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June 30, 2022 Project No. 14-01-156

Alan Pineda, PE
Professional Engineer
Bureau of Industrial Site Cleanup
Nevada Division of Environmental Protection
375 E. Warm Springs Rd., Ste. 200
Las Vegas, NV 89119

Re: Focused Feasibility Study Report – Soil and Mine Wastes, Revision 2
Three Kids Mine, Henderson, Nevada

Dear Mr. Pineda,

Broadbent & Associates, Inc. (Broadbent) is pleased to submit this *Focused Feasibility Study Report – Soil and Mine Wastes, Revision 2* (FFS) for the Three Kids Mine located in Henderson, Nevada.

Please do not hesitate to contact us if you should have any questions or require additional information.

Sincerely,
BROADBENT & ASSOCIATES, INC.

Kirk Stowers, CEM
Principal Geologist

cc: JD Dotchin, NDEP
James Carlton Parker, NDEP
Joe McGinley, McGinley & Associates, Inc.
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**Focused Feasibility Study Report – Soil and Mine Wastes, Revision 2**
**Three Kids Mine**
**Henderson, Nevada**

JURAT: I, Karen Gastineau, hereby certify that I am responsible for the services in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulation and ordinances.

Karen Gastineau

June 30, 2022

**Karen Gastineau**
**Senior Hydrogeologist**
**Certified Environmental Manager #2468 (4/1/2023)**

**Date**

ATTACHMENT A
Responses to NDEP Comments made on June 9, 2022

1. **Attachment A, Responses to NDEP Comments made on April 12, 2022, Response to Comment 7** – The FFS has been revised to delete Section 1.9.3, Risk Assessment, including the reference to the Risk Assessment Work Plan. The response to comment 8 discusses the use of risk assessment for post-remediation conditions. There should be a short discussion in the FFS that a risk assessment will be conducted for post-remediation conditions in accordance with the Work Plan to document that the 3KM reclamation program is compliant with the CERCLA risk assessment process even though a "baseline" risk assessment will not be conducted. Also, "post-remedy selection" is a better term to be using if the risk assessment will be used to fine tune the remedy prior implementation to ensure protection of public health and environment. If this interpretation is correct, it is implied that additional data will be collected prior to remedy implementation, e.g., a pre-design investigation. Clarification is required on this subject.

   With the placement of 10 feet of clean cover, most of the risk assessment process as outlined in the Risk Assessment Work Plan is not necessary. The risk assessment process as outlined will be followed up to the point that it can be demonstrated that exposure pathways are not complete. However, a risk assessment will be completed as part of the closure report for each unit. Sentences were added to Sections 4.2, 4.3, and 4.4 to indicate that risk will be assessed.

   Currently, there is no plan for risk assessments to be used to fine tune the remedy. Based on results of the RI, metals concentrations are elevated at depth beneath the former mine site, which is why the preferred alternative is placing 10 feet of clean cover.

2. **Section 1.0 Introduction** – This section states that suitable borrow material is available on the property from the Muddy Creek Formation and River Mountain Volcanics. This material was characterized in the background study by only sampling the 0-1 foot interval. Any use of this material as fill on the site after excavation will require a testing program to ensure it meets the PRGs.

   BTVs have been established in the NDEP-approved Background Soil Report, Revision 2. There is no driver to further characterize the background area.

3. **Section 1.4.3 Three Kids Mine Remediation and Reclamation Act** – The second to last paragraph mentions a leaching study that is in progress and how the results could create a need for a groundwater OU. However, the RI report indicates that the Leaching Analysis Report was issued on April 4 yet this document is dated April 28. Also, Table 6.1 (Solid Waste Landfill Design, and Maintenance) indicates solid wastes are “dry” and not expected to generate leachate, implying data has been reviewed.

   Section 1.4.3 was revised to state that, based on results presented in the Leaching Analysis Report, a separate OU for groundwater is not needed. Where relevant, language was changed to reflect the current submission status of several documents.

4. **Section 2.3 Preliminary Remediation Goals** – The proposed PRG for lead (400 mg/kg) is not based on a health protection methodology. Risk to lead and subsequent PRGs are normally

computed with the EPA IEUBK Blood lead model (children) and the Adult lead model (ALM). It might be useful to perform screening level calculations at this time to gauge the suitability of the 400 mg/kg value.

Noted, however, the preferred alternative includes placement of 10 feet of clean cover. If risk-based screening levels are used in the future, the IEUBK blood lead model and adult lead model will be considered.

5. **Section 2.4 Occurrence and Volume of Affected Soil and Waste** – The last paragraph indicates the site will be covered with 10 feet of clean fill because BTVs cannot be achieved due to natural conditions related to the surrounding ore. However, this only applies to alternatives S-3 and S-4. Furthermore, as noted in the bullets above, tailings extend to a depth of 60 feet bgs, and the volume estimate is used to determining the excavation and compaction costs for Alternatives S-2, S-3, and S-4. Is the volume estimate based on a 10 foot or 60 foot tailing depth seeing as there is no reason to excavate deeper than 10 feet to eliminate the direct contact pathway for humans? Also, given that BTVs cannot be achieved due to natural conditions related to the surrounding ore, there seems to be little point excavating deeper than 2 feet for Alternative S-2. In this case, the cost estimate for S2 will be significantly lower than S-3 and S-4. Although these observations do not change selection of the preferred remedy, it is confusing.

   Leaving tailings in place in a residential area was screened out during project inception based on agency and community acceptance.

6. **Sections 4.2, 4.3, & 4.4** – Alternatives S-2, S-3, and S-4 indicate excavation and removal of <u>select</u> contaminated soil, waste rock, and tailings. As mentioned in Comment 2, BTVs cannot be achieved at the mine site due to the natural conditions related to the ore body. Therefore, it is unclear why only select material is excavated.

   Additional detail on select contaminated soil to be excavated is provided in the Corrective Action Plan – Soil and Mine Wastes and is based on the results of the RI. Select contaminated soil to be excavated will include PAH-impacted soil and soil to achieve planned final grade of the excavation.

# Focused Feasibility Study Report – Soil and Mine Wastes, Revision 2

## Three Kids Mine
## Henderson, Nevada

*Prepared for*

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACM | Asbestos-containing material |
| amsl | Above mean sea level |
| ARAR | Applicable or relevant and appropriate requirement |
| bgs | Below ground surface |
| BISC | Bureau of Industrial Site Cleanup |
| Broadbent | Broadbent & Associates Inc. |
| BTV | Background threshold value |
| C&D | Construction and Demolition |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COC | Contaminant of concern |
| DLA | Defense Logistics Agency |
| EA | EA Engineering, Science, and Technology, Inc., PBC |
| EPA | U.S. Environmental Protection Agency |
| ESA | Environmental Site Assessment |
| FFS | Focused Feasibility study |
| HHRA | Human Health Risk Assessment |
| IC | Institutional control |
| Lakemoor | Lakemoor Ventures LLC. |
| mg/kg | Milligram per kilogram |
| mg/L | Milligram per liter |
| MRRA | Mine Remediation and Reclamation Agreement |
| MWMP | Meteoric Water Mobility Procedure |
| NAC | Nevada Administrative Code |
| NCP | National Oil and Hazardous Substance Pollution Contingency Plan |
| NDEP | Nevada Division of Environmental Protection |
| PCB | Polychlorinated biphenyl |
| PRG | Preliminary remediation goal |
| RAO | Remedial action objective |
| RCRA | Resource Conservation and Recovery Act |
| RSL | Regional screening level |

## LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| SAL | Soil action level |
| SAP | Sampling and Analysis Plan |
| site | Three Kids Mine Site |
| $SO_2$ | Sulfur dioxide |
| SNHD | Southern Nevada Health District |
| SRC | Site Related Chemical |
| TKE | Three Kids Enterprises |
| TBC | To be considered |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TPH | Total petroleum hydrocarbon |
| TMV | Toxicity, mobility, or volume |

# 1. INTRODUCTION

EA Engineering, Science, and Technology, Inc., PBC (EA), as a teaming partner with Broadbent & Associates Inc. (Broadbent), has prepared this Focused Feasibility Study (FFS) Report – Soil and Mine Waste, Revision 2 for the Three Kids Mine (site) in Henderson, Nevada for Lakemoor Ventures LLC (Lakemoor). Lakemoor, in partnership with the Nevada Division of Environmental Protection (NDEP), has agreed to undertake the steps necessary to achieve closure of legacy contamination associated with former mining activities.

The FFS has been prepared in accordance with regulations and guidance documents which include, but are not limited to, the following:

- National Oil and Hazardous Substance Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300 (U.S. Environmental Protection Agency [EPA] 1990) and

- Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (EPA 1988).

This FFS is based on historical documents prepared by various parties and agencies and data collected in 2021 and 2022 by Broadbent during the Remedial Investigation (RI). The RI is being conducted to assess the nature and extent of mining related impacts to support a Mine Remediation and Reclamation Agreement (MRRA) pursuant to the Three Kids Mine Remediation and Reclamation Act, United States Public Law 113-135, Section 3.b.2.B.

This FFS is being submitted prior to approval of the RI Report, which in the CERCLA framework is premature. However, based on waste rock, tailings, and soil data collected during the RI; NDEP precedence at other soil contamination sites; and ongoing conversations with NDEP, the remediation and reclamation required is understood. Therefore, the basis for this FFS is substantial and well supported. Additionally, because the act has a withdrawal provision 10 years from the date of passage, time is of the essence.

The underlying information that supports this FFS includes the following:

- Investigation of mining wastes (waste rock piles and tailings ponds) indicates that both waste rock and tailings exceed arsenic and other metals concentrations acceptable for human exposure.

- Soil underlying waste rock piles and tailings ponds also exceeds acceptable levels of arsenic and other metals.

- Within the mine site area proper (pits, waste rock piles, tailing ponds, and mill site), native soils have highly variable metals concentrations at depth which are attributed to sedimentary ore deposition processes. Clearing the zero to 10-foot soil pathway for

residential and construction worker exposure via removal of impacted media does not appear possible.

- Based on precedence, NDEP prefers 10 feet of clean final cover or separation from contamination exceeding Regional Screening Levels (RSLs) or background threshold values (BTVs).

- Suitable borrow material is available on the property: west of the mine site in Muddy Creek Formation, and east and south of the mine site in River Mountain Volcanics.

- The sheer volume of tailings and waste rock on site makes off-site hauling and disposal cost prohibitive. Moreover, the presence of the former open mine pits demands substantial fill to render the property suitable for redevelopment. The volume of waste rock and tailing is sufficient to fill the pits.

- Sufficient volume of borrow from the Muddy Creek Formation and River Mountains is available on-site to cover placed mining wastes.

- Covering the mining wastes with 10-feet of clean final cover eliminates shallow soil and construction worker pathways and is consistent with NDEP precedence.

Isolating the mine wastes with clean cover to eliminate shallow soil and construction worker pathways supports a MRRA without removing mining wastes from the site. An environmental covenant on deep soil (e.g., greater than 10 feet below grade) will protect construction workers for future deep construction. Furthermore, this approach does not require hauling significant clean fill onto the site. Balancing the excavation and fill with onsite materials virtually eliminates traffic risks associated with over road hauling.

With the current knowledge of metals nature and extent, and the constraint of virtually no net export or import of materials, the basis for this FFS is sound, and its timing within the CERCLA framework appropriate.

## 1.1 PURPOSE OF REPORT

The overall goal of this report is to support selection of remedies for the Three Kids Mine that are protective of human health and the environment by:

- Proposing remedial action objectives (RAOs),

- Defining specific preliminary remediation goals (PRGs),

- Developing and analyzing a range of remedial alternatives, and

- Presenting recommendation(s) for a preferred alternative.

## 1.2 ORGANIZATION OF THE REPORT

The report is organized into six sections which include:

- **Section 1. Introduction**: Includes the purpose of the report, site description, site history, ownership and future land use, general site topography, surface water, geological and hydrogeological conditions, and previous site investigation.

- **Section 2. Remedial Objectives and Applicable or Relevant and Appropriate Requirements**: Proposes RAOs and PRGs, discusses the applicable or relevant and appropriate requirements (ARARs), and summarizes quantity of the contaminated soil and waste.

- **Section 3. Development and Screening Technologies**: Includes the technology screening process and identifies the technologies that are included in the alternatives.

- **Section 4**. **Development of Remedial Alternatives**: Develops and discusses the alternatives.

- **Section 5. Evaluation of Remedial Alternatives**: Evaluates the alternatives against regulatory criteria.

- **Section 6. References**: Provides references cited in the report.

## 1.3 SITE LOCATION AND DESCRIPTION

The site is located approximately five miles northeast of central Henderson, Nevada, along East Lake Mead Parkway (State Road 564). The site occupies most of section 35 and parts of sections 26, 34, and 36 of Township 21S, Range 63E of the Mount Diablo Meridian. Access to most of the site is gained via unpaved roads heading southeast from Lake Mead Parkway just east of Henderson. Three small portions of the site are located north of Lake Mead Parkway and can be accessed by foot. Figure 1-1 shows a general location map of the site.

The Project area consists of approximately 1,165 acres in 18 parcels, of which 411 acres are considered the disturbed former mine site, 108 acres are potentially impacted by windblown sediment, and 646 acres are considered undisturbed, or background. These parcels have been given ID numbers as shown in Figure 1-2. Seven parcels totaling approximately 851 acres are under federal administration. The remaining 314 acres are distributed across 11 parcels, controlled by three different entities: Lakemoor (295 acres), Laker Plaza (5 acres), and Lake Mead Boat Storage (14 acres). The latter two are not part of this FFS.

The site is the former Three Kids Mine. It was utilized for the mining of manganese from 1917 to 1961. Site operations were permanently discontinued in 1961 when the open pits were exhausted.

Key features of the site include three major open pits, overburden, ore yard, mill, and three tailings ponds (Figure 1-3). The three open pits are the combined A and B Pits (A-B Pit), Hydro Pit, and Hulin Pit as showed on Figure 1-3. A smaller open pit, the Three Kids Mine Pit, is located east of the A-B Pit. The three large pits (A-B Pit, Hydro Pit, and Hulin Pit) represent approximately nine million cubic yards of vacant volume. Overburden and waste rock generated from excavation during mining are left in piles near the pits. Based on previous sample results, the overburden is composed of gypsiferous sandstone/siltstone and low-grade wad, a dark brown or black impure mixture of manganese and other oxides (GeoTek 2007).

In the northeast of the site are mill building foundations remaining in part or in whole, and remnants of eight circular flotation cells that were used in the manganese beneficiation process. Three tailings ponds are located in the west central portion of the site, and were used for disposal of tailing slurry produced from the beneficiation process.

Most areas of the site are erosive and the mill site, mine pits, and waste piles are poorly vegetated, causing visible dust during moderate and high wind conditions. Despite numerous measures implemented, the site remains largely unprotected and allows for access, trespassing, and illegal dumping. Abandoned boats and automobiles, appliances, tires, construction and demolition (C&D) waste, and trash are present at the site. The open pits are not fenced or protected for fall hazards except for a small section in the Hydro Pit.

## 1.4 SITE HISTORY

Manganese ore was discovered at the site in 1917 and was mined intermittently until 1961. During the years 1942-43 and 1953-1961 a mill was operated at the site, which utilized a process of acidulation, flotation, and sintering. Details of the site history are described in the Phase I Environmental Site Assessment (ESA; Zenitech 2007).

To produce high-grade manganese oxide nodules, poor quality wad which contained approximately 20 percent manganese was first mined and stockpiled for processing. The wad was crushed, mixed with water, sulfur dioxide ($SO_2$), diesel fuel, and detergents, and was then vigorously mixed. The resulting emulsion was sent to a series of large circular flotation tanks (thickeners) to separate the emulsion and produce manganese-rich concentrate ("pregnant liquor"). The "pregnant liquor" was further thickened, partially dried, combined with coke and other calcining agents, then sent through three kilns: a calciner, a nodulizer, and a cooling kiln. The resulting manganese nodules were of sufficient purity (approximately 65 percent manganese) for use in the ferromanganese foundry industry. Coke, bunker oil, and the diesel fuel in the concentrate were used as fuels for the kilns.

The waste called gangue that sank in the flotation process contained silicon- and aluminum-rich minerals, lead, arsenic, manganese, iron, and some amount of residual diesel fuel, in addition to water. It was pumped to the tailings ponds for disposal. It is known from previous sampling events that the surface of the tailings has dried, but that the subsurface has a variable moisture content ranging from 10.3 to 54.4%.

Mill operations were terminated in the summer of 1961. Mill equipment was auctioned off in January 1962 and secondary lead, a byproduct of the kilns, was transported off the site, reportedly to a smelter in Utah from 1961 to 1963. Following is a summary of the activities after mill closure.

- 1963 – 1979: Unpermitted salvage, dumping, and vandalism took place.
- 1979 – 1984: A dump area near the Hulin Pit was permitted by Clark County as a landfill and received friable asbestos and drummed waste.
- 1959: Manganese nodules remaining from mining operations were stockpiled for government reserves beginning in 1959. In 2004, the last of the nodule reserves were moved from the west side of the ore yard to a portion of Tailings Pond No. 1.
- 1982: A portion of the privately held land at the site was developed into a boat storage facility (currently known as Lake Mead Boat Storage) and a gas station/convenience store (currently known as Laker Plaza). Other privately owned parcels were assembled by an entity composed of three local businessmen under the name Three Kids Enterprises (TKE).
- 1992 – 1995: NDEP opened case file H-001347 for the elevated lead found in the soils to the north of the site, under the current roadbed of Lake Las Vegas Parkway. The soil was remediated under the case as Henderson Lead Site and the case was closed in 1995 (NDEP 2008).
- 1999: Total petroleum hydrocarbons (TPHs) were found exceeding NDEP reporting levels and Nevada soil action level (SAL) in a portion of the tailings owned by TKE. Because lead at the Henderson Lead Site was traced to run-off from the site, NDEP re-opened case file H-001347 which remains open at the time of this report.

A series of site investigation and studies were conducted to characterize the site contamination. This subsection provides a summary of major site studies. Details of previous site investigation activities can be found in the *Phase II Sampling and Analysis Plan* (SAP; Broadbent 2021b).

### 1.4.1 Previous Investigations and Reports

- 1999 – 2000: During this period, the following major reports and studies were developed:

    - *Preliminary Soil Assessment Report (N&M 1999a)*
    - *Test Well Sampling Report (N&M 1999b)*
    - *Supplemental Preliminary Soil Assessment and Waste Characterization Report (N&M 1999c)*
    - *Site Investigation Report (JBR 2000).*

    These reports found that the site soils and tailings contained high concentrations of metals (primarily arsenic) and TPH. The TPH concentrations exceeded the Nevada SAL and triggered NDEP to reopen a previously closed site case file which remains open. The site soil and tailings may also generate dissolved metals (i.e., arsenic) based on the test results of Meteoric Water Mobility Procedure (MWMP), indicating potential migration of the contaminants in the soils and tailings. The tailings were not acid generating. In

addition, the groundwater test well sampling study (N&M 1999b) found that the groundwater showed a geothermal signature with warm temperature and elevated concentrations of arsenic and dissolved solids.

- 2001 and 2004: In this period, the following major reports were prepared:

  - *Final Preliminary Assessment (Parsons 2001)*
  - *Manganese Ore Disposition (DLA 2004).*

  The two reports were related to the Defense Logistics Agency (DLA) manganese stockpiles. The reports indicated that the residual soils' concentrations in the ore yard were consistent with the ore sample results and that the soil beneath one former ore pile showed an arsenic result by the Toxicity Characteristic Leaching Procedure (TCLP) exceeding the toxicity regulatory level of 5 milligrams per liter (mg/L).

  In addition, an asbestos survey was conducted and cited in the *Summary Report: Environmental Studies and Reclamation Activities* (JBR 2001a). The survey found that friable and non-friable asbestos containing materials (ACM) were present at the site.

- 2007: *Phase I Environmental Site Assessment Report (Zenitech 2007).*

  The report describes the chemical processes that were utilized during the years of mill operations, discusses previous investigation and studies, and describes overall site conditions through document reviews, interviews, and site inspection.

- 2021: *Updated Phase I Environmental Site Assessment Report (Broadbent 2021a).*

  The report updates the 2007 ESA on property owners, current land uses, current conditions of the site, and environmental records search.

### 1.4.2 Previous Geotechnical Investigations and Studies

Several geotechnical sampling events were conducted and studies were prepared that focused primarily on marketability and reuse of the materials at the site. The findings include the followings:

- Overburden at the site would not make good quality commercial aggregate and soil fertility was poor (JBR 2001b).

- Most materials on the site can be utilized in remediation and reclamation under the conditions that soil solubility is monitored during remediation and that Type V cement is used if future structures will contact gypsiferous soils (GeoTek 2007). This conclusion was based on an evaluation of geotechnical characteristics of the site overburden, low-grade ore, tailings, a native welded tuff borrow reserve, and a native sedimentary borrow reserve.

- Consistent with the findings of the site tailings, the native rock was found not to be acid generating but leached soluble arsenic using the MWMP (GES 1998).

### 1.4.3 Three Kids Mine Remediation and Reclamation Act

On 25 July 2014, U.S. Congress approved the Three Kids Mine Remediation and Reclamation Act, which provides a timeframe and means by which federally owned land within the site can be conveyed to the City of Henderson Redevelopment Agency for the purpose of site assessment, remediation, and reclamation.

The Bureau of Industrial Site Cleanup (BISC) of the NDEP is the lead environmental agency for overseeing the assessment and remediation of the site. Work to be accomplished at the site includes assessment of impacted soil, geotechnical investigations, leaching analysis, preparation of a conceptual site model, remedy selection, the preparation and execution of a corrective action plan, risk assessment, and execution of the federal land transfer. Under a partnership with BISC-NDEP, Lakemoor has agreed to undertake the site cleanup. In late 2020, Lakemoor hired Broadbent as part of their site development team, to which EA is a subcontractor, and is responsible for preparation of this FFS.

Ongoing investigations and subsequent reports for activities conducted in 2021 to 2022 (present) include the following:

- Remedial Investigation (RI) and RI Report
- Background Soil Report
- Leaching Analysis Report, and
- Screening Level Ecological Risk Assessment.

These reports establish nature and extent of mining-related impacts, BTVs for principal site metals which establishes areas of rock and soil suitable for "clean" cover over mine wastes, analysis of whether mine wastes may generate a leachate above RSLs which in turn could migrate to and impact groundwater, and current inventory of ecological receptors on site.

The leaching study was conducted independent of management of surface mine wastes. Results presented in the Leaching Analysis Report do not indicate a risk to groundwater (Broadbent, 2022a). Therefore, a separate Operable Unit to address groundwater and groundwater-related pathways is not needed. Operable Unit is defined at CERCLA (40 CFR Section 307.14. as *"a discrete action …of a remedial response (that) manages migration, or eliminates or mitigates a release, threat of release, or pathway of exposure. Operable units … may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site. Operable units will not impede implementation of subsequent actions, including final action at the site."*

For the Three Kids Mine, separation of groundwater pathways makes functional sense: the movement and placement of contaminated mine wastes requires excavation and physical containment (i.e., within existing pits), neither of which apply to groundwater pathways.

## 1.5 SITE OWNERSHIP AND FUTURE LAND USE

The site consists of approximately 1,165 acres in 18 parcels. These parcels have been given ID numbers as shown in Figure 1-2. Seven parcels totaling approximately 851 acres are under federal administration. The remaining 314 acres are distributed across 11 parcels, controlled by three different entities: Lakemoor (295 acres), Laker Plaza (5 acres), and Lake Mead Boat Storage (14 acres). The latter two are not part of this FFS.

Most of the areas at the site currently are inactive and unused, with exception of Lake Mead Boat Storage and a gas station/convenience store (Laker Plaza) located in the north-central portion of the site along Lake Mead Parkway. For future development, residential land use has been proposed for the site, which is used as the basis for this FFS.

There are only four wells located one-half mile within the site perimeter and no other wells were found within one mile of the site (Broadbent 2021b). Elevated total dissolved solids (N&M 1999b), result in the water not being a viable drinking water source without treatment.

## 1.6 TOPOGRAPHY

The site is situated near the northern end of the River Mountains in southern Nevada and is part of the Basin and Range province. The site is on the side of an open basin surrounded on the south, east, and north by volcanic units of the River Mountains and opening to the west. Mining activities in the past changed the topography through the excavation of large strip mine pits, the construction of tailings ponds, and the emplacement of upgradient dams to prevent washes from emptying into pit operations.

Site elevations range from 1,550 to 2,515 feet at mean sea level (amsl) with large portions at approximately 1,800 feet amsl. The three major open pits at the site vary in depth. The A and B Pits located in the east of the site are connected and approximately 300 to 400 feet in depth. The Hulin Pit, located to the northwest of the A-B Pit, is relatively shallow at approximately 225 feet in depth. The Hydro Pit in the south center of the site is much deeper at approximately 411 feet in depth, but has a smaller perimeter compared to the A-B Pit with a steep-walled cylindrical pit like Hulin Pit. Tailings dams, waste rock, and overburden of various heights and thicknesses are present across the site with waste rock and overburden near the large open pits. In the mill site, where some of the mill building foundation rubbles are located, most of the surface area is flat and is currently close to the pre-mining elevations of approximately 1,800 to 1,870 feet amsl (Zenitech 2007).

## 1.7 SURFACE WATER

Prior to the onset of mining activities, most of the present-day disturbed area sat upon an alluvial plain at the north end of the River Mountains. Most surface water, both local and that draining

from the River Mountains, flowed in a combination of narrow channels and washes that exited the site at the northwest boundary. At that location it joined a larger drainage system known historically as the Three Kids Wash, which flowed north approximately one mile to the Las Vegas Wash (Broadbent 2021b).

A secondary drainage ("the northeast drainage") flowed through a pass in the mountains along what is now Lake Mead Parkway and exited the site at the northeast corner. This drainage also would have emptied into the Las Vegas Wash, approximately 1.5 miles north of the site. The Three Kids Wash and the northeast drainage appeared wet in 1950 and 1955 aerial images and may have received wastewater discharge during the mill years (Broadbent 2021b).

Currently, no perennial or intermittent streams are present at the site, but there is visual evidence of contemporary surface water flow following heavy storm events. In the event of stormwater flow, tailings dams and mine pits would constrain most disturbed area surface water from exiting the site. The northeast drainage still flows off-site at the northeast corner and could transport soils from the east of the site during storm events generating surface flow.

## 1.8 GEOLOGY AND HYDROGEOLOGY

As indicated in the topography section, the site is surrounded by volcanic units of the River Mountains on all sides except the west to which the site is open to a basin. Prior to mining activities, the site overlaid a thin alluvial plain deposit within the basin. The alluvial plain where the mine and mill were constructed sat above units of the sedimentary Muddy Creek Formation, which is a late Miocene/early Pliocene sedimentary deposit. Units in the Three Kids Mine location are gypsiferous red siltstones, sandstones, mudstones, tuffs, and beds of massive gypsum (Broadbent 2021b). Overall thickness of the Muddy Creek at the site is estimated at greater than 1,000 feet (Broadbent 2021b), except where it thins to meet the River Mountains volcanics. Figure 1-4 shows the site-specific geology.

Much of the geology is well understood although ore body genesis and fault locations are still debated. As showed in Figure 1-4, three significant faults, Extension, Annex, and Lowney faults are located in the southeast corner of the site. Between the Extension fault and the Annex fault is the B Pit, and between Annex fault and Lowney fault is the A Pit. The most notable of the faults is the Lowney fault. Mining processes have extensively stripped the headwall from this fault and exposed the footwall as a 300- to 400-foot-high scarp on the southwest side of the A Pit.

Site soils tend to be gypsiferous with clasts of dacite, basalt, and tuff. Gypsum content is locally highly variable. Artificial fill found at the site is composed of tailings, overburden/low-grade ore, and manganese nodules from mining operations. The fill ranges from less than an inch to near 90 feet in thickness. Areas of thick artificial fill from tailings disposal show little or no soil development and are classified as regoliths or regosols. Appearance, texture, and grain size of tailings sediments indicate silty to clayey silt soils and are typically gypsiferous or silicaceous in composition. Tailings are dry and dusty at or near the surface and may become damp several feet below ground surface (bgs).

There are four wells located one-half mile within the site perimeter as showed on Figure 1-5. These wells include a test well (Well # 35212), a well at 2310 Lake Mead Parkway (Well # 82441), and two monitoring wells (Wells # 111218 and # 111266). Depth to first water bearing zone ranges from 500 to 700 feet bgs based on the data collected from Wells # 35212 and #82441. Groundwater elevations are lower than the base of the open pits because water is not observed to seep and accumulate in the open pits. Flow of groundwater through faults and fractures is minimal and does not currently create wet seeps or springs. The groundwater appears to be confined based on the data collected from Wells # 35252 and # 82441. The faulting system can cause hydraulic disconnection of the aquifers at the site, which was observed at the two wells, Wells # 35212 and #82441. Additional information on site hydrogeology is included in the Work Plan for Leaching Analysis of Hydro Pit Fill, Revision 1 (Broadbent 2021c).

## 1.9 REMEDIAL INVESTIGATION STATUS AND CURRENT SITE CONDITIONS

As previously summarized, several assessments and studies at the site took place in the late 90s through early 2000s. A Phase I ESA was completed in 2007 (Zenitech 2007) followed by an updated Phase I ESA in 2021 (Broadbent 2021a). The Phase I ESA identified environmental conditions, data gaps, and recommendations for further characterization and remediation of the site.

Results of the Phase II ESA to further characterize the site for remediation and future area development are presented in the RI Report (Broadbent 2022d). This subsection provides a summary of current understanding of the site contamination and data gaps based on the available site documents.

### 1.9.1 Nature and Extent of Contamination

Tailings, one of the source materials, are present primarily in the three tailings ponds in the west central portion of the site in addition to the tailings dams and mixed tailings/overburden. The total area of the tailing ponds is approximately 55 acres, and thickness of the tailings ranges from approximately 3 feet to 60 feet, with an estimated volume of approximately 1.6 million cubic yards. Impacts to native soil/rock below tailings are described in the RI Report and further discussed in the Leaching Analysis Report (Broadbent 2022a and Broadbent 2022d).

Other than tailings, there are significant amounts of overburden and waste rock across the site. Waste rock and waste rock mixed with tailings can serve as source material and cause environmental impacts. Volume of the overburden and waste rock is estimated approximately 7.2 million cubic yards.

Site-related chemicals associated with tailings, waste rock, and mill site soil include metals, TPH, semi-volatile and volatile organic compounds, polychlorinated biphenyls (PCBs), and dioxins. Based on previous investigations, the disturbed area (approximately 425 acres) has been impacted. Additional details are provided in the RI Report, but select findings are included below (Broadbent 2022d).

- Surface soil throughout the mill site is impacted with elevated metals, primarily arsenic, lead, and manganese, including samples collected at random locations and subjective samples collected from the chemical processing, thermal processing, mill site dump, and fuel farm areas.

- Drainages contain soil with elevated concentrations of metals, primarily arsenic, lead, and manganese.

- Results from sampling in December 2021 and January 2022 to address vertical extent data gaps in the mill site, drainages, native soil/rock below tailings, and native soil/rock below waste rock indicate highly variable metals concentrations at depth that in many cases exceed RSLs and BTVs. Elevated concentrations are attributed depositional processes that resulted in the nearby ore body.

- Samples collected from select areas of the mill site exhibited semi-volatile organic compound concentrations exceeding RSLs.

An ACM survey was conducted periodically between May 2021 and February 2022 by licensed asbestos abatement consultants in the State of Nevada. The asbestos inspection included an evaluation of building materials associated with the operation of the former Three Kids Mine as well as materials that appear to have been illegally dumped onto the site since mining operations were terminated (Broadbent 2022c). An update to the ACM survey was submitted on April 6. The estimated quantity of ACM is approximately 1,400 cubic yards, including building materials and illegally dumped waste.

### 1.9.2 Contaminant Fate and Transport

An evaluation of contaminant fate and transport for the site is presented in the RI (Broadbent 2022d). Numerous factors impact the fate and transport of the contaminants, including previous mine operations and processes; physical, geochemical, and biological characteristics of the contaminants; and site-specific conditions such as climate, topography, hydrology, and geochemistry of the aquifers. Three potential pathways have been evaluated:

- **Leaching to groundwater**: There is potential for tailings and mill wastes to leach dissolved contaminants into the soils underneath, and contaminants can further travel vertically to the groundwater. Samples of native soil/rock below tailings and waste rock were collected as part of the RI and results are presented in the RI Report. Additional analysis of the potential for leaching to groundwater, including an analysis of MWMP results and acid generating potential, are documented in the Leaching Analysis Report.

- **Wind transport of tailings:** Tailings that are fine grained are especially prone to producing dust under dry conditions, therefore being mobilized to downwind areas. Surface samples were collected in downwind areas and waste rock areas apparently impacted by tailings. Results of both are presented in the RI Report.

- **Transport via surface water during major storm events:** Contaminants in the waste or tailings can also be mobilized and transported through run-off during storm events

through physical particulate movement or/and dissolution in the rainwater. Test pits and borings were installed during the RI in drainages leading offsite, and results are presented in the RI Report.

# 2. REMEDIAL ACTION OBJECTIVES AND APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section proposes RAOs and PRGs for the contaminated soil at the site. The section also discusses the ARARs related to the site and identifies areas and volumes of contaminated soil exceeding the PRGs and, therefore, to be addressed in the FFS.

## 2.1 REMEDIAL ACTION OBJECTIVES

The RAOs were developed for contaminated soil to address unacceptable risks and protect human health and environment. The property future land use and contaminant exposure pathways were included in the RAO development. The following describes the RAOs for the site soil.

- Prevent human exposure to the mining wastes and soil with concentrations of contaminants of concern (COCs) exceeding PRGs.
- Minimize leaching and transport of soil and waste contaminants.
- Prevent direct human exposure to ACM.
- Convert the site surface area to residential use.

## 2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Remedial actions must protect public health and the environment. Section 121(d) of CERCLA requires that federal and state ARARs be identified and that response actions achieve compliance with the identified ARARs. This requirement makes CERCLA response actions consistent with pertinent federal and state environmental requirements as well as adequately protecting public health and the environment.

The NCP (40 CFR §300.5) defines “applicable” and “relevant and appropriate” requirements. Applicable requirements are those requirements (i.e., cleanup standards, criteria, or facility sitting laws) that specifically and directly address the situation at the site. Relevant and appropriate requirements may not specifically apply but may address similar issues or situations that might be encountered at the site. A requirement must be either applicable or both relevant and appropriate to be selected as an ARAR.

A list of potential ARARs has been generated for this site and are presented in Table 2-1. The identification of the ARARs for the site is based on site conditions and in consideration of screened remedial technologies described in Section 3, and the potential remedial alternatives development in Section 4 of this document.

ARARs are divided typically into three categories: chemical-specific, location-specific, and action-specific. The ARARs for the site in Table 2-1 were compiled based on these three categories.

- **Chemical-specific ARARs** are usually health- or risk- based numerical values or methodologies used to determine acceptable concentrations of chemicals that may be found in or discharged to the environment.

- **Location-specific ARARs** restrict actions or contaminant concentrations in certain environmentally sensitive areas. Examples of areas regulated under various federal laws include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present.

- **Action-specific ARARs** are usually technology- or activity-based requirements or limitations on actions or conditions involving specific substances.

In additional to these three categories, some EPA and State guidelines also need "to be considered" (TBC). The TBC criteria are non-promulgated, non-enforceable, guidelines or criteria useful for developing a remedial action or necessary for evaluating what protect human health and/or the environment. Examples include Nevada Administrative Code (NAC) 519A.245 – 345 for requirements of reclamation of mined lands.

## 2.3 PRELIMINARY REMEDIATION GOALS

Site PRGs are typically developed based on future land use and results of the site investigation including evaluation of background levels of contaminants. Site PRGs are proposed below are based on available EPA regional screening levels (RSL) with a target cancer risk of $1x10^{-6}$ and a target hazard quotient of 1.0, BTVs, and other appropriate federal and state regulatory limits. The following are the proposed soil PRGs:

- Arsenic – 20.85 milligrams per kilogram (mg/kg; the BTV for the sedimentary units/Muddy Creek Formation; Broadbent 2022b)

- Cadmium – 7.1 mg/kg (the residential RSL)

- Chromium VI – 0.3 mg/kg (the residential RSL)

- Lead – 400 mg/kg (the residential RSL)

- Manganese – 1,800 mg/kg (the residential RSL)

- PAHs (all residential RSLs) – benzo(a)anthracene 1.1 mg/kg; benzo(a)pyrene 0.11 mg/kg; benzo(b)fluoranthene 1.1 mg/kg; chrysene 110 mg/kg; dibenz(a,h)anthracene 0.11 mg; indeno(1,2,3-cd)pyrene 1.1 mg/kg and naphthalene 2 mg/kg

- Total Petroleum Hydrocarbons – 100 mg/kg (the state screening level)

- Total tetrachlorodibenzo-p-dioxin – 4.8 ng/kg (the residential RSL)

## 2.4 OCCURRENCE AND VOLUME OF AFFECTED SOIL AND WASTE

Based on results of the Phase II ESA, the entire 425 acres of the site have been either impacted by the mining wastes or are natural concentrations elevated above BTV and related to initial ore deposition processes.

The estimated volumes of the materials and wastes present at the site that are required to be addressed in this FFS follows:

- ACM – 1,400 cubic yards
- Tailings – 1.6 million cubic yards (55 acres and 3 feet – 60 feet in depth)
- Overburden and waste rock – 7.2 million cubic yards.

The volume evaluation provides an approximate scale for the remediation and assists development and costing of treatment technologies and alternatives. The volume used in this FFS shall not be used for remedial design and implementation.

On the mine site, exploratory borings to depth indicated highly variable concentrations of arsenic, lead, and manganese. The variability is thought to be related to the original ore deposition – that ore deposition and hydrothermal processes created a zone of elevated concentrations in native soils and rock surrounding the ore. The variability is such that excavation or scraping of shallow impacted soil to achieve a surface that tests below BTV or RSLs is not possible. Therefore, onsite mine wastes will be placed in pits and low areas, and the mine site will be covered with 10 feet of borrowed soil over mine wastes and native soil surfaces to eliminate the 0- to 10-foot pathway exceedances. Deep soil (greater than 10 feet) will have an environmental covenant requiring testing and worker protection for deep construction work.

# 3. DEVELOPMENT AND SCREENING OF TECHNOLOGIES

The overall approach of this FFS follows the EPA's guidance (EPA 1988). The development and screening of alternatives includes the following steps:

- Develop RAOs for the site soil
- Identify potential ARARs
- Develop PRGs
- Estimate volume or area of contaminated soil exceeding the PRGs
- Develop general response actions for the site soil
- Identify and screen technologies applicable to each general response action
- Identify and evaluate technology process options.

This section describes the process of development and screening of technologies as shown in the last two steps above. The development process starts by identifying general response actions and associated technologies for the contaminated soil and wastes. The remedial technologies are then screened for the three criteria: effectiveness, implementability, and cost per the EPA guidance (EPA 1988).

General costs were used in the screening process. Detailed cost evaluations are included in the detailed analysis of the FFS process.

The three screening criteria are primary elements of the nine criteria listed in 40 CFR 300.430(e)(9), which include:

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

The nine criteria were used during the further process of the FFS, i.e., detailed evaluation of the remaining alternatives after the screening.

## 3.1 GENERAL RESPONSE ACTIONS AND REMEDIAL TECHNOLOGIES

General response actions may include institutional controls, containment, treatment, excavation, disposal, or a combination of these as described in the EPA 1988 guidance. As required by the NCP (40 CFR §300.430.e.6), selected remedial alternatives must include a no-action alternative to be used as the baseline against which the effectiveness of all other alternatives are evaluated.

No-action alternative means nothing is done to the site. A no-action alternative does not control, contain, or remediate contaminant sources, and it does not reduce the mobility, volume, or toxicity of the contamination at the site.

In addition, institutional controls (ICs) are also included in evaluation of all medium types. ICs may include restrictions on land use, access restrictions, environmental monitoring, security measures, and notification and education advisories to inform the public and adjacent landowners about the site. Common ICs include zoning, enforceable land and groundwater use restrictions (i.e., deed notice and covenant restriction), and long-term environmental monitoring.

The general response actions considered suitable for the site soil and wastes include following:

- No action
- ICs
- Containment
- Removal
- Treatment
- Disposal

Containment may involve capping of the contaminated materials to prevent direct exposure. Typical materials used to build a cap includes clay, synthetic membranes, and chemical sealants or stabilizers. Treatment technologies for soil may include biological, physical/chemical and thermal treatments. *Ex situ* chemical soil washing may involve separating the fine clay and silt particles that tend to bind and adsorb more contaminants than coarser sand and gravel soil particles, and treating the fine materials with solvents, surfactant, or acid solutions. The liquid generated from the washing process is treated to remediate the contaminants. *In situ* soil flushing is the extraction of contaminants from the soil with water or surfactant solutions or other solutions. It involves injecting a solution into the soil (either vadose zone or saturated zone or both) to extract contaminants. The solution with dissolved contaminants is extracted and treated above ground. Removal and disposal consist of excavation and transportation of the contaminated soil and solid wastes to a permitted offsite facility for disposal onsite.

## 3.2 REMEDIAL TECHNOLOGY SCREENING

Tables 3-1 presents the screening processes for potential soil and wastes technologies.

### 3.2.1 Preliminary Screening Criteria

Three preliminary screening criteria: effectiveness, implementability, and cost were used during the technology screening.

Effectiveness is a measure of a technology's ability to reduce toxicity, volume, or mobility of the contaminants to meet the site PRGs; and to be reliable under site-specific conditions with minimal impacts to human health and environment during implementation phase. Technologies that do not provide adequate protection of human health and environment or are not reliable (i.e.,

performance of technology is not consistent to maintain a required treatment standard) are screened out from further consideration.

Implementability is a measure of both technical and administrative feasibility of implementing a technology process. Aspects of the implementability may include workability of the technology under site conditions; availability of special equipment, materials, and skilled workers required; complexity of the technology; and permitting and access to the offsite facilities. Technologies that are unworkable under the site conditions or pose considerable challenges due to complicated technical process during the construction are eliminated for further consideration.

Cost (capital and operation and maintenance costs) is a measure of resources that are required in technology implementation. The costs used in this document were obtained from published resources and previous projects. Cost evaluation at the technology screening phase is relative, typically presented as high, low, or medium compared to other technologies within the same technology type. The technologies with high cost but low protection of human health and environment are not considered for further evaluation.

### 3.2.2 Screening Summary

Tables 3-1 shows the rationales for technologies retained or eliminated based on the three preliminary criteria. The technologies retained for further evaluation include following:

- No Action
- ICs
- Capping
- Excavation
- Consolidation and onsite disposal.

# 4. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section presents the alternatives for the site soil and wastes to meet the RAOs and PRGs proposed in Section 2, in consideration of the ARARs. The technologies retained after the screening process from Section 3 were assembled to develop a range of alternatives and provide greater flexibility in selecting preferred alternatives. Site-specific conditions, i.e., open pits and aspects of the large scale of the contamination and large quantities of the wastes were incorporated in the development process. The development of the alternatives was based on the EPA's document, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988), which advises to include:

- Alternatives that permanently reduce the toxicity, mobility, or volume of contaminants. The range of alternatives should, if possible, vary in the degree of reliance on long-term management of untreated wastes
- Permanent solutions to the maximum extent practicable
- Innovative treatment technologies and resource recovery technologies to maximum extent practicable
- One or more containment alternatives that involve little or no treatment of hazardous contaminants
- A "No Action" alternative.

This section provides a description for each of the remedial alternatives developed to address treatment and/or disposal of soil and wastes exceeding the site PRGs. Four remedial alternatives developed for the contamination in soil and wastes include:

**Alternative S-1**: No Action

**Alternative S-2**: Consolidation, 2-Foot Cover, and ACM Offsite Disposal

**Alternative S-3**: Consolidation, 10-Foot Cover, and ACM Onsite Disposal

**Alternative S-4**: Consolidation, 10-Foot Cover, and ACM Offsite Disposal

Table 4-1 provides a summary of the alternatives and RAOs that each alternative potentially could achieve.

## 4.1 ALTERNATIVE S-1: NO ACTION

Alternative S-1 assumes no remedial action for soil and wastes. It is considered as a baseline for comparison to other remedial alternatives, as required by the NCP. Under this alternative, the contaminated soil and wastes would be left in place.

## 4.2 ALTERNATIVE S-2: CONSOLIDATION, 2-FOOT COVER, AND ACM OFFSITE DISPOSAL

Alternative S-2 includes excavating contaminated soil, overburden/waste rock, tailings, placing the materials in the open pits, and covering the areas with two feet of clean soil. The two feet of clean soil is intended to eliminate the shallow soil ingestion pathway for residents. However, two feet of clean cover does not eliminate:

- Construction worker pathway for the soil interval two to 10 feet below ground level.
- Exposure to deeper residential excavations for planting trees and larger shrubs.

Institutional controls are required on the property title to prevent exposure for construction workers via implementation of engineered controls. Prevention of exposure to residents' landscape excavations deeper than two feet is problematic: no construction permit is required for these residential excavations, so enforcing the IC would be difficult.

ACM and C&D waste from the former mill facilities will be removed and disposed in a RCRA permitted and licensed landfill. In addition, a stormwater detention basin will be constructed at the Hydro Pit.

The main components of Alternative S-2 include:

- Pre-excavation delineation of contaminated soil exceeding the PRGs
- Excavation and removal of select contaminated soil, waste rock, and tailings
- Consolidation of the excavated and removed materials into the open pits and construction of a 2-foot cover over the contaminated materials
- Capping wastes placed in the Hydro Pit with a synthetic liner via installation of the stormwater detention basin
- Abatement and removal of ACM and disposal of ACM and C&D waste offsite
- Backfilling of the excavated areas with clean soil (or waste rock in select deep fill areas) and final grading of the site
- Implementation of ICs to require protection measures for any drilling and earth moving activities at the capped area to prevent construction workers and the public from being exposed to the contaminants.

Excavated materials will be consolidated and placed in the open pits, and then covered with two feet of clean soil. A remedial design will be conducted before the remediation, and the design

will include approach and strategy for filling the open pits, requirements for compaction, prevention measures for potential settling, quantities of cut and fill, site layout for staging and haul route, final grading, potential borrow sources, offsite waste disposal facilities, reuse of the onsite materials, cost estimate, and schedule.

The detention basin will be designed and sized based on local stormwater runoff analysis and overall site drainage plan to dissipate peak storm discharge in the area. The basin will include a low permeability bottom liner. Stormwater drainage and infiltration will be controlled.

Abatement, removal, transportation, and offsite disposal of the ACM will be conducted in accordance with the requirements in NAC 444.965 – 976.

This alternative will address the RAOs by placing two feet of clean cover over contaminated materials to prevent the direct exposure to the environment and minimize potential migration of contaminants to the other site soil and surface water. It will eliminate residential soil ingestion pathways. It will not eliminate construction worker pathways and exposure to waste materials. A risk evaluation will be performed to demonstrate exposure pathways. Additionally, a risk assessment will be completed as part of the closure report for each unit. The liner will virtually eliminate infiltration, thereby significantly reducing leaching into the Hydro Pit. ACM and C&D waste will be disposed offsite, therefore their exposure will be eliminated. However, ICs will be established to require protection of construction workers and the public during earth moving activities that will disturb the contaminated materials two feet bgs. These construction activities include swimming pool construction, landscaping, and utility construction and repairs.

## 4.3 ALTERNATIVE S-3: CONSOLIDATION, 10-FOOT COVER, AND ACM ONSITE DISPOSAL

Alternative S-3 includes the same components as in Alternative S-2 for excavation and placement of the contaminated materials into the open pits and construction of a detention basin. However, the excavated materials will be capped and covered with 10 feet (rather than two feet) of clean soil (Figure 4-1). ACM will be buried deep in Hulin Pit under a Class III landfill waiver for mine sites along with C&D waste from the former mill facilities. An environmental covenant will be required for construction in deep soil (greater than 10 feet).

The main components of Alternative S-3 include:

- Excavation and removal of select contaminated soil, waste rock, and tailings
- Consolidation of the excavated and removed materials into the open pits and placement of a 10-foot final cover over the contaminated materials
- Capping wastes placed in the Hydro Pit with a synthetic liner via installation of the stormwater detention basin
- Abatement of the ACM

- Placement of ACM and C&D waste from the former mill facilities deep in the Hulin Pit under a Class III landfill waiver for mine sites

- Backfilling of the excavated areas with clean soil (or waste rock in select deep fill areas) and final grading of the site.

As stated previously, Alternative S-3 has the same components as Alternative S-2 for excavation and placement of the excavated materials and construction of a detention basin. This alternative would build a thicker cover (10 feet) than the one under Alternative S-2, and place ACM and other C&D wastes on site. An environmental covenant will be placed on soil deeper than 10 feet for deep construction.

Placement of ACM and C&D wastes will follow applicable construction standards in NAC 444.731 – 747; however, under a waiver. A Class III waiver will be requested per the regulations and must be approved by the Southern Nevada Health District (SNHD) or NDEP. According to NAC 444.731.3, SNHD or NDEP may waive the requirements for a Class III landfill if the site demonstrates that:

- All waste which is placed in the landfill is incidental to industrial operation
- The landfill is located on property controlled by the operator of the industrial operation; and
- The landfill will not receive any hazardous wastes and is unlikely to produce pollutants or contaminants that may degrade Waters of the State.

A plan must be submitted to the SNHD or NDEP for approval for application of a waiver. The plan must include:

- A description of the type and estimated amount of material which will be placed in the landfill; and
- A program for the maintenance of the site.

Alternative S-3 will address the RAOs by capping the contaminated materials to prevent the direct exposure to the environment and minimize potential migration of contaminants to the other site soil and surface water. A risk evaluation will be performed to demonstrate no exposure pathways. Additionally, a risk assessment will be completed as part of the closure report for each unit. The detention basin and liner will reduce the infiltration therefore reducing leaching into the Hydro Pit. ACM and C&D wastes will be contained in the Hulin Pit to prevent direct exposure. The site will be converted to a full residential use, under an assumption that the Hulin Pit will be covered with a 10-foot cover.

## 4.4 ALTERNATIVE S-4: CONSOLIDATION, 10-FOOT COVER, AND ACM OFFSITE DISPOSAL

Alternative S-4 involves the same components as Alternative S-3 except that the ACM and C&D waste from the former mill facilities will be disposed offsite, instead of being contained onsite.

The main components of Alternative S-4 include:

- Excavation and removal of select contaminated soil, waste rock, and tailings
- Consolidation of the excavated and removed materials into the open pits and placement of a 10-foot final cover over the contaminated materials
- Capping wastes placed in the Hydro Pit with a synthetic liner via installation of the stormwater detention basin
- Abatement of the ACM
- Abatement and removal of the ACM and disposal of the ACM and C&D waste offsite
- Backfilling of the excavated areas with clean soil (or waste rock in select deep fill areas) and final grading of the site.

Alternative S-4 will address the RAOs by capping the contaminated materials to prevent the direct exposure to the environment and minimize potential migration of contaminants to the other site soil and surface water. A risk evaluation will be performed to demonstrate no exposure pathways. Additionally, a risk assessment will be completed as part of the closure report for each unit. The liner will virtually eliminate infiltration, thereby significantly reducing leaching into the Hydro Pit. ACM and C&D waste will be removed and disposed offsite in a RCRA permitted facility, therefore eliminating direct exposure risk.

# 5. EVALUATION OF REMEDIAL ALTERNATIVES

This section evaluates the remedial alternatives developed in Section 4 following the EPA's guidance (EPA 1988). The alternatives were evaluated against the seven of the nine criteria required in the NCP. Alternatives are compared, and key tradeoffs among them are identified to determine the most appropriate remedial action for the site. The approach is designed to provide decision-makers with sufficient information to adequately compare the alternatives and provide the basis for selecting an appropriate site remedy.

## 5.1 EVALUATION CRITERIA

Provisions of the NCP require that each alternative be evaluated against nine criteria listed in 40 CFR 300.430(e)(9). These criteria serve as the basis for conducting detailed analyses of alternatives and for subsequently selecting an appropriate remedial action. The following are the evaluation criteria:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with ARARs.

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume (TMV)
- Short-term effectiveness
- Implementability
- Cost.

Modifying Criteria

- State acceptance
- Community acceptance.

The evaluation criteria are divided into three groups: threshold, balancing, and modifying criteria. The first two criteria as threshold criteria must be met by all alternatives to be eligible for selection as a remedial action. If ARARs are not met, six circumstances may be considered as listed in the NCP (see 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6)), and a waiver may be obtained before the alternative being selected as a remedy. The next five criteria as balancing criteria are the primary criteria upon which the detailed analysis is based. Unlike the threshold criteria, the five balancing criteria weigh the tradeoffs between alternatives. A low ranking for one balancing criterion can be offset by a higher ranking on another balancing criteria. The last two criteria as modifying criteria are deferred until the public comment process and following receipt of feedback from the state and community. The nine criteria are described in the following subsections.

### 5.1.1 Threshold Criteria

To be eligible for selection, an alternative must meet the two threshold criteria or, in the case of ARARs, must justify why a waiver is appropriate.

- **Overall Protection of Human Health and the Environment.** A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed by the site through exposure pathways. Evaluation of protectiveness focuses on how the alternative achieves and maintains protection of human health and the environment.

- **Compliance with ARARs.** Alternatives are evaluated against this criterion to determine if each alternative will meet all the federal and state ARARs or whether there is justification for waiving one or more ARARs. Section 2 of this document identifies and presents ARARs for the site.

### 5.1.2 Balancing Criteria

There are five balancing criteria, and they are described below.

- **Long-Term Effectiveness and Permanence.** This criterion is used to assess the residual risks at a site after RAOs have been met. The following factors can be focused during the evaluation:

  — Magnitude of the residual risks after remedial activities

  — Adequacy and reliability of controls to mitigate the remaining risks after the remedial activities.

- **Reduction of TMV through Treatment.** This criterion addresses the CERCLA statutory preference for remedial actions that permanently and significantly reduce the TMV of the hazardous substances. Following factors will be focused during the evaluation:

  — The amount of hazardous materials that will be destroyed or treated

  — The degree of reduction in TMV measured as a percentage of reduction

  — The degree to which the treatment will be irreversible

  — The type and quantity of treatment residuals that will remain following treatment.

- **Short-Term Effectiveness.** This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until RAOs are met. Under this criterion, alternatives are evaluated with respect to their effects on human health and the environment during implementation of the remedial action. The following factors will be evaluated:

- Protection of community during implementation
- Protection of workers during implementation
- Potential adverse environmental impacts resulted from implementation and construction
- Time to achieve RAOs
- Sustainability.

- **Implementability.** This criterion addresses technical and administrative feasibility of implementing an alternative and availability of various services and materials required during its implementation. Following types of factors will be considered:
  - Technical feasibility during implementation:
    - Difficulties and unknown issues associated with construction and operations
    - Reliability of the technology
    - Ease of undertaking additional remedial actions
    - Ability to monitor the effectiveness of the remedy.
  - Administrative feasibility during implementation:
    - Ability and time to obtain any necessary approvals and permits.
  - Availability of services and materials, including
    - Availability of adequate offsite treatment, storage capacity, and disposal capacity and services
    - Availability of necessary equipment, specialists, and provisions to ensure any necessary additional resources
    - Availability of services and materials
    - Availability of prospective technologies.

- **Cost**. Cost encompasses capital, operation, and maintenance costs incurred over the life of the project. As stated in the EPA guidance (EPA 2000), cost estimates in the FFS are expected to provide an accuracy of minus 30 percent to plus 50 percent (-30 percent to

+50 percent). The estimated costs are designed to be used only for evaluating and comparing alternative technologies and not for setting budgets.

### 5.1.3 Modifying Criteria

Community and state acceptance are the two modifying criteria. These criteria are the basis for evaluation of the issues and concerns of the community and state regarding each alternative. These criteria cannot be evaluated until the state and community have reviewed and commented on the alternatives presented in the FFS Report.

## 5.2 ALTERNATIVE EVALUATION

Evaluation of alternatives consists of the following two components:

- Evaluation of each alternative against seven of the nine evaluation criteria
- Comparative evaluation of alternatives relative to one another to identify key tradeoffs.

This section presents the evaluation of each alternative individually and the following section presents comparative evaluation of the alternatives. Table 5-1 shows the detailed evaluation of individual alternatives against the seven criteria. The detailed evaluation confirms if alternatives achieve the threshold criteria, presents significant aspects and differentiators of the alternatives, and identifies uncertainties associated with the evaluation.

## 5.3 COMPARATIVE ANALYSIS

This section presents the comparison among the alternatives based on the detailed evaluation of each alternative. The comparison potentially identifies the most favorable alternative on each evaluation criterion. Table 5-2 provides a summary of comparative analysis.

Four remedial alternatives include:

**Alternative S-1**: No Action

**Alternative S-2**: Consolidation, 2-Foot Cover, and ACM Offsite Disposal

**Alternative S-3**: Consolidation, 10-Foot Cover, and ACM Onsite Disposal

**Alternative: S-4**: Consolidation, 10-Foot Cover, and ACM Offsite Disposal.

### 5.3.1 Overall Protection of Human Health and Environment

All alternatives, except S-1 (No Action), provide overall protection of human health and environment. Alternative S-2 requires ICs to restrict earth moving activities, i.e., drilling and excavation deeper than two feet unless protection measures installed to protect workers and public from being exposed to the contaminants.

Alternative S-3 ranks the most satisfactory among the four alternatives regarding protection of human health and environment because of the short-term traffic risk stemming from hauling ACM and C&D waste over public highways (Alternative S-4) is not required. Deep burial of ACM eliminates potential human exposure.

### 5.3.2 Compliance with ARARs

Table 2-1 presents a compilation of the federal, state, and local ARARs identified for the site. All alternatives are anticipated to comply with ARARs, except Alternative S-1.

### 5.3.3 Long-Term Effectiveness and Permanence

All alternatives, except for Alternative S-1, provide long-term effectiveness and permanence with different extents. Alternative S-3 would provide the best long-term effectiveness and permanence because all contaminated materials are excavated, contained, and covered in a 10-foot cap. ACM is isolated at great depth and traffic risk of hauling is not realized as in Alternative S-4. Alternative S-2 would leave the contaminated materials covered with only two feet clean soil that requires maintenance to ensure the cover is well protected and the contaminated materials are not exposed.

### 5.3.4 Reduction of TMV through Treatment

All alternatives except Alternative S-1 reduce the mobility of the contaminated materials, but no alternatives would reduce the toxicity and volume of the contaminated soil and waste. Alternative S-4 is the best in reducing the mobility of the contaminants by using a thicker cap and disposal of ACM and C&D waste offsite.

### 5.3.5 Short-Term Effectiveness

All alternatives, except Alternative S-1, pose short-term impact during the remediation on workers, communities, and the environment. Proper personal protective equipment and best practice management will be used to alleviate the impacts. Alternative S-3 would require a slightly longer time to implement than Alternatives S-2 and S-4, because this alternative would require on-site disposal of ACM and C&D waste versus loading and hauling off site. The longer construction periods for Alternatives S-3 and S-4 due to greater volume of material handling would potentially generate more environmental impacts, i.e., air pollution, noise, and dust. Therefore, Alternative S-2 ranks the most satisfactory in terms of short-term effectiveness.

### 5.3.6 Implementability

All alternatives involve mature technologies and typical construction methods and equipment. Thus, they are readily implementable. However, Alternative S-3 requires more processes, i.e., requesting a waiver for on onsite landfill, and Alternatives S-3 and S-4 require more materials for a 10-foot cap than Alternative S-2; therefore, Alternative S-2 ranks the most satisfactory regarding implementability.

### 5.3.7 Cost

Table 5-1 presents the cost of the alternatives. Appendix A provides the detailed cost estimates.

# 6. SELECTED REMEDIAL ALTERNATIVE

The selected alternative is Alternative S-3. Alternative S-3 provides the following features that are beneficial to ultimate site reuse:

- Ten feet of clean final cover separates soil pathways from waste materials and increases the infiltration length of precipitation or lawn irrigation.
- An environmental covenant will be placed on soil deeper than 10 feet to require testing and worker protection for deep construction.
- Tailings are isolated in the Hydro Pit under a liner where contact with residents is not possible.
- ACM and C&D waste is disposed deep in the Hulin Pit as inert, non-mobile waste where residents will never contact ACM.
- Short term traffic risks of ACM and C&D waste transport are eliminated.
- State regulatory and community acceptance criteria are likely.
- Compliance with ARAR is demonstrated (Table 6-1).

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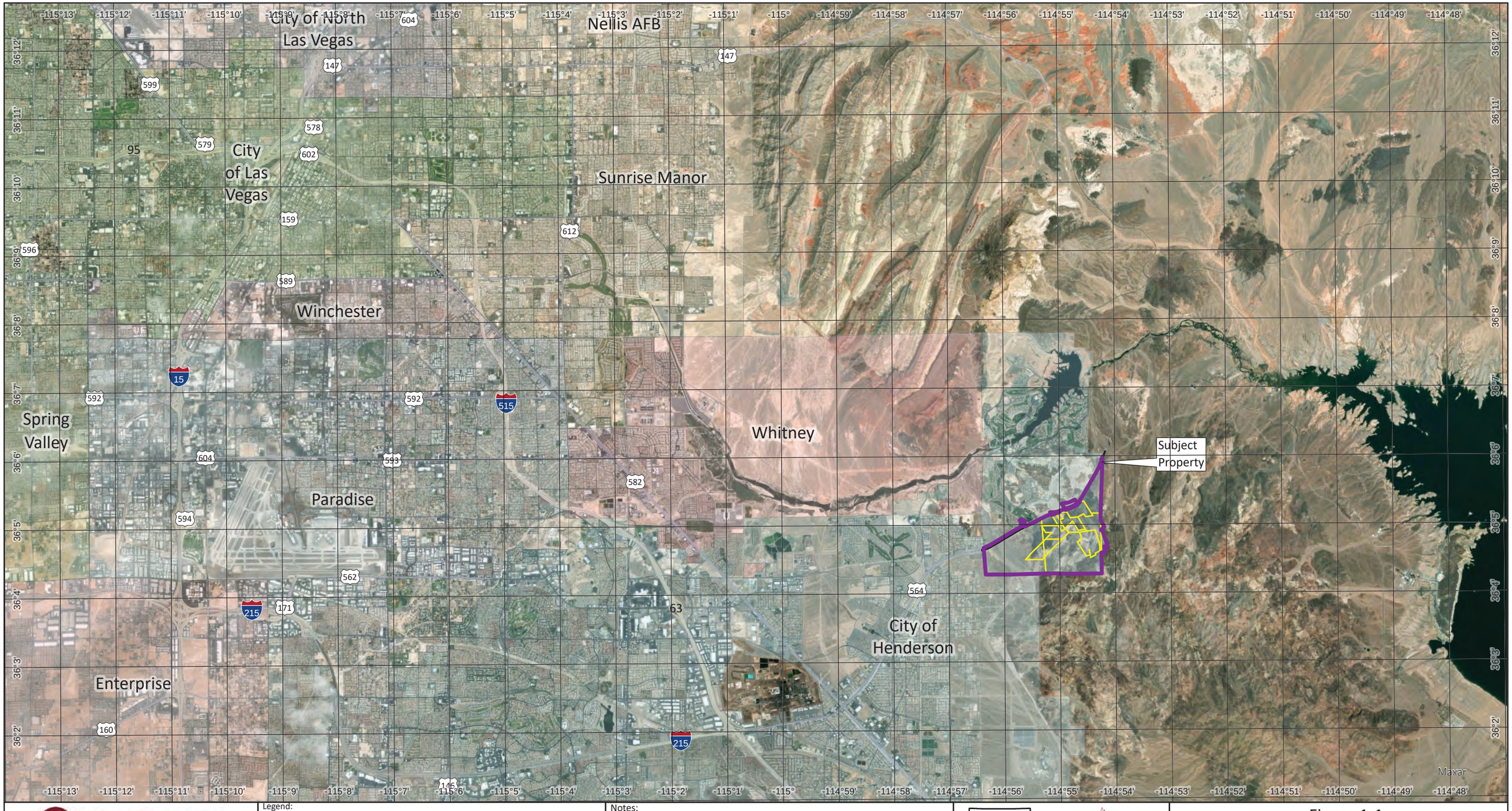
# Figures




BROADBENT
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 5/1/2021

Legend:

- Subject Property
- Project Area Parcel
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County
- Enterprise
- Nellis AFB
- Paradise
- Spring Valley
- Sunrise Manor
- Whitney
- Winchester

Notes:
1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Political Boundary Source: Clark County GIS Management Office.
4. Parcel Boundary Source: Clark County Assessor.
5. Roads Source: Nevada DOT GeoHub.

N

Scale: 1:100,000

1 0.5 0 1

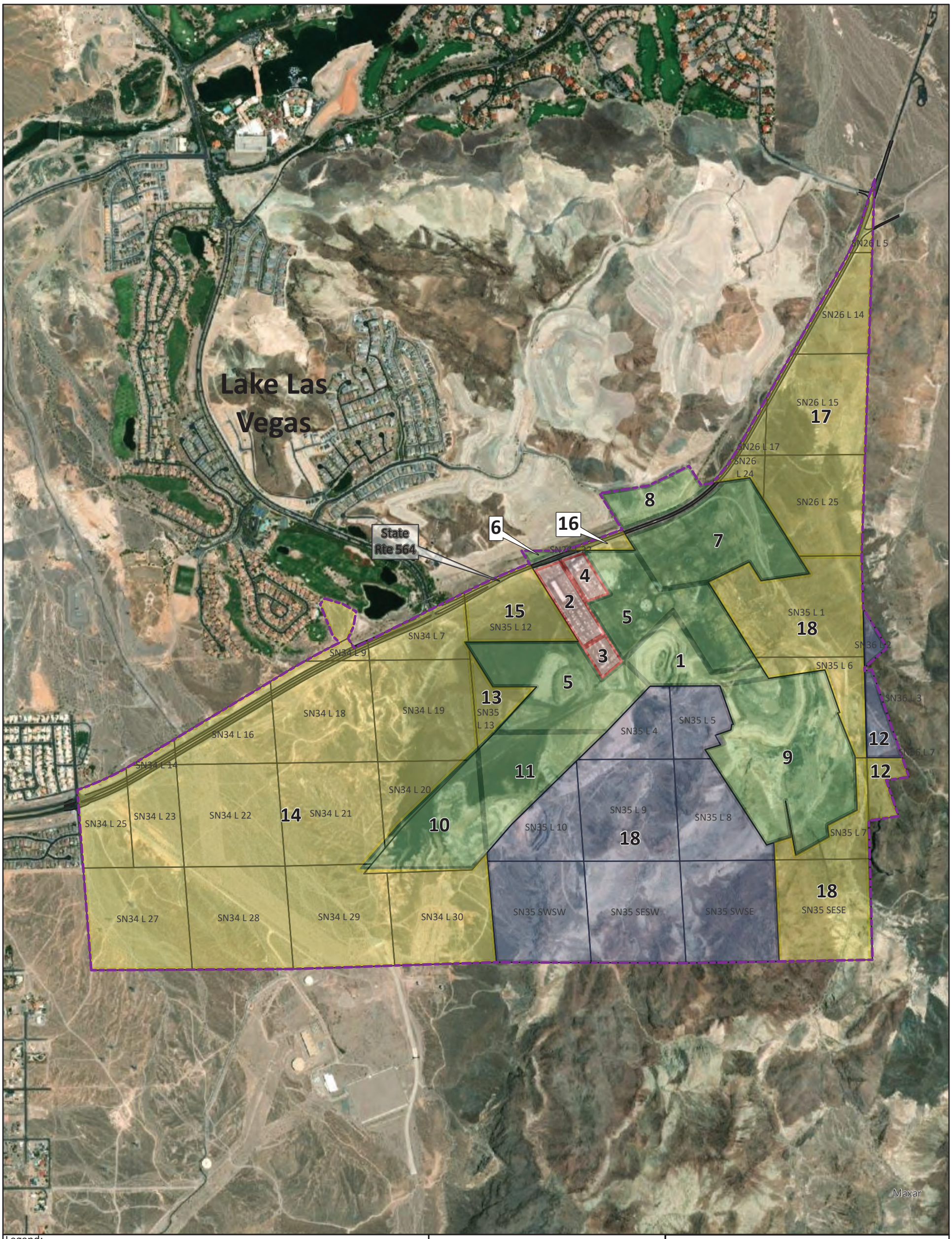
Miles

Figure 1-1

Site Location

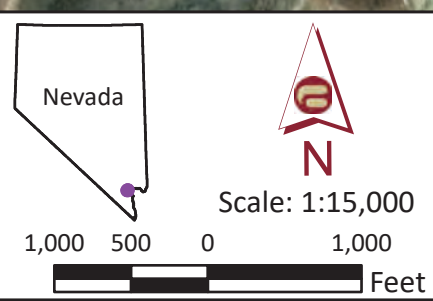
Three Kids Mine

| | |
|---|---|
| Designed | |
| Drawn | JCM |
| Approved | |




Legend:

- Project Area
- BOR Withdrawn
- Three Kids Inc. et al. and Kings Beach Ltd.
- M&R LP and Laker Plaza Inc.
- BLM
- Public Lands Survey System (BLM, 10/29/2020)




# Figure 1-2

## Parcel Map

## Three Kids Mine

BROADBENT
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 2/22/2022

Notes:
1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Not a survey.
4. Parcel Source: Clark County Assessor and BLM Administrative Units.

| | |
|---|---|
| Designed | |
| Drawn | JCM |
| Approved | |


Legend:

- Site Feature
- River Mountains Trail
- Unimproved Road
- Tailings Dam
- Project Area

Nevada

N

Scale: 1:14,000

1,000 500 0 1,000 Feet

Notes:

1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Not a survey. Derived from aerial imagery.

BROADBENT

8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

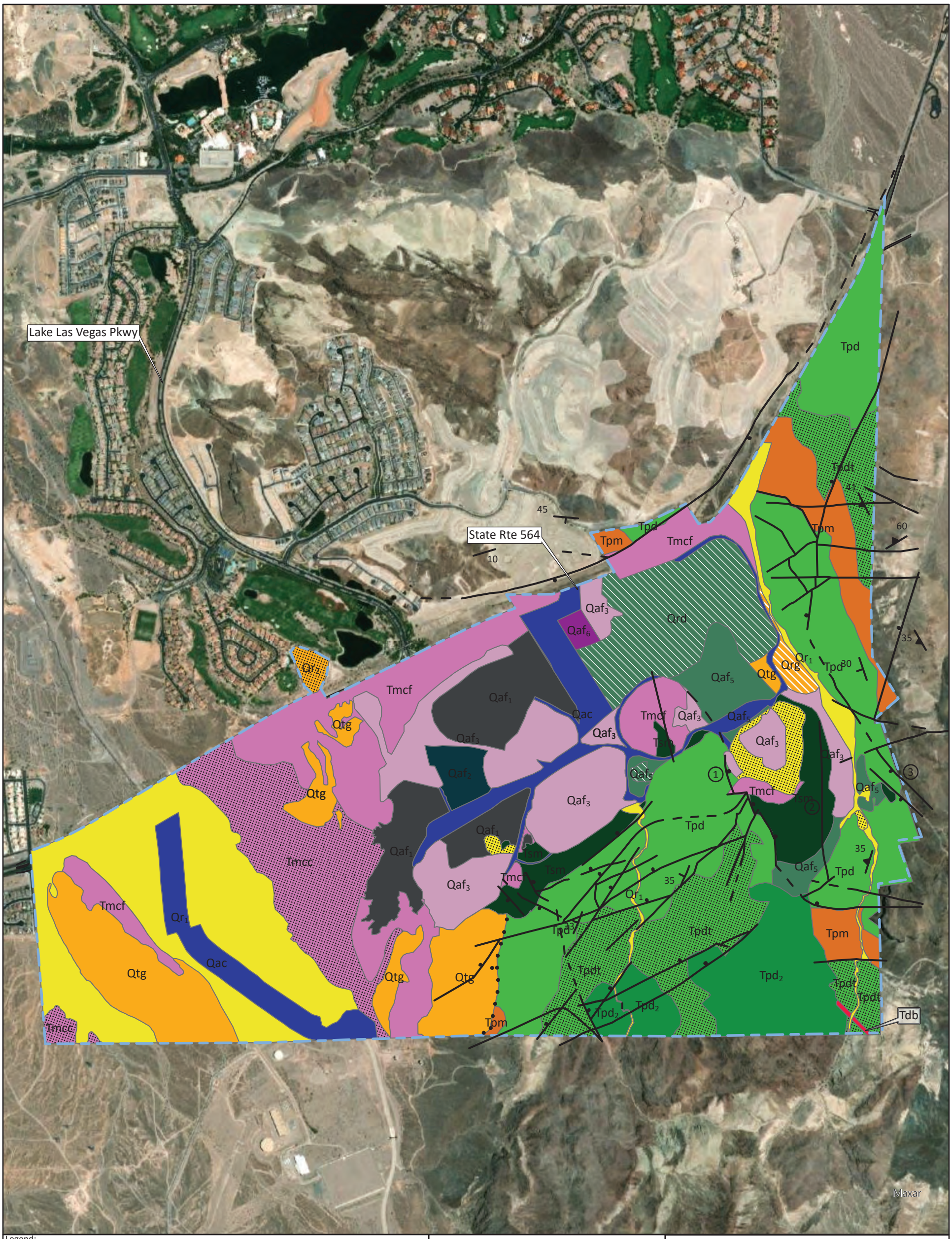
Job # 14-01-156 Date: 2/27/2022

# Figure 1-3

## Mill Site Layout on Aerial

## Three Kids Mine

| | |
|---|---|
| Designed | |
| Drawn | JCM |
| Approved | |

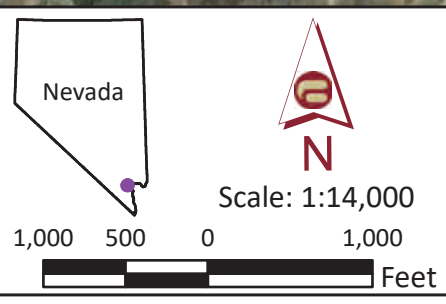



Legend:

- Project Area
- 1 Lowney Fault
- 2 Annex Fault
- 3 Extension Fault

See Figure 4B for detailed lithology key.

- Qac
- $Qaf_1$
- $Qaf_2$
- $Qaf_3$
- $Qaf_4$
- $Qaf_5$
- $Qaf_6$
- $Qr_1$
- $Qr_2$
- Qrd
- Qrg
- Qtg
- Tdb
- Tmcc
- Tmcf
- Tpd
- $Tpd_2$
- Tpdt
- Tpm
- Tsm




# Figure 1-4

## Detailed Geologic Map

## Three Kids Mine

BROADBENT
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 2/22/2022

Notes:
1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Source: 2005-2008 Field and Aerial data combined with data from Bell and Smith, 1980, *Geologic map of the Henderson Quadrangle, Nevada*, Nevada Bureau of Mines and Geology, Map 67, and Hunt, et. al., 1942, *Three Kids Manganese District Clark County, Nevada*, United States Department of the Interior, Bulletin 936-L.

| | |
|---|---|
| Designed | |
| Drawn | JCM |
| Approved | |


Legend:

- Site Feature
- Project Area

Wells in Project Area

- Active Well
- Plugged Well

N

Scale: 1:14,000

1,000 500 0 1,000 Feet

# Figure 1-5

## Well Locations

## Three Kids Mine

BROADBENT

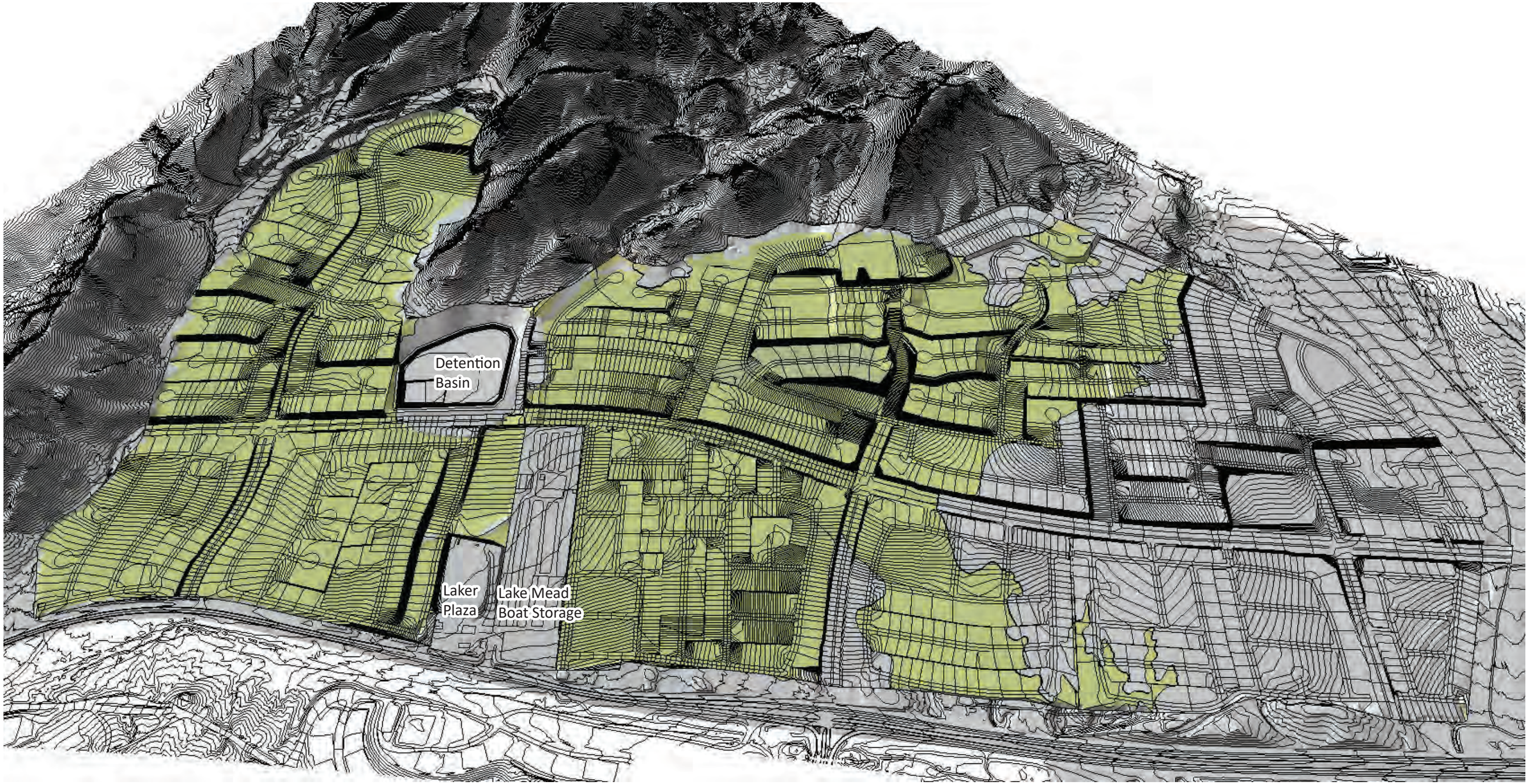
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 12/22/2021

Notes:

1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Source: Nevada Well Log Data Base.

| | |
|---|---|
| Designed | |
| Drawn | JCM |
| Approved | |




BROADBENT
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 2/25/2022

Legend:

Areas to receive 10 feet of clean cover

N

Figure 4-1

Conceptual Rendering of 10-Foot Final Cover

Three Kids Mine

| | |
|---|---|
| Designed | |
| Drawn | LS |
| Approved | |

# Tables

# Table 2-1. Potentially Applicable or Relevant and Appropriate Requirements

| ARARs/TBCs | Citation or Reference | Requirements | Applicability |
|---|---|---|---|
| **Chemical-Specific ARARs** | | | |
| Designation of Hazardous Substances, Determination of Reportable Quantities | 40 CFR 302.4 – 302.5<br><br>NAC 444.842 – 955<br><br>NAC 444.965 – 976 (Asbestos) | This section provides tables on the following substances:<br>a). Listed hazardous substances. The elements, compounds, and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under Section 102(a) of CERCLA.<br><br>b). Unlisted hazardous substances. A solid waste, as defined in 40 CFR 261.2, which is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b), is a hazardous substance under Section 101(14) of CERCLA if it exhibits any of the characteristics identified in 40 CFR 261.20 through 261.24.<br><br>NAC provides requirements for hazardous waste identification, transportation, and disposal which include regulations for polychlorinated biphenyl (PCB) in NAC 444.940 – 955. | Applicable because hazardous substances might be in the contaminated soil and sediment. Waste encountered during the remediation of the contaminated media will be characterized to determine whether it is hazardous or nonhazardous. |
| Identification and Listing of Hazardous Waste | 40 CFR 261 | Identifies those waste subject to regulation as hazardous wastes. | The criteria and limitations used to identify wastes as being hazardous or nonhazardous are applicable to all wastes transported offsite and are relevant and appropriate to all alternatives at the site. |
| Exclusions for Hazardous Wastes | 40 CFR 261.4 (b)(3), and (7) | Lists the solid wastes which shall not be considered as hazardous wastes which include mining overburden that is returned to the mine site and solid waste from beneficiation of ores and minerals. | Applicable to the remedial alternatives that handle overburden and the solid waste generated from the previous beneficiation process. |
| EPA Regional Screening Levels | 40 CFR 300.430(e)(2) | Risk-based contaminant concentrations calculated from acceptable human health exposure levels. | To be considered |

| ARARs/TBCs | Citation or Reference | Requirements | Applicability |
|---|---|---|---|
| Airborne Contamination Monitoring | American Conference of Governmental Industrial Hygienists – Threshold Limit Values (TLV) | Based on the development of a time-weighted average exposure to an airborne contaminant over an 8-hour workday or a 40-hour workweek, TLVs identify levels of airborne contaminants at which health risks may be associated. | Applicable during implementation of alternatives. |
| Airborne Contamination Monitoring | American Conference of Governmental Industrial Hygienists – Estimated Limit Values (ELV) | ELVs provide some indication of airborne contaminant levels at which adverse health effects could occur. | Applicable during implementation of alternatives. |
| OSHA Worker Protection | 29 CFR 1910, 1926 and 1904 | Establishes requirements for occupational health and safety applicable to workers engaged in hazardous waste site or CERCLA response actions | Applicable during implementation of alternatives. |
| **Location-Specific ARARs/TBCs** | | | |
| Clark County Unified Development Code | Title 30 Clark County Code of Ordinances<br><br>NRS Chapter 278 Planning and Zoning | This Title is adopted to implement the Comprehensive Master Plan for Clark County in order to promote the general prosperity, health, safety, and welfare of the citizens of Clark County. It sets forth the regulations that govern the subdivision, use, and/or development of land, divides the County into Zoning Districts, and sets forth the regulations pertaining to such districts. | Applicable |
| Endangered Species Act of 1973 | 16 USC 1531 et seq.<br>50 CFR 200 | Requires remedial agency to consult with Fish and Wildlife Service if action may affect endangered species or critical habitat. Requires action to conserve endangered species within critical habitats upon which endangered species depend, includes consultation with Department of Interior. | No endangered species have been observed at the site but desert iguana, listed on the Nevada Natural Heritage Watchlist has been sighted. The site is located within an area considered to be potential habitat for the desert tortoise, a Threatened Species, although no desert tortoises or signs have been seen on the site.<br><br>It is relevant and appropriate to confirm the previous observations during the soil remediation to ensure protection of the endangered species if found. |

| ARARs/TBCs | Citation or Reference | Requirements | Applicability |
|---|---|---|---|
| **ACTION-SPECIFIC ARARs/TBCs** | | | |
| Three Kids Mine Remediation and Reclamation Act | U.S. Public Law 113-135 | Governs remediation and reclamation schedule, sequence and transfer of land from the federal government to Henderson Redevelopment Agency | Applicable |
| Reclamation of Land Subject to Mining Operations or Exploration Projects | NAC 519A.245 through 345 | Standards and requirements for reclamation of mined lands. Provides guidance for reclamation and closure for Three Kids Mine. | To be Considered. Not required for mining activities that ceased prior to January 1, 1981. |
| Hazardous Substances | 40 CFR A Parts 116.3 and 116.4 | Establishes reporting requirements for certain discharges or reportable quantities of hazardous substances. Creates no substantive clean up requirement. | May be applicable to the site based on the chosen remedial alternative and if discharges of reportable quantities of hazardous substances occur during implementation of the remedy. |
| RCRA<br><br>Nevada Division of Environmental Protection (NDEP) Regulations Applicable to Transporters of Hazardous Waste | 40 CFR. Part 262 Subsection B, & Part 263, 49 CFR 100 through 199<br><br>NAC 459.975 – 991 | Establishes responsibilities for transporters of hazardous waste in handling, transportation, and management of the waste. Sets requirements for manifesting, recordkeeping, packing, labeling, and emergency response action in case of a spill.<br><br>The rules apply to transportation of hazardous materials in the State of Nevada. | Applicable depending on waste classification and if it is transported offsite for disposal. |
| RCRA Land Disposal | 40 CFR Part 268 | Land Disposal Restrictions (LDRs): Establishes restrictions on land disposal unless treatment standards are met or a "no migration exemption" is granted. LDRs establish prohibitions, treatment standards, and storage limitations before disposal for certain wastes as set forth in Subparts C and D. Treatment standards are expressed either as concentration-based performance standards or as specific treatment methods. Wastes must be treated according to the appropriate standard before wastes or the treatment residuals of wastes may be disposed in or on the land. The Universal Treatment Standards establish a concentration limit for 300 regulated constituents in soil regardless of waste type. | Applicable for disposal of hazardous wastes |
| Asbestos Handling and Management | Chapter 4, Section 4-1, SNHD Solid Waste Management Authority Regulations | Standards for handling and transportation of asbestos waste. | Applicable |

| ARARs/TBCs | Citation or Reference | Requirements | Applicability |
|---|---|---|---|
| Transportation | 49 CFR. Part 171 | Hazardous materials that may be transported off site cannot be transported in interstate and intrastate commerce, except in accordance with the requirements of 49 CFR Part 171, Subpart C. | Applicable. Any offsite transportation of hazardous waste will comply with these regulations, which contain packaging, placarding, labeling, and other shipping requirements. |
| Discharges of Storm Water Associated with Construction and Land Disturbance Activities | Clean Water Act (CWA) Section 402; 40 CFR Parts 122,123,124<br><br>Clark County Code 24.40 | If 1 or more acres of land will be disturbed during construction activities (e.g., conveyance pipe installation), compliance with Section 402 of the CWA would be applicable and BMPs used to prevent impacts to surface water. If less than 1 acre is disturbed, the same BMPs will be used to prevent degradation of surface water quality.<br><br>Stormwater control and construction Best Management Practices | Applicable given size of surface disturbance to reclaim mine site |
| Clean Air Act | Title I, Part A – Air Quality and Emission Limitations | Calls for development and implementation of regional air pollution control programs. Section 101 of Part A delegates primary responsibilities for regional air quality management to the states. | Regulations promulgated under the Clean Air Act may apply to possible actions at the site that generate air emissions, i.e., volatiles potentially generated from soil and tailings removal alternatives and fugitive particulate emissions. |
| National Primary and Secondary Ambient Air Quality Standards | 40 CFR 50 and Clean Air Act Part A, 109<br><br>NAC 445B.22097 | Establishes ambient air quality standards.<br><br>No person may 1) handle or transport any material in a manner which allows controllable particulate matter to become airborne; 2) cause or permit the construction or use of unpaved areas without best practical methods (paving, chemical stabilization, watering, phased construction) to prevent particulate matter from becoming airborne; or 3) disturb or cover 5 acres or more of land or its topsoil until the person has obtained an operating permit for surface area disturbance to clear, excavate, or level the land. | Applicable to alternatives that potentially generate particulate emissions, i.e., excavation and waste removal. |

| ARARs/TBCs | Citation or Reference | Requirements | Applicability |
|---|---|---|---|
| Requirements for Preparation, Adoption, and Submittal of Implementation Plans | 40 CFR 51 | Requires excavation activities be controlled to minimize fugitive dust emissions. | Applicable to some alternatives that will generate fugitive dust emissions from excavation of contaminated soil. |
| Guidelines for Land Disposal of Solid Wastes | 40 CFR 241 | Offsite solid waste land-disposal units must meet the federal guidelines for the land disposal of solid wastes. | Applicability depends on waste classification for wastes generated from the remediation. |
| Criteria for Classification of Solid Waste Disposal Facility and Practices | Subtitle D, 40 CFR 257<br><br>NAC 444.570 – 749 | Sets standards for land disposal facilities for nonhazardous waste. | Applicable to transport and disposal of any nonhazardous waste. |
| Solid Waste Landfill Design, and Maintenance | NAC 444.731 – 747<br><br><br>SNHD Solid Waste Management Authority Regulations | Specifies the requirements to which a Class III landfill shall be designed, and maintained, including final cover, monitoring, closure and post-closure care.<br><br>Provides for Class III Landfill waiver | Applicable to landfilling the solid waste onsite. |
| Hazardous Waste Management; Standards Applicable to Generators of Hazardous Waste; and Standards Applicable to Transporters of Hazardous Waste | Subtitle C 40 CFR 260, 262, and 263. | Regulates the generation, transport, storage, treatment, and disposal of hazardous wastes generated in the course of a remedial action. Regulates the construction, design, monitoring, operation, and closure of hazardous waste facilities. | Requirements under these regulations may be relevant and appropriate to storage of certain non-hazardous wastes or treatment system residuals if the risk they present are similar to those associated with hazardous wastes. The criteria and limitations used to identify wastes as being hazardous or nonhazardous are applicable to the site. |
| Uniform Environmental Covenants Act | NRS 445D | Specifies process and requirements for environmental covenants in the state of Nevada. | Applicable to alternatives in which contamination remains in place. |
| Monitoring Well Construction, Geotechnical Boreholes, and Plug & Abandonment Policy | NAC 534 | Provides a set of guidelines for installation and plugging and abandonment of groundwater monitoring wells and boreholes. | Potentially applicable if installation or plugging and abandonment of groundwater monitoring wells or boreholes takes place. |

| ARARs/TBCs | Citation or Reference | Requirements | Applicability |
|---|---|---|---|
| Notes:<br><br>ARAR = Applicable or relevant and appropriate requirement<br>BMP = Best management practice<br>CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act<br>CFR = Code of Federal Regulations<br>CWA = Clean Water Act<br>ELV = Estimated Limit Values<br>LDR = Land Disposal Restrictions<br>NAC = Nevada Administrative Code<br>NDEP = Nevada Division of Environmental Protection<br>NRS = Nevada Revised Statutes<br>RCRA = Resource Conservation and Recovery Act<br>SNHD = Southern Nevada Health District<br>TBC = To be considered<br>TLV = Threshold Limit Values<br>USC = United States Code | | | |

## Table 3-1. Remedial Technology Screening

| Environmental Media | General Response Action | Technology | Process Option | Description | Effectiveness [(a)] | Implementability [(a)] | Cost [(a)] | Status |
|---|---|---|---|---|---|---|---|---|
| Soil / Waste Rock / Tailings | No Action | Not applicable | Not applicable | No actions taken to address risks at site. | Not effective. No actions are taken to meet the RAOs. | Not applicable. | None | Retained as required by NCP |
| | Limited Action | Institutional Controls | Deed Restriction | Administrative and legal instruments would require health and safety measures for soil 2-10 feet bgs during construction to prevent worker exposure. ICs typically used in concert with other technologies. | Effective at preventing worker exposure during construction activities via engineered controls. Mechanism for enforcement required (e.g., provisions in building and construction permits). No actions are taken to reduce contaminant mass. | Implementable. Would require coordination with City of Henderson Building and Fire Safety Department for enforcement mechanism. | Low | Retained |
| | Containment | Capping | Placement of a synthetic or natural liner over underlying media | Contaminated media is isolated from human exposure and infiltration with an impermeable layer (synthetic or natural) | Effective at reducing human exposure to contaminants in soil. Effective at reducing infiltration and subsequent leaching of contaminants through the vadose zone. No actions are taken to reduce contaminant mass in underlying soil. | Limited Implementability. Restricted to common areas and below utility alignments. Cap in residential lots would restrict future land use. | Low | Retained |
| | Removal | Excavation | Mechanical Excavation | Contaminated media is removed with conventional mechanical equipment (e.g., excavator, bulldozer, etc.). | Effective. Physical removal of contaminated media renders several technologies implementable: off-site disposal, placement in onsite pits, ex situ soil washing, etc. | Implementable. Excavation of waste rock and tailings will not be encumbered by existing structures or easements. | Moderate | Retained |
| | Treatment | Ex Situ Chemical Soil Washing | Soil Washing | Soil washing uses particle size separation (separating fine grained soil [e.g., silt and clay] with high tendency to sorb contaminants from cleaner large particles [sand]) to isolate the bulk of contaminant mass. This refined fraction can then be treated with solvent, surfactant or acid to remove contaminants. | Limited effectiveness due to highly variable contaminant reductions. Achieving RAO may proved difficult. Generates secondary waste stream to be managed. | Implementable in concert with excavation. Intense multi-step process with low volumetric treatment rate relative to total volume of waste rock and tailing. Unlikely to meet project schedule. | High | Not Retained |
| | | In Situ Soil Flushing | Contaminant mobilization and extraction via flushing solution | In situ soil flushing extracts contaminants from soil using water, chemicals in water, or solvents to extract contaminants from soil via injection, leaching, and extraction. | Limited effectiveness in low permeability and highly heterogeneous soils. Requires in situ contact of flushing solutions with sorbed contaminants. Capture and extraction of all injected solution can prove difficult. Achieving RAO unlikely. | Not implementable given other required earth moving activities required on site. | High | Not Retained |
| | Disposal | Off-site Disposal | Landfilling | Contaminated media is collected and transported to a permitted off-site disposal facility. | Effective with permanent removal of waste rock and tailings from site. Hauling poses significant traffic risk to short term effectiveness. | Not implementable. The volume of waste rock and tailings on site precludes over-road transport (hundreds of thousands loads). Would require commensurate import of clean fill for material balance. | High | Not Retained |

| Environmental Media | General Response Action | Technology | Process Option | Description | Effectiveness [(a)] | Implementability [(a)] | Cost [(a)] | Status |
|---|---|---|---|---|---|---|---|---|
| Soil / Waste Rock / Tailings | Disposal | On-site Consolidation | Containment in Pits | Contaminated media is consolidated in existing mine pits and low areas under suitable cover. | Effective. Depending on final cover which can vary based on areas of capping, institutional controls, and final cover thicknesses, will isolate impacted media from human health exposure. Grading and drainage controls will minimize infiltration through contained waste. | Implementable. Mine closure requires backfilling pits and stabilizing rock slopes. Waste rock and tailings provide suitable fill with appropriate final covers. Material balance eliminates export or import of earthen materials. | Moderate | Retained |
| Solid Waste | No Action | Not applicable | Not applicable | No actions taken to address risks at site. | Not effective. Not allowed by rule. ACM must properly disposed. | Implementable. | Low | Retained as required by NCP |
| | Removal/ Disposal | Excavation/ Loading/ Transportation | Off-site Landfilling | Removal of all solid wastes from site including asbestos containing material (ACM), transport, and disposal at permitted special waste landfill. | Highly effective. Removes solid and special waste (ACM) from site. Permanent. Hauling poses traffic risk to short term effectiveness. | Implementable | High | Retained. |
| | Removal/ Disposal/ Containment | | ACM separation with disposal in permitted facility. On-site concrete disposal and/or recycling | Separate ACM from concrete waste. Transport and dispose ACM off-site in permitted facility. Other concrete waste disposed on site. | Effective. Removes ACM from site. Hauling poses traffic risk to short term protectiveness. | Implementable | Moderate | Retained |
| | Removal/ Containment | Containment | Landfilling | On-site Class III Landfill waiver in accordance NAC 444.731 for mine site wastes. | Effective. ACM and construction wastes will disposed at deep level in pit and buried under waste rock. | Implementable. On-site solid wastes are acceptable for this | Low | Retained |

**Notes:**
(a) The criteria were assigned one of the following ratings:
**Effectiveness:** Three ratings as Effective; Limited Effectiveness, and Not Effective.
**Implementability:** Three ratings as Implementable, Limited Implementability, Not Implementable.
**Cost**: Three ratings as High, Moderate, and Low.
ACM - asbestos containing materials
NAC- Nevada Administrative Code
NCP - National Contingency Plan
RAO - remedial action objective

**Table 4-1. Summary of Alternatives and Remedial Action Objectives to Be Achieved**

| Alternative | Remedial Action Objectives | | | |
|---|---|---|---|---|
| | Prevent human exposure to the solid waste and soil with concentrations of COCs exceeding preliminary reduction goals (PRGs) | Minimize migration of soil contaminants and waste into the groundwater, surface water, and other site soil | Prevent direct human exposure to ACMs | Convert the site surface area to residential use |
| **Alternative S-1: No Action** | Does not address the remedial action objective (RAO). | Does not address the RAO. | Does not address the RAO. | Does not address the RAO. |
| **Alternative S-2: Consolidation, 2-Foot Cover, and ACM Offsite Disposal.** Excavation and consolidation of contaminated soil, mill site soil, waste rock, tailings in the open pits, capping and cover of the materials with 2 feet of clean soil; capping contaminated materials in the Hydro Pit with a synthetic liner; disposal of the construction wastes and ACMs offsite, and implementation of ICs. | Will prevent direct human exposure to the waste and soil with concentrations of COCs exceeding PRGs with 2-foot cover. However, the 2-foot cover will not protect construction workers during earth work that reaches to a depth greater than 2 feet. Therefore, ICs will be implemented to prevent contaminant exposure to workers and public by requiring protection measures during earth moving activities. | Will minimize migration of contaminants into other site soil and surface water; will reduce migration of contaminants to groundwater in the Hydro Pit area by reducing infiltration of precipitation to the groundwater with a synthetic bottom liner of the stormwater detention basin. | Will prevent direct exposure to ACMs by removal and disposal of the ACMs offsite. | Will convert the site surface area to a certain extent; and drilling, excavation and other earth moving activities below the capped and covered area to 10 feet below final grade will require engineered controls to protect construction workers and the public from being exposed to the contaminants. These restrictions and measures will be implemented via ICs. |
| **Alternative S-3: Consolidation, 10-Foot Cover, and ACM Onsite Disposal.** Excavation and consolidation contaminated soil, mill site soil, waste rock, tailings in the open pits, capping and cover of the materials with 10 feet of clean soil; capping contaminated materials in the Hydro Pit with a synthetic liner; disposal of the construction wastes and ACMs in Hulin Pit onsite. | Will prevent direct human exposure to the waste and soil with concentrations of COCs exceeding PRGs with 10-foot cover. | Ten-foot cover in concert with grading and drainage controls will minimize migration of contaminants into other site soil and surface water; will reduce migration of contaminants to groundwater. Capping wastes in the Hydro Pit with synthetic liner (synthetic bottom liner of the stormwater detention basin) will virtually eliminate infiltration of precipitation. | Will prevent direct exposure to ACMs by removal and disposal of the ACMs at great depth in Hulin Pit. | Will convert the site to a full residential use. Requires approval of Class III Landfill waiver. |
| **Alternative S-4: Consolidation, 10-Foot Cover, and ACM Offsite Disposal.** Excavation and consolidation contaminated soil, mill site soil, waste rock, tailings in the open pits, capping and cover of the materials with 10 feet of clean soil; capping and cover of the materials with 10 feet of clean soil; capping contaminated materials in the Hydro Pit with a synthetic liner; disposal of the construction wastes and ACMs offsite. | Will prevent direct human exposure to the waste and soil with concentrations of COCs exceeding PRGs with 10-foot cover. | Ten-foot cover in concert with grading and drainage controls will minimize migration of contaminants into other site soil and surface water; will reduce migration of contaminants to groundwater. Capping wastes in the Hydro Pit with synthetic liner (synthetic bottom liner of the stormwater detention basin) will virtually eliminate infiltration of precipitation. | Will prevent direct exposure to ACMs by removal and disposal of the ACMs offsite. | Will convert the site to a full residential use. |

NOTES:
ACM = Asbestos containing material
COC = Contaminant of concern
IC = Institutional control
PRG = Preliminary remediation goal
RAO = Remedial action objective

## Table 5-1. Alternative Evaluation Summary

| Evaluation Criteria | Alternative S-1: No Action | Alternative S-2: Consolidation, 2-Foot Cover, ICs, and ACM Offsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 2-foot cover.<br>• Installation of a stormwater detention basin.<br>• Abatement and disposal of ACMs & construction debris offsite | Alternative S-3: Consolidation, 10-Foot Cover, and ACM Onsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 10-foot cover.<br>• Installation of a stormwater detention basin.<br>• Containment of ACMs and construction debris onsite. | Alternative S-4: Consolidation, 10-Foot Cover, and ACM Offsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 10-foot cover.<br>• Installation of a stormwater detention basin.<br>• Abatement and disposal of ACMs & construction debris offsite. |
|---|---|---|---|---|
| **THRESHOLD CRITERIA** | | | | |
| 1. Overall protection of human health and environment | No.<br><br>Alternative S-1 would not be protective of environment because potential exposure associated with contaminated soil and waste would not be reduced. | Yes.<br><br>Alternative S-2 would provide protection of human health and environment through excavating, consolidating, and capping of contaminated soil and waste; and offsite disposal of ACMs and construction debris to remove direct exposure risk.<br><br>The capped contaminated materials would be protected by institution controls (ICs) to prevent the cap from being damaged; resulting in direct exposure to construction workers and public. | Yes.<br><br>Alternative S-3 would be protective of human health and environment through excavating, consolidating, and capping of contaminated soil and waste; and disposal of ACMs and construction debris onsite in the Hulin Pit to remove direct exposure risk.<br><br>The 10-foot clean soil that covers the contaminated materials would be sufficient to prevent the contaminants from being exposed by construction activities, except for deep construction for which an environmental covenant would be enacted. | Yes.<br><br>Alternative S-4 would be protective of human health and environment through excavating, consolidating, and capping of contaminated soil and waste; and offsite disposal of ACMs and construction debris to remove direct exposure risk.<br><br>The 10-foot clean soil that covers the contaminated materials would be sufficient to prevent the contaminants from being exposed by construction activities, except for deep construction for which an environmental covenant would be enacted. |
| 2. Compliance with ARARs | No.<br><br>Alternative S-1 would not comply with ARARs. | Yes.<br><br>Alternative S-2 would comply with ARARs by consolidating and capping of contaminated soil and waste at the site to prevent direct exposure to the contaminants. | Yes.<br><br>Alternative S-3 would comply with ARARs by consolidating and capping contaminated soil and waste; and disposal of ACMs and construction debris onsite in the Hulin Pit with waiver to prevent direct exposure | Yes.<br><br>Alternative S-4 would comply with ARARs by consolidating and capping of contaminated soil and waste to prevent direct exposure; and removal of ACMs and construction debris for offsite disposal. |
| **BALANCING CRITERIA** | | | | |
| 3. Long-term effectiveness and permanence<br><br>(Magnitude of residual risk and adequacy and reliability of controls) | • Alternative S-1 would not provide long-term effectiveness and permanence. Unacceptable risk remains at the site.<br><br>• No control would be used under this alternative. | • Alternative S-2 would provide somewhat long-term protection with low residual risk because the contaminated soil and waste would be capped to remove exposure risk, but the 2-foot cover would not be protected without ICs from being damaged to expose contaminants by construction and earth moving activities.<br><br>• ICs would be adequate to prevent capped materials from being exposed to the environment. | • Alternative S-3 provides long-term effectiveness with 10-foot cover of the contaminated materials and ACMs.<br><br>• An environmental covenant would be placed on soil deeper than 10 feet for deep construction. | • Alternative S-4 provides long-term effectiveness with 10-foot cover of the contaminated materials and ACMs offsite disposal.<br><br>• An environmental covenant would be placed on soil deeper than 10 feet for deep construction. |

| Evaluation Criteria | Alternative S-1: No Action | Alternative S-2: Consolidation, 2-Foot Cover, ICs, and ACM Offsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 2-foot cover.<br>• Installation of a stormwater detention basin.<br>• Abatement and disposal of ACMs & construction debris offsite | Alternative S-3: Consolidation, 10-Foot Cover, and ACM Onsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 10-foot cover.<br>• Installation of a stormwater detention basin.<br>• Containment of ACMs and construction debris onsite. | Alternative S-4: Consolidation, 10-Foot Cover, and ACM Offsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 10-foot cover.<br>• Installation of a stormwater detention basin.<br>• Abatement and disposal of ACMs & construction debris offsite. |
|---|---|---|---|---|
| 4. Reduction of toxicity, mobility, and volume through treatment<br><br>(Amount of hazardous materials destroyed or treated,; degree of expected reductions in toxicity, mobility, and volume; and residuals remaining after treatment) | • No amount of contaminated materials destroyed or treated.<br><br>• No reduction in toxicity, mobility, and volume.<br><br>• Contaminants remain at the site. | • No amount of the contaminated materials destroyed or treated but capped on site; and ACMs abated and removed offsite for disposal.<br><br>• No reduction in toxicity and volume, but mobility is reduced by consolidating and capping of the contaminated materials onsite. ACMs' mobility is also reduced by offsite disposal.<br><br>• Contaminants remain at the site. | • No amount of the contaminated materials would be destroyed or treated, but contaminants would be consolidated and covered onsite. ACMs would be abated and contained onsite.<br><br>• No reduction in toxicity and volume, but mobility is reduced by consolidating and capping of the contaminated materials onsite and containing ACMs in the Hulin Pit.<br><br>• Contaminants remain at the site. | • No amount of the contaminated materials destroyed or treated but capped on site; and ACMs abated and removed offsite for disposal.<br><br>• No reduction in toxicity and volume, but mobility is reduced by consolidating and capping of the contaminated materials onsite. ACMs' mobility is also reduced by offsite disposal.<br><br>• Contaminants remain at the site. |
| 5. Short-term effectiveness<br><br>(Community protection during RA, worker protection during RA, Environmental impacts during RA, and time until RAOs achieved) | • No additional risk presented because there is no remedial action.<br><br>• The RAOs would not be achieved under this no -action alternative. | • Minimal short-term impact on the community. Remedial activities would generate noise and dust and cause traffic to increase in the area. Best practice management would be applied during the remediation to control traffic and dust.<br><br>• ACM transport would create traffic risk<br><br>• Low short-term risk to workers. Standard construction techniques and engineering controls including PPE will be used to ensure minimal exposure of the contaminants to workers.<br><br>• Minimal impacts on environment during remediation. Protection measures will be used to identify and protect potential habitats of birds and animals in the area. | • Minimal short-term impact on the community. Remedial activities would generate noise and dust and cause traffic to increase in the area. Best practice management would be applied during the remediation to control traffic and dust.<br><br>• Low short-term risk to workers. Standard construction techniques and engineering controls including PPE will be used to ensure minimal exposure of the contaminants to workers.<br><br>• Minimal impacts on environment during remediation. Protection measures will be used to identify and protect potential habitats of birds and animals in the area.<br><br>• May take a longer time than Alternative S-2 to achieve RAOs because of construction of a thicker cap and containment of ACMs. | • Minimal short-term impact on the community. Remedial activities would generate noise and dust and cause traffic to increase in the area. Best practice management would be applied during the remediation to control traffic and dust.<br>• ACM transport would create traffic risk<br><br>• Low short-term risk to workers. Standard construction techniques and engineering controls including PPE will be used to ensure minimal exposure of the contaminants to workers.<br><br>• Minimal impacts on environment during remediation. Protection measures will be used to identify and protect potential habitats of birds and animals in the area.<br><br>• May take a longer time than Alternative S-2 because of construction of a thicker cap but shorter time than Alternative S-3 because ACM containment would not be constructed. |

| Evaluation Criteria | | Alternative S-1: No Action | Alternative S-2: Consolidation, 2-Foot Cover, ICs, and ACM Offsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 2-foot cover.<br>• Installation of a stormwater detention basin.<br>• Abatement and disposal of ACMs & construction debris offsite | Alternative S-3: Consolidation, 10-Foot Cover, and ACM Onsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 10-foot cover.<br>• Installation of a stormwater detention basin.<br>• Containment of ACMs and construction debris onsite. | Alternative S-4: Consolidation, 10-Foot Cover, and ACM Offsite Disposal<br>• Excavation of the contaminated soil, waste rock, and tailings.<br>• Consolidation of the excavated materials in the open pits and construction of a 10-foot cover.<br>• Installation of a stormwater detention basin.<br>• Abatement and disposal of ACMs & construction debris offsite. |
|---|---|---|---|---|---|
| 6. Implementability<br><br>(Reliability of technology, permits required, availability of disposal services, availability of equipment and specialists, and maturity of technology for full-scale) | | • No remedy would be implemented under this alternative. | • Alternative S-2, consolidating and capping and construction of stormwater detention basin are reliable and mature technologies. But it will require an offsite disposal facility, which must have a sufficient capacity for more than 1,400 cubic yards of ACMs and construction debris.<br><br>• The alternative requires typical construction methods and equipment.<br><br>• The alternative requires long-term maintenance and ICs to protect the 2-foot cover. | • Alternative S-3, consolidating and capping and construction of stormwater detention basin and containing ACMs are reliable and mature technologies. It does not require offsite disposal facilities.<br><br>• The alternative requires typical construction methods and equipment.<br><br>• The alternative does not require long-term maintenance, assuming Class III Landfill requirements are waived for the Hulin Pit. | • Alternative S-4, consolidating and capping and construction of stormwater detention basin are reliable and mature technologies. But it will require an offsite disposal facility, which must have a sufficient capacity for more than 500 tons of ACMs and construction debris.<br><br>• The alternative requires typical construction methods and equipment.<br><br>• The alternative does not require long-term maintenance. |
| 7. Cost | Total capital cost | $0 | $129,884,000 | $184,924,000 | $185,559,000 |

Notes:
ARAR = Applicable or relevant and appropriate requirement
IC = Institutional control
PPE = Personal protective equipment
RA = Remedial action
RAO = Remedial action objective

## Table 5-2. Comparative Analysis of Remedial Alternatives

**Alternative S-1:** No action
**Alternative S-2:** Consolidation, 2-foot cover, and ACM offsite disposal
**Alternative S-3:** Consolidation, 10-foot cover, and ACM onsite disposal
**Alternative S-4:** Consolidation, 10-foot cover, and ACM offsite disposal

| Evaluation Criteria | Comparison Summary | Most Satisfactory | Less Satisfactory |
|---|---|---|---|
| **Threshold Criteria** | | | |
| 1. Overall protection of human health and environment | • All alternatives are protective of human health and environment, except Alternative S-1.<br>• Alternative S-2 would require ICs to maintain protection of construction workers.<br>• Alternative S-3 requires Class III Landfill Waiver | Alternative S-3 | Alternative S-2 |
| 2. Compliance with ARARs | • All alternatives are in compliance with ARARs except Alternative S-1. | None | None |
| **Balancing Criteria** | | | |
| 3. Long-term effectiveness and permanence | • All alternatives provide some extent of long-term effectiveness and permanence except Alternative S-1.<br>• Alternative S-2 would require long-term monitoring and maintenance to ensure the long-term effectiveness of 2-foot cover. | Alternatives S-3 and S-4 | Alternative S-2 |
| 4. Reduction of TMV through treatment | • No alternatives would reduce the toxicity and volume of the contaminated soil and waste.<br>• All alternatives reduce mobility of the contaminants, except Alternative S-1.<br>• Alternative S-4 is the best in reducing mobility of the contaminants by using a thicker cap and disposal of ACMs and construction debris offsite. | Alternative S-4 | Alternatives S-2 |

| | | | | | |
|---|---|---|---|---|---|
| 5. Short-term effectiveness | | • Alternatives S-3 and S-4 would require a longer time to implement than Alternative S-2 due to more earthmoving. Longer implementation time would pose more impacts on workers, communities, and environment. Alternative S-2 creates traffic risk of off-mine-site hauling. | | Alternative S-2 | Alternative S-3 |
| 6. Implementability | | • All alternatives are readily implementable with typical construction methods and equipment.<br>• Alternatives S-3 and S-4 would require more processes and materials than Alternative S-2. | | Alternative S-2 | Alternatives S-3 |
| 7. Cost | **Alternative** | **Alternative S-1** | **Alternative S-2** | **Alternative S-3** | **Alternative S-4** |
| | Total capital cost | 0 | $130,696,000 | $185,735,000 | $186,370,000 |

Notes:

ARAR = Applicable or relevant and appropriate requirement
ACM = Asbestos containing material
IC = Institutional control
TMV = Toxicity, mobility, or volume

# Table 6-1 Preferred Alternative 3 ARAR Compliance

| ARARs/TBCs | Citation or Reference | Remedy Specific Requirement | Compliance | Protection of Health and Environment |
|---|---|---|---|---|
| **Chemical-Specific ARARs** | | | | |
| Exclusions for Hazardous Wastes | 40 CFR 261.4 (b)(3) and (b)(7) | Mining overburden returned to the mine site. Solid waste from the extraction, beneficiation, and processing of ores and minerals. | All mine wastes to remain on site with preferred alternative. RCRA exempt. | Mine wastes will be placed as deep fill in former pits and low areas and covered with clean borrow material. |
| EPA Regional Screening Levels | 40 CFR 300.430(e)(2) | Risk-based contaminant concentrations calculated from acceptable human health exposure levels. | Mine wastes and mine site soils that exceed BTVs and RSLs will be isolated with 10 feet of clean cover with restrictive covenant for future construction below 10 feet. | The placement of clean fill over mine wastes and mine site soils will eliminate 0-10 foot exposure pathways. |
| Airborne Contamination Monitoring | ACGIH – Threshold Limit Values (TLV) | Control exposure to airborne contaminants over an 8-hour workday or a 40-hour workweek. | Worker protections will be specified in site specific health and safety plan | Worker protection will be ensured via site health and safety plan and engineered controls (e.g., enclosed cabs on equipment) |
| OSHA Worker Protection | 29 CFR 1910, 1926 and 1904 | Establishes requirements for occupational health and safety applicable to workers engaged in hazardous waste site or CERCLA response actions | Site Health and Safety Plan will be implemented during course of Remedial Action to maintain worker safety and site restrictions. | Dust control, worker monitoring, and perimeter air monitoring will ensure short-term protection during Remedial Action. |
| **Location-Specific ARARs/TBCs** | | | | |
| Three Kids Mine Remediation and Reclamation Act | U.S. Public Law 113-135, Section 3 Paragraph b.1.C | Requires Phase I, Phase II and estimate of costs to assess, remediate, and reclaim the site. | It was agreed CERCLA response action process satisfies ASTM Phase II requirements | Achieves protection of human health and environment via CERCLA response action process |

| ARARs/TBCs | Citation or Reference | Remedy Specific Requirement | Compliance | Protection of Health and Environment |
|---|---|---|---|---|
| Henderson Development Code | Title 19 | Governs the subdivision, use, and/or development of land in the city of Henderson. | Submission of plans for final grading and drainage, stormwater management, utilities, roads, and elevations to Comprehensive Planning Department. | Achieved through compliance with applicable city of Henderson ordinances |
| Endangered Species Act of 1973 | 16 USC 1531 et seq.<br>50 CFR 200 | Query[1] results indicated four species listed under the Endangered Species Act (ESA) occur within the region: the endangered Southwestern Willow Flycatcher, Yuma Ridgways (clapper) Rail, and Pahrump Poolfish, and the threatened Desert Tortoise. | These species were evaluated for their potential to occur within the Site. The desert tortoise was the only species determined to have limited potential to be present in the undisturbed areas (native boundary areas east and west of former mining operations).<br><br>No critical habitat was identified within the Project area.<br><br>No ESA-listed plant species were reported. | The act requires action to conserve endangered species within critical habitats upon which endangered species depend. No critical habitat was identified within the Site.<br><br>Clark County Desert Conservation Plan for the desert tortoise encompasses all private land in Clark County. A fee permits "incidental" take of potential habitat and funds conversation. Once Federal land transfer occurs, this fee will be applicable. |
| **ACTION-SPECIFIC ARARs/TBCs** | | | | |
| Reclamation of Land Subject to Mining Operations or | NAC 519A.275.2 | Land which is returned to its pre-mining use or reclaimed after mining or exploration to a level of | Site will be redeveloped for residential housing which is consistent with development at | Residential development will be facilitated via placement of clean cover from borrow areas |

[1] USFWS Information for Planning and Consultation (IPaC) database was queried on March 29, 2021 to gather information on all Federally-listed Threatened, Endangered, and candidate species and critical habitat which may occur in the vicinity of the Project location.

| ARARs/TBCs | Citation or Reference | Remedy Specific Requirement | Compliance | Protection of Health and Environment |
|---|---|---|---|---|
| Exploration Projects | | productivity which is generally consistent with the pre-mining level of productivity or the level of productivity of the surrounding land shall be deemed to be a productive postmining use. | nearby Lake Las Vegas. | over mine wastes to eliminate residential and construction worker pathways with environmental covenant to address construction deeper than 10 feet below final grade. |
| Asbestos Handling and Management | Chapter 4, Sections 4-1.01 and -1.02, SNHD Solid Waste Management Authority Regulations | Standards for handling and transportation of asbestos waste. Permit required for transport of asbestos. | Compliance with SNHD requirements for on-site disposal option for asbestos. | Compliance with handling and transportation requirements will minimize exposure to asbestos during remediation. |
| Discharges of Storm Water Associated with Construction and Land Disturbance Activities | Clean Water Act Section 402; 40 CFR Parts 122,123,124<br><br>Clark County Code 24.40 Storm Sewer System Discharge | If 1 or more acres of land will be disturbed during construction activities (e.g., conveyance pipe installation), compliance with Section 402 of the CWA would be applicable and BMPs used to prevent impacts to surface water. | Clark County Code 24.40.032 requires inspection, monitoring, implementation of BMPs, and Spill Response | Implementation of BMPs to control storm water runoff will minimize off-site transport of site sediments |
| Nevada Uniform Environmental Covenants Act | NRS 445.D | Environmental covenant is required to prevent or control exposure to deep fill below 10-foot clean cover | Will be administered by Clark County and NDEP regarding deep construction activities. | The restrictive covenant will ensure that construction activities in soil deeper than 10 feet from grade requires testing and worker protection. |
| Nevada Standards for Quality of Ambient Air | NAC 445B.22097 Emissions of Particulate Matter: Fugitive Dust.<br><br>Section 94 Clark County Air Quality Regulations Dust Control for Construction and Temporary Commercial Activities | No person may 1) handle or transport any material in a manner which allows controllable particulate matter to become airborne; 2) cause or permit the construction or use of unpaved areas without best practical methods (paving, chemical stabilization, watering, phased construction) to prevent particulate matter from becoming airborne; or 3) disturb or cover five acres or more of land or its topsoil until the | Dust control permit will be obtained from Clark County Division of Air Quality Dust Control Operating Permit. | Perimeter air quality monitoring and trained and Clark County trained on site Dust Control monitors during all earth moving and other potential dust generating activities. |

| ARARs/TBCs | Citation or Reference | Remedy Specific Requirement | Compliance | Protection of Health and Environment |
|---|---|---|---|---|
| | | person has obtained an operating permit for surface area disturbance to clear, excavate, or level the land. | | |
| Solid Waste Landfill Design, and Maintenance | Chapter 3, Section 3-3.01 SNHD Solid Waste Management Authority Regulations | Provides for Class III Landfill waiver to dispose of mining and industrial wastes on site | Onsite handling and disposal of solid waste will be in accordance with SNHD stipulated waiver requirements | Burial of on-site solid wastes deep in the pits will isolate waste from exposure to humans. Solid wastes are "dry" and not expected to generate leachate. |
| Monitoring Well Construction, Geotechnical Boreholes, and Plug & Abandonment Policy | NAC 534 | Provides a set of guidelines for installation and plugging and abandonment of groundwater monitoring wells and boreholes. | Abandonment of on-site test well will be in accordance with Nevada regulations. | Test well abandonment in accordance with regulations will protect groundwater from adverse impacts due to improperly abandoned wells. |

Notes:

ARAR = Applicable or relevant and appropriate requirement
BTV = Background Threshold Value
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations NAC = Nevada Administrative Codes
NDEP = Nevada Division of Environmental Protection
NRS = Nevada Revised Statutes
RCRA = Resource Conservation and Recovery Act
SNHD = Southern Nevada Health District
TBC = To be considered
TLV = Threshold Limit Values
USC = United States Code

# Appendix A

# Remedial Alternative Cost Estimates

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Summary**

| Cost Estimate Summary - Soil and Waste Alternatives | | | | |
|---|---|---|---|---|
| | **Alternative S-1** No action | **Alternative S-2** Consolidation, 2-Foot Cover, and ACM Offsite Disposal | **Alternative S-3** Consolidation, 10-Foot Cover, and ACM Onsite Disposal. | **Alternative S-4** Consolidation, 10-Foot Cover, and ACM Offsite Disposal. |
| **Capital Cost** | **$0** | **$129,884,000** | **$184,924,000** | **$185,559,000** |

**Notes:**
1. Estimate was based on EPA guidance document: EPA. 2000. *A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002* . July.
2. Estimate not intended for construction
3. Expected accuracy +50%/-30%

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Alternative S-2: Consolidation, 2-Foot Cover, and ACM Offsite Disposal**
(Accuracy Range: +50% / -30%)

**Quantities**

| | Area (Acre) | Volume (CY) | Weight (Ton) |
|---|---|---|---|
| Grading area | 425 | 9,900,000 | |
| Overburden & waste rock | | 7,200,000 | |
| Tailings | 55 | 1,600,000 | |
| Asbestos containing materials | | 1,400 | 1000 |

| Cover | | 10-Foot | 2-Foot | |
|---|---|---|---|---|
| | | 6,200,000 | 1,240,000 | CY |
| | Blasting | 5,500,000 | 1,100,000 | CY |
| | Crushing | 500,000 | 100,000 | CY |

| | | |
|---|---|---|
| **Stormwater Detention Basin** | 750,000 | SF |

| Description | Quantity | Unit | Unit Cost | Total Cost | Notes |
|---|---|---|---|---|---|
| **CAPITAL COST** | | | | | |
| **Site Preparation** | | | | | |
| Mobilization / Demobilization | 1 | LS | $150,000 | $150,000 | Based on Basis of Estimate |
| Sanitary Facilities | 1 | LS | $2,500 | $2,500 | |
| Work Zone Setup and Haul Route Setup | 10 | ACRE | $500 | $5,000 | Based on previous project similar in nature |
| Site Clearing and Grubbing | 425 | ACRE | $7,193 | $3,057,170 | Based on previous project similar in nature |
| Utility Locate | 1 | DAY | $2,000 | $2,000 | Based on previous project similar in nature |
| Erosion Controls | 5,000 | LF | $4 | $20,000 | Based on previous project similar in nature |
| **Demolition of Building Foundations** | 1 | LS | $336,844 | $336,844 | Based on Basis of Estimate |
| **Excavation** | | | | | |
| Tailings | 1,600,000 | CY | $1.61 | $2,576,000 | Based on previous project similar in nature |
| Overburden/Waste Rock | 7,200,000 | CY | $1.61 | $11,592,000 | Based on Basis of Estimate |
| Contaminated Materials | 11,000 | CY | $3.22 | $35,420 | Based on Basis of Estimate |
| Asbestos and Concrete Wastes | 1 | LS | $501,470 | $501,470 | Based on Basis of Estimate |
| **Consolidation and Placement in the Open Pits** | | | | | |
| Pit access construction | 48,038 | CY | $2.83 | $135,948 | RSMeans |
| Material transport and placement | 9,898,600 | CY | $4.09 | $40,485,274 | RSMeans |
| Compaction | 9,898,600 | CY | $0.57 | $5,642,202 | RSMeans |
| Grading | 9,898,600 | CY | $2.26 | $22,370,836 | RSMeans |
| **2-Foot Cover Construction** | 1,240,000 | CY | $8.91 | $11,048,400 | Quantity assumed proportionally based on 10-foot cover |

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Alternative S-2: Consolidation, 2-Foot Cover, and ACM Offsite Disposal**
(Accuracy Range: +50% / -30%)

| | | | | | |
|---|---|---|---|---|---|
| **ACM and Construction Debris Offsite Disposal** | | | | | |
| Transportation | 3,000 | Mile | $8.36 | $25,080 | |
| Disposal | 1,400 | CY | $340.28 | $476,390 | |
| **Stormwater Detention Basin Construction** | 750,000 | SF | $6.00 | $4,500,000 | |
| **Survey During Design** | 10 | Day | $2,000 | $20,000 | Based on previous project similar in nature |
| **Survey During Construction (Including ICs Survey)** | 45 | Day | $2,000 | $90,000 | Based on previous project similar in nature |
| **Institutional Controls** | 1 | LS | $7,500 | $7,500 | |
| **Waste Sample Analysis for Offsite Disposal** | 5 | EACH | $500 | $2,500 | |
| **SUBTOTAL** | | | | **$103,082,533** | |
| **Design, Construction Oversight, & Technical Support** | | | | | |
| Design | 6% | | | $6,184,952 | Per EPA 2000 Document, Exhibit 5-8 ($500k - $2M), p. 5-13 |
| Project/Construction Management | 10% | | | $10,308,253 | Per EPA 2000 Document, pp. 5-10 & 5-11 |
| Contingency | 10% | | | $10,308,253 | Per EPA 2000 Document, p. 5-14. |
| **TOTAL - CAPITAL COST** | | | | **$129,883,992** | |

**Reference**
U.S. Environmental Protection Agency. July 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (EPA 2000).

**Notes:**
CY = Cubic yard
LF = Linear foot
LS = Lump sum
SF = Square foot
EPA = U.S. Environmental Protection Agency

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Alternative S-3: Consolidation, 10-Foot Cover, and ACM Onsite Disposal.**
(Accuracy Range: +50% / -30%)

**Quantities**

| | Area (Acre) | Volume (CY) | Weight (Ton) |
|---|---|---|---|
| Grading area | 425 | 9,900,000 | |
| Overburden & waste rock | | 7,200,000 | |
| Tailings | 55 | 1,600,000 | |
| Asbestos containing materials | | 1,400 | 1,000 |

| Cover | 10-Foot | |
|---|---|---|
| **10-foot cover** | 6,200,000 | CY |
| Blasting | 5,500,000 | CY |
| Crushing | 500,000 | CY |

| | | |
|---|---|---|
| **Stormwater Detention Basin** | 750,000 | SF |

| Description | Quantity | Unit | Unit Cost | Total Cost | Notes |
|---|---|---|---|---|---|
| **CAPITAL COST** | | | | | |
| **Site Preparation** | | | | | |
| Mobilization / Demobilization | 1 | LS | $150,000 | $150,000 | Based on Basis of Estimate |
| Sanitary Facilities | 1 | LS | $2,500 | $2,500 | |
| Work Zone Setup and Haul Route Setup | 10 | ACRE | $500 | $5,000 | Based on previous project similar in nature |
| Site Clearing and Grubbing | 425 | ACRE | $7,193 | $3,057,170 | Based on previous project similar in nature |
| Utility Locate | 1 | DAY | $2,000 | $2,000 | Based on previous project similar in nature |
| Erosion Controls | 5,000 | LF | $4.00 | $20,000 | Based on previous project similar in nature |
| **Demolition of Building Foundations** | 1 | LS | $336,844 | $336,844 | Based on Basis of Estimate |
| **Excavation** | | | | | |
| Tailings | 1,600,000 | CY | $1.61 | $2,576,000 | Based on previous project similar in nature |
| Overburden/Waste Rock | 7,200,000 | CY | $1.61 | $11,592,000 | Based on Basis of Estimate |
| Contaminated Materials | 11,000 | CY | $3.22 | $35,420 | Based on Basis of Estimate |
| Asbestos and Concrete Wastes | 1 | LS | $501,470 | $501,470 | Based on Basis of Estimate |
| **Consolidation and Placement in the Open Pits** | | | | | |
| Pit access construction | 48,038 | CY | $2.83 | $135,948 | RSMeans |
| Material transport and placement including | | | | | |
| ACMs onsite | 9,900,000 | CY | $4.09 | $40,491,000 | RSMeans |
| Compaction | 9,900,000 | CY | $0.57 | $5,643,000 | RSMeans |
| Grading | 9,900,000 | CY | $2.26 | $22,374,000 | RSMeans |

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Alternative S-3: Consolidation, 10-Foot Cover, and ACM Onsite Disposal.**
(Accuracy Range: +50% / -30%)

| | | | | |
|---|---|---|---|---|
| **10-Foot Cover Construction** | 6,200,000 CY | $8.91 | $55,242,000 | Quantity assumed proportionally based on 10-foot cover |
| **Stormwater Detention Basin Construction** | 750,000 SF | $6.00 | $4,500,000 | |
| **Survey During Design** | 10 Day | $2,000 | $20,000 | Based on previous project similar in nature |
| **Survey During Construction** | 40 Day | $2,000 | $80,000 | Based on previous project similar in nature |
| **SUBTOTAL** | | | **$146,764,351** | |
| **Design, Construction Oversight, & Technical Support** | | | | |
| Design | 6% | | $8,805,861 | Per EPA 2000 Document, Exhibit 5-8 ($500k - $2M), p. 5-13 |
| Project/Construction Management | 10% | | $14,676,435 | Per EPA 2000 Document, pp. 5-10 & 5-11 |
| Contingency | 10% | | $14,676,435 | Per EPA 2000 Document, p. 5-14. |
| **TOTAL - CAPITAL COST** | | | **$184,923,082** | |

**Reference**

U.S. Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (EPA 2000).

**Notes:**
CY = Cubic yard
LF = Linear foot
LS = Lump sum
SF = Square foot
EPA = U.S. Environmental Protection Agency

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Alternative S-4: Consolidation, 10-Foot Cover, and ACM Offsite Disposal.**
(Accuracy Range: +50% / -30%)

**Quantities**

| | Area (Acre) | Volume (CY) | Weight (Ton) |
|---|---|---|---|
| Grading area | 425 | 9,900,000 | |
| Overburden & waste rock | | 7,200,000 | |
| Tailings | 55 | 1,600,000 | |
| Asbestos containing materials | | 1,400 | 1,000 |

| Cover | | 10-Foot | |
|---|---|---|---|
| **10-foot cover** | | 6,200,000 | CY |
| | Blasting | 5,500,000 | CY |
| | Crushing | 500,000 | CY |

| | | |
|---|---|---|
| **Stormwater Detention Basin** | 750,000 | SF |

| Description | Quantity | Unit | Unit Cost | Total Cost | Notes |
|---|---|---|---|---|---|
| **CAPITAL COST** | | | | | |
| **Site Preparation** | | | | | |
| Mobilization / Demobilization | 1 | LS | $150,000 | $150,000 | Based on Basis of Estimate |
| Sanitary Facilities | 1 | LS | $2,500 | $2,500 | |
| Work Zone Setup and Haul Route Setup | 10 | ACRE | $500 | $5,000 | Based on previous project similar in nature |
| Site Clearing and Grubbing | 425 | ACRE | $7,193 | $3,057,170 | Based on previous project similar in nature |
| Utility Locate | 1 | DAY | $2,000 | $2,000 | Based on previous project similar in nature |
| Erosion Controls | 5,000 | LF | $4 | $20,000 | Based on previous project similar in nature |
| **Demolition of Building Foundations** | 1 | LS | $336,844 | $336,844 | Based on Basis of Estimate |
| **Excavation** | | | | | |
| Tailings | 1,600,000 | CY | $1.61 | $2,576,000 | Based on previous project similar in nature |
| Overburden/Waste Rock | 7,200,000 | CY | $1.61 | $11,592,000 | Based on Basis of Estimate |
| Contaminated Materials | 11,000 | CY | $3.22 | $35,420 | Based on Basis of Estimate |
| Asbestos and Concrete Wastes | 1 | LS | $501,470 | $501,470 | Based on previous project similar in nature |
| **Consolidation and Placement in the Open Pits** | | | | | |
| Pit access construction | 48,038 | CY | $2.83 | $135,948 | RSMeans |
| Material transport and placement | 9,900,000 | CY | $4.09 | $40,491,000 | RSMeans |
| Compaction | 9,900,000 | CY | $0.57 | $5,643,000 | RSMeans |
| Grading | 9,900,000 | CY | $2.26 | $22,374,000 | RSMeans |

**Appendix A. Cost Estimate for Remedial Alternatives**
**- Alternative S-4: Consolidation, 10-Foot Cover, and ACM Offsite Disposal.**
(Accuracy Range: +50% / -30%)

| | | | | |
|---|---|---|---|---|
| **10-Foot Cover Construction** | 6,200,000 CY | $8.91 | $55,242,000 | Quantity assumed proportionally based on 10-foot cover |
| **ACM and Construction Debris Offsite Disposal** | | | | |
| Transportation | 3,000 Mile | $8.36 | $25,080 | |
| Disposal | 1,400 CY | $340.28 | $476,390 | |
| **Stormwater Detention Basin Construction** | 750,000 SF | $6.00 | $4,500,000 | |
| **Survey During Design** | 10 Day | $2,000 | $20,000 | Based on previous project similar in nature |
| **Survey During Construction** | 40 Day | $2,000 | $80,000 | Based on previous project similar in nature |
| **Waste Sample Analysis for Offsite Disposal** | 5 EACH | $500 | $2,500 | |
| **SUBTOTAL** | | | **$147,268,321** | |
| **Design, Construction Oversight, & Technical Support** | | | | |
| Design | 6% | | $8,836,099 | Per EPA 2000 Document, Exhibit 5-8 ($500k - $2M), p. 5-13 |
| Project/Construction Management | 10% | | $14,726,832 | Per EPA 2000 Document, pp. 5-10 & 5-11 |
| Contingency | 10% | | $14,726,832 | Per EPA 2000 Document, p. 5-14. |
| **TOTAL - CAPITAL COST** | | | **$185,558,085** | |

**Reference**
U.S. Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (EPA 2000).

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LF = Linear foot
LS = Lump sum
SF = Square foot
EPA = U.S. Environmental Protection Agency