C NQ	C NQ	I I	I I	
										Groundwater	Ingestion Direct Contact	NA NQ	NQ I	I I	I I	I I	I I	I I	
				Seeps*	Partitioning*					Seep Water*	Ingestion Direct Contact	NA NQ	I I	C NQ	C NQ	C NQ	I I	I I	
			Seep Sediment*							Ingestion Direct Contact	NA NQ	I I	NQ NQ	NQ NQ	NQ NQ	I I	I I		
				Ponds**	Partitioning**					Pond Water**	Ingestion Direct Contact	NA NQ	I I	C NQ	C NQ	C NQ	NQ NQ	NQ C	
			Pond Sediment**							Ingestion Direct Contact	NQ NQ	NQ NQ	C NQ	C NQ	C NQ	NQ C	NQ NQ		
			Upstream Little Cottonwood Creek			Runoff					Creek Water	Ingestion Direct Contact	NA NQ	I I	C NQ	C NQ	C NQ	NQ NQ	NQ C
											Creek Sediment	Ingestion Direct Contact	NA NQ	I I	I I	I I	I I	NQ C	NQ NQ

\*Applicable to three seeps (SW- or SD-6, 7, 8).  
 \*\* Includes tributary/seep (SW- or SD-4) feeding the ponds. Other seeps do not migrate to the ponds.

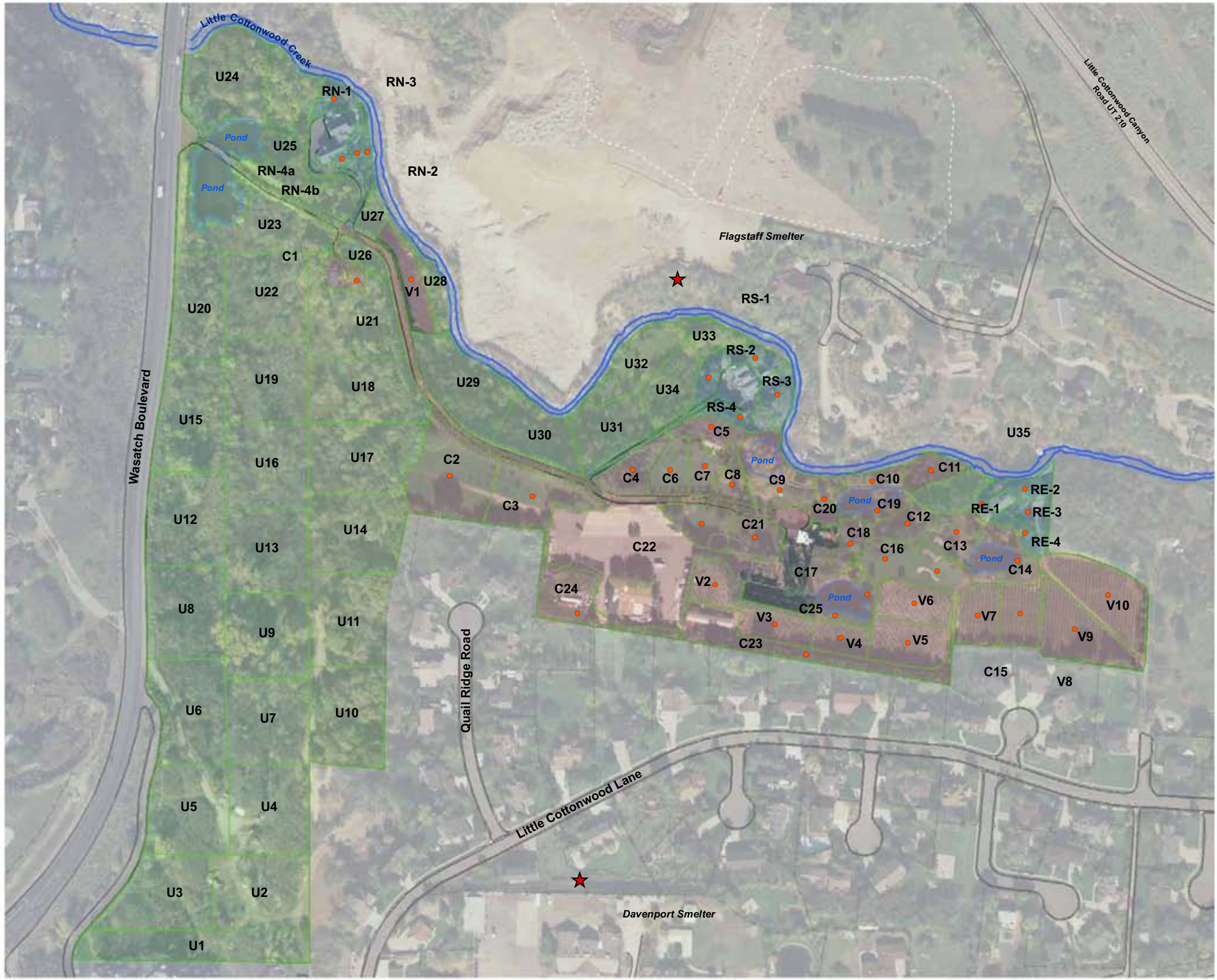
C - Exposure pathway potentially Complete, quantifiable  
 I - Exposure pathway Incomplete, not quantified  
 NQ - Exposure potentially complete, but Not Quantified  
 NA - Exposure pathway Not Applicable, not logical, not quantified

Exposure pathway complete  
 Exposure pathway incomplete, not significant, or not quantified



Figure 5-3. Ecological Conceptual Site Model





- Discrete Soil Sample Location
- OU2 Boundary
- U7 Grid and Composite Sample Boundary<sup>1</sup>  
*Label Represents Center Point of Composite Sample*
- Commercial Area
- Undeveloped Area
- Residential Area
- C22 Samples from Grid also Submitted for TCLP Analysis

Note:  
1. For each Undeveloped (U) zone, 10-point composite samples were collected from depths of 0-2 inches and 2-18 inches. For each Commercial (C), Vineyard (V), and Residential (RS, RE, RN) zone, 10-point composite samples were collected from 0-2 inches.

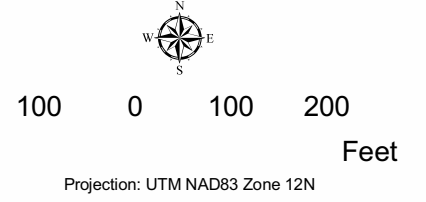
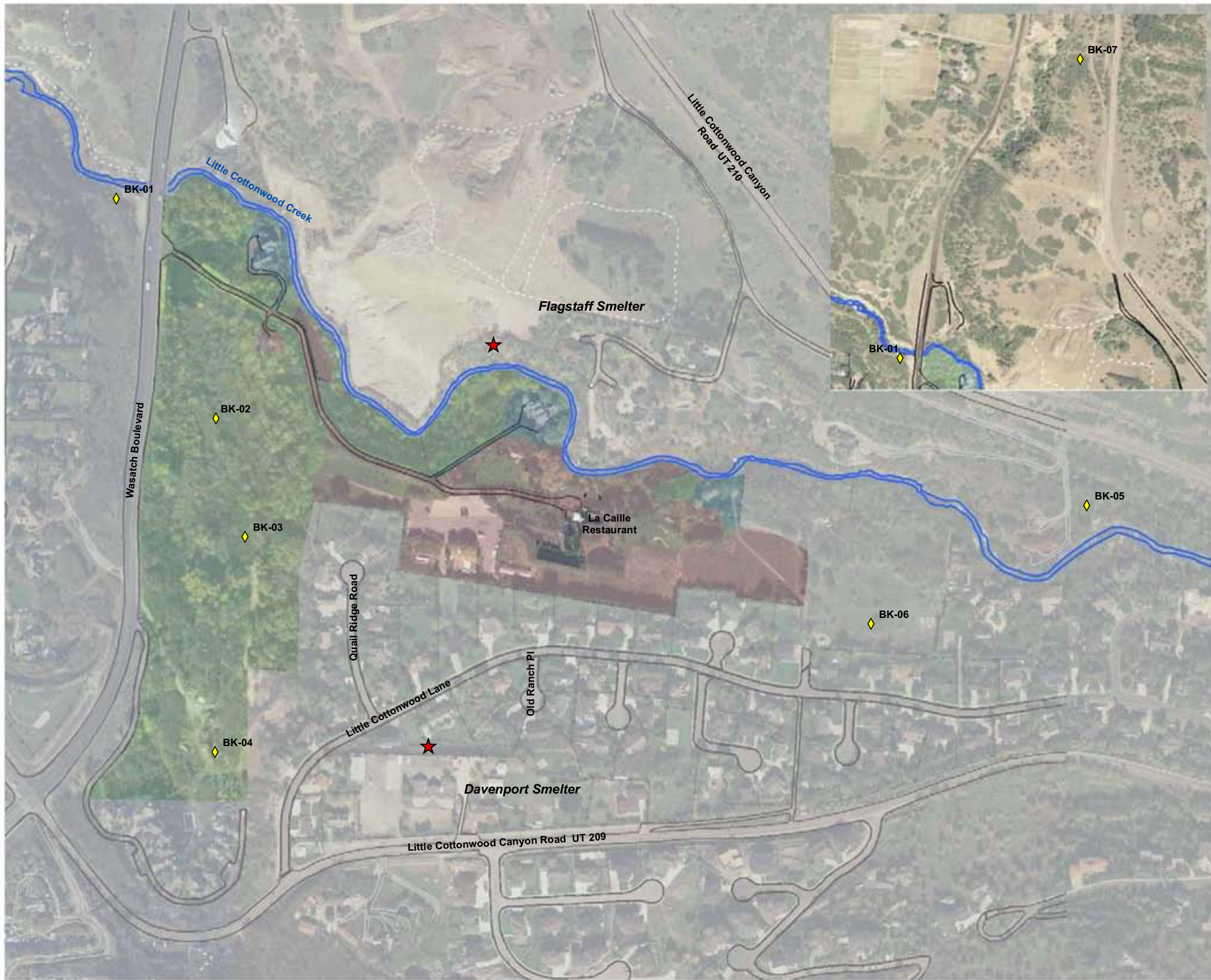


Figure 5.3-1  
Soil Sample Location Map

File: X:\Projects\UDEQ\Davenport-Flagstaff\2009\OU2 Flagstaff Davenport GIS\OU2 Record of Decision\Figure5.3-2\_Background.mxd



- ◆ Background sample
- OU2 Boundary
- Commercial Area
- Undeveloped Area
- Residential Area



150 0 150 300  
Feet

Projection: UTM NAD83 Zone 12N



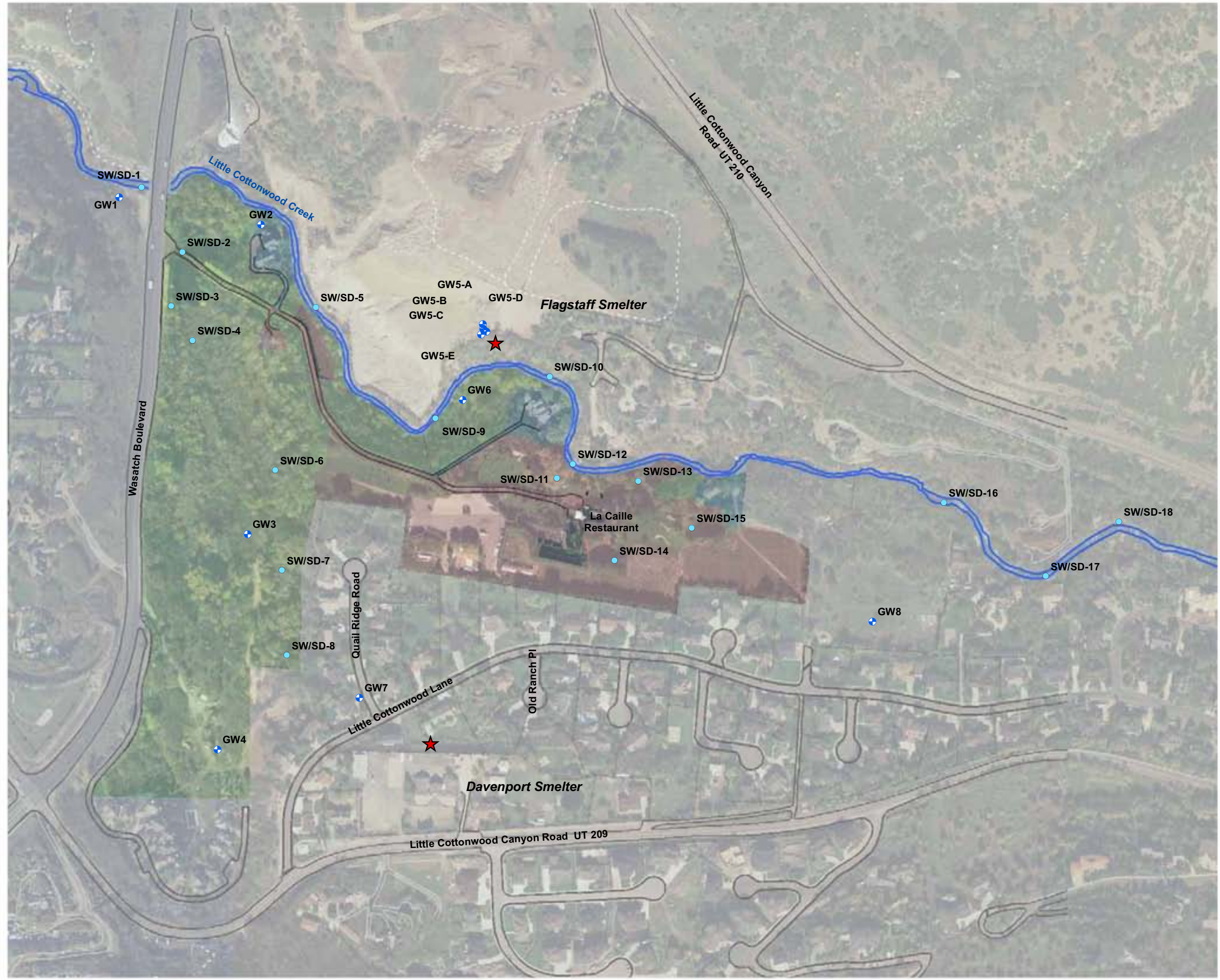
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Figure 5.3-2  
Background Soil Sample  
Location Map



File: X:\Projects\UDEQ\Davenport-Flagstaff\2009\OU2 Flagstaff Davenport GIS\OU2 Record of Decision\Figure5.3-3\_SampleLocs.mxd



- Surface Water/Sediment Sample Location
- + Groundwater Sample Location
- OU2 Boundary
- Commercial Area
- Undeveloped Area
- Residential Area

N  
W E S

150 0 150 300  
Feet

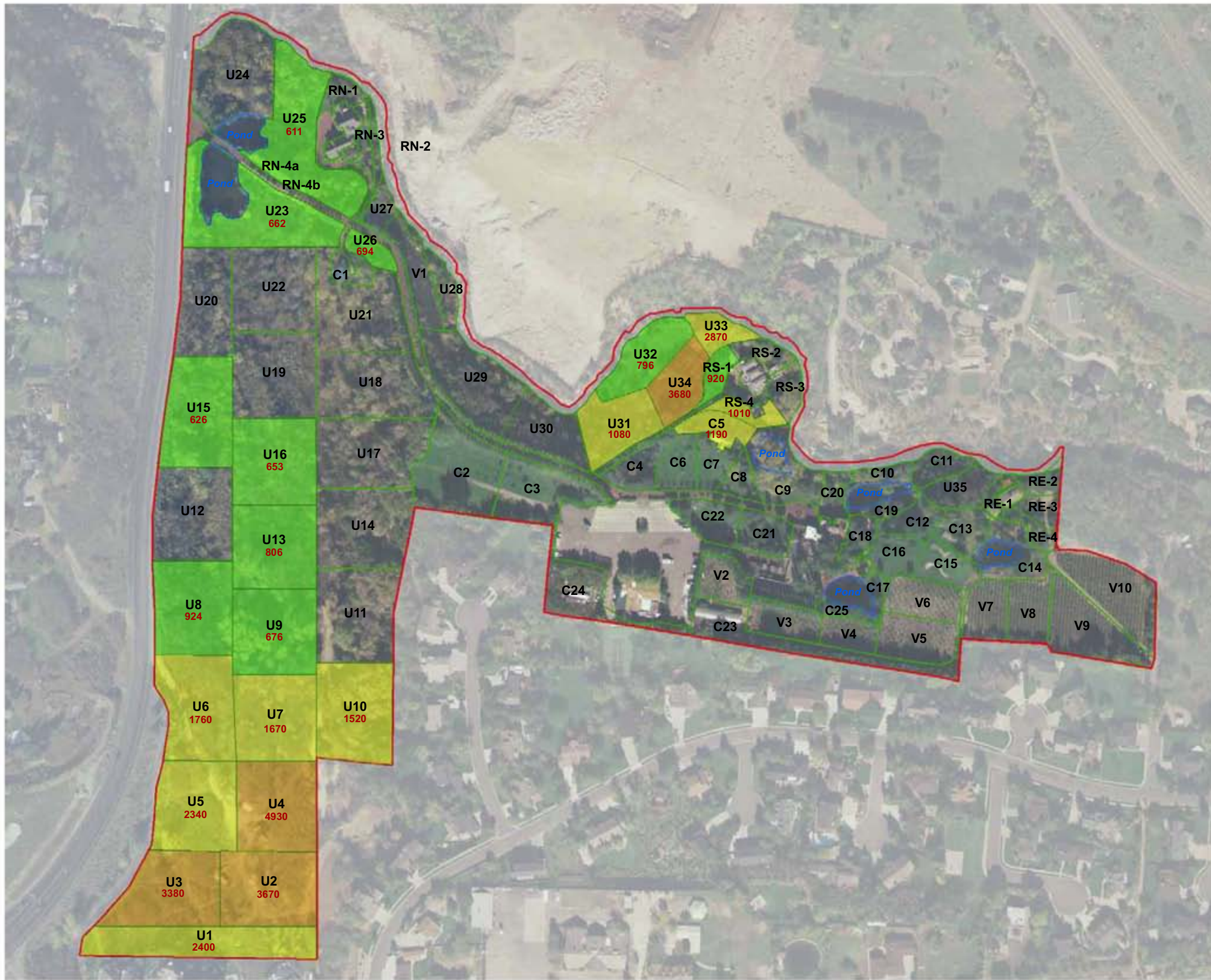
Projection: UTM NAD83 Zone 12N

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**Figure 5.3-3**  
**Surface Water, Sediment,**  
**and Groundwater**  
**Sample Location Map**



File: X:\Projects\UDEQ\Davenport-Flagstaff\2009\OU2 Flagstaff Davenport GIS\OU2 Record of Decision\Figures\3-4\_Surface Lead.mxd



**Composite Lead Result (mg/kg)**

- 600 - 999
- 1000 - 2999
- 3000 - 4999
- >10,000



Concentrations < 600 mg/kg not shaded

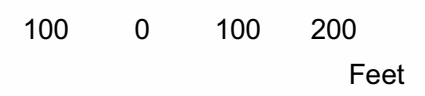
**3380 = sample result mg/kg**

- OU2 Outline
- Grid Boundary
- Water

- U = Undeveloped
- C & V = Commercial
- RN, RS, & RE = Residential

**Cleanup Levels**

- Commercial
- 1000 mg/kg Lead
- 1000 mg/kg Arsenic
- Undeveloped
- 3000 mg/kg Lead
- 1000 mg/kg



Projection: UTM NAD83 Zone 12N

Salt Lake County, Utah  
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**Figure 5.3-4**  
**Lead Results - Surface**  
**Composite Soil Samples**



File: X:\Projects\UDEQ\Davenport-Flagstaff\2009\OU2 Flagstaff Davenport GIS\OU2 Record of Decision\Figures\3-5\_Subsurface Lead.mxd



**Composite Lead Result (mg/kg)**

- 600 - 999
- 1000 - 2999
- 3000 - 4999
- >10,000

Concentrations < 600 mg/kg not shaded

**1290 = sample result (mg/kg)**

- Discrete Soil Sample

OU2 Outline  
Grid Boundary  
Water

U = Undeveloped  
C & V = Commercial  
RN,RS, & RE = Residential

**Cleanup Levels**

**Commercial**  
1000 mg/kg Lead  
1000 mg/kg Arsenic

**Undeveloped**  
3000 mg/kg Lead  
1000 mg/kg

100 0 100 200 Feet

Projection: UTM NAD83 Zone 12N





Grids Exceeding Lead Clean-Up Level & Requiring Remediation

Commercial

Undeveloped

Remediated Residential Properties

OU2 Boundary

Note: Commercial Clean-Up Level > = 1,000 mg/kg;  
Undeveloped Clean-Up Level > = 3,000 mg/kg



100 0 100 200 Feet

Projection: UTM NAD83 Zone 12N

Aerial Reference: AGRC 2006 High Resolution Ortho-Imagery 1 Foot Color



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Figure 8-1  
Anticipated Extent of  
Clean-up



**Table A-1  
Davenport and Flagstaff Smelters OU2  
Cost Summary**

	Capital	Annual O&M	Present Worth	Brief Description of Alternative
<b>COMMERCIAL AREAS</b>				
Alternative 1	\$0	\$0	\$0	No action
Alternative 2	\$607,000	\$9,000	\$776,000	Excavation/Disposal/Restoration
Alternative 3	\$335,000	\$23,000	\$781,000	Excavation/Disposal/Soil Cover/Restoration
<b>UNDEVELOPED AREAS</b>				
Alternative 1	\$35,544	\$0	\$35,544	No action (cost includes removal of access road built for remediation of OU1)
Alternative 2 & 3	\$1,266,000	\$9,000	\$1,435,000	Excavation/Disposal/Restoration
Alternative 4	\$565,000	\$35,000	\$1,249,000	Soil Cover/Restoration

**Table A-2  
Davenport and Flagstaff Smelters OU2  
Remedial Quantities**

AREA	AREA (acres)	DEPTH (inches)	VOLUME (cu.yd.)	WEIGHT (tons)
<b>COMMERCIAL AREAS</b>				
<b>LEAD &amp; ARSENIC CONTAMINATION &gt; 1,000 mg/kg</b>				
Inaccessible Area/Large Trees/Boulders				
C4	0.15	6	121	180
C5	0.19	12	300	446
C24	0.06	6	52	78
Subtotal	0.40		473	703
Accessible Area				
C4	0.17	6	136	201
C24	0.34	6	278	413
Subtotal	0.51		414	614
Total for Commercial Areas	0.91		887	1,317
<b>UNDEVELOPED AREAS</b>				
<b>LEAD &amp; ARSENIC CONTAMINATION &gt; 3,000 mg/kg</b>				
U2 <sup>1</sup>	0.76	6	610	906
U3 <sup>1,2</sup>	0.72	6	580	861
U4	0.76	18	1,830	2,717
U34 <sup>1,3</sup>	0.22	6	177	264
Total for Undeveloped Areas	2.45		3,196	4,747
<b>TOTAL FOR ALL AREAS</b>	<b>3.36</b>		<b>4,084</b>	<b>6,064</b>

Average Natural Dry Density = (typical value taken from Literature for similar soils)	110 lb/ft <sup>3</sup>
--	------------------------

<sup>1</sup>Although the lead exceedances in these grids are in the surface (0 to 2 inches below ground surface), the depth used to calculate removal volumes is 6 inches because that is the depth that can realistically be removed using excavation machinery.

<sup>2</sup>Area does not include the steep slope in small northern area of U3 (0.03 acres).

<sup>3</sup>Area does not include steep slope through northern central portion of U34 (0.08 acres) or remediated area in the eastern portion of the site (0.04 acres).

$$\text{Weight} = [(\text{Area, ac}) \times (43560 \text{ ft}^2/\text{ac})] \times [(\text{Depth, in}) / (12 \text{ in/ft})] \times (\text{Density, lb/ft}^3) / (2000 \text{ lb/ton})$$

Table A-3  
 Develop and Pledge Numbers OUI  
 Material Requirements and Waste Generation

Activity	Materials		Mechanical Equipment		Road Equipment		Concrete Forms		Reinforcing Steel		Top Soil		Cement		Large Items		Waste
	AE/EA	(tonnes)	DE/TE	WE/WEI	DE/TE	WE/WEI	AE/EA	(cubic yd)	DE/TE	WE/WEI	DE/TE	WE/WEI	DE/TE	WE/WEI	DE/TE	WE/WEI	
<b>COMMERCIAL</b>																	
<b>Absecon J</b>																	
C-4	0.17	0.11	0	136	202	0	121	180	0	0	0	0	0	0	0	0	0.2
C-5	0.16	0.10	0	120	202	0	120	180	0	0	0	0	0	0	0	0	0.2
C-14	0.16	0.10	0	116	202	0	116	180	0	0	0	0	0	0	0	0	0.2
<b>Total</b>	<b>0.51</b>	<b>0.31</b>	<b>0</b>	<b>372</b>	<b>606</b>	<b>0</b>	<b>357</b>	<b>540</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.6</b>
<b>Absecon J</b>																	
C-4	0.17	0.11	0	136	202	0	121	180	0	0	0	0	0	0	0	0	0.2
C-5	0.16	0.10	0	120	202	0	120	180	0	0	0	0	0	0	0	0	0.2
C-28	0.18	0.10	0	218	415	0	218	415	0	0	0	0	0	0	0	0	0.3
<b>Total</b>	<b>0.51</b>	<b>0.31</b>	<b>0</b>	<b>572</b>	<b>819</b>	<b>0</b>	<b>559</b>	<b>975</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.7</b>
<b>Absecon J R. 5</b>																	
C-12	0.76	0.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
C-17	0.72	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
C-18	0.72	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
C-14	0.22	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
<b>Total</b>	<b>2.42</b>	<b>2.42</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3.2</b>
<b>UNDEVELOPED</b>																	
<b>Absecon J</b>																	
C-12	0.76	0.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
C-17	0.72	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
C-18	0.72	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
C-14	0.22	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
<b>Total</b>	<b>2.42</b>	<b>2.42</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3.2</b>

MD - Not Allowed

Amounts shown are based on 100% of the total project value.  
 Capital values shown from 1/1/2010 to 12/31/2010

100 %

**Table A-4**  
**Davenport and Flagstaff Smelters OU2**  
**Commercial Alternative 2 (Excavation/Disposal/Restoration) - Capital Cost Estimate**

Item#	Description	Units	Quantity	Unit Cost	Notes	Cost
1	Clear and grub brush	Acres	0.5	\$6,395	2	\$3,280
2	Move, Stage, and Replace Debris	Lump Sum	1	\$4,000	3	\$4,000
3	Water Truck - Dust Suppression	Months	3	\$8,000	4	\$24,000
4	Excavation	Ton	614	\$15	3	\$9,217
5	Hand Excavation	Ton	703	\$200	3	\$140,595
6	Analytical Cost - TCLP	Sample	2	\$150	5	\$300
7	Transport non-hazardous Waste to Salt Lake County Landfill	Ton	1,317	\$6	3	\$7,905
8	Disposal of Non-Hazardous Waste at Salt Lake County Landfill	Ton	1,317	\$22	6	\$28,984
9	Backfill - material, haul, and machine placement	Ton	307	\$30	7	\$9,217
10	Top Soil - material, haul, and machine placement	Ton	307	\$40	7	\$12,290
11	Backfill - material, haul, and hand placement	Ton	351	\$200	7	\$70,297
12	Top Soil - material, haul, and hand placement	Ton	351	\$224	7	\$78,733
13	Revegetation	Sq ft	22,345	\$0.4	8	\$8,938
14	Large Tree Replacement	Each	15	\$200	3	\$3,000
15	Health & Safety Ambient Air Monitoring	Lump Sum	1	\$36,930	1,9	\$36,930
16	Final Site Wide Clean-up	Lump Sum	1	\$56,300	1	\$10,000
Total Cost						\$447,688
Mobilization (10%)						\$44,769
Demobilization (3%)						\$13,431
Subtotal						\$505,887
Unidentified Construction Cost (10%)						\$50,589
Construction Management (10%)						\$50,589
<b>TOTAL</b>						<b>\$607,065</b>

**Assumptions:**

- Soil with Pb < 1,000 ppm will be have TCLP < 5 mg/L lead and will be considered non-hazardous for costing purposes. All soil in the commercial area are assumed to be non-hazardous.
- One TCLP sample required per 1,000 tons of soil excavated for off-site disposal.

**Notes:**

- Engineering estimate.
- RS Means Environmental Remediation: Unit Cost Book, 2005; 17-01-0107 Medium brush, medium trees (<10"), clear, grub, haul.
- Estimate from ER (Russ Gullodge), includes labor (July, 2008)
- Estimate from ER (Russ Gullodge). Includes truck driver and truck rental, assumes source of water on site. For more detailed pricing, source of water needs to be determined (July, 2008).
- Estimate from Northern Analytical (Kathy Smith) (July, 2008).
- Salt Lake County Landfill Website (July, 2008).
- Estimate from ER (Russ Gullodge). Assuming that source of soil is near site (July, 2008).
- Estimate from ER (Russ Gullodge), includes labor, seeding with harrowing of native species of grasses and shrubs (July, 2008).
- See Table A-17 for detailed estimate.

**Table A-5**  
**Davenport and Flagstaff Smelters OU2**  
**Commercial Alternative 3 (Excavation/Disposal/Soil Cover/Restoration) - Capital Cost Estimate**

Item#	Description	Units	Quantity	Unit Cost	Notes	Cost
1	Clear and grub brush	Acres	0.9	\$6,395	2	\$5,844
2	Move, Stage, and Replace Debris	Lump Sum	1	\$4,000	3	\$4,000
3	Water Truck - Dust Suppression	Months	3	\$8,000	4	\$24,000
4	Excavation	Ton	614	\$15	3	\$9,217
5	Analytical Cost - TCLP	Sample	1	\$150	5	\$150
6	Transport Non-hazardous Waste to Salt Lake County Landfill	Ton	614	\$6	3	\$3,687
7	Disposal of Non-hazardous Waste at Salt Lake County Landfill	Ton	614	\$22	6	\$13,519
8	Backfill - material, haul, and machine placement	Ton	307	\$30	7	\$9,217
9	Top Soil - material, haul, and machine placement	Ton	307	\$40	7	\$12,290
10	Clean Soil - material, haul, and hand placement	Ton	480	\$224	7	\$107,557
11	Geotextile Fabric 3oz.	Sq yd	1,940	\$1	8	\$1,940
12	Revegetation	Sq ft	22,345	\$0.4	9	\$8,938
13	Health & Safety Ambient Air Monitoring	Lump Sum	1	\$36,930	1,10	\$36,930
14	Final Site Wide Clean-up	Lump Sum	1	\$56,300	1	\$10,000
Total Cost						\$247,289
Mobilization (10%)						\$24,729
Demobilization (3%)						\$7,419
Subtotal						\$279,437
Unidentified Construction Cost (10%)						\$27,944
Construction Management (10%)						\$27,944
<b>TOTAL</b>						<b>\$335,325</b>

**Assumptions:**

- a). Soil with Pb < 1,000 ppm will be have TCLP < 5 mg/L lead and will be considered non-hazardous for costing purposes.  
 All soil in the commercial area are assumed to be non-hazardous.
- b). One TCLP sample required per 1,000 tons of soil excavated for off-site disposal.

**Notes:**

1. Engineering estimate.
2. RS Means Environmental Remediation: Unit Cost Book, 2005; 17-01-0107 Medium brush, medium trees (<10'), clear, grub, haul.
3. Estimate from ER (Russ Gullledge), includes labor (July, 2008).
4. Estimate from ER (Russ Gullledge). Includes truck driver and truck rental, assumes source of water on site. For more detailed pricing, source of water needs to be determined. (July, 2008).
5. Estimate from Northern Analytical (Kathy Smith) (July, 2008).
6. Salt Lake County Landfill Website (July, 2008).
7. Estimate from ER (Russ Gullledge). Assuming that source of soil is near site (July, 2008).
8. Estimate from Bill Killpack at ACF West (July, 2008).
9. Estimate from ER (Russ Gullledge), includes labor, seeding with harrowing of native species of grasses and shrubs (July, 2008).
10. See Table A-17 for detailed estimate.

**Table A-6  
Davenport and Flagstaff Smelters OU2  
Commercial Alternative 2 - Operation and Maintenance Cost Estimate**

Alternative:	2	units
Excavation & Backfill:	0.91	acres
Clean Soil	-	acres

**Monitoring Summary Reports - Annual**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Other Direct Charges</b>							
Site Visit (Round Trip)	Visit	1	1	\$150	\$150	URS	One per visit
Reproduction	Page	250	1	\$0.15	\$38	URS	10 copies, 25 pages per copy
Postage / Packaging	Package	3	1	\$20	\$60	FedEx	Express Mail / FedEx
ODC Subtotal					<b>\$248</b>		
<b>Labor Charges</b>							
Project Management (PM)	Hour	12	1	\$100	\$1,200	URS	1 person, 1.5 days, 8hr/day
Onsite Labor	Hour	16	1	\$90	\$1,440	URS	1 person, 2 days, 8hr/day, geologist rate
Offsite Labor	Hour	40	1	\$90	\$3,600	URS	1 person, 5 days, 8hr/day, engineer rate
Drafting/Graphics	Hour	16	1	\$65	\$1,040	URS	1 person, 2 days, 8hr/day, CADD operator rate
Clerical Support	Hour	16	1	\$65	\$1,040	URS	1 person, 2 days, 8hr/day, clerical staff rate
Labor Subtotal					<b>\$8,320</b>		
Contingency Allowance		10%		\$248	\$25		
Annual Cost					<b>\$8,592</b>		

**Table A-7**  
**Deverport and Flagstaff Smelters O&M**  
**Commercial Alternatives 3 - Operation and Maintenance Cost Estimate**

Alternative:	3	tons
Excavation & Backfill:	0.9	acres
Clean Soil:	0.4	acres
Institutional Controls:	0.4	acres

**Soil Monitoring - Annual Sampling**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Subcontractor Cost</b>							
Laboratory Analysis	Each	2	1	\$287	\$574		See Notes 1 and 2
Subcontractor Subtotal					\$574		
<b>Other Direct Charges</b>							
Sample Shipping	Each	1	1	\$110	\$110	Fuelix	Per cooler, including insurance
Instrumental Rental	Week	1	1	\$2,490	\$2,490	Innovex, Monson	XRF analyzer, GPS Unit
Travel (Round Trip)	Visit	1	1	\$150	\$150	URS	One per visit
ODC Subtotal					\$2,668		
<b>Labor Charges</b>							
Project Management (PM)	Hour	8	1	\$100	\$800	URS	1 person, 1 day, Holiday
Onsite Labor	Hour	20	1	\$90	\$1,800	URS	1 person, 1 day, 20 holiday, geologist rate
Offsite Support	Hour	4	1	\$90	\$360	URS	1 person, 1 day, 4 holiday, engineer rate
Labor Subtotal					\$2,960		
Contingency Allowance		10%		\$3,234	\$323		
Annual Cost					\$6,517		

**Notes:**

1. Analysis for total lead and arsenic by ICP and leachable lead by TCLP, including 1 field duplicate.
2. Collect 1 sample per 5000 sq ft that were soil covered for XRF analysis, and send 10% to the lab for analysis.

**Periodic Maintenance - Annual**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Other Direct Charges (ODC)</b>							
Repair Supplies	Lump Sum	1	1	\$3,980	\$3,980	Engineer estimate	Drums, clean soil, seeds, hand tools, etc.
Instrumental Rental	Lump Sum	1	1	\$800	\$800	Engineer estimate	Assume \$0.10 per square foot for beat loader, fertilizer spreader, etc.
Travel (Round Trip)	Visit	2	1	\$150	\$300	URS	One per visit
ODC Subtotal					\$5,080		
<b>Labor Charges</b>							
Project Management (PM)	Hour	2	1	\$100	\$200	URS	1 person, 1 day, 2 holiday
Onsite Labor	Hour	20	1	\$65	\$1,300	URS	1 person, 2 days, 1 holiday, technician rate
Onsite Supervision	Hour	20	1	\$90	\$1,800	URS	1 person, 2 days, 1 holiday, geologist rate
Offsite Support	Hour	4	1	\$65	\$260	URS	1 person, 1 day, 4 holiday, clerical staff rate
Labor Subtotal					\$3,560		
Contingency Allowance		10%		\$3,040	\$588		
Annual Cost					\$9,148		

**Notes:**

1. Maintenance is estimated to occur annually after the first year.
2. Maintenance labor will consist of a technician supervised by a geologist for 2 days.
3. Maintenance will include excavating contaminated soil, replacing with clean soil, erosion control, and reseeded if necessary.

**Monitoring Summary Reports - Annual**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Other Direct Charges</b>							
Reproduction	Page	250	1	\$0.15	\$38	URS	10 copies, 25 pages per copy
Postage / Packaging	Package	3	1	\$20	\$60	Fuelix	Express Mail / Fuelix
ODC Subtotal					\$98		
<b>Labor Charges</b>							
Project Management (PM)	Hour	12	1	\$100	\$1,200	URS	1 person, 12 hours
Labor	Hour	40	1	\$90	\$3,600	URS	1 person, 3 days, 4 holiday, engineer rate
Drafting/Graphics	Hour	16	1	\$65	\$1,040	URS	1 person, 2 days, 4 holiday, CADD operator rate
Clerical Support	Hour	16	1	\$65	\$1,040	URS	1 person, 2 days, 4 holiday, clerical staff rate
Labor Subtotal					\$6,880		
Contingency Allowance		10%		\$98	\$98		
Annual Cost					\$6,987		

**Total Annual O&M Cost: \$22,640**

**Table A-8**  
**Davenport and Flagstaff Smelters OU2**  
**Undeveloped Alternative 2 & 3 (Excavation/Disposal/Restoration) - Capital Cost Estimate**

Item#	Description	Units	Quantity	Unit Cost	Notes	Cost
1	Clear and grub brush	Acre	2.45	\$6,395	2	\$15,671
2	Brick Road Protection	Lump Sum	1	\$1,000	3	\$1,000
3	Access Road Restoration	Lump Sum	1	\$35,544	9	\$35,544
4	Water Truck - Dust Suppression	Months	3	\$9,820	4	\$29,460
5	Excavation	Ton	4,747	\$15	3	\$71,201
6	Analytical Cost - TCLP	Sample	5	\$150	5	\$750
7	Stabilization	Ton	4,747	\$80	3	\$379,758
8	Transport Non-hazardous Waste to Salt Lake County Landfill	Ton	4,747	\$6	3	\$28,480
9	Disposal of Non-hazardous Waste at Salt Lake County Landfill	Ton	4,747	\$22	6	\$104,428
10	Backfill - material, haul, and machine placement	Ton	2,826	\$30	7	\$84,785
11	Top Soil - material, haul, and machine placement	Ton	1,921	\$40	7	\$76,822
12	Revegetation	Sq ft	106,745	\$0.4	8	\$42,698
13	Large Tree Replacement	Each	80	\$200	3	\$16,000
14	Health & Safety Ambient Air Monitoring	Lump Sum	1	\$36,930	1,10	\$36,930
15	Final Site Wide Clean-up	Lump Sum	1	\$56,300	1	\$10,000
Total Cost						\$933,508
Mobilization (10%)						\$93,351
Demobilization (3%)						\$28,005
Subtotal						\$1,054,864
Unidentified Construction Cost (10%)						\$105,486
Construction Management (10%)						\$105,486
<b>TOTAL</b>						<b>\$1,265,837</b>

**Assumptions:**

- a). Soil with Pb>3,000 ppm will be have TCLP > 5 mg/L lead and will be considered hazardous for costing purposes.  
 All soil being removed in the undeveloped area is assumed to be hazardous
- b). One TCLP sample required per 1,000 tons of soil excavated for off-site disposal.

**Notes:**

1. Engineering estimate.
2. RS Means Environmental Remediation: Unit Cost Book, 2005; 17-01-0107 Medium brush, medium trees (<10'), clear, grub, haul.
3. Estimate from ER (Russ Gullledge), includes labor (July, 2008).
4. Estimate from ER (Russ Gullledge). Includes truck driver and truck rental, assumes source of water on site. For more detailed pricing, source of water needs to be determined (July, 2008).
5. Estimate from Northern Analytical (Kathy Smith) (July, 2008).
6. Salt Lake County Landfill Website (July, 2008).
7. Estimate from ER (Russ Gullledge). Assuming that source of soil is near site (July, 2008).
8. Estimate from ER (Russ Gullledge). includes labor, seeding with harrowing of native species of grasses and shrubs (July, 2008).
9. See Table A-16 for detailed estimate.
10. See Table A-17 for detailed estimate.

**Table A-9**  
**Davenport and Flagstaff Smelters OU2**  
**Undeveloped Alternative 4 (Soil Cover/Restoration) - Capital Cost Estimate**

Item#	Description	Units	Quantity	Unit Cost	Notes	Cost
1	Clear and grub brush	Acres	2.5	\$6,395	2	\$15,671
2	Brick Road Protection	Lump Sum	1	\$1,000	3	\$1,000
3	Access Road Restoration	Lump Sum	1	\$35,544	11	\$35,544
4	Water Truck - Dust Suppression	Months	3	\$8,000	4	\$24,000
5	Backfill - material, haul, and machine placement	Ton	2,956	\$30	6, 9	\$88,665
6	Backfill - material, haul, and hand placement	Ton	88	\$200	6, 9	\$17,613
7	Cover Soil - material, haul, and machine placement	Ton	2,847	\$40	6	\$113,898
8	Cover Soil - material, haul, and hand placement	Ton	88	\$224	6, 9	\$19,727
9	Geotextile Fabric 3oz.	Sq yd	11,861	\$1	7	\$11,861
10	Revegetation	Sq ft	106,745	\$0.4	8	\$42,698
11	Health & Safety Ambient Air Monitoring	Lump Sum	1	\$36,930	1,10	\$36,930
12	Final Site Wide Clean-up	Lump Sum	1	\$56,300	1	\$10,000
Total Cost						\$417,006
Mobilization (10%)						\$41,701
Demobilization (3%)						\$12,510
Subtotal						\$471,217
Unidentified Construction Cost (10%)						\$47,122
Construction Management (10%)						\$47,122
<b>TOTAL</b>						<b>\$565,460</b>

**Assumptions:**

- a) Soil with Pb > 3,000 ppm will be have TCLP > 5 mg/L lead and will be considered hazardous for costing purposes.  
 All soil being removed in the undeveloped area is assumed to be hazardous.
- b) One TCLP sample required per 1,000 tons of soil excavated for off-site disposal.

**Notes:**

1. Engineering estimate
2. RS Means Environmental Remediation: Unit Cost Book, 2005: 17-01-0107 Medium brush, medium trees (<10'), clear, grub, haul
3. Estimate from ER (Russ Gullodge), includes labor (July, 2008)
4. Estimate from ER (Russ Gullodge), includes truck driver and truck rental, assumes source of water on site. For more detailed pricing, source of water needs to be determined (July, 2008).
5. Estimate from Northern Analytical (Kathy Smith) (July, 2008).
6. Estimate from ER (Russ Gullodge), Assuming that source of soil is near site (July, 2008)
7. Estimate from Bill Killpuck at ACF West (July, 2008).
8. Estimate from ER (Russ Gullodge), includes labor, seeding with harvesting of native species of grasses and shrubs (July, 2008).
9. Estimated 3% of total area require hand placement of cover around large trees.
10. See Table A-17 for detailed estimate.
11. See Table A-16 for detailed estimate.

**Table A-10**  
**Davenport and Flagstaff Smelters OU2**  
**Undeveloped Alternative 2 & 3 - Operation and Maintenance Cost Estimate**

Alternative:	2	units
Excavation & Backfill:	2.5	acres
Clean Soil		acres
Institutional Control:	2.5	acres

**Monitoring Summary Reports - Annual**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Other Direct Charges</b>							
Site Visit (Round Trip)	Visit	1	1	\$150	\$150	URS	One per visit
Reproduction	Page	250	1	\$0.15	\$38	URS	10 copies, 25 pages per copy
Postage / Packaging	Package	3	1	\$20	\$60	FedEx	Express Mail / FedEx
ODC Subtotal					<b>\$248</b>		
<b>Labor Charges</b>							
Project Management (PM)	Hour	12	1	\$100	\$1,200	URS	1 person, 1.5 days, 8hr/day
Onsite Labor	Hour	16	1	\$90	\$1,440	URS	1 person, 2 days, 8hr/day, geologist rate
Offsite Labor	Hour	40	1	\$90	\$3,600	URS	1 person, 5 days, 8hr/day, engineer rate
Drafting/Graphics	Hour	16	1	\$65	\$1,040	URS	1 person, 2 days, 8hr/day, CADD operator rate
Clerical Support	Hour	16	1	\$65	\$1,040	URS	1 person, 2 days, 8hr/day, clerical staff rate
Labor Subtotal					<b>\$8,320</b>		
Contingency Allowance		10%		\$248	\$25		
Annual Cost					<b>\$8,592</b>		

**Total Annual O&M Cost: \$8,592**

**Table A-11  
Davenport and Flagstaff Smelters OU2  
Undeveloped Alternative 4 - Operation and Maintenance Cost Estimate**

Alternative:	3	units
Excavation & Backfill:	2.5	acres
Clean Soil:	2.5	acres
Institutional Controls:	2.5	acres

**Soil Monitoring - Annual Sampling**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Subcontractor Cost</b>							
Laboratory Analysis	Each	1	1	\$287	\$287		See Notes 1 and 2
Subcontractor Subtotal					\$287		
<b>Other Direct Charges</b>							
Sample Shipping	Each	1	1	\$110	\$110	FedEx	Per cooler, including insurance
Instrumental Rental	Week	1	1	\$2,400	\$2,400	Innovs, Monson	XRF analyzer, GPS Unit
Travel (Round Trip)	Visit	3	1	\$150	\$450	URS	One per visit
ODC Subtotal					\$2,960		
<b>Labor Charges</b>							
Project Management (PM)	Hour	8	1	\$100	\$800	URS	PM labor rate
Onsite Labor	Hour	20	1	\$90	\$1,800	URS	2 persons, 1 day, 10 hr/day each/geologist rate
Office Support	Hour	4	1	\$65	\$260	URS	Office clerical staff rate
Labor Subtotal					\$2,860		
Contingency Allowance		10%		\$3,247	\$325		
Annual Cost					\$6,432		

- Notes:  
 1. Analysis for total lead and arsenic by ICP and leachable lead by TCLP, including 1 field duplicate  
 2. Collect 1 sample per 5000 sq ft that were soil covered for XRF analysis, and sent 10% to the lab for analysis

**Annual Maintenance**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Other Direct Charges (ODC)</b>							
Repair Supplies	Lump Sum	1	1	\$10,670	\$10,670	Engineer estimate	Drums, clean soil, needs, hand tools, etc. Assume \$0.10 per square foot
Repair Equipment, Rental	Lump Sum	1	1	\$800	\$800	Engineer estimate	Bobcat loader, fertilizer spreader, etc.
ODC Subtotal					\$11,470		
<b>Labor Charges</b>							
Project Management (PM)	Hour	2	1	\$100	\$200	URS	PM labor rate
Onsite Labor	Hour	40	1	\$65	\$2,600	URS	1 person, 2 days, 10 hr/day/technician rate
Onsite Supervision	Hour	40	1	\$90	\$3,600	URS	1 person, 2 days, 10 hr/day/geologist rate
Chemical Support	Hour	4	1	\$65	\$260	URS	Office clerical staff rate
Labor Subtotal					\$6,660		
Contingency Allowance		10%		\$11,470	\$1,147		
Annual Cost					\$19,277		

- Notes:  
 1. Maintenance is estimated to occur annually after the first year.  
 2. Maintenance labor will consist of a technician supervised by a geologist for 2 days.  
 3. Maintenance will include excavating contaminated soil, replacing with clean soil, erosion control, and reseeded if necessary.

**Monitoring Summary Reports - Annual**

Description	Unit	Quantity per Event	Frequency (Events per Year)	Unit Cost	Total	Source	Notes
<b>Other Direct Charges</b>							
Reproduction	Page	250	1	\$0.15	\$38	URS	10 copies, 25 pages per copy
Postage / Packaging	Package	3	1	\$20	\$60	FedEx	Express Mail / FedEx
ODC Subtotal					\$98		
<b>Labor Charges</b>							
Project Management (PM)	Hour	12	1	\$100	\$1,200	URS	PM labor rate
Labor	Hour	40	1	\$90	\$3,600	URS	Geologist / engineer rate
Drafting/Graphics	Hour	20	1	\$65	\$1,300	URS	CADD/ GIS technician rate
Chemical Support	Hour	16	1	\$65	\$1,040	URS	Office clerical staff rate
Labor Subtotal					\$8,140		
Contingency Allowance		10%		\$98	\$98		
Annual Cost					\$9,047		

**Total Annual O&M Cost: \$34,756**

**Table A-12**  
**Present Worth Cost of Construction, Operation, Maintenance, and Monitoring**  
**Commercial Alternative 2 - Excavation/Disposal/Restoration for material over 1,000 ppm lead**

Year	Capital Cost	Annual O&M Cost	Subtotal Annual Expenditures	Discount Factor <sup>a</sup>	Present Worth <sup>b</sup>
0	\$607,065		\$607,065	1.000	\$607,065
1		\$8,592	\$8,592	0.973	\$8,358
2		\$8,592	\$8,592	0.946	\$8,131
3		\$8,592	\$8,592	0.920	\$7,909
4		\$8,592	\$8,592	0.895	\$7,694
5		\$8,592	\$8,592	0.871	\$7,484
6		\$8,592	\$8,592	0.847	\$7,280
7		\$8,592	\$8,592	0.824	\$7,082
8		\$8,592	\$8,592	0.802	\$6,889
9		\$8,592	\$8,592	0.780	\$6,701
10		\$8,592	\$8,592	0.759	\$6,519
11		\$8,592	\$8,592	0.738	\$6,341
12		\$8,592	\$8,592	0.718	\$6,169
13		\$8,592	\$8,592	0.698	\$6,001
14		\$8,592	\$8,592	0.679	\$5,837
15		\$8,592	\$8,592	0.661	\$5,678
16		\$8,592	\$8,592	0.643	\$5,524
17		\$8,592	\$8,592	0.625	\$5,373
18		\$8,592	\$8,592	0.608	\$5,227
19		\$8,592	\$8,592	0.592	\$5,084
20		\$8,592	\$8,592	0.576	\$4,946
21		\$8,592	\$8,592	0.560	\$4,811
22		\$8,592	\$8,592	0.545	\$4,680
23		\$8,592	\$8,592	0.530	\$4,553
24		\$8,592	\$8,592	0.515	\$4,429
25		\$8,592	\$8,592	0.501	\$4,308
26		\$8,592	\$8,592	0.488	\$4,191
27		\$8,592	\$8,592	0.474	\$4,077
28		\$8,592	\$8,592	0.462	\$3,966
29		\$8,592	\$8,592	0.449	\$3,858
Present Worth of Capital Cost					\$607,000
Present Worth of O&M Cost					\$169,000
Total Present Worth (30 Years)					\$776,000

Note:

<sup>a</sup> Discount rate of 2.8% 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) and the 2008 discount rate given by the U.S. Office of Management and Budget.  
Discount factor =  $1/(1+\text{Discount Rate}^{\text{Year}})$ .

<sup>b</sup> Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.  
Cost rounded to the closest \$1000.  
Assume that Year 0 is the year 2008.

**Table A-13**  
**Present Worth Cost of Construction, Operation, Maintenance, and Monitoring**  
**Commercial Alternative 3 - Excavation/Disposal/Soil Cover/Restoration for material**  
**over 1,000 ppm lead**

Year	Capital Cost	Annual O&M Cost	Subtotal Annual Expenditures	Discount Factor <sup>a</sup>	Present Worth <sup>b</sup>
0	\$335,325		\$335,325	1.000	\$335,325
1		\$22,653	\$22,653	0.973	\$22,036
2		\$22,653	\$22,653	0.946	\$21,435
3		\$22,653	\$22,653	0.920	\$20,852
4		\$22,653	\$22,653	0.895	\$20,284
5		\$22,653	\$22,653	0.871	\$19,731
6		\$22,653	\$22,653	0.847	\$19,194
7		\$22,653	\$22,653	0.824	\$18,671
8		\$22,653	\$22,653	0.802	\$18,162
9		\$22,653	\$22,653	0.780	\$17,668
10		\$22,653	\$22,653	0.759	\$17,187
11		\$22,653	\$22,653	0.738	\$16,718
12		\$22,653	\$22,653	0.718	\$16,263
13		\$22,653	\$22,653	0.698	\$15,820
14		\$22,653	\$22,653	0.679	\$15,389
15		\$22,653	\$22,653	0.661	\$14,970
16		\$22,653	\$22,653	0.643	\$14,562
17		\$22,653	\$22,653	0.625	\$14,166
18		\$22,653	\$22,653	0.608	\$13,780
19		\$22,653	\$22,653	0.592	\$13,404
20		\$22,653	\$22,653	0.576	\$13,039
21		\$22,653	\$22,653	0.560	\$12,684
22		\$22,653	\$22,653	0.545	\$12,339
23		\$22,653	\$22,653	0.530	\$12,003
24		\$22,653	\$22,653	0.515	\$11,676
25		\$22,653	\$22,653	0.501	\$11,358
26		\$22,653	\$22,653	0.488	\$11,048
27		\$22,653	\$22,653	0.474	\$10,747
28		\$22,653	\$22,653	0.462	\$10,455
29		\$22,653	\$22,653	0.449	\$10,170
Present Worth of Capital Cost					\$335,000
Present Worth of O&M Cost					\$446,000
Total Present Worth (30 Years)					\$781,000

Note:

<sup>a</sup> Discount rate of 2.8% 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) and the 2008 discount rate given by the U.S. Office of Management and Budget. Discount factor = 1/(1+Discount Rate<sup>n</sup>(Year)).

<sup>b</sup> Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1. Cost rounded to the closest \$1000. Assume that Year 0 is the year 2008.

**Table A-14**  
**Present Worth Cost of Construction, Operation, Maintenance, and Monitoring**  
**Undeveloped Alternative 2 & 3 Excavation/Disposal/Restoration for material over 3,000 ppm**  
**lead**

Year	Capital Cost	Annual O&M Cost	Subtotal Annual Expenditures	Discount Factor <sup>a</sup>	Present Worth <sup>b</sup>
0	\$1,265,837		\$1,265,837	1.000	\$1,265,837
1		\$8,592	\$8,592	0.973	\$8,358
2		\$8,592	\$8,592	0.946	\$8,131
3		\$8,592	\$8,592	0.920	\$7,909
4		\$8,592	\$8,592	0.895	\$7,694
5		\$8,592	\$8,592	0.871	\$7,484
6		\$8,592	\$8,592	0.847	\$7,280
7		\$8,592	\$8,592	0.824	\$7,082
8		\$8,592	\$8,592	0.802	\$6,889
9		\$8,592	\$8,592	0.780	\$6,701
10		\$8,592	\$8,592	0.759	\$6,519
11		\$8,592	\$8,592	0.738	\$6,341
12		\$8,592	\$8,592	0.718	\$6,169
13		\$8,592	\$8,592	0.698	\$6,001
14		\$8,592	\$8,592	0.679	\$5,837
15		\$8,592	\$8,592	0.661	\$5,678
16		\$8,592	\$8,592	0.643	\$5,524
17		\$8,592	\$8,592	0.625	\$5,373
18		\$8,592	\$8,592	0.608	\$5,227
19		\$8,592	\$8,592	0.592	\$5,084
20		\$8,592	\$8,592	0.576	\$4,946
21		\$8,592	\$8,592	0.560	\$4,811
22		\$8,592	\$8,592	0.545	\$4,680
23		\$8,592	\$8,592	0.530	\$4,553
24		\$8,592	\$8,592	0.515	\$4,429
25		\$8,592	\$8,592	0.501	\$4,308
26		\$8,592	\$8,592	0.488	\$4,191
27		\$8,592	\$8,592	0.474	\$4,077
28		\$8,592	\$8,592	0.462	\$3,966
29		\$8,592	\$8,592	0.449	\$3,858
Present Worth of Capital Cost					\$1,266,000
Present Worth of O&M Cost					\$169,000
Total Present Worth (30 Years)					\$1,435,000

Note:

<sup>a</sup> Discount rate of 2.8% 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) and the 2008 discount rate given by the U.S. Office of Management and Budget. Discount factor =  $1/(1+\text{Discount Rate})^{\text{Year}}$ .

<sup>b</sup> Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1. Cost rounded to the closest \$1000. Assume that Year 0 is the year 2008.

**Table A-15**  
**Present Worth Cost of Construction, Operation, Maintenance, and Monitoring**  
**Undeveloped Alternative 4 - Excavation/Disposal/Restoration for material over 3,000 ppm lead**

Year	Capital Cost	Annual O&M Cost	Subtotal Annual Expenditures	Discount Factor <sup>a</sup>	Present Worth <sup>b</sup>
0	\$565,460		\$565,460	1.000	\$565,460
1		\$34,756	\$34,756	0.973	\$33,809
2		\$34,756	\$34,756	0.946	\$32,888
3		\$34,756	\$34,756	0.920	\$31,993
4		\$34,756	\$34,756	0.895	\$31,121
5		\$34,756	\$34,756	0.871	\$30,274
6		\$34,756	\$34,756	0.847	\$29,449
7		\$34,756	\$34,756	0.824	\$28,647
8		\$34,756	\$34,756	0.802	\$27,867
9		\$34,756	\$34,756	0.780	\$27,108
10		\$34,756	\$34,756	0.759	\$26,369
11		\$34,756	\$34,756	0.738	\$25,651
12		\$34,756	\$34,756	0.718	\$24,952
13		\$34,756	\$34,756	0.698	\$24,273
14		\$34,756	\$34,756	0.679	\$23,612
15		\$34,756	\$34,756	0.661	\$22,968
16		\$34,756	\$34,756	0.643	\$22,343
17		\$34,756	\$34,756	0.625	\$21,734
18		\$34,756	\$34,756	0.608	\$21,142
19		\$34,756	\$34,756	0.592	\$20,566
20		\$34,756	\$34,756	0.576	\$20,006
21		\$34,756	\$34,756	0.560	\$19,461
22		\$34,756	\$34,756	0.545	\$18,931
23		\$34,756	\$34,756	0.530	\$18,416
24		\$34,756	\$34,756	0.515	\$17,914
25		\$34,756	\$34,756	0.501	\$17,426
26		\$34,756	\$34,756	0.488	\$16,952
27		\$34,756	\$34,756	0.474	\$16,490
28		\$34,756	\$34,756	0.462	\$16,041
29		\$34,756	\$34,756	0.449	\$15,604
Present Worth of Capital Cost					\$565,000
Present Worth of O&M Cost					\$684,000
Total Present Worth (30 Years)					\$1,249,000

Note:

<sup>a</sup> Discount rate of 2.8% 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) and the 2008 discount rate given by the U.S. Office of Management and Budget.  
Discount factor =  $1/(1+\text{Discount Rate})^{\text{Year}}$ .

<sup>b</sup> Present Worth = Annual expenditures x Inflation Factor x Discount Factor. Inflation Factor = 1.

Cost rounded to the closest \$1000.

Assume that Year 0 is the year 2008.

**TABLE 2-1  
Preliminary Chemical-Specific ARARs**

<b>Regulation</b>	<b>Citation</b>	<b>Compliance with ARAR</b>
<b>FEDERAL:</b>		
Criteria for Identification and Listing of Hazardous Waste	40 CFR Part 261	Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. This includes soils excavated for off-site disposal.
Land Disposal Restrictions	40 CFR Part 268	Hazardous wastes generated during remedial actions and disposed of off-site must be managed in accordance with these requirements. Treatment of wastes may be necessary prior to land disposal.
National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Emissions from the remedial alternatives must meet the standards of this regulation.
<b>STATE:</b>		
Identification and Listing of Hazardous Waste	UAC R315-2-1	Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. This includes soils excavated for off-site disposal.
Land Disposal Requirements	UAC R315-13	Hazardous wastes generated during remedial actions and disposed of off-site must be managed in accordance with these requirements. Treatment of wastes may be necessary prior to land disposal.
Cleanup and Risk-Based Closure Standard	UAC R315-101	Allows closure of facilities to risk based standards. Appropriate site management, such as corrective action, post closure care, and institutional controls, is required based on identified levels of risk.
State Rule Requiring Compliance with NAAQS	UAC R301-101-1	
Emission Standards - Visible Emissions	UAC R307-201-3	Emissions from excavation operations must meet the standards of this regulation. Remedial actions are not expected to cause significant visible emissions.
Non-Attainment Area for PM <sub>10</sub> : Fugitive Emissions and Fugitive Dust	UAC R307-309	Fugitive dust must be controlled during ground disturbing activities such as stabilization, excavation, and soil covering. Any fugitive dust source one-quarter acre or greater requires a dust control plan.

ARAR Applicable or Relevant and Appropriate Requirements

CFR Code of Federal Regulations

Notes: UAC Utah Administrative Code

NAAQS National Ambient Air Quality Standards

Particulate Matter

PM

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

<b>Regulation</b>	<b>Citation</b>	<b>Compliance with ARAR</b>
<b>FEDERAL:</b>		
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	All activities that generate hazardous waste must comply with this regulation. This includes excavation of soils for off-site disposal.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	All activities associated with transporting hazardous wastes must comply with this regulation. This includes manifesting, record-keeping, and discharge clean-up requirements.
General Facility Standards	40 CFR Part 264, Subpart B	Hazardous waste facilities (for on-site stabilization and excavation activities) must be constructed in accordance with this regulation.
Standards of Preparedness and Prevention	40 CFR Part 264, Subpart C	Hazardous waste facilities must be designed, constructed, maintained, and operated in accordance with these requirements.
Contingency Plan and Emergency Procedures	40 CFR Part 264, Subpart D	A Contingency Plan must be developed and implemented for remedial action activities.
Manifest System, Recordkeeping, and Reporting Requirements	40 CFR Part 264, Subpart E	All hazardous wastes generated and transported off-site must be manifested in accordance with this regulation.
Closure and Post-Closure Standards	40 CFR Part 264, Subpart G	Contaminated soil would be addressed in compliance with closure and post closure standards to prevent direct contact threats and contaminant transport.
Standards for the Use and Management of Containers	40 CFR Part 264, Subpart I	All management of containers holding hazardous waste must be in accordance with this subpart. This includes containers used for handling hazardous wastes during on-site stabilization operations and storing excavated soils prior to disposal.
Landfills	40 CFR Part 264, Subpart N	Requirements for a landfill closure are relevant and appropriate for any alternative where a cover over contaminated soil is used to address a direct contact threat.
Staging Piles	40 CFR Part 264, Subpart S Section 264.554	Establishes requirements for waste piles to prevent contaminant migration to adjacent subsurface soil, groundwater, or surface water. Measures include installation of liners, covers, run-off/run-on controls as appropriate.
Corrective Action Management Unit (CAMU) for Storage and Treatment Only	40 CFR Part 264.552(f)	A CAMU will be designated if the remedial action involves excavation of contaminated soil followed by on-site storage and treatment.
<b>STATE:</b>		
Air Pollution Prohibited	UAC R307-102-1	Emission of air contaminants in sufficient quantities is prohibited.
Non-Attainment Area for PM <sub>10</sub> Fugitive Emissions and Fugitive Dust	UAC R307-309	Fugitive dust must be controlled during ground disturbing activities such as stabilization, excavation, and soil covering. Any fugitive dust source one-quarter acre or greater requires a dust control plan.
Corrective Action Cleanup Standards Policy – Underground Storage Tank (UST) and CERCLA Sites	UAC R311-211	Initially, steps must be taken to eliminate the source of contamination either through removal or appropriate source control. Regulation also requires establishing appropriate cleanup standards for remaining contamination.

**TABLE 2-2 (Continued)**

<b>Regulation</b>	<b>Citation</b>	<b>Compliance with ARAR</b>
Identification and Listing of Hazardous Waste	UAC R315-2	Wastes generated during the remedial actions must be identified and listed as hazardous wastes, as appropriate. This includes soils excavated for off-site disposal.
Hazardous Waste Generator Requirements	UAC R315-5	All activities that generate hazardous waste must comply with this regulation. This includes excavation of soils for off-site disposal.
Hazardous Waste Transporter Requirements	UAC R315-6	All activities associated with transporting hazardous wastes must comply with this regulation. This includes manifesting, record-keeping, and discharge clean-up requirements.
Requirements for Hazardous Waste Facilities - General Facility Standards	UAC R315-8-2	Hazardous waste facilities (for on-site stabilization and excavation activities) must be constructed in accordance with this regulation.
Preparedness and Prevention	UAC R315-8-3	Hazardous waste facilities must be designed, constructed, maintained, and operated in accordance with these requirements.
Contingency Plan and Emergency Procedures	UAC R315-8-4	A Contingency Plan must be developed and implemented for remedial action activities.
Manifest System, Recordkeeping, and Reporting	UAC R315-8-5	All hazardous wastes generated and transported off-site must be manifested in accordance with this regulation.
Closure and Post Closure	UAC R315-8-7	If contaminated soils above PRGS will remain in place, actions must be taken to prevent dermal and ingestion exposure and contaminant transport.
Use and Management of Containers	UAC R315-8-9	All management of containers holding hazardous waste must be in accordance with this subpart. This includes containers used for handling hazardous wastes during on-site stabilization operations and storing excavated soils prior to disposal.
Waste Piles	UAC R315-8-12	Establishes requirements for waste piles to prevent contaminant migration to adjacent subsurface soil, groundwater, or surface water. Measures include installation of appropriate liners and leachate collection systems.
Landfills	UAC R315-8-14	Requirements for landfill closure are relevant and appropriate for any alternative where a cover over contaminated soil is used to address a direct contact threat.
Corrective Action for Solid Waste Management Units	UAC R315-8-21	A CAMU will be designated if the remedial action involves excavation of contaminated soil followed by an on-site storage and treatment.
Emergency Control Requirements	UAC R315-9	A Contingency Plan must be developed and implemented for remedial action activities.
Cleanup and Risk-Based Closure Standard	UAC R315-101	Allows closure of facilities to risk based standards. Appropriate site management, such as corrective action, post closure care, and institutional controls, is required based on identified levels of risk.
Ground Water Quality Protection Rule	UAC R317-6	Removal of contaminated soil from OU2 would promote protection of groundwater.

Notes:

- ARAR Applicable or Relevant and Appropriate Requirements
- CAMU Corrective Action Management Unit
- CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
- CFR Code of Federal Regulations
- PM Particulate Matter
- UAC Utah Administrative Code
- UST Underground Storage Tank

**Table 2-3  
Preliminary Location-Specific ARARs**

<b>Regulation</b>	<b>Citation</b>	<b>Compliance with ARAR</b>
<b>FEDERAL:</b>		
National Historic Preservation Act	36 CFR Part 800 40 CFR Part 6.301(b) 16 USC Section 470	Any undertakings on sites listed or eligible for listing on the National Register of Historic Places must comply with these requirements.
Archaeological and Historic Preservation Act	40 CFR Part 6.301(c) 16 USC Section 469	If any remedial activity will cause irreparable loss or destruction of significant cultural resources, data recovery and preservation activities must be conducted in accordance with these requirements.
Migratory Bird Treaty Act	50 CFR Part 10	Prevents taking of migratory birds, their nests, or eggs without special permits.
General Facility Standards - Location Standards	40 CFR Part 264.18	Hazardous waste management units must be located in accordance with this regulation. This includes on-site stabilization and excavation activities.
<b>STATE:</b>		
Community Culture and History	UAC R212-6	State Register for historic resources and archeological sites analogous to the National Register requirements.
General Facility Standards - Location Standards	UAC R315-8-2.9	Hazardous waste management units must be located in accordance with this regulation. This includes on-site stabilization and excavation activities.

**TABLE 2-4**  
**Preliminary To Be Considered (TBC) Regulations and Guidance**

<b>Regulation</b>	<b>Citation</b>	<b>Compliance with ARAR</b>
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 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", CDC, August 2005	CDC recommends preventing lead exposures to children. Blood lead levels higher than 10 µg/dL in children results in the greatest adverse effects.

**Part 3 - Appendix C**  
**Responsiveness Summary**  
**Record of Decision**  
**Davenport and Flagstaff Smelters Superfund Site (Site)**  
**Operable Unit Two**

**Overview:**

Since OU2 contains both commercial and undeveloped properties, and the risks associated with these areas are different, separate remedies were selected for each type of property.

The Selected Remedy for addressing the Commercial Areas of OU2 is excavation and off-Site disposal of all soils in excess of 1,000 mg/kg lead, replacement with clean soil and re-vegetation.

The Selected Remedy for addressing the undeveloped areas of OU2 is the excavation and ex-situ treatment of all soils failing the Toxicity Characteristic Leaching Procedure (TCLP) test for lead, and disposal of all soils in excess of 3,000 mg/kg lead, replacement of soil, and re-vegetation.

There were no modifications to the remedy as it was presented in the Proposed Plan. Most of the comments received did not specifically comment on the preferred alternative versus other alternatives. The exception is the comment, as noted below, that suggested the "no action" alternative would be appropriate for the Site.

**Background on Community Involvement:**

EPA and UDEQ have conducted the required community participation activities through the presentation of the RI, HHRA, ERA, FFS and Proposed Plan (PP), a 30 day public comment period, a public meeting, and the presentation of the Preferred Remedy in the PP. 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 Sandy City Public Library and at the EPA Superfund Record Center. A notice advertising the availability of the AR and the Proposed Plan was published in the Deseret News and The Salt Lake Tribune on February 6, 2009.

The Proposed Plan for OU2 was issued on February 6, 2009. The RI/FFS and other documents in the Administrative Record were made available to the public at this time as well. In addition, over 400 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 February 6 to March 9, 2009.

A public open house was held on February 18, 2009 in the Metropolitan Water District of Salt Lake and Sandy 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.

## Comments:

### Summary of Comments

During the public comment, the community expressed concerns regarding the cleanup levels, how the remediation will be performed and whether specific properties in the nearby residential area had been impacted by smelter releases. One commenter thought the plan was well written. Two property owners, The City of Salt Lake and the City of Sandy expressed concerns about remedial activities affecting a down stream water intake, increased vehicular traffic due to the transport of contaminated soil, and the impact of construction vehicle emissions on air quality. The Metropolitan Water District of Salt Lake and Sandy echoed the cities' concerns regarding the down stream water intake. Salt Lake City challenged many of the assumptions made in both the Human Health and Ecological Risk Assessments and argued for a "no action" remedy.

### Public Comments and Agency Responses

#### **Received from Mary Young:**

*1. Comment: In several areas of the Proposed Plan it refers to elevated concentrations of lead and arsenic. However, the RI sampling results indicate that the majority of the samples had arsenic concentrations below 20 mg/kg. Since the goals on Page 5 indicate that the clean up goal for arsenic is 1000 mg/kg, the cleanup alternatives simply describe ways of cleaning up the lead, rather than the arsenic, which doesn't seem to be a problem. If the last statement is true, then why speak about elevated levels of lead and arsenic elsewhere in the document?*

**Response:** Arsenic concentrations throughout OU2 are elevated with respect to normal or "background" concentrations found throughout the rest of the Salt Lake Valley. The cleanup goal of 1000 mg/kg for arsenic was calculated to be protective of current and reasonably anticipated future use scenarios. Although arsenic concentrations are elevated, with respect to background concentrations observed in the Salt Lake Valley throughout OU2, the concentrations are below the human health cleanup level for these scenarios.

*2. Comment: I note that in various parts of the plan the statement is made that there will be no closure or relocation of any businesses required during the remediation activities. This is comforting. However, in consideration of La Caille's Natural concerns about possible impacts to their employees and customers, is there a more detailed document about how remediation will be accomplished, that might be reviewed to ensure their management of minimal impact.*

**Response:** The Remedial Design for OU2 will go into more detail about how the remediation will be accomplished as well as further delineate the areas that will require cleanup. Property owners will be personally consulted during the design process to

identify and address, to the extent practicable, concerns such as these. The Remedial Design is scheduled to be conducted during 2009. Every effort will be made to avoid disruption of business operations during cleanup activities.

*3. Comment: In trying to conduct a reasonably intelligent review of the document, I reviewed some other state's articles about lead contamination in soil and its related health problems. This naturally led to a bit of confusion about whether there is a "standard cleanup goal" for soil in areas similar to OU2. I saw goals of 300 to 500 ppm reflected in some articles. Is there an EPA standard or does this vary according to usage?*

**Response:** There is not a nationwide standard cleanup level of lead or arsenic contamination. Cleanup levels are calculated using, to the extent practicable, site specific data such as observed and expected uses, chemical and physical characteristics of contaminants, contaminant transport and targets. Exposures due to different use scenarios within the same site (residential use vs. commercial use) can also yield different cleanup levels. This is the case on this site. OU1 and OU3 were cleaned up to a residential cleanup level of 600 mg/kg lead and 126 mg/kg arsenic, OU2 will be cleaned up for commercial and recreational exposures.

*4. Comment: Except for some of the comments above, I felt the plan was extremely well written and understandable, and I personally agree with the selected alternatives.*

**Response:** Duly noted, thank you.

**Received from Taylor Hartman:**

*5. Comment: I am writing regarding the proposal mailed to us because we are adjacent to the property in question. Our home address is 3853 Little Cottonwood Lane, Sandy Utah 84029. I am concerned that we have never been contacted regarding our own soil. I own 2 acres and most people around us and on our street have had their soil tested and subsequently replanted. Is there a reason we have never been contacted about this?*

**Response:** The Davenport Smelter was located on the southern half of the parcel located at 3594 Little Cottonwood Lane. In 1998 and 2000 investigators sampled properties within the immediate vicinity of the smelter and then branched out from there. Sampling results demonstrated that the further east of the smelter a property was located, the lower the lead and arsenic concentrations were. Your home was not sampled because it is far enough away from the Davenport smelter that there was no suspected impact. Properties between your home and the smelter have been sampled and were found to have lead and arsenic concentrations lower than the cleanup goals for the Site, and therefore are not expected to pose a threat to human health. A Proposed Plan for Operable Unit One (OU1), which addressed contamination in residential areas, was prepared and distributed to area property owners in 2003 and a public meeting was also held to solicit community input. EPA and UDEQ have been involved in cleanup activities in the area from 2004 to

2007 and were available to answer questions regarding sampling and cleanup. All cleanup activities for OU1 have been completed at this time.

**6. Comment:** *Have there been any links to infertility and this soil?*

**Response:** No studies that would demonstrate any links to infertility to Site contaminants have been conducted for the Site.

**Received from Scott Whipperman:**

**7. Comment:** *We live near or within the Davenport & Flagstaff Smelter Superfund Site. Our home sits on the site of an old millpond associated with the smelter. This was pointed out to us by several old time residents. We constructed the home and have lived here for approximately 27 years. My concern is that on the map that I viewed that the survey area (to determine dangerous levels) did not include our property. I would like someone to check our property and hope that I am not too late.*

**Response:** The Davenport Smelter was located on the southern half of the parcel located at 3594 Little Cottonwood Lane. In 1998 and 2000 investigators sampled properties within the immediate vicinity of the smelter and then branched out from there. Sampling results demonstrated that the further east of the smelter a property was located the lower the lead and arsenic concentrations were. Your home was not sampled because it is far enough away from the Davenport smelter that there was no suspected impact. Properties between your home and the smelter have been sampled and were found to have lead and arsenic concentrations lower than the cleanup goals for the Site, and therefore are not expected to pose a threat to human health. A Proposed Plan for Operable Unit One (OU1), which addressed contamination in residential areas, was prepared and distributed to area property owners in 2003 and a public meeting was also held to solicit community input. EPA and UDEQ have been involved in cleanup activities in the area from 2004 to 2007 and were available to answer questions regarding sampling and cleanup. All cleanup activities for OU1 have been completed at this time.

**Received from Todd Young:**

**8. Comment:** *Doesn't Sandy City Water Department, have a water well near the U-2, 3 & 4 Properties? And if so have you coordinated this plan with them? It seems that the 3000 mg/kg level of "goals" would be insufficient there.*

**Response:** Sandy City owns a water tank near U2, 3 & 4, but does not own a municipal water well in the area. They do own a well some distance down-gradient of the Site. However, there is a water intake along the Little Cottonwood Creek that Sandy City, as well as Salt Lake City and the Metropolitan Water District have expressed concern about. UDEQ and EPA are coordinating cleanup activities with all three of these entities and will design the cleanup to ensure that Little Cottonwood Creek is not impacted. (See response to comment 10.) The 3,000 mg/kg cleanup level was calculated to be protective of human health for current and reasonably anticipated exposure scenarios (i.e. ingestion

of contaminated soil). Groundwater samples taken from locations near U2, 3 & 4 during the Remedial Investigation did not contain elevated concentrations of Site contaminants, indicating that ground water in that area has not been impacted at this time. Removal of principal threat wastes (soils that fail the Toxicity Leaching Procedure (TCLP) as described in the Selected Remedy will eliminate Site contaminants from entering ground water.

*9. Comment: The other question that relates to the same units (U2, 3, and 4) have to do with the possibility of antiquities being there. Do you coordinate these remediations with the Utah State archeologist's office?*

**Response:** UDEQ and EPA will conduct a cultural resource survey as part of the remedial design that is scheduled to take place during 2009. Any mitigation efforts will be coordinated with the State Historic Preservation Office.

**Received from the Metropolitan Water District of Salt Lake & Sandy:**

*10. Comment: The District is very concerned with the proximity of OU2 to Little Cottonwood Canyon and believes that disturbing the soils as recommended by the Preferred Cleanup Alternative, creates an opportunity for contaminants to be introduced into Little Cottonwood Creek greatly increasing the potential for water quality impairment. Contaminants introduced into the water supply have the capability to affect more than 500,000 people, as they ingest the potentially tainted water. Whereas, the contaminated soils do not have the probability to expose as large of a population since only a relatively small number of individuals will visit the site. The District is very troubled by the risk of contamination of the raw water supply which was not addressed in the Proposed Plan.*

**Response:** UDEQ and EPA will prepare a storm water pollution prevention plan as part of the Remedial Design that will address controlling run off as well as the risk of contamination of the raw water supply during construction activities. UDEQ and EPA will coordinate the preparation of the storm water pollution prevention plan with property owners and local regulating authorities as required. As has been observed by both Sandy City and Salt Lake City (See Comments 11 and 15), neither lead nor arsenic contamination have been detected at the water intake. However, EPA and private parties (operating under EPA oversight) have conducted extensive soil cleanups near the Little Cottonwood Creek during the past several years. These construction activities, associated with OUs 1 and 2, were performed much nearer to the creek. The excavation activities described in the Selected Remedy will take place in areas much further away from the Little Cottonwood Creek. As with these cleanups, controls such as silt fences, berm construction and run-off collection areas will be used during construction activities to ensure that the creek is not impacted. Removal of the contaminated soil along with the installation of clean fill and top soil as well as the re-vegetation of excavated areas as described in the Selected Remedy will ensure that excavated areas will be stabilized after construction activities. UDEQ and EPA disagree with the claim that the lack of lead or arsenic contamination at the raw water intake down stream of the Site can only be

attributed to a weathered and stabilized soil. Several other factors; such as distance to the creek, dilution by the volume of water in the creek and the sediment filtering properties of the wetlands bordering the creek, could be also be contributing to the lack of contaminant detection at the raw water intake.

**Received from Sandy Public Utilities:**

*11. Comment: The first concern is contamination to Sandy City's raw water supply. Sandy City receives water from a raw water intake on Little Cottonwood Creek. This intake accepts surface water, including that which originates on OU2, less than .5 miles away. To date, Sandy City has not identified any lead or arsenic contamination at this raw water intake; however, disturbing surface and subsurface soils impacted by lead and arsenic within this short distance from the intake is an issue. With the levels currently identified with the soil, this can only be attribute to a weathered and stabilized soil condition on OU2. Disturbing this area, as recommended by the Preferred Remedy, exposing new soils surfaces and creating an opportunity for sediment transport during remedial action would greatly increase the potential for water quality impairment. This short-term risk is of great concern to the Sandy City but was not addressed in the Plan.*

**Response:** See response to Comment 10 above.

*12. Comment: The other concern would be the potential for increased vehicle emissions and increased fatalities. Air quality and greenhouse gas ("GHG") emissions are of significant concern to Sandy City, along with Salt Lake City. The Salt Lake Valley experiences intense periods of unhealthy air quality during winter inversion and summer heating, primarily due to vehicle emissions. The Plan's Preferred Remedy will require more vehicle trips adding air pollutants and GHG emissions (based on assumptions, approximately 100 tons of CO2 equivalent emissions in the preferred alternative). We feel that vehicle emissions should be considered in the short term risks for each of the alternatives.*

**Response:** Many opportunities exist to reduce the negative impacts of an excavation-based remedy, which commonly include high rates of fuel consumption and off-Site disposal of excavated material. One of the ways in which fuel consumption as well as the number of trips to an off-Site disposal facility can be reduced is to determine the minimum extent to which excavation is required through effective Site investigations and a clear delineation of contaminated areas. Prior to any construction activities being performed at the Site, an extensive Remedial Design will be performed that will delineate the extent of contaminated areas more accurately than the data currently available can. Other green remediation tools, such as the use of biofuels and recyclable and recycled materials will be assessed during the Remedial Design. UDEQ is planning on preparing the Remedial Design for OU2 during 2009.

*13. Comment: Another area of concern is the increased trips to the landfill and the risk of higher traffic fatalities. Based on the estimated number of vehicle trips necessary to implement the Preferred Alternative prepared by Salt Lake City's environmental*

*consultant, it appears that the probability of death from traffic accidents during waste fill and topsoil hauling is approximately  $2.3E-3$ , many times higher than EPA's level of concern for chemical exposure risk.*

**Response:** See response to Comment 14.

**Comments From Salt Lake City Department of Public Utilities (March 6, 2009):**

*14. Comment: The short-term risk of death(s) from truck-related collisions is quantified below with the resulting risks very likely exceeding human health risks associated with Site contaminants. The action alternatives for the undeveloped area all involve large earthworks. According to earthwork quantity estimates in the FFS (URS, 2008), the Preferred Remedy will include:*

- *Truck transportation of 4,747 tons of waste 19 miles to the Salt Lake County Landfill*
- *Importation of 4,747 tons of fill and topsoil (unidentified haul distance).*

*Assuming each truck hauls a 10-ton load and that the one way haul distance for imported fill is also 19 miles, the preferred remedy includes 36,077 miles of haul.*

*Federal Highway Administration ("FHA") published statistics for police-reported combination-unit truck crashes for the period 1989-1993 include 6.4 fatal crashes per 100,000,000 miles traveled.*

*Based on anticipated haul miles and FHA statistics, the probability of at least one death as a result of the Preferred Remedy is  $2.3 E-03$ . Unlike the multiple layers of conservatism that enter into the EPA's risk estimates from the exposure to Site contaminants, the probability of a truck-related fatality includes no such conservatism. The value of  $2.3E-3$  is 23 times higher than the  $1E-4$  cancer risk threshold that EPA has established for action at NPL sites.*

*A short-term risk of this magnitude should have been identified in the Plan and formed the basis for rejecting the Preferred Alternative as well as other action alternatives that involve large amounts of soil requiring truck transport to and from the Site.*

**Response:** EPA and UDEQ agree that potential short-term risk due to increased truck traffic associated with the selected remedy must be adequately addressed. To this end, haul routes and stringent traffic safety and control measures will be implemented in cooperation with appropriate authorities. The agencies believe that short-term impacts due to transportation of materials to and from the Site can be adequately managed and see no reason why such transportation should preclude implementation of the Selected Remedy (or any of the other alternatives involving active remediation).

The comment attempts to quantify the short-term risk of fatal accidents related to truck traffic using FHA statistics and certain assumptions about the Selected Remedy. It then compares the resulting numerical value to a cancer risk threshold of  $1 E-04$ . EPA and

UDEQ believe that it is important to point out that the 1 E-04 value cited in the comment is a lifetime excess cancer risk level based on human exposures to Site-related contaminants. This is a very different type of risk than the short-term risk that the comment attempts to quantify. For this reason the agencies do not believe that a direct comparison is particularly meaningful.

*15. Comment: The City receives water from a raw water intake on the Little Cottonwood Creek. This intake accepts surface water that includes waters that originate from OU2 less than 0.5 miles away from the intake. Disturbing several acres of surface and subsurface soils impacted by lead and arsenic within this close proximity of the intake becomes an issue because of the potential for exposing the City water supply to increased levels of lead and arsenic.*

*To date the City has not identified any lead or arsenic contamination at this raw water intake, suggesting a weathered and stabilized soil condition on OU2 in which contaminated soils do not impact surface water quality. The City is very concerned that the proposed excavation activities will expose new soil surfaces and create an opportunity for sediment transport during remedial action that greatly increases the potential for water quality impairment. This short-term risk is of great concern to the City but was not addressed in the plan.*

**Response:** See response to comment 10.

*16. Comment: Air quality and greenhouse gas ("GHG") emissions are of significant concern to Salt Lake City. The Salt Lake Valley experiences intense periods of unhealthy air quality during winter inversions and summer heating, primarily due to vehicle emissions. In addition, the City is committed to aggressively reducing greenhouse gas emissions. The Preferred Remedy would result in the emission of significant quantities of air pollutants and GHGs. For example, based on our assumptions, the Preferred Remedy would result in the unnecessary release of approximately 100 tons of CO2 emissions.*

**Response:** See response to comment 12.

*17. Comment: In our April 17, 2008, comments on the HHRA, we called UDEQ's attention to EPA guidance calling for the use of a simple mean lead concentration across an exposure unit as the appropriate input to blood lead models. Several recent examples were identified where the simple mean lead concentration was used as the input to blood lead models for a recreational land-use scenario at NPL sites in Utah.*

*As further discussed in our comments on the HHRA, if the simple mean lead concentration (mean of composite sample results) had been input to the blood lead model, the model would have predicted health effects below a level of concern. This conclusion is true if the undeveloped area were evaluated as a single exposure area, if the exposure area identified in the Draft Remedial Investigation ("RI") Report (URS, 2007b) were used, or if each individual one acre parcel were evaluated independently. Such an outcome presumably would have lead to the selection of a no-action remedy.*

*Instead, the use of the UCLM lead concentration has resulted in an overestimate of potential adverse health effects, triggering the development and selection of a remedial alternative requiring costly and unnecessary response actions. The use of the UCLM lead concentration instead of the simple mean lead concentration is unwarranted under these circumstances.*

**Response:** The selection of the exposure unit area size is based on professional judgment which takes into consideration the receptor, duration of exposure, size of the site, geographical features of the site and the heterogeneity of the contaminant concentrations. An exposure unit area is defined as the geographical area the receptor is expected to come into contact with for a specified period of time. For a resident this is typically a residential home (generally .25 acres). For a commercial worker the exposure area is typically the worksite. For a recreational/trespassing receptor professional judgment and experience are used to determine the exposure unit. This exposure unit can be further refined by geographical features of the site or variability in how the contaminant is spatially distributed. Areas of high contaminant concentrations may be distinct exposure areas from areas of low contaminant concentration.

The exposure point concentration term is defined as an estimate of the arithmetic mean concentration of a chemical in a medium within an exposure unit area. However, because the true arithmetic mean concentration can not be calculated with certainty from a limited number of measurements, EPA recommends that the 95<sup>th</sup> percentile upper confidence limit (UCL) of the arithmetic mean at each exposure point be used when calculating exposure and risk at that location (see Supplemental Guidance to RAGS: Calculating the Concentration Term (pdf) (Publication 9285.7-081, May 1992). The Guidance Manual for the IEUBK Model recommends the arithmetic average for the exposure point concentration term be used when the exposure unit area is small (e.g. a single residential yard) and the contaminant concentration is relatively homogenous--two distinctions that are not applicable to OU2. When the exposure unit area increases in size and contaminant concentrations become more variable, as is the case in OU2, it is prudent to use the 95% UCL on the arithmetic mean to account for this uncertainty.

Thus, based on the application of the 95% UCL on the arithmetic mean, as well as other considerations as described above the Selected Remedy is appropriate.

**18. Comment:** *UDEQ's explanation for its use of the UCLM lead concentration is that the surface soil sample size at OU2 is uniquely small and variable so as to preclude the use of the simple mean concentration. UDEQ's position is not supported by the information we have reviewed. Actual surface soil sample frequency is ten samples per acre (based on a 10 point composite sample per acre). Therefore, within the eight-acre exposure area delineated in the HHRA as the area of concern, there are a total of 80 surface soils sample results (eight, 10 point composites). Surface soil sample density at Region 8 NPL Sites where the simple mean was used for blood lead modeling of recreational exposure scenarios reveals that the sample density at the Site is well within the range of sample densities available at similar sites where the simple mean was deemed appropriate for use in the blood lead modeling. Therefore, the use of the UCLM*

*in blood lead modeling is not justified based on the facts and circumstances related to the Site and apparently will result in the implementation of an unnecessary and costly remedy.*

**Response:** See response to Comment 17.

*19. Comment: Another reason UDEQ posited for using the UCLM lead concentration is the alleged variability in lead concentrations in the sample set. Although the variability in lead concentration within a single composite sample is unknown, lead variability can readily be examined across composite samples within an exposure area. The reported lead concentrations in the eight-acre exposure area delineated in the HHRA as the area of concern ranged between 1,520 mg/kg and 4,930 mg/kg. This range of lead concentrations across eight samples is not consistent with UDEQ's claim of high variability in lead concentrations.*

*We are aware of subsurface soil samples within the exposure area described as group 2 containing lead concentrations as high as 10,800 mg/kg. However, vertical variability in lead concentrations does not justify the use of the UCLM lead concentration. The trespasser scenario assumed for the Site precludes a completed exposure pathway with subsurface soils.*

*Based on the discussion above, we believe that risk management decision related to lead contamination at the Site should be based on blood lead modeling conducted using the simple mean lead concentration for each exposure area.*

**Response:** See response to Comment 17

*20. Comment: In our April 17, 2008 comments, we raised concerns regarding the delineation of exposure areas based on aggregating similar concentration values, thereby resulting in an overestimation of risks. But even ignoring those comments, however, we believe that running the blood lead model even using the exposure areas defined in the RI report will show that estimates of health risks due to lead in that area are below level of concern. This outcome would lead to the conclusions that an IC remedy for the Site to restrict future land use is protective of human health under foreseeable use of the area and that the Preferred Remedy is based on an overestimation of risks posed by the lead in the shallow soils.*

**Response:** See responses to Comments 17 and 21.

*21. Comment: UDEQ' blood lead modeling concluded that health risks to trespassers area above a target level of concern. This conclusion triggered the preparation of a memorandum describing the derivation of a remedial goal for lead in Site soils.*

*In our April 17, 2008, comments on the HHRA we stated that the use of a Reasonable Maximum Exposure ("RME") soil ingestion rate is inconsistent with EPA guidance for blood lead modeling. We note that UDEQ' calculation of a remedial goal for lead in Site*

soils also includes the RME soil ingestion rate. To illustrate the effects of RME vs. Central Tendency Estimate ("CTE") of daily soil intake on the calculated remedial goal, we developed a spread sheet that replicated UDEQ's calculations. This analysis also incorporates calculation based on the CTE of .025 grams per day (g/d) that was specified in the HHRA, as well as fraction of the CTE soil ingestion value to reflect exposure duration associated with likely actual use of the Site. These additional calculations incorporating the CTE of soil ingestion first assumes that half of the central tendency value would come from the Site, and then assumes that the Site contributes to soil ingestion one hour of a 16 hour day. All of these incorporate UDEQ's "high-high" scenario, where background lead levels and the GSD are set to the high end of the range.

A review of the data described above reveals that as we move away from an RME soil ingestion rate, the calculated remedial goal climbs to concentrations greater than 5,000 mg/kg. Under the most likely foreseeable land use, where visitation occurs for only one hour per day, the calculated remedial goal exceeds 90,000 mg/kg.

This type of evaluation has been used to support a no-action alternative for lead contamination in recreational areas at other sites. Lead is a common contaminant of concern at many sites, primarily due to historical mining operation throughout Region 8. We investigated the range of remedial goals established for lead in surface soils under a recreational or trespasser land use scenarios at mining NPL sites in Region 8 and particularly in Utah. A review of a summary of this information shows that there are several sites where the soil lead remedial goal is based on a commercial land use scenario and is still higher than the remedial goal proposed by UDEQ at the Site. Human exposure under a commercial land use scenario is generally assumed to be more intense than under recreational land use scenarios due to the frequency and duration of the exposure.

This summary illustrates how conservative the proposed remedial goal of 3,000 mg/kg is relative to other similar sites in Region 8, especially when the actual Site use patterns are taken into consideration. In instances where "recreational use" of the site is addressed, those areas are frequently present of public lands with unrestricted public access, and the scenario evaluated incorporates potential exposures under relative high-intensity soil contact, such as might be incurred by individuals on dirt bikes, ATVs, or horseback riding. The soil contact under these "recreational" scenarios is in contrast to Site uses, where contact with Site soils is restricted to minimal contact by trespassers during brief walks on the Site.

Based on the administrative record for the Site and our conversations with UDEQ about risk assessment and risk management decisions at the Site, it appears that UDEQ took an unduly conservative approach. This approach is generally inconsistent with the data set available regarding the Site and EPA guidance and precedent set at similar sites. As a result, UDEQ has overestimated the human health risks from lead and established a remedial goal that is overly conservative, thereby driving the development and selection of the Preferred Remedy.

**Response:** UDEQ and EPA disagree that "...the remedial goal is overly conservative, thereby driving the development of and selection of the preferred remedy." The selection of the remedial goal by the risk managers from UDEQ and EPA is based on several considerations. One of these considerations was the range of the lead values that could be used as a potential remedial goal. The agencies do recognize that when a different parameter is used in the lead model that is smaller than the one used by the agencies (i.e., ingestion rate and exposure frequency) a significantly higher remediation goal results, just as would be expected. The remedial goal was arrived at by using assumptions regarding current land use (i.e. current potential for exposure, surrounding residential land use, observed activity patterns) and potential ecological risks. The agencies selection of the lead remedial goal is reasonable when addressing the lead contamination at this Site for both human health and ecological health. The agencies also disagree that the approach is inconsistent with the data set available for the Site.

*22. Comment: As discussed in our prior comments on the ecological risk assessment, actual ecological risks were not adequately quantified due to a lack of site specific ecological data. Estimated ecological risks are associated with high levels of uncertainty, which results in risk values that are very conservative. Therefore, ecological risks should not drive the need for remedial action in the absence of human health risks above a level of concern.*

**Response:** UDEQ and EPA agree that the ecological risks as described in the ERA are conservative and associated with high levels of uncertainty. The agencies, in turn, also agree that additional sampling might reduce this uncertainty. However, the need for action at OU2 is driven by risks to human health which when implemented will significantly reduce the exposure of ecological receptors to soil contamination. As stated in the ERA, the lead concentrations in surface and subsurface soils would have to be lowered to below 29 mg/kg – less than background concentrations – in order to achieve protectiveness for the most sensitive ecological receptors

Despite the conservative nature of the ERA there are areas within OU2 that contain lead concentrations that are of real concern with respect to ecological receptors. It is believed that cleanup to levels protective of human health (3,000 mg/kg lead) will address the bulk of the source material that is driving risk to ecological receptors, while also minimizing the damage that the undeveloped area would sustain through more intrusive and aggressive construction activities. The exposure of herbivorous and invertivorous birds to materials that pose an ecological risk will be reduced by the selected remedy but will not be quantifiable.

While additional ecological sampling would reduce the uncertainty associated with the ERA, it is likely that a cleanup driven by ecological risk factors and exposure would result in even more stringent clean-up levels requiring a more intrusive and aggressive construction than that involved in the selected remedy.

*23. Comment: Alternative U3 requires excavation and likely treatment of surface and subsurface soils exhibiting lead concentrations over 3,000 mg/kg to a maximum depth of*

*18 inches. Soil excavation, treatment and backfill quantities are based on data collected during the RI. Additional analytical data collected during and after remedial excavation will certainly be required in order to demonstrate that design criteria have been met. The additional data may drive the need to excavate, treat and backfill larger quantities of soil that identified in the FFS and used to develop the remedial costs identified in the plan.*

*Contrasting with the uncertainty in capital costs associated with Alternative U3, earthwork requirements for Alternative U4 are known since the remedy is a simple soil cover to be installed over parcels of land that are already delineated. No uncertainty exists as to the vertical extent of the remedial action necessary. Thus, the cost comparisons between Alternative U3 and Alternative U4 may be misleading since there is the significant risk that capital costs for Alternative U3 were underestimated, while there is no such risk associated with the capital costs of Alternative U4.*

**Response:** UDEQ and EPA agree that additional analytical data will need to be collected in order to further delineate the exact extent of material requiring excavation in Alternative U3. Furthermore, the agencies agree that the additional data may drive the need for excavation and treatment of larger quantities of soil than has been identified in the FFS. However, it is anticipated that further delineation of contaminated areas during Remedial Design will be able to more accurately determine the extent of material requiring remediation. As directed by EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies, all of the cost estimates in the FFS represent a +50 to -30% range. The agencies disagree that the cost comparisons are misleading and that the capital costs for Alternative U3 have been underestimated.

**24. Comment:** *Certain elements of remedial construction proposed under Alternative U4 are unnecessary and increase capital costs. Among these is the geotextile layer. A demarcation layer is unnecessary given ICs are part of the alternative and are intended to prohibit Site development. Also, all alternatives recognize the need to remove/restore the existing haul road on OU2. Under Alternative A4, the road would be removed and the same area would receive fill and topsoil. The existing haul road consists of fill already in-place. This existing cover material should remain in-place (possibly subjected to additional grading) in order to save costs. Incorporation of these modifications to Alternative 4 will significantly lower capital costs.*

**Response:** The purpose of the geo-textile layer is to provide a baseline for future monitoring to ensure that the cap maintains its integrity. Therefore, the agencies disagree that the geo-textile layer is unnecessary. Furthermore, the estimated cost of the geo-textile layer is \$11,861, a relatively small percentage of the total remedy cost. Additionally, it has been the agencies' experience during similar remedial activities that road base does not provide sufficient nutrients or organic matter to successfully re-vegetate and restore a remediated area. Furthermore, the current access agreement with the Salt Lake City/ Public Works Department requires the removal and restoration of the mentioned road. UDEQ and EPA do not agree that these items can be removed from the cost estimate, nor would their elimination significantly lower the capital costs. Also, cost

is only one of the criteria analyzed in the selection of the preferred remedy. In this case the agencies felt that the additional protectiveness, the preference for treatment, and long-term risk reduction provided by Alternative U-3 warranted its selection over Alternative U4.

*25. Comment: The level of O&M proposed under Alternative U4 is excessive when compared to similar sites. The FFS details those O&M activities that were used to develop the 30-year net present value shown in the Proposed Plan.*

*O&M activities required at Region 8 NPL and CERCLIS sites in Utah where a soil cover remedy has been implemented (Midvale Slag OU2, and Murray Smelter) only require periodic inspection and repair as necessary. By contrast, the O&M requirements spelled out in the FFS include soil sampling and chemical analyses. It is not necessary to sample and analyze a soil cover at the time of installation or any time thereafter. If these costs are eliminated, the overall cost of Alternative U4 is reduced.*

**Response:** The agencies disagree that the level of O&M proposed for Alternative U4 in the FFS is unnecessary, and disagree that these costs can be eliminated. The soil cover alternative has a much greater amount of uncertainty associated with its protectiveness and permanence since a much greater quantity of contaminated material that poses a risk to human health will remain at the Site. This uncertainty is reflected in the O&M requirements.

*26. Comment: The O&M costs also include approximately \$20,000 in perpetual annual repairs to the cover and another \$10,000 in annual reporting. Small breaches in the soil cover proposed in Alternative U4 from wind (not likely to erode 12 inches of compacted fill and topsoil) or water will not increase exposure risks in a meaningful way. Therefore, the need for annual maintenance of this magnitude in perpetuity is unlikely and the O&M costs should be modified accordingly. In any event, the mature vegetation currently on the Site effectively controls erosion and wind, further arguing against earthmoving activities on the Site:*

**Response:** Due to the proximity of the areas requiring remediation in the Proposed Plan to a vibrant and thriving wetland and Little Cottonwood Creek, as well as the run-off and erosion potential due to the slopes associated with the Site the potential exists for a small breach to quickly lead to remedy failure and possible contamination of Little Cottonwood Creek and the Valley drinking water supply. Guidance documents developed by EPA advise that worst case assumptions and conservatism be utilized on all of the evaluated alternatives. Since more uncertainty is associated with the cover alternative the estimated O&M costs are naturally greater. The agencies recognize that the mature vegetation currently on the Site appears to be preventing the migration of Site contaminants to off-Site receptors. However, the vegetation does not prevent human exposure to contaminated surface soil.

*27. Comment: The FFS costing-tables reference EPA costing guidance (EPA 2000) as the basis for selecting a discount rate of 2.8%. That guidance document actually*

*recommends the use of a 7% discount rate (inflation adjusted) except for federal facilities. OU2 is not a federal facility.*

*The guidance instructs the reader to consult with any update to OSWER Directive 9355.3-20 for changes to the policy of using 7% for non-federal facilities. There has been no relevant update to this OSWER Directive.*

*Simply changing the discount rate to 7% reduces the 30-year net present value of Alternative U4 O&M costs from \$684,000 to \$431,000. Eliminating the annual soil sampling further reduces this cost to \$351,000. Assuming the hypothetical cover repair costs to be a periodic cost that only reoccurs every 2 years, instead of annually, for a term limited to the first 6 years, when vegetation would be expected to be fully established, the 30 year O&M costs are reduced to \$136,000.*

*When these issues are addressed, the cost differential between Alternatives U3 and U4 are much more dramatic.*

**Response:** While OU2 is not a Federal Facility, at this time it is anticipated that Federal funds will be utilized to perform construction activities at the Site. Therefore, it is appropriate to utilize a discount rate of 2.8% rather than 7%. The difference between the discount rate for federal and non-federally funded sites is based on the earning power of federal monies compared to that of private monies. Federal dollars have a much higher level of investment restriction and will, therefore, generally earn less. This is why the federal discount rate published yearly by the OMB is lower than the rate recommended for private entity use.

**29. Comment:** *Overall protection of Human Health and the Environment; The last sentence of the plan states that Alternative U4 is more dependent on ICs than Alternative U3. In reality, the land use restrictions necessary to limit exposure to contaminants on un-remediated portions of the undeveloped portion of OU2 would also prevent excavations that could breach the soil cover under Alternative U4. ICs are expected to prohibit Site development under all action alternatives, including prohibitions against excavations within any soil cover area.*

**Response:** As explained in the Proposed Plan, contaminated material that poses a threat to human health and the environment would be permanently removed from the Site with Alternative U3, thus completely removing the contaminated material and the associated risk from the Site. It is anticipated that the ICs required if Alternative U4 had been selected would include an inspection and O&M component in addition to the access and building restrictions that would be required for Alternative U3.

**30. Comment:** *Long-Term Effectiveness and Permanence: The last paragraph of this section states that the soil cover (under Alternative U4) could be breached by water and wind erosion or construction activities related to a change in land use. Although a soil cover may be damaged by wind or water erosion, human health risks are based on*

*average exposure across an area where an individual might be exposed. Small breaches in a soil cover are not likely to cause a meaningful rise in human health risks.*

*Routine inspections (and repair, as necessary) required under any of the action alternatives will minimize the chances of such breaches. As discussed above, ICs would preclude excavations through the soil cover.*

**Response:** It can not be automatically assumed that health risks will be negligible if there is a breach in the soil cover.

**31. Comment:** *Reduction of Toxicity, Mobility or Volume through Treatment: This section of the Plan identifies Alternative U2 and U3 as the only alternatives that reduce toxicity. This is achieved through treatment of excavated soils that fail Toxicity Characteristic Leaching Procedure ("TCLP").*

*Based on previous sections of the Plan and the FFS, the soils proposed for treatment will fail TCLP. However, Site documents are clear in dismissing groundwater as a medium of concern. If the potential of soils leaching metals to groundwater is not of concern, then the only reason to treat soils is to meet a regulatory requirement for a waste (to transform a characteristic hazardous waste to a non-hazardous waste for ease of disposal in a landfill). The soils are only a waste once they are excavated. If left in-place, there is no technical rational or regulatory requirement to treat them. Therefore, Alternatives U2 & U3 have no true advantage over Alternative U4.*

**Response:** The determination that ground water contamination is not a concern is based on the lack of contaminants from the Site being detected in ground water. The potential of Site-related contaminants leaching to ground water will still exist if the leachable material is not removed from the Site. Furthermore, the Site-material that exhibits a characteristic of hazardous waste (fail TCLP) is considered source material and is a principal threat waste. The treatment of principal threat waste described in Alternatives U2 and U3 still meets the preference for treatment criteria where Alternative U4 does not.

**32. Comment:** *Short-Term Effectiveness: See Comment above (14).*

**Response:** See response to comment 14.

**33. Comment:** *Implementability: This section of the plan discusses how the soil cover remedy (Alternative U4) would need to be destroyed should additional earthmoving activities be required after cleanup. It is unclear to the City how this concern bears on remedy implementability or under what circumstances such a scenario would arise.*

**Response:** Per the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, one of the items that has to be considered is the ease of performing additional earth moving actions. Additionally, given the proximity of OU2 to a residential area and the problems with accessing some of the surrounding residential

properties that was demonstrated during OU1 construction activities, EPA and UDEQ believe it is not unlikely that such a scenario could arise.

### **Salt Lake City comments on the Ecological Risk Assessment**

Note: These comments were received by UDEQ and EPA on May 5 2008 and not during the public comment period associated with the Proposed Plan. Since they are referenced in the comments submitted by Salt Lake City on the proposed Plan they are included in this responsiveness summary as a reference and to provide continuity. The issues discussed in these comments are addressed in the response to comment 22.

*One of the largest areas of uncertainty in the risk analysis for ecological receptors is the absence of actual, Site specific biota data. Because no Site-specific data were generated, the ERA relies exclusively on exposure models based on estimated concentrations of metals in plant food and prey to estimate risks to wildlife. The use of Bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) to estimate plant and prey tissue concentrations from concentrations measured in soils and sediment is a highly uncertain method. BCFs and BAFs tend to over-predict actual tissue concentrations and therefore estimate risk. In particular, the assumption that metal in environmental media are 100 percent bioavailable is overly conservative and likely results in artificially high risk estimates when using BAFs or BCFs.*

*For wildlife, the greatest estimated ecological risks are to birds, specifically the American robin and horned lark. The risks to these receptors were estimated without the benefit of Site-specific biota data and they appear to be driving risk management decision at the Site. Given the conservatism inherent in risk estimates performed without the benefit of Site-specific biota data it is inappropriate to use these estimates for risk management decisions.*

*We recommend that UDEQ undertake additional studies to gather Site-specific data that can then be used to develop a more realistic characterization of actual risks posed by conditions at the site. Such an approach would be consistent with EPA guidance on how to conduct consistent and technically defensible ecological risk assessments.*

*Another area of significant uncertainty in the EAR is that the Problem Formulations does not include adequate habitat characterization. Without an understanding of the habitat available at the Site, the validity of the Conceptual Site Model is unclear, and it is impossible to determine if URS's selection of representative ecological receptors is reasonable.*

*Other approaches used in the assessment that also result in an overestimate of risk include the use of an overly conservative toxicity reference value for lead, and an inappropriate use of screening benchmarks to identify chemicals of concern for plants, soil invertebrates, and sediment macroinvertebrates. In particular, the misapplication of screening benchmarks results in conclusions regarding risk that are contradicted by observed conditions at the site. UDEQ should have conducted soil or sediment toxicity*

tests data with appropriate test organisms to develop Site-specific risk thresholds for these receptors instead of incorrectly drawing conclusions based on screening benchmarks.

Section 1.4. Conceptual Site Model. The relevance of incidental ingestion of subsurface soil as an exposure pathway for most of the avian and mammalian receptors is questionable. None of the species modeled are burrowers, and in most cases they are exposed only to surface-dwelling prey. Therefore, the likelihood of direct or indirect exposure in metals in sub-surface soils is low. This does not have any major implications for risk results as no chemical is identified as a risk driver for wildlife in subsurface soil that is not also a risk driver in surface soils, but rather is a question of ecological relevance.

Section 1.6. Ecological Receptors. As mentioned in the general comments above, it is unlikely that some of the selected ecological receptors are affected by the identified exposure pathways. The ERA includes kestrel, meadow vole, mule deer, and masked shrew in models that evaluate risk from exposure to pond sediments. However, none of these receptors is aquatic not primarily associated with aquatic habitats or the aquatic food web, and the likelihood of these receptors' exposure to sediment or aquatic prey is low. As such, the conclusion that exposure to cadmium in pond sediment constitutes an unacceptable risk to wildlife, as based on an exposure model for shrews (refer to Section 3.1.7), is inappropriate and may overestimate risk to invertivores.

Section 1.7. Screening of Results (Identification of Chemicals of Potential Ecological Concerns). The screening process should not have used comparisons to the lowest screening value available, but the lowest value for each receptor group. For example, it is not appropriate to use a screening value based on earthworms to screen for potential effects to wildlife. Under the proper approach, chemicals retained for analysis would be receptor-dependent. Cadmium, selenium and silver would not be retained as Chemicals of Potential Ecological Concern (COPECs) for earthworms in soil, and copper and lead would not be retained as COPECs for mammals in pond sediment. Although this oversight may not affect the outcome of the risk assessment, it suggests a low standard of care in conducting the assessment.

42. Section 2.1.2. Exposure of Wildlife Receptors through Ingestion. In general, the exposure factors selected for the wildlife receptors (Table 13) appear appropriate. However, the assumed soil ingestion rate for horned larks ( $IR_s = 10.4$  percent) likely overestimates exposure. This value is based on soil ingestion by woodcock, a species that, because of their probing feeding method and earthworm diet, is more prone to incident soil ingestion than the lark, which primarily gleans surface seeds or insects. The result of this overestimation of soil exposure is inflated Hazard Quotients (HQs), or an overestimation of risk for the lark. Conversely, the Area Use Factor (AUF) for wood duck is low, as it is based on a feeding radius, not an actual foraging range, which the ERA acknowledges in the uncertainty analysis. In this case, this may result in an under-prediction of exposure. However, even if a more ecologically realistic AUF was used for

wood duck, it is very unlikely that resultant hazard quotients would exceed 1.0, which would not alter risk conclusions for this receptor from what is stated in the ERA.

Section 2.1.3, Biotic Exposure Point Concentrations. As mentioned in the general comments above, the use of BCFs and BAFs to estimate plant and prey tissue concentrations on the basis of media concentrations is a highly uncertain method, and one that is likely to result in very conservative, or artificially high tissue concentration estimates, and thus overestimates of risk. Most of the actual BCF and BAF values used by URS cannot be evaluated for technical merit, as they are drawn from a Los Alamos National Laboratory Ecorisk Database, for which access is controlled. At a minimum, the full technical derivation of these BCF and BAF values should be included as appendices to the document. We believe that it would be technically feasible and appropriate to obtain empirical data on biotic exposure point concentrations, either through collection and analysis of prey species from OU2 or through testing of soils from OU2 to develop Site-specific uptake factors. This approach is likely to result in lower risk estimates.

Section 2.2.1, Direct Exposure TRVs and Section 3.1, Risk Estimation. Using a value that is arbitrarily 5-times the selected ecological screening level (in the case of plants and soil invertebrates), or using screening values (e.g., sediment probable effects concentrations, and acute water quality criteria) as the basis for determining the HQs for plants, soil invertebrates, and benthic macroinvertebrates is inappropriate and contrary to ecological risk assessment guidance. Screening levels are conservative values designed to determine "safe" concentrations below which an unacceptable level of risk would not be expected. However, exceedance of a screening value (or even 5x a screening value) does not imply that there is an unacceptable level of risk, only that further investigation may be warranted. This is clearly specified in EPA technical guidance, which notes that ecotoxicological thresholds (i.e., screening values) are "media-specific contaminant concentrations above which there is sufficient concern regarding adverse ecological effects to warrant further Site investigation" (U.S. EPA 1996<sup>2</sup>). Therefore, using screening levels as the basis for TRVs generates HQs that have no relevance for drawing risk conclusions, and are likely to overestimate actual risks. A way to develop meaningful data to assess the potential for adverse effects to these receptors would be to conduct soil or sediment toxicity tests data with appropriate test organisms to develop Site-specific risk thresholds for plants, soil invertebrates, and/or benthic invertebrates.

Section 2.2.2, Ingestion Pathway TRVs. As with the BCF/BAF values, the toxicity reference values (TRVs) used by URS are drawn primarily from the Los Alamos database, and therefore the actual values are the studies used on the basis for TRV derivation cannot be assessed. In comparing the URS TRVs with other, publicly-available values for birds and mammals, the values were found to be generally consistent (usually within a factor of 10 or less), although sometimes slightly lower. This was most apparent for the avian TRV for lead. The risk assessment uses a lowest-observed-adverse-effect level (LOAEL) of 3.26 mg/kg-d to assess avian risk from exposure to lead. This LOAEL TRV is lower than a frequently used no-observed-adverse-effect level (NOAEL) of 3.9 mg/kg-d derived from a study on kestrels, and about 3-fold lower than a

*LOAEL of 11 mg/kg-d based on a study with quail. This has relevance to the outcome of the risk assessment, as lead exposure for birds is one of the primary risk drivers of the ERA. Using higher LOAEL (11 mg/kg-d) as a TRV would lower lark and robbing HQs for lead in surface soils to approximately 12 (from the URS estimate of 40-41). While still exceeding unity, this, in combination with other approaches discussed above (i.e., empirical, Site-specific data on chemical concentrations in prey species), could result in a ultimate HQ that would be less than 1.0. Also, the approach of scaling the LOAEL as 5 times the NOAEL is weak and unsupported by scientific evidence, and introduces further uncertainty into the ERA. The risk assessors should have located other studies that could be used to empirically drive a LOAEL TRV, or provide technical substantiation for the scaling factor adopted in the assessment.*

## Human Health Risk Assessment Comments

Note: These comments were received by UDEQ and EPA on May 5 2008 and not during the public comment period associated with the Proposed Plan. Since they are referenced in the comments submitted by Salt Lake City on the proposed Plan they are included in this responsiveness summary as a reference and to provide continuity. The issues discussed in these comments are addressed in the response to comment 17.

*One of the largest areas of uncertainty in the HHRA pertains to the method used for aggregating data in the undeveloped area of the Site. Specifically, the assessment breaks the undeveloped area into three separate exposure areas without substantiation that exposure in these areas would be qualitatively or quantitatively distinct. Rather, the separation is made based on "similar concentrations" and "proximity of the samples". This is not consistent with the intention of exposure assessment or risk assessment.*

*The other primary area of technical comments, is directed at what appears to be a misapplication of pharmacokinetic models for blood lead modeling. Most importantly, in the models currently recommended by the U.S. EPA, the input concentrations for soil lead levels should reflect a simple average across the exposure area, rather than a upper confidence limit of the mean (UCLM) or the maximum measured value. This is in contrast to other chemicals. For which the appropriate concentration value is represented by an UCLM. Similarly, input values for other parameters in the model should reflect central tendency estimates of exposure. In the current HHRA, blood lead modeling was conducted using the UCLM or maximum soil lead concentrations, and a combination of "central tendency" and "reasonable maximum" values for other exposure parameters. This approach is inconsistent with the structure of the model and with existing guidance application of the model to site-specific risk assessment, and results in a significant overestimate of predicted blood lead levels.*

*Section 3.1.1 and 3.3.4. These sections discuss how the undeveloped areas of the Site are "difficult to access," but then goes on in 3.3.4 to state that the area is "specifically attractive" to older children. While it is plausible that older children may have lower levels of supervision and might investigate the area, it is not established that this might represent an attractive location for frequent visits. Therefore the exposure frequency assumed in the assessment is likely an overestimate of actual exposures, and so blood lead modeling under current assumptions of exposure frequency provides a conservative estimate of risk.*

*Section 3.5, Exposure Areas for Risk Assessment. This section defines the areas of the Site that are included in the risk assessment. For the undeveloped area, the document states, "the undeveloped area was divided into three exposure areas based on similar concentrations and proximity of sampling zones." Although it may be appropriate in risk assessment to take into consideration physical characteristics of the Site "with respect to those characteristics that influence exposure" (U.S. EPA 1989<sup>3</sup>), subdividing a site to aggregate similar concentration values is arbitrary and inappropriate. The result for this Site is that, because of the small number of samples included in each subset of the*

undeveloped area, the calculated EPCs are higher than they would be if averaged over a greater area. This comment is particularly relevant for Undeveloped Area-A, where only 5 sample values are included and the EPC represented is the maximum concentration detected in this small area. Without a clear rationale for how exposures may be different in different areas of the Site, subdivision of exposure areas should not have been included in the assessment of this Site. Additionally, the use of the derived EPCs in blood lead modeling is inappropriate. This is discussed further in Specific Comment number 3, below.

Section 3.6, EPCs in Surface Soils. The risk assessment is correct that "the EPC should be the estimate of average arsenic concentration measured over the area to which an individual would be exposed," and that for most chemicals "EPA recommends the use of the 95% UCLM as the appropriate estimate of the average site concentration." For lead, however, the average concentration is specified as the input value for the pharmacokinetic models used to estimate blood lead concentrations from environmental sources. For example, the Guidance Manual for application of the IEUBK model for assessing children's exposure to lead recommends "using a simple average or arithmetic mean of soil lead concentrations from a representative area" (U.S. EPA, 1994<sup>4</sup>). Similarly, the EPA recommendations for adult lead modeling specify that the "average concentration in assessed individual exposure area" be used as the input value for soil concentrations (U.S. EPA, 2003<sup>5</sup>). Therefore, it is incorrect to use the 95% UCLM (or the maximum, if the UCLM exceeds the maximum detected site concentration), and the appropriate EPC for lead at the Site should be revised to reflect the simple average lead concentrations in each exposure area. Specifically, this results in EPCs for lead of 236 mg/kg in the commercial soils, and 1,172 mg/kg in the Undeveloped Area. This section of the assessment, Table 4 (which presents EPCs), and risk characterization for lead should be updated to reflect the incorporation of the appropriate average statistic for blood lead modeling.

Section 3.7.2, Lead Exposures. The use of a combination of central tendency (CT) and reasonable maximum exposure (RME) inputs is not appropriate in application of blood lead modeling (U.S. EPA 1994, 2003). The distribution of blood lead levels is modeled based on inputs of central tendency estimates, with higher end estimates of risk accounted for by incorporation of the geometric standard deviation (GSD) in the model. Although default soil ingestion rates in the Adult Lead Exposure Model (ALM) used in the assessment for the Site are set to 50 mg/day, this assumes a full day of exposure. Application of the ALM for workers and visitors to the Site should be adjusted to reflect CT estimates of soil ingestion.

