Phase I Environmental Site Assessment (ESA)

Three Kids Mine and Mill Site
Clark County, Nevada

December 28, 2007

Commissioned by:

Lakemoor Development, LLC
Las Vegas, Nevada

Prepared by:

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Section 1
Overview

1.1 Executive Summary

The subject property of this study is the former Three Kids Mine and Mill (TKM) Site east of the City of Henderson, in Clark County, Nevada. The subject is comprised of 18 private and public parcels totaling approximately 1,270 acres. From 1917 to 1961, the site was utilized for the mining and beneficiation of manganese. Subsequent to closure of the mine, land disposal of solid wastes and trespassing activities resulted in additional impacts to the site. As a result of this range of historical activities, chemical and physical hazards are known to exist on the Site.

This study was designed to satisfy the Phase I Environmental Site Assessment (ESA) standard established by the American Society for Testing and Materials (ASTM) and the All Appropriate Inquiries (AAI) standard of the U.S. Environmental Protection Agency (EPA). Environmental liabilities identified during the AAI Phase I are reported as recognized environmental conditions (RECs).

This Phase I ESA utilized three principal research methods, namely, the review of reasonably ascertainable public records, interviews with knowledgeable parties, and a physical site inspection. This study did not include environmental sampling, but did report on sampling performed previously by others. As a result of these inquiries, Zenitech identified RECs pursuant to the AAI standard. Additional non-AAI findings are also discussed in this report. Supporting figures, tables, records, and photographs are provided in the appendices to this report.

Recognized chemical hazards at this time include:

1. Fine mineral dusts, mill site residues, and mineral processing wastes containing lead, arsenic, manganese, and petroleum in concentrations above guidance levels;

2. Solid, hazardous, and special waste such as friable asbestos, automotive batteries, abandoned boats and vehicles; vehicle fuels, lubricants, and coolants; appliances, tires, construction debris, and trash;

3. Potential subsurface impacts due to two operating septic tanks, a formerly unsecured well head, presence of three underground storage tanks, and deposition of unknown materials into mine pits;

4. Potential dioxin levels due to wire burning activities; and

5. Potential polychlorinated biphenyl and other polyaromatic hydrocarbon levels due to prior transformer substations and a mill fire.

Physical safety and security issues include:

1. Unsecured open pit mines and mill structures with precipitous drops, hidden cavities, and unstable walls and surfaces which do not comply with Nevada regulations; and

2. Trespassing from off-highway vehicle users, rock collectors, hikers, vandals, and unwarranted disposers contributing to hazardous dust generation, power pole vandalism, wire burning, dumping, and other public safety issues.

Zenitech is aware of a pending proposal by Lakemoor Development to assemble federal and private mine-related lands. As part of the necessary federal land conveyances, compliance with the National Environmental Policy Act (NEPA), the National Historic Preservation Act, and the Endangered Species Act may be required. This report provides recommendations for further studies and action, based on this long-term goal and the findings of records reviews, interviews, and site reconnaissance.

1.2 Authorization

Zenitech Environmental, LLC performed this scope of services under contract with Unger Development, LLC (predecessor in interest of Lakemoor Development, LLC), dated October 21, 2006. Authorization to conduct site inspections on private property was provided by Mr. Robert Unger as authorized agent of Three Kids Enterprises, LLP (TKE). Authorization to inspect and sample Bureau of Reclamation withdrawn lands was granted in an Entry Permit signed November 30, 2006 by the Director of the Lower Colorado Resource Management Office. Bureau of Land Management lands were accessed under the terms of "casual use."

1.3 Purpose and Customs

Most commonly, a Phase I ESA is performed on a parcel of commercial real estate with the intent of identifying contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, i.e. Superfund) as well as petroleum products. The Phase I ESA is intended to permit a potential CERCLA-liable owner/operator/trustee to satisfy one of the requirements necessary to qualify for the innocent landowner defense

to CERCLA liability, specifically: "all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice" as defined in 42 USC § 9601(35)(B). This inquiry is commonly referred to as “environmental due diligence.”

ASTM Standard Practice. The current industry standard for environmental assessments is the *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM standard E1527-05, i.e. “the standard”) [1]. The standard is not a regulation, but rather a guidance describing the minimum level of inquiry necessary to qualify as “consistent with good commercial or customary practice.”

The Phase I identifies recognized environmental conditions. RECs include suspect hazardous substances or petroleum products released into the environment, whether or not their presence on the site is a result of lawful activity.

RECs are not intended to include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Some examples include: minor petroleum stains in the soil, lead paint in good condition on structures not accessible to children, or trace residues of pesticides resulting from the proper usage of same.

This Phase I ESA is structured similarly to the ASTM standard, but it is also designed to comply with EPA's recent "All Appropriate Inquiry" (AAI) standard pursuant to 40 CFR § 312 [2], effective November 1, 2006. This Phase I ESA has been prepared by Zenitech to meet or exceed the ASTM standard and the AAI standard.

All Appropriate Inquiry Standard. All Appropriate Inquiry (AAI) refers to the requirements for assessing the environmental conditions of a property prior to its acquisition. The AAI regulations found in 40 CFR § 312 are similar to the ASTM E1527-05 standard, however, the AAI rules create a more enforceable environment for demonstrating the legal concept of “innocent landowner” and also allow for limits of liability under CERCLA for bona fide prospective purchasers and contiguous property owners. Other areas of difference include: the definition of environmental professional, certain interviewing requirements, and the documentation of data gaps that may affect an environmental professional's ability to render an opinion on the conditions of a property.

Pursuant to ASTM and AAI standards, this study has been performed under the oversight of a qualified environmental professional who possesses necessary expertise in the evaluation of sites such as the subject property. In the State of Nevada, a Nevada Certified Environmental Manager (CEM) in good standing (NAC § 459) is required to oversee the work. Resumes of key project staff have

been previously provided to Lakemoor Development.

1.4 Limitations

Zenitech planned and conducted this assessment for the purpose of identifying RECs and recommending further actions. Zenitech relied on publicly available databases, statements of others, reports previously prepared by others, and visual inspection of the subject property in support of these conclusions and recommendations.

The assessment team has exercised due and customary care in the performance of this Phase I ESA. Zenitech assumes no liability for any loss resulting from errors or omissions arising from the use of inaccurate/incomplete information or misrepresentations made by others.

Site inspections were performed on July 11, December 1, December 21, 2006 and January 9 and 18, 2007. Environmental Data Resources' records search was dated October 31, 2006. This Phase I ESA references conditions as of these dates; reliant parties shall recognize that conditions may change over time due to changes in site activities and migration or biotransformation of contaminants, if any. Third parties who rely on this report shall do so at their own risk. This report is not licensed for open distribution on the internet or through other publishing means.

1.5 Assessment Team and Jurat

The ESA research and findings described in this document were prepared by the following team:

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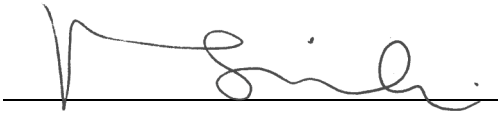
Environmental Data Resources, Subcontractor

I hereby certify that I am responsible for the services described in this document and for the preparation of the 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, regulations and ordinances.



Signature

December 28, 2007
Date of Report

Matthew R. A. Stinchfield, CEM No. 1533
Nevada Certified Environmental Manager

June 26, 2009
Expiration Date

Section 2
Background

2.1 Physical Location

The subject property is located approximately five miles northeast of central Henderson, Nevada along East Lake Mead Parkway (State Road 564). The property occupies most of section 35 and parts of sections 26, 34, and 36 of Township 21S, Range 63E, Mount Diablo Meridian. The approximate center of the site is at 36°05'00"N latitude and 114°54'50"W longitude. Access to most of the site is gained via a locked gate and unpaved road in the northeast corner of the subject property. A small portion of the property is located north of Lake Mead Drive and can be accessed by foot. A general location map is provided in Appendix A.1, Figure 1.

2.2 Legal Description

The subject property discussed in this Phase I ESA is a group of 18 parcels owned variously by two federal bureaus and four private entities. All of the parcels are related to the historic operation of the Three Kids Mine and Mill Site and each has sustained environmental impact. Table 1 in Appendix A.2 lists each parcel with location, ownership, and acreage information. An outline of the subject property showing parcel numbers is provided in Figure 2 and a figure showing historical ownership and claim information is provided in Figure 3, Appendix A.1.

2.3 Site Description

The subject property is the site of the former Three Kids manganese mine and mill. There are four noticeable open pits on the property: the Three Kids Pit, the combined A and B Pits, the Hydro Pit, and the Hulin Pit. In the process of mining the ore, volumes of gypsiferous overburden were stripped from the pits and left in waste rock piles near the pits or utilized to construct dams. Tailings, resulting from the beneficiation of the manganese ore, were pumped into ponds constructed in the central and western portions of the site. The mill site was located in the northeast corner of the property. The pits, waste rock, mill site, and tailings comprise the bulk of large features visible at the present time. Figures 4A through 4D in Appendix A.1 show the development of these features at the end of each of the three boom periods of the mine, and at the present time. These figures are referenced in detail in Sections 2.5.3 through 2.5.5. Table 2, below,

summarizes the various mineral claims and their relationship to the principal features.

Table 2
Principal Mine and Mill Site Features

CLAIMS (patented and otherwise)	PRINCIPAL ACTIVITY AREA	APPROXIMATE MINE ACTIVITY
Three Kids, Three Kids Fraction	Three Kids Pit	1917-1918
Annex, Annex #1, Cuna	B Pit	1918-1944
Lowney, Lowney Extension, Estrella, Triangle Fraction	A Pit	1942-1955
Hydro, Hydro #1	Hydro Pit	1956-1961
Las Vegas Extension #1	Hulin Pit	1959-1961
Hydro #3-6, Extension, Extension #1, Extension #2, Triangle Fraction Millsite, Three Kids Millsite Lode Claim, Lowney Millsite, Hydro #13 Millsite	Mill Site	1942-1961
Hydro #13, Las Vegas, Las Vegas Fraction, Las Vegas Extension #2.	Waste Rock, Cutoff Dams and Overburden	1917-1961
Hydro #2, Hydro #7-12, Hydro #14-17	Tailings	1942-1961

The mill hardware was sold in the early 1960's after the 1961 closure, and the mill buildings have since been removed or demolished. Building foundations are still present in part or whole at the site as well as the foundations of eight circular flotation tanks. Tailings dams, tailings, and mixed tailings/overburden are all present on site. The mine pits have not been adequately secured since the early 1960's; all are impacted with solid waste. The three large pits (combined A and B Pits, Hydro Pit, and Hulin Pit) represent approximately 12 million cubic yards of vacant volume.

2.4 Natural Setting

2.4.1 Biome

Climate. The subject property is located in southern Nevada within the Mohave Desert Biome. Regional climate is arid with coldest month temperatures averaging above 32 ºF [3], leading to a Köppen classification of BWh. Average summer temperatures range from 54 to 104 ºF though highs of greater than 115 degrees are not uncommon. Average winter temperatures range from 34 to 57 ºF [4].

Site elevation ranges from 1550 to 2250 feet above mean sea level (msl) with large portions near 1800 feet in elevation [5]. Annual rainfall averages 4.5 inches per year with an annual evaporation rate of greater than 70 inches per year [3]. The location is generally windy, with an annual average wind speed of 9 mph. Wind direction varies seasonally: winter winds tend to blow from the northeast, while summer winds arise from the south and west [6, 7].

Flora and Fauna. Native flora of the Mohave include sparsely populated creosote bush, tumbleweed, occasional grasses, perennial wildflowers, and cacti. Observed plant species on the subject property include creosote bush (*Larrea tridentata*), tumbleweed (*Salsola sp.*), trumpet plant (*Eriogonum inflatum*), prickly pear cactus (*Opuntia sp.*), and silverleaf sunray (*Enceliopsis argophylla*).

Vegetative distress is observable in much of the mill site, particularly around former flotation cells and in the tailings. Tailings sediments do not support visible plant life. Grasses have contributed to soil stabilization in the area of the former ore storage yard where ice cream wastes were land applied in the 1990's. Specific observations are discussed in Section 5.2.3.

Reptilian fauna of the Mohave include collared lizards, horned lizards, desert tortoises, and both venomous and non-venomous snakes. Common lizards have been observed on the subject property, but have not been classified. The desert tortoise is discussed below. Amphibians are generally rare in this setting.

The range of bird species in the Mohave is broad and in some areas may include over 100 species [8]. A small number of bird species, including a species of desert sparrow (*Amphispiza sp.*), have been observed on the site, but have not been classified.

Mammals include small ground squirrels, coyote, kitfox, bats, desert cottontail, and jackrabbit. Many of the fauna are nocturnal; field observations to date at the subject property have noted the presence or signs of the white-tailed antelope squirrel (*Ammospermophilus leucurus*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), feral burro (*Equus asinus*), mule deer (*Odocoileus hemionus*), and coyote (*Canis latrans*). Game trails of larger mammals suggest that animals cross the subject property in a north-south fashion, potentially to gain access to forage and water at Lake Las Vegas.

Rare, Threatened, or Endangered Species. The site is located within an area potentially considered as habitat for the desert tortoise (*Gopherus agassizii*) [9] and desert bighorn sheep (*Ovis canadensis*) [10]. The desert tortoise is listed as a Threatened Species pursuant to the Endangered Species Act of 1973, as amended (16 USC § 1531 et seq.). Desert bighorn sheep are listed by the Bureau of Land Management (BLM) as Special Status Species in Nevada and are protected by the State of Nevada by statute NRS § 501 [11].

The River Mountains Area of Critical Environmental Concern (ACEC) is a 5,617 acre region of protected desert bighorn sheep habitat and scenic viewshed for

the communities of Henderson and Boulder City [12, 13]. ACEC designations apply only to BLM-administered public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources; or other natural systems or processes; or to protect life and safety from natural hazards. Approximately 15.4 acres of parcel 12 have been designated by BLM as ACEC. This area corresponds to the original Three Kids excavation, which at this writing has been observed to possess physical safety hazards, mine waste products, and accumulations of solid waste. The remaining federal lands in the project area are not designated as ACEC.

The silverleaf sunray has been observed on the subject property. This species is listed by the BLM as a Special Status Species in Nevada. The plant is further considered sensitive and rare by the Nevada Natural Heritage Program [14], however, it is not specifically protected by current laws or regulations. The silverleaf sunray is considered an indicator species for the Las Vegas bear poppy (*Arctomecon californica*); both plants tolerate arid, gypsiferous soils. The bear poppy is listed as a "species of concern" under the Endangered Species Act and listed as "critically endangered" by the state of Nevada. The bear poppy has not been observed on the subject property by Zenitech or by Bureau of Reclamation (BOR) biologists who have accompanied Zenitech on several occasions, nor have there been any reasonably ascertainable recorded observations of the species on or near the subject property. Most bear poppy populations have been found north of the Las Vegas Wash in the Frenchman Mountains [13, 15].

Southern Nevada is home to the Clark County Multiple Species Habitat Conservation Plan (CCMSHCP). The CCMSHCP covers 79 species, both plants and animals, of which four are endangered (the southwestern willow flycatcher and three desert fish) and one is threatened (desert tortoise). The remaining identified species are treated as though they are listed under the Endangered Species Act [15]. In consideration of the federal action, in this case the transfer of public lands for remediation and reclamation, the CCMSHCP should be consulted. In general, any plant listed in the Conservation Plan is considered sensitive and worthy of conservation efforts, regardless of federal status under the Endangered Species Act.

Based on the type of habitat available and nearby known populations, Zenitech has concluded that it is reasonable to expect occurrences of the desert tortoise (*Gopherus agassizii*) and desert bighorn sheep (*Ovis canadensis*) on the subject property. A biological assessment consistent with either Sections 7 or 10 of the Endangered Species Act does not appear to have been conducted at the subject property.

2.4.2 Geology/Geomorphology

Study of the geology in the Three Kids Mine area began in 1920 and has continued to the present. Much of the geology is well understood although aspects, such as ore body genesis and fault location and history, are still

debated. The description that follows relies on previous work, mainly of Hunt et al. in 1942 [16] supplemented with field observations and map data from Bell and Smith, 1980 [5]. A geologic map modified from Bell and Smith, as well as a geologic cross section are provided in Appendix A.1 as Figures 5 and 6. Conclusions and recommendations related to the geologic setting are presented in Section 6.1.1.

Surface Geomorphology and Topography. The subject property 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. Prior to mining activities, the properties sat on a gently northwest sloping, thin, alluvial plain deposit within the basin with gullies [17]. The alluvial plain sat on units of the sedimentary Muddy Creek formation.

Mining activities in the 1940's and 50's 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 within the subject property range from 1550 feet msl in the bottom of the A pit to 2515 feet msl at a nearby peak in the River Mountains. Most of the surface area of the mill site, although modified by mill activities, is currently close to the pre-mining elevations of approximately 1800 to 1870 feet msl [5, 16]. A topographic map from 1983 is provided in Appendix A.1, Figure 7.

Geology. Eleven to twelve million years ago in the mid-Tertiary, the River Mountains were formed as part of a strato-volcano complex six miles southeast of the site. At the location of the subject property, these mountains are composed of lava flows. Bell and Smith mapped three different units in the locality with the major unit being volcanic lava flows of mainly dacite composition interbedded with epiclastic (local source) sandstones, conglomerates and breccias, and pyroclastic units [5]. The dacite is biotite, plagioclase, and hornblende bearing, and of variable texture. Upper and lower parts of many individual flows are brecciated. Individual flows vary in texture and minor mineral composition. Many flows are vesiculated and some exhibit interbedded breccia, tuff, or agglomerate.

Subsequent to placement of the River Mountains, compression caused folding resulting in a set of east/west axial anticlines with a syncline adjoining them at the subject property location. Later extensional processes induced faulting, causing the syncline block to drop and form a basin, or graben. Most of the faults in the area trend northeast or northwest and are typically normal [5, 17, 18]. Fault displacement is highly variable and ranges from a few feet to many tens of feet. The most notable of the faults is the northwest trending 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. The units of the River Mountains unconformably contact the younger late-Tertiary rocks of the Muddy Creek formation that make up the subsurface of the basin at

the subject property.

The Muddy Creek formation is a late Miocene/early Pliocene sedimentary deposit, approximately 6 million years old [5, 19], that flanks the northern parts of the River Mountains. According to most authors, the Muddy Creek formation was "lapped into" or deposited into basins around the River Mountains, including the basin at the subject property, as subaerial (near shore) lake and evaporitic deposits [17, 20, 21]. Units in the Three Kids location are gypsiferous red siltstones, sandstones, mudstones, tuffs, and beds of massive gypsum [16]. Gypsum beds contain thin interbeds of clay and silt giving some gypsum a "rose" or "rusty" appearance. Overall thickness of the Muddy Creek at the subject property is estimated at greater than 1000 feet [16], except where it thins to meet the River Mountains volcanics. Faulting continued post Muddy Creek deposition and is evidenced onsite as well as noted in literature [20]. These units were overburden to deeper manganese rich units. During mining, large portions of the Muddy Creek formation were removed and incorporated onsite to construct dams and control erosion, or deposited as waste rock on the surface. Most of this construction occurred on the west side of the mining properties where large boulders of Muddy Creek gypsum are observable.

The manganiferous ore body mined at Three Kids existed as a stratigraphic unit on the south side of the basin near the contact between the Muddy Creek Formation and River Mountains units. Previous studies have focused on the location and thickness of this unit, however its origins are not completely understood. Most studies speculate that the unit is part of the Muddy Creek formation and is a product of alteration or hydrothermal replacement [20]. The unit is generally described by most authors as a manganiferous or "wad" rich, tuffaceous, silty sandstone of 10-80 feet in thickness [16-18, 20]. Chemically, wad of the Las Vegas District is hydrated manganese oxide, which has partially replaced silica. Evidence onsite of hydrothermal activity around faults and manganiferous seep deposits along the exposed Lowney fault wall support a transport and replacement theory.

Manganese ore bodies have been described elsewhere in Nevada, particularly in the Yucca Mountain area [22, 23], Ely and Pioche [24], Gabbs [25] and elsewhere in the River Mountains [26, 27]. Although all Nevada ores tend to be oxidized, ores from Pioche and Gabbs may have had greater carbonate content and less silica, making them more suitable for different extraction methodologies than those used at Three Kids.

Bell and Smith describe the ore unit at TKM as tuffaceous or pyroclastic in origin and mapped it as "Tsm," manganiferous sedimentary rocks of the Three Kids Mine [5]. They believe that the ore body was a separate unit from the Muddy Creek formation, either associated with the River Mountains or independent. They speculate that the unit was emplaced between the times of the River Mountains and Muddy Creek and is partially still present on site. This is inconsistent with previous authors who describe the ore body as part of the Muddy Creek formation. Most of the original ore body was mined out in the

1950's making detailed modern study difficult.

The youngest geologic units on the site are Quaternary surface deposits. These deposits unconformably overlie the top of the Muddy Creek Formation. Bell and Smith mapped the entire area of mining activity as "Qaf" in 1980, a deposit of Quaternary artificial fill composed of tailings at Three Kids Mine [5]. This artificial fill ranges from less than an inch to many tens of feet in thickness, and is composed of tailings, overburden/waste rock, product, and ore. The unit overlies the original natural Quaternary alluvial deposits derived from River Mountain volcanic material. The natural alluvium layer is variable in thickness, generally on the order of 20 feet. The layer is composed of silty, sandy, pebble to cobble sized clasts. Clasts are typically dacite, basalt, or tuff and the deposit is locally gypsiferous.

Soils. Soils in less disturbed areas of the subject property are typical of arid regions with poorly developed or absent O and A horizons. Site soils tend to be gypsiferous. These soils are not optimal for roadways and foundations due to fast weathering, high solubility, and reactivity with concrete. A limited study of soils was performed by GES, Inc. in 1998 to assess the potential for creating a gravel operation. Results indicated poor quality materials with high calcium sulfate content [28].

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 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 become damp to paste-like below a depth of approximately five feet below ground surface (bgs).

2.4.3 Groundwater Hydrology

There are two wells located one the subject property. No other wells were found within one mile of the site. The older of the two wells is on property currently owned by Three Kids, Inc. (parcel 7). This well is a 10-inch test well drilled in January of 1991 on the northeast corner of the parcel. Well construction is reported to be 1100 feet of uncased boring through rock, with a surface completion consisting of a 20 foot steel casing. Well logs indicate the shallowest water bearing strata as a cemented conglomerate at 720 feet bgs. Surface elevation at the well location is approximately 1820 feet msl, placing the water-bearing zone at 1100 feet msl. Well test flow rates were reported to be in the range of 50-75 gallons per minute. Water quality results from 1991 were not found among reasonably ascertainable records. Sometime after 1991 the well ceased to be sampleable.

After rehabilitation, this well was sampled and analyzed in October of 1999 by Ninyo & Moore [29]. Depth to groundwater was reported to be 562 feet bgs. Either a confined aquifer or fractured, low yield structure is believed to be responsible for the increase in water elevation. Fracture flow is the preferred

explanation in this hydrogeologic setting.

Ninyo & Moore reported that approximately 2,000 gallons of water were purged in a three-hour period, at an average rate of approximately 11 gallons per minute. Analysis results indicate the water is brine with 2,880 mg/l total dissolved solids and a sulfate concentration of 1,200 mg/l. The sample was measured at 92-94ºF and contained arsenic at a concentration of 0.064 milligrams per liter (mg/l). The sample exceeded the recently revised maximum contaminant level (MCL) for arsenic of 0.010 mg/l.[1] Arsenic is a known human mutagen / probable human carcinogen which has been associated with systemic effects to the dermis, circulatory system, and digestive system.

Toluene was also reported in the 1999 sample analysis at a concentration of 26 micrograms per liter (µg/l), which is below the MCL of 1,000 µg/l. It was suspected at that time that this detection was a result of the pipe dope used in the well sampling effort. Ninyo & Moore conducted a test of the pipe dope and found that it did contain toluene [30].

Aluminum concentration in the test well was reported at 0.076 mg/l, which is above the recommended secondary drinking water standard of 0.050 mg/l. Excess aluminum can cause discoloration and scaling in water. The sample also exceeded the secondary drinking water standard for total dissolved solids of 500 mg/l. A high level of dissolved solids causes precipitation of salts when used for dust control and causes scaling on surfaces and appliances. The warm temperature and high mineralization of the sample is indicative of water influenced by geothermal conditions [29]. Based on these findings, this water could not be considered a viable drinking water source without treatment for arsenic and dissolved solids.

The newer well on the subject property is located at the Laker Plaza property at 2310 Lake Mead Drive (parcel 4). The well log for this well indicates a total depth of 600 feet bgs with the first water bearing strata of cemented gravel (conglomerate) at 480 feet bgs. Static water level measured after well placement in February of 2001 was 160 feet bgs, behaving similarly to the test well discussed above. Ground elevation at the well location is approximately 1810 feet msl. A review of raw water quality from the Nevada Division of Environmental Protection (NDEP) Bureau of Safe Drinking Water database was conducted for the Laker Plaza well. According to state records, the well was first permitted in 2001. The pre-treated water is considered "very hard," with an average total dissolved solids content of 2800 ± 1100 mg/l (n=6, one outlier discarded), for the years 2001 through 2006. The pH was reported at 7.37 ± 0.22 pH units (n=4) for the same period. Arsenic and lead values were not reported.

When taken together, data from both wells suggest that the depth to ground water at the subject property is in the range of 500-700 feet bgs. It should be noted that previous investigators and Zenitech have observed that water does

[1] Revised January 23, 2006.

not accumulate in the pits, suggesting that the true static groundwater elevation is lower than 1,530 feet msl, or at least 280 feet bgs at the Laker Plaza well [31].

Additional evidence of fracture flow of groundwater can be seen at the exposed scarp of the Lowney fault where mineral seep deposits occur along fractures in the footwall. Further, hydrothermal alteration is apparent along many of the faults and is likely related to ore body formation. This complex faulting combined with a lack of well data prohibit determining groundwater flow direction at the site. Conclusions and recommendations related to the groundwater setting are presented in Section 6.1.1.

2.4.4 Surface Water Hydrology

Prior to mining activities, the subject property was an alluvial plain with drainages that exited the River Mountains on the south side of the mine property and drained through the site mainly west and northwest where they joined with a larger drainage system flowing north approximately one mile to the Las Vegas wash. This larger drainage is sometimes referred to as Three Kids Wash.

A smaller drainage on the east side of site flowed north-northeast through a pass in the mountains along what is now Lake Mead Drive. This drainage also emptied into the Las Vegas wash approximately 1.5 miles north of the site. Both washes are observed to be wet in 1950 and 1955 aerial images and likely received wastewater discharge during the mill years.

Mining activities from 1917 through the 1950's changed the topography through the emplacement of dams to hold tailings and stop drainages from emptying into pit operations. These dams and impoundment areas are still present today and act to detain surface water. Breaks in dams on the west side of the site as well as tailings in washes at the bases of the dams suggest that some surface water still exits the site on the west side into the larger drainage system. The drainage system on the east side of the site was channelized during the 1940’s and is still largely intact, draining surface water from the east flanking River Mountains units. Conclusions and recommendations related to the site's surface water hydrology are presented in Section 6.1.1.

2.5 Site History

2.5.1 Prehistoric Period

Pre-Ceramic Cultures. Archaeological evidence from the Las Vegas Valley and certain excavated caves in the Frenchman mountains supports early human habitation and/or hunting in the region dating back to 10,000 BC – AD 300 [32]. During this time, the Las Vegas Valley was more lush and supported megafauna such as mammoths, horses, giant sloths, and bison. Limited evidence of thrusting spear points has been found, which are likely associated with the paleo-archaic inhabitants of the region [32]. The pre-ceramic peoples were hunter/gatherers, who in later years, becoming more skilled and specialized,

produced basketry, throwing spears/darts, and grinding tools.

Ceramic Cultures. Beginning around AD 300 and lasting into the beginning of the 19th century, the introduction of bow hunting and pottery marks the ceramic period. Excavated sites in the Las Vegas Valley have frequently shown pottery remains of several groups: Anasazi, Patayan (or Mohave), and Southern Paiute. Of the Southern Paiute, both the Las Vegas band and the Chemehuevi band were present until the latter migrated into Mohave territory at the end of the 18th century. Farming is thought to have become more significant during this time, indicated by the reduced portability of pottery vessels.

The earliest pottery is associated with the Virgin River Anasazi who were a puebloid people in the Virgin and Muddy River area approximately 40 miles northeast of the subject property. Anasazi pottery shards have been found in the Las Vegas Valley, as well [32]. The Anasazi appear to have vacated or disappeared shortly after AD 1150. According to Maxon, this timeframe coincided with the migration of Shoshoneans into the region; these emigrants are thought to be the ancestors of the Southern Paiute [33]. Another theory suggests that the Pauite are descendants of archaic peoples and proponents cite both their hunter/gatherer way of life and Uto Aztecan linguistic family.

Evidence summarized by HRA, Inc. indicates that Patayan and Paiute peoples most certainly lived on an historic bajada between the Frenchman and River Mountains: areas now occupied by the Clark County Wetlands Park and Lake Las Vegas. This planar area provided ready access to water, forage, and game. Of relevance to the subject property is whether these early inhabitants of the streamside also lived, hunted, or traveled higher up into the River Mountains where the mine and mill site are located. The Southern Paiute and Mohave peoples to the south appear to have been trading partners, as evidenced by findings in the Las Vegas Valley [32] and the Willow Beach area [33]. Paiute hunters roamed into area mountains to hunt larger game (desert bighorn and deer) in the autumn [34].

Due to the close proximity of the Las Vegas Wash, montane hunting resources, and trading routes, regions of the subject property that have not been altered due to mining/milling activities may potentially contain archaeological resources from this period. Anecdotal reports from a BOR employee indicate that evidence of a ceramic culture cache was found in the River Mountains. No reasonably ascertainable studies of River Mountains cultural resources have been found by Zenitech as of this printing.

2.5.2 Early Nevada History, ca. 1820 - 1917

Beginning in the early 1800's, Southern Paiute people were encountered by explorers and Anglo hunters. The first recorded contact was with Utah trappers ca. 1820 [33]. In 1829, Spanish explorer Rafael Rivera came across the lush drainages of present day Las Vegas and reportedly gave the city its name (Spanish for "the meadows") [35]. By 1840, white settlers began passing through

Southern Nevada [36]. In 1848 the Treaty of Guadalupe Hidalgo was signed between the U.S. and Mexico. As a result, most of present day Nevada was wrested from Mexico.

In 1855 Mormon leader Brigham Young sent 30 missionaries to Las Vegas, although their fort was abandoned by 1887. It is reported that the Mormons attempted to teach the Southern Paiute farming techniques, though these methods were largely rejected [35]. During this episode, Nevada gained statehood in 1864 and within nine years the Moapa Paiute reservation was first established [34]. Most accounts state that the white settlement of the Las Vegas Valley began about 1890, a timeframe associated with the beginning of the decline of the Southern Paiute. The railroad arrived in Las Vegas by 1905, the same year the city was founded. By 1911 Las Vegas was reported to have 800 residents.

2.5.3 Early Mine History, ca. 1917 - 1936

The Three Kids Mine is widely reported to have been the discovery of three local men in 1917. Their names were B.R. Jefferson,[2] R.N. Edwards, and J.F. Marrs. By November of that year, the so-called Three Kids had sold or leased their interest to a group of three different men: Gillice, Connors, and McCoy [26, 37-39]. These individuals were organized under the name of the Manganese Association. Another group with the similar name of the Lowney Manganese Association held claims adjacent to the Manganese Association claims [39, 40].[3]

The discovery of manganese by the Three Kids led to the designation of the region as the Manganese District. This mining district was later renamed the Las Vegas District, after the gypsum claims of the Frenchman Mountains were added [41, 42]. The original body of ore comprising the Three Kids claim was approximately 40 percent manganese and could be used in ferromanganese foundries of the day without further processing. Ore was removed from a hillside in the southeast corner of the subject property with picks, axes, and dynamite, after the surface had been stripped of non-ore rock by horse-drawn scrapers. By January of 1918 the first loads of ore had been mined, hauled to Las Vegas, and shipped by rail to Temple, Pennsylvania [37]. At this time, roads to the railhead in Las Vegas were nearly nonexistent; the ore runs took over 20 hours round trip [39].

In April 1918 a banker and minerals investor from Los Angeles named Thomas Thorkildsen purchased the Three Kids and Las Vegas claims for $100,000 [37, 38, 43]. Thorkildsen kept the name of Manganese Association for the company. A workforce of 150 men worked the mine by June 1918, but activities slowed

[2] Jefferson is reported as being the sole resident of present day Henderson at this time, as well as the co-founder of the early Jericho Heights neighborhood ca. 1929.

[3] Another assemblage of three men (Richard Busteed, George Hallock, and Robert Puelz) formed the Original Las Vegas Manganese Company in April 1918. Original claims encompassing what was later referred to as the Hulin Pit were named Las Vegas, Las Vegas Extension #1, Las Vegas Extension #2, and Las Vegas Fraction, thus it is conceivable that this entity held these claims, which were later assembled by either Thorkildsen, West, or the Boulder Dam Manganese Co.

dramatically by March 1919, with a net production of 12,000 to 16,000 tons of 40 percent ore [18, 26, 38, 43]. In 1919 and 1920 “several thousand tons” more ore were mined [16]. The mine was fully dormant by 1920. Mine closure coincided with several factors: the end of World War I, reduced demand for domestic manganese, and depletion of the most easily accessible ore.

By 1930, the population of Las Vegas was reported at 5,165, although present day Henderson was limited to a handful of outlying ranches [32, 35, 37]. From 1920 through 1936 the mine remained nearly dormant, reportedly producing only “several hundred tons” [16]. Area miners most likely found employment with the building of the Hoover Dam, which commenced construction in March 1931. The earliest modern settlements of Jericho Heights and Pittman, those that led to present day Henderson, were founded between 1929 and 1931 [44, 45]. The dam, dedicated in September 1935, first provided power 13 months later [46].

2.5.4 Mine to Mill Site History, ca. 1936 - 1963

Prior to 1943, the mine had only ever shipped unprocessed ore, but in the period from 1943 to 1961 two consecutive mills were operated to produce manganese nodules for the U.S. government by pyrometallurgical methods. The operational period of these mills corresponded to periods of high demand driven by the arms races of WWII and the early Cold War and Korean conflict years (ca. 1949-1963). Figure 8 (Appendix A.1) shows the domestic and Nevada manganese production rates from the years 1900 through 1963. As can be seen, the three national production booms coincide with high production periods in Nevada, the majority of which took place at the Three Kids Mine. During the period of 1956 to 1961, TKM produced about one third of the domestic supply, making it the single largest producer in the nation [47]. TKM’s peak production year, 1957, coincided with the largest recorded domestic production. At its best in this year, the domestic production only accounted for about one eighth of the nation’s demand [48]. Additional supporting information on Nevada’s manganese production is provided in Appendix D.2.

The First Mill. Interest in the mine began anew in 1936 with the founding of the Boulder Dam Manganese Co. (BDMC) [26]. The BDMC provided ore to the newly constructed Metallurgical Research Laboratory (MRL) in nearby Boulder City [49]. Three Kids ore was experimentally processed at the MRL using both a pyrometallurgical process involving milling, flotation, thickening, and sintering in pots, and an electrochemical process of milling, extraction, cleanup, and electrowinning. With the acknowledgement that World War II would increase demand and create foreign supply difficulties, the U.S. sought to improve domestic resources for the metal.[4]

By 1940 the Manganese Ore Co. and Western Minerals Exploration (WME) laid claim to the known reserves (Manganese Ore held the Hydro claims, and WME

[4] Indeed, beginning in September 1941, the Basic Magnesium Inc. plant in Henderson was under construction for similar purposes related to producing high purity magnesium metal.

had the Three Kids, Annex, and Las Vegas claims). It is not clear which entity purchased the claims of the BDMC, however it was the Manganese Ore Co. (a wholly owned subsidiary of M.A. Hanna Co., Cleveland, Ohio), managed by Mr. H. S. West [39, 50], that later became an agent for the Defense Plant Corporation, the Metals Reserve Co., and the U.S. government. Manganese Ore ran the mill, owned some of the patented claims, and made earnings on selling processed manganese to the government. In turn, the U.S. owned the mill and was effectively the sole purchaser of product. Mill construction began in 1942.

The 1,000-ton per day mill was estimated to have cost $6 million [39]. At best the plant produced a maximum of 300 tons per day, with a total production of only 14,000 tons of nodules during 11 months of operation. Over 500 workers were laid off when the site closed in September 1944. With the mining occurring much faster than the processing, 300,000 tons of ore had been staged onsite by the time of the mill's closure (stockpiles are shown in Figure 4B and can be seen in a 1950 aerial image) [51].

Although blueprints of this plant design have not been found, the ore storage, mill site, thickeners, waste rock heaps, and tailings pond are visible in a 1943 plan of the site and in some early photographs from the archives of the Three Kids Enterprises [51, 52]. Additionally, various reports by Nevada Bureau of Mines inspectors indicate that the mill was a flotation-based process with a nodulizer [39, 52]. The best description of the process was found in a 1944 issue of the Mining Congress Journal, which states:

> The ore, after careful blending, is finely dry-ground and leached in a combination of towers and agitators with a solution of sulfur dioxide to yield a concentrated solution consisting primarily of manganese sulfate. The leached pulp is countercurrently washed in a series of seven thickeners, the first two of which are acid-proof construction and 250 ft. in diameter, thus making them the largest acid-proof thickeners ever constructed. The leach solution, after neutralization, is evaporated in quadruple-effect evaporators to produce manganese sulfate salt which is roasted in a rotary kiln 360 ft. long by 11 ft. 3 in. in diameter, to yield a calcine of manganese oxide and sulfur dioxide gas. The gas is used in the leaching towers to extract additional manganese from ore. Miscellaneous sulfur dioxide losses are made up by burning sulfur. The manganese oxide from the roasting kiln, while still hot, is transferred to another smaller rotary kiln where it is nodulized to give a product suitable for making high grade ferromanganese and other products. The nodules contain 65 percent or more of manganese. [53]

It is Zenitech's conclusion that the flotation tanks were originally designed as thickeners and were modified to be used as flotation tanks when the mill was reworked in 1952. The kiln was also replaced, as indicated by the change in kiln dimension and type.

The ore bodies worked during the 1940's were fault block deposits positioned between three significant faults in the southeast corner of the subject property. Between the Extension fault and the Annex fault was the B Pit. Between the Annex fault and the Lowney fault was the A Pit. The B Pit was mostly mined before the A Pit was begun. Together, these pits form a "J-shaped" pit up to

2,000 feet long and 350 feet deep, sometimes referred to in whole as the Annex Pit. Ore from the A and B Pits was somewhat less rich than the Three Kids claim, but averaged greater than 20 percent manganese.

Coinciding with mill construction in 1942, the Manganese Townsite was built for worker housing. The townsite was located across Lake Mead Parkway, beneath the present location of Lake Las Vegas Drive (Refer to Figure 4B). The townsite was only useful through 1944, when, at the end of the war, the U.S. regained the mine claims, closed the mill, and abandoned the townsite. Homes in the townsite, so-called "demountables," were moved to Henderson and Boulder City circa 1947, or were left for salvagers [37].

The construction of the mill coincided with the construction of the Basic Magnesium plant, later referred to as BMI, in Henderson. BMI constructed a 40-inch diameter water main from Lake Mead to Henderson to supply the BMI Complex. The pipeline is still in use to this day; its location is depicted on Figures 4B through 4D. In the northeast corner of the subject property, a 12-inch line was taken off the main to supply water for the Three Kids mill. The water was pumped to a tank on the ridge east of the mill site, where it flowed to the mill in a 12-inch pipe, bifurcated to an 8-inch supply line for the townsite. The pump control line, which ran from BMI to the pump station at Lake Mead, still exists along the south portion of the subject property. Power was supplied to the mill by way of a Southern Nevada Power Co. line along the north side of the mill site, which fed into a 69 KV substation on the mill site.

Boulder City Labs. Meanwhile, beginning with the operation of the Hoover Dam, the U.S. Bureau of Mines made plans to take advantage of the surplus electricity. In 1936, the Bureau of Mines began construction of the Metallurgical Research Laboratory (MRL) in Boulder City, often referred to as the Boulder City Labs or as the Date Street Complex. The purpose of the MRL was to provide a public-private research entity for the research and development of pyro- and electro-metallurgical extraction and purification techniques. The MRL developed renowned processes for purification of manganese, titanium, uranium, beryllium, and other materials prior to its closure in 1985.

One of the lab’s first challenges pertained to beneficiation of manganese ores, specifically those related to resources in Southern Nevada. In the late 1930's research efforts seemed focused on pyrometallurgical methods involving chemical extraction, flotation, and nodulizing in sintering pots. This was the method utilized at the Three Kids mill beginning in 1942, with the exception that a nodulizing kiln was used in place of the sintering pots. Later, in the 1950’s, the MRL experimented with a miniature nodulizing kiln (23 ft long x 22 in. dia.) while conducting further research on nodule production [18, 46, 54].

In 1940, concurrent to West's plans for re-opening Three Kids, the MRL received $2 million in funding for work on electrochemical purification, also called electrowinning [55]. Electrowinning results in a very high-grade product, greater than 99 percent purity, suitable for use in dry battery cells and the production of

specialized aluminum and copper alloys [56-58]. Using Three Kids ore, extensive R&D was conducted at the MRL between November 1941 and November 1944. The result, in 1945, was the complete design of an electrometallurgical plant to be built at the Three Kids mine [59]. This plant was never built, however, in deference to a plan to improve the existing flotation/nodulizing plant at the site. The significant impact of this decision is that the present day contaminants of concern at the site derive from the flotation/nodulizing chemistry, and not from the extraction/electrowinning process.

The Second Mill. From the mill's first closure in 1944 through the beginning of plant modifications in 1951, activities at the mine and mill were limited. The private claims had reverted to U.S. ownership in 1944 [60], although it is not known what portion of these were patented or unpatented claims.

Beginning about 1949, West was reported to be negotiating with the U.S. government for reinstatement or repurchase of the mineral claims. In 1951 he formed Manganese, Inc., another wholly owned subsidiary of M. A. Hanna Co. [18]. Under the terms of a nine-year contract, Manganese, Inc. constructed an improved mill. It is apparent from early photographs, site drawings, and physical evidence found during recent site reconnaissance that the original thickeners were retrofitted for use as flotation cells in the second plant. Similarly, the two octagonal sump buildings are thought to have been used by both mills. The remodeled mill opened on September 1, 1952, fifteen months after plant modifications began.

Mining began aggressively to remove the remainder of the B Pit reserves and to open up the bulk of the A Pit. Contractors stripped the remaining overburden and hauled ore to a grading station immediately north of the B Pit haul road. Once graded, the ore was dumped in the ore storage yard south of the mill site. The ore yard already held surplus ore from the 1940's.

Ore was blended in the ore storage yard by layering various grades. The average ore delivered to the mill was in the range of 22.5 to 24 percent manganese [61]. The ore was run through the crusher circuit, where the fine particles were then introduced to the beneficiation reagents. The reagents were an emulsified mixture of petroleum, plant-based oils, detergents, and sulfurous acid and are discussed in more detail in Section 6.1.3. The ore-reagent mixture was vigorously mixed (conditioned) until necessary chemical reactions occurred, upon which the organic and aqueous layers were separated using the large, circular thickening tanks. The sediment from this operation, called gangue, was pumped to the tailings ponds, while the manganese-rich concentrate was run back to the mill.

The concentrate was pressed to dry it out somewhat and coke and sodium carbonate were added. This blend was conveyed to the twin, parallel calcining kilns where water, carbon dioxide, sulfur dioxide, and some metal fumes were driven off at a temperature of approximately 1800ºF. The organic reagents and coke assisted combustion in the calciners. The now desiccated manganese oxide concentrate entered the nodulizing kiln which was fired with Bunker C fuel oil.

The kiln was run at temperatures approaching 2400ºF. Lead sulfate was volatilized in this process and manganese nodules formed. After cooling in a fourth kiln, the nodules were conveyed into 375 ton piles by an automated conveyor [54, 61].

The mill underwent two significant shutdowns and a plant upgrade between 1953 and 1956. In February 1953, the nodulizing kiln failed, breaking in half and crashing to the ground. Judging from photographs reviewed by Zenitech and included in Appendix C.1, this must have been a dramatic event. The kiln was repaired and an additional bearing stand was installed [52, 60, 62].

Then in June 1953, the mill building caught fire and was destroyed. The mill building, as it was commonly called, was the structure in which reagents were emulsified and then mixed with ground ore in multiple high shear mixers. This building included reagent tanks and an attached electrical substation [60, 62]. No detailed descriptions of the fire were reasonably ascertainable. Zenitech has found only a poor quality newspaper image of the burnt rubble and it is not apparent what structures/systems were destroyed in the fire or where the rubble may have been taken [60].

The mill was fully operational again by November 1953. Except for labor relations problems [49, 60], the plant operated normally for the next two years, at which time modifications to the plant were made. Notable among these was an addition to the kiln fume handling system in 1956, which increased the recovery of lead sulfate emitted mostly from the nodulizing kiln [18]. Other changes included a pilot plant for researching the flotation physics [61, 63, 64] and replacement of the crusher circuit ball mills with rod mills [65].

By 1958 the A and B Pits were exhausted and stripping operations were in full swing above the Hydro ore reserves. While stripping was taking place, stockpiled ore from the 1940's was processed [49]. The Hydro Pit began producing around 1958 and the Hulin Pit was explored and stripped beginning in 1959 [66, 67]. The Hulin Pit was soon exhausted and by 1961 the mine and mill were closed and government contracts were terminated.

The mill was offered piecemeal at auction in January 1962. Lead reserves resulting from the kiln operation were shipped to an unspecified smelter in Utah through 1963, resulting in the closed mine being the largest producer of lead in the state [48].

Stockpiling of government reserves of manganese also began in 1959. A lease between Manganese, Inc. and the U.S. government describes stockpiles consisting of 50,000 long tons of nodules and 8,440 long tons of metallurgical grade ore [52]. Nationally, the U.S. government (the Defense Logistics Agency or DLA) began selling off its various manganese stockpiles in 1965, however, the last of the Three Kids reserves was not taken out of the national inventory until 2004 [58, 68]. The majority of the DLA stockpile was apparently sold prior to this year, since the total stockpile was reported to weigh 26,000 tons in January

2004, compared to 109,000 tons in 1961 [52, 68, 69]. Due to the high cost of shipping the stockpile to a solid waste facility, the material was used to help control dust on property withdrawn to BOR [70].

2.5.5 Abandoned Mine History, ca. 1963 - Present

Little is documented about the demolition of the mill. It is suspected that after the auction, steel and usable wood were taken by salvagers. Some undated historical photographs seem to depict the mill after the 1961 closure: kilns are gone, some structures are still intact, and general decrepitation is visible. The DLA continued to lease space from site owners, with that lease ultimately being transferred to TKE.

From 1963 until the beginning of the Lancaster/Roy landfilling operations in 1979 the site languished. This period was marked with the federal government, various individuals, and bank receivers owning title to parcels.

From 1979 through 1984 a solid waste landfill was operated in and near the Hulin Pit, for a year by Mr. J.C. Lancaster, then for four years by Mr. Leonard Roy, Sr. The landfill was listed under various owners/operators, who are listed in Table 4 in Section 3.1.3. After a 1991 ruling by the Nevada Supreme Court (case no. 21332 Roy vs. Lancaster), Parcel 18, which contained the landfill, was ruled to be federal property and ownership was transferred, or returned, to BLM. The landfill is treated in more detail in Section 3.1.3.

Beginning in the early 1980's parcels of the subject property were sold off and redeveloped. Parcels 2 and 3 were bought by Mr. John Holbrook in 1982 and the Three Mile Boat Storage was established. As this timing predated NDEP's involvement in the subject property, the facility was apparently constructed on top of the east end of Tailings Pond 1. At about this same time (1982-83), Parcel 4 was sold and a convenience store with gas pumps was erected.

It is thought that in the late 1970's to early 1980's, Paul Dino Bertuccini II bought some land within the present day subject property. By 1987 he was assembling individual parcels involving former patented claims, namely land that would today be called parcels 5 through 11. Zenitech found records that the Defense Logistics stockpile lease was renewed to Bertuccini in 1984, but it is not clear if it was renewed/transferred to him at that time, or if he had already assumed the lease from a former property owner in the period prior to 1984. This lease persisted until the piles were removed in November 2003. Between 1994 and 2003 Bertuccini, dba TKE, leased an area in the B Pit to Sandex, Inc.[5] as a secure storage yard for explosives magazines. Other leases have been let to Fireworks by Grucci and to Brand Ford, a building mover.

[5] During the lease period, the lessee was known by several business names, including Sanders Construction and Western States Drilling and Blasting.

Circa 1990, discussions were held with Clark County Health District regarding the possible placement of water treatment sludges from the Alfred Merritt Smith Water Treatment Facility on the subject property. Laboratory data for the sludge was observed in the CCHD files and treatment sludge disposal was discussed briefly in the 1995 Preliminary Assessment produced by BOR [65, 71]. Land application of solid wastes is discussed more specifically in Section 3.1.3.

Evidence of when the mill foundations were partially demolished was not reasonably ascertainable by Zenitech. In 2000, HRA conducted a cultural resources assessment for the Las Vegas Wash that included examination of mine tailings and related wastes presumed to have originated from the subject property. Their assessment did not recommended cultural resource mitigation or conservation of these features, or listing under the National Historic Preservation Act [32].

Beginning in the 1990's there were several proposals put forward by members of the Three Kids partnership to develop the site as a gravel pit and/or as a construction/demolition landfill. The partners also began sponsoring limited environmental investigations in the 1990's, however, these slowed after petroleum in excess of the State Action Level was discovered and reported to NDEP.

By the year 2001 dust blowing from the dry surface of the tailings was causing problems with Lake Mead Boat Storage and Laker Plaza. It took approximately two years for dust production to be reduced through the combined efforts of BLM, BOR, and the Three Kids Partners.

2.6 Current Conditions

2.6.1 Physical Condition

The physical condition of most of the subject property is erosive and deteriorating. Without active mining or other legitimate activities on site, tailings dams, cutoff dams, drainages, roadways, and cliff faces are failing.

The mill site, mine pits, and waste piles are poorly vegetated, allowing visible dust to be formed during moderate to high wind conditions. Dust palliatives, where applied, are now over five years old and largely ineffective. Photographs of the current conditions are provided in Appendix C.3 and discussed in narrative form in Section 5.2.

2.6.2 Security and Physical Hazards

The site today is largely unprotected from trespassing and poses obvious physical hazards to persons thereon. All of the original pits continue to be open and possess extreme fall hazards. Some parts of the mill site have existing fall hazards as well.

Access to the site has allowed widespread dumping of solid waste, boats, and automobiles. Wire burning, while not widespread, has been noted. Both Mr. Grossheim (Laker Plaza) and Mr. Sanders (Lake Mead Boat Storage) have reported thefts and vandalism.

2.6.3 Chemical Hazards

Mine Processes. Manganese is a common transition metal found throughout the Earth's crust, however it is rarely found in ore concentrations in the U.S. The principal use of manganese (about 90 percent) is as a constituent of ferromanganese steels, and in some more specialized alloys of stainless steel, aluminum, and copper. Other uses include dry cell batteries, brick coloring, animal feed, and plant fertilizer [56].

Manganese used in ferromanganese steelmaking does not have to be in the form of pure manganese metal, but instead can be added as manganese oxide nodules. It was this form of manganese that was produced at the subject property from 1943 through 1961. Prior to 1943, high grade manganese oxide was mined directly and shipped to steel mills in the Northeast [39, 49].

The first mill (1943-44) utilized milling, a sulfurous acid (SO_2 gas and water) extraction, thickening and countercurrent rinsing, neutralization, drying, calcining, and nodulizing. Neutralizing chemicals and any additives to the kilns were not discussed in available literature. The thickening tanks were constructed in the early 1940's and are visible in photographs dating from the late 1940's through 1950. It was not stated in any resources reviewed whether the method of countercurrent rinsing involved the use of petroleum-based flotation chemicals.

The second mill (1952-1961) was based generally on the first mill, but with some notable changes in process machinery and chemistry. Ore was milled, acidified with sulfurous acid, combined with an emulsion of flotation reagents, mixed in high sheer conditioners, thickened, dried, calcined, and nodulized. It is apparent that the second mill utilized at least some of the existing thickeners by modifying them for the revised process. Some overflow weirs are observed to have been intentionally blocked up. An additional thickener (the eighth one) was added near the flotation building. After thickening and removal of some water, coke and sodium carbonate was added and the slurry was fed into a revised calciner circuit, this one using twin parallel calciners smaller than the first mill's (150 ft long by 8 ft diameter). The calcine went into a separate nodulizer (150 ft by 10 ft diameter), then a cooling kiln (96 ft by 8 ft diameter), and by steel pan conveyor to stockpiles. Based on process knowledge and review of aerial photographs, the bulk of tailings at the subject property resulted from the operation of the second mill.

As was noted in Section 2.5.4, the MRL in Boulder City did conduct research on electrochemical purification methods with the goal of establishing an electrowinning plant at Three Kids, but the Three Kids mill only ever operated a nodulizing operation. This is an important distinction in discussing process

chemistry, since the production of high purity manganese metal by electrochemical methods requires different chemicals [54, 59, 72] and would result in a corresponding change in the potential chemicals of concern at the site.

The major chemical step in the second mill's process began as follows:

1. Vigorous mixing of ground ore with water, sulfur dioxide, diesel fuel, tall oil soap[6], Oronite S[7], and sometimes quebracho[8] and sodium carbonate, to form an emulsion.

Sulfur dioxide combined with water resulted in sulfurous acid, which helped drive the organic fraction away from the aqueous fraction, thus enhancing flotation. The sulfate/sulfite would also precipitate manganese sulfate, which was carried into the organic froth.

The organic phase of this emulsion was comprised of diesel fuel and tall oil soap. Tall oil soap's primary constituents are considered non-hazardous [73, 74]. A small amount of sodium sulfonyl sulfate (Chevron product Oronite-S) was also used. Toxicological data on Oronite-S is not readily available. The tall oil soap and Oronite acted as detergents to allow the diesel/aqueous emulsion to form. Quebracho and sodium carbonate were sometimes added to assist in the precipitation/flocculation of undesired metals/metal complexes in the froth. Diesel fuel was the bulk of the organic fraction, as diesel was relatively inexpensive and it benefited later kilning steps by combusting in the kilns. Diesel is a complex mixture of petroleum distillates containing both volatile and semivolatile compounds, including naphthalene [75, 76].

2. Thickened foam containing manganese oxide, manganese sulfate, petroleum, detergents, and some water was then floated off the thickeners into a drying circuit where coke and sodium carbonate were added. This mixture was then conveyed to the calciners.

The role of the calciners was to drive off sulfur, carbon dioxide, and water to result in a dry, hot, amorphous calcine comprised mostly of loose manganese oxide and manganese sulfate.

3. Calcine was fed directly into the nodulizing kiln and taken to a temperature of up to 2400 °F. The calcine emitted lead sulfate and possibly some zinc sulfate at this time. Strontium sulfate was sometimes added to this calcine to force the emission of lead salts. Lead was an important secondary product of the mill and efforts were made throughout the 1950's to capture it in cyclone precipitators.

[6] Tall oil soap is a pine tar-like mixture resulting from the first steps in the making of paper. It is primarily composed of oleic and linoleic acids, not dissimilar from the composition of olive oil.
[7] Oronite S was a product of Chevron, sodium sulfonyl sulfate, a detergent compound.
[8] Quebracho is a general term for tree tannins produced from one of several hardwood trees found in Mexico (quebracho is thought to derive from the verb "to break" and the word for "axe"). The substance was used to drive selective precipitation of metals during the extraction process.

4. The gangue from the thickeners, containing lead and arsenic, which were elevated above the original concentrations in the ore, was pumped to the tailings ponds.

Based on this process, which was used for the vast majority of manganese production, chemical impacts from the mill operation are most likely to include arsenic, lead, manganese, total petroleum diesel/oil, and individual petroleum compounds.

2.6.4 Natural Mineralogical Hazards

Lead, arsenic, manganese, zinc, and copper existed in the ore in concentrations greater than regional background levels. Most of this ore has been mined and what is left is several hundred feet below Muddy Creek sediments. However, it is reasonable to assume, based on observed minerals and limited testing conducted by others, that lead, arsenic, and manganese in certain rock strata do exist.

Naturally Occurring Radioactive Materials (NORMs). NORMs are ubiquitous in the earth's crust. Of the various radioactive isotopes commonly existing, radon gas is believed to cause the majority of disease associated with natural ionizing radiation [77]. Radon exposure increases the likelihood of lung cancer. Since radon ultimately arises from uranium, soils and rocks with elevated uranium content are associated with increased radon levels.

Radioisotopes of potassium, carbon, and the rare earth metal praseodymium (^{40}K, ^{14}C, $^{142}Pr/^{143}Pr$) are examples of non-transuranic NORMs that release energy through pathways independent of radon. The non-transuranic NORMs are not expected to be prevalent at the site, based on what we currently know of site geology.

Zenitech has evaluated the potential for elevated levels of NORMs by the following means:

1. Literature research focusing on reported occurrences of radioactive minerals,
2. Performance of field surveys for elevated ionizing radiation, and
3. Review of radon gas studies conducted by EPA and the State of Nevada.

The subject property falls within the Basin and Range Uranium Province according to Finch [78]. This province, covering Nevada, southern Arizona, southern New Mexico, and Northern Mexico, though the largest by area on the continent, accounts for only 0.1 percent of known North American resources.

The two primary ores of uranium are simple oxides known as uraninite and pitchblende [79-81]. There are no reported occurrences of either uraninite or

pitchblende in Clark County [82-85].

The most significant secondary ore of uranium is a mineral called carnotite. Carnotite is a hydrous uranium vanadium oxide with the formula of $K_2(UO_2)_2[VO_4]_2 \cdot 3H_2O$. It is a soft, dull mineral appearing as yellow monoclinic crystals, or more often as a yellow to rusty crust in thin deposits [79, 82]. This mineral has numerous reported prospects in Clark County, but none have been reported as having development potential. The most frequent occurrences have been noted in the Sloan-Jean area and in the Goodsprings District [86]. There are reports for the Moapa District and the Muddy Mountains District, as well. The nearest reported occurrence for carnotite is in the McClanahan District, in the mountains south of the Hacienda Hotel and Casino along State Highway 93, approximately ten miles southeast of the subject property. No occurrences of carnotite have been reported for the Las Vegas District [12, 82, 83]. A review of reasonably ascertainable records of the TKM site revealed no mention of uranium or other NORMs occurrence.

Zenitech surveyed the subject property for the existence of elevated gross alpha, beta, and gamma ionizing radiation on December 1, 2006. Waste rock, mill areas, mine tailings, native geology, and exposed mineralized veins were surveyed with a Ludlum Instruments Model 3 radiation survey meter and Model 44-9 pancake probe. This method is consistent with those used for prospecting uranium, thorium, and radium deposits [87]. All readings conformed to a normal distribution at background levels (x=109 ± 23 cpm, n=26). Based on these findings, which will be documented in Zenitech's Phase II ESA of the subject property, it is unlikely that elevated levels of naturally occurring radiation exist in subject property minerals, soils, and mine byproduct materials. Mine tailings possessed comparable readings to unprocessed materials, providing evidence that any naturally occurring radioactive minerals were not incidentally concentrated during manganese beneficiation.

Radon Gas. The State of Nevada has undergone considerable testing for radon due to its known tendency to cause lung cancer [77, 88]. From 1989 through 1993, the Nevada Bureau of Mining and Geology (NBMG) and the Nevada Department of Health (NDOH) evaluated potential radon exposure through the following means:

1. Canister testing of homes
2. Sampling of soil gas
3. Measurement of ambient radon levels in outdoor air
4. Estimation of natural uranium by aerial gamma-ray remote sensing
5. Evaluation of geology, soils, and groundwater formations.

These data were statistically correlated in order to develop the "Indoor Radon Potential Hazard Map of Nevada" [88, 89]. Localities were ranked into low, intermediate, and high hazard areas in a manner consistent with various other

EPA studies [90-92]. The subject property falls into a low hazard designation.

The statewide average for indoor radon was found to be 2.9 picocuries per liter of air (pCi/l), compared to the national average of 3.0 pCi/l. The statewide average for outdoor radon agreed with the national average at a concentration of 0.41 pCi/l. When corrected for population density, it was reported that approximately one in ten Nevada households exhibits an indoor radon concentration over the EPA recommended guidance level of 4 pCi/l [93].

The NBMG/NDOH study states that the greater Las Vegas area averaged three percent of households over the guidance level, while the Henderson area showed no homes over 4 pCi/l. Homes built on alluvium close to the Las Vegas Wash may exhibit elevated radon due to Precambrian gneiss derived from erosion of the Frenchman Mountains, however those sediments are believed by Zenitech to not be present at the TKM site [5, 83]. Rather, the subject property's alluvial deposits appear to derive from the River Mountains to the immediate south of the subject property; these deposits are younger, show less metamorphism, and have not been associated with elevated uranium.

Based on these data, Zenitech believes that indoor radon levels of homes built at the subject property are reasonably anticipated to fall below the EPA guidance limit. If desired, homes can be built with inexpensive passive radon ventilation systems to further protect occupants [94].

2.7 Proposed Land Use

The proposed land use, subsequent to remediation and reclamation, includes commercial, residential, and public access uses. The site will undergo an assessment phase, then enter into remediation under an NDEP-approved corrective action plan, then be remediated to the satisfaction of the state. The coalescence of the public and private lands will be necessary for the remediation to take place. Residential land use will be based on meeting or exceeding target cleanup levels, which will be derived from a human-health risk assessment in combination with statutory and negotiated target cleanup levels.

2.8 Regulatory Milieu

2.8.1 Lead Agency

Within the State of Nevada, the Bureau of Corrective Actions (BCA) within NDEP is the lead environmental agency for overseeing the assessment and remediation of the subject property. BCA has the statutory authority to make a demand for cleanup and currently has the subject property listed as an active corrective action site.

Within NDEP the Bureau of Waste Management would oversee the generation, storage, shipment, and disposal of hazardous wastes, should they be found on the subject property. The Bureau of Water Quality Control permits both

stormwater pollution prevention plans and wastewater reuse.

Subsidiary permits and compliance issues (local air quality, flammable storage, and asbestos demolition) are typically managed by local authorities in Southern Nevada.

2.8.2 Other State Authorities

Other state authorities expected to participate in specifications and permits pertaining to the site investigation and remediation include the Nevada Division of Water Resources (NDWR) for well permitting, the Nevada Division of Minerals relating to abandoned mine land hazards, and the Nevada Division of Industrial Relations pertaining to asbestos management and general Occupational Safety and Health Administration (OSHA) requirements.

2.8.3 Regional, County, and City Authorities

The two local environmental jurisdictions expected to play a major role in remediation planning and implementation are the solid waste authority of the Southern Nevada Health District (SNHD) and the dust control and permitting authority of the Clark County Department of Air Quality and Environmental Management (CCDAQEM). Additional local permits will be required for placement of rock/soil, for blasting, for fuel storage, etc.

Section 3
Records Review

3.1 Agency Records Review

Records review for this study was prepared by a utilizing a contracted database review firm in combination with personal reviews of specific agency files. Environmental Data Resources, Inc. (EDR), Milford, Connecticut was used for review and summary of online databases. EDR maintains current databases through regular contact with federal, state, and local agencies. Supplemental records review was conducted by Zenitech, if so indicated. Appendix B.1 contains the report provided by EDR.

3.1.1 Federal Environmental Records

Comprehensive Environmental Response Compensation Liability Act (CERCLA), U.S. EPA. The subject property is not listed in any reasonably ascertainable records of CERCLA (aka "Superfund"). At present time, there are no Superfund sites in Southern Nevada [95].

The NDEP corrective actions database and anecdotal information indicate that NDEP prepared a CERCLA-styled Preliminary Assessment/Site Investigation (PA/SI) by 1995. This document was not reasonably ascertainable. Case officer Mr. Quint Aninao was listed as the document contact. It was reported anecdotally that the PA/SI findings did not support a Hazard Ranking System score sufficient to rank the site as a National Priority List site.

Some downstream vicinity parcels (part of present day Lake Las Vegas, not a part of this subject property) were remediated of excess lead and asbestos between 1990-92. It is thought that at least some of the lead waste was resultant from former TKM activities. These parcels were principally comprised of the Hydro and White Rock placer claims and were ultimately transferred by patent from the federal lands inventory to private ownership (Lake Las Vegas Joint Venture in 2001 and LLV-1, LLC in 2004) as part of a BLM land exchange. A summary of the remedial actions is recorded in the patents. The 2004 patent makes specific reference to §120(h) of CERCLA, stating that the land has been examined and that no evidence was found to indicate that any hazardous substances had been stored, released or disposed of upon the property. The patents are provided in Appendix D.3.

Mine Safety and Health Administration (MSHA), U.S. Department of Labor. The subject property is not listed in any reasonably ascertainable records of MSHA as a known mine or mill site. The Federal Mine Safety and Health Act (FMSHA), which created MSHA, dates from 1977.

Uranium Mill Tailings Reclamation and Control Act (UMTRACA or UMTRA), U.S. EPA. The subject property is not listed as an UMTRA mill site or vicinity property. Section 2.6.4 of this document discusses the potential for elevated levels of naturally occurring radioactive materials on the subject property. A review of uranium levels in the Henderson area found low to average values consistent with background levels and insufficient for uranium mining purposes.

Nuclear Regulatory Commission (NRC). The subject property is not shown in the NRC list of licensees as a handler of licensed radioactive materials.

Toxic Substances Control Act (TSCA), U.S. EPA. The subject property is not shown in reasonably ascertainable TSCA databases as a manufacturer, importer, or other notifier of TSCA regulated substances. Databases evaluated included: Federal Insecticide, Fungicide, Rodenticide Act list of registered pesticide producers; TSCA list of polychlorinated biphenyls (PCB) activity notifiers; Emergency Planning and Community Right to Know Act (EPCRA) tracking database for regulated substances pertinent to TSCA. PCBs may have been present at the mill site, ca. 1942-1961.

U.S. Department of Defense. The subject property is not listed as a current or former Department of Defense site. No such sites were found within a one mile radius of the subject property. The subject property did have a DLA stockpile of manganese nodules on it from about 1959 through November 2004. This is discussed in more detail in Section 2.5.4.

Superfund Amendments and Reauthorization Act (SARA), U.S. EPA. The subject property is not shown as a toxic chemical release inventory system (TRIS) notifier under SARA. Records were found which indicate that the subject property did receive waste from a TRIS notifier, namely the Good Humor Corporation, during the years 1991-94, inclusive. Additional details of these permitted releases are found in Section 3.1.3 “Land Application.”

Reported Spills. The subject property is not listed in any reasonably ascertainable records of federally reported hazardous materials spills. Databases evaluated included: U.S. Department of Transportation hazardous materials information reporting system; and U.S. Coast Guard emergency response notification system. There have been various state and local spill reports filed. These are discussed in Sections 3.1.2 and 3.1.3.

Public Water Supplies. EDR reported that the subject property is not listed in any reasonably ascertainable records of public water supplies. Databases evaluated included: U.S. Geological Survey (USGS) national water inventory system and the Federal Data Reporting System public water supply list. According to the NDWR database, Laker Plaza (Parcel 4) does maintain a permit for a public water supply (permit no. 66108, well log no. 82441). The business sells beverages and ice made from treated water drawn from its well. Additional discussion is provided in Section 2.4.3.

Landfills and Brownfields. The subject property is not listed in any reasonably ascertainable records of landfills or Federal brownfields projects. Databases evaluated included: EPA open dump inventory and EPA brownfields registry.

Miscellaneous Non-AAI Considerations. The subject property is not listed in 100 or 500 year floodzone listings developed by the Federal Emergency Management Agency. The subject property is not listed in the national wetlands inventory provided by the U.S. Fish and Wildlife Service (FWS). Refer to Figure 9, Appendix A.1 for a map of the area wetlands. The subject property is not within 1.0 mile of an airport landing facility according to the Federal Aviation Authority.

3.1.2 State Environmental Records

Hazardous Waste Activity, Nevada Division of Environmental Protection (NDEP). The subject property is not shown in reasonably ascertainable records as a generator, transporter, or treater/disposer of hazardous waste under the Resource Conservation Recovery Act (RCRA).

Databases evaluated electronically included: Resource Conservation Recovery Information System; NDEP RCRA Corrective Actions; NDEP Solid and Hazardous Waste Sites list; and NDEP voluntary cleanup list.

Zenitech reviewed the most recent publicly accessible NDEP project tracking database to identify past or current cases for the subject property or any facility within approximately one mile of the property. The sole active case file at this time is for the subject property itself, in regard to lead, arsenic, manganese and petroleum.

Table 3
NDEP Corrective Action Cases
Related to the Subject Property

FACILITY OWNER or OPERATOR	CASE NO.	ACTIVITY STATUS
Subject Property Cases		
Three Kids Mine & Mill Site (BLM lands north of subject property)	H-001347 [a]	closed 7/10/1995
Three Kids Mine & Mill Site (subject property of this report)	H-001347 [b]	open
Laker Plaza (Parcel 4)	8-000511	3 active underground storage tanks, no spills appear to have been reported
Cases Related to Subject Property Operations		
BOR Lake Las Vegas (gasoline impact north of subject property)	H-000508 [c]	closed 5/5/2000
BOR Lake Las Vegas (lead impact north of subject property)	H-000508 [d]	closed 10/15/1993
BLM Lake Las Vegas (lead impact north of subject property)	H-000588	closed 7/23/1992
Levy Realty Trust (lead, arsenic, manganese impact from staging manganese nodules at railhead)	H-000837	closed 9/22/2004
Bureau of Reclamation (Lead, arsenic, chromium impact from pilot processing of Three Kids ores)	8-000904	closed 6/13/2005

[a] Original case file for lead released from the subject property. Case officer: Brenda Pohlmann. Report date: 8/17/1992.

[b] Re-opened case file pursuant to discovery of released petroleum and elevated arsenic, lead, and manganese. Case officer: Todd Croft. Report date: 4/7/1999.

[c] Gasoline impact not related to TKM operations. Case officer: Brenda Pohlmann. Report date: 2/24/2000.

[d] Case file for lead released from the subject property and/or from target shooting impacts. Case officer: Ed Basham, Report date: 4/11/1991.

State Superfund Equivalent Sites. The State of Nevada does not operate a program analogous to the Federal Superfund program as some states do. Corrective actions of historical spills adhere to the standards and oversight of the NDEP Bureau of Corrective Actions, or, in the case of active mines sites operational anytime since 1989, the NDEP Bureau of Mining Regulation and Reclamation.

Petroleum Storage Tanks. Databases evaluated included: NDEP registered underground storage tank (RUST) list; NDEP leaking underground storage tank (LUST) list; NDEP project tracking activity list; NDEP above-ground storage tank (AST) list; and EPA Native American UST/LUST lists.

Parcel 4 is listed in the NDEP RUST database as having three permitted underground petroleum storage tanks, NDEP facility number 8-000511. This fact was corroborated by an interview with the property owner, Mr. David Grossheim [96]. Two tanks are 10,000 gallon unleaded gasoline and one tank is a 10,000 gallon diesel fuel tank. The tanks are listed as having been installed in January 1984, however Mr. Grossheim indicates that they were installed by the previous owner when the facility was constructed in 1983. All three tanks are reported as single-walled fiberglass construction. The tanks are wired to an automated inventory / leak detection system. The tanks reportedly passed their most recent tightness testing conducted in February 2006 by a Nevada-certified tank tester.

According to Mr. Grossheim, one or more of the tanks began leaking in June 2006 after blasting was conducted across Lake Mead Parkway. The Westmark Group performed subsurface sampling near the tanks in December 2006 and reported no detectable petroleum. According to Mr. Kris Everett of Westmark on January 8, 2007, the firm will be present to oversee tank replacement in early 2007. As of July 2007, there is no reported spill from this site listed in the NDEP Corrective Actions database.

Energy Facilities. The subject property is not listed in a proprietary EDR database of known former coal gas facilities. The subject property has high power transmission lines over Parcel 14, and lesser power lines over Parcels 3, 4, 5, 11, 14, and 18. No oil or gas pipelines are known to be located on the subject property.

Groundwater Wells. Databases evaluated included: NDWR well list and Nevada groundwater site inventory. Nevada is currently developing a centralized listing of known and suspected Class V underground injection control sites pursuant to the EPA Clean Water Act. According to Mr. Russ Land of NDEP Bureau of Water Pollution Control, the list is compiled based on industry type, focusing on those industries that historically have utilized unpermitted dry disposal wells. Mr. Land indicated that the historic industry at the subject site is not part of the suspect group of industries.

Parcels 4 and 7 are known to possess groundwater wells. These wells are recorded in the NDWR database. The Parcel 4 well is the supply well of Laker Plaza. This well was installed in 2001 and is registered with NDWR as well log no. 82441. The well and associated appurtenances are registered as a public water supply through November 30, 2007. The NDEP identification number of the water supply system is CL-0942-12NC. The water from the well is highly mineralized. Mr. Grossheim has an elaborate water treatment system to render the water potable (filtration, reverse osmosis). The treated water is used to

produce fountain drinks and ice for public consumption.

The Parcel 7 well is the 10-inch diameter test well previously discussed in Section 2.4.3. This well was installed in 1991 and is listed in the NDWR database as well log number 35212. This well is currently out of service and may be in need of either rehabilitation or formal abandonment. Its recently observed condition is discussed in Section 5.2.2.

At least two lysimeters are installed in the ore storage yard. These were reportedly installed by Kleinfelder in the late 1980's or early 1990's to monitor the land application of ice cream sludge [97]. These devices do not appear to be registered with NDWR, nor are they serviceable at this time.

3.1.3 County and Local Environmental Records

Local Fire Department. The City of Henderson Fire Department has responded to various fires at the subject property over the years. Anecdotally, Zenitech was informed of a callout 10-12 years ago in which tires in the Hydro Pit were on fire. The fire department declined to fight the fire [96].

During review of county solid waste records concerning the former permitted landfill in the Hulin Pit, Zenitech found several references to fires in the early 1980's. On July 20, 1981 a lumber fire was reported at the landfill operated by Mr. Leonard Roy. The Henderson Fire Department responded. On August 4, 1981 a fire inspection by the Clark County Fire Department noted no violations, however. [71].

Zenitech made several attempts to contact the Emergency Management Coordinator for the City of Henderson Fire Department to investigate reports of fires at the site. Zenitech understands that Henderson does not maintain a readily searchable listing of fires or hazardous materials incidents.

Sanborn Maps. No Sanborn maps were found for the subject property or the immediate vicinity.

Landfills. The subject property is listed in the records of the Southern Nevada Health District (formerly the Clark County Health District, CCHD) under the case file name of Three Kids Landfill, LW001-JJD-01 [71]. A CCHD permitted landfill was operated in the Hulin Pit (Parcel 18) from July 1, 1979 through June 30, 1984, under the ownership and operation of two of the parcel's former owners, Mr. J.C. Lancaster and Mr. Leonard Roy, Sr.. According to the record, Mr. Lancaster operated the landfill for the first year and Mr. Roy operated it for the four subsequent years.

Table 4, following, summarizes the owners and operators during landfilling and land application years at the subject property. Title to this parcel is now held by the BLM.[9]

The landfill was permitted for construction waste, with explicit prohibitions against "wet garbage or toxic wastes." It was approved for the disposal of friable asbestos providing that daily cover was emplaced and a CCHD inspector was on hand during the burial of asbestos.

Mr. Roy was found to be frequently in violation of his operating conditions and often in contention with CCHD regulators. Examples from the record include: lack of site security, failure to prevent ongoing fires in the landfill, failure to prevent landfilling in the other two large pits, failure to provide daily cover, and dumping of fiber bags of friable asbestos over the edge of the 135 foot deep Hulin Pit. Evidence in the CCHD file included a photocopy of an asbestos bag label. At least one reported asbestos disposal client was Vegas Plasterers.

A caretaker who lived onsite, a Mr. Bill Kirkwood, reported in November 1983 that drums of paint or paint thinner were dumped by a company called State Stove, but a CCHD inspector did not find them upon inspecting the facility. During the period of operation, Mr. Roy was subject to no fewer than 28 inspections, sometimes as often as twice per week.

When the landfill permit expired in 1984, no formal closure or long term controls were recorded. Mr. Roy is deceased and since the property has reverted to BLM, no apparent controls or remediation of the landfill are known to have occurred.

Land Application. CCHD files included records of NDEP-issued land application permits from the NDEP Bureau of Water Pollution Control or its predecessor bureau. Their office in Carson City was not able to readily locate permit files for verification, however.

From March 1, 1990 through June 7, 1996, Gold Bond Ice Cream, Inc. (after 1993 known as Good Humor-Breyers® Ice Cream, a subsidiary of Unilever) was permitted to land apply ice cream wastes on land owned by Three Kids Enterprises, LP. Table 4 lists the permit numbers, owners, and operators found in available records. The sludge was land applied to the east half of the ore storage yard. The western remaining portion of the yard, that part closest to the Hydro Pit, was occupied with the DLA manganese stockpile at this time. The area where land application was performed now grows grasses in a density greater than elsewhere on site.

Clean Air Act Amendments (CAAA). The subject property is not listed in reasonably ascertainable records of NDEP as a facility requiring a risk

[9] Messrs. Roy and Lancaster, and others, lost their claim of simple fee title in a color of title act lawsuit and subsequently a 1991 Nevada Supreme Court ruling. The Hulin Pit and other properties Mr. Roy contended he owned were found by the court to belong to the USA and this finding was later recorded at the Clark County Assessor August 25, 1993.

management plan or as a CAAA Title V permitee for hazardous air pollutants under the National Emissions Standards for Hazardous Air Pollutants. BLM, BOR, and TKE were compelled to implement dust control measures ca. 2001-2003.

Table 4
State and County Disposal Permits
On the Subject Property

PERMITEE / OWNER	OPERATOR	PERMIT NO.	PERMIT DATES
Solid Waste Permits			
Three Kids Mobile Park, Inc.	J. C. Lancaster (Parcel 18)	B0041	7/1/1979-6/30/1980
Three Kids Mobile Park, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	B0041	7/1/1980-6/30/1981
Three Kids Mobile Park, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	B0041	7/1/1981-6/30/1982
Three Kids Mobile Park, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	[a]	7/1/1982-6/30/1983
Nevada Disposal, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	B0041	7/1/1983-6/30/1984
Three Kids Enterprises, LP (Bertuccini, Andress, Gubler)	Hollywood Gravel Co. LP (Parcels 1 & 9)	application only, withdrawn	7/1/1998-7/1/2018
Wastewater Application Permits			
Gold Bond Ice Cream, Inc.	Three Kids Enterprises, LP (Parcel 5)	87900301	3/1/1990-2/28/1993
Gold Bond Ice Cream, Inc.	Three Kids Enterprises, LP (Parcel 5)	NEV91002	6/7/1991-6/7/1996
Septic Tank Permits			
M&R LP	Lake Mead Boat Storage (Parcel 2)	S110Z	N.D. [b]
David Grossheim	Laker Plaza (Parcel 4)	[c]	N.D. [b]

[a] Permit inferred from other case records, which indicate the landfill activity and inspections; actual permit records not found.

[b] Date not reported.

[c] Permit not confirmed and was not reasonably ascertainable.

3.1.4 Miscellaneous Records

A Phase I Resource Checklist of all records reviewed for this Phase I ESA is provided in Appendix B.1. Supplemental land records showing patents, deeds, rights-of-way, and other conveyances are provided in Appendix B.2.

Facility Compliance Records. No reasonably ascertainable facility operation records were found, including from the original mine or mill site. Plans, diagrams, site layouts, and mine cross sections were obtainable and have been reviewed. The findings from this review are contained in the historical narrative, Sections 2.5.3 and 2.5.4, and in Section 3.2.

Occupants of Parcels 2-4 employ less than 10 persons and consequently are not required to have established hazard communication programs pursuant to 29 CFR § 1910.1200. No SARA tier I, tier II, or toxic release inventory (Form R) under the Title III Community Right to Know Act was found, except that for the Gold Bond Ice Cream Company, previously discussed.

3.2 Historical Records

Zenitech has reviewed a vast number of historical records of the mine, mill operation, and subsequent landfilling and land application records. As well, several earlier limited Phase II studies of the site have been reviewed. Zenitech was not able to obtain explicit operational records of the mills; most of what we know about the actual plant processes has been assembled from hundreds of individual references pieced together. A list of libraries consulted is provided at the end of the body of this report.

Referring to maps found mostly in the state libraries at University of Nevada, Reno, Zenitech was able to corroborate the approximate timing and sequence of events at the site from the years 1917 through 1961, as previously shown in Table 2. Some of these maps, if properly assembled, may provide a topographic map of most of the early mine site prior to the existence of the A and B Pits, the Hydro Pit, the Hulin Pit, and the tailings ponds. Such a map would be useful in subsequent remediation planning activities.

3.3 Prior Assessments

The work of Ninyo & Moore, JBR, Envirocon, BOR, and others has preceded current study on the subject property and the downhill property to the north. Significant findings have been discussed previously in this report. Prior studies may have been conducted during a time when different regulatory standards were in place, with a targeted scope of services, or with limited financial resources available. Consequently, findings of these documents may not agree with Zenitech's current findings. Furthermore, expanded site assessment yet to be conducted may modify current findings. A summary of the most significant environmental and geotechnical reports reviewed is provided in Table 5.

Table 5
Significant Prior Assessments/Studies Reviewed
(Not including Workplans, Biological, or Cultural Studies)

TITLE/YEAR	AUTHORING ENTITY	SIGNIFICANT FINDINGS
Geologic/Geotechnical Evaluation of Proposed 1000 Acre Development, Clark County, Nevada, 1984 [a]	Geotechnical Services, Inc.	Soil fertility is problematic; overburden will not make good quality commercial aggregate.
Draft Preliminary Assessment, Henderson Lead Site, Clark County, Nevada, 1995 [65]	Bureau of Reclamation	Elevated lead levels on north side of Lake Mead Parkway resulted from former mine/mill operations.
The Migration of Arsenic and Lead in Surface Sediments at Three Kids Mine, Henderson, Nevada, 1995 [98]	University of Nevada, Las Vegas	Arsenic and lead are transported by storm events, not solubility; some off-site influences from the site were detected.
Manganese Transport: A Preliminary Study of the Three Kids Mine and Surrounding Area, 1997 [99]	University of Nevada, Las Vegas	Manganese is transported by storm events; aerial deposition after wind events also moves contaminants; five metals (arsenic, lead, copper, zinc, and manganese) were not normally distributed.
Overburden and Native Material Characterization, Three Kids Mine, Clark County, Nevada, 1998 [28]	Geotechnical and Envmtl Svcs, Inc.	Native rock generates soluble arsenic using MWMP[b]; native rock is not acid generating.
Preliminary Soil Assessment Report, Three Kids Mine, Clark County, Nevada, 1999 [31]	Ninyo & Moore	Tailings contain elevated lead, arsenic and petroleum; petroleum exceeds state action level
Test Well Sampling Report, Three Kids Mine, Clark County, Nevada, 1999 [29]	Ninyo & Moore	Groundwater has geothermal signature and is naturally high in arsenic, aluminum, and total dissolved solids.
Asbestos Bulk Sample Survey, Three Kids Mine Site, Henderson, Nevada, 1999 [a]	BEI	Friable and non-friable asbestos containing materials exist on site and will require licensed removal.
Supplemental Preliminary Soil Assessment and Waste Characterization Report, Three Kids Mine, Clark Cty, NV, 2000 [100]	Ninyo & Moore	Tailings generate arsenic-bearing runoff using MWMP; tailings are not acid generating; native material beneath tailings is not impacted by tailings; mill site soil generates several metals using MWMP.
Site Investigation Report, Three Kids Mine Property, Clark County, Nevada, 2000 [101]	JBR Environmental Consultants	TPH in tailings is typically less than 3,000 mg/kg diesel range; TCLP exceedances are uncommon in tailings.
Site Investigation Report Supplement, Three Kids Mine Property, Clark County, Nevada, 2001 [102]	JBR Environmental Consultants	Arsenic, lead, and manganese exceed Reg. IX PRGs in all tailings ponds, but other RCRA metals always below PRGs in tailings.
Summary Report: Environmental Studies and Reclamation Activities, Three Kids Mine Property, Clark County, Nevada, 2001 [103]	JBR Environmental Consultants	Summarizes the findings of previous reports; tailings are Bevill exempt under RCRA; estimated tailings at 2.1 M yds^3 and pits at 8.5 M yds^3.
Final Preliminary Assessment, Henderson Remote Site, Nevada, 2001 [69]	Parsons Engineering Science	Nodules and ore formerly stored by DLA did not exhibit RCRA metal characteristic levels; soil in one pile footprint failed TCLP for arsenic.
Manganese Ore Disposition, Three Kids Mine Site, Henderson, Nevada, 2004 [68]	Defense Logistics Agency	Nodules and ore may have lead up to 2%; soil in ore yard consistent with ore.

[a] Study referred to in *Summary Report: Environmental Studies and Reclamation Activities, Three Kids Mine Property, Clark County, Nevada*, 2001 [103].

[b] *Meteoric Water Mobility Procedure*

Section 4
Interviews

4.1 Interviews

Interviews and ongoing conversations were conducted with persons knowledgeable of the site. The operational period of the mill ended 46 years ago, making it difficult to identify living persons with a first hand knowledge of mine and millsite operations.

Mr. Todd Croft, supervisor of the Las Vegas office of NDEP's BCA, has been actively involved in the regulatory oversight of the subject property since April 1999, when levels of petroleum hydrocarbons in the tailings were first reported to NDEP. Mr. Croft was familiar with the case file on the subject property, particularly with regard to what is currently known about the chemistry of the tailings and the geology and hydrology of the site. He indicated that NDEP's goal for the site is for property owners to work jointly under a single assessment and corrective action to control existing hazards to human health and the environment.

Mr. Croft is knowledgeable about other sites in the Henderson area and informed Zenitech that some beneficiated manganese was reported to have been sent to Western Electrochemical Company, Inc. (WECCO) for processing into high purity manganese dioxide. Anecdotally and from limited mention in historical texts, it appears that the processes employed by WECCO (predecessor to Kerr-McGee Chemical, itself predecessor to today's Tronox LLC), utilized the carbonate-based manganese of the Pioche and Gabbs mines, not the high silica manganese of the Three Kids Mine [24, 25, 97, 104]. Mr. Croft also indicated that manganese from TKM was transferred to a rail siding in Henderson for loading. This location is more recently known as the Levy Trust site (in the vicinity of the Interstate 215-95 interchange and the Fiesta Hotel and Casino, Henderson). The Levy Trust site is a closed case.

Mr. Jeffrey Smith is the Regional Hazardous Materials Coordinator for BOR, Lower Colorado Region. Mr. Smith has been involved in the site since the outset of dust control concerns, circa 2002. He was BOR's liaison to CCDAQEM in controlling dust from BOR's eastern tailings (Tailings Pond 1), by using the DLA stockpile of low-grade nodules to act as a dust palliative. He was fairly certain that ore pile 3 was moved on site to Parcel 15, to a position close to Parcel 2.

See the related discussion in Section 4.2 [105].

During the evaluation of the EDR database report, numerous orphan sites were noted (Appendix B.1). The term orphans, as used by EDR, means case files which are lacking decisive locational information. EDR lists records that may or may not be within the designated radii. Orphans are reconciled by confirming the location of these sites with agency staffers. Mr. Croft (BCA) and Mr. Michael Richardson, Supervisor of NDEP Bureau of Waste Management, were both consulted regarding orphans [97, 106]. All EDR orphans were found to be sufficiently distant from and/or unrelated to the subject property. Vicinity cases known to have a relationship to mine or mill operations were previously summarized in Table 3.

On January 2, 2007, Zenitech interviewed Mr. Laird Noble-Sanders, owner/operator of Lake Mead Boat Storage (LMBS), which occupies Parcels 2 & 3. Mr. Sanders put the age of his buildings at 20 to 22 years (ca. 1985-87). The property was originally developed by a Mr. Holbrook who then sold it to Mr. Sanders. Mr. Sanders' business entity has changed over the years; it is currently known as M&R LP. He stated that his buildings did not have lead-based paint, asbestos containing materials, or PCBs. According to Mr. Sanders, no hazardous materials or explosives are allowed on site.

Mr. Sanders stated that he does not have a well or a city water hookup. He hauls water from a hydrant permitted by the City of Henderson. LMBS has two toilets on a permitted septic system, which utilizes the hauled water. The system is a septic tank/leach field type, which is pumped out "every few years." He stated that there were no underground storage tanks on his property.

When asked about the land his facility was built on, he stated that it was his understanding that the "surface was pushed back and gravel was put down." He was unsure if his property had originally contained tailings. He referred to a 1995 Phase I ESA prepared by Western Technologies that apparently did not find any RECs. This study has not been reviewed by Zenitech.

Mr. Sanders was asked about the rest of the subject property. He stated that trespassing was a serious problem and that off-highway vehicle (OHV) traffic increases the production of dust that often blows onto his site. Mr. Sanders stated that he only uses water as a dust control on his lots and that he has noticed that his soil "hasn't grown [anything]."

He referred to a former ultralight aircraft operation that took place on the west-central portion of the subject property. The operation was discontinued due to lack of permits. He indicated that a Mr. Gripentog was involved in the operation and that he was killed in a light aircraft accident. Further research into this person and the former operation was inconclusive [107].

Mr. David Grossheim was interviewed on January 4, 2007. Mr. Grossheim is owner/operator of Laker Plaza (Parcel 5). The facility is a combination gas

station, convenience store, bait shop, and boat storage facility. Mr. Grossheim sublets a portion of his lot to a jetski rental company called Skiwi Rentals. He stated that the property was developed in 1983 and that he bought it in 1988. The buildings are reported to not have lead based paint, asbestos containing materials, or PCBs, according to Phase I ESA studies performed by Terracon in 1995 and 2002.

Mr. Grossheim indicated that the property has its own well with a drinking water treatment system. The facility is permitted under a public water supply permit to dispense the water in fountain drinks and to make ice. He stated that the facility has a septic tank and leach field.

There are currently three USTs on site. Mr. Grossheim stated that he had been in compliance with the tanks until June 2006 when a leak test failed. He attributed the leak to blasting which took place across the street just prior to the tank failure. These “illegal” blasts resulted in windows being blown out of his storefront and large boulders being dislodged from a retaining wall behind his property. He hired Westmark Group to investigate the tanks and they reported no total petroleum hydrocarbons (TPH) in excess of the SAL. As of this writing, the tanks have been repaired or replaced and are awaiting backfilling. No corrective action case file had been opened for the site as of this report’s publication date, suggesting that no reportable release has been detected.

Mr. Grossheim stated that trespassing on the subject property is frequent. He estimated approximately 50 times per year he has observed trespassing. On one occasion in 2006 three apparent rock collectors were seen in the bottom of the Hydro pit, a pit with adverse safety hazards. His storage tenants have been vandalized and robbed on several occasions, typically with the perpetrators gaining access from the mill site through a back fence.

Asked about any other information he could share, Mr. Grossheim stated that he remembered a fire in the Hydro pit approximately 10-12 years previous (ca. 1995-97). He thought that tires in the pit were on fire. He stated that the Henderson fire department was called but that they were unable to fight the fire [96].

Mr. Lee Sorensen was interviewed on January 2, 2007. He is owner/operator of Brand-Ford, a building relocator. Mr. Sorensen leases a laydown yard from TKE for the large “I-beam” steel and other supplies used in his trade. He has been a tenant since approximately January 2005. He stated that the steel is 30 to 40 years old, but that it has never been sandblasted or stripped.

He stated that trespassing has been a problem. He indicated that “rockhunters, four-wheelers and dirt bikers” have been seen on the site and that someone has been stripping his vehicles. He indicated that he had not seen any fires, but he had seen evidence of them in the way of burnt wood [108].

On January 29, 2007, Mr. John Janus was interviewed. Mr. Janus' father, a Mr. David McDowell, worked at TKM, starting in late 1954 or early 1955. He was a welder and repairman for the kilns. Mr. Janus was in the armed services in the mid-1960's, re-entering civilian life in June 1967. At that time he worked with his father salvaging one of two 10,000 to 30,000 gallon steel tanks on site. These tanks were not water tanks. Mr. McDowell had previously removed the tops of the tanks. Mr. Janus climbed down a ladder into one of the tanks to begin cutting the sides. The sparks from the welding ignited a layer of sludge on the bottom of the tank. The two were unable to extinguish the fire. They apparently notified the nearest fire department, who then responded. The fire was out the next day, but the welding gas cylinder or cylinders had exploded during the fire, denting the steel tank. Mr. McDowell died some time ago and Mr. Janus has retired to Utah [109].

Zenitech interviewed Mr. Elmer Marshall on August 3, 2007. Mr. Marshall worked on the drilling and blasting crew from 1955-57. He was in his early 20's at the time. He worked in the stripping and mining operations in the A pit and the Hydro pit. Mr. Marshall said he didn't know anything about the mill side of the operation, but he was able to identify for Zenitech staff some of the early buildings which were previously difficult to characterize. He also indicated that the Hulin pit was named for a man who worked in the scalehouse. Mr. Marshall stated that he knew of none of his former coworkers or bosses who were still alive [110].

4.2 Anecdotal References

During the course of researching the history of the subject property Zenitech received unqualified or uncorroborated information regarding historical site operations. The accuracy of these statements has not been verified, although attempts to do so have been noted, as appropriate.

During the past three years, Zenitech has observed the placement of additional trash, vehicles, boats, and tires on the subject property, although this has slowed significantly since trespassing controls were instituted February to April 2007. Zenitech was particularly concerned with the timeframes associated with the use of the pits as dumpsites, since aerial photographs were not of sufficient resolution to observe changes in dumping patterns. Field reconnaissance revealed that many of the tires, boats, and drums are significantly weathered, suggesting a timeframe of ten or more years ago. A tire repairman in Boulder City commented that he used to roll tires into the pits "about 25 years ago."

A local geologist mentioned a certain Joe Espy (deceased), who, in the early 1980's, apparently obtained some sort of waste product from the City of Henderson, which he intended to market as a fertilizer. The City advised him to have it tested for pollutants and it was found to contain elevated levels of DDT and other, unnamed constituents. The source indicated that he may have dumped the material somewhere on the east side of the subject property. No material fitting this description was observed during site reconnaissance.

The DLA Preliminary Assessment stated, “approximately 500 square feet of Pile 3 contains a white powdery substance that was deposited at an unknown date. Facility reports indicate that this material is an alkali that may be a result of leachate (notification of stockpile inspection report, February 1, 1978)” [69]. Zenitech is unable to ascertain if this substance is the rumored Espy material as Pile 3 was removed from the DLA lease area and no white deposits are apparent. Due to terminology used in the subsequent DLA report on the management of the ore and nodules, it is unclear if the ore was placed onto the Parcel 14 tailings or taken offsite [68]. Visual inspection of the tailings suggests that only the nodules were placed there.

Section 5
Site Reconnaissance

5.1 Photo History

A variety of photographic resources were utilized in this investigation, including historic aerial photographs and satellite images, historic mill photos, archived snapshots, and recent photos of site conditions. Historic aerial images were sourced from the USGS, Quickbird (a commercial satellite), and archived reports.

5.1.1 1950 Aerial Image

An aerial photograph from July 1950 was reviewed. The image is of good quality. The Three Kids Pit and the B Pit are visible. Stripping of the A Pit, Hydro Pit, and Hulin Pit have not yet begun. The wash that would have run into the B Pit has been modified to drain around the B Pit to the east and north. This realignment of the drainage also kept surface water from flowing into the mill site. No large piles of waste rock are visible, suggesting that all overburden from stripping of the B Pit was used in the cutoff dam, the wash re-alignment, the tailings dam, or as base for the ore yard.

The ore storage yard appears dark across the entire acreage. The mill site outline is visible, although individual mill buildings are either poorly defined or have already been removed. The water tank on the hill east of the mill is visible. The seven original thickeners are visible, as is a whitish area approximately 300 feet in diameter to the immediate northwest of the thickeners. It is not apparent whether this is scarified land or a pile of byproduct material.

The outline of the original tailings pond (Tailings Pond No. 1), as was recorded in a 1945 plan view of the site (Plate 8, Appendix C.1), is visible. The volume of tailings in the pond is quite small, relative to later images. Dark coloration of several drainages is visible. Since the mill site had been inactive for six years leading up to this image, these dark areas are thought to be stains and are consistent with the discharge of mill process wastewaters into the washes. At least six darkened drainages are visible: one east of the mill layout, one northeast of the mill, two smaller drainages from the northwest corner of the mill site, and two larger channels beneath the tailings dam. The easternmost dark area starts abruptly, suggesting the outfall of a waste pipe. The first two drainages combine northeast of the subject property and appear to flow to the Las Vegas Wash, becoming less dark as their distance from the mill increases.

The next two small drainages appear to pass under or over Lake Mead Parkway and follow a southwest-bearing channel along the north side of the present day parkway. This drainage then joins the tailings pond drainages in the Three Kids Wash and together they flow northwest to the Las Vegas Wash. Discoloration does not lessen significantly with distance from the site, suggesting that in 1950 the tailings dam was still seeping free liquid. It can also be seen that the south face of the tailings dam wrapped around as it did to allow a major braided wash to drain northwest, around the tailings impoundment.

The BMI control line service road is apparent in the southwest quadrant of the subject property, although poles are not. Also notable in this image is the street layout of the former townsite, located in the position of present day Lake Las Vegas Parkway.

5.1.2 1955 Aerial Image

A reprinted aerial photograph from a 1954-55 timeframe was reviewed. The source of the image reviewed was a U.S. Bureau of Mines report from 1956, although the photo appears very similar to one printed in a 1954-era issue of Manganese News. The image is of moderately poor quality.

In the photo, the B Pit is open, and stripping on the A Pit has not progressed much further than in the 1950 image. The ore stockpiles are better defined and appear to be more level than when the second mill inherited 300,000 tons of ore from the first mill (i.e. some of the stockpile had been processed by this time).

In the mill area, the crusher, mill building, and filtration building can be seen. A cloud of effluent gases/fumes is visible, appearing to emanate from the lead and manganese scrubbers. The two largest and three smallest thickener tanks appear to be in use, and the newest eighth thickener is also visible. The northeast drainages are again discolored, albeit less so than in the 1950 image.

North and southwest of the thickeners are several regions of unexplained dark material, as well as the previously observed whitish area. Tailings Pond No. 1 has had an interstitial dike constructed and more tailings are observed than previously. Additional tailings ponds have not yet been constructed, although an extension to the waste haul road south of the tailings has been added. Dark seepage is observed below the tailings dam.

5.1.3 1973 Aerial Image

A USGS aerial photograph from October 1973 was reviewed. This image is of poor quality, but major features could be distinguished. All of the pits are now visible. In the ore yard, ore appears to be absent, but the DLA stockpile adjacent to the Hydro Pit is seen.

The mill area is indistinct, however the water tank, northeast drainage, and thickeners are visible. The drainage is not visibly darkened. All three tailings impoundments are visible as are major waste rock piles, mine roads, and processing wastes, largely in the condition they are found in present day.

5.1.4 1980 Aerial Image

An October 1980 USGS aerial photograph was reviewed. This image is of moderately poor quality. All pits are observable. The DLA stockpile is present as in the 1973 image. The mill site features are indistinct, although it appears that there may be a mound of material in the vicinity of the former kiln line. It cannot be determined if the water tank is still present, or only its foundation. Thickener tanks are visible. Tailings and waste rock piles appear similar to 1973. In the western edge of the subject property a swath of clear land is observable and is thought to be a Southern Nevada Water Association (SNWA) waterline alignment. A portion of the townsite is still visible north of present day Lake Mead Parkway.

5.1.5 1994 Satellite Image

A USGS digital orthoimagery quarter quadrangle (DOQQ) satellite image from July 1994 was reviewed. The image is of very good quality. All pits, waste rock heaps, and tailings are visible, as previously seen. The water tank is absent. The mill area is visible, with darker regions in the nodule stockpiling area and around the former filtration building. The seven original thickener foundations are seen, as are the two octagonal sump foundations. The DLA stockpile is seen in the western corner of the ore storage yard.

Several new activities are visible in this image. In the ore yard, the middle third of the yard is visibly dark, as is a portion of the mine road approaching this area. The date of this image is consistent with the land application of ice cream sludge, and possibly also drinking water treatment sludge, in this area.

For the first time, Lake Mead Boat Storage (LMBS) and Laker Plaza are visible. Both occupy a portion of Tailings Pond No. 1, with the majority of LMBS overlaying the original tailings. There are indications that material was piled onto the tailings immediately west of LMBS, which may have been the result of grubbing the surface of the tailings to create a level business place. LMBS appears to have utilized approximately 70 percent of the area of Parcel 2, but nearly none of Parcel 3, at this time.

Laker Plaza (Parcel 4), and an equal sized parcel to its east appear graded or filled with a light colored material. The present day back lot of Laker Plaza shows some objects parked in a row, of a scale that suggests vehicles or storage boxes. The pump stand and bait shop building appear indistinctly. It is not clear from this image whether Laker Plaza is built upon clean fill placed over the tailings or if the original tailings were first stripped.

Along the western edge of the main tailings dam, an access road from Lake Mead Parkway through the face of the dam is visible for the first time. The road heads southwest through Tailings Pond No. 2 and then appears to turn southwest up onto the Hulin waste rock piles. Zenitech believes this road may have been constructed as a haul road for the landfill operations of 1979-1984. The position of this road also suggests that wastes were dumped off the top of the Hulin waste piles, northwest of the pit itself, and possibly directly over the side of the pit, corroborating findings during records review and site inspection.

Outside the property lines of the subject property to the south and west, some of the early infrastructure of the SNWA water distribution system can be seen, notably, access roads, a vertical, cylindrical tank (appearing as a rectangular shape due to shadowing), and additional waterline easements heading northwest. Due north of the water tank, on the subject property and close to the BMI control line, a manmade rectangular feature is visible. It was not visible in earlier years due to image resolution and is not visible in future years due to installation of a riprap drainage over the same area.

North of the subject property, Lake Las Vegas Parkway is partially constructed. Remains of the western edge of the townsite are still visible. The northeast corner of the intersection of Lake Las Vegas Parkway and Lake Mead Parkway is freshly graded. It was in this area that the Henderson Lead Site remediation had been concluded two years prior.

5.1.6 1999 Satellite Image

A USGS September 1999 DOQQ satellite image was reviewed. Image quality was fair. The mine pits, ore yard, mill site, waste piles, and tailings appeared largely as previously observed in 1994. The DLA stockpile is clearly visible. Land application of sludge is not apparent.

LMBS appears much as in 1994, with the addition of increased activity in the back 4-acre parcel (Parcel 3). A covered storage area appears to have been added to the premises. The front driveway of Laker Plaza appears asphalted. The bare lot next to Laker Plaza appears similar to its condition in 1994.

In 1999, two water tanks are now visible near the SNWA compound and land for an improved drainage has been cleared on the subject property. North of the subject property, Lake Las Vegas has begun landscaping their main entrance and has added a new entrance road across from the very northern tip of Parcel 17.

5.1.7 2005 Satellite Image

A Quickbird satellite image from June 2005 was reviewed. The image quality was very good. Onsite features remained largely as in 1999 except in the DLA stockpile area, where the stockpiles were no longer visible, and in the west end of tailings pond 1, where manganese nodules had been laid down as a dust

suppressant. Across Lake Mead Parkway to the north, golf links and home lots are visible around the Lake Las Vegas entrance.

5.1.8 Incidental Snapshots

Various incidental snapshots were reviewed in the archives of PJB Management, the NDEP case file, the SNHD case file, the BOR project records, and throughout numerous reports reviewed. Photos providing substantive content are mentioned herein.

Files of PJB Management included snapshots covering a range of topics [52]. Of greatest significance and rarity were at least 100 8x10 inch black and white prints from the 1950's. These photos showed many important mine and mill site features, including excavation and blasting in the A/B Pit, the crusher circuit, the inside and outside of the new mill building (ca. late 1953-early 1954), the flotation circuit, the kilns, and the product stockpiling. Also shown is the nodulizing kiln failure of February 1953, and Tailings Pond 1 prior to placement of tailings. A selection of these photographs most indicative of the processes of the site are included on the disk in Appendix C.1.

Also of interest in the PJB files was a snapshot of the lower bench of the B Pit showing the explosives magazines of Sanders Construction (aka Sandex). The PJB record included photos of dust control activities from the early 2000's. Application of dust palliatives, the chemical products used, and the watering truck were depicted. BOR records also included images of the dust control activities.

The SNHD case file includes photos of the land application of ice cream factory sludge onto the ore storage area. The photo indicates that large oval tracks of sludge were laid down. In the SNHD file on the Three Kids landfill, the most significant image was a photograph of bags of dumped asbestos, which were reportedly disposed into or near the Hulin Pit. The image indicated the contents to be 100 percent asbestos fibers [71].

5.2 Site Inspection

Site inspection occurred over a one-year timeframe, from December 2005 through January 9, 2007. Many of these visits were prior to retention of Zenitech as environmental consultant by Lakemoor Development, but which contribute to a more complete understanding of current site conditions. Inspections directly related to this Phase I study occurred on December 1 and 21, 2006 and January 9 and 18, 2007. Conditions described in the following sections are current as of the last inspection date. Photographs provided in Appendix C.3 state the date on which they were taken.

5.2.1 Mines

Open Pits. The first historic mine pit, the Three Kids Pit, was observed to be in relatively undisturbed condition due to the deep channel which bisects it from the A and B Pits. Impacts from target shooting and littering were noted. Large objects of waste, such as abandoned vehicles or boats, were absent. No containers of potentially hazardous materials were observed. Desert plants, though sparse due to the rocky terrain, did not appear to be in distress. Two shallow adits were observed on the hillside above the pit, but dangerous conditions due to the abandoned pit and shafts were found to be low. The Three Kids Pit is shown in Photo 1, Appendix C.3.

The A and B Pits were found to be partially accessible by 4WD vehicle. The upper portion of the pit, comprised mostly of the B Pit excavation, is up to 180 feet deep (Photo 2). Abandoned vehicles, trash, and two small wire burning sites were noted (Photos 37 and 42). The pit has unsecured sheer cliff faces in excess of 100 feet. The A Pit is accessed from the bottom west end of the B Pit. Due to erosion, the haul road to the bottom of the A Pit is inaccessible by vehicle. Zenitech personnel were able to gain access to near the pit bottom by foot. The A Pit has an abandoned piece of heavy equipment and some trash in it (Photos 3 and 41). No containers of potentially hazardous materials were observed. Desert plants were observed to be very sparse. The very bottom of the A Pit reveals dried, cracked mud, but no standing water.

The Hydro Pit is not safely accessible without ropework due to waste rock which has been previously pushed onto the pit haul road about 200 yards from the top of the pit (Photo 4). The pit was observed to have several abandoned vehicles and boats on lower portions of the haul road and in the bottom. Tires, trash, and unidentifiable debris also exist in the pit bottom (Photo 43). Visible portions of the bottom of the Hydro Pit reveal dried, cracked mud, but no standing water.

The Hulin Pit may be entered by foot to a position close to the bottom (Photo 5). The haul road is partly eroded near the entrance to the pit. The pit was observed to have several abandoned vehicles and boats on lower portions of the haul road and in the bottom. Tires, trash, rusty containers, and unidentifiable debris also exist in the pit bottom and along the east sidewall (Photos 36 and 44). Dried, cracked mud, but no standing water, was observed on the very bottom of the Hulin Pit.

Waste Rock and Overburden. Gypsiferous waste rock and gravelly overburden are piled in three principal areas and have been used to construct three earthen dams. Waste rock piles are generally associated with the three larger pits, with A/B Pit waste piled north and northwest of the pit (Photo 50); Hydro Pit waste piled west and northwest, near and in the tailings areas (Photo 49); and the Hulin Pit wastes piled to the northwest of that pit (Photos 40 and 49). Waste rock was comprised of Muddy Creek gypsum and mudstone, plus low-grade wad and gravelly alluvium.

Waste rock areas generally showed less visible impact than the pit bottoms. Some trash, target shooting, and abandoned boats were observed. The area near the Hulin Pit access is littered with a large quantity of solid waste ranging from building materials to abandoned drums (Photo 39). Waste rock piles were observed to have typically sparse vegetation. Though Las Vegas bear poppies tend to grow in gypsiferous soils, which the waste rock piles consist of, no individuals were observed in this area.

Immediately southwest of the Hydro Pit (Parcel 18), is an area of blackish processing waste, which is neither tailings, nor nodules. Some of this material appears to have been fired in a kiln, other regions give off a noticeable odor of aged petroleum when the weather is warm, and still other material appears as if it is low-grade ore (Photo 30). The area was formerly fenced with barbed wire by BLM during earlier dust controls, but the fence has been cut in two places allowing OHV's to pass through the area. This area was noted as an REC in BLM's most recent land disposal environmental impact statement [111].

In the waste rock piles immediately northwest of the Hulin Pit, buried debris consistent with a landfilling operation was noted (Photo 40). Stacked tires, cardboard, construction debris, and steel drums were observed to be eroding from a hillside covered with waste rock. This area is possibly one of the asbestos burial locations referred to in CCHD records. South of this pile is a large steel furnace component still containing some firebrick. It appears to be a high temperature hopper used at the feed end of the former nodulizing kiln.

5.2.2 Mill Site

Ore Storage. The south end of the mill site, a large flat area of approximately 23 acres, is the location of the former ore stockpiling area. The area is divided into three roughly equivalent rectangular parcels oriented north to south. The westernmost of these is bounded by the Hydro Pit to the west and was used for the DLA stockpile of manganese nodules and ore between 1959 and 2004 (Photo 7). The area is now vacant with a black color to the earth. Plant growth here ranges from none to very sparse.

The central region of the ore storage area was used for storing ore into the late 1950's and was vacant by 1961 (Photo 6). This area was observed to be largely covered by a desert grass, dried and apparently dormant, at the time of reconnaissance. Sparse creosote bush was also observed. This area was the location of land application of ice cream sludge during the 1990's. It stands to reason that the greater grass growth noted here is a result of additional organic matter resulting from sludge application.

The eastern third of the ore storage area formerly housed the ore grading station and/or scalehouses, some mill site outbuildings, and ore storage. During reconnaissance, the area was observed to be used by a tenant of TKE (Brand Ford) as a laydown yard. The materials observed include: large lengths of I-beam steel (the tenant is a building relocator), wood blocks and beams, three trucks,

and various other appurtenances required in the building relocation trade. Also noted were piles of solid waste consisting of wood and steel scrap.

Crusher Circuit. North of the ore storage area, in the south central region of the former mill site, ore was fed into the crusher circuit. All that currently remains of these facilities is a concrete retaining wall and wooden beams where the ore hopper was once located. The crusher buildings are entirely gone, although some foundations may exist under the existing ground surface.

Mill Buildings. All of the buildings of the former mill are gone. Varying amounts of foundation rubble exist, but other evidence of buildings is almost entirely absent. Zenitech presumes that any valuable articles of steel or wood were either sold off in the 1962 auction or taken later by salvagers. The mill site grounds are widely blackened by manganese ore; creosote bush and tumbleweed have been successfully reestablished (Photos 10-16). In some parts of the mill site waste materials are seen in heaps (Photos 33-35).

Thickener Circuit. The foundations of all eight thickening tanks remain on site. Seven date from the 1942 mill; an eighth was added during the operation of the second mill. These are circular concrete basins ranging in diameter from 120 to 250 feet (Photos 12, 14, 17 and 18). Each has a circumferential concrete wall approximately 4 to 8 feet in height. Several of the thickeners were observed to be largely empty, except for some recently abandoned solid waste. At least two are partially filled with a thickener-related residue. The westernmost three thickeners are surrounded by a fine black sediment similar to the tailings. On the outer wall of some thickeners, remains of a vitrified clay pipe (VCP) drainage system are present. Some VCP contains a whitish residue, some contains a blackish residue, while other VCP was observed to be intentionally blocked up with rags, probably from the mill retrofit ca. 1952.

Also in the thickener area are two octagonal sump building foundations. No pumps, flooring, or roofs remain. A close review of the 1952 plant flowchart (Plate 9, Appendix C.1) does not clearly reveal the name or function of these sumps. They may have been used to capture overflow of concentrate from the thickeners, or conversely, to capture underflows which were then pumped to the tailings pond. Then again, they may have been used only in the first mill and are therefore not depicted in the 1952 plans. The sumps can be seen with their roofs in Plate 48, Appendix C.1. The sumps have unprotected hazardous fall potential and may also harbor hazardous conditions in the underground chases (Photos 19 and 20).

Kiln Area. The former kilns were arranged in a north-south fashion in the middle of the mill site. The only apparent remain of the kiln circuit is the north end support for the nodulizing kiln trunions (Photo 16). Residues in this area appear similar to those throughout the remainder of the mill site.

In several places in the kiln area and overall mill area, former pipelines and waste lines are in evidence. In the area east of the nodule cooling and storage area, a

steel pipe approximately 16 inches in diameter is exposed (Photo 21). To the northeast of this location, an exposed trench has the remains of what appears to be a wooden wastewater conveyance and a ductile iron pipe (Photos 22 and 24). In several locations around the kiln and mill site, remnants of old-fashioned brick and mortar wastewater interceptors were seen (Photo 23).

Product Stockpile Area. The northernmost end of the mill site, adjacent to Lake Mead Parkway, is where finished nodules were staged for loading into trucks. The area has foundation rubble, building debris, and other forms of solid waste. The surface is blackened. Creosote bush is established in moderate density (Photo 16).

The test well discussed previously in Section 2.4.3 is located east of the former product stockpile area (Photo 31). During the site reconnaissance the well cover on the test well was observed to be vandalized and open. Judging from rust and lack of recent tire tracks or footprints, it appears to have been in this condition for some time. The well was sounded to 1,000 ft bgs and fitted with a new lock in May 2007.

5.2.3 Tailings

Tailings consisting of water, silica, iron, lead, arsenic, and petroleum flotation residuals were piped into tailings ponds west of the thickeners (Photo 29). The largest tailings pond, generally referred to as Tailings Pond No. 1, was closest to the thickener circuit. These tailings are bisected by the TKE-BOR property bounds and correspondingly have two different dust control treatments. The TKE tailings surface was observed to be powdery dry, with no vegetation growth, and with low to moderate damage from OHVs. The BOR portion was covered with approximately four inches of waste nodules (Photo 25). Two other tailings ponds, Nos. 2 and 3, are west and southwest of the first pond, respectively. These ponds do not have a good crust for dust control, primarily due to damage from OHV trespassers. Tailings Pond No. 2 has some grass growing, with densities ranging from none to slight (Photo 26). Tailings Pond No. 3 has better grass growth ranging from none to moderately low (Photo 27).

Fugitive dust was observed to be created by OHV trespassers who ride across the tailings, waste rock heaps, and mine roads at a high rate of speed. Tailings Ponds No. 2 and 3 appear the hardest hit, as well as mine roads in the south half of the subject property, where trespassers can more often pass through undetected (Photo 28). Trespass reducing berms and Jersey barricades installed circa 2002 have been largely defeated by OHV riders.

5.2.4 Lake Mead Boat Storage

Parcels 2 and 3 comprising LMBS were not subject to a detailed site inspection during this study, but were evaluated using recent aerial images, interviews, report review, and informal inspection (Photos 45 and 46). The LMBS infrastructure consists of an office building, and both covered and uncovered boat

storage. Most of the acreage is used as uncovered storage and has boats, trailers, vehicles, recreational vehicles, and intermodal containers parked on it.

The surface area has been regraded as a shallow inclined plane going up in elevation the further south from Lake Mead Parkway. The surface has been covered with imported gravel. De minimis releases of petroleum products are expected in this setting, though none were specifically observed.

5.2.5 Laker Plaza

Parcel 4 is the property of Laker Plaza and was not subject to a detailed site inspection during this study. The property was evaluated by reviewing recent aerial images, by interviews, by report review, and by informal inspection during site visits (Photos 47 and 48). Laker Plaza consists of a retail bait shop/convenience store also selling gasoline, high-octane gasoline, and diesel fuel. On a recent visit the fuel island was out of service and two 55-gallon drums, presumably drill cuttings, were staged in the northwest corner of the lot.

The Laker Plaza parcel is divided into three areas: the bait shop/gas station, a watercraft rental company (Skiwi Jet Ski Rentals) which leases space from Laker Plaza, and an uncovered boat storage and miscellaneous area to the rear. The surface of the bait shop/gas station area is asphalt paved. The surface of the rental company and the boat storage in the rear appears to be dirt. De minimis releases of petroleum products are expected in this setting, though none were specifically observed.

5.2.6 Outlying Federal Land

Zenitech performed inspection of the outlying contiguous federal property related to the mine site through aerial image review and limited on the ground inspection. All seven parcels of federally owned/managed land in the subject property have observable impacts from the mine or mill operation, or from subsequent activities such as landfilling, dumping, and OHV use, or from multiple activities. Property boundaries are depicted in Figure 2 of Appendix A.1.

Parcel 12 is a sawtoothed shaped area of approximately 23 acres along the easternmost boundary of the subject property. The parcel is managed in part by BLM (15.5 acres) and in part by BOR (7.5 acres). It comprises the original Three Kids workings. The main pit has cliff faces in excess of 40 feet in height. Some littering and target shooting were in evidence.

Parcel 14 includes large portions of Tailings Ponds 1 and 2, as well as the entire tailings dam and downgradient drainage towards Lake Mead Parkway and Lake Las Vegas. The leeward side of the dam was observed to have had numerous loads of construction waste deposited onto it, due to ready access from Lake Mead Parkway. This parcel represents one of two primary access points for OHV trespassers into the subject property (the other being Parcel 12).

Parcel 14 abuts Parcels 13 and 15, and together, these three parcels represent approximately 60 percent of Tailings Pond No. 1 and 70 percent of Tailings Pond No. 2 (the remainder of these being owned by Three Kids et al). Parcel 13 is entirely comprised of mill tailings, and Parcel 15 is approximately 70 percent covered with tailings.

Parcel 16 is a small parcel fronting on Lake Mead Parkway, east of Laker Plaza (Parcel 4). The soils of this parcel are blackened on the east and southeast portion and appear to have been bladed away in the west portion.

Parcel 17 was inspected on foot and by aerial reconnaissance. It is a 108-acre parcel occupying the northeast corner of the subject property. This area includes a portion of the northeast wash, downgradient from the former mill site, as well as the locations of the former water tank and water pipelines. Sediments carried by rainfall have covered potentially impacted sediments resulting from mill wastewater discharges and surface migration. Deeper sediments in this area have not been previously assessed, to Zenitech's knowledge.

Parcel 18 is a 357-acre federal parcel (237 acres under BLM, 120 acres BOR withdrawn) located in the south center of the mine site, and wrapping around to the east and north to include a portion of the ore laydown yard and mill site. This parcel includes the entire Hulin Pit, piled mill wastes, a portion of the Hydro Pit, two dammed arroyos, the northern end of the B Pit, approximately 60 percent of the ore yard, and a portion of the mill site near the former crushers. Also included in this parcel is a less impacted area of approximately two hundred acres that may comprise bighorn sheep and/or desert tortoise habitat.

Section 6
Conclusions and Recommendations

6.1 Conclusions and Recommendations

The Three Kids Mine and Mill site has enjoyed a complex history of human activities in the past 90 years. Mining, mill and furnace operations, and tailings disposal are perhaps the most obvious environmental impacts upon first inspection. Illegal dumping and burning activities have impacted the three major open pits, as well as many other regions of the site since the 1960's. Additionally, landfilling of construction waste and friable asbestos took place in the early 1980's, followed by permitted land application of ice creamery wastes in the 1990's. Additional actual or potential environmental impacts exist from buried drums and unspecified solid wastes, underground storage tanks, septic tanks, an abandoned well, wire burning and shooting activities, and commercial and tenant activities. Most of the subject property is poorly secured, bringing about concerns for the safety and welfare of recreational vehicle operators, mineral collectors, and others who may trespass on the site.

In the remainder of this report, we provide a summation of identified conditions and recommendations for subsequent tasks designed to either further characterize or remediate the identified conditions.

6.1.1 Hydrologic and Geologic Setting

Geologic Setting. The subject property is situated in a complex geologic setting comprised of numerous subunits of volcanic and sedimentary origins. It is to be expected that specific rocks in specific subunits contain differing natural concentrations of lead and arsenic. These subunits should be delineated and background concentrations measured in order to support the proposed conceptual site model (CSM), human health risk assessment, and corrective action plan deliverables. Zenitech recommends a specific background study be performed during future Phase II ESA sampling. This background study will support the risk assessment and CSM tasks.

Groundwater Setting. Based on the limited number of wells in the vicinity of the subject property, and the obvious, extensive faulting, Zenitech concludes that groundwater depth, direction, and flow conditions have not been well characterized. If the prescribed remediation design for the site includes placement of tailings into the pits, additional groundwater characterization may

be required in order to develop a technically sound CSM.

Test Well. During the site reconnaissance it was observed that the test well cover had been vandalized and the well was open. Judging from rust and the lack of recent tire tracks or footprints, it appears to have been in this condition for some time, during which foreign objects may have been sent down the casing. According to test results from 1999, this well does not deliver potable water. Zenitech repaired the wellhead hasp and added a lock in the spring of 2007. At such time as the well may be rehabilitated or abandoned, a Nevada-licensed driller following NDWR regulations and procedures will be required.

Surface Water Setting. Historic aerial images depict wastewater from the mill operation being diverted into two drainages that historically entered the Las Vegas Wash and Lake Mead. Based on a review of reasonably ascertainable previous studies, the source drainages have not been adequately assessed for environmental impacts from the full range of potential contaminants of concern. Zenitech recommends characterization of the on-site drainages in Phase II ESA efforts.

6.1.2 Biological and Cultural Resources

Biological and cultural resources assessments may be required for the federal action (land transfer and remediation). Compliance with NEPA may be required in the performance of these assessments, and would likely take the form of a NEPA-conforming environmental assessment (EA).

Biological Assessment. Lands currently managed by BLM and those withdrawn to BOR may require a biological assessment and consultation with the FWS pursuant to the Endangered Species Act. Assessment would be under the oversight of a Department of Interior qualified biologist. The assessment and subsequent actions may also need to conform to the CCMSHCP. Habitat protection and/or species relocation may be required, as well as mitigation fees.

Area of Critical Environmental Concern. Approximately 15.5 of the 1270 acres proposed for remediation and redevelopment are currently designated as part of the River Mountains ACEC. Assembly of the 18 parcels, NDEP approval of the Corrective Action Plan, and inclusion in Henderson's redevelopment zone would require that the lead federal agency work with project stakeholders to revise the ACEC boundaries or otherwise permit necessary remediation activities on those portions of the site.

Cultural Resources Assessment. The subject property may require a cultural resources assessment of historic and prehistoric cultural values pursuant to the National Historic Preservation Act, as implemented through the State of Nevada Historic Preservation Office. Assessment would be overseen by a Department of Interior qualified archeologist. Cultural resource preservation may be required, depending on the type and extent of resources identified.

6.1.3 Recognized Environmental Concerns

RECs exist in number. Mining and milling manganese ore resulted in widespread impacts to the site. Other RECs are due to specific instances of landfilling, dumping, vandalism, wire burning, building fires, target shooting, underground storage tanks (petroleum), and commercial facility septic tanks.

Mine and Mill Site Impacts. The generalized result of manganese ore mining and processing at the subject property is the widespread release of arsenic, lead, manganese, and petroleum in concentrations greater than background levels. NDEP has been previously notified of these contaminants and has an open case file on the project.

Contaminants affect site soils and structures, and may also affect drainage sediments and proximate locales due to windblown migration and/or surface water transport. Most evidence gathered by others and reviewed for this study indicates that the metal contaminants on this site demonstrate low solubility, and presumably low mobility towards groundwater. Organic constituents in the tailings and mill soils have not been sufficiently evaluated for site migration, in Zenitech's opinion. Groundwater has not been well characterized at this site, but is believed to be a complex, fracture flow setting with fairly deep water bearing regions at least several hundred feet below grade.

In order to consider redevelopment of this site, it will be necessary to characterize and remediate fine mineral dusts, mill site residues, and mineral processing wastes containing lead, arsenic, manganese, and petroleum in concentrations above guidance levels. On a site such as this, it is typical for site-specific target cleanup levels to be established through a combination of human-health risk assessment, evaluation of natural levels, comparison to guidance levels, technical achievability, and cost-benefit analysis.

Landfilling and Illegal Dumping Impacts. The operation of a solid waste landfill from 1979 through 1984 is clearly recorded in county records and is corroborated by both visual evidence and anecdotal reports. Solid, hazardous, and special waste such as friable asbestos, automotive batteries, abandoned boats and vehicles, vehicle fuels, lubricants, coolants and solvents, appliances, tires, construction debris, and trash constitute RECs.

Wire Burning. Two small wire burning sites have been discovered on site. It is likely that soils and ash left behind exhibit levels of lead and dioxins above health-based guidelines and constitute an REC.

Building Fires. Due to the number of power substations, transformer stands, and electrical switch gear that the former mills utilized, potential elevated PCB levels constitute an REC. Additionally, the 1953 mill fire could have released PCBs, dioxins, or polyaromatic hydrocarbons (PAHs) into the surrounding soils and building materials. The mill fire rubble or residue has not been found on site, but in Zenitech's opinion, it is likely to be discovered during later site activities

and does represent an REC.

Target Shooting. Small arms target shooting evidence was observed in many areas throughout the subject property. Shell types and targets indicate that pistols, rifles, and shotguns have been discharged. The environmental consequence of these activities is the potential for elevated lead and PAHs (the latter due to skeet shooting of clay targets). However, due to the ubiquitous nature of lead and soots at the site, Zenitech considers the effects of target shooting to be of a de minimis nature, as described by ASTM. Zenitech recommends that the corrective action plan should include provisions for remediating target shooting sites with elevated high lead and PAH levels, though this is not expected to be the remediation driver.

Underground Tanks. Three underground fuel storage tanks and two septic tanks exist on the subject property. One or more of the fuel tanks may have failed in 2006, and although limited sampling did not identify a reportable release, the tanks and appurtenances are an REC.

The two commercial facilities have had septic tanks since the early 1980's. No assessment of the tanks' condition was reasonably ascertainable. Septic tanks at commercial facilities often receive incidental or intentional discharges of regulated substances, and thus Zenitech believes these tanks constitute an REC.

6.1.4 Physical Hazards

Abandoned Mine Hazards. Open pits and structures existing on the subject property meet the definition of a "dangerous condition" pursuant to NAC §§ 513.230 and .320. The site scores 5 or 6 out of a possible 10 points (NAC §§ 513.330-.360). Timely improvements in the security of the site, including the fencing and signing of open pits and other fall hazards, are recommended.

6.2 No Further Assessment Recommendations

Zenitech is recommending that certain subject areas be excluded from further assessment at this time based on strong supporting evidence.

6.2.1 Radioactive Materials

Based on observed site geology, interviews, records research, and a radiation survey conducted by Zenitech, we have found that there is no adverse impact from anthropogenic or natural radioactive material at the site in excess of regional background levels. Uranium, radium, and thorium concentrations in site soils, rocks, and tailings are expected to be consistent with, or below, national background levels. There is currently no evidence for the presence of technologically enhanced naturally occurring radioactive materials as a result of the beneficiation process.

Based on a review of several studies for radon gas potential, constructed homes on the site are expected to have lower indoor radon concentrations than the average Nevada home. There is no evidence that radioactive materials were utilized in the mill processes, or that they were disposed on site.

6.2.2 Sludge Application

Land application of ice creamery biosolids, and possibly water treatment plant sludge, occurred in the ore yard in the 1990's. Zenitech has reviewed available laboratory reports, EPCRA reporting forms, conducted interviews, and inspected the subject property with regard to land application. We find that the chemical composition of the sludges would not constitute a source of hazardous substances. We observed that the area that received the sludges has supported the growth of grasses better than any other portion of the mill site.

6.2.3 Target Shooting

As discussed previously in Section 6.1.3, small arms target shooting has occurred in many areas across the site. While these activities might contribute elevated hazardous substances in a pristine area with low natural lead levels, at the subject property the contribution of contaminants to the total mass of elevated lead resulting from mining would be negligible. Skeet shooting has been limited and clay target fragments are relatively scarce.

6.2.4 Ubiquitous Petroleum Oils

Petroleum in the diesel and oil ranges is commonplace throughout the subject property. Petroleum impacts may be due to the historic use of diesel equipment, blasting formulations, and flotation emulsion. Petroleum impacts may also have originated from spills, pipeline leaks, mismanagement of tailings, dumping, abandoned vehicles, recreational vehicles, and the migration of petroleum from any of these potential sources.

While not recommending that petroleum oils be entirely dismissed, Zenitech is acknowledging that attempting to fully characterize such an ubiquitous contaminant on a site driven by the high toxicity of arsenic will not appreciably contribute to the design of a remediation plan. That is, since it is likely that petroleum cleanup levels will be a product of a human-health risk assessment and agency negotiation, and that waste management procedures will be driven by arsenic content, non-exhaustive petroleum characterization is warranted at this time. Volatile hydrocarbons related to the tailings should be a major focus in Phase II characterization work, however. Data gathered should be adequate to support the risk assessment.

6.3 Anticipated Deliverables

Based on RECs identified in this Phase I ESA, and upon consultation with project stakeholders, Zenitech believes the environmental studies, plans, and agreements shown in Table 6 will be required in order to effect the remediation and reclamation of the subject property. Deliverables are listed in the approximate order in which they will be required. Deliverables that are not directly related to the assessment and remediation of the subject property are not listed. These may include deliverables required for land conveyance, reclamation design, and supporting documents for cultural and biological preservation.

Industry practice recommends that this Phase I ESA be updated every six months if environmental due diligence is ongoing. Otherwise, it is prudent to update this Phase I at such time as operations change, ownership changes, or a spill or release of a hazardous substance or petroleum occurs.

Table 6
Potential Environmental Deliverables and Agreements

DOCUMENT	AUTHORITY	PROJECT PHASE
Enforceable Administrative Order of Consent (AOC) describing responsibilities of site owners to assess and remediate	NDEP	Pre-Planning
Site access permits	BLM, BOR	Pre-Planning
Dust Control Permit	CCDAQEM	Planning
Sampling and Analysis Plan (SAP)	NDEP	Planning
Cultural Resources Assessment	SHPO	Planning
Biological Resources Assessment	FWS	Planning
Phase II Environmental Site Assessment - Background Study - Site Assessment of Contaminants - Data to Support Risk Assessment - Geotechnical Study of Site Resources	NDEP	Planning
Conceptual Site Model (CSM) - Hydro-geologic Characterization - Contaminant Fate and Transport - Exposure Pathways - Presumptive Remedy	NDEP	Planning
Human Health Risk Assessment (RA)	NDEP	Planning
Corrective Action Plan - Remediation Workplan - Health & Safety Plan and Decon Plan - Air Monitoring Plan - Asbestos Management Plan - Stormwater Pollution Prevention Plan - Dust Control Plan - Engineering Design - Grading Plan - Waste Cell Design	NDEP	Planning
Covenant Deferral Request pursuant to CERCLA § 120(h)(3) - Community Relations Plan	Dept. of Interior	Property Transfer
Closure Report - Narrative and confirmatory analyses - Issuance of No Further Action	NDEP	Post-Remediation
Uniform Environmental Covenants Act - Amend deeds on parcels containing waste cells, limiting the type of future use for those areas	State of Nevada	Post-Remediation

Libraries Consulted

In addition to electronic database queries of reasonably ascertainable environmental records resources, the following libraries and recordkeeping systems were also utilized:

1. Clark County Assessors Office, 500 South Grand Central Parkway, Second Floor, Las Vegas, NV
2. City of Henderson, Office of the City Attorney and Office of Property Management and Redevelopment, 240 Water Street, Henderson, NV
3. Southern Nevada Health District; Environmental Health, Solid Waste and Compliance Records, 400 Shadow Lane, Suite 105, Las Vegas, NV
4. Nevada Division of Environmental Protection, Corrective Actions Case Files, 2030 East Flamingo Road, Suite 230, Las Vegas, NV
5. Boulder City Library, General Circulation and Special Collections, 701 Adams Boulevard, Boulder City, NV
6. Lied Library, University of Nevada Las Vegas, General Circulation and Special Collections, 4505 Maryland Parkway, Las Vegas, NV
7. US Department of the Interior, Bureau of Land Management, Branch of Information, 1340 Financial Boulevard, Reno, NV
8. DeLaMare Library, McKay School of Mines, University of Nevada Reno, 1664 North Virginia Street, Reno, NV
9. Nevada Bureau of Mines and Geology, Archives, Scrugham Engineering Building, University of Nevada Reno, 1664 N. Virginia Street, Reno, NV
10. Nevada State Library, Archives, 100 N. Stewart Street, Carson City, NV
11. U.S. Department of the Interior, Bureau of Reclamation, Three Kids case file, Mead Building, Buchanan Road, Boulder City, NV
12. PJB Management, Three Kids Enterprises private records, 3110 East Flamingo Road, Las Vegas, NV
13. Lakemoor Development, Three Kids / Lakemoor Canyon private records, 2470 St. Rose Parkway, Suite 206, Henderson, NV

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Glossary of Acronyms

µg/l	micrograms per liter
AAI	All Appropriate Inquiries
ACEC	Area of Critical Environmental Concern
AST	Above-ground Storage Tank
ASTM	American Society for Testing and Materials
BCA	Bureau of Corrective Actions, NDEP
BDMC	Boulder Dam Manganese Co.
bgs	below ground surface
BLM	Bureau of Land Management, U.S. Dept. of the Interior
BOR	Bureau of Reclamation, U.S. Dept. of the Interior
CAAA	Clean Air Act Amendments of 1990
CCDAQEM	Clark County Department of Air Quality and Environmental Management
CCHD	Clark County Health District
CCMSHCP	Clark County Multiple Species Habitat Conservation Plan, also ...Multi-Species...
CEM	Certified Environmental Manager
CERCLA	Comprehensive Environmental Response Compensation Liability Act
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
DLA	Defense Logistics Agency
DOQQ	Digital Orthoimagery Quarter Quadrangle
EA	Environmental Assessment
EDR	Environmental Data Resources, Inc.
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Environmental Site Assessment
FWS	Fish and Wildlife Service
GIS	Geographic Information System
LMBS	Lake Mead Boat Storage
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram, essentially parts per million (ppm)
MRL	Metallurgical Research Laboratory

MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
msl	mean sea level
MWMP	Meteoric Water Mobility Procedure
NAC	Nevada Administrative Code
NBMG	Nevada Bureau of Mining and Geology
NDEP	Nevada Division of Environmental Protection
NDOH	Nevada Department of Health
NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act
NORM	Naturally Occurring Radioactive Material
NRC	Nuclear Regulatory Commission
NRS	Nevada Revised Statutes
OHV	Off-Highway Vehicle
OSHA	Occupational Safety and Health Act (or Administration)
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
pCi/l	picoCuries per liter
RCRA	Resource Conservation Recovery Act
REC	Recognized Environmental Condition
RUST	Registered Underground Storage Tank
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Office
SNHD	Southern Nevada Health District
SNWA	Southern Nevada Water Association
TKE	Three Kids Enterprises, LLP
TKM	Three Kids Mine and Mill Site
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
UMTRA	Uranium Mill Tailings Reclamation and Control Act
USC	United States Code
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VCP	Vitrified Clay Pipe
WECCO	Western Electrochemical Company, Inc.
WME	Western Minerals Exploration

Appendices

A Figures and Tables

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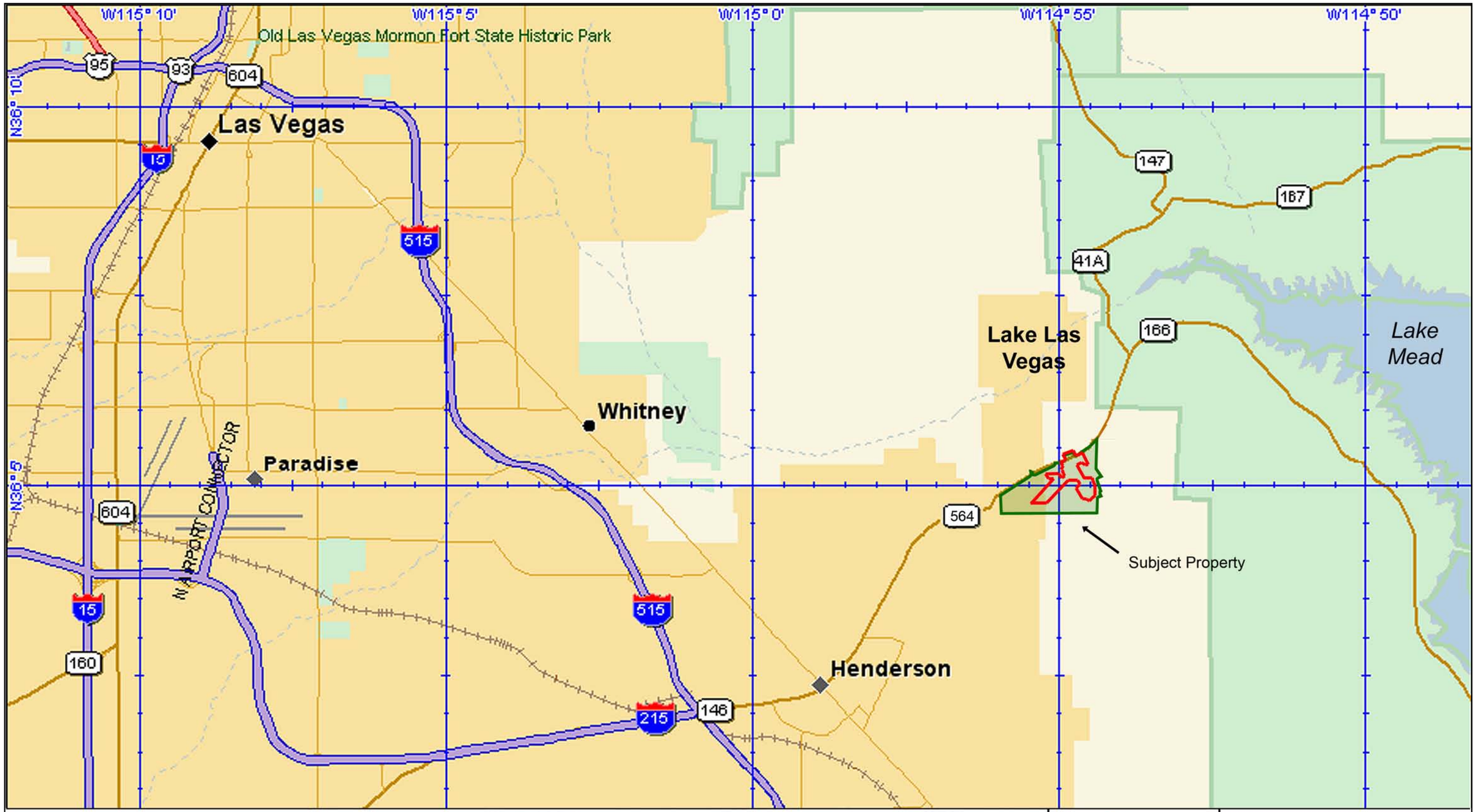
Appendix A

Figures and Tables

Appendix A.1

Figures

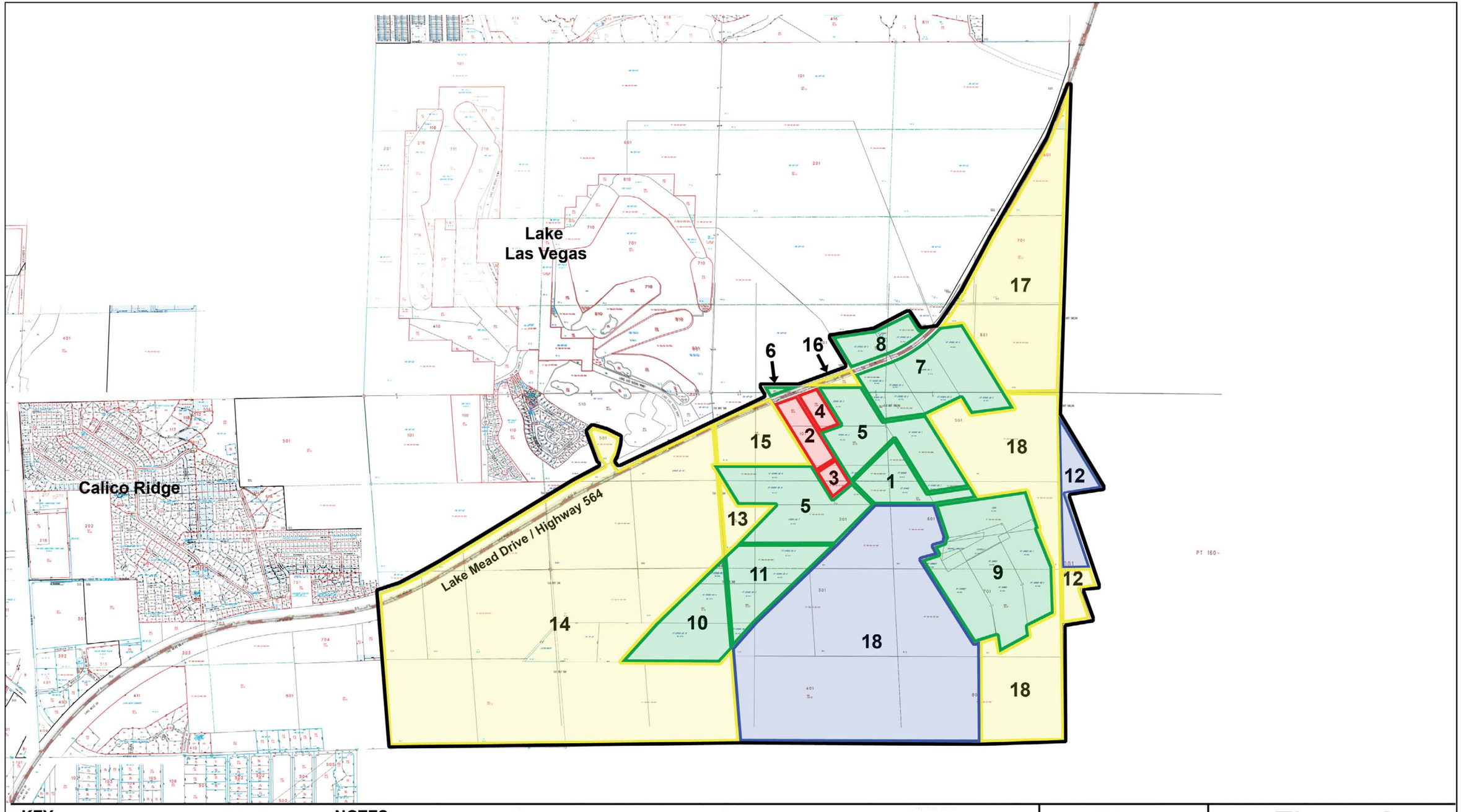


ZENITECH ENVIRONMENTAL

Figure 1
General Location

Three Kids Mine and Mill Site

SCALE: As Shown	DATE: 1/05/07
DRAWN: CTA	APPVD: MS



KEY

- US Bureau of Reclamation withdrawn
- Three Kids Inc. et. al. and Kings Bench LTD
- M&R LP (Lake Mead Boat Storage) and Laker Plaza
- US Bureau of Land Management
- Subject Property Boundary

NOTES

18 parcels shown are proposed assembled public/private lands for remediation and redevelopment

N

Source: 2005-06 Clark County Assessor, USBR and BLM data

Scale:
0 2000 Feet

ZENITECH ENVIRONMENTAL

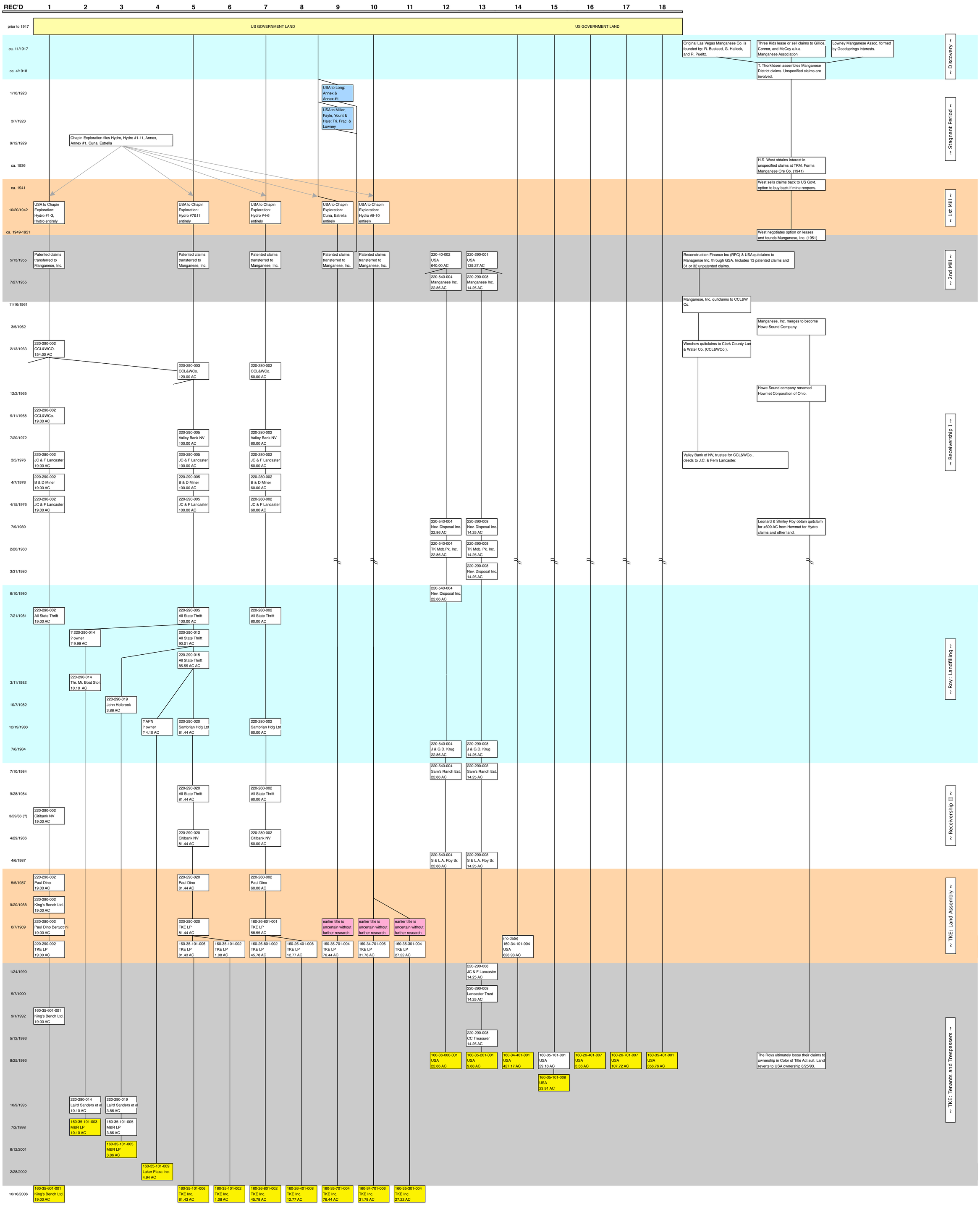
Figure 2
Property Map

Three Kids Mine and Mill Site

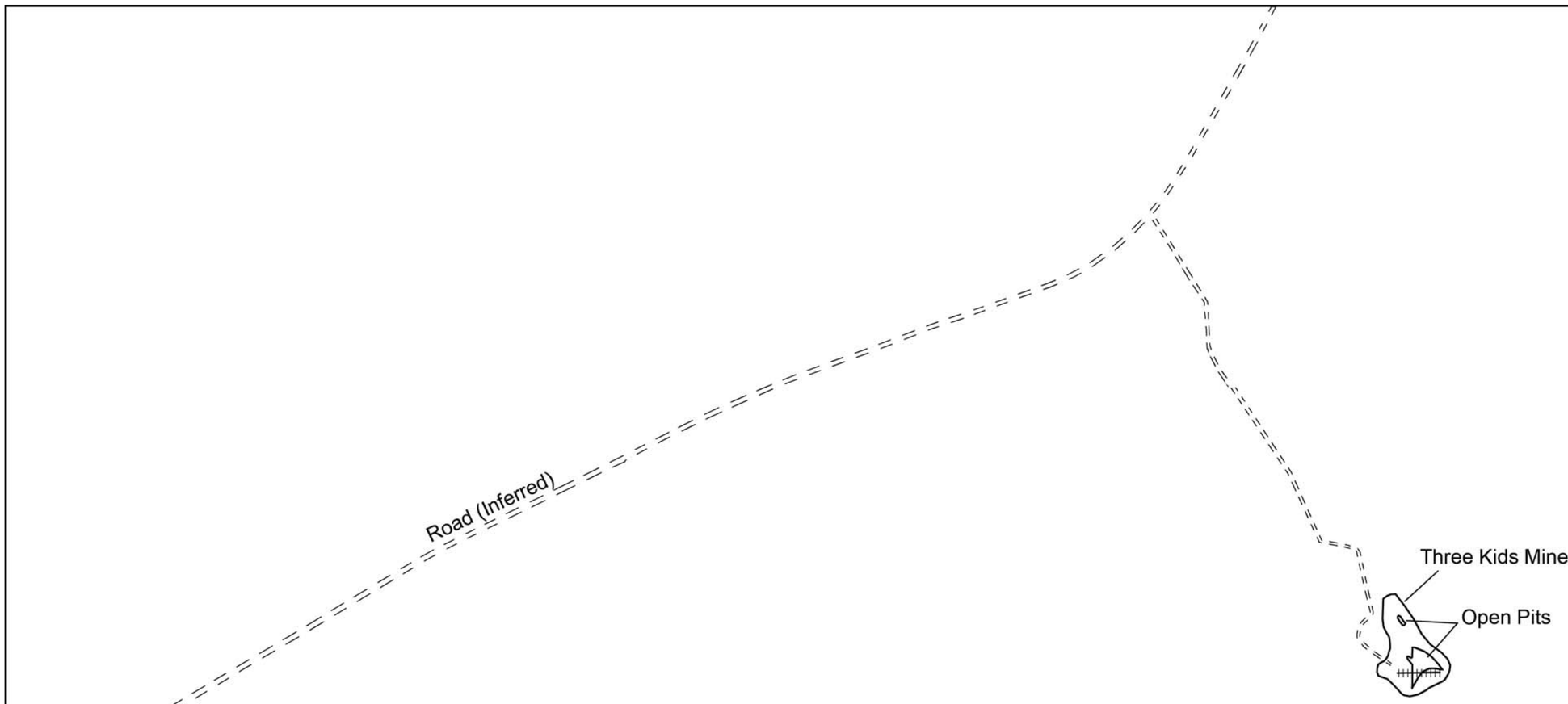
SCALE: As Shown	DATE: 09/12/07
DRAWN: CTA	APPVD: MS

THREE KIDS MINE & MILL SITE

Figure 3
Ownership History



Additional References	Survey: 4743 Claims: pt Hydro pt Hydro #1, #2	Survey: 4743 Claims: pt Hydro #2, #3	Survey: 4743 Claims: pt Hydro pt Hydro #2	Survey: 4743 Claims: pt Hydro #2, #3	Survey: 4743 Claims: Hydro #7, Hydro #11, pt Hydro, pt Hydro #1-3	Survey: 4743 Claims: pt Hydro #3	Survey: 4743 Claims: pt Hydro #4-6	Survey: 4743 Claims: pt Hydro #4-5	Surveys: 4455, 4533, 4743 Claims: Annex, Annex #1, Tri. Frac., Lowney, Cuna Estrella	Survey: 4743 Claims: pt Hydro #8-10	Survey: 4743 Claims: pt Hydro #8-10	Claims: pt Ext. #2, pt Three Kids, pt Three Kds Frac.	Gov lots: 13	Gov lots: 7,9,14, 16,18-23,25, 27-30,32	Gov lots: 12	Gov lots: 22	Gov lots: 5,14,15, 17,24,25	Gov lots: 1,4-10	
Current Acreage per CCA	19.00	10.10	3.86	4.94	81.43	1.08	45.78	12.77	76.44	31.78	27.22	22.86	9.88	427.17	23.91	3.36	107.72	356.76	**Govt ttl 951.66**	**TK ttl 295.50**	**Other ttl 18.90**	**Grand total 1266.06**



KEY

Unimproved Road

Ore Cart Rail

NOTES

Source: 2006 Clark County Assessor and Pardee and Jones 1920 data.

N

SCALE:

0 1000 2000 feet

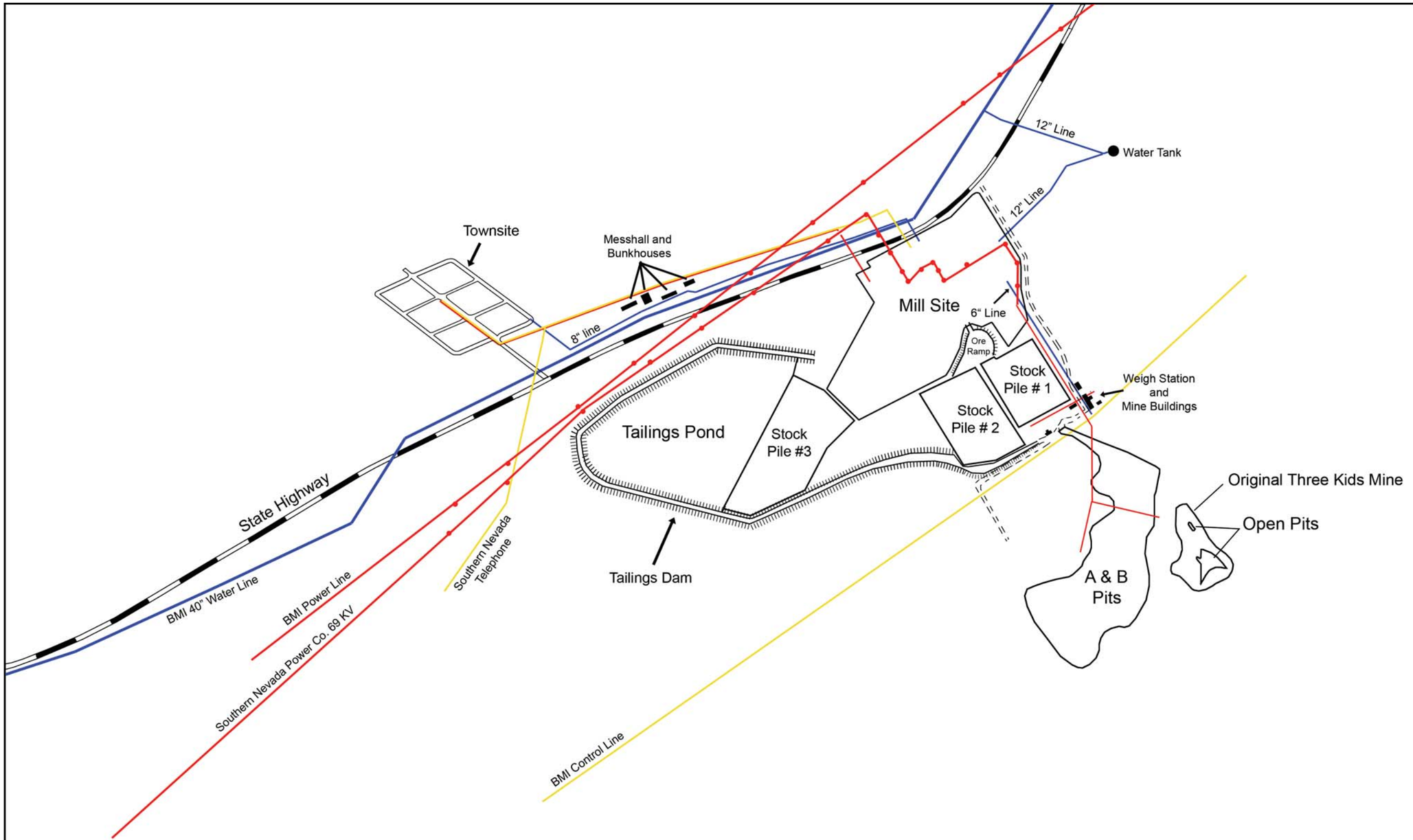
ZENITECH ENVIRONMENTAL

Figure 4A

Mine and Mill Site Features, 1918

Three Kids Mine and Mill Site

SCALE: As Shown	DATE: 01/04/07
DRAWN: CTA	APPVD: MS



KEY

- Phone/Control Line
- Power Line
- Water Line
- State Highway
- Unimproved Road

NOTES

Source: 2006 Clark County Assessor and 1943 Manganese Ore Company data.

N

SCALE:
0 1000 2000 feet

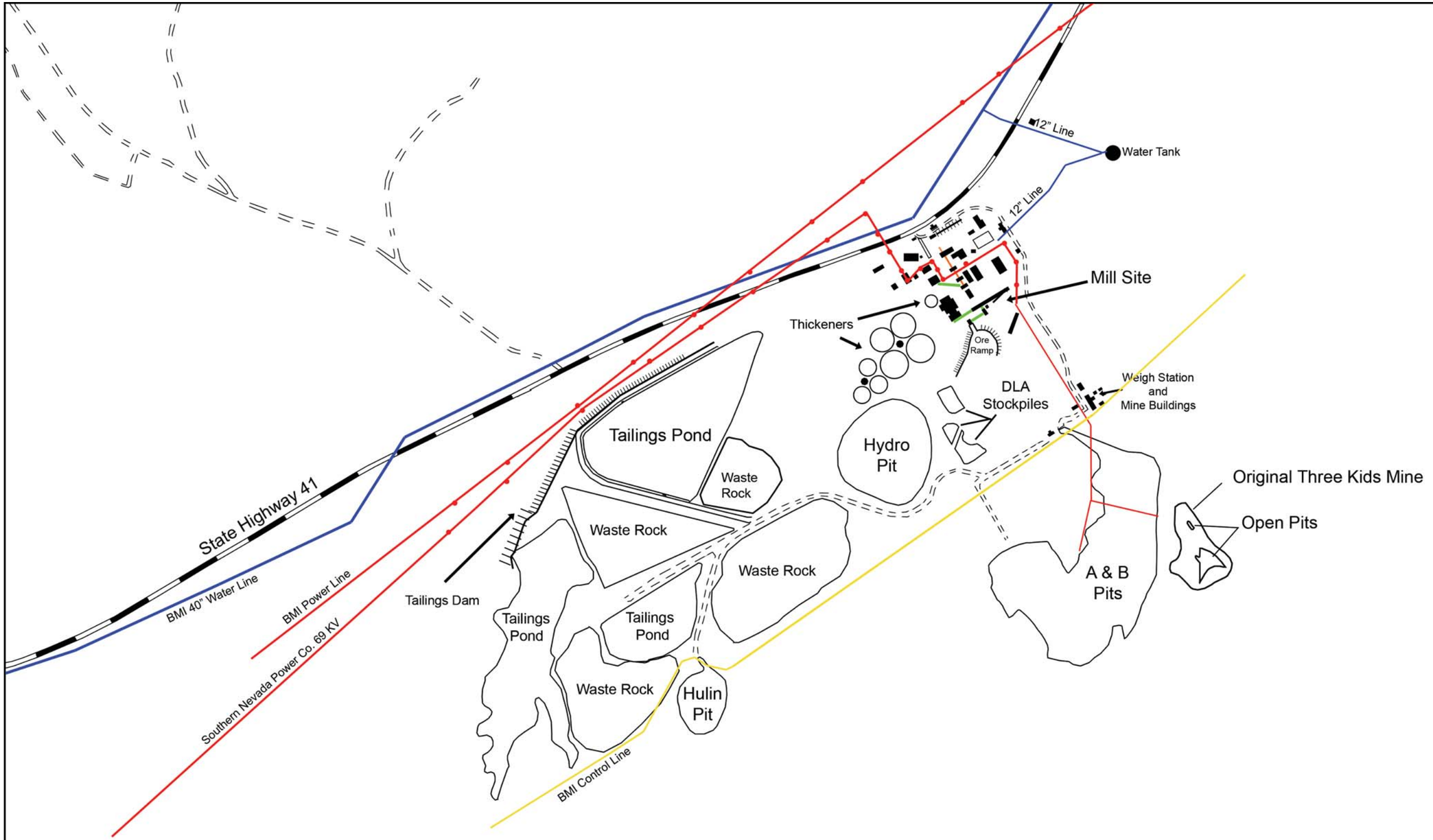
ZENITECH ENVIRONMENTAL

Figure 4B

Mine and Mill Site Features, 1943

Three Kids Mine and Mill Site

SCALE: As Shown	DATE: 01/04/07
DRAWN: CTA	APPVD: MS



KEY

- Phone/Control Line
- Power Line
- Water Line
- State Highway
- Unimproved Road
- Buildings and Structures

NOTES

Source: 1973 and 2006 Clark County Assessor data and 1952 USGS 7.5' topographic map.

N

SCALE:
0 1000 2000 feet

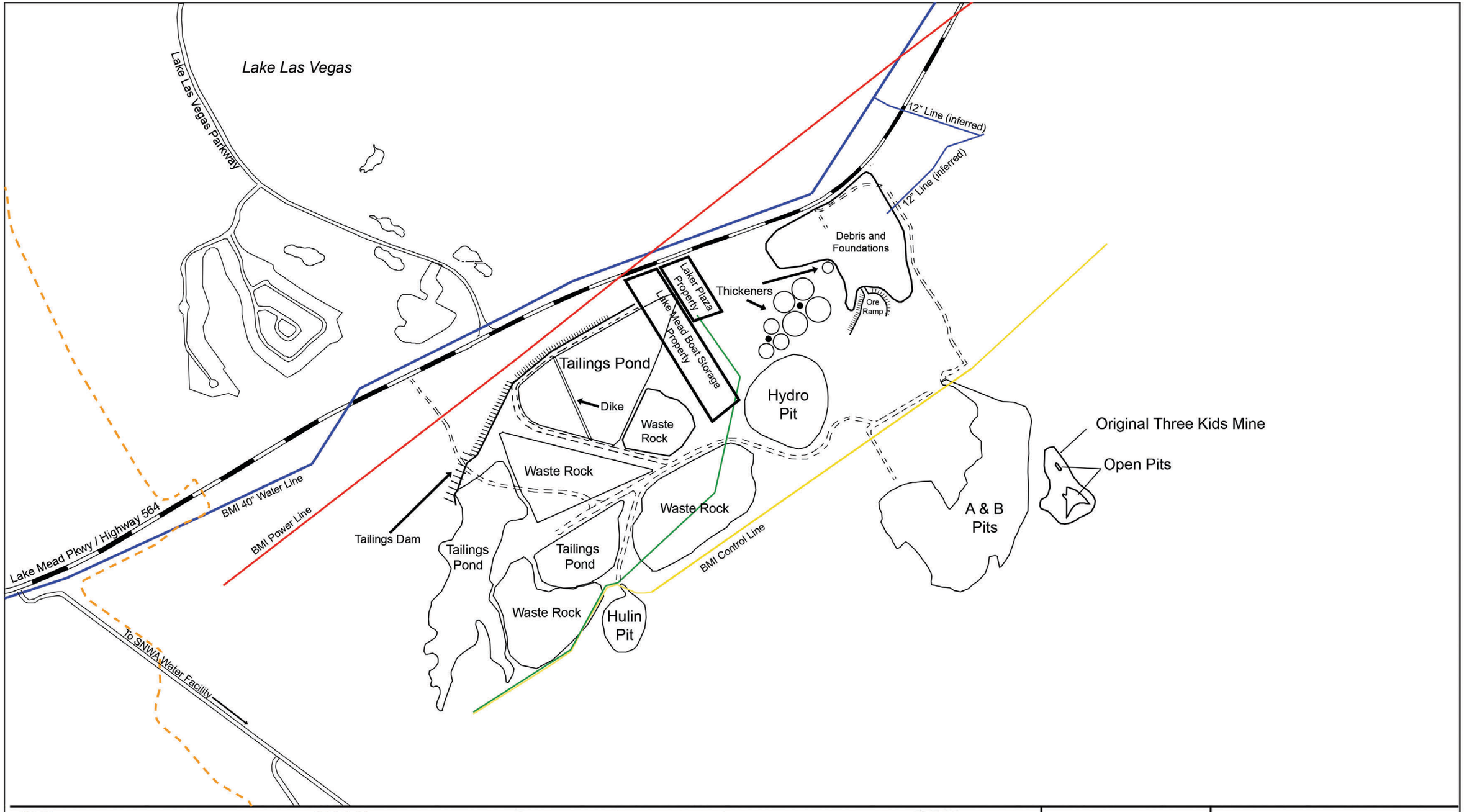
ZENITECH ENVIRONMENTAL

Figure 4C

Mine and Mill Site Features, 1960

Three Kids Mine and Mill Site

SCALE: As Shown	DATE: 01/04/07
DRAWN: CTA	APPVD: MS



KEY

- Phone/Control Line
- Power Line
- Water Line
- State Highway
- Unimproved Road
- Phone/Power Line to Laker Plaza
- River Mountains Trail

NOTES

Source: 1973 and 2006 Clark County Assessor data.

N

SCALE: 0 1000 2000 feet

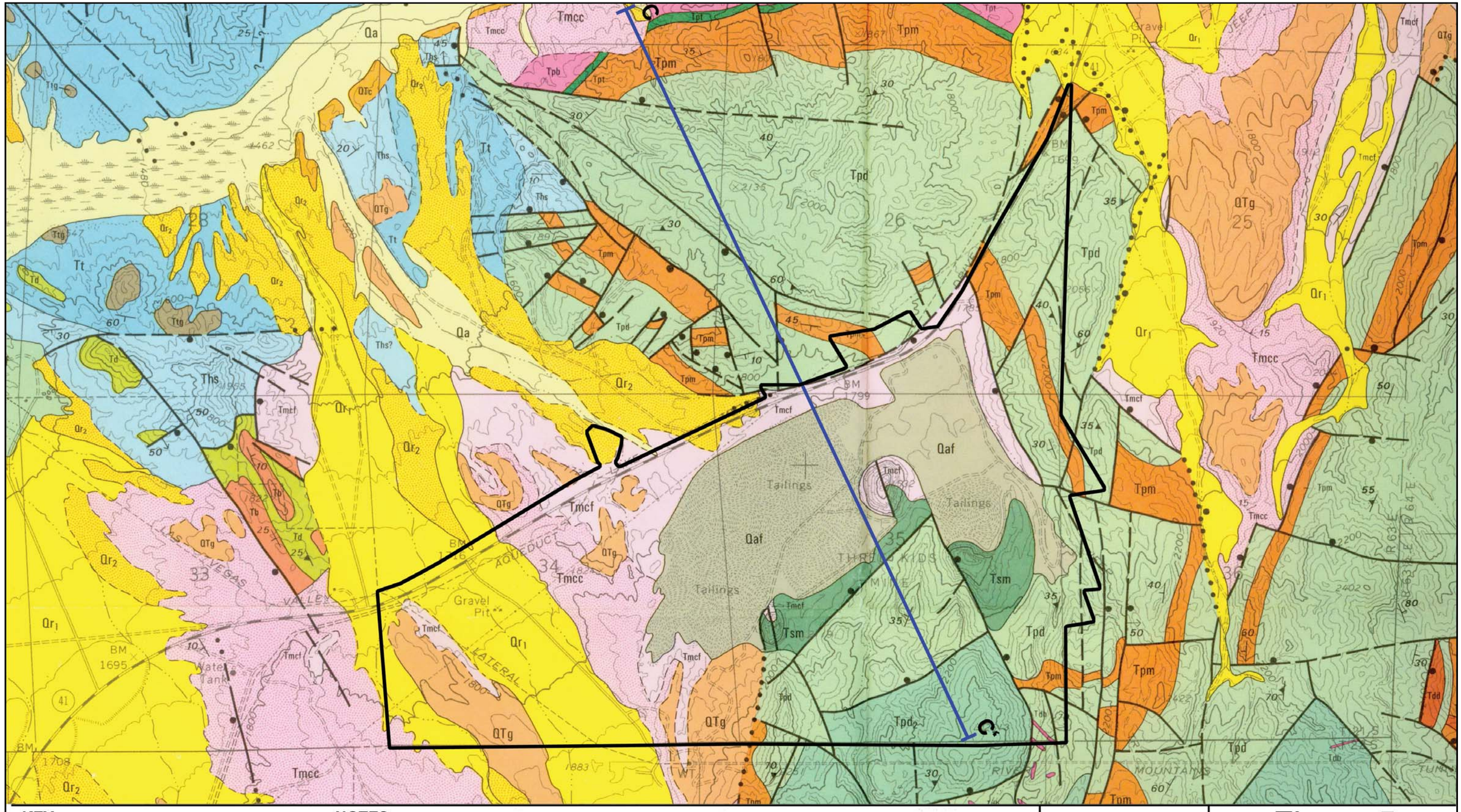
ZENITECH ENVIRONMENTAL

Figure 4D

Mine and Mill Site Features, 2006

Three Kids Mine and Mill Site

SCALE: As Shown	DATE: 01/04/07
DRAWN: CTA	APPVD: MS



KEY

Geologic Cross Section

Subject Property

NOTES

See Figure 6 for Geologic key and Cross Section

N

Source: Bell and Smith, 1980, Nevada Bureau of Mines and Geology

Scale:

0 2000 Feet

ZENITECH ENVIRONMENTAL

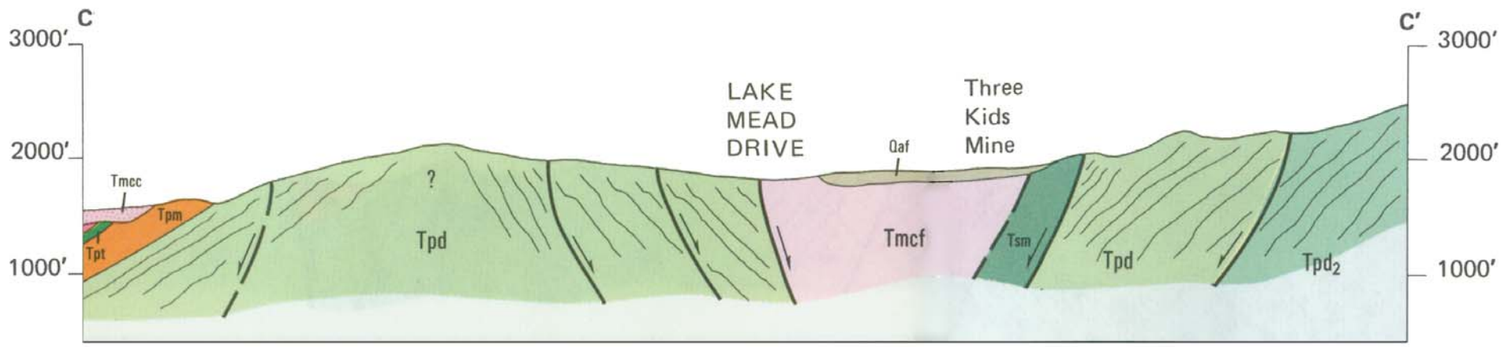
Figure 5

Geologic Map

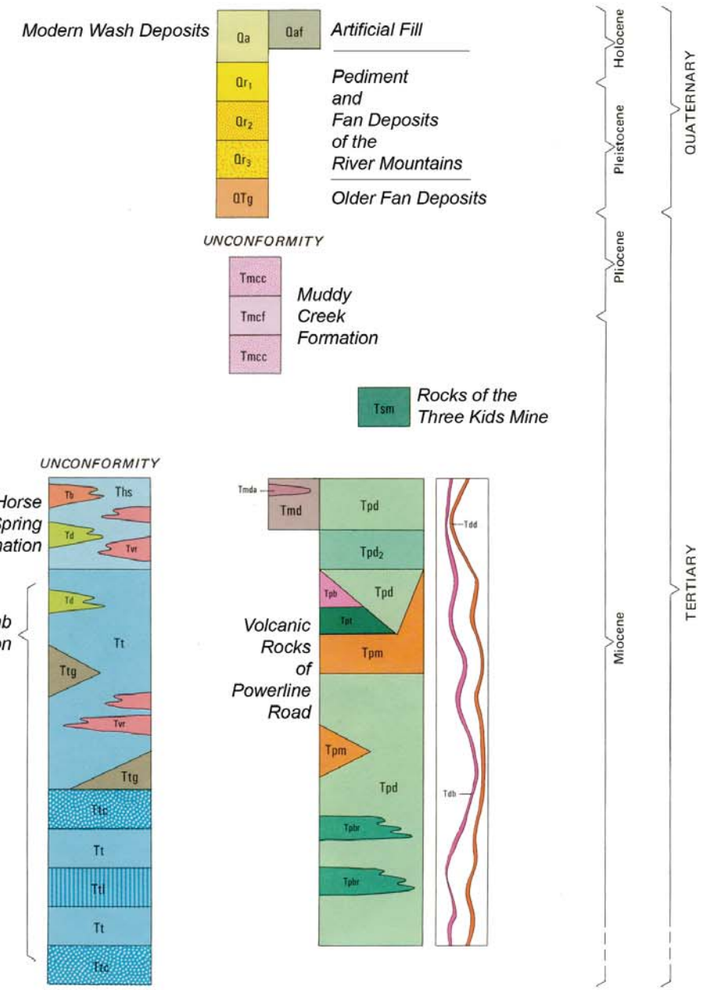
Three Kids Mine and Millsite

SCALE: As Shown	DATE: 01/05/07
DRAWN: CTA	APPVD: MS

Cross Section



Lithologic Key



Map Symbol Key

Contact. Dashed where approximately located, dotted where concealed.

Fault. Dashed where approximately located, dotted where concealed, ball on downthrown side, arrow indicates fault plane attitude.

Strike and dip of beds.

Strike and dip of foliation.

Breccia zone.

KEY
As Above

NOTES
Key is applicable to both Figures 5 & 6

N

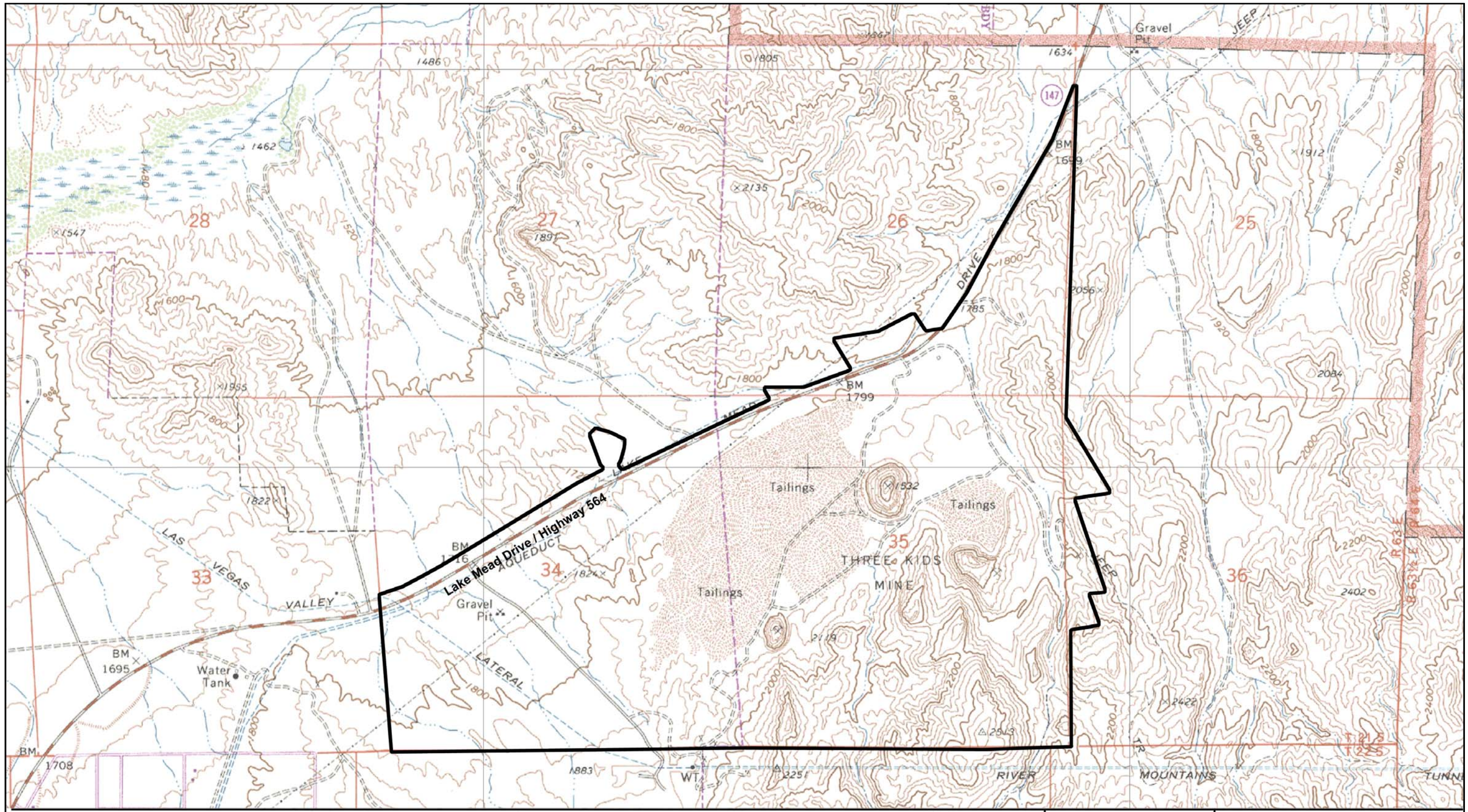
Source: Bell and Smith, 1980,
Nevada Bureau of Mines and Geology

ZENITECH ENVIRONMENTAL

Figure 6
Geologic Cross Section

Three Kids Mine and Millsite

SCALE: As Shown	DATE: 01/05/07
DRAWN: CTA	APPVD: MS



KEY

Subject Property

NOTES

Contour interval is 40 feet

N

Source: USGS 1983 7.5' Henderson quadrangle and Clark County Assessor 2005-06 property data.

Scale:

0 2000 Feet

ZENITECH ENVIRONMENTAL

Figure 7

Topographic Map, 1983

Three Kids Mine and Millsite

SCALE: As Shown	DATE: 01/05/07
DRAWN: CTA	APPVD: MS

FIGURE 8
MANGANESE PRODUCTION HISTORY
1900 - 1963

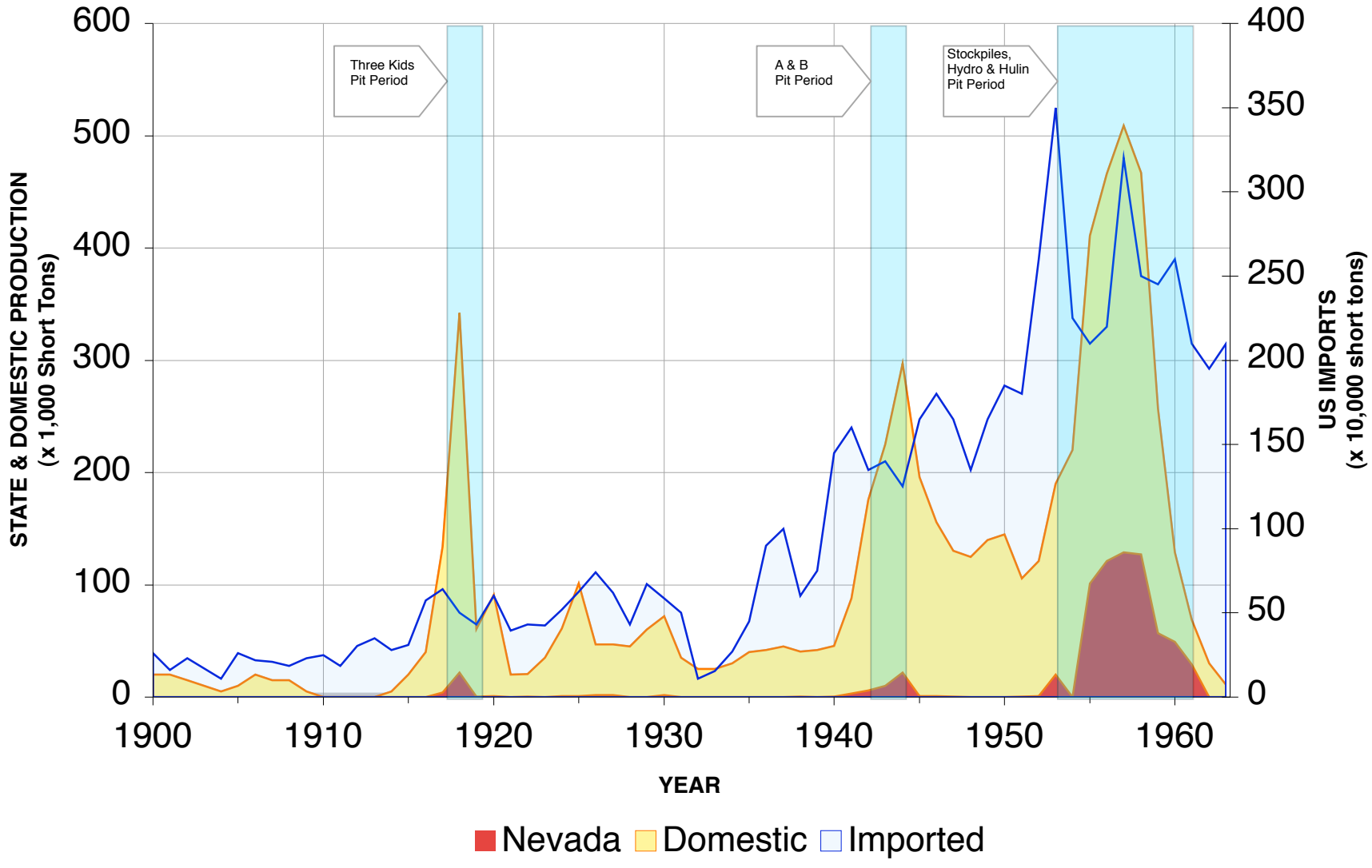
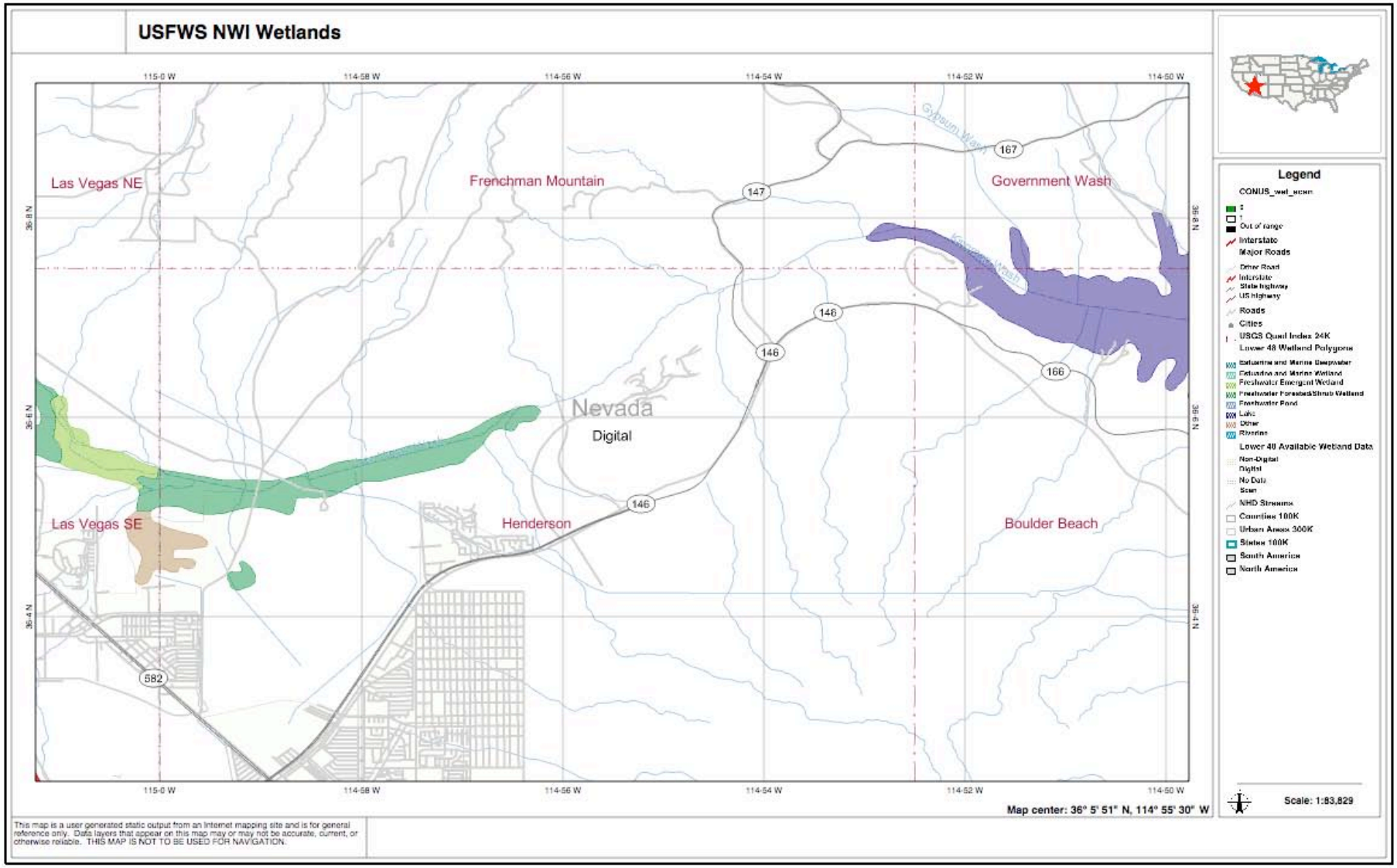


FIGURE 9
NATIONAL WETLANDS INVENTORY



Appendix A.2

Tables

TABLE 1
PARCEL OWNERSHIP AND ACREAGE
THREE KIDS MINE AND MILL SITE

PARCEL ID NO.	ASSESSOR'S PARCEL NO.	LOCATION T / R / S	PROPERTY OWNER(S)	JURISDICTION	SIZE	NOTES
1	160-35-601-001	21S 63E Sec. 35	King's Bench Ltd.	Clark County	19.00	
2	160-35-101-003	21S 63E Sec. 35	M&R Limited Partnership	Clark County	10.10	
3	160-35-101-005	21S 63E Sec. 35	M&R Limited Partnership	Clark County	3.86	
4	160-35-101-009	21S 63E Sec. 35	Laker Plaza, Inc.	Clark County	4.94	
5	160-35-101-006	21S 63E Sec. 35	Three Kids, Inc. et al, et al	Clark County	81.43	[a]
6	160-35-101-002	21S 63E Sec. 35	Three Kids, Inc. et al, et al	Clark County	1.08	
7	160-26-801-002	21S 63E Sec. 26	Three Kids, Inc. et al, et al	Clark County	45.78	
8	160-26-401-008	21S 63E Sec. 26	Three Kids, Inc. et al, et al	Clark County	12.77	
9	160-35-701-004	21S 63E Sec. 35	Three Kids, Inc. et al, et al	Clark County	76.44	
10	160-34-701-004	21S 63E Sec. 34	Three Kids, Inc. et al, et al	City of Henderson	31.78	
11	160-35-301-004	21S 63E Sec. 35	Three Kids, Inc. et al, et al	Clark County	27.22	
12	160-36-000-001	21S 63E Sec. 36	USA, administered by Bureau of Land Management	Clark County	15.42	[b], [c]
			USA, administered by Bureau of Reclamation		7.44	[c]
13	160-35-201-001	21S 63E Sec. 35	USA, administered by Bureau of Reclamation	Clark County	9.88	
14	160-34-401-001	21S 63E Sec. 34	USA, administered by Bureau of Reclamation	City of Henderson	427.17	
15	160-35-101-008	21S 63E Sec. 35	USA, administered by Bureau of Reclamation	Clark County	23.91	
16	160-26-401-007	21S 63E Sec. 26	USA, administered by Bureau of Reclamation	Clark County	3.36	
17	160-26-701-007	21S 63E Sec. 26	USA, administered by Bureau of Reclamation	Clark County	107.72	
18	160-35-401-001	21S 63E Sec. 35	USA, administered by Bureau of Land Management	Clark County	237.25	[c]
			USA, administered by Bureau of Reclamation		119.52	[c]

[a] Three Kids, Inc. et al, et al is comprised of: Three Kids, Inc.; Jennie, LLC; And3Kids, LLC; Gub3Kids, LLC; and W.R. Underhill Family, LLC.

[b] This parcel is partially or completely designated as an Area of Critical Environmental Concern.

[c] This parcel has divided administration by BLM and USBR. Acreage under each is estimated.

Total, King's Bench, Ltd.	19.00
Total, M&R LP	13.96
Total, Laker Plaza, Inc.	4.94
Total, Three Kids, Inc.	276.50
Total, Bur. of Reclamation	699.00
Total, Bur. of Land Mgmt.	252.67
Grand Total	1266.07

Table 2
Principal Mine and Mill Site Features

CLAIMS (patented and otherwise)	PRINCIPAL ACTIVITY AREA	APPROXIMATE MINE ACTIVITY
Three Kids, Three Kids Fraction	Three Kids Pit	1917-1918
Annex, Annex #1, Cuna	B Pit	1918-1944
Lowney, Lowney Extension, Estrella, Triangle Fraction	A Pit	1942-1955
Hydro, Hydro #1	Hydro Pit	1956-1961
Las Vegas Extension #1	Hulin Pit	1959-1961
Hydro #3-6, Extension, Extension #1, Extension #2, Triangle Fraction Millsite, Three Kids Millsite Lode Claim, Lowney Millsite, Hydro #13 Millsite	Mill Site	1942-1961
Hydro #13, Las Vegas, Las Vegas Fraction, Las Vegas Extension #2.	Waste Rock, Cutoff Dams and Overburden	1917-1961
Hydro #2, Hydro #7-12, Hydro #14-17	Tailings	1942-1961

Table 3
NDEP Corrective Action Cases
Related to the Subject Property

FACILITY OWNER or OPERATOR	CASE NO.	ACTIVITY STATUS
Subject Property Cases		
Three Kids Mine & Mill Site (BLM lands north of subject property)	H-001347 [a]	closed 7/10/1995
Three Kids Mine & Mill Site (subject property of this report)	H-001347 [b]	open
Laker Plaza (Parcel 4)	8-000511	3 active underground storage tanks, no spills appear to have been reported
Cases Related to Subject Property Operations		
USBR Lake Las Vegas (gasoline impact north of subject property)	H-000508 [c]	closed 5/5/2000
USBR Lake Las Vegas (lead impact north of subject property)	H-000508 [d]	closed 10/15/1993
BLM Lake Las Vegas (lead impact north of subject property)	H-000588	closed 7/23/1992
Levy Realty Trust (lead, arsenic, manganese impact from staging manganese nodules at railhead)	H-000837	closed 9/22/2004
US Bureau of Reclamation (Lead, arsenic, chromium impact from pilot processing of Three Kids ores)	8-000904	closed 6/13/2005

[a] Original case file for lead released from the subject property. Case officer: Brenda Pohlmann. Report date: 8/17/1992.

[b] Re-opened case file pursuant to discovery of released petroleum and elevated arsenic, lead, and manganese. Case officer: Todd Croft. Report date: 4/7/1999.

[c] Gasoline impact not related to TKM operations. Case officer: Brenda Pohlmann. Report date: 2/24/2000.

[d] Case file for lead released from the subject property and/or from target shooting impacts. Case officer: Ed Basham, Report date: 4/11/1991.

Table 4
State and County Disposal Permits
On the Subject Property

PERMITEE / OWNER	OPERATOR	PERMIT NO.	PERMIT DATES
Solid Waste Permits			
Three Kids Mobile Park, Inc.	J. C. Lancaster (Parcel 18)	B0041	7/1/1979-6/30/1980
Three Kids Mobile Park, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	B0041	7/1/1980-6/30/1981
Three Kids Mobile Park, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	B0041	7/1/1981-6/30/1982
Three Kids Mobile Park, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	[a]	7/1/1982-6/30/1983
Nevada Disposal, Inc. (Leonard Roy Sr.)	Three Kids Landfill (Parcel 18)	B0041	7/1/1983-6/30/1984
Three Kids Enterprises, LP (Bertuccini, Andress, Gubler)	Hollywood Gravel Co. LP (Parcels 1 & 9)	application only, withdrawn	7/1/1998-7/1/2018
Wastewater Application Permits			
Gold Bond Ice Cream, Inc.	Three Kids Enterprises, LP (Parcel 5)	87900301	3/1/1990-2/28/1993
Gold Bond Ice Cream, Inc.	Three Kids Enterprises, LP (Parcel 5)	NEV91002	6/7/1991-6/7/1996
Septic Tank Permits			
M&R LP	Lake Mead Boat Storage (Parcel 2)	S110Z	N.D. [b]
David Grossheim	Laker Plaza (Parcel 4)	[c]	N.D. [b]

[a] Permit inferred from other case records which indicate the landfill activity and inspections; actual permit records not found.

[b] Date not reported.

[c] Permit not confirmed and was not reasonably ascertainable.

Table 5
Significant Prior Assessments/Studies Reviewed
(Not including Workplans, Biological, or Cultural Studies)

TITLE/YEAR	AUTHORING ENTITY	SIGNIFICANT FINDINGS
Geologic/Geotechnical Evaluation of Proposed 1000 Acre Development, Clark County, Nevada, 1984 [a]	Geotechnical Services, Inc.	Soil fertility is problematic; overburden will not make good quality commercial aggregate.
Draft Preliminary Assessment, Henderson Lead Site, Clark County, Nevada, 1995 [65]	US Bureau of Reclamation	Elevated lead levels on north side of Lake Mead Parkway resulted from former mine/mill operations.
The Migration of Arsenic and Lead in Surface Sediments at Three Kids Mine, Henderson, Nevada, 1995 [80]	University of Nevada Las Vegas	Arsenic and lead are transported by storm events, not solubility; some off-site influences from the site were detected.
Manganese Transport: A Preliminary Study of the Three Kids Mine and Surrounding Area, 1997 [104]	University of Nevada Las Vegas	Manganese is transported by storm events; aerial deposition after wind events is also moves contaminants; five metals (arsenic, lead, copper, zinc, and manganese) were not normally distributed.
Overburden and Native Material Characterization, Three Kids Mine, Clark County, Nevada, 1998 [28]	Geotechical and Environmental Services, Inc.	Native rock generates soluble arsenic using MWMP; native rock is not acid generating.
Preliminary Soil Assessment Report, Three Kids Mine, Clark County, Nevada, 1999 [31]	Ninyo & Moore	Tailings contain elevated lead, arsenic and petroleum; petroleum exceeds state action level
Test Well Sampling Report, Three Kids Mine, Clark County, Nevada, 1999 [29]	Ninyo & Moore	Groundwater has geothermal signature and is naturally high in arsenic, aluminum, and total dissolved solids.
Asbestos Bulk Sample Survey, Three Kids Mine Site, Henderson, Nevada, 1999 [a]	BEI	Friable and non-friable asbestos containing materials exist on site and will required licensed removal.
Supplemental Preliminary Soil Assessment and Waste Characterization Report, Three Kids Mine, Clark Cty, NV, 2000 [105]	Ninyo & Moore	Tailings generate arsenic-bearing runoff using MWMP[b]; tailings are not acid generating; native material beneath tailings is not impacted by tailings; mill site soil generates several metals using MWMP.
Site Investigation Report, Three Kids Mine Property, Clark County, Nevada, 2000 [106]	JBR Environmental Consultants	TPH in tailings is typically less than 3,000 mg/kg diesel range; TCLP exceedances are uncommon in tailings.
Site Investigation Report Supplement, Three Kids Mine Property, Clark County, Nevada, 2001 [107]	JBR Environmental Consultants	Arsenic, lead, and managese exceed Reg. IX PRGs in all tailings ponds, but other RCRA metals always below PRGs in tailings.
Summary Report: Environmental Studies and Reclamation Activities, Three Kids Mine Property, Clark County, Nevada, 2001 [108]	JBR Environmental Consultants	Summarizes the findings of previous reports; tailings are Bevill exempt under RCRA; estimated tailings at 2.1 M yds^3 and pits at 8.5 M yds^3.
Final Preliminary Assessment, Henderson Remote Site, Nevada, 2001 [69]	Parsons Engineering Science	Nodules and ore formerly stored by DLA did not exhibit RCRA metal characteristic levels; soil in one pile footprint failed TCLP for arsenic.
Manganese Ore Disposition, Three Kids Mine Site, Henderson, Nevada, 2004 [68]	Defense Logistics Agency	Nodules and ore may have lead up to 2%; soil in ore yard consistent with ore.

[a] Study referred to in *Summary Report: Environmental Studies and Reclamation Activities, Three Kids Mine Property, Clark County, Nevada*, 2001 [108].

Table 6
Anticipated Environmental Deliverables and Agreements

DOCUMENT	AUTHORITY	PROJECT PHASE
Enforceable Administrative Order of Consent (AOC) describing responsibilities of site owners to assess and remediate	NDEP	Pre-Planning
Site access permits	BLM, USBR	Pre-Planning
Dust Control Permit	CCDAQEM	Planning
Sampling and Analysis Plan (SAP)	NDEP	Planning
Cultural Resources Assessment	SHPO	Planning
Biological Resources Assessment	FWS	Planning
Phase II Environmental Site Assessment - Background Study - Site Assessment of Contaminants - Data to Support Risk Assessment - Geotechnical Study of Site Resources	NDEP	Planning
Conceptual Site Model (CSM) - Hydro-geologic Characterization - Contaminant Fate and Transport - Exposure Pathways - Presumptive Remedy	NDEP	Planning
Human Health Risk Assessment (RA)	NDEP	Planning
Corrective Action Plan - Remediation Workplan - Health & Safety Plan and Decon Plan - Air Monitoring Plan - Asbestos Management Plan - Stormwater Pollution Prevention Plan - Dust Control Plan - Engineering Design - Grading Plan - Waste Cell Design	NDEP	Planning
Covenant Deferral Request (CDR) pursuant to CERCLA § 120(h)(3) - Community Relations Plan	DOI	Property Transfer
Closure Report - Narrative and confirmatory analyses - Issuance of No Further Action	NDEP	Post-Remediation
Uniform Environmental Covenants Act - Amend deeds on parcels containing waste cells	State of Nevada	Post-Remediation

Appendix B

Environmental and Land Records

Appendix B.1
Phase I Resource Checklist
EDR Database Report

Appendix B.2
Land Records

- Please see attached disc -

Appendix C

Photographs

Appendix C.1
Historic Mine and Mill Site Photos

Appendix C.2
Aerial and Satellite Images

- Please see attached disc -

Appendix C.3

Recent Photographs

Photo 1 – Original Three Kids Pit facing S. January 9, 2007.

Photo 2 – B Pit (the first mined portion of what was called the Annex Pit) facing NE. January 9, 2007.

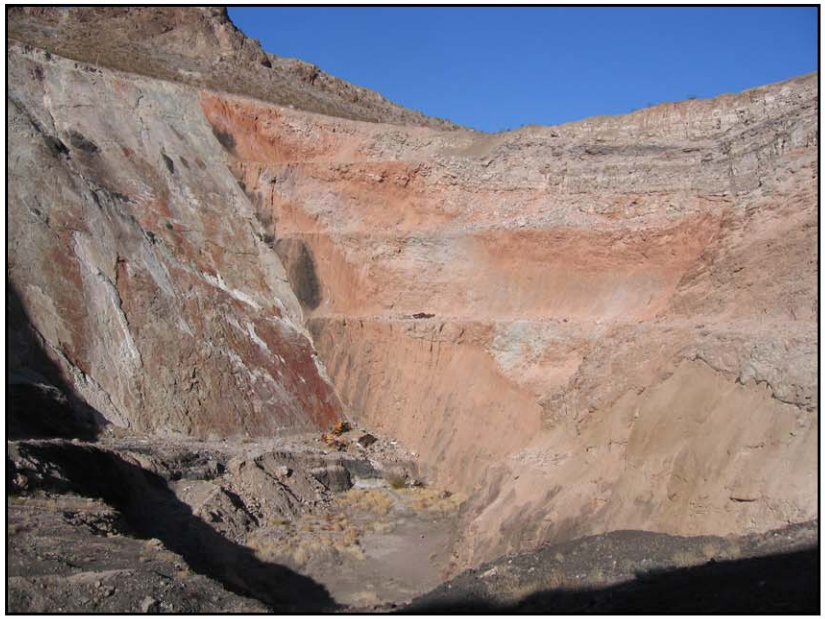


Photo 3 – A Pit (the latter mined portion of what was called the Annex Pit) facing NW. January 9, 2007.

Photo 4 – Hydro Pit facing SW. January 9, 2007.

Photo 5 – Hulin Pit facing S. January 9, 2007.

Photo 6 – Ore stockpile yard facing S. July 11, 2006.

Photo 7 – Ore stockpile yard / former DLA reserve stockpiles facing SE. January 9, 2007.

Photo 8 – Former ore hopper location facing down and NE. July 11, 2006.

Photo 9 – Former ore hopper location facing up and SE. January 9, 2007.

Photo 10 – Mill site location, view 1, facing NE. January 9, 2007.

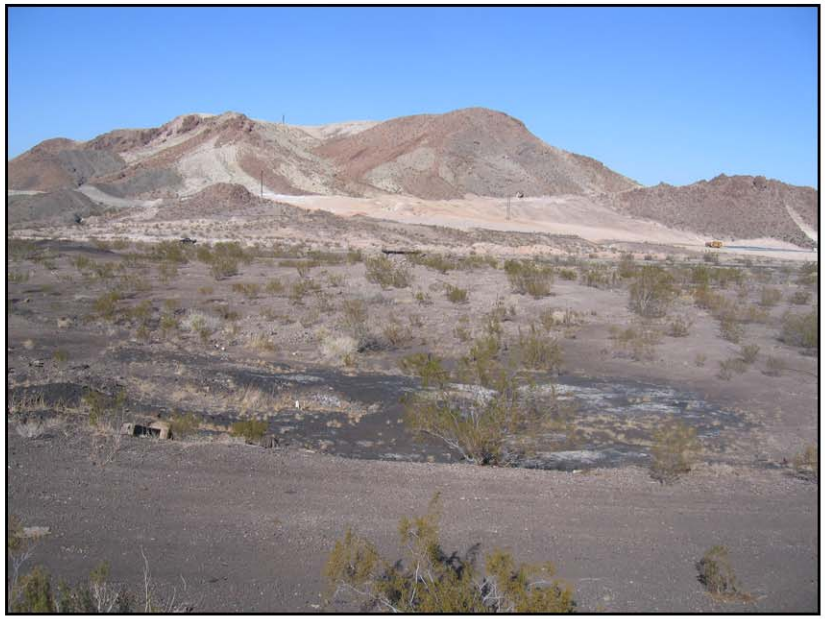


Photo 11 – Mill site location, view 2, facing N. January 9, 2007.

Photo 12 – Mill site location, view 3, facing NW. January 9, 2007.

Photo 13 – Mill site foundations facing SW, July 11, 2006.

Photo 14 – Mill building foundations, conditioner piers, and thickener facing NW. December 1, 2006.

Photo 15 – West side of mill area, thickeners, Lake Mead Boat Storage in background, facing W. July 11, 2006.

Photo 16 – Nodule stockpile area with kiln foundation behind facing S. July 11, 2006.

Photo 17 – Thickener with abandoned vehicle facing NNW. January 9, 2007.

Photo 18 – Thickener showing vitrified clay pipe with residues. January 9, 2007.

Photo 19 – East octagonal sump depicting fall hazard facing NW. January 9, 2007.

Photo 20 – East octagonal sump interior, approximately 15 ft fall, facing N. January 9, 2007.

Photo 21 – Pipeline segment, E side of mill site, facing E. January 9, 2007.

Photo 22 – Exposed pipeline, NE of mill site. January 9, 2007.

Photo 23 – Remains of brick sewer line interceptor, mill site area. January 9, 2007.

Photo 24 – Remains of subsurface wooden drainage, NE of mill site, facing W. January 9, 2007.

Photo 25 – Tailings pond 1 facing NW. Left side of tailings with waste manganese nodules; right side without. January 9, 2007.

Photo 26 – Tailings pond 2 facing NNW. Dust palliative deteriorated due to high OHV traffic. January 9, 2007.

Photo 27 – Tailings pond 3 facing NW. Dust palliative deteriorated due to high OHV traffic. January 9, 2007.

Photo 28 – Example of dust caused by OHV trespassers, main mine road facing W. January 9, 2007.

Photo 29 – Tailings waste pipe, tailings pond 1, facing NW.
July 11, 2006.

Photo 30 – Waste pile SW of Hydro Pit facing E. December 21, 2006.

Photo 31 – Test well showing vandalized well completion.
NE of mill site. January 9, 2007.

Photo 32 – Pole number on BMI control line,
N of B Pit mine haul road. January 9, 2007.

Photo 33 – Weathered transite asbestos containing material, between thickeners and N edge of Hydro Pit facing W. January 9, 2007.

Photo 34 – Weathered apparent friable asbestos in mill site E of former calcining kilns. January 9, 2007.

Photo 35 – Weathered transite asbestos and apparent friable asbestos between thickeners and N edge of Hydro Pit. January 9, 2007.

Photo 36 – East wall of Hulin Pit. Friable asbestos was reportedly disposed ca. 1982, facing down and NE. January 9, 2007.

Photo 37 – Wire burning site in B Pit (one of two identified sites in B Pit). January 9, 2007.

Photo 38 – Abandoned drums near thickeners. January 9, 2007.

Photo 39 – Abandoned drums along S edge of tailings pond 3 facing N. January 9, 2007.

Photo 40 – Buried drums and solid waste NW of Hulin Pit facing N. January 23, 2007.

Photo 41 – Solid waste and vehicles, A Pit. January 9, 2007.

Photo 42 – Solid waste, B Pit. January 9, 2007.

Photo 43 – Solid waste, boats, and vehicles, Hydro Pit. January 9, 2007.

Photo 44 – Solid waste and vehicles, Hulin Pit. January 9, 2007.

Photo 45 – Lake Mead Boat Storage, front view facing S. January 18, 2007.

Photo 46 – Lake Mead Boat Storage, rear view including adjacent tailings, facing NW. January 9, 2007.

Photo 47 – Laker Plaza, front view facing S. January 18, 2007.

Photo 48 – Laker Plaza, rear view, center of photo, Lake Mead Boat Storage in foreground, facing NE. January 9, 2007.

Photo 49 - North facing panorama of Hydro overburden, Hydro Pit, and commercial establishments; Lake Las Vegas in center background, January 23, 2007

Photo 50 - Northwest facing panorama of A & B Pits, January 9, 2007

Appendix D

Supplemental Documents

Appendix D.1
Interview Records

Appendix D.2
Mining

Appendix D.3
Land Use

- Please see attached disc -