

FIRST FIVE YEAR REVIEW REPORT

KENNECOTT SOUTH ZONE

**OU3 Butterfield Mine, Butterfield Canyon/Creek,
Herriman Residential Lands
Herriman Agricultural Lands
OU6 Lark Waste Rock & Tailings
OU7 South Jordan Evaporation Ponds
OU17 Bastian Sink
OU18 Acid Mine Drainage**

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LIST OF ACRONYMS & DEFINITIONS

Agencies	Collectively the U.S. Environmental Protection Agency Region VIII & Utah Department of Environmental Quality
AOC	Administrative Order on Consent
ARARS	Applicable or Relevant and Appropriate Requirements
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC(s)	Contaminant of Concern(s)
CWA	Clean Water Act
DERR	Utah Division of Environmental Response & Remediation
DOGM	Utah Division of Oil, Gas and Mining
DWQ	Utah Division of Water Quality
EPA	United States Environmental Protection Agency Region VIII
Facilities or facilities	Operational, waste disposal, or waste impacted portions of an OU
gpm	Gallons per minute
HAG	Herriman Agricultural Ground
IC(s)	Institutional Control(s)
Kennecott	Kennecott Utah Copper Corporation
NAMS	North American Mine Services
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPL	National Priorities List
mg/kg	Milligram per Kilogram
mg/l	Milligram per liter
O&M	Operation and Maintenance
O,M&R	Operation, Maintenance & Replacement
OSHA	Occupational Safety and Health Act
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PA/SI	Preliminary Assessment/Site Investigation
RA	Remedial Action
RAO(s)	Remedial Action Objective(s)
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
ROD	Record of Decision
RP	Responsible Party
SARA	Superfund Amendments and Reauthorization Act
SAS	Superfund Alternative Sites
UU/UE	Unrestricted Land Use/Unrestricted Exposure (standard)
UDEQ	Utah Department of Environmental Quality
UPDES	Utah Pollution Discharge Elimination System

EXECUTIVE SUMMARY

Utah Department of Environmental Quality (UDEQ) has conducted the first five-year review of the remedial actions implemented at Operable Units (OUs) No. 3 (Butterfield Mine & Canyon/Creek, Herriman Residential & Agricultural Lands), No. 6 Lark Waste Rock & Tailings, No. 7 South Jordan Evaporation Ponds, No. 17 Bastian Sink, and No. 18 (Acid Mine Drainage, including Tunnel & Dump sites, in Tooele County) of the Kennecott South Zone site, located in Herriman, unincorporated Salt Lake County and in unincorporated Tooele County, Utah. The review was conducted from June 2008 through March 2009. The results of the five-year review indicate that portions of the various remedies are protective of human health and the environment.

- Operable Unit No. 3 is a large operable unit comprised of Butterfield Mine, Canyon & Creek and the Herriman Residential & Agricultural Lands. For the most part the areas comprising OU3 were found to be protective of human health based on current land use. The surface soils on the affected properties were found to be stable. Some previously capped areas within Butterfield Canyon were recognized during this review. Development activities within the Herriman Residential & Agricultural Lands were largely in areas of non-impact within the City of Herriman's jurisdiction (but some notable large developments on impacted agricultural lands were being overseen by the City). The selected remedy of institutional controls (ICs) was found not to be universally applied to portions of OU3 and pertinent ARARS were noted not to have been listed in the 2001 Kennecott South Zone Record of Decision (ROD). Some mapping, ICs development and ARARs incorporation were recommended as part of this review.
- Operable Unit No. 6 is a large operable unit comprised of Lark Waste Rock & Tailings and ancillary facilities. For the most part the areas comprising OU6 were found to be protective of human health based on current land use. The surface soils on the affected properties were found to be stable. UDEQ assessed that the Lark Waste Rock removal action was successful to reach the cleanup goals of 1000 mg/kg lead and 100 mg/kg arsenic (even though UDEQ noted the lack of a risk assessment, these were the cleanup goals selected under the Administrative Order on Consent (AOC)). UDEQ also assessed that soils with elevated lead and arsenic above potentially applicable unrestricted land use/unrestricted exposure standards for lead and arsenic still exist on site at Lark Tailings and ancillary facilities. As part of this five-year review it has been recommended that the Lark Tailings and ancillary facilities be mapped and appropriate institutional controls be developed with the applicable land owners.
- Operable Unit No. 7 South Jordan Evaporation Ponds, Operable Unit No. 17 Bastian Sink & other ancillary facilities were observed to be in a stable condition and supportive of current land use (i.e. residential, commercial, recreational). The removal work performed by Kennecott Land in 2006-2007 was found to have attained the residential land use standards (700 mg/kg lead and 100 mg/kg arsenic, respectively) at OU7 and OU17. Except for the new work to review, the response actions at the Bastian Ditch, Pond A0 & F, and the Evaporation Ponds Canal and Tailwater Ditches, and to oversee the implementation of removal actions along the historical rail corridors associated with OU1, no further response action is being planned at this time. Since no waste is left in place above the residential standards established by the Agencies, no further five-year reviews will be necessary and protectiveness statements were not needed for this five-year review. For further explanation see Appendix J.

- Operable Unit No. 18, Acid Mine Drainage (Tunnels & Dump sites) in Tooele County was determined to be stable and the selected remedies were deemed to still be protective. The primary site of concern in this Operable Unit is the Utah Metals Tunnel and Utah Metals Tunnel Dump site in Middle Canyon, Tooele County. The water from the tunnel is now directed from the portal of the dump (via pipe) to the base of the Dump's western embankment. Revegetation efforts were found to be progressing to cover the dump surface. No waste rock was found in the Middle Creek channel. Management of the Utah Metals Tunnel and Utah Metals Tunnel Dump is recommended to be continued by Kennecott Utah Copper Corporation under the pending Site Wide Management Plan for wastes left in place.

Areas of concern (i.e. issues) include: (1) Limited sampling data to independently verify the condition of post remediated surfaces on properties within the City of Herriman boundaries, (2) No ICs program implemented by the planning and engineering divisions of Salt Lake County to facilitate the management of soils during proposed land use changes, (3) No formal federal and state Applicable or Relevant and Appropriate Requirements (ARARs) to cover soil removal activities on Herriman Residential & Agricultural lands, (4) Soils above potentially applicable Unrestricted Land Use/Unrestricted Exposure (UU/UE) standards for lead and arsenic in OU6 with no ICs to control changes in land use, (5) No formal federal and state ARARs to ensure proper management of soils within OU6, (6) Site management reports for the Utah Metals Tunnel and Utah Metals Tunnel Dump have been infrequently provided to UDERR, (7) Areas with soils exceeding potentially applicable unrestricted land use/unrestricted exposure standards for lead and arsenic buried or near the surface.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site name (from WasteLAN): Kennecott South Zone		
EPA ID (from WasteLAN): UTD000826404		
Region: 8	State: UT	City/County: City of Herriman, City of South Jordan, Salt Lake County & Tooele County, Utah
SITE STATUS		
NPL status: <input type="checkbox"/> Proposed <input type="checkbox"/> Final <input type="checkbox"/> Deleted <input checked="" type="checkbox"/> Proposal Withdrawn		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input type="checkbox"/> Complete		
Multiple OUs? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Construction completion date: N/A	
Has site been put into reuse? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
REVIEW STATUS		
Reviewing agency: <input type="checkbox"/> EPA <input checked="" type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency		
Author name: Douglas Bacon		
Author title: Remedial Project Manager/Environmental Scientist	Author affiliation: UDEQ	
Review period: June 2008 to March 2009		
Date(s) of site inspection: June 26, 2008 and September 25, 2008		
Type of review: <input checked="" type="checkbox"/> Statutory <input type="checkbox"/> Policy (<input type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-Sara <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion)		
Review number: <input checked="" type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify)		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction <input type="checkbox"/> Actual RA Start at OU # ___ <input type="checkbox"/> Construction Completion <input type="checkbox"/> Previous Five-Year Review Report <input checked="" type="checkbox"/> Other (specify): UDEQ plan entitled <i>Five Year Review Schedule & Operable Unit Inclusion</i> (dated February 14, 2008) establishes triggers for five-year review.		
Triggering action date (from WasteLAN):		
Due date (SCAP GOAL): 04/30/09		

Five Year Review Summary Form

Issues:

The following issues affect current protectiveness of the selected remedies at the noted operable units:

- (OU3) Up-gradient waste rock piles located in the side drainages of Butterfield Canyon (if left uncontrolled) could by erosion and migration potentially cause a reintroduction of waste rock into the remediated areas of Butterfield Canyon.
- (OU3) Trash and general refuse debris was located around Eva's Pond, a small wetland pond once used as a debris catch basin during removal actions in Butterfield Canyon and Creek.
- (OU3) At the confluence of Saints Rest and Yosemite drainages (with Butterfield Canyon) there are buried soils that exceed potentially applicable unrestricted land use/unrestricted exposure (UU/UE) standards for lead and arsenic.
- (OU3) ICs program by the City of Herriman is being revised. UDEQ has developed some concerns during a review of the proposed procedures. If the revisions by the City of Herriman lessen the protectiveness of the ICs, the remedy may be at risk.
- (OU6) In the areas of the Lark Tailings reclamation work and the noted ancillary sites there is the potential for materials (soils or mixed soils/tailings) with lead and arsenic above potentially applicable UU/UE standards for lead and arsenic.
- (OU18) A map of the Utah Metals Tunnel and Utah Metals Tunnel Dump site has not been submitted as of yet by Kennecott Utah Copper Corporation. The required work under the North Zone & South Zone ROD of 2002 has not been completed, work plans are pending.
- (OU18) Site management annual inspection reports from Kennecott Utah Copper Corporation for the Utah Metals Tunnel and Utah Metals Tunnel Dump have not been successively submitted to UDEQ since the selection of the remedial action, listed in the North Zone & South Zone ROD of 2002.

The following issues could effect current protectiveness of selected remedies, at the noted operable units:

- (OU3) At the confluence of Saints Rest and Yosemite drainages (with Butterfield Canyon) there are buried soils that exceed potentially applicable unrestricted land use/unrestricted exposure standards for lead and arsenic.
- (OU3) Residential Lands in the City of Herriman had a removal action performed upon them, and in some locations elevated concentrations of lead and arsenic may still exist under an 18 inch soil cover. Mapping and institutional knowledge of these Residential Lands is limited.
- (OU3) Pasture lots or extended lots at residential properties were not universally addressed during the removal work and subsequently could have elevated lead and arsenic concentrations in the surface and near surface soils. Un-controlled land use changes could cause a release or a risk of exposure to the public.
- (OU3) The selected remedy (i.e. ICs program) for the City of Herriman to oversee the management of soils with elevated concentrations of lead and arsenic (above certain land use standards) does not require independent verification (by the overseeing authorities) that the post remediated surface meets the land use standards listed in the 2001 Record of Decision. ICs program is a self certification program.
- (OU3) No ARARs were listed in the ROD for the ICs program, required as the remedy for the Community of Herriman.
- (OU3) There is no ICs program that could be verified as implemented by the engineering and planning divisions of Salt Lake County to oversee the redevelopment of residential or agricultural properties (within the County's jurisdiction) around the City of Herriman.
- (OU3) Some recent re-development projects at some of the agricultural properties in the City of Herriman may have left soils on site with elevated lead and arsenic concentrations, concentration is currently unknown.
- (OU6) In the areas of the Lark Tailings reclamation work and the noted ancillary sites there is the potential for materials (soils or mixed soils/tailings) with lead and arsenic above potentially applicable UU/UE standards for lead and arsenic.

Five Year Review Summary Form

Recommendations and Follow-Up Actions:

For issues that do not affect current protectiveness:

- (OU3) During subsequent five-year reviews, compliance by Kennecott Utah Copper Corporation with their UPDES, Stormwater and Groundwater Protection permits should be reviewed.
- (OU3) Salt Lake County Parks & Recreation and Public Works departments should be notified about trash build-up in certain locations in Butterfield Canyon (i.e. Eva's pond) and suggest they notify local service organization (i.e. Boy Scout of America, Girl Scouts of America) about canyon cleanup service project opportunities.
- (OU3) The Agencies (UDEQ & EPA) should adopt UU/UE standards for lead and arsenic, develop an ICs program coordinating with Kennecott and Salt Lake County, perform an ARARs analysis and continue to perform five year reviews for the Butterfield Canyon confluences with Saints Rest and Yosemite drainages.
- (OU3) UDEQ should provide the City of Herriman with comments concerning information and procedural gaps observed by UDEQ in the proposed revised ICs program.
- (OU6) The Agencies should adopt UU/UE standards for lead and arsenic, develop an ICs program coordinating with Kennecott and Salt Lake County, perform an ARARs analysis and continue to perform five year reviews for the Lark Tailings area and the ancillary facilities at OU6.
- (OU18) As part of the Site Wide Management Plan for wastes left in place (a plan to be submitted by Kennecott Utah Copper Company as part of the pending North Zone & South Zone Consent Decree) a map for the Utah Metals Tunnel and Utah Metals Tunnel Dump site should be submitted as part of the management plan.
- (OU18) As part of the Site Wide Management Plan for wastes left in place (a plan to be submitted by Kennecott Utah Copper Company as part of the pending North Zone & South Zone consent decree) a schedule for annual inspection reports for the Utah Metals Tunnel and Utah Metals Tunnel Dump should be included.

For issues that could affect current protectiveness:

- (OU3) The Agencies should adopt UU/UE standards for lead and arsenic, develop an ICs program coordinating with Kennecott and Salt Lake County, perform an ARARs analysis and continue to perform five year reviews for the Butterfield Canyon confluences with Saints Rest and Yosemite drainages.
- (OU3) UDEQ could assist the City of Herriman to verify they have pertinent records for the residential properties that have elevated lead and arsenic concentrations above specified land use standards listed in the 2001 Record of Decision, below an existing 18 inch soil cover or on in the surface and near surface soils of pasture lots & extended backyards.
- (OU3) UDEQ could verify with the City of Herriman that they are in receipt of records denoting the location of pasture lots and extended "backyards" that did not undergo a removal action to address elevated concentrations of lead and arsenic. UDEQ will verify that land use on these areas has not changed since the selection of the remedial activities and implementation of response work, and ensure that development on these areas will be overseen by the City of Herriman's ICs program.
- (OU3) On a limited basis (and after acquisition of access agreements) the Agencies could screen biased locations on properties that have recently undergone a remedial action as part of development, pursuant to the ICs program of the City of Herriman.
- (OU3) The Agencies should do a reanalysis of the ARARs for the selected remedy (ICs) for the Community of Herriman.
- (OU3) The Agencies will coordinate outreach to the engineering and planning divisions of Salt Lake County to negotiate and assist them with development of an ICs program they can use to oversee the proper management of soils with elevated lead and arsenic above applicable land use standards established in the September 2001 Kennecott South Zone ROD, during future redevelopment of residential and agricultural lands within their jurisdiction around the City of Herriman.
- (OU6) The Agencies should adopt UU/UE standards for lead and arsenic, develop an ICs program coordinating with Kennecott and Salt Lake County, perform an ARARs analysis and continue to perform five year reviews for the Lark Tailings area and the ancillary facilities at OU6.

Five Year Review Summary Form

Protectiveness Statement:

- **OU3 Butterfield Mine, Butterfield Canyon & Creek, Herriman Residential and Agricultural Lands (City of Herriman and Salt Lake County):**

The remedy for OU3 is not protective because: (1) potential redevelopment (i.e. change in land use) on portions of the operable unit is not managed through an ICs program, (2) the current ICs program in the City of Herriman is a "self certification" program which lacks independent verification of statements made by building permit applicants that a site is protective for the intended land use, (3) there are no listed ARARs for the selected remedy.

- **OU6 Lark Waste Rock & Tailings and ancillary facilities:** The remedy for the Lark Waste Rock removal project is protective of human health and the environment for current (industrial, open space) and potentially applicable future land use (open space, agricultural, residential) because the response work removed materials above the cleanup goals. The remedy for Lark Tailings (re-grading and cover) and the ancillary facilities (some characterization, some hotspot removals) is protective of human health and the environment for current land use applications (i.e. open space and agricultural).

Development of ICs for the Lark Tailings area and ancillary facilities will ensure that if (in the future) the land use changes, the soils at these two sites are investigated to determine if they support the intended land use.

- **OU18 Acid Mine Drainage:** The remedy at Operable Unit 18 is protective of human health and the environment. Source controls are in place at the Water Supply Tunnel and Water Supply Tunnel Dump and are being maintained and operated in compliance with the September 2002 North Zone & South Zone ROD. These controls are being monitored by Kennecott. The response action (stabilization of the waste rock in the dump and prevention of erosion) remains intact and there were no new impacts to the remediated area.

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FIRST FIVE YEAR REVIEW
BUTTERFIELD MINE & CANYON/CREEK, HERRIMAN
RESIDENTIAL & AGRICULTURAL LANDS, LARK WASTE ROCK &
TAILINGS, SOUTH JORDAN EVAPORATION PONDS, BASTIAN
SINK, ACID MINE DRAINAGE & DUMP SITES IN TOOELE COUNTY
KENNECOTT SOUTH ZONE
OUs 3, 6, 7, 17 &18

I. INTRODUCTION

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings and conclusions of reviews are documented in five-year review reports. In addition, five-year reviews reports identify issues found during the review, if any, and identify recommendations to address them.

UDEQ is preparing this five-year review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

UDEQ interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The UDEQ conducted the five-year review of the remedies or response work implemented at Operable Units 3, 6, 7, 17, & 18 of the Kennecott South Zone site, located in Salt Lake and Tooele Counties, Utah. This review was conducted by the Utah Department of Environmental Quality, UDEQ, Division of Environmental Response & Remediation, DERR, project manager (Mr. Douglas Bacon) on behalf of the United States Environmental Protection Agency Region VIII, EPA, (Rebecca Thomas, Remedial Project Manager). The review ran from June 2008 through March 2009. This report documents the results of the review.

This is the first five-year review for Operable Units No. 3, 6, 7, 17 & 18 of the Kennecott South Zone site. The triggering action for this statutory review was the completion of remedial action for OU3, 6, & 7 under the remedial design/remedial action consent decree of January 2003 and the agreed upon deferment by EPA Region VIII and UDEQ in the

document entitled *Five Year Review Schedule & Operable Unit Inclusion* dated February 14, 2008.

A. Scope of this First Five Year Review Report

The Kennecott Sites, Kennecott North Zone and Kennecott South Zone, were divided into 24 operable units (OUs). Later, two of the operable units were addressed as separate sites (Old Cobalt Ponds Removal Action and International Smelter and Refining NPL Site, OUs 20 & 21). Under the UDEQ document entitled *Five Year Review Schedule & Operable Unit Inclusion* dated February 14, 2008, EPA and UDEQ agreed to a reorganization of the operable units requiring a five-year review, and the timing for such. A summary of the operable units requiring a five-year review and triggers for such is given as follows (please note per agreement between EPA and UDEQ reviews are slated for performance and completion within a calendar year cycle, unless subsequently agreed upon by the parties to change):

Table 1 – Operable Units and Five Year Review Triggers

Operable Unit Groups/Area	Operable Units	Five Year Trigger	Date of First or Subsequent Five Year Reviews
No. 1 - South Zone Bingham Creek Area and operational areas	1, 5, 10, 11, 24	First Five Year Review completed in June 2004	June 2009
No. 2 - South Zone, SW Jordan Valley ground water plumes and Bingham Canyon underflow	2, 16	Remedial action Consent Decree May 2008	December 2013 [♦]
No. 3 - South Zone Butterfield Creek area and Tooele County areas	3, 18 [†]	Remedial Action Consent Decree 2003, and agreed upon deferment of the FYR start	September 2009
No. 4 – North Zone operational areas and AOC removal sites	8, 13, 14, 15, 19, 22, 23, Bingham Magna Ditch	Remedial Design and Remedial Action start still in progress or implemented, Design and Action to be finalized by Consent Decree	Not Scheduled / To Be Determined *

* Pursuant to the UDEQ document entitled *Five Year Review Schedule & Operable Unit Inclusion* dated February 14, 2008, EPA Region VIII and UDEQ agreed to defer scheduling until the Remedial Design (RD) and Remedial Action (RA) activities are completed during the negotiations of the North Zone & South Zone consent decree for said action.

[†] Pursuant to EPA Region VIII Enforcement requests, UDEQ included Operable Units No. 6, 7, & 17 in the five-year review and report for group No. 3 (midway through the review).

[♦] Pursuant to the UDEQ document entitled *Five Year Review Schedule & Operable Unit Inclusion* dated February 14, 2008, EPA Region VIII and UDEQ agreed to defer the five-

year review for Group No. 2 until five years from the RDCD date (a document which included the acceptance of the remedial action completion report).

Subsequent to the initiation of negotiations on the North Zone- South Zone remedial design/remedial action consent decree, UDEQ investigated reports of soils exceeding unrestricted land use/unrestricted exposure (UU/UE) standards capped or left at the surface in Operable Units No. 3, 6, 7 & 17. Though the agency agreement dated February 14, 2008 noted OU6, OU7 & OU17 did not need a five-year review, EPA and UDEQ agreed that this five-year review would investigate the noted reports of capped soils.

Though outside the normal process, this report covers the closure determinations for Operable Units No. 7 & No. 17 in Appendix J of this report. The following chapters may allude periodically to OU7 & OU17 but for the more detail description on the closure recommendations, please refer to Appendix J.

II. Site Chronology

OUs No. 3, 6 & 18 of the Kennecott South Zone site were addressed at separate times during the progression of the CERCLA investigations. As such, the chronology of each OU is provided in separate tables below.

As requested by EPA Region VIII – Enforcement, UDEQ included a shortened review of OUs 7 & 17, simply to acknowledge the formal remedial action at these operable units was completed (refer to Appendix J). This was done to facilitate the completion of the Kennecott North Zone & South Zone Consent Decree. Per advice from Region VIII, this shortened review did not require the traditional categories of a five-year review report, hence the chronology of events at these two OUs is not provided in this Chapter.

Table 2 – Chronology of actions at OU3 Butterfield Mine (source, Sept. 2001 Kennecott South Zone ROD for OU3, 6, 7)

Date	Activity
1991	Preliminary Assessment and Site Investigation study
1991	Administrative Order on Consent for removal project, Butterfield Mine Waste Rock (including Castro Gulch Waste Rock)
1991 – 1993	Removal work implementation
1993	Final removal report received
1993	Final site inspection
1994	Close out of Administrative Order
2001	Record of Decision
2003	Remedial Design Consent Decree entered
2008	Site Inspection for Five Year Review

Table 3 – Chronology of action at OU3 Butterfield Canyon and Creek (source, Sept. 2001 Kennecott South Zone ROD for OU3, 6, 7)

Date	Activity
1994	Assessment of on-site historic facilities
1997	Administrative Order on Consent for removal project to address tailings and waste rock, establishment of sediment traps and implement monitoring of creek.

Pending	Final site inspection
Pending	Close out of Removal Order
2001	Record of Decision
2003	Remedial Design Consent Decree entered
2008	Site Inspection for Five Year Review

Table 4 – Chronology of action at OU3 Herriman Residential and Agricultural Lands
(source, Sept. 2001 Kennecott South Zone ROD for OU3, 6, 7)

Date	Activity
1994	Initial assessment
1996-97	Removal assessment
1997	Removal project for Herriman Residential Soils, Administrative Order on Consent
1998	Amendment to Administrative Order on Consent to cover another two years of removal activities
1998	Preliminary assessment of Herriman agricultural lands
1999	Assessment of Herriman agricultural lands
Pending	Close out of removal project
2001	Record of Decision
2003	Remedial Design Consent Decree entered (did not include fund lead portion of the project)
2008	Site Inspection for Five Year Review

Table 5- Chronology of actions at OU6 Lark Waste Rock & Tailings

Date	Activity
1986	CERCLA Preliminary Assessment and Site Investigation for State Motorcycle Park and for Lark Tailings determined the existence of elevated concentrations of hazardous substances in the soils of the sites.
1988	Kennecott cancels lease with Herriman Irrigation Co. for use of Bingham Tunnel water. State had expressed concern that the water quality was not good enough for irrigation purposes.
1989	Kennecott (or State) cancels the lease for the State Motorcycle Park due to fugitive dust problems.
1991	Site wide CERCLA Consent Decree negotiations begin with EPA, UDEQ and Kennecott. Listing activities put on hold.
1993	EPA approves Work Plan for Lark area and cleanup begins with oversight by EPA and UDEQ.
1994	UDEQ conducts study of all watersheds in the area. Included in this study were Midas Creek and Copper Creek. These are similar to PA/SI investigations.
1994	Kennecott begins study of all historic facilities on their property including: Mascotte Pond, Copper Gulch, Midas Silo, and Randolph Peterson Gate. These are similar to PA/SI investigations.
1995	Cleanup work completed on first phase of Lark Removal.

1995	Parties reach agreement to continue cleanups under the provisions of a Memorandum of Understanding. Kennecott agrees to continue cleanups; EPA and UDEQ agree to take no further action regarding listing of the site.
1998	Administrative Order on Consent is signed by EPA and Kennecott to cover previous cleanup activities in the Lark area.
1998	Site is expanded to include cleanup of nearby historic facilities including Copper Creek, Mascotte Pond, Midas Silo, Mascotte Tailings, and Lone Tree.
1998	Final report and all amendments received.
1995, 1998	Final site inspections.
1998	Administrative Order closed out.
2001	Record of Decision
2003	Remedial Design Consent Decree entered

Table 6- Chronology of actions at OU18 Utah Metals Tunnel and Dump, Other Tunnels and Dumps

Date	Activity
1993 - 1995	Ecological risk assessment sample collections in Pine Canyon and along the crest of the Oquirrh Mountains.
1995	Site investigation (grab samples of soil, waste rock, water) of the Utah Metals Tunnel Dump, and Bingham West Dip Tunnel.
2000 – onward	Routine monitoring of water quality under the existing UPDES permit for the Pine Canyon area.
2001	Relaxed slopes of the Utah Metals Tunnel Dump, Stabilized Middle Canyon Creek channel, and Revegetated the Utah Metals Tunnel Dump.

III. Background

A. General history of the OUs

Cleanups began in and around Butterfield Mine (Kennecott South Zone OU3) from 1991 to 1993 to address waste rock (Butterfield Waste Rock Site No. R2, AOC CERCLA VIII-91-18). Assessment and cleanup of tailings from historical mill operations in Butterfield Canyon (near the confluences of Yosemite and Saints Rests drainages) was initiated around 1997 (Butterfield Canyon Site, SSID No. 08-R2, AOC CERCLA VIII-97-09). Pursuant to the removal actions in the Canyon monitoring of Butterfield Creek was undertaken to assess the lead and arsenic concentration in the Total Suspended Solids load of Butterfield Creek for 4 years. This monitoring ceased in 2001 with agreement by UDEQ (on behalf of EPA).

Characterization/removal action was conducted on 85 residential lands in the City of Herriman from 1997 to 1999. In some cases the residential cleanup left elevated concentrations of lead and arsenic at depth under a minimum 18 inch soil cover. Characterization of agricultural lands in Herriman was performed from 1998 to 1999. These characterization and cleanup actions were pursued under Administrative Orders on

Consent (AOCs) negotiated between EPA and the responsible party (RP), Kennecott Utah Copper Corporation (Kennecott). Later, to ensure proper management of soils with elevated concentrations of lead and arsenic on agricultural properties (as well as the residential properties with contaminants of concern left at depth) during future redevelopment activities, an institutional controls (ICs) only Record of Decision (ROD) was issued for OU3 by EPA in September, 2001.

Response action (i.e. characterization, regrading and removal work) was performed in and around OU6 Lark Waste Rock and Tailings, and the ancillary facilities to the site, from 1993 to 1994 to address waste rock and tailings left at the site (Administrative Order on Consent Docket CERCLA VIII-98-09). The waste rock removal project addressed waste rock from the drilling of on-site tunnels or other mining operations with a lead and arsenic concentration greater than 1000 mg/kg and 100 mg/kg respectively. After characterization efforts, the area of Lark Tailings (sourced to the reworking of existing mill tailings by Ohio Copper Company) was re-graded and covered. Ancillary facilities in OU6 received some characterization and some soil removal actions.

Response action (i.e. characterization, removal, and consolidation work) was performed in and around the South Jordan Evaporation Ponds (Kennecott South Zone OU7) and the Bastian Sink (Kennecott South Zone OU17) from 1994 through 1995. Initial characterization and removal work at OU7 was performed under an Administrative Order on Consent Docket No. CERCLA-VIII-94-18. The early response work left consolidated sulfate sludge in the two capped ponds onsite, which were subsequently removed by Kennecott Land from 2006 to 2007. Kennecott Land's response work was reported to and approved by the Agencies in December 2007.

Initial characterization of the Bastian Sink (OU17) was performed under Unilateral Administrative Order Docket No. CERCLA-VIII-93-06. Subsequent removal action in OU17 was performed by Kennecott Land from 2006 to 2007. Kennecott Land's response work was reported to and approved by the Agencies in December 2007. Please refer to Appendix J for the substantive discussion of OU7 & 17.

Pursuant to initial characterization efforts overseen by UDEQ, Kennecott assessed the nature and extent of contamination (if any) at the various tunnels, adits and dumps existing along the Oquirrh Mountains front, in Tooele County from 1996 to 2000. The Utah Metals Tunnel Dump (waste rock with elevated lead concentrations) underwent a remedial effort to relax the slopes, stabilize the drainage channel and revegetate the Dump slopes in 2001 pursuant to a negotiated work plan under the Environmental On-site and Off-site Assessment program. Further reclamation work was pursued by Kennecott in 2006 and 2007.

In general, cleanups began in and on the operable units of the Kennecott South Zone (i.e. OU3, OU6, OU7 and OU17) as removal actions; OU18 was handled initially as a preliminary assessment/site investigation activity. Concurrent with these actions, EPA began negotiations with Kennecott on a then-novel concept involving cleaning up mining wastes without listing the site on the NPL. In order to streamline the responses, most of the cleanups at the site were performed using the removal authorities of CERCLA, under the provisions of AOCs as noted above. This approach was called at the time an Enforcement Pilot. More recently, sites where this approach has been used have been called non-NPL sites, NPL equivalent, NPL-alternative sites or Superfund Alternative Sites (SAS).

One of the principal concepts used by EPA and UDEQ for management of these cleanups was that the responses would be equivalent to the responses which would have been required had the site been listed on the NPL. This concept included quality of the cleanups, risk assessments, and community involvement. In all cases, the requirements of CERCLA and the NCP for response at NPL sites was achieved or exceeded. There was a strong commitment to community involvement as well.

B. OU Specific History – Operational Background & Remedy

1. OU3 Butterfield Mine, Canyon & Creek, Herriman Residential & Agricultural Lands: OU3 is composed of several subunits.
 - a. Butterfield Mine: The Butterfield Mine is located about 2.5 miles up-gradient of the mouth of the Butterfield Canyon. Waste rock from the Mine was deposited in the bottom and along the sides of the canyon. Waste rock was found on 14 acres, amounting to about 1.4 million tons. The Butterfield Mine adit has a flow which discharges into Butterfield creek. It has a Utah Pollution Discharge Elimination System (UPDES) permit. Butterfield Creek runs through the site.

As part of the removal work, a temporary sedimentation pond was installed downstream along Butterfield Creek to trap construction debris. Because the pond attracted wildlife and a diversity of wetland plants the pond was left after construction. By reference, under the project the pond has been called “Eva’s Pond”. The Butterfield Mine Tunnel portal still exists on site and still discharges water drained from the mining shaft and interconnecting tunnel workings. As noted above, the discharge from the tunnel is covered by a UPDES permit. A Salt Lake County road, which transects the site, was reconstructed after the removal of the waste rock, and is only open in the summer.
 - i. Remedy for Butterfield Mine: The removal action for Butterfield Mine addressed 14.23 acres of waste rock deposited approximately 2.5 miles up Butterfield Canyon, on the eastern slopes of the Oquirrh Mountains in Salt Lake County. The work was conducted by Kennecott under the supervision of EPA. Approximately 1.4 million tons of waste rock with a maximum lead and arsenic concentration of 13,900 mg/kg (milligrams per kilogram) and 501 mg/kg (respectively) and a mean concentration of lead and arsenic of 6643 mg/kg and 327 mg/kg (respectively) were removed and placed in a repository in Castro Gulch behind the storm water collection system (“Eastside Collection System”). Post-removal surface sampling documented a maximum lead and arsenic concentration of 550 mg/kg and 150 mg/kg (respectively) and a mean lead and arsenic concentration of 143 mg/kg and 31 mg/kg (respectively).
 - b. OU3 Butterfield Canyon and Creek: Also in the Butterfield Canyon area were deposits of tailings left by early milling operations in the Canyon. Tailings were observed in the confluence area of Saints Rests and Butterfield Creek drainages, and in the confluence area of Yosemite and Butterfield Creek drainages. The tailings were deposited on both sides of Butterfield Creek. The tailings found at the site amounted to 25,050 cubic yards. Within and up-gradient of Butterfield Canyon and its drainage, are the locations of several mining and milling

operations and waste deposits. These include: Revere Mill, Yosemite Mill, Brooklyn Mill, Holt Mill, Queens Mine and Mill, Blackjack Gulch Mines, St. Joes Mine, Yosemite Gulch Mines, Saints Rest Mines.

- i. Remedy for Butterfield Canyon and Creek: The removal action in Butterfield Canyon addressed approximately 5 acres, located between the mouth of the Canyon and the site of the Butterfield Mine, and some of the side canyon drainages (i.e. Queen, Olson, Castro, Yosemite, Saints Rest, Black Jack and St. James). During removal a number of artifacts dating to early mine activities were unearthed and a number of historic milling operations were addressed. Approximately 25,050 cubic yards of tailings material was removed to the Bluewater Repository by Kennecott with supervision from EPA. The tailings material removed (from the Yosemite and Saints Rest Gulches at their confluence with Butterfield Canyon) had a maximum lead and arsenic concentration of 65,900 mg/kg and 819 mg/kg (respectively), and a mean lead and arsenic concentration of 12,400 mg/kg and 136 mg/kg (respectively). Post removal surfaces were analyzed and shown to have a maximum lead and arsenic concentration of 1420 mg/kg and 51 mg/kg (respectively) and a mean lead and arsenic concentration of 427 mg/kg and 18.2 mg/kg (respectively). Removal actions in the Saints Rest and Butterfield Canyon drainage confluence areas on average removed 3 feet of mixed material (tailings and soils); similar action in the area of Yosemite and Butterfield Canyon addressed 1 to 2 feet of mixed material (tailings and soils). Both removal areas were brought back up to grade with on average an 18 inch soil cover, but in some places even thicker.

Other historic facilities investigated in the canyon (i.e. located and characterized, located and found buried by the up-gradient waste rock piles, or located, characterized and removed) included the Revere Mill, Yosemite Mill, Brooklyn Mill, and Holt Mill. Of these, the Holt Mill was suspected to be located in an alfalfa field downstream of the mouth of Butterfield Canyon. Based upon the known historical information concerning the ore body and other milling operations in the canyon, it is known that this mill processed lead ores; however the location of wastes left over are unknown as is the potential volume of said wastes. The suspected location of the mill was sampled and no traces of milling or mining activities were found. Local residents believe that filling operations in the 1950s buried this operation. The Yosemite and Brooklyn Mills are located in the Yosemite drainage. Lead ores were delivered to the mills via a tram from Yosemite #1 and #2 mines (and other sources); tailings from the mill were sluiced down the drainage. The Yosemite and Brooklyn Mill footprints were not addressed during the removal action (they are up-gradient of the Eastside Collection System and buried by the Bingham Canyon Waste Rock Dumps in the upper reaches of the Yosemite drainage). The Revere Mill located at the confluence of Saints Rest and Butterfield Canyon was a stamp mill/concentrator that from the late 1800's to the early 1900's processed lead ores received via tram from mines in Yosemite and elsewhere. The Revere Mill tailings were reported to have a 3.2% lead content. The Revere Mill footprint was removed during the tailings removal project.

During the tailings removal action in the Yosemite and Saints Rest drainage and confluence areas with Butterfield Canyon, sedimentation basins were constructed in Butterfield Creek. These basins were installed to control debris migration downstream during the removal work. For a period of 4 years (1997 to 2001) Kennecott monitored the water quality of Butterfield Creek near the Canyon mouth for lead and arsenic concentrations (EPA established a limit for lead of 500 mg/kg) in the Total Suspended Solids. In 1999 the sedimentation basins were removed per agreement between Kennecott and the Utah Department of Natural Resources. In 2002 Kennecott reported on the monitoring activity in Butterfield Creek (see Appendix C - Kennecott Utah Copper report entitled *Final Report for Compliance Monitoring of Suspended Solids in Butterfield Creek* dated January 18, 2002).

The side drainages (or gulches) to Butterfield Canyon (i.e., Queen, Olson, Castro, Yosemite, Saints Rest, Black Jack and St. James) have waste rock dumps located in their upper reaches. The Queen drainage (also known as Black Jack) had tailings also left within its upper reaches. Though left in place, these dumps (and tailings as it pertains to Queen's Mine) are located behind the Eastside Collection System. The Eastside Collection System (Operable Unit No. 12 of the Kennecott South Zone) is an operating facility, used to capture leach water running from the dumps both in the alluvium down-gradient of the dumps and on the surface of the individual drainages. To date, Kennecott has maintained compliance pursuant to the Groundwater Protection permit over this system (see Appendix B - Communiqué with the DWQ Groundwater Protection Program). Distinctly pointed out in the 2001 Record of Decision, waste rock and tailings were left in place at the Queen Mine historic facility located in the Black Jack drainage. The volume of waste rock left in place is unknown but it is known to have a maximum lead and arsenic concentration of 31,500 mg/kg and 3150 mg/kg (respectively), and a mean lead and arsenic concentration of 8916 mg/kg and 1646 mg/kg (respectively).

- c. OU3 Herriman Residential & Agricultural Lands: Located downstream of the Butterfield Mine and Canyon sites is the farming community of Herriman (comprised of the City of Herriman and areas within the jurisdiction of Salt Lake County). Herriman residents and farmers have traditionally used the entire flow of Butterfield Creek for irrigation of their crops and lawns. Wastes dumped into the creek upstream were spread throughout the area by the Herriman irrigation systems. Eighty-five properties were affected by the contamination within the residential area. Another 238-335 acres of agricultural lands were also contaminated by the irrigation waters.
- i. Remedy for Herriman Residential & Agricultural Lands: During the Herriman residential investigation and removal action (from 1996 to 2000) surface and at depth soils (to a depth of 18 inches), impacted by mine influenced irrigation water, were excavated and removed from some of the 85 residential properties in the developed portions of the City of Herriman (incorporated as a town in 1999 and a city in 2001). These properties represented approximately 46 acres. The removal action addressed soils tainted with tailings; these soils had surface concentrations of lead (on

average) greater than 6000 mg/kg. These soils were removed by EPA, with assistance from Kennecott.

Lead was found to be the primary contaminant of concern (COC) though arsenic was also found to exist in high concentrations. Where lead was elevated arsenic was elevated; hence the focus of the removal action was on elevated lead concentrations. On average pre-removal surface lead concentrations ranged from 0 to greater than 10,000 mg/kg. After removal, the post removal (pre-capping) surface soils had lead concentrations (on average) ranging from 0 to greater than 10,000 mg/kg.

It was noted from review of the removal action that at some of the residential lots, the maximum excavation depth (18 inches) was achieved and the COCs at that depth continued to be elevated. Backfilling these lots with the non-engineered capping soil effectively created a barrier to prevent surface contact to the elevated COCs. All non-engineered capping soils complied with the removal action’s residential soil standard of 1200 mg/kg for lead and 100 mg/kg for arsenic.

85 residential properties were investigated but not all 85 properties required removal action. The table denotes the percentage of samples taken within the removal area that were found to be within each of the noted lead concentration ranges. The table further denotes the percentage of soils removed that had a lead concentration within the specified ranges, from the properties requiring cleanup (to a maximum depth of on average 18 inches).

Table 7– Lead concentrations in Herriman residential neighborhoods
(source, September 2001 Kennecott South Zone Record of Decision for Operable Units 3, 6 & 7)

Range of lead concentrations in soil (Herriman residential)	Pre-removal characterization (surface)	Post-removal (pre-capping)	Removed soils
0 – 400 mg/kg lead	16.8%	17.7%	4.9%
400 – 800 mg/kg lead	21.6%	22.9%	5.8%
800 – 1200 mg/kg lead	24.9%	21.7%	14.4%
1200 – 1600 mg/kg lead	15.4%	13.7%	28.3%
1600 – 4000 mg/kg lead	15.4%	20.5%	34.1%
4000 – 10,000 mg/kg lead	5.8%	2.9%	12.7%
>10,000 mg/kg lead	0%	0.6%	0%

(Percentages of total number of samples collected in the remediated area)

During the residential lands removal action, some properties had extensions to the property that were classified as pasture lots or extended back yards. On average these extensions of the investigated properties were not addressed under the removal action because EPA did not assess that there was a risk posed to human health or the environment, or the property owner did not grant access.

Kennecott’s assistance was further provided in the form of disposal space for excavated soils, at the Bluewater Repository (located behind the Eastside

Collection System) in the Bluewater I drainage near Bingham Canyon and providing the replacement soil. Their participation was done under the provisions of an Administrative Order on Consent, Docket No. (CERCLA-VIII-97-08 dated July 9, 1997).

During the investigation of the residential properties, it became known that the same water used to irrigate these properties in the past also was used (via the Herriman Pipeline Company) to irrigate agricultural properties within the community. As such, the UDEQ (with assistance from EPA, Kennecott, and the community of Herriman) began to investigate the location of historic and current irrigation ditches and canals to assess which agricultural properties needed to be characterized. Approximately 238-335 acres of land (north, east and west of settled parts of Herriman) used for agricultural activities were investigated by UDEQ.

Similar to the residential properties, soils on the agricultural properties were found to be impacted with elevated concentrations of lead and arsenic, but lead was the primary contaminant of concern. Soils were tainted with tailings and the average surface soil lead concentration was 12,595 mg/kg.

The following table approximates the percentage of properties (out of those investigated by UDEQ) that had average lead concentrations (across the whole of the property) within the specified concentration ranges. The table further denotes the percentage of samples collected during the investigation that fell within the specified lead concentration ranges. An approximate total of 10,450 samples were collected during the agricultural land investigation.

Table 8– Lead in agricultural soils near Herriman (source, September 2001 Kennecott South Zone Record of Decision for Operable Units 3, 6 & 7)

Range of lead concentrations	Property-wide averages (%)	Individual samples (%)
0 – 400 mg/kg lead	24.1%	31.5%
400 – 800 mg/kg lead	17.7%	15.2%
800 – 1200 mg/kg lead	14.5%	12.1%
1200 – 1600 mg/kg lead	11.2%	10.2%
1600 – 4000 mg/kg lead	27.4%	24.3%
4000 – 10,000 mg/kg lead	4.8%	6.4%
>10,000 mg/kg lead	0%	0.2%

The EPA selected a remedy which involved leaving the soils on the agricultural properties in place, because they on average complied with the applicable land use standards selected by EPA (Agricultural – 10,000 mg/kg for lead and 300 mg/kg for arsenic) for the land use to be implemented at the time. To ensure redevelopment of these properties would address elevated concentrations of lead and arsenic (when proposed) the EPA worked with the City of Herriman (and tried to do so with Salt Lake County) to develop a institutional controls (ICs) program (via the building permit process), where the City of Herriman ensures that developers address the elevated lead and arsenic based upon the proposed land use. No specific remedial steps to be

taken were specified, so as to make best use of management practices at the time of proposed development.

2. OU6 Lark Waste Rock and Tailings: Includes areas in and near the former town of Lark which were contaminated by wastes generated by historical mining activities. Waste included waste rock from digging the tunnels and shafts of the mines, tailings generated by several mills, and acid mine drainage discharged onto soils and into holdings ponds. The area covered by tailings was approximately 470 acres; waste rock was deposited on about 40 acres; and another 200 acres were affected by mine drainage. It was estimated that there was about 5 million tons of tailings and 2 million tons of waste rock present on the site. The site is transected by two intermittent streams, Midas Creek (entering from the northwest) traveling approximately in a southeast direction along the north and easterly boundaries of the tailings area and Copper Creek (entering from the west) traveling approximately east along the southern boundary of the tailings area. Neither of which normally contains water.

Within OU6 are the locations of several historic mining, and milling operations, and waste deposits from these operations. These historical locations include: Proler (this site is north of Bingham Creek and may be in a different OU), Dalton and Lark Railroad, three Ohio Copper Company Mills, Fortune Mill, New Mammoth Mill, Dalton and Lark Mill, Mascotte Tunnel, Mascotte Pond (≈ 1 acre), Mascotte Tailings (i.e. Randolph Peterson Gate soils, ≈ 300 acres), Midas Creek, Midas Creek Silo area (≈ 3.5 acres), Southeast Area (≈ 45 acres), Lone Tree Tailings (≈ 2 acres), State Motorcycle Park (actually on the Lark Tailings & Waste Rock site), Lark Waste Rock, Randolph Peterson Gate soils (i.e. Mascotte Tailings), Copper Creek (≈ 10 acres) and Gulch, Copper Gulch Mines, East Side Bingham Canyon Dumps, Midas Pond, Eastside Reservoir, Bingham Tunnel, and Old Bingham Tunnel.

Within OU6 there were two ditches that transected or traversed through the site (or along sections of its periphery) that have led to discoloration of soils or distressed vegetation in areas within the site. The Bastian Ditch operated from 1898 to approximately 1936. The Mascotte Ditch operated from 1942 to 1971.

- a. Remedy for OU6: Due to the size of OU6 UDEQ undertook a review of the remedy in a piecemeal manner so that each facility comprising OU6 was accounted for. It was understood from the September 2001 Record of Decision covering OU6 that at the time of the ROD, all the removal actions adequately had satisfied remedial objectives and EPA determined that no further action at Lark was needed or required. Pursuant to this review (please refer to Chapter IX Recommendations), this decision is not completely accurate.

Waste rock within OU6 that was documented as existing farther to the west (associated with the noted historical mills, see Section A of this chapter) except for Ohio Copper's operations and the drilling of the Mascotte and Bingham Tunnels, was found to be under the existing Bingham Canyon Waste Rock dumps and behind the Eastside Collection System. No remedy was determined to be necessary because these sites were buried. Ohio Copper's operations were the subject of the remedial or removal actions discussed below. The footprints of the Ohio Copper milling operations (outside of the Mascotte Tunnel) were addressed during the Lark Waste Rock and Tailings response work.

- i. **Lark Waste Rock:** The Lark Waste Rock area was an area where the spoils from drilling the Mascotte Tunnel (constructed in 1901) and Bingham Tunnel (constructed from 1948 to 1952) were deposited. In addition to some tailings left by the Ohio Copper Company mill No.1, there were twelve dumps of waste rock in the Lark area. The waste rock dumps came from driving the noted tunnels above, plus the Ohio Copper Company mine workings (Long Dump), the U.S. and Lark Mine (Miscellaneous Dump), and the Lark Mine waste rock (Round Dump). Around 1993 (under an EPA Region VIII AOC, Docket No. CERCLA-VIII-98-09) Kennecott initiated and completed a removal of waste rock from the site to the cleanup goals of 1000 mg/kg lead and 100 mg/kg arsenic. Approximately 2 million tons of waste rock (that had an acid generating potential) was removed to the Eastside Waste Rock Dumps of the Bingham Canyon Mine, located behind the Eastside (leachate) Collection System. Pre-removal sampling documented a maximum lead and arsenic concentration of 20,000 mg/kg and 296 mg/kg respectively. Said sampling also documented a mean lead and arsenic concentration of 9631 mg/kg and 199 mg/kg respectively. As delineated in the post removal reports, Table 9 below documents the average lead and arsenic concentrations in post removal samples per pile.

Table 9 – Average lead and arsenic concentrations in post removal samples collected from each Lark Waste Rock Pile (concentrations given in mg/kg)

Pile No.	Lead	Arsenic
1	200	39
2	276	25
3	352	37
4	201	34
5	128	23
6	228	16
7 & 8	127	<50
9	302	<50
10	472	27
11	449	38
12	146	19
Average	261	32

* Data was derived from Kennecott drawing No. 451-T-3601 (March 1994)

No waste rock was left nor found (during the site inspection or records search) to be left on site.

- ii. **Lark Tailings:** The Lark Tailings area was an area where the Ohio Copper Company milling wastes were deposited over the years (1909 to 1950's). Aerial photos (from the 1930's onward) documented wind dispersion of the deposited tailings in the predominant wind path in the Southwest corner of the Salt Lake Valley. The milling and precipitation operations of Ohio Copper Company (1909 to approximately 1950) left a large area (470 acres) covered by tailings (7 to 8 million tons) with elevated lead and arsenic. Characterization sampling determined a maximum lead and arsenic

concentrations of 9560 mg/kg and 790 mg/kg respectively. Said sampling also determined a mean lead and arsenic concentration of 2153 mg/kg and 260 mg/kg. As noted in the September 2001 ROD, under an EPA Region VIII AOC (Docket No. CERCLA-VIII-98-09) a removal action was performed to address tailings with elevated lead and arsenic. However, a review of the project records found multiple characterization efforts (two to be exact) prior to and after a re-grading effort (not a removal) of the tailings in Lark. Re-grading and reclamation of the Lark Tailings involved removing areas where tailings deposition was thin, to expose native soils. Exposed native soil was used as soil cover for areas containing thicker depositions of tailings. A further topsoil cover was placed over the reclaimed tailings area; soils were borrowed from local sources or other locations at Kennecott. Once re-graded the tailings area was sampled (prior to application of the cover soils) and the currently available documentation did not delineate sample points above the potentially applicable UU/UE standards for lead and arsenic (1200 mg/kg and 100 mg/kg respectively). But as noted from the previous characterization effort, there were samples with lead and arsenic above the potentially applicable UU/UE standards for lead and arsenic prior to re-grading.

- iii. **Randolph Peterson Gate:** The Randolph Peterson Gate area (a.k.a. Mascotte Tails) is an area that is located approximately ½ mile northeast of Lark, comprising approximately 200 to 300 acres characterized by stressed vegetation and having red-stained soils. The area is on the west side of Hwy 111 near the Randolph Petersen Gate. Site history leads to a suspicion that contaminated waters with arsenic in solution or suspended were collected in this area because of its lower topography. Characterization data documents arsenic concentrations in some samples as exceeding the potentially applicable UU/UE standard for arsenic (100 mg/kg). The area did not receive a formal removal action by Kennecott under the Lark response work, but the soils were amended with calcium carbonate alluvium which was tilled into the surface soils in 1993. Once amended, the site was covered with a 6 to 8 inch topsoil cover and then the whole area was reseeded. The soils amendment action addressed the acidity characteristics of these soils.

- iv. **Bastian Ditch:** The Bastian Ditch was used to transfer water primarily from Bingham Canyon (Bingham Creek water amongst the sources) to the farmers in Herriman to irrigate their fields. The Bastian Ditch transected OU6 in a generally north to south direction entering east of Route 111 and north of 11800 South. The Bastian Ditch was potentially buried by the Lark Tailings, but originally trended north to south through the tailings footprint and continued in a southerly direction to Herriman. The Lark Tailings response work did not address the Bastian Ditch directly, though indirectly the cover over the top of the Bastian Ditch (in the area of the Lark Tailings) is likely comprised of soils and regraded tailings. Subsequent to the time of the ROD, both Kennecott Utah Copper and Kennecott Land removed or characterized sections of the Bastian Ditch west of Rt. 111 and north of 11800 South. Both response work activities are or will soon undergo an evaluation by the Agencies, separate from this review. South of 11800 South the Bastian Ditch is suspected of remaining in place.

- v. Mascotte Ditch: The Mascotte Ditch was used to transfer water from Mascotte Tunnel (and potentially from Bingham Tunnel) to the Mascotte Ponds, where the water was then supposedly used for irrigation purposes. The Mascotte Ditch emanated from the portal of the Mascotte Tunnel (near the Bingham Tunnel portal) and proceeded northeast along the northern periphery of the Lark Tailings area. At the juncture of the Mascotte Ditch and Bastian Ditch, the Mascotte Ditch continued in a generally easterly direction past the Midas Creek Silos site and into the Mascotte Pond. The Mascotte Ditch was not characterized or removed, nor was the area between the Midas Creek Silos and Mascotte Pond (where red tained soils were observed at depth) suspected to be the corridor of the Mascotte Ditch. Midas Creek was not characterized up or down gradient of the confluence of the Mascotte and Bastian Ditches. How the Mascotte and Bastian Ditches crossed Midas Creek is still unknown.

- vi. Midas Creek Silos area: The Midas Creek Silos area was a location that had 3 concrete structures near the southeast corner of the intersection of Rt. 111 and 11800 South. After elevated lead concentrations near a culvert under Rt. 111 were discovered, further investigations were done. The Midas Creek Silos area was found to have layers of tailings (similar to Lark Tailings) in the channel of Midas Creek near an intersection with the Mascotte Ditch. This area is suspected to be the location of the intersection of the Bastian and Mascotte ditches. Characterization of the tailings determined a maximum lead and arsenic concentration of 2643 mg/kg and 142 mg/kg respectively. Said sampling also determined a mean lead and arsenic concentration of 454 mg/kg and 37 mg/kg respectively. Some of the sampled material was acidic, with a paste pH of 3.56. Soils were often found to be discolored. The area received a partial removal, after which it was regraded/recontoured. The September 2001 ROD states that post removal sampling delineated a maximum lead and arsenic concentration of 175 mg/kg and 37 mg/kg respectively. Said post removal sampling also delineated a mean lead and arsenic concentration of 160 mg/kg and 31 mg/kg. During this review, representatives of Kennecott noted that not all of the Midas Creek Silos area was characterized and it is possible that some soil containing elevated lead and arsenic above the potentially applicable UU/UE standards may still remain at the site.

- vii. Mascotte Pond: The Mascotte Pond received water from the Mascotte Tunnel via the Mascotte Ditch built in 1942. The water in the pond is suspected to have been used for irrigation purposes on farmlands located further south, from 1920 to 1935. Discharge from the Mascotte Pond was suspected to have gone into Midas Creek. There is some suspicion that the Bastian Ditch (which ran from the area of ARCO tails, OU5, to the south of the Lark Tailings area near Copper Creek) may have contributed water to the Mascotte Pond. Characterization of the site determined a maximum lead and arsenic concentration of 12,300 mg/kg and 1100 mg/kg respectively. Under the Lark removal work plan the sediments were removed from the pond and placed into the Bluewater I Repository along with the Lark Tailings in 1993. Post removal samples determined a maximum lead and arsenic concentration of 620 mg/kg and 45 mg/kg respectively. Said sampling also determined a

mean lead and arsenic concentration of 288 mg/kg and 20 mg/kg respectively.

Between the Midas Creek Silos and the Mascotte Pond areas response workers had observed discolored soils, but no characterization or subsequent response work was initiated (Interview with Mr. Brian Vinton, NAMS, April 15, 2009). As noted by Mr. Brian Vinton there appeared to have been a corridor of red colored soils following a natural topographical flow path.

- viii. Southeast Area: Located near the Southeast corner of the Lark Tailings Area, was an open field that during the characterization and response work in Lark was entitled, Southeast Area (approximately 45 acres). Stressed vegetation was observed in this area and so it underwent a characterization. This area was found to have been crossed by multiple ditches from early farming activities. Characterization sampling delineated a maximum lead and arsenic concentration of 17,000 mg/kg and 580 mg/kg respectively. Said sampling delineated a mean lead and arsenic concentration of 2348 mg/kg and 127 mg/kg respectively. Some of the soil paste pH samples were in the range of 5.5. The Southeast Area underwent a removal action (under the Lark removal work plan). Approximately 16,640 cubic yards of material was removed to the Bluewater Repository (under the Lark response work). Post removal sampling delineated a maximum lead and arsenic concentration of 232 mg/kg and 19 mg/kg respectively. Said sampling also delineated a mean lead and arsenic concentration of 151 mg/kg and 11 mg/kg respectively. After removal work, which is deemed protective of current land use (when compared to potentially applicable open space and agricultural standards found in the OU3 chapter of the Sept. 2001 ROD, please refer to Chapter IX Recommendations) the Southeast Area was reclaimed and seeded.
 - ix. Lone Tree Area: Another location southeast of the Lark Tailings area was found to exhibit stunted wheat growth, Lone Tree (approximately 2 acres). The Lone Tree site is approximately 1 mile northwest of Herriman. Characterization of the site delineated a maximum lead and arsenic concentration of 646 mg/kg and 40 mg/kg respectively. Soil paste pH values were delineated at a low of 4.67. During this review Kennecott noted that this area received a minimal characterization and that it was reclaimed.
3. OU18 Acid Mine Drainage: OU18's name is a misnomer. Though initially it was thought that the various waste rock dumps associated with mine adits or tunnels located along the western slope of the Oquirrh Mountains (Tooele County) might have acid mine drainage issues, subsequent characterization did not discover any. A number of facilities were investigated along the western slope of the Oquirrh Mountains, as listed below.
 - a. Utah Metals Tunnel and Utah Metals Tunnel Dump: The Utah Metals Tunnel and Utah Metals Tunnel Dump are sometimes referred to as Middle Canyon Tunnel and Middle Canyon Dump or the Water Supply Tunnel and Water Supply Tunnel Dump. This site is located in Middle Canyon, Tooele County, Utah. The tunnel was driven in 1913 to facilitate a water exchange between Tooele and Bingham City. The tunnel was also suspected to potentially have been used to transport ores from the Carr Fork operations to the smelter on the Tooele side, and for

generation of water power. One end of the tunnel daylighted in the Bingham Pit and the other near Middle Canyon Creek. At the time of the North Zone & South Zone ROD of September 2002, EPA noted that the historical water exchange (between Kennecott and the irrigation company was no longer in force). The tunnel is about 11,000 feet long and measures 8 feet by 9 feet. The associated waste rock dump of the tunnel located on the Middle Canyon side is about 250 feet in diameter. The volume of waste rock is approximately 30,000 cubic yards. The tunnel drainage is approximately 500 gallons per minute (gpm).

- i. Remedy for Utah Metals Tunnel and Utah Metals Tunnel Dump: The Utah Metals Tunnel is no longer used for ore haulage, transportation to and from Tooele County to the pit, nor for water supply (under contract or enforced). In 2006 Kennecott (for safety purposes) constructed a concrete bunker around the mine portal. This action forever sealed the portal from unauthorized access. Water produced from along the length of the tunnel is collected and piped into the holding and delivery system of a local irrigation company down-gradient from the Utah Metals Tunnel Dump.

As noted above, there is an approximately 30,000 cubic yard waste rock dump associated with the Utah Metals Tunnel in upper Middle Canyon (near where the Tooele County paved road ends). Though occasionally visited by hikers and bikers (there is a popular primitive campground nearby), most of the potential exposures (if any) have an ecological receptor. A characterization of the waste rock (in 2000) discovered (via grab samples) a maximum lead concentration of 2110 mg/kg, a maximum arsenic concentration of 107 mg/kg, and a maximum Selenium concentration of <0.5 mg/kg. Water quality samples were also taken of the discharge from the tunnel. The results of the sample analysis discovered an arsenic concentration of <0.005 milligrams per liter (mg/L), a lead concentration of <0.005 mg/L, and a selenium concentration of 0.003 mg/L. Though the threat of an ecological impact (absent a formal risk assessment) was deemed low, the continue erosion of the Dump's embankments and introduction of waste rock into the nearby Middle Canyon Creek (used by wildlife for drinking purposes) was not desired by the EPA and UDEQ risk managers.

As such, in 2000-2001 the Utah Metals Tunnel Dump underwent a reclamation activity initiated by Kennecott and overseen by UDEQ. The Dump's embankments and top surface were regraded and a native seed mixture was randomly scattered across the surface of the top of the dump. Revegetation along the Dump's embankments was reliant upon the voluntary introduction of seed from establish stands of vegetation in the canyon and near the Dump. A berm was constructed around the top of the Dump approximately 3 feet back from the edge of the Dump's embankments, and approximately 12 to 18 inches high (the berm is also approximately 18 inches in width). The berm served the purpose to direct surface water flowing from the tunnel toward a constructed drainage channel located along the western embankment of the Dump. The drainage channel directed run-off water from the top of the Dump down to a wooden reservoir belonging to the local irrigation company. The berm also served (and still does) the purpose to reduce the amount of run-off flow down the Dump's embankments to prevent continued erosion of these surfaces. Material that had eroded from the embankments of the Dump and migrated

toward Middle Canyon Creek was drawn back toward the Dump embankments. Middle Canyon Creek had a layer of rock placed in its channel to prevent continued undercutting of the waste rock slope area.

Originally the Dump's top surface drainage mechanism was an enclosed HDPE pipe with a catch basin area on top of the Dump (see figure No. 73, Appendix I) on the top of the western embankment. However, during a reconstruction of the tunnel portal in 2006, water was pushed out from the tunnel and began to undercut this drain/catch basin. Subsequent to this finding, Kennecott reconstructed the Dump's top surface drainage channel (in 2007) into an open aired, significantly rip-rapped channel approximately 1.5 feet in depth, 1.5 feet in width, and approximately 100 yards in length from the top of the Dump down to local irrigation companies collection area. Also, Kennecott installed a pipe inside the tunnel entrance which now serves to direct water produced by the tunnel down off the Dump and into the local irrigation system (see Photos No. 82-86, Appendix I). Since the water flowing from the tunnel portal complies with applicable surface water standards for the beneficial use of the Middle Canyon Creek and the irrigation system, no water treatment was deemed necessary during any of the above listed remedial action.

Annual reports to UDEQ were required as part of this remedial/reclamation activity. A map denoting the location of the Dump was also required as part of the remedial action selected by EPA in 2002.

- b. Other tunnels on the Western Slope or the crest of the Oquirrh Mountains: There were numerous tunnels which were constructed to access Bingham Canyon claims but with portals on the western slope of the Oquirrh Mountain range to bring ores to the International Smelter in the 1920s to 1971 and later copper ores to Anaconda's concentrator located within Pine Canyon, Tooele County, Utah. These other tunnels include: Apex (Parvenu) as connected to the Pine Canyon Tunnel, Bingham West Dip, Adamson, Copper Boy, Spring Canyon Tunnels, Upper Bruneau, and Helen B. At the time of the September 2002 North Zone & South Zone ROD Kennecott owned the water rights associated with these tunnels, but most of the water flows were and are still very small. The results of the construction of these tunnels lead to a waste rock dump near one of the completed portals. The International Smelter is separate NPL site.

Apex Parvenu Tunnel: Apex Tunnel was probably constructed between 1905 and 1907 and was used for haulage and drainage from the Apex working above the 1000 foot level. The Apex Tunnel interconnects with the Pine Canyon Tunnel (Operable Unit No. 20 of Kennecott South Zone); both are at the same elevation. The tunnel has also intersected with the Bingham Pit, and was proposed as a possible method to transport tailings should a tailings disposal area be needed in Tooele County; this plan was ultimately rejected.

Bingham West Dip Tunnel (Levine Tunnel): The Bingham West Dip Tunnel was on the Angell claim and may have been built prior to 1900. There is no evidence of any ore discoveries or extraction. By 1926, the tunnel had been converted to a water supply tunnel and the water was piped to the International Smelter. The tunnel was used for this purpose until 1985. The tunnel portal has subsequently caved in, but a steel pipe transects the tunnel and discharges to a cement sump

near the portal and then to a storage tank outside the tunnel. There is a waste rock dump near the tunnel portal. The volume of waste rock dump is approximately 4150 cubic yards. The tunnel drainage is approximately 150 to 200 gpm. The tunnel is located in Pole Canyon, a tributary to Pine Canyon. The water now spills out of the tank into the creek.

Adamson Tunnel: International Smelter drove this tunnel in 1925 to collect water for its processing needs. Any excess not used by the smelter was sent down the creek for use as irrigation water. The tunnel was 319 feet long and transected the bottom of Pine Canyon. The water right associated with the tunnel is 413 gpm. The tunnel drains into Pine Canyon via a water storage tank. Because of its reported location is close to Pine Canyon Tunnel, it may have been obscured by a mudflow. The tank overflows into Pine Canyon Creek.

Copper Boy Tunnel: Copper Boy Tunnel was located in Baltimore Gulch a tributary to Pine Canyon. It is at 7700 feet elevation and has a water right of 200 gpm.

Spring Canyon Tunnels: Spring Canyon (located between Pine Canyon and Middle Canyon), had three water tunnels (Hardrock Tunnel, McBride Tunnel and Main Tunnel). The waters (water right totaling 325 gpm) were used by the International Smelter for processing.

Upper Bruneau Tunnel: There is a Kennecott water right associated with a tunnel located up Pass Canyon (just north of Pine Canyon) for 54.8 gpm. It is also known as the Pass Canyon Tunnel.

Helen B Tunnel: There is a Kennecott water right associated with a tunnel located on the south fork of Swenson's Canyon (just north of Pine Canyon) for 20 gpm.

i. Remedy for Other Tunnels: From 1996 to 2000 the other tunnels (Apex (Parvenu), Bingham West Dip, Adamson, Copper Boy, Spring Canyon Tunnels, Upper Bruneau, and Helen B) and any waste rock dumps associated with their construction were investigated to assess the need for remedial action. Most of the tunnels were found to not have any waste rock dumps or issues associated with them other than Bingham West Dip Tunnel. Sampling of the Bingham West Dip Tunnel Dump found a maximum lead concentration of 236 mg/kg, a maximum arsenic concentration of 29.3 mg/kg and a maximum selenium concentration of 36.3 mg/kg. These concentrations were found to be within recreational soils standards (for lead and arsenic, protective of human health) originally compiled for other operable units of the Kennecott North and South zones, as well as being under the industrial land use standards established for the Kennecott North Zone facilities. As such no remedial action was selected for the Bingham West Dip Tunnel Dump.

The two tunnels that have significant water production (beyond the Utah Metals Tunnel) include the Bingham West Dip Tunnel and the Upper Bruneau Tunnel. Earlier samples from the Bingham West Dip Tunnel discharge discovered an arsenic concentration of <0.005 mg/l, a lead concentration of <0.005 mg/L, and a selenium concentration of 0.008 mg/L. A sample collected

in 2000 discovered an arsenic concentration of <0.005 mg/L, a lead concentration of <0.005 and selenium was not reported on. Samples taken of the water discharge from the Upper Bruneau Tunnel discovered an arsenic concentration of <0.005 mg/L, a lead concentration of <0.005 mg/L and selenium was not reported on. Most of the significant water discharges from the tunnels in the area were studied during the investigation. The water was of drinking water quality and therefore was assessed not to pose a threat to potential downstream human users.

IV. Remedial Actions

Remedial action was pursued at OUs 3, 6, 7, 17, & 18, at various times. As noted above in Chapter II & III, various decision instruments were used by EPA Region VIII for ordering or selecting the necessary remedial actions; Administrative Orders on Consent or Records of Decisions were used. For some of the “facilities” of each of the operable units, characterization through a non-traditional preliminary assessment/site investigation process determined that no further action was necessary. In other cases removal or remedial action was required. Please refer to Chapter III above.

The past response work had the general objectives to:

- Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles
- Prevent exposures of humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses
- Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers
- Protect flora and fauna in areas which are prime wildlife habitat

For OU18 the response work had the following general objectives:

- Reduce or eliminate unacceptable levels of exposure to wildlife
- Reduce or eliminate unacceptable levels of exposures to recreational and industrial works

Specific remedial activities for these operable units are listed in Chapter III, under Section B above. For OU7 & 17 please refer to Appendix J. For some of the operable units operation and maintenance requirements were selected as part of the remedial response actions.

A. OU3 Butterfield Mine, Canyon & Creek, Herriman Residential & Agricultural Lands

The City of Herriman agreed to supervise long term management of the agricultural properties of Herriman using the authorities invested in its building permits and land use planning divisions. The UDEQ (with funding from EPA) has offered in the past, and continues to do so, assistance to the City of Herriman during proposed redevelopments to assessed management strategies for addressing the elevated lead and arsenic concentrations.

The Salt Lake County was initially approached by EPA back in 2000 to receive an education concerning the results of the sampling efforts by UDEQ and EPA. The goal of the outreach was to have Salt Lake County develop an ICs program similar to what the City of Herriman developed. The EPA began to pursue negotiations with the County to assist them with developing an ICs program for those portions of the site within the jurisdiction

of Salt Lake County. To date, no such program has been found to exist and in the future as properties within the site begin to develop such actions will likely drive the need for such a program at Salt Lake County.

B. OU6 Lark Waste Rock & Tailings, Ancillary Facilities

Pursuant to the September 2001 Record of Decision EPA Region VIII had assessed that the removal and remedial work that had been implemented under the Lark removal work plan was sufficient to address risks at the site posed to the then receptors. EPA Region VIII stated that no further action or institutional controls were necessary for the site.

During this review UDEQ coordinated with Kennecott to assess the project documentation to assess if there is the potential for waste left in place within OU6. Said review has determined that there is the potential, if not the actual existence of lead and arsenic above the potentially applicable UU/UE standards.

C. OU18 Acid Mine Drainage

Long term management of the remediation/reclamation of the Utah Metals Tunnel Dump and the surface water controls structures fell to Kennecott as the land owner. Again as noted previously, there is not a perceived human health threat from either the waste rock contaminants of concern (i.e. lead) or from the tunnel discharge water. There is the potential for downstream ecological receptors to become impacted from drinking the water if the waste rock were to continue to be eroded into Middle Canyon Creek. Pursuant to the long term management plan, Kennecott is required to inspect the Utah Metals Tunnel and Utah Metals Tunnel Dump on an annual basis and report to UDEQ – DERR on the observations.

The UDEQ – DERR project manager periodically joins Kennecott during the annual inspections.

V. Progress Since Last Five Year Review

This was the first five year review for these operable units of the Kennecott South Zone site.

VI. Five Year Review Process

A. Administrative Components

Pursuant to the UDEQ and EPA Site Specific Enforcement Agreement (dated April 2007) UDEQ took the lead to perform this first five-year review of the referenced operable units. Work was initiated by the UDEQ-DERR project manager (Mr. Douglas Bacon), on June 2008 and initial involved staff of UDEQ-DERR and EPA Region VIII as part of the Kennecott five year review team.

At times representatives from the local government entities and the responsible party were contacted and used as a resource to assess ongoing developments and to inspect pertinent records. The resource group included the following:

Michelle Baguley, Herriman City Council Member, long-term advisor to the Kennecott South Zone Technical Review Committee and Technical Advisory Group Coordinator for the Herriman Residential and Agricultural Removal and Assessment projects;

Larry Elkin, North American Mine Services, a Kennecott contractor now and at the time of the original cleanups.

Gordan Haight, City of Herriman Engineer, individual responsible to ensure that the City of Herriman implements the institutional controls program required by the September 2001 Record of Decision:

Jorry Howell, City of Herriman Engineering Department, department inspector working with the City Engineer to ensure implementation of the institutional controls program.

Kelly Payne, Principle Advisor for Closure and Remediation for Kennecott Utah Copper, the Kennecott Superfund response action manager;

Brian Vinton, North American Mine Services, a Kennecott contractor now and at the time of the original cleanups.

During June 2008 the review team established the review schedule (which subsequently was adjusted mid-way through the review) and delineated the components of the review, which included:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspections;
- Local Interviews; and
- Five Year Review Report Development and Review

Because of the added review elements (per the request by EPA Region VIII Enforcement) the scheduled for completion was initially extended to December 2009. However, per request by EPA HQ's staff, this review was slated for completion by September 30, 2009.

The review was conducted by first listing the changes which could have occurred at the site since the original removals were conducted and then evaluating if changes took place and if so, did these changes result in possible impairment of the remedies. Changes included changes of land use, changes due to weathering, and changes due to construction activities. To determine if the remedies remained effective in protecting human health and the environment, each operable unit was visited and appropriate records inspected.

Where it was suspected that hazardous substances might have been uncovered or still remained on-site above potentially applicable UU/UE standards, such areas were investigated. Kennecott and City of Herriman participants aided in the location of these areas. Where appropriate, existing monitoring data was gathered from existing resources to assess potential disturbances as part of developing the recommendations included herein.

B. Community Involvement

In-person community interviews for the OU3 and OU18 five-year reviews were conducted in the Salt Lake Valley and Tooele Valley. The interviews were conducted by Mr. Dave Allison and Mr. Douglas Bacon of UDEQ-DEIR. Residential property owners, municipal officials and representatives of the RP were interviewed. The results of the community interviews are given in Appendix A.

An announcement that EPA was conducting a five-year review appeared in both daily newspapers (Salt Lake Tribune and Deseret News) on August 28, 2008 (see Appendix A).

C. Document Review

This five year review consisted of a review of relevant documents including:

- State of Utah Groundwater Protection and UPDES permit records
- Reports on subsequent cleanups performed under existing O&M plans
- Past cleanup report documentation to assess the existence of soils left in place exceeding potentially applicable UU/UE standards

The documents reviewed are listed in Appendix H; excerpts of such are also reproduced in Appendix B, C, D, F, & G. The two Records of Decision, dated September 28, 2001 and September 26, 2002 were also evaluated for cleanup requirements and pertinent ARARs. On an operable unit specific basis the following records were evaluated during this review.

1. OU3 Butterfield Mine, Canyon & Creek, Herriman Residential & Agricultural Lands:
 - a. State Permits: Kennecott has kept monitoring records with regard to sump waters and ground water at the Bluewater repositories which hold the wastes from the Herriman residential cleanup project, as well as some of the removal projects in the Butterfield Canyon area. The records are included in the annual Ground Water Permit report provided to the DWQ. A review of the permit records found compliance with the permit limitations at the monitoring wells associated with the Bluewater Repository (Appendix B - Communiqué with DWQ Groundwater Protection Program, permit compliance).

Though periphery to Butterfield Canyon, the active drainages up-gradient (i.e. Queen, Olson, Castro, Yosemite, and Saints Rest) have cutoff walls installed to prevent alluvial and surface flow and to assist in the control of surface water drainage from the waste rock dumps in these drainages. The cutoff walls are a series of concrete dams, keyed into bedrock down-gradient of the waste rock dumps, used to ensure the containment of acid mine drainage from the dumps. Though the Eastside Collection System is Operable Unit 12 of the Kennecott South Zone, oversight of this facility was deferred to the DWQ under its Groundwater Protection Program permit. As part of the five-year review process for Butterfield Canyon, DEIR inspected the compliance record of Kennecott with the permit limitations of the DWQ Groundwater Protection Program. To date, Kennecott has been in compliance with the permit limitations (Appendix B - Communiqué with DWQ Groundwater Protection Program, permit compliance).

Since cleanup of the Butterfield Mine and Canyon/Creek sites, Kennecott has maintained compliance with the UPDES permit associated with the Butterfield Mine Tunnel discharge. An inquiry and review of the DWQ database documented compliance with the permit limitations for outfall #10. Monitoring records from the DWQ found that Butterfield Creek was not impaired for water quality (Appendix B - Communiqué with DWQ UPDES Program, permit compliance).

- b. Post Removal Sampling: A review of the removal action documentation and post removal samples for the Butterfield Canyon Waste Rock and Tailings removal areas determined (Appendix F),
 - i. 1 grab sample (prior to backfilling) in the area of the Butterfield Mine Waste Rock removal action was found to exceed the potentially applicable unrestricted land use/unrestricted exposure standard for arsenic (100 mg/kg). This sample was found to be located in a steep section of the Canyon along the southern topography of the removal area. The post removal sample had an arsenic concentration of 150 mg/kg, exceeding the potentially applicable unlimited land use/unrestricted exposure (UU/UE) standard for arsenic (100 mg/kg arsenic).
 - ii. 4 grab samples (prior to backfilling) in the drainage confluence area of Saints Rest and Butterfield Canyon (also the location of the Revere Mill footprint along the north side of the Salt Lake County Road) exceed potentially applicable UU/UE standards for lead and arsenic (1200 mg/kg lead, 100 mg/kg arsenic). Because the County road was not removed and two of the post removal samples were taken from soils near the road, it is suspected that under the road in this section of Butterfield Canyon soils do exist above the potentially applicable UU/UE standards for lead and arsenic.
 - iii. 2 grab samples (prior to backfilling) in the drainage confluence area of Yosemite and Butterfield Canyon exceed the potentially applicable UU/UE standards (1200 ppm mg/kg lead, 100 mg/kg arsenic). Because the County road was not removed and one of the post removal samples was taken from soils near the road, it is suspected that under the road in this section of Butterfield Canyon soils do exist above the potentially applicable UU/UE standards for lead and arsenic.
 - iv. 6 sample locations were found to exceed the potentially applicable UU/UE standards for lead and arsenic (1200 mg/kg lead, 100 mg/kg arsenic) in the Queen's mine site and drainage. Though not remediated during response work, it was noted that this area is in the upper reaches of the Queen's Drainage (a.k.a. Black Jack drainage), on mine owned and managed property, and is fairly steep. Land use supported by the area is industrial and open space.
- c. City of Herriman Institutional Controls Program: A review of the City of Herriman's building records found the following projects underwent a remediation effort during a redevelopment project, since the EPA selected remedy has been in place. Activities at these sites suggest a need to further evaluate the surface and near surface soils (refer to Chapter IX Recommendations).

Table 10– Remediation projects during redevelopment in the City of Herriman

Property HAG No.	Development Name	Contaminant Management Plan	Plan Date	Completion Date
Multiple properties	Butterfield Creek Storm Drain	No information available	No information available	No information available
010	Western Creek	All arsenic/lead contaminated soils excavated (approx. 8600 yds ³) from the residential portion of the development remains entirely on-site in the soil repository on the open space portion of the development. Soil repository was covered with a minimum of 2 feet of clean fill (undefined).	8/1/2006	7/2/2007
011	Black Hawk Estates	Soils containing lead from 1600-4000 ppm & arsenic 100-850 ppm were placed in a non-residential open space with 2 feet of cover (undefined). Soils greater than lead of 4000 ppm & arsenic of 850 ppm were transported to Kennecott's Bluewater Soil Repository.	9/28/2007	11/7/2008
010, 011, 012, 019, 020	Butterfield Creek Sewer Project – South Valley Sewer District	@ HAG 10, 11, 12, 19, 20 soils above the residential levels were used as backfill in the sewer pipeline. Lead & arsenic above 1600 ppm & 100 ppm on Ms. Myrna Carter's property was treated as commercial and topsoil was left on the surface at her request.	8/16/2007	12/22/2008
020	Silver Bowl Estates Lots #112 & #113 ONLY	Samples showed that lead & arsenic levels were low enough that remediation was not	3/1/2006	12/5/2005

		required for Lots #112 & #113 in Silver Bowl Estates, as determined by the City of Herriman.		
021	Lafayette Estates Subdivision	Contaminated soil is planned to be removed and deposited off-site, on an easterly adjacent property. The contaminated soil will be covered with 18 inches of soil (undefined for COCs).	12/1/2006	
025	Sunset Meadows Subdivision	Soils are to be removed and located in the future commercial area of the subdivision.	8/1/2004	
030	*Tuscany Estates	Site owner and developer applied to the VCP to manage the redevelopment and disposal of soils with elevated lead and arsenic. Residential lots were remediated to 1200 ppm for lead and 100 ppm for arsenic. Phase 5, soils repository, was never finalized in terms of run-on/run-off management, cap preservation and institutional controls and the State subsequently withdrew the project from the VCP.		
030	Garbett Homes – Herriman Downs	Soils containing 1600 ppm lead or greater were removed to the Kennecott Repository.	4/1/2006	10/1/2006
031	Herriman Parkway	Top of soils returned to trench.	No information available	No information available
033	Umbria Estates	All lead & arsenic soils that was excavated from the residential part of the development was contained in a repository under the commercially	12/1/2005	5/1/2006

		developed section of the property.		
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*Information on the Tuscany Estates Project was derived from the UDEQ's project file under the Voluntary Cleanup Program. Dates are provided for when the property entered the VCP and when it was withdrawn. It was noted by the reviewer that the City of Herriman is intending to develop a portion of Phase 5, along the southern boundary of the contaminated soils pile, as a primary thorough-fare into the City.

2. OU6 Lark Waste Rock & Tailings:

- a. Response Action Reports: During this five-year review Kennecott representatives assisted with a review of the response work documentation to assess what was historically done to address OU6. This information assisted UDEQ to understand where waste (soils with elevated concentrations of lead and arsenic above the potentially applicable UU/UE standards for lead and arsenic) could still exist on site. As noted above, portions of Lark Tailings and the ancillary sites of Midas Creek, Midas Creek Silos, Mascotte Ditch, Bastian Ditch (south of 11800 South), Randolph Peterson Gate, Southeast Area, and potentially Copper Creek have soils with lead and arsenic above the potentially applicable UU/UE standards. Maps and data tables documenting the characterization and post response soil analyses are provided in Appendix G of this report.
- b. State Permits: Lark Waste Rock was removed and relocated onto the Eastside Waste Rock Dumps of the Bingham Canyon Mine. These dumps are located behind the Eastside Collection System which is operated by Kennecott in compliance with a Utah Groundwater Protection Permit (Appendix B - Communiqué with DWQ Groundwater Protection Program, permit compliance). The Eastside Collection System prevents meteoric water from filtering out of the dumps and into the valley alluvium aquifer. Some "hotspots" from the Lark Tailings area were hauled to Bluewater I Repository. This repository is operated and maintained by Kennecott in compliance with a Utah Groundwater Protection Permit (Appendix B). All removal materials from OU6 are prevented from migrating, by being disposed of in approved disposal areas behind or in capture and containment facilities.
- c. Post Construction Sampling: Beyond the initial characterization and post response work sampling that was performed in the early 1990's, no further sampling has been done at OU6. Since the initial response work, there has been limited reuse of the OU6, its ancillary sites, and adjacent lands.

Offset from the northern, eastern and southern boundaries of the Lark Tailings reclamation area adjacent lands have continued to be dry farmed as they have historically. No sampling data was available.

Between 2001 and 2002 Kennecott Land constructed a soil haul road to take soils being removed from the footprints of the South Jordan Evaporation Ponds and Bastian Sink areas in the Daybreak Community to the Copper Notch repository located on the Eastside Waste Rock Dumps in Copper Gulch. The haul road transected through the Southeast Area and into the Lark Tailings reclamation area along its southern boundary. No soil samples were taken prior to construction of

the road corridor. Approval of the road construction was granted by EPA Region VIII during the approval of the South Jordan Evaporation Ponds and Bastian Sink removal work plans submitted by Kennecott Land between 2001 and 2002.

3. OU18 Acid Mine Drainage:

Though required to submit annual inspection reports to UDEQ on the management of the Utah Metals Tunnel and Utah Metals Tunnel Dump site, a review of the project record found submission to be sporadic by Kennecott. However, it should be noted that the risk potentially posed by this site (if left uncontrolled) was previously deemed minimal by the risk managers. UDEQ has gone on inspections of this site periodically with Kennecott, and has seen Kennecott take an active role to address the potential for uncontrolled releases from the site when they have arisen.

The other tunnels (and associated waste rock dumps or water discharges), i.e. Apex (Parvenu), Bingham West Dip, Adamson, Copper Boy, Spring Canyon Tunnels, Upper Bruneau, and Helen B, are primarily located in tributaries of Pine Canyon. Though Pine Canyon (separate operable unit under the Kennecott South Zone, OU20) does not require a five-year review (as noted in the UDEQ documented entitled *Five-Year Review Schedule & Operable Unit Inclusion* dated February 14, 2008), a review of Kennecott's compliance with the water quality limitations associated with outfall 009 was performed. Pursuant to a communiqué from the DWQ (see Appendix B - Communiqué from DWQ concerning UPDES permit compliance for outfall 009) Kennecott has maintained compliance since 2001 with the UPDES discharge limitations for Pine Canyon.

During the community interviews with representatives of Tooele County (i.e. Engineering and Planning Departments and County Council) no proposed developments were brought to UDEQ's attention for the areas of the other tunnels and dumps of OU18. The County Engineering Department representative made an inquiry about what type of land use the Utah Metals Tunnel Dump site might support (without specifically relating a imminent desire or plan for redevelopment activity). It was noted during the interview that the Utah Metals Tunnel Dump and Tunnel are owned by Kennecott and until land ownership were to change this site remains un-developable by third parties.

- a. Post Construction Sampling: Beyond the sampling performed during characterization activities at the Utah Metals Tunnel, Utah Metals Tunnel Dump, and other Tunnels and associated dumps (i.e. Apex (Parvenu), Bingham West Dip, Adamson, Copper Boy, Spring Canyon Tunnels, Upper Bruneau, and Helen B) no other sampling has been performed as of the time of this review.

D. Data Review

Sampling, as a part of the scope of work for this five-year review, was not performed. However, existing data (where pertinent) was evaluated (in some cases re-evaluated) to understand the nature and extent of material with COCs above potential UU/UE standards. The following is an operable unit by operable unit listing of what data was reviewed.

1. OU3 Butterfield Mine, Canyon & Creek:

Available data (from post removal sampling) was re-evaluated to ascertain if soils (with COCs above potential UU/UE standards) were left in place. As noted from the maps and data tables provided in Appendix F, soils above potentially applicable UU/UE standards for lead and arsenic still remain within the response work areas, for Saints Rests and Yosemite drainages. Similarly, soils above potentially applicable UU/UE standards for lead and arsenic were left in place in the upper reaches of Queen drainage near the Queen Mine workings.

As part of evaluating the remedy, data made available from the DWQ concerning the quality of water within Butterfield Creek was reviewed. As noted in Appendix B, water quality in Butterfield Creek (in terms of Total Suspended Solids, T-Pb and T-As have remained low) since cleanup activities were pursued.

2. OU3 Herriman Residential & Agricultural Lands:

Beyond the original characterization and (in some cases) the post removal sampling, there has been limited sampling since the ROD was approved in Sept. 2001. Though some redevelopment projects were pursued since remedy implementation, soil data from these projects was not available at the time of this review.

The lack of available post remedial response work data is a concern. If in the future post removal sampling data is not available, the recommendation herein (Chapter __ Recommendations) includes a sampling event to screen existing soils for potential COCs above the applicable land use standards listed in the 2001 ROD.

3. OU6 Lark Waste Rock & Tailings:

Available data (from post removal sampling) was re-evaluated to ascertain if soils (with COCs above potential UU/UE standards) were left in place. As noted from the maps and data tables provided in Appendix G, soils above potentially applicable UU/UE standards for lead and arsenic still remain within the response work areas, for Lark Tailings and the ancillary facilities at the operable unit.

No specific data was reviewed for OU7, 17, & 18 as part of this review. As noted in Appendix J, the UDEQ and EPA Region VIII previously evaluated post removal data collected by Kennecott Land after their response work under the December 2006 O&M plan implemented at OU7 & OU17. As such, the UDEQ project manager did not re-evaluate this same data as part of this review. The remedy at OU18 did not require ongoing monitoring and as such there was no quantitative data to evaluate. If in the future, stabilization of the Utah Metals Tunnel embankments becomes problematic future reviews could re-evaluate the need for monitoring the conditions of suspended solids loading to Middle Canyon Creek through monitoring activities.

E. Site Inspection

Various site inspections took place at the operable units covered under this review, at different times. The primary inspector was the UDEQ project manager, who was assisted or joined at various times by UDEQ's community outreach specialist, and representatives of Kennecott. Please direct your attention to Appendix I for the individual sites inspections

photo & observation logs. The following are narratives on what was observed at the operable units when inspected.

1. OU3 Herriman Residential & Agricultural Lands, Butterfield Mine, Canyon & Creek: Inspections at the site were performed most recently on September 25, 2008 by the UDEQ project manager (see Appendix I). The purpose of the inspection was to evaluate the Butterfield Mine, Butterfield Canyon/Creek and Herriman Residential & Agricultural Properties cleanup areas to determine if there were possible damages to the remedies by: (1) changes in the land use, (2) changes in the topography of the site due to construction, (3) changes in the topography due to erosion, and/or (4) changes in conditions which are different than those assumed during the design of the remedies. The existence (or lack thereof) of institutional controls (ICs) and their effectiveness was assessed by discussing the existence of such with City and County representatives (see Appendix A and Chapter IX Recommendations).

Since implementation of the remedy in Herriman, property use has remained relatively the same. The agricultural properties are primarily used to raise either alfalfa or other crops (dependent upon the planting cycle). Some of the agricultural fields have been left to fallow and subsequently have been repopulated with native weed species such as grasses and forbs (i.e. sage and rabbit brush). The residential properties also appeared to be structural intact (in terms of consistent vegetated soil covers). (See Appendix I, Photos No. 1 thru 6).

The City of Herriman has noted that only a few large development projects (on the lands with elevated lead and arsenic) have been pursued to date. The most notable (and the ones inspected by UDEQ) include: (1) Tuscany Estates (partially completed, withdrawn from the State of Utah Voluntary Cleanup Program), (2) Western Creek, (3) Blackhawk.

- a. Though Tuscany Estates (i.e. Fassio Egg Farm) was remediated and homes have been constructed, under the State of Utah VCP program the management status of Phase 5 (soil repository) along its northern property boundary has not been completely addressed. The VCP applicant has been withdrawn and the property associated with the soil repository has been given to the City of Herriman. Current development plans by the City call for the construction of a road, during which soils unearthed will be managed by the City of Herriman's contractor pursuant to the City's ICs program.
- b. The Western Creek and Blackhawk developments (in close proximity to each other) have undergone a remediation (interview with Mayor Crane, February 25, 2009). Soils with elevated concentrations were primarily hauled off to the Kennecott repository (under a negotiated agreement). It is currently suspected that some soils have been consolidated and capped onsite, (interview with Mr. Brian Vinton, North American Mine Services, NAMS, September 25, 2008 and site inspection). These two developments have not proceeded beyond the initial grubbing and remediation exercises.
- c. Around 2003/2004 the Salt Lake County Flood Control division initiated and completed the construction of a storm water sewer (buried pipe) between approximately 6200 West and 5600 West, parallel to and within the historic drainage of Butterfield Creek. Though it is widely thought by individuals familiar

with the project that the excavated soils in the agricultural lands this pipe crosses were placed back into the excavation and capped in place, no documentation at this time has been retrieved to document such steps. (See Appendix I Photos No. 6).

Absent overseeing the Salt Lake County Flood Control Division's efforts to construct the noted storm water sewer, the City of Herriman has been involved with the above listed development projects (see Chapter VI. Section C). The ICs program for the Herriman agricultural lands requires a property owner or developer to apply for a building permit, and address the remediation of waste (i.e. soils with lead and arsenic exceeding the listed land use standards in the 2001 Record of Decision for OU3, 6, & 7). As noted above, soils appeared to have been managed from a remedial perspective (based upon the planned change in land use), but as noted in there is not post remediation sampling data.

With no exceptions, the revegetation efforts during the removal and reclamation activities in Butterfield Canyon and Mine were in excellent shape. As noted in the pictures (see Appendix I, Photos 7 thru 18) it is hard to imagine that a removal action was undertaken in the Canyon. Since the implementation of removal activities, there has been but a few incidences or issues related to the waste rock dumps in the upper reaches of the side drainages (i.e. Queen, Olson, Castro, Yosemite, Saints Rest, Black Jack and St. James).

A previous inspection of Butterfield Canyon was done in 2007 by UDEQ in response to a storm event and release that took place in the Yosemite drainage (Appendix D - DERR Inspection Report dated August 28, 2007). Beyond the response action (inspection to ensure protection of the CERCLA remedy) by UDEQ - DERR project manager, the State of Utah Division of Oil, Gas and Mining (DOG M) and the UDEQ Division of Water Quality (DWQ) were involved and pursued separate action per their authorities. The material released (i.e. tailings) was observed along the bottom of the drainage and in the Butterfield Creek channel. Samples taken delineated lead and arsenic concentrations in compliance with the agricultural and open space standards set in the 2001 Record of Decision for OU3. As noted in Appendix I (Photos No. 9&10) and during discussion with the Stormwater Protection Permit manager for DWQ (see Appendix B) Kennecott has addressed upgrades to the storm water run-off system to maintain compliance with DWQ's permit.

2. OU6 Lark Waste Rock & Tailings:

On April 23, 2009 UDEQ - DERR project manager coordinated with representatives of Kennecott (Mr. Kelly Payne and Mr. Brian Vinton) and conducted a site tour of OU6. The purpose of the inspection was to assess current conditions of the various facilities associated with OU6, and to assess if soils with lead and arsenic were left on site above UU/UE concentrations. Existing vegetative covers were observed, as were site control features (though it was noted no security requirements were selected as part of the earlier response work). Records were inspected by Kennecott personnel to assess the existence of soils in place with elevated COCs (lead and arsenic) above the potentially applicable UU/UE standards.

The areas associated with or addressed as part of the response work performed at OU6 were found to be in relatively good and stable condition. The current surface grades were found in tact, with just a few minor occurrences of tailings (within the area of

Lark Tailings) at the surface. The majority of the post response surfaces were well vegetated, though the increasing population of jack rabbits in the area is starting to overgraze the existing vegetation.

The following remarks are provided for the primary facilities inspected.

- a. Mascotte Tunnel and Bingham Tunnel: The Mascotte Tunnel (driven in 1902) and the Bingham Tunnel (driven in 1948-52), both were found to have water discharges associated with them. The water produced from along the length of the tunnels is currently captured by Kennecott and placed into their water collection and management system, which is operated in compliance with a Utah Groundwater Protection Permit. (See Appendix I, Photos No. 19 thru 31).
- b. Lark Waste Rock: The area of the waste rock removal project was found to be in good condition, successfully vegetated and supportive of current land uses (i.e. open space, agricultural, industrial). The two inspected dump sites (i.e. Long Dump and North Dump) epitomize the current land characteristics of the other 8 dump removal sites. In one of the dump removal location (i.e. Long Dump) an experimental wetlands treatment project addressing seep water with elevated sulfate concentrations was found to no longer be actively managed as a wetlands treatment project, but was sustaining some wetland wildlife (i.e. red-winged blackbirds, mallards, deer). (See Appendix I, Photos No. 31 thru 40).
- c. Lark Tailings: The Lark Tailings Response area is the largest area at OU6 and is bounded by the ancillary facilities discussed previously (i.e. Midas Creek Silos, Mascotte Ditch, Midas Creek, Bastian Ditch, Mascotte Pond, Southeast Area, Lone Tree area, and Copper Creek). The Lark Tailings area that underwent regarding and reclamation was found to be fenced off from the surrounding farm lands that are being used to grow hay and/or alfalfa. In one location, near the Southeast Area, the fence was found to be in disrepair and/or actually removed to facilitate haul trucks removing soils from the Daybreak area (OU7) under EPA Region VIII approved plans. (See Appendix I, Photos No. 41 thru 66).

No ICs were assessed to be in use for this site.

3. OU18 Acid Mine Drainage:

UDEQ-DERR project manager performed an inspection in August of 2005 and June 2008 of the Utah Metals Tunnel and Utah Metals Tunnel Dump to determine if there were possible damages to the stabilization work by: (1) Changes in the land use, (2) Changes in the topography of the site due to construction, (3) Changes in the topography due to erosion, and/or (4) Changes in conditions which are different than those assumed during the design of the remedies. During both inspections the UDEQ-DERR project manager was joined by representatives of Kennecott (Mr. Kelly Payne and Mr. Brian Vinton).

Over the two inspections the UDEQ-DERR project manager observed the continuously successful establishment of a vegetative cover, via voluntary seeding. The remedial response work implemented by Kennecott was two fold, (1) regrade the Dump surfaces (and where possible the embankments) to better control run-off water (derived from precipitation and tunnel flow), and (2) stabilize the Dump embankments and the

channel embankment of Middle Canyon Creek. Revegetation by the voluntary seeding from nearby grasses, wildflowers, and alpine trees was selected by Kennecott to allow for native species of plants to populate the Dump. Kennecott's efforts to reduce the impact from recreational vehicles were observed to have increased the success rate of this voluntary seeding.

The Utah Metals Tunnel Dump was assessed to support open space land use, and the Dump's embankments were observed to be fairly stable. The southern embankment (due to its slope ratio) continues to show rilling problems, but the material did not appear to be migrating into Middle Canyon Creek. As noted in Chapter IV.C, the institutional control selected for this site (i.e. mapping where COCs exist above potentially applicable UU/UE standards) has yet to be completed.

F. Interviews

For OU3 & 18 please refer to Appendix A for the summary report on community interviews and individual interview logs, for the interviews performed by UDEQ.

Though initially not included in the scope of five-year review, OU6 was assessed as requiring a five-year review due to documentation of potential wastes left in place (refer to section C of this chapter). During the review it was assessed that the public has limited access to the site and the nearest town (City of Herriman) is approximately 5 to 6 miles to the south by southeast. Since no public live on, near or within site boundaries, UDEQ did not interview any public directly accessing OU6.

The only periodic use of land adjacent to the OU6 is by a farmer dry cropping the land bordering the north, east and south boundaries of the Lark Tailings reclamation area. Limited Kennecott employee and contractor support access exists to ensure management and upkeep of the Bingham Tunnel, Mascotte Tunnel, and water management facilities (plus other ancillary buildings used in support of the mine operations). The only long term worker presence onsite is at the Lark Gate (access point to the Bingham Canyon Mine) located approximately ¼ mile from the Mascotte Tunnel, Bingham Tunnel, USSRM buildings and the site of the Lark Waste Rock – North Dump site.

Since the site is within the jurisdiction of Salt Lake County and was assessed to need institutional controls to manage future changes to land use, UDEQ staff spoke briefly to County staff and was unable to conduct formal interviews for this review. Salt Lake County welcomed future discussions regarding information on institutional controls for this area.

VII. Technical Assessment

A. OU3 Butterfield Mine, Canyon & Creek, Herriman Residential & Agricultural Lands

1. Question A: Is the remedy functioning as intended by the decision documents?
 - a. Butterfield Mine, Canyon & Creek: The removal actions on average were successful to remove elevated concentrations of lead and arsenic, from the site of the Butterfield Mine, Canyon & Creek. A review of post removal reports found that current surface grades comply with open space and recreational land use standards selected under the 2001 ROD. Though un-noticed during the site inspection, Butterfield Canyon (and to a lesser extent Creek, for purposes of

foraging and in limited cases nesting) represents prime wildlife habitat. However there are no endangered species or threatened species within this habitat. Continued monitoring of Butterfield Creek (under Utah's UPDES program) has found compliance with applicable water quality standards. A site inspection of this portion of OU3 found the current surface grade stable and well vegetated, with little disturbance of sub-grade soils both within the Canyon and Creek. No ongoing operation and maintenance, access control, or monitoring requirements exist. No ARARS or institutional controls were selected under the 2001 ROD.

In two locations (the confluences of Saints Rest and Yosemite drainages with Butterfield Canyon) post removal samples document (at depth) soils with elevated lead and arsenic above potentially applicable UU/UE standards (on average 2 to 3 feet below the current surface grade). As long as current surface grades (comprised of either soil covers, or road base/asphalt) remain intact these portions of OU3 are protective of current land uses (i.e. recreational and open space), with unlimited access. This review did not assess an ecological risk, as long as surface covers remain intact.

The findings of the document review suggest that institutional controls should now be considered (see recommendations Chapter IX). If land use were to change from recreational and/or open space, and the soils with COCs above potentially applicable UU/UE standards were to be excavated, some kind of control to ensure compliance with the RAOs should be developed.

- b. Herriman Residential & Agricultural Lands: The review of documents, discussions with the staff of the City of Herriman and the site inspection found the remedy as selected by EPA Region VIII under the 2001 ROD, on average functioning as intended. Based upon current land use, the past response work, and the selection of ICs for these portions of OU3, the implemented remedy has currently achieved the RAOs. No ongoing operation and maintenance, access control, ARARs or monitoring requirements exist.

Past removal response work addressed 85 residential properties, through characterization and in some cases removal of soils with elevated COCs above the residential cleanup goals to a depth of 18 inches. During the inspection a select number of these properties were looked at and found to have surfaces with various types of vegetative cover, in various stages of success. To the understanding of the City of Herriman staff, none of these residential properties have been proposed for subdivision and redevelopment. The knowledge of where elevated COCs in soils are located on these properties was found to be limited after reviewing available documentation and discussions with the City of Herriman staff. No operation & maintenance, or monitoring requirements were selected as part of the long term remedy. These properties (when proposed for subdivision) are considered by the City of Herriman to be subject to the ICs selected for the agricultural properties.

The agricultural lands (primarily used for raising crops, but in some cases as pasture lots) were largely found in use for the same land use as noted during remedy selection. Some of these properties have been left to fallow, and hence could be considered as open space. The ICs selected for these properties are intended (and are functioning) to ensure that during redevelopment (dependent upon the proposed land use) soils with elevated COCs are managed appropriately.

The City of Herriman has been implementing the ICs program for properties in their jurisdiction; a few redevelopment projects were observed.

The ICs program implemented by the City of Herriman is a self certification program, in that no independent verification of compliance with applicable land use standards is done by the City of Herriman. During the review inquires to arrange interviews with representatives of Salt Lake County (who has jurisdiction over some of the agricultural, and in a few cases the residential properties) were unsuccessful. During these inquires it became known that the County does not have an ICs program in place to ensure proper management of soils with elevated COCs during redevelopment. As such, this review has provided a number of recommendations for the remedy at this portion of OU3, please refer to Chapter IX.

As of the time of the site inspection, the procedures for developing properties in Herriman with elevated COCs were undergoing revision. An opportunity was present for the UDEQ-DERR project manager to assist the City of Herriman with a review of the proposed development procedures on lands with elevated COCs. Some concerns arose during this review and as noted in the recommendations for this portion of OU3, Chapter IX, an opportunity is available to help the City of Herriman enhance the ICs program.

The ICs program developed for the City of Herriman is meant to ensure that during the review of a development proposal, if the property in question resides in the sensitive lands overlay zone the developer is responsible to ensure that COCs are in compliance with the intended land use. The developer is responsible to provide a plan documenting how elevated COCs above the land use standards will be addressed, implement the plan and document final soils conditions once the remedial work is done. A limitation of the ICs program is that it was not intended to ensure management of potential soil migration during farming practices. This will potentially become more problematic as the current lands used for agricultural activities begin to be developed.

2. Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
 - a. Butterfield Mine, Canyon & Creek: The remedial action objectives (listed in the 2001 ROD for the residential and agricultural lands of Herriman) could be considered applicable for this portion of OU3. Based on the findings noted from the document review and site inspection, these RAOs are currently being complied with,
 - Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles
 - Prevent exposures of Humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses
 - Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers
 - Protect flora and fauna in areas which are prime wildlife habitat
 - i. Changes in Standards and To Be Considers: Since the completion of removal work was done prior to the 2001 ROD, EPA Region VIII stated that no further

work was required for these portions of OU3. As such, no ICs or ARARs were developed. However as noted above in VII.A.1.a, there are some locations where soils exist above potentially applicable UU/UE standards at depth. The 2001 ROD did not select UU/UE standards for the soils located in OU3. So the UDEQ-DERR project manager made use of the residential cleanup standards (1200 mg/kg lead and 100 mg/kg arsenic) used during the residential cleanup around the City of Herriman, for purposes of comparing the soils located at depth in Butterfield Canyon to potential land use options. As noted in the recommendations chapter (Chapter IX) the Agencies should consider the development of UU/UE standards for OU3.

The requirements of the following federal rules or acts are potential ARARs that should be considered during soil cleanup activities in the Butterfield Canyon area (in light of potential change to current land use practices, and because of the elevated COCs above potentially applicable UU/UE standards).

- Occupational Safety and Health Act (OSHA),
- Superfund Amendments and Reauthorization Act (SARA) (as it pertains to notification of spills to the environment),
- Clean Air Act (CAA), and
- Clean Water Act (CWA)

The following protection programs or rules of the State (and their federal equivalents) of Utah, should be evaluated as potential state ARARs in light of potential change to current land use practices, and because of the elevated COCs above potentially applicable UU/UE standards.

- Surface water protection programs (UPDES and Stormwater) and groundwater protection programs,
- Air quality protection regulations (most notably the Fugitive Dust Rule and National Emission Standards for Hazardous Air Pollutants, NESHAP),
- Hazardous waste (generation, transportation and disposal) regulations,
- Solid waste regulations (most notably R 301 through R303, and R315-8), and
- Utah OSHA regulations

- ii. Changes in Exposure Pathways: The exposure pathways for this site were presented in the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999) in which the Kennecott site was divided into two zones. Exposure pathways considered for the Kennecott South Zone, which is where Butterfield Mine, Canyon, and Creek are found, include Recreational Visitors, Commercial Workers, and Industrial Workers. The Recreational Visitor exposure pathway includes ingestion of surface soils and inhalation of airborne particulates through activities such as all-terrain vehicle use, horseback riding, camping, hiking, hunting and picnicking. The commercial and Industrial Worker exposure pathway includes ingestion of surface soils and interior dust and inhalation of airborne particulates. Current land use remains the same as present in the 2001 ROD. No changes to the exposure pathways are expected as long the future

land use is consistent with current land use. However, if in the confluence area of Butterfield canyons with Saints Rests and Yosemite canyons, if the current land use changes and excavations were to intrude approximately three feet beneath current surface COCs will be present. Thus the above mentioned exposure scenarios potentially will no longer be protective.

In reference to the review of the 2001 ROD it is noted that the development of the recreational standard for lead and arsenic made use of a document entitled *Butterfield Canyon Ecological Risk Assessment* (1997). This document was not found during this phase of document review, thus an evaluation of the ecological exposure assumptions were not completed at this time. Based upon the data review of the removal project, the understanding that existing COCs are at depth and the surface grades in these areas are stable it is not suspected that there would be a current exposure risk to ecological receptors. Future reviews should consider the destabilization of these known buried COCs, to evaluate potential future exposure risks.

- iii. Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in the toxicity factors or characteristics for the COCs that were used in the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999).
 - iv. Changes in Risk Assessment Methods: There has been no change to the standardized methodology that could affect the protectiveness of the response action.
 - v. Expected Progress Towards Meeting RAOs: Because no further action was selected as the remedy for Butterfield Mine, Canyon & Creek (after the initial response action), no RAOs were selected (as noted above). However, comparable RAOs for the community of Herriman were deemed applicable for this portion of OU3 during this review. As long as the COCs at depth in the Canyon remain at depth, compliance with the applicable RAOs will be met.
- b. Herriman Residential & Agricultural Lands: The remedial action objectives (listed in the 2001 ROD for the residential and agricultural lands of Herriman) are for the most part being complied with. The RAOs are:
- Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles
 - Prevent exposures of Humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses
 - Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers
 - Protect flora and fauna in areas which are prime wildlife habitat

In cases of land use changes, compliance with the RAOs (as measured by analytical testing) was not able to be verified as part of this review. Analytical results from soil sampling were not available for data review.

- i. Changes in Standards and To Be Considered: Past removal action addressed cleanups at various residential properties, to attain a goal of 1200 mg/kg lead and 100 mg/kg arsenic. In some cases, soils above these concentrations were left 18 inches or deeper (because 18 inches was the established max depth for cleanup). Coinciding with these soils at depth on the residential properties, soils above the various land use standards selected in the 2001 ROD were left on the surface and at depth on the agricultural properties. ICs were selected for implementation and management by the local jurisdictions over building permits (City of Herriman and Salt Lake County) and said programs were to make use of the land use standards listed in the 2001 ROD as benchmarks to ascertain the need for cleanup work, when redevelopment is proposed. Though the standards are generally still okay to ensure protectiveness for public health and the environment, the Agencies could consider the adoption of UU/UE standards for this and other portions of OU3.

Since no further removal action was required under the 2001 ROD (unless redevelopment proposals are submitted), EPA Region VIII did not list any federal or state ARARs under the ROD for continued remedial work. A notation was made about the potential need to address sensitive habitat regulations if a developer were to build in such areas (i.e. wetlands). No ARARs addressing the generation, treatment or disposal of contaminated soils were ever selected. The noted ARARs that could be considered for the Butterfield Canyon and Creek portion of the site (VII.A.2.a) could be considered for the Herriman portion as well.

- ii. Changes in Exposure Pathways: The exposure pathways were defined for the community of Herriman in the *Endangerment Assessment for Herriman, Utah, Residential Soil-Lead Removal* and the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999). These exposure pathways included Residential (including Day care and Playgrounds), Recreational/Open space, Commercial, Industrial and Agricultural. The Residential exposure pathway includes ingestion of surface soils and interior dust. The Recreational Visitor/Open Space exposure pathway includes ingestion of surface soils and inhalation of airborne particulates through activities such as all-terrain vehicle use, horseback riding, camping, hiking, hunting and picnicking. The commercial and Industrial Worker exposure pathway includes ingestion of surface soils and interior dust and inhalation of airborne particulates. The agricultural exposure pathway includes the ingestion of surface soils and inhalation of airborne particulates. Currently the community's growth has significantly expanded since the 2001 ROD. Both residential and commercial development has happened at this site. While many of these developments have replaced uncontaminated agricultural lands, there are instances that some homes have been built on areas of known contamination that may or may not have been cleaned up prior to construction. Additionally, some homes that were cleaned up previously as part of the residential removal action may have COCs below the 18 inch horizon and large properties may have had an extended back yard that wasn't cleaned up. Therefore, there is a greater chance that a person living in a residence may have a greater risk of exposure from living on these properties. Local Government's (Herriman City and Salt Lake County) have the responsibility to

implement the selected ICs of the remedy, which equivalent to a self certification cleanup program.

- iii. Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in the toxicity factors or characteristics for the COCs that were used in the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999) and the *Endangerment Assessment for Herriman, Utah, Residential Soil-Lead Removal*.
 - iv. Changes in Risk Assessment Methods: There has been no change to the standardized methodology that could affect the protectiveness of the response action.
 - v. Expected Progress Towards Meeting RAOs: As residential and agricultural properties begin to undergo land use changes, assurance of compliance with the selected RAOs is a function of the ICs programs (of which there is not one at Salt Lake County). It is recommended that current and future compliance with the selected RAOs should be evaluated as a follow up action pursuant to this review.
3. Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Periodically in the spring, Utah experiences rain events that at times are localized and fairly strong. Prior to upgrades to the Eastside Collection System, storm events in the upper reaches of the side drainages to Butterfield Canyon (most notably the Yosemite Drainage) historically caused waste rock to migrate into Butterfield Creek and down into the community of Herriman (most notably in 1997 and most recently in 2007). In 2008 (as reported in the Salt Lake Tribune) storm events during the month of May caused for flooding in the area of 6000 West from 11800 South to 12600 South. There was a potential for soils with elevated COCs on agricultural lands in this area to migrate. The ICs remedy and lack of ARARs does not account for this type of event.

4. Technical Assessment Summary

According to the data reviewed, the site inspections and the interviews the remedy for OU3 Herriman and Agricultural lands is functioning as intended by the 2001 ROD. However, there are currently opportunities to enhance the ICs remedy and potentially increase the scope of what it is intended to cover or manage. The City of Herriman's procedures for development has some noted deficiencies (Chapter IX Recommendations) that could be addressed. Though infrequent, significant storm events can cause for localized migration of soils with elevated COCs. No ARARs for soil contamination were considered at the time of the 2001 ROD, and should be considered now. There have been no changes in the toxicity factors for the contaminants of concern that were used in the risk assessments and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

According to the data review, the site inspections, document review and interviews with Kennecott representatives the response work performed at Butterfield Mine,

Canyon & Creek was successful to address a cleanup to current land use goals (open space, recreational). However, there are soils a depth in the Canyon above potentially applicable UU/UE standards for lead and arsenic. An opportunity is available to develop appropriate ICs, ARARs and UU/UE standards to assist with addressing soil contamination in the future at the time of land use changes. There have been no changes in the toxicity factors for the contaminants of concern that were used in the risk assessments and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

B. OU6 Lark Waste Rock & Tailings

1. Question A: Is the remedy functioning as intended by the decision documents?

The removal actions on average were successful to remove elevated concentrations of lead and arsenic, from the site of OU6, Lark Waste Rock & Tailings. A review of post removal reports found that current surface grades comply with open space and recreational land use standards selected under the 2001 ROD for a nearby operable unit, OU3. A site inspection of OU6 found the current surface grade stable and well vegetated, with little disturbance of sub-grade soils. No ongoing operation and maintenance, access control, or monitoring requirements exist. No ARARS or institutional controls were selected under the 2001 ROD.

Pre and post remedial action samples (Appendix G) document portions of Lark Tailings and the ancillary sites of Midas Creek, Midas Creek Silos, Mascotte Ditch, Bastian Ditch (south of 11800 South), Randolph Peterson Gate, Southeast Area, and potentially Copper Creek as having soils with lead and arsenic above their potentially applicable UU/UE standards. UDEQ-DERR project manager assessed that because of OU6's location to the community and similarity to the wastes that caused the lead and arsenic impacts in the community of Herriman, the residential standards for lead and arsenic (listed in the 2001 ROD) were a good benchmark to start with for this comparison. As long as current surface grades (comprised of either soil covers, or road base/asphalt) remain intact these portions of OU6 are protective of current land uses (i.e. recreational and open space), with unlimited access. For this comparison, the benchmarks provided in the 2001 ROD for OU3 for open space and recreational land uses were used (for the same reasons that the residential standards were used).

2. Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The findings of the document review suggest that institutional controls should now be considered (see recommendations Chapter IX), to protect public health in the future at the time land use is changed. If land use were to change from recreational and/or open space at OU6 to residential, and the soils with COCs above potentially applicable UU/UE standards were to be excavated, some kind of control to ensure compliance with the applicable RAOs is necessitated.

The remedial action objectives (listed in the 2001 ROD) for the removal action could be considered pertinent for the ongoing remedial concerns (when land use is changed). These removal action RAOs include:

- Prevent ground water contamination from uncontrolled releases of acids and metals leached from waste rock piles
 - Prevent exposures of Humans to unacceptably high levels of lead and arsenic in soils, based on different exposure rates at different land uses
 - Prevent downstream migration of unacceptable levels of lead and arsenic in waters used for irrigation by homeowners and farmers
 - Protect flora and fauna in areas which are prime wildlife habitat
- a. Changes in Standards and To Be Considered: Since the completion of removal work was done prior to the 2001 ROD, EPA Region VIII stated that no further work was required for all of OU6. As such, no ICs were developed nor were any ARARs listed for consideration. However as noted above in VII.B.1, there are some locations where soils exist above potentially applicable UU/UE standards at depth. The 2001 ROD did not select UU/UE standards for the soils located in OU6 (nor any other land use standards or benchmarks). So the UDEQ-DERR project manager made use of the residential cleanup standards (1200 mg/kg lead and 100 mg/kg arsenic) used during the residential cleanup around the City of Herriman, for purposes of comparing the soils remaining potentially at the surface and at depth, in OU6. As noted in the recommendations chapter (Chapter IX) the Agencies should consider the development of UU/UE standards for OU6.

The requirements of the following federal rules or acts are potential ARARs that should be considered during soil cleanup activities in the Lark Tailings area (in light of potential change to current land use practices, and because of the elevated COCs above potentially applicable UU/UE standards). Such consideration would take place at the time of redevelopment.

- Occupational Safety and Health Act (OSHA),
- Superfund Amendments and Reauthorization Act (SARA) (as it pertains to notification of spills to the environment),
- Clean Air Act (CAA), and
- Clean Water Act (CWA)

The following protection programs or rules of the State (and their federal equivalents) of Utah, should be evaluated as potential state ARARs in light of potential changes to current land use practices, and because of the elevated COCs above potentially applicable UU/UE standards. Such consideration would take place at the time of redevelopment.

- Surface water protection programs (UPDES and Stormwater) and groundwater protection programs,
- Air quality protection regulations (most notably the Fugitive Dust Rule and National Emission Standards for Hazardous Air Pollutants, NESHAP),
- Hazardous waste (generation, transportation and disposal) regulations,
- Solid waste regulations (most notably R 301 through R303, and R315-8), and
- Utah OSHA regulations

- b. Changes in Exposure Pathways: It is understood from the document review that a removal action was performed under an AOC at OU6. As such no formal risk assessment was conducted, although it is suspected that the most likely exposure pathways are recreational/Open Space, Industrial and Agricultural (from the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999)). The Recreational Visitor/Open Space exposure pathway includes ingestion of surface soils and inhalation of airborne particulates through activities such as all-terrain vehicle use, horseback riding, camping, hiking, hunting and picnicking. The commercial and Industrial Worker exposure pathway includes ingestion of surface soils and interior dust and inhalation of airborne particulates. The agricultural exposure pathway includes the ingestion of surface soils and inhalation of airborne particulates. When future land use is proposed appropriate exposure pathways should be considered.

In terms of ecological receptors, no formal ecological risk assessment was performed. However, in the 2001 ROD elk, deer, cougars and birds were listed as potential ecological receptors to impacted groundwater and soils. As noted during the inspection performed at OU6 as part of this review, deer (e.g. mule deer) red wing blackbirds and mallard ducks were observed near the groundwater seep. At least one coyote and two jack rabbits were observed in the Lark Tailings area. At the time of this review, it was impossible to evaluate a risk of exposure or pathway for these species.

- c. Changes in Toxicity, and Other Contaminant Characteristics: Based upon a review of the 2001 ROD, soils with elevated lead and arsenic were addressed (either through removal action or regrading). Some soils with an acid generation capacity received a lime treatment and were revegetated (i.e. Randolph Peterson Gate soils) and for a limited time groundwater appearing at a localized seep (i.e. Experimental Wetlands) underwent an experimental wetland sulfide bioreactor treatment. It is known that no formal risk assessment was performed at OU6 prior to this response work, so a formal evaluation of the toxicity and chemical characteristics of these potential COCs was not done.
 - d. Changes in Risk Assessment Methods: No formal Risk Assessment could be found.
 - e. Expected Progress Towards Meeting RAOs: The removal action and larger scale re-grading efforts at the Lark Tailings portion of OU6 provided a surface soil that is consistently complying with the RAOs. However, when the land use in OU6 undergoes a change, it is possible that compliance with the RAOs may need to be addressed again.
3. Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The Lark Tailings area and the Experimental Wetlands (constructed during the early response work) are being used by wildlife (Appendix I). The site inspection of OU6 observed deer, coyote, jack rabbit, red-winged blackbirds and mallards making use of the habitat located within OU6. Some of the observed species are transitory, in that they are not utilizing the area of Lark Tailings or its ancillary facilities (i.e.

Experimental Wetlands) as a permanent home. These species (deer, coyotes) are potentially traveling through as they forage. The jack rabbit (non-native species in Utah) population has begun to grow and at least represents one species likely utilizing the Lark Tailings and ancillary facilities as their primary habitat. At least one burrow was observed along the eastern edge of the Lark Tailings site (Photo No. 60, Appendix I) and tailings material was observed on the current surface. Document reviews did not find concerns related to ecological impacts during the response work development, and no formal ecological risk assessment was found for OU6. There is currently no agriculture use within ¼ mile of the Lark Tailings. The habitat presented at Lark Tailings (and some of its ancillary facilities) represents good wildlife habitat, absent significant human influence.

It is understood from interviews with representatives of Kennecott, that OU6 represents a significant land holding which is primed for redevelopment. Population growth continues to encroach on the open spaces available along the western portions of Salt Lake Valley. Future prospects for OU6 are likely to see a mixed use development project within the next century.

4. Technical Assessment Summary

According to the data review, the site inspections, document review and interviews with Kennecott representatives the response work performed at Lark Waste Rock & Tailings (and the ancillary facilities) was successful to address a cleanup to the then selected land use goals (open space, recreational). However, there are potentially soils at the surface and at depth at the Lark Tailings and ancillary facilities above potentially applicable UU/UE standards for lead and arsenic. An opportunity is available to develop appropriate ICs, ARARs and UU/UE standards to assist with addressing soil contamination in the future at the time of land use changes.

Because of the transitory nature of the species making use (for foraging and nesting) of the Lark Tailings and ancillary facilities (more specifically the Experimental Wetlands), and because the one residential species (jack rabbit) is not an endangered species (and is a non-native species in Utah), this review did not assess a need for an ecological assessment specific to this site. In the past there was a broader ecological assessment done for the Oquirrh range (both the crest of and certain canyons along the range). The results of which are recommended as being applicable for OU6.

No formal risk assessment was done for the response work performed at OU6; as such no evaluation of the toxicity of the COCs was initially done. Since no formal risk assessment was performed, a review of risk assessment methodology was not completed under this five year review.

C. OU18 Acid Mine Drainage

1. Question A: Is the remedy functioning as intended by the decision documents?

OU18 (though consisting of more than one site, comprising mostly of tunnel, adits and waste rock piles) had one remedial response action that was required for one of the facilities within it. The Utah Metals Tunnel Dump was known to have at least one sample documenting an elevated lead concentration. As noted in previous text, the area of the Utah Metals Tunnel and Utah Metals Tunnel Dump (located in the mid-upper

reaches of Middle Canyon, Tooele County) is primarily used for open space and recreational land use. The mine currently retains ownership and access to the top surface of the Dump is limited to pedestrian traffic. The elevated lead datum was of concern to the Agencies because at the time of remedy selection (primarily reclamation action) the Dump embankments were unstable and material was being washed into Middle Canyon Creek, a source of water for localized wildlife. The reclamation efforts by Kennecott to manage tunnel discharge and precipitation run-on/run-off was found to continue to be effective to minimize the migration of dump material (i.e. waste rock) into Middle Canyon Creek.

The Utah Metals Tunnel waste rock dump in Middle Canyon is largely comprised of limestone and limey quartzite. On the geologic map of the Bingham District as presented in Bingham District Guidebook, Plate 1, 1991, the Utah Metals Tunnel cuts through Butterfield Peaks and Bingham Mine formations. More than 8000 ft of the 11,500 ft long tunnel from the Middle Canyon Utah Metal Tunnel Portal to the Bingham Pit encountered the limestone and limey quartzite units. Utah Metals Tunnel drains out both portals with approximately 8,000 ft of the tunnel draining to Middle Canyon and about 3,500 ft that drains to Bingham Pit. Water quality of the water that drains to Middle Canyon has a neutral pH and all inorganic parameters meet drinking water quality.

Waste rock in the Utah Metals Tunnel Dump, as observed, contains a large percentage of limestone and very limited amounts of intrusive rock. The intrusive rock weathers to clayey type soil with moderate amounts of iron.

Kennecott has sampled the waste rock as part of the Priority Site investigations and found that the average lead concentration was 2110 ppm and other metals and metalloids were less than typical residential standards for the southwest Salt Lake Valley mining impacted areas. Kennecott also leach tested the sample containing 2110 ppm lead with SPLP and all RCRA eight analytes were less than detection. Kennecott also sampled the only yellow colored area on the Dump that measures approximately 60 ft by 60 ft on the top surface for agronomic purposes. This area contained intrusive volcanic rock altered to clay and it had a pH of 5.92 and conductivity of 2400 umhos/cm. Because this altered volcanic rock is surrounded by limestone and limey quartzite waste rock, it is not viewed as problematic in terms of producing acid and it does support vegetation.

The data collected from the Utah Metals Tunnel Dump area suggests that ARD is not a current problem and would not be a future problem. Drainage from the Utah Metals Tunnel drains an area of low sulfide content and high limestone and limey quartzite. The tunnel portal water has been used by Middle Canyon Irrigation Company for almost 100 years and based upon the drainage capture area of the tunnel, it is anticipated that water quality will not change appreciably over the future.

Though the Dump's southern embankment continues to show signs of rills or gullies caused by precipitation run-off (Photos No. 70-71 & 80-81, Appendix I) it should be noted that this erosional action is caused by precipitation hitting the embankment's surface (not flowing off the top of the Dump). Though this erosion is causing for waste rock to migrate, there is a toe berm at the base of the dump which has been successful to prevent the eroded material from washing into Middle Canyon Creek. The eastern and western slopes of the Dump are not as steep as the southern and were not observed

to have as significant erosional activity. The reclamation efforts to prevent overflow from the Dump's top surface has been very successful to reduce this erosional action, as shown by the increase in successive plant growth along the southern embankment from year to year.

2. Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The Agencies selected (in the 2002 ROD) the following RAOs for OU18,

- Reduce or eliminate unacceptable levels of exposure to wildlife
- Reduce or eliminate unacceptable levels of exposures to recreational and industrial workers.

The reclamation efforts pursued from 2006 to 2007 by Kennecott were assessed to be sufficient to attain these RAOs, which continue to remain valid.

- a. Changes in Standards and To Be Considered: Since the completion of the reclamation efforts on the Dump surface and the construction of the run-on/run-off controls (completed in phases from 2006 to 2007), the Agencies have agreed that only continued site inspections to assess the condition of these controls is necessary. No ICs were developed nor were any ARARs listed for consideration, because they were not necessary at the time of accepting the reclamation response work. Neither is currently necessary as of this review, because current land ownership and use is intended to remain the same for some time.
- b. Changes in Exposure Pathways: There was no formal risk assessment developed for OU18. The remedial decisions (i.e., stabilization of the Utah Metals Dump) was not based on a human health risk assessment, but relied on information provided in the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999) and an *Ecological Risk Assessment-Northern Oquirrh Mountains* (Oct 1996).

In terms of human receptors and pathways, based upon a review of the land use (both at the time of the remedy selection and this review) recreational visitors and industrial workers are suspected to be the exposure pathways. Exposure is caused by the inadvertent ingestion of soils with elevated COCs or inhalation of airborne particulates with the COCs. Based upon a comparison of limited soil data (for the Dump) to the PRG goals for these receptors, there appears to be a limited risk of exposure.

At the time of remedial decisions EPA Region 8 made a risk management determination that there was a potential for ecological impacts from migrating Dump material into the nearby Middle Canyon Creek. The Creek is utilized by local fauna as drinking water source (both up and down gradient of the Dump). Though the ecological risk assessment (noted above) did not specifically address the local fauna and potential for exposure risk in Middle Canyon, EPA's remedial decision to have the Dump stabilized was based upon the limited data on lead and arsenic in comparison to concentrations reported in the ecological risk assessment that could cause exposure.

- c. Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in the toxicity factors or characteristics for the COCs that were used in the *Preliminary Remediation Goals for Addressing Risk to Human Health From Exposures to Chemicals in Kennecott Soils* (Dec 1999). From an ecological perspective (as it pertains to the investigation reported in the *Ecological Risk Assessment-Northern Oquirrh Mountains*, Oct 1996) changes in toxicity and other characteristics of the selected COCs needs to be evaluated along with a comparison of the listed COCs in the 2002 ROD to the concentrations reported in the eco-risk assessment for the Northern Oquirrh Mountains.
 - d. Changes in Risk Assessment Methods: No formal risk assessment for human health was done. Limited comparable eco-risk information was used by EPA Region 8 but not specifically developed for OU18, more specifically Utah Metals Tunnel Dump.
 - e. Expected Progress Towards Meeting RAOs: The selected remedy has met the RAOs selected under the 2002 Record of Decision for the North and South Zones of Kennecott. As long as current land use remains the same and Kennecott continues to ensure the slopes of the Utah Metals Tunnel Dump remain stable, the RAOs will be met.
3. Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No weather related events have affected the protectiveness of the reclamation actions or the current run-on/run-off controls. Previous to the reconstructed run-off control channel (Photo No. 82&83, Appendix I) located on the western embankment of the Utah Metals Tunnel Dump, a collection basin (Photo No. 73) for the previously installed HPDE down spot pipe had been undercut. The new rip-rapped channel was installed to mitigate this occurrence and has been successful. Dump material (i.e. waste rock) continues to be limited from impacting the nearby Middle Canyon Creek. The completion of annual site inspections by Kennecott remains the most current significant issue (see Chapter VIII, Section C, Table 13). There is no further information that calls into question the protectiveness of the response work.

Future land use options were inquired about by representatives of Tooele County, Utah. Though the Utah Metals Tunnel and Utah Metals Tunnel Dump facility of OU18 is held in ownership by Kennecott, the site has historically and continues to be used for recreational purposes (though vehicular access to the Dump's top surface has been restricted). The pending map of the facility (documenting COCs above pertinent land use standards, in this case a rationale UU/UE standard) will assist future land planners when considering a land use change.

4. Technical Assessment Summary

According to the data review, the site inspections, document review and interviews with Kennecott representatives the response work performed at Utah Metals Tunnel and Utah Metals Tunnel Dump was successful to mitigate the continued erosion and migration of Dump material (i.e. waste rock) into Middle Canyon Creek. Current ownership of the site belongs to Kennecott, who on annual basis is responsible to

inspect the integrity of the Dump. Current land use (open space, recreational) is likely to remain the same into the near future.

No formal risk assessment was done for the response work performed at OU18; as such no evaluation of the toxicity of the COCs was initially done. Since no formal risk assessment was performed, a review of risk assessment methodology was not completed under this five year review.

VIII. Issues

A. OU3 Butterfield Mine, Canyon & Creek, Herriman Residential & Agricultural Lands

1. A summary of issues for OU3 are given in the following table:

Table 11– OU3 Summary of issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N) - explain
#1 Up-gradient waste rock piles (if left uncontrolled) could by erosion impact downstream remediated areas in Butterfield Canyon.	N	Y
#2 Trash and general refuse debris was generally found in the area of Eva’s Pond which was constructed as a debris basin, as part of the removal activities at Butterfield Mine.	N	N
#3 In the confluence areas of Saints Rest and Yosemite drainages with Butterfield Canyon there are buried areas that exceed potentially applicable unrestricted land use/unrestricted exposure standards (1200 mg/kg and 100 mg/kg respectively) for lead and arsenic.	N (protective of current land use)	Y(if development upon these areas is not overseen by ICs program)
#4 Some residential properties in Herriman had a removal action removing the first 18 inches of soil with elevated lead and arsenic, and were backfilled. This left elevated lead & arsenic below surface grade. Mapping of these properties plus institutional knowledge of their location is limited.	Y (if excavations at these properties is un-controlled)	Y (if excavations at these properties is un-controlled)
#5 Pasture lots or “extended backyards” at the Herriman Residential properties were not universally addressed by removal action. It is not known if such areas would be overseen as part of the City of Herriman’s ICs program.	Y (if development upon these areas is not overseen by ICs program)	Y (if development upon these areas is not overseen by ICs program)
#6 ICs program by the City of Herriman is being revised. UDEQ developed some concerns during a review of the proposed procedures.	N	Y (If changes lessen restrictions)
#7 No ARARs were listed in the ROD for the selected ICs remedy for Herriman.	Y (no control over how	Y (no control over how excavated soils

	excavated soils with elevated COCs are managed)	with elevated COCs are managed)
#8 UDEQ was unable to assess if an ICs program was ever developed by the engineering and planning divisions of the Salt Lake County.	Y (if development upon these areas is not overseen by an ICs program)	Y (if development upon these areas is not overseen by an ICs program)
#9 Certain redevelopment or new construction projects may have left elevated concentrations of lead and arsenic in the near surface soils (City of Herriman’s ICs program is a “self-certification” program.)	Y (If current projects left elevated lead & arsenic in surface and near surface soils)	Y (If future projects leave elevated lead & arsenic in surface and near surface soils)

B. OU6 Lark Waste Rock & Tailings

1. A summary of issues for OU6 are given in the report is given in the following table:

Table 12– OU6 Summary of issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N) - explain
#1 In portions of the Lark Tailings and the ancillary facilities there is the potential for soils with lead and arsenic above potentially applicable unrestricted land use/unrestricted exposure standards.	N (current land use applications, open space and agricultural, are not impacted by known concentrations of the COCs)	Y (if land use changes to residential, some exposure might be possible)

C. OU18 Acid Mine Drainage

1. A summary of issues for OU18 are given in the following table:

Table 13– OU18 Summary of issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N) - explain
#1 Site delineation map for the Utah Metals Tunnel and Utah Metals Tunnel Dump has not been submitted.	N	Y (If site ownership changes and redevelopment takes place, potential for waste rock release)

		into Middle Canyon Creek.)
#2 Site management reports have been inconsistently provided to UDEQ.	N	Y - Such reports might document the need for further stabilization action. UDEQ response would be delayed.

IX. Recommendations and Follow-up Actions

A. OU3 Butterfield Mine, Canyon & Creek, Herriman Residential & Agricultural Lands

1. Butterfield Mine:

UDEQ found the removal area well vegetated and supportive of the recreational land use. The post removal sampling demonstrated that the area was protective for the current land use. By reference the Kennecott Utah Copper report entitled Final Report for Compliance Monitoring of Suspended Solids In Butterfield Creek (dated January 18, 2002; see Appendix C) reports that the post removal surface on average complied with the lead standard. As noted during the records review, one post removal sample (BFWX-11, 150 mg/kg arsenic) was found to exceed the potentially applicable unrestricted land use/unrestricted exposure (UU/UE) standard for arsenic (100 mg/kg). This sample is located within a relatively steep section of Butterfield Canyon that primarily is supportive of open space and recreational land use types. As such, this one location is not found to contribute to a significant risk of exposure. UDEQ recommends that the waste rock removal project was successful at reducing the risk of exposure to the public that might make use of this recreational area. Subsequently it is the recommendation that the Butterfield Mine waste rock removal site does not need to have another five-year Review.

What future source concerns that remain near this site, where originally beyond the scope of the response action and left to management by Kennecott through protection permits (UPDES, including Stormwater, and Groundwater Protection). These permits are overseen by the DWQ. As part of this five-year review UDEQ assessed Kennecott’s compliance with the DWQ Groundwater Protection Permit on the Eastside Collection System, the Stormwater Protection Permit for the up-gradient (of this site) waste rock dumps and the UPDES discharge permit for the Butterfield Mine Tunnel. Kennecott was found to be in compliance for the past 5 years (actually since 2001) for all three permits and their respective limitations. Ultimately if the waste rock dumps above this site were to migrate (i.e. erode) down to the Butterfield Mine area (and into the Butterfield Creek) or the Butterfield Mine Tunnel discharge were to fall out of compliance, corrective action would have to be pursued by Kennecott as required under these permits. As such, when the Butterfield Canyon/Creek and Herriman sites undergo subsequent five-year reviews it is recommended that compliance with the referenced DWQ permits should be assessed.

2. Butterfield Canyon and Creek:

UDEQ found the removal area well vegetated and supportive of recreational land use. The post removal sampling demonstrated that the removal action did leave, under a backfill cover, 4 locations (sample points SRX-9, SRX-11, SRX-22 & 2SRX-3) at the confluence of Saints Rest and Butterfield Canyon drainages lead above the potentially applicable UU/UE standard for lead (1200 mg/kg). Similarly the removal action did leave, under the backfill cover, 2 locations (sample points YSX-8 & YSX-26) at the confluence of Yosemite and Butterfield Canyon drainages lead above the potentially applicable UU/UE standard for lead. Also, the County Road was not removed during removal, as such tailings are suspected to be located under the road. The Saints Rest area has approximately 1000 linear feet of road that was not addressed through removal, and the Yosemite area has approximately 1000 linear feet of road that was not addressed.

UDEQ has assessed that these two removal areas are protective of current land use types (i.e. open space and recreational). UDEQ notes that these areas may not be protective of future land use applications because of the samples exceeding the potentially applicable UU/UE standards. As such, UDEQ has five recommendations for the Butterfield Canyon Tailings removal areas.

- a. The Agencies render a risk management decision to formally adopt the potentially applicable UU/UE standards for lead and arsenic (1200 mg/kg and 100 mg/kg respectively) that were utilized during this review. Comparatively the soils/tailings mix at the confluence of Saints Rest, Yosemite and Butterfield Canyon drainages are chemically similar to soils that were observed on agricultural and residential properties in the Community of Herriman. The residential land use standards used by the Agencies during the residential removal work in Herriman (1200 mg/kg lead and 100 mg/kg arsenic) addressed soils similar in chemical composition to those soils addressed at Saints Rest and Yosemite. As such, UDEQ recommends from a risk management stand point that the UU/UE standards for lead and arsenic should be the same as the residential cleanup standards at Herriman.
- b. The Agencies coordinate with Kennecott to develop appropriate institutional controls to ensure that at the time of redevelopment on portions of this site Kennecott or their successors own, an analysis of whether the land is suitable for the proposed use is performed with oversight by the Agencies.
- c. The Agencies, with assistance from Kennecott, coordinated with Salt Lake County to develop appropriate institutional controls to ensure that no release or inappropriate exposure happens at those portions of the site overlain by the County road or from portions of the site the County has rights too. The Agencies should also, with assistance from Kennecott, verify land ownership in the areas of the confluence of Saints Rest, Yosemite and Butterfield Canyon drainages to assess if other coordination efforts on institutional controls are necessary.
- d. The Agencies perform a ARARs analysis during the selection of appropriate institutional controls for the Saints Rest and Yosemite confluence areas with Butterfield Canyon and Creek.

- e. Because of the existence of capped (i.e. soil cover) soils/tailings above the potentially applicable UU/UE standards for lead within the confluences of Saints Rest, Yosemite and Butterfield Canyon drainages, UDEQ recommends this site continue to undergo five-year reviews.

3. Herriman Residential & Agricultural Lands:

As part of this five-year review UDEQ interviewed representatives of the City of Herriman to ascertain from their perspective the City's success with implementing the ICs remedy selected under the Kennecott South Zone 2001 ROD for Operable Units 3, 6, and 7. UDEQ found the City of Herriman implementing the selected remedy, which is primarily a "self-certification" program under which a property owner/developer certifies (via the stamp of a certified engineer) that all response work was performed. The few developments on the agricultural lands that have been initiated within the City's jurisdiction have attempted to address existing contaminated soils via excavation, consolidation on site and cover or excavation and haul to Kennecott's Bluewater Repository. Development at pasture lots or extended back yards on the residential properties has been even more limited. Though noted by the City Engineer that development on pasture lots (not previously addressed via removal action) does get overseen through the institutional controls program, the 2001 Record of Decision does not specify that such review action is required.

As part of this review, the UDEQ agreed to evaluate the proposed City of Herriman document entitled *Development of Contaminated Properties – Procedures of Herriman City*. Though not formally adopted by the City, this document is intended to facilitate educating interested parties how to proceed with development in light of the lead and arsenic contamination in the some of the residential and agricultural soils of the City. The procedures to develop contaminated properties in the City of Herriman are being implemented, even though the procedures plan drafted by the City has not been formally adopted under rule. UDEQ (during its assessment of the City guidance document) found a number of concerns. The general concerns UDEQ has with the guidance document included:

- Observed discrepancies with defined terminology;
- Partial references to the prescribed land use standards in the 2001 Record of Decision;
- Incomplete listing of response action documentation that should be submitted by the applicant (i.e. worker health and safety plan, environmental controls/decontamination plan, quality assurance project plan, site management plan, etc.);
- Lack of required environmental inspections for development activities on impacted lands;
- Lack of requirements necessitating individual developments to ensure that capped areas will be maintained in perpetuity; and

- Lack of requirement for the application of erosion and sediment environmental engineering controls (fact sheets for such controls were found to describe the controls but there appeared to be no requirement for their use).
- a. UDEQ recommends that the Agencies coordinate with the City of Herriman to address the noted concerns and get the procedures plan finalized and published.

The success of previous developments to have addressed the lead and arsenic contamination in a sufficient manner to prevent future risks to human health or the environment could not be easily ascertained during the five-year review. Sampling was considered outside the scope of the review and an evaluation of current records found incomplete information.

- b. UDEQ recommends a limited screening of surface and near surface soils on selected project properties to assess if redevelopment activities have left soils in the near surface zone that may cause an impact to human health and the environment, or be allowed to migrate (i.e. erode). Selected developments for screening level sampling include: (1) Blackhawk, (2) Western Creek, and the (3) Salt Lake County Flood Control sewer inlet.
- c. UDEQ also recommends offering environmental inspection assistance to the City of Herriman while it constructs the 126th South By-pass road through the Tuscan Estates soils repository. Such assistance will help to educate the staff of the City of Herriman on how to perform such inspections.
- d. UDEQ recommends that the Agencies incorporate, as part of a modification of the selected remedy, the review and oversight of development on pasture lots/extended back yards for those residential properties that have such extensions to their property under the selected institutional controls program implemented by the City of Herriman.
- e. The Agencies perform a ARARs analysis to ensure that those federal, state and local regulations that should be ARARs are included since soils are being excavated and disposed of within the Community of Herriman.
- f. There are agricultural lands impacted with elevated concentrations of lead and arsenic that are within the jurisdiction of Salt Lake County. In 2000 EPA had initiated an effort to negotiate with the engineering and planning divisions of Salt Lake County to develop an ICs program (similar to what the City of Herriman had done). Said ICs program would allow the Salt Lake County to ensure that property owners and/or developers were addressing inappropriate concentrations of lead and arsenic (for the intended land use) at the time of redevelopment. During this five-year review UDEQ was not able to assess if such an ICs program was ever developed by the Salt Lake County. UDEQ recommends coordinating with EPA to educate the staff of the Salt Lake County engineering and planning divisions on an ICs plan and assisting them with developing and implementing an ICs plan.
- g. UDEQ's recommends that this portion of OU3 continue to receive five-year reviews since soils with elevated lead and arsenic above potentially applicable

UU/UE standards will remain buried or at the surface on the residential and agricultural lands within the community of Herriman for some time.

4. A summary of recommendations for OU3 are given in the following table:

Table 14– Summary of OU3 Recommendations

Issue - Entity	Recommendation/ Follow-up Action	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)	
				current	future
#1	Continue to evaluate Kennecott's compliance with DWQ permits for the waste rock dumps, during subsequent five-year review investigations.	UDEQ	2 nd Five Year Review Completion - October 2014	N	Y
#2	Notify the Salt Lake County Public Works and park/rec divisions, to see if they can facilitate a cleanup. Recommend as a local service project to youth group organizations.	UDEQ	June 2010	N	N
#3	Identify performance standards for residual metals concentrations in soil. If residual contamination meets performance standards, the area will be identified as UU/UE. If residual contamination exceeds performance standards, institutional controls must be implemented.	UDEQ & EPA, coordinating with Kennecott and Salt Lake County	June 2010	N	Y
#4	Coordinate with the City of Herriman to ascertain if maps, of the residential properties with	UDEQ & City of Herriman	Notification by City that maps of capped lots exist and are	Y	Y

	elevated contaminants of concern exist below current surface grade, are held by the City Planning & Zoning Department. Ensure mechanism to maintain institutional knowledge.		held by the City - June 2010		
#5	Assure that pasture lot and “extended backyard” redevelopment falls within the scope of oversight by the City of Herriman under the City’s ICs program.	UDEQ & City of Herriman	Notification by City that pasture land redevelopment does require environmental assessment - June 2010	Y	Y
#6	Provide the City of Herriman with comments concerning information and procedural gaps observed by UDEQ in the proposed revised ICs program.	UDEQ & City of Herriman	Provide comments on the proposed ICs procedures plan – July 2010.	N	Y
#7	Perform an ARARs analysis and reevaluate applicability for the ICs remedy in light of excavations being performed at the agricultural properties	UDEQ & EPA, coordinate with the City of Herriman	June 2010	Y	Y
#8	Initiate negotiations with the Salt Lake County Engineering and Planning Divisions to assist with the development of appropriate ICs program.	UDEQ & EPA	Negotiation start – June 2010 IC Implementation - TBA	Y	Y
#9	Perform a limited screening (via collected soil samples and/or X-ray Fluorescence soil	UDEQ	Develop sampling and analysis plan – June 2010	Y (dependent upon results)	Y (dependent upon results)

	screening) to ascertain the lead and arsenic concentration in surface and near-surface soils at selective properties.		Negotiate site access – July 2010 Sample – August 2010		
#10	Continue five-year reviews	UDEQ	Five years from the completion of the 1 st five year report	N	N

B. OU 6 Lark Waste Rock & Tailings

1. Lark Waste Rock:

As noted during the review, the Lark Waste Rock piles were removed completely. The material removed was placed on the Eastside Waste Rock Dumps of the Bingham Canyon Mine, which are located behind the Eastside Collection System. Twelve waste rock piles were removed completely to native soils underneath the piles, to achieve a post removal surface of 1000 mg/kg for lead and 100 mg/kg for arsenic. As delineated in the post removal reports, Table 9 above documents the average lead and arsenic concentrations in post removal samples per pile. This review determined that post removal samples were below the potentially applicable unrestricted land use/unrestrictive exposure (UU/UE) standards for lead and arsenic (1200 mg/kg and 100 mg/kg respectively).

At this time, UDEQ acknowledges that the Lark Waste Rock removal project was successful to mitigate current and potential long term risk concerns associated with the waste. UDEQ recommends that the areas of the waste rock removal areas do not need subsequent five-year reviews.

2. Lark Tailings:

The inspection of this portion of OU6 found the vegetative cover intact and the site supportive of current land use. A fence along the site's boundaries (installed for purposes to protect the reseeding effort) was also found to be relatively intact (one intrusion through the fence exists near the Southeast corner of the Lark Tailings reclamation area where the Kennecott Land haul road transects the sites southern boundary). Though it was noted from the response work documentation that some "hotspot" removal work (no data was available) was performed, in general the Lark Tailings area was primarily regraded, covered and then revegetated. As noted by Kennecott representatives during the records review, the pre-grading characterization data documented lead concentrations ranging from 3 mg/kg to 8700 mg/kg and arsenic concentrations ranging from 5 mg/kg to 220 mg/kg. Prior to covering the regraded Lark Tailings reclamation area, large scale composite samples were collected and analyzed for lead and arsenic. This second characterization effort delineated a lead concentration on the regraded slopes ranging from 13 mg/kg to 170 mg/kg and an arsenic concentration ranging from 12 mg/kg to 120 mg/kg. Currently, it is suspected

that some of the higher lead and arsenic concentrations still remain onsite under the covered, regraded slopes.

UDEQ has assessed that the response work implemented at the Lark Tailings area (Lark Tailings reclamation area) is supportive of current land use practices (i.e. open space, agricultural). Potentially applicable open space and agricultural land use standards could and were drawn from the OU3 portion of the September 2001 ROD during this review to provide for a comparison of the pre-cover sample data (open space – lead 3000 to 10,000 mg/kg and arsenic 250 to 300 mg/kg; agricultural – lead 10,000 mg/kg and arsenic 300 mg/kg). The open space and agricultural land use standards used during this review by UDEQ were selected pursuant to the explanation provided under subpart “a” (second paragraph) of this recommendation. At this time, UDEQ notes that the Lark Tailings may not be protective of future land use applications because of the mixed soils/tailings having the potential to exceed the potentially applicable UU/UE standards for lead and arsenic (noted in Section C of this chapter). As such, UDEQ has four recommendations for the Lark Tailings area.

- a. The Agencies render a risk management decision to formally adopt the potentially applicable UU/UE standards for lead and arsenic (1200 mg/kg and 100 mg/kg respectively) that were utilized during this review.

The soils/tailings mix at OU6 Lark Tailings was derived from the milling of an ore body by the Ohio Copper Company (from 1909 to 1919) that was primarily a porphyry copper deposit with a low lead and arsenic concentration. Comparatively, the ore mined and milled at the Revere operations in Butterfield Canyon processed a skarn ore deposit that was high for lead and silver (phone interview with Mr. Brian Vinton, NAMS, April 28, 2009). The residential land use standards used by the Agencies during the residential removal work in the Community of Herriman (1200 mg/kg lead and 100 mg/kg arsenic) were developed in light of a risk assessment using samples from the Butterfield Canyon site, samples that had a higher potential for elevated lead and arsenic concentrations. As such, UDEQ recommends from a risk management stand point that the UU/UE standards for lead and arsenic for the Lark Tailings area should be the same as the potentially more conservative residential cleanup standards developed for the Community of Herriman.

- b. The Agencies coordinate with Kennecott to develop appropriate institutional controls to ensure that at the time of redevelopment on portions of OU6 - Lark Tailings Kennecott or their successors own, an analysis of whether the land is suitable for the proposed use is performed with oversight by the Agencies.
- c. The Agencies perform a ARARs analysis during the selection of appropriate institutional controls for the Lark Tailings reclamation area.
- d. Because of the existence of regraded soils/tailings above the potentially applicable UU/UE standards for lead within OU6 Lark Tailings, UDEQ recommends this site continue to undergo five-year reviews.

3. Lark Waste Rock and Tailings Ancillary Facilities:

The ancillary sites, Randolph Peterson Gate, Mascotte Ditch, Bastian Ditch, Midas Creek Silos Area, the area between Mascotte Pond and Midas Creek Silos, Southeast Area, and the Lone Tree Area, received some characterization and response actions during the Lark Tailings response work. A review of the characterization or post response data for Randolph Peterson Gate, Midas Creek Silos area, and the Southeast and Lone Tree Areas delineated lead and arsenic concentrations that are supportive of the current land use (i.e. open space or agricultural, standards for which were drawn for comparison from the Sept. 2001 ROD OU3 Chapter). Characterization data for the Mascotte Ditch, Bastian Ditch, portions of Midas Creek Silos area, the area between the Mascotte Pond and Midas Creek Silos were more limited but are suspected to be supportive of the current land use (open space or agricultural) after a review of the history of the site. As noted there is the potential to have soils at these ancillary sites (except for the Lone Tree site) that could exceed the potentially applicable lead and arsenic UU/UE standards used during the review (and drawn from the OU3 Chapter of the September 2001 ROD).

At this time, UDEQ notes that the ancillary sites may not be protective of future land use applications because of the mixed soils/tailings having the potential to exceed the potentially applicable UU/UE standards for lead and arsenic. As such, UDEQ has four recommendations for the Lark Tailings area.

- a. The Agencies render a risk management decision to formally adopt the potentially applicable UU/UE standards for lead and arsenic (1200 mg/kg and 100 mg/kg respectively) that were utilized during this review.

The soils/tailings mix at OU6 Lark Tailings was derived from the milling of an ore body by the Ohio Copper Company (from 1909 to 1919) that was primarily a porphyry copper deposit with a low lead and arsenic concentration. Comparatively, the ore mined and milled at the Revere operations in Butterfield Canyon processed a skarn ore deposit that was high for lead and silver (phone interview with Mr. Brian Vinton, NAMS, April 28, 2009). The residential land use standards used by the Agencies during the residential removal work in the Community of Herriman (1200 mg/kg lead and 100 mg/kg arsenic) were developed in light of a risk assessment using samples from the Butterfield Canyon site, samples that had a higher potential for elevated lead and arsenic concentrations. As such, UDEQ recommends from a risk management stand point that the UU/UE standards for lead and arsenic for the Lark Tailings area ancillary sites should be the same as the potentially more conservative residential cleanup standards developed for the Community of Herriman.

- b. The Agencies coordinate with Kennecott to develop appropriate institutional controls to ensure, at the time of redevelopment on portions of ancillary sites that exceed applicable UU/UE standards for lead and arsenic that Kennecott or their successors own, an analysis of whether the land is suitable for the proposed use is performed with oversight by the Agencies.
- c. The Agencies perform an ARARs analysis during the selection of appropriate institutional controls for the Lark Tailings ancillary sites Randolph Peterson Gate,

Mascotte Ditch, Bastian Ditch, Midas Creek, Midas Creek Silos area, Southeast and Lone Tree Areas.

- d. Because of the existence of regraded soils/tailings above the potentially applicable UU/UE standards for lead within OU6 Lark Tailings, UDEQ recommends this site continue to undergo five-year reviews.

4. A summary of recommendations for OU6 are given in the following table:

Table 15– OU6 Summary of OU6 Recommendations

Issue - Entity	Recommendation/ Follow-up Action	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)	
				current	future
#1	Identify performance standards for residual metals concentrations in soil. If residual contamination meets performance standards, the area will be identified as UU/UE. If residual contamination exceeds performance standards, institutional controls must be implemented. Develop ICs program to control future land use changes. Perform a ARARs analysis.	UDEQ & EPA, coordinating with Kennecott	June 2010	N	Y

C. OU18 Acid Mine Drainage

- 1. Utah Metals Tunnel and Utah Metals Tunnel Dump:

UDEQ found that stabilization and reconstruction efforts implemented by Kennecott since 2000, to have been successful at preventing the continued migration of waste rock material from the Utah Metals Tunnel Dump into Middle Canyon Creek. The site access barriers were viewed to be successful by UDEQ to prevent vehicular traffic from

disturbing the revegetation effort along the top surface of the Utah Metals Tunnel Dump. The piping of discharge water from the Utah Metals Tunnel off the Dump and delivery to the local irrigation company's collection system (since 2006) was found to be successful to prevent the erosion of the Utah Metals Tunnel Dump's top surface. Lastly, the reconstructed drainage channel from the top of the Dump down the western slope of the Dump was found by UDEQ to be a robust structure for future storm events.

No known complaints have been received from the irrigation company to date. The land use at the site remains as it was during the selection of the remedy (recreational/open space) and thus the selected remedy remains protective. Because the waste rock still has contaminants of concern (i.e. 2000 mg/kg lead, eco risk) above unrestricted land use standards, UDEQ recommends this site receive a subsequent Five Year Review.

As part of the stabilization effort, under the September 2002 Kennecott North Zone & South Zone ROD Kennecott was required to submit annual inspection reports on the stabilization controls and water management controls at this site. Such reports were to be submitted to UDEQ. As part of the selected remedy a map of this site's location for use by land planners in the future (during proposed redevelopment actions) was to be submitted to the EPA and UDEQ as part of the larger Kennecott North Zone mapping exercise. This larger exercise is tasked to delineate the location of capped or covered waste left in place across the North Zone and portions of the South Zone of the Kennecott site. To date such map has not been received. UDEQ recommends that this map and site management exercise get wrapped up in the pending Site Wide Management Plan for waste left in place (being drafted during the negotiations of the North Zone & South Zone consent decree). UDEQ further recommends that this portion of OU18 continue to undergo five-year reviews while soils continue to be present above the potentially applicable UU/UE standards, for the COC in question (i.e. lead).

2. Other Tunnels and Dumps:

The other tunnels (i.e. Apex (Parvenu), Bingham West Dip, Adamson, Copper Boy, Spring Canyon Tunnels, Upper Bruneau, and Helen B) and waste rock dump (i.e. Bingham West Dip) are located in areas still currently being used as open space or industrial land use. Subsequent to the observance of no land use change plans being proposed the UDEQ assessed that the original remedy specified for these sites is still adequate and protective. As noted in the records review, Kennecott has maintained compliance with its UPDES permit limitations in Pine Canyon (the primary drainage for the tributaries these tunnels and dump are located within. This portion of OU18 does not need to continue to undergo five year reviews.

3. A summary of recommendations for OU18 are given in the following table:

Table 16– Summary of OU18 Recommendations

Issue	Recommendation/ Follow-up Action	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)	
				current	future
#1	Submission of map delineating the location of the Utah Metals Tunnel & Utah Metals Tunnel Dump site in Middle Canyon.	Kennecott	¹ Please see footnote at bottom of page	N	Y
#2	Reporting requirement to be stated within the pending Site Wide Management Plan.	Kennecott	¹ Please see footnote at bottom of page	N	Y
#10	Continue five-year reviews for the Utah Metals Tunnel and Utah Metals Tunnel Dump portion of OU18.	UDEQ	Five years from the completion of the 1 st five year report	N	N

X. Protectiveness Statements

A. OU3 Butterfield Mine, Butterfield Canyon & Creek, Herriman Residential and Agricultural Lands (City of Herriman and Salt Lake County):

The remedy for OU3 is not protective because: (1) potential redevelopment (i.e. change in land use) on portions of the operable unit is not managed through an ICs program, (2) the current ICs program in the City of Herriman is a “self certification” program which lacks independent verification of statements made by building permit applicants that a site is protective for the intended land use, (3) there are no listed ARARs for the selected remedy.

There are portions of OU3 which are in compliance with the intent of the selected remedy or the goals of the previous removal actions. For example, in Butterfield Canyon (Mine, Canyon and Creek) source controls for the up-gradient waste rock dumps are being maintained and operated in compliance with the Utah Groundwater Water Protection and UPDES permit limitations. The permits have corrective action requirements associated with them to address out-of-compliance conditions if they arise. The removal actions in the Canyon (for the mine waste rock and tailings sites) were effective to remediate this portion of OU3 and to reduce the risk of exposure for the intended and current land use (i.e. open space, recreational).

¹ Submission of a map and discussion of reporting requirements is subject to the Site Wide Management Plan for waste left in place being drafted and negotiated during the negotiation of the North Zone & South Zone consent decree. The milestone date is subject to approval of the Site Wide Management Plan under the noted consent decree.

The following actions need to be taken to ensure protectiveness where soils exceed selected land use standards listed in the 2001 Kennecott South Zone ROD:

1. UDEQ and EPA need to coordinate with the Salt Lake County divisions of engineering and planning to assist with the development of an ICs program (with a listing of pertinent ARARs) that is effective to ensure the proper management of soils with elevated lead and arsenic above selected land use standards when agricultural properties within the County jurisdiction undergo redevelopment.
2. UDEQ and EPA need to coordinate with the City of Herriman to:
 - i. Screen surface and near surface soils in known disturbed locations on redeveloped properties within Herriman's jurisdiction.
 - ii. Provide comments and assist with the finalization of the document entitled *Development of Contaminated Properties – Procedures of Herriman City* to ensure proper management of soils with elevated lead and arsenic above selected land use standards when agricultural properties within the City's jurisdiction undergo redevelopment. This effort shall also include a listing of pertinent ARARs.
 - iii. Ensure capped or un-remediated residential properties and residential pasture lots/extended backyards are documented (i.e. mapped), so the City can ensure redevelopment in these areas will fall under the scope of their ICs program.
3. UDEQ and EPA need to work with Kennecott and Salt Lake County to develop ICs for the confluence areas of Saints Rest and Yosemite drainages with Butterfield Canyon. This action will ensure that if the current land use is changed, the soils in the confluence areas are investigated to determine if they support the intended land use.

B. OU6 Lark Waste Rock & Tailings and Ancillary Facilities:

The remedy for the Lark Waste Rock removal project is protective of current (industrial, open space) and potentially applicable future land use (open space, agricultural, residential) because the response work removed materials above the cleanup goals. The remedy for Lark Tailings (re-grading and cover) and the ancillary facilities (some characterization, some hotspot removals) is protective of current land use applications (i.e. open space and agricultural).

Development of ICs for the Lark Tailings area and ancillary facilities will ensure that if (in the future) the land use changes, the soils at these two sites are investigated to determine if they support the intended land use.

C. OU18 Acid Mine Drainage:

The remedy at Operable Unit 18 (more specifically the Utah Metals Tunnel and Utah Metals Tunnel Dump, and other tunnels and dump located along the western face of the Oquirrh Mountains) is protective of human health (based upon current land use, open space/recreational) and the environment. Response action source controls are in place at the Utah Metals Tunnel and Utah Metals Tunnel Dump, and are being maintained and operated in compliance with the September 2002 North Zone & South Zone ROD. These controls are being monitored by Kennecott. The response action (stabilization of the waste rock in the dump and prevention of erosion) remains intact and there were no new impacts to the remediated area.

XI. Next Review

This review was required by statute. The next review will be conducted within five years of the completion of this five-year review report. The completion date is the date of the signature shown on the signature cover attached to the front of the report.

ATTACHMENTS



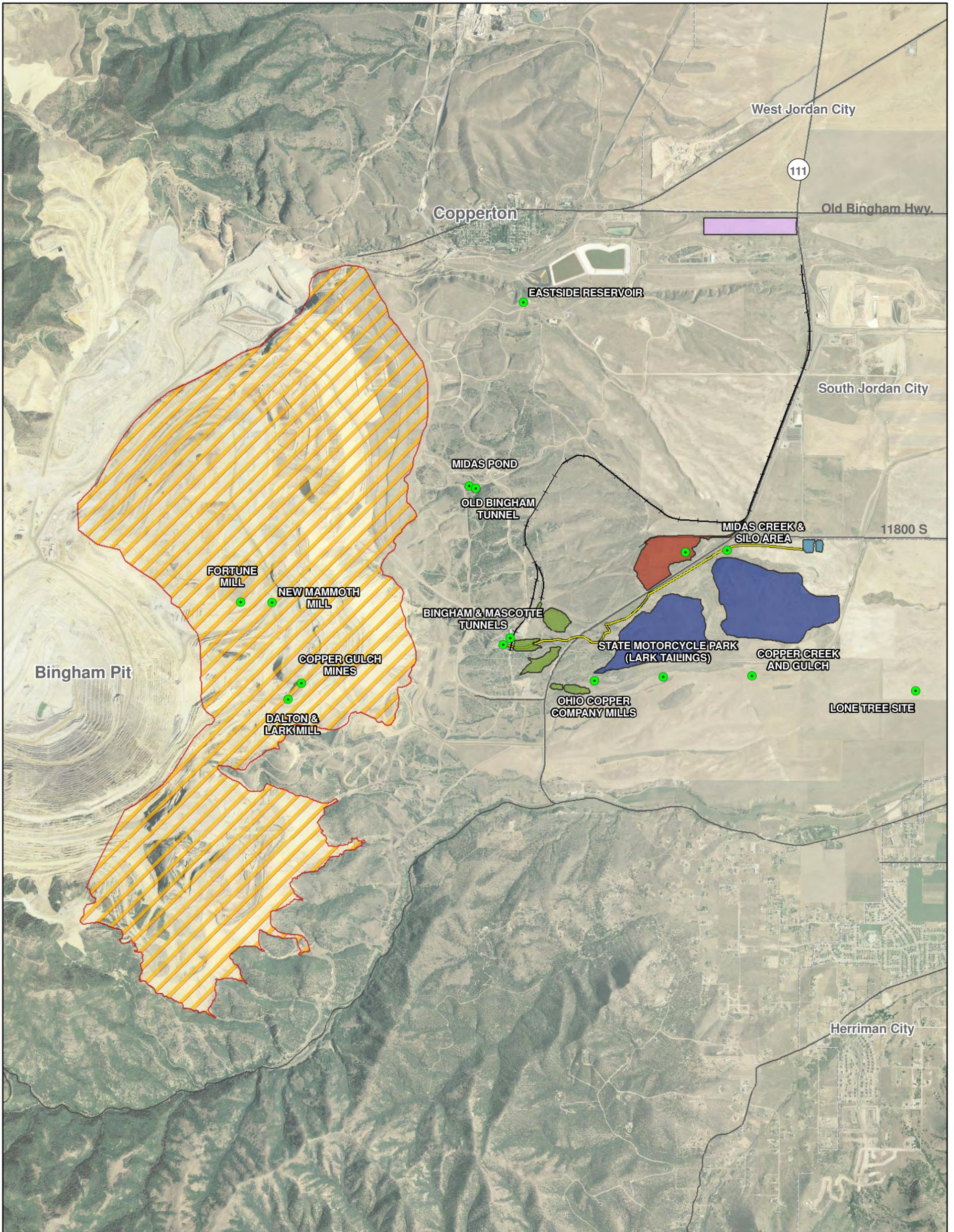
OU3

- BUTTERFIELD WASTE ROCK
- HERRIMAN RESIDENTIAL AND AGRICULTURAL
- BUTTERFIELD CANYON CREEK WASTE ROCK TAILINGS
- HISTORIC MILLING AND MINING LOCATIONS

Note: All areas and site are in approximate location.



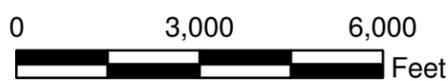
RioTinto	KENNECOTT SOUTH ZONE OPERABLE UNIT 3 BUTTERFIELD CANYON AND HERRIMAN
	ENVIRONMENTAL RESTORATION GROUP
	Drawing Number: OU3_72309
	Date: 7/09 Drawn By: JI Project Mgr: BV Rev:



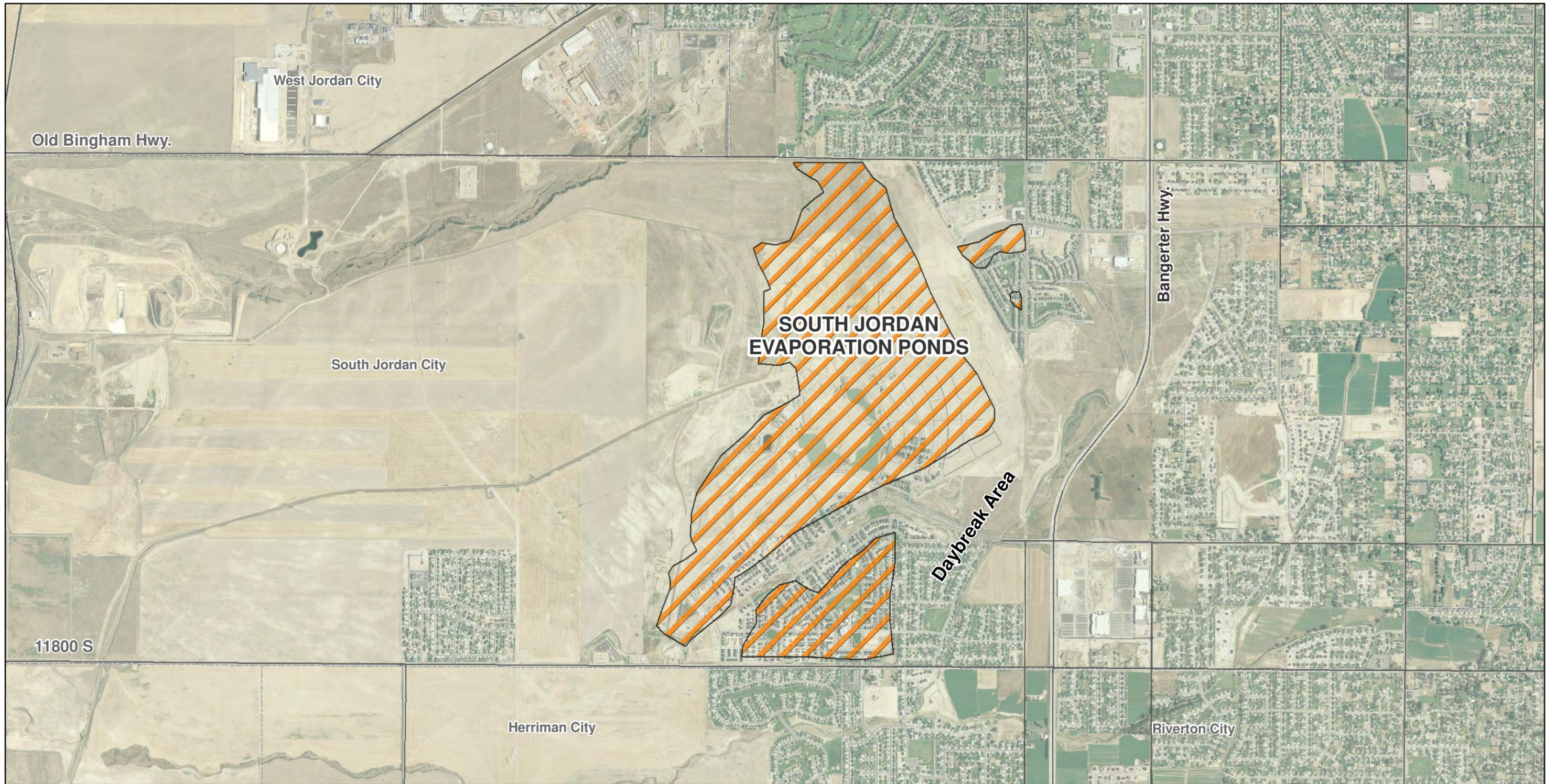
OU6 - LARK WASTE ROCK & TAILINGS

- EAST SIDE BINGHAM CANYON DUMPS
- LARK TAILINGS
- LARK WASTE ROCK
- MASCOTTE POND
- PROLER
- RANDOLPH PETERSON GATE
- HISTORIC MINING & MILLING OPERATIONS
- DALTON AND LARK RAILROAD
- MASCOTTE DITCH

Note: All sites and areas are shown in approximate locaton.



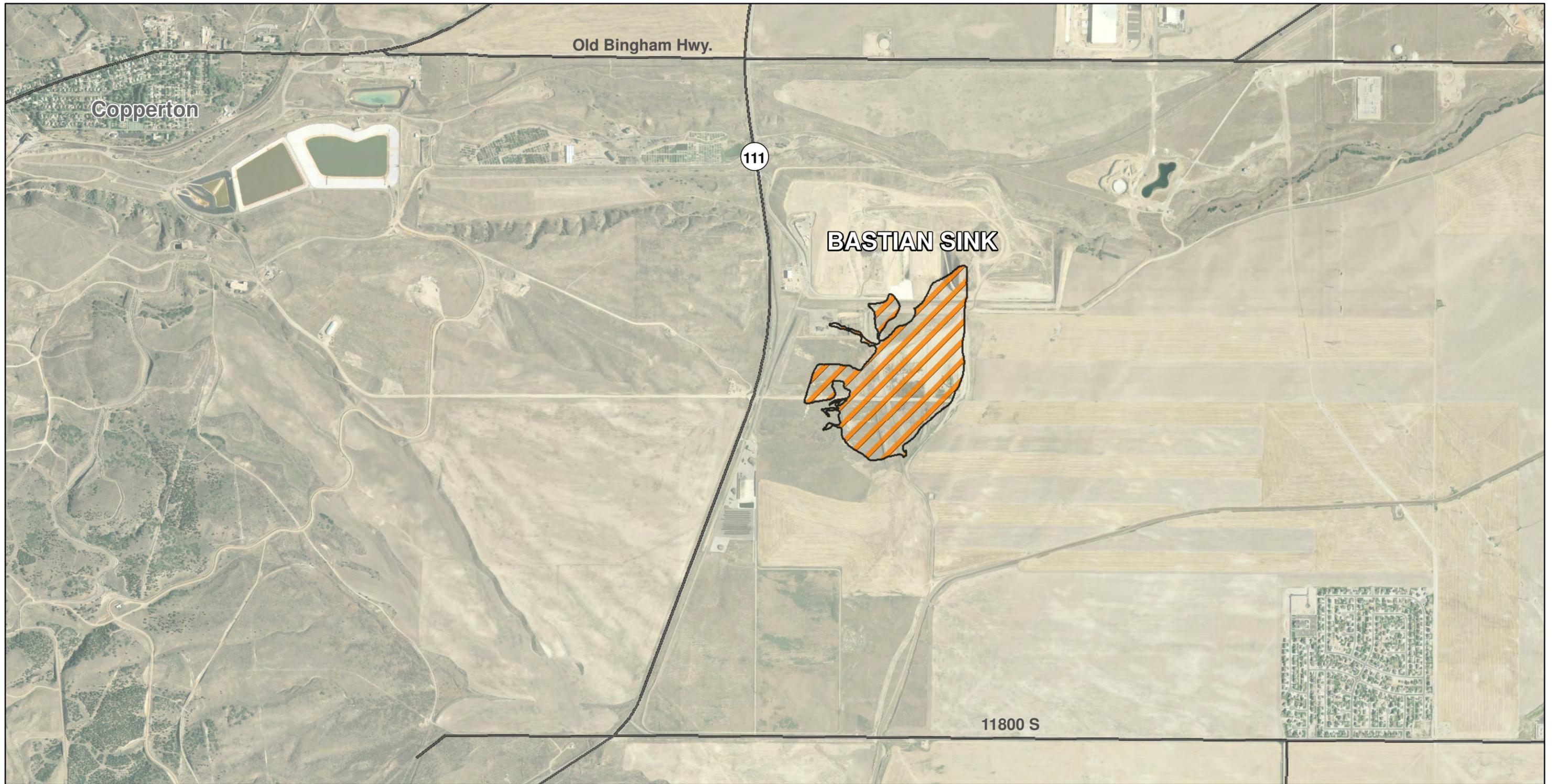
KENNECOTT SOUTH ZONE OPERABLE UNIT 6 LARK WASTE ROCK AND TAILINGS	
ENVIRONMENTAL RESTORATION GROUP	
Drawing Number: OU6_72309	
	Date: 7/09 Drawn By: JI Project Mgr: BV Rev:



OU7 - SOUTH JORDAN EVAPORATION PONDS
(APPROXIMATE LOCATION)



RioTinto	KENNECOTT SOUTH ZONE OPERABLE UNIT 7 SOUTH JORDAN EVAPORATION PONDS
	ENVIRONMENTAL RESTORATION GROUP
	Drawing Number: OU7_72309
	Date: 7/09 Drawn By: JI Project Mgr: BV Rev:



OU17 - BASTIAN SINK
(APPROXIMATE LOCATION)

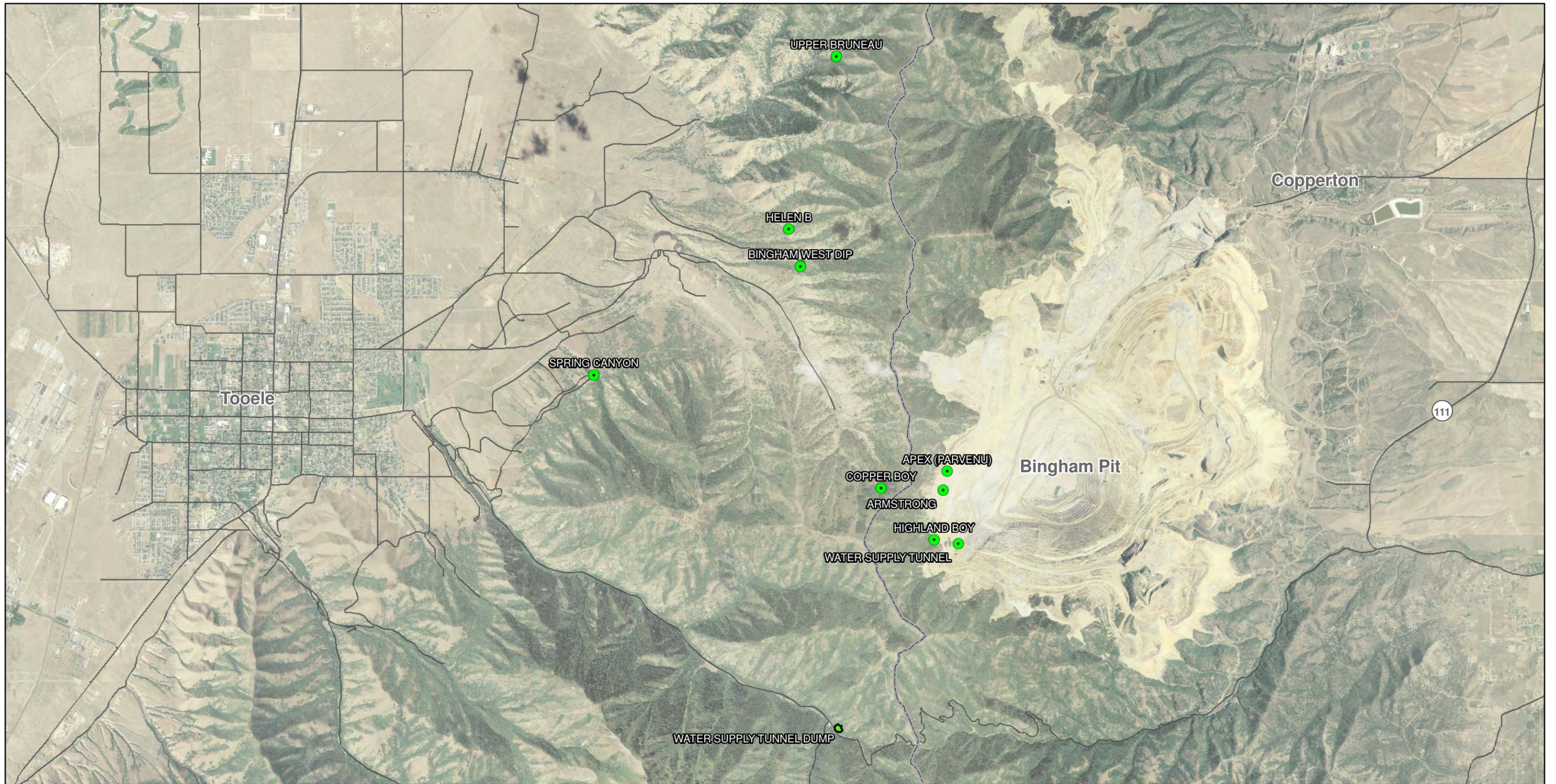


**KENNECOTT SOUTH ZONE
OPERABLE UNIT 17
BASTIAN SINK**

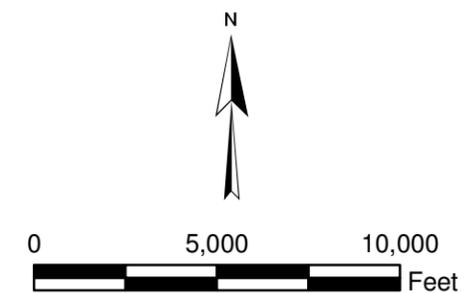
**ENVIRONMENTAL
RESTORATION GROUP**

Drawing Number: OU17_72309

Date: 7/09
Drawn By: JI
Project Mgr: BV
Rev:



● OU18 - ACID MINE DRAINAGE (TOOELE CO. AREA) SITES (APPROXIMATE LOCATIONS)



RioTinto	KENECOTT SOUTH ZONE OPERABLE UNIT 18 ACID MINE DRAINAGE (TOOELE CO. AREAS)
	ENVIRONMENTAL RESTORATION GROUP
	Drawing Number: OU18_72309
	Date: 7/09 Drawn By: JI Project Mgr: BV Rev: