3.0 AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes the environment that would be affected by the development of the Proposed Action and the alternatives analyzed in this EIS. The baseline information summarized in this chapter was obtained from published and unpublished materials; interviews with local, state, and Federal agencies; and from field and laboratory studies conducted in the study area. The affected environment for individual resources was delineated based on the area of potential direct and indirect environmental impacts for the proposed project. For resources such as soils and vegetation, the affected area was determined to be the physical location and immediate vicinity of the areas to be disturbed by the proposed project. For other resources such as water quality (surface and ground) and water use, air quality, wildlife, social and economic values, and the transport of hazardous materials, the affected environment was more extensive (e.g., airshed, local communities, etc.).

To comply with the NEPA, the BLM is required to address specific elements of the environment that are subject to requirements specified in statute, or regulation or by executive order. **Table 3.1-1** lists the supplemental authorities that must be addressed in all environmental analyses, as well as other resources deemed appropriate for evaluation by the BLM, and denotes if the Proposed Action or No Action Alternative affects those elements.

Table 3.1-1
Supplemental Authorities to be Considered

Supplemental Authority[1]	Not Present[2]	Present/Not Affected	Present/May be Affected[3]	Rationale
Air Quality			X	Sections 3.7 and 4.7.
Area of Critical Environmental Concern (ACEC)	X			Would not be affected. Resource not present in or near the proposed project area.
Cultural/Historical			X	Sections 3.4 and 4.4.
Environmental Justice			X	Sections 3.21 and 4.21.
Farmlands Prime or Unique	X			Would not be affected. Resource not present in or near the proposed project area.
Noxious Weeds/Invasive Non-native Species			X	Sections 3.15 and 4.15.
Native American Religious Concerns			X	Sections 3.5 and 4.5.
Floodplains	X			Would not be affected. Resource not present in or near the proposed project area.
Riparian/Wetlands			X	Sections 3.14 and 4.14.
Threatened, Endangered Species			X	Sections 3.18 and 4.18.
Migratory Birds			X	Sections 3.17 and 4.17.

Table 3.1-1 (Continued)

Supplemental Authority[1]	Not Present[2]	Present/Not Affected	Present/May be Affected[3]	Rationale
Waste – Hazardous/Solid			X	Sections 3.6 and 4.6.
Water Quality			X	Sections 3.3 and 4.3.
Wild & Scenic Rivers	X			Would not be affected. Resource not present in or near the proposed project area.
Wilderness			X	Sections 3.11 and 4.12.
Forests and Rangelands (Healthy Forests Restoration Act [HFRA] only)	X		X	Would not be affected. Resource not present in or near the proposed project area.
Human Health and Safety			X	Section 2.5.

[1] See H-1790-1 (January 2008) Appendix 1 Supplemental Authorities to be Considered.

[2] Supplemental Authorities determined to be Not Present or Present/Not Affected need not be carried forward for analysis or discussed further in the document.

[3] Supplemental Authorities determined to be present/May be Affected must be carried forward for analysis in the document.

Other resources of the human environment that have been considered for this EIS are listed in **Table 3.1-2**. Elements that may be affected are further described in the EIS. Rationale for those elements that would not be affected by the Proposed Action and alternative also are listed in the table.

Table 3.1-2
Other Resources of the Human Environment

Other Resources	Not Present[1]	Present/Not Affected	Present/May be Affected	Rationale
Grazing Management			X	Sections 3.16 and 4.16.
Land Use Authorization			X	Sections 3.19 and 4.19.
Minerals			X	Sections 3.2 and 4.2.
Paleontological Resources			X	Sections 3.8 and 4.8.
Recreation			X	Sections 3.10 and 4.10.
Socio-economic Values			X	Sections 3.9 and 4.9.
Soils			X	Sections 3.13 and 4.13.
Special Status Species			X	Sections 3.18 and 4.18.
Vegetation			X	Sections 3.14 and 4.14.
Visual Resources			X	Sections 3.12 and 4.12.
Wild Horses and Burros	X			Would not be affected. Resource not present in or near the proposed project area.
Wildlife			X	Sections 3.17 and 4.17.

[1] Other Resources determined to be Not Present or Present/Not Affected need not be carried forward for analysis or discussed further in the document based on the rational provided.

3.2 Geology and Minerals

The study area for geology and minerals includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor). The Cumulative Effects Study Area (CESA) for geology and minerals includes the southern half of Big Smoky Valley and the northern one-third of Tonopah Flat. This area encompasses the Toquima Range on the east side of the Big Smoky Valley, the Toiyabe Range on the west side of the valley, and includes the Round Mountain, Gold Hill, Manhattan, Jefferson Canyon, and Barcelona mining districts. The Round Mountain and Gold Hill mining districts are located on the east side of the Big Smoky Valley near the Town of Round Mountain. The Manhattan Mining District is located in the Toquima Range, 12 miles south of the Town of Round Mountain. The Jefferson Canyon and Barcelona mining districts are historic underground mining districts, located in the Toquima Range east and southeast of the Town of Round Mountain, respectively.

3.2.1 Physiography and Regional Geology

The proposed project is located within the Basin and Range Physiographic Province, an area in Nevada and western Utah characterized by north-south trending mountain ranges separated by broad alluvial valleys. The mountain ranges are composed of Paleozoic sedimentary rocks, Tertiary volcanic rocks, and Tertiary and Mesozoic igneous intrusives. The basins are filled with late Tertiary to Quaternary alluvium. In general, valleys have internal drainage and playa deposits are often found near the center of the valleys. The mountains are bounded by Basin and Range normal faults formed by extensional faulting during the late Tertiary and Quaternary periods. Basin and Range faulting frequently obscures earlier episodes of late Cretaceous thrust faulting, resulting in the complex geology of superimposed faults exhibited in the mountain ranges. Elevations in the area range from over 11,000 feet amsl in the Toiyabe Range to 5,540 feet amsl in the Big Smoky Valley.

The Toquima Range, located east of the proposed project area, is characterized by abundant Tertiary volcanic rocks, late Cretaceous intrusive igneous rocks, and Paleozoic sedimentary rocks (**Figures 3.2-1** and **3.2-2**) (Kleinhampl and Ziony 1985). The Tertiary volcanic rocks are largely pyroclastic rocks formed by voluminous eruptions of rhyolitic tuffs from large nested caldera complexes. The intrusive rocks are of granitic composition and are widespread across the southern part of the range. Paleozoic sedimentary rocks in the southern part of the Toquima Range consist of metamorphosed Cambrian-Ordovician shale and limestone. Farther north, the Paleozoic rocks are composed of chert, siltstone, and volcanic rocks.

The geology of the study area consists of Paleozoic sedimentary and metasedimentary rocks intruded by a large late Cretaceous granite stock and overlain by Tertiary volcanic flows and tuffs erupted from nested calderas in the Round Mountain Area. Four main calderas occur in the Round Mountain Area, the Gold Hill Area, and at Manhattan (**Figure 3.2-1**). The Paleozoic sedimentary rocks in the Round Mountain Area consist of Cambrian phyllites, argillites, schists, and limestones of the Gold Hill, Mayflower, and Harkless formations overlain by Ordovician argillites and limestones of the Zanzibar and Toquima formations. As shown in **Figure 3.2-2**, these Paleozoic rocks are found in the walls of the existing Round Mountain Pit. The Paleozoic rocks are intruded by a Cretaceous granite stock and overlain by the Tertiary volcanic flows and tuffs.

The southern Toiyabe Range, located west of the proposed project area, is composed of similar assemblages of Tertiary volcanic rocks, Mesozoic and Tertiary intrusive igneous rocks, and Paleozoic sedimentary rocks. The Paleozoic sedimentary rocks consist of Cambrian to Silurian meta-sedimentary rocks and the Permian Pablo and Diablo formations. The Pablo Formation consists of volcanic rocks and

minor sedimentary rocks and the Diablo Formation consists of conglomerate, quartzite, limestone, black shale, and chert (Kleinhampl and Ziony 1985).

The valley fill in the Big Smoky Valley consists of alluvial fans along the mountain fronts that are largely composed of coarse material (i.e., gravels) grading to finer-grained fluvial and lake deposits towards the center of the valley (Kleinhampl and Ziony 1985). Reworked beach deposits consisting mainly of sand have provided material for sand dunes that are present at various locations in the valley. Approximately 3,000 to 5,000 feet of valley fill occurs in the Big Smoky Valley west of the study area (WMC 2008).

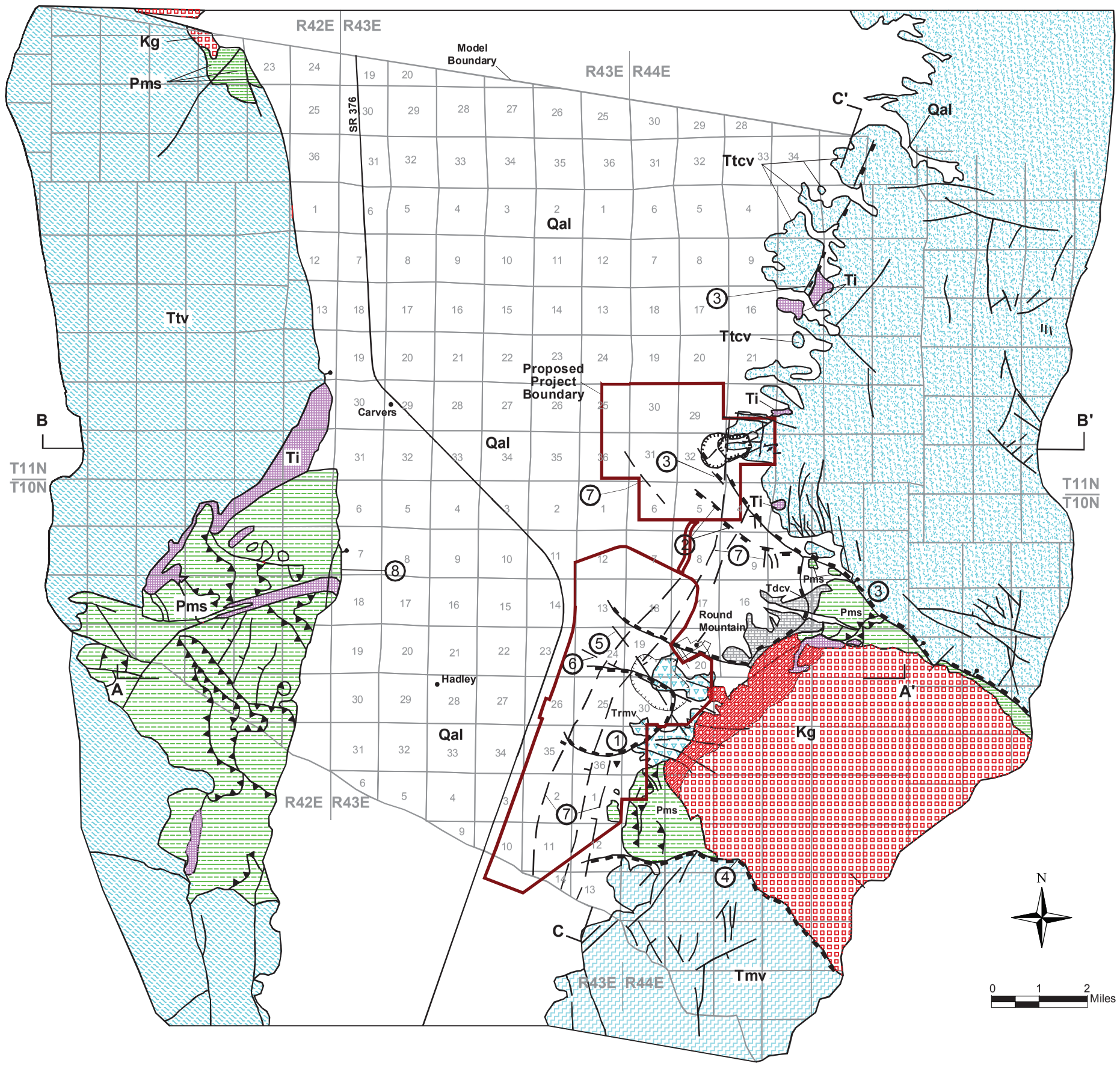
Prominent fault zones are present on the west side of the Toquima Range and the east side of the Toiyabe Range (dePolo 2008). The range-front fault zone that trends generally south-north along the western side of the Toquima Range is composed of down-to-the-west normal faults, which are generally obscured by valley alluvial fill, but can be seen as scarps on pediments east of Round Mountain and near Manhattan Gulch (Sawyer 1998). The Toiyabe Range Fault Zone contains south-north trending down-to-the-east normal faults along the contact between the east side of the range and the alluvial fans of Big Smoky Valley. The fault traces are very prominent and well defined (Sawyer and Lidke 1998). Quaternary faults in the Big Smoky Valley are shown on **Figure 3.2-3**.

3.2.2 Site Geology

3.2.2.1 Stratigraphy

The stratigraphy of the Round Mountain Area consists of a basement of folded and thrust-faulted Paleozoic sedimentary rocks that have been locally metamorphosed by a Cretaceous granitic intrusion and then altered by mineralization and hydrothermal activity associated with the volcanic calderas that dominate the proposed project area. The principal Paleozoic unit in the Round Mountain Area is the Zanzibar Formation (WMC 2008). The granitic stock found along the east wall of the Round Mountain Pit has been dated at 75 to 83 million years. The volcanic caldera in the Round Mountain Area was active during the middle Tertiary (25 to 35 million years ago) and produced a variety of ash-fall and welded tuffs. Most of the volcanics are overlain by a siliceous lacustrine and volcanoclastic unit called the Stebbins Hill Formation. This unit is relatively impermeable to the flow of groundwater and separates the volcanics from the overlying Quaternary alluvial sands and gravels. All units, except the Quaternary gravels, are mineralized.

The stratigraphy of the Gold Hill Area is dominated by the volcanics of the Tertiary Mount Jefferson Tuff. The Gold Hill Area and proposed mine pit are situated along the western margin of the Toquima Caldera Complex (WMC 2008). Paleozoic units and a Cretaceous granite have been encounted in drill holes, but are not found on the surface and would not be exposed in the proposed mine pit. The Mount Jefferson Tuff is overlain along the west side of the Gold Hill Area by a Tertiary hot-spring sinter unit. Air-fall tuffs overlay the sinter unit and these in turn are overlain by Quaternary alluvial gravels that are cemented and have a low porosity. Tertiary dikes are found in the Gold Hill Area and the mineralization is controlled by an east-west fault zone that runs through the proposed project area.



Legend

- Unit Contact
- Caldera Margin
- Fault: Ball On Down Thrown Side
- Thrust Fault, Sawteeth on Upper Plate
- Pit Outline
- A — A' Cross-section Location (See Figure 3.2-2)

Geologic Units

- Qal — Quaternary Alluvium
- Ti — Tertiary Intrusive
- Ttv — Tertiary Toiyabe Volcanics
- Tmv — Tertiary Manhattan Volcanics
- Ttcv — Tertiary Toquima Caldera Complex Volcanics
- Trmv — Tertiary Round Mountain Volcanics
- Tdcv — Tertiary Dry Canyon Volcanics
- Kg — Cretaceous Granite/ Rhyolitic Dike Swarm
- Pms — Paleozoic Metasedimentary Rocks

1. Round Mountain Caldera Margin
2. Dry Canyon Caldera Margin
3. Toquima Caldera Complex Margin (Mt. Jefferson Caldera Margin)
4. Manhattan Caldera Margin
5. Automatic Fault Zone
6. Fluorite Fault Zone
7. Basin and Range Faults
8. Toiyabe Range Fault Zone

Notes:
1. Caldera margins defined by drilling in the Alluvial (Qal) areas.

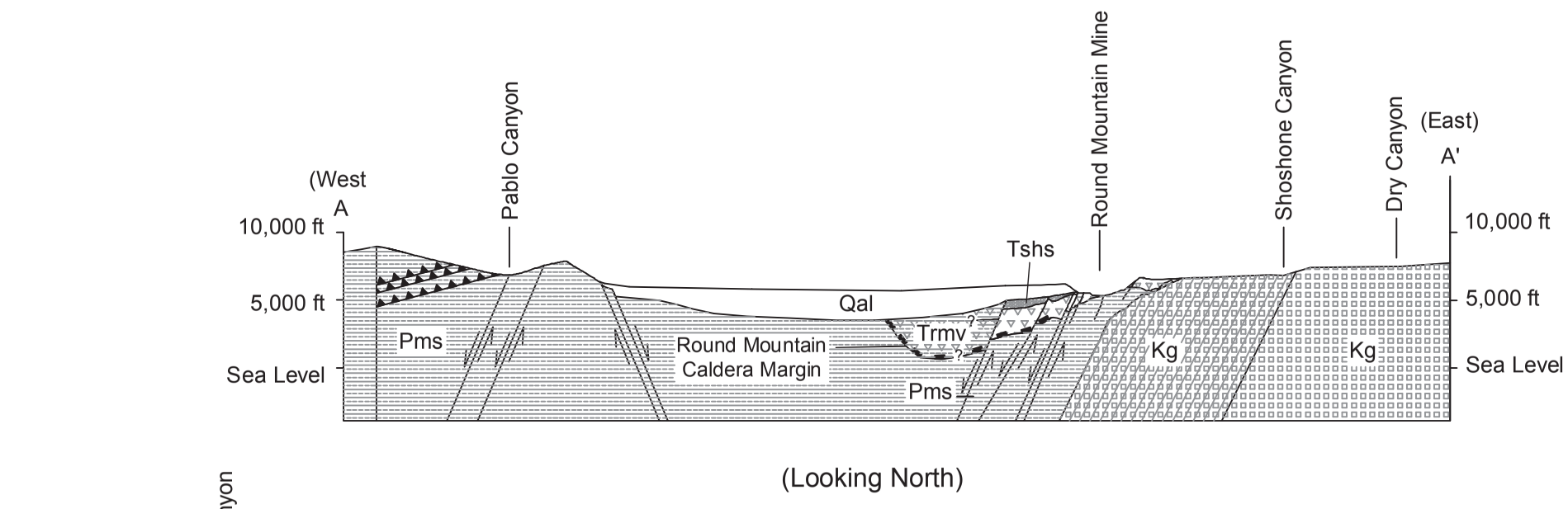
Sources: WMC 2008; BLM 1996; Boden 1992; Kleinhampl and Ziony 1985.

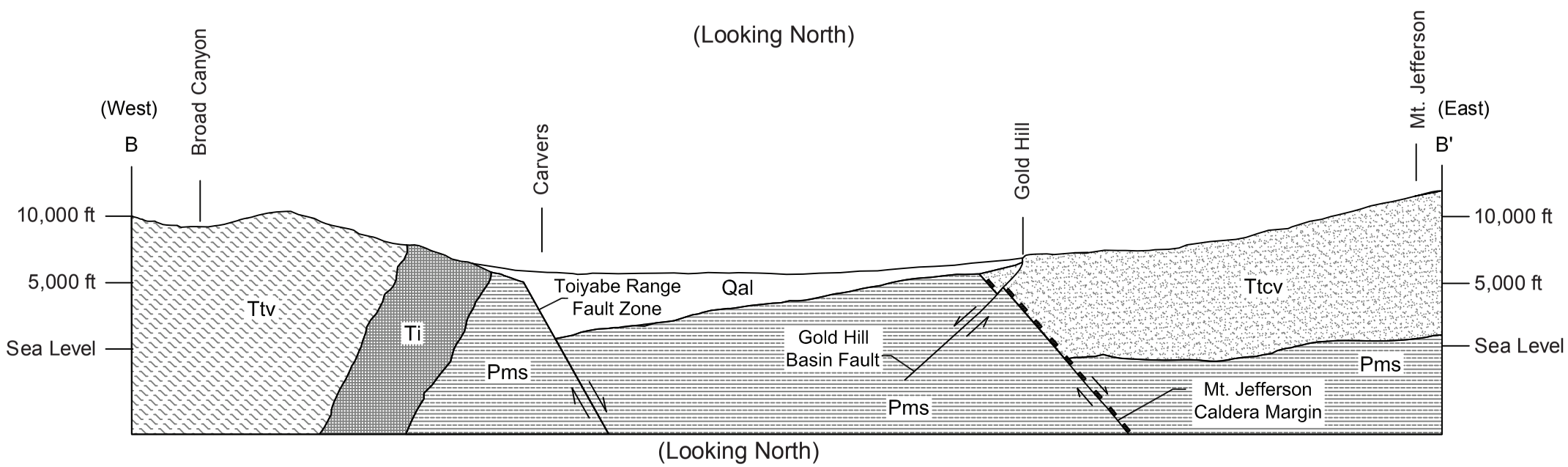
Round Mountain Expansion Project

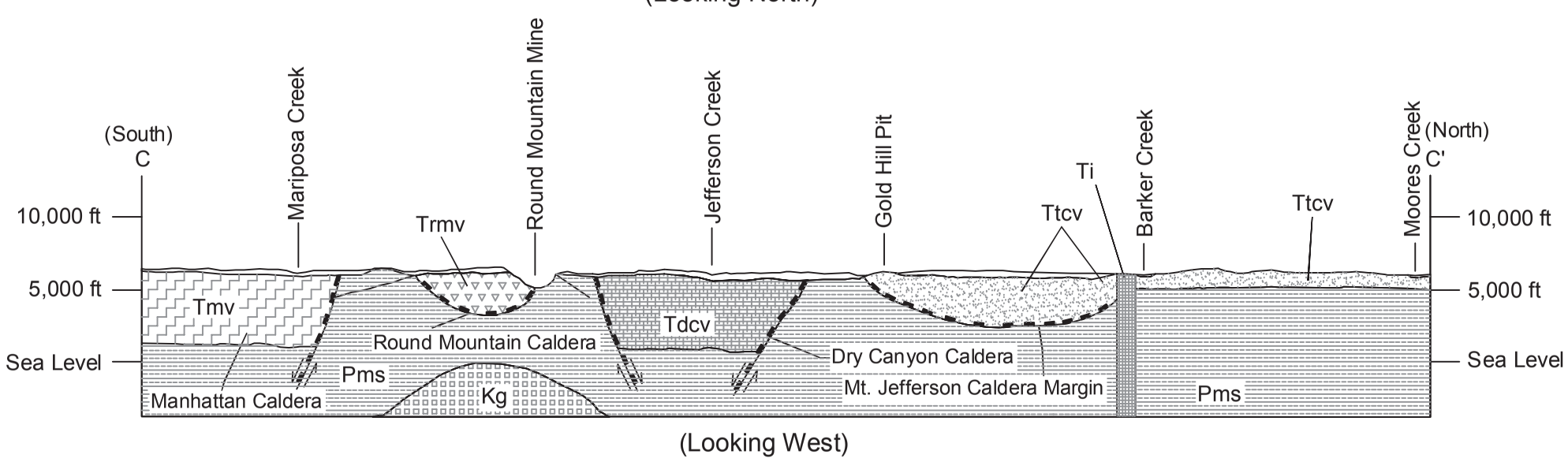
Figure 3.2-1

Regional Geology

04/12/09







Legend

- Contact
- Fault Showing Displacement
- Caldera Margin

Geologic Units

- Qai — Quaternary Alluvium
- Ti — Tertiary Intrusive
- Ttv — Tertiary Toiyabe Volcanics
- Tshs — Tertiary Stebbins Hill Sediments
- Tmv — Tertiary Manhattan Volcanics
- Tdcv — Tertiary Toquima Caldera Complex Volcanics
- Trmv — Tertiary Round Mountain Volcanics
- Ttcv — Tertiary Dry Canyon Volcanics
- Kg — Cretaceous Granite
- Pms — Paleozoic Metasedimentary Rocks

0 5,000 1,000 1,5000 20,000 Feet

APPROXIMATE SCALE
NO VERTICAL EXAGGERATION

USGS 1929 V

Note: See **Figure 3.2-1** for cross-section locations. Topographic elevations provided in feet, ertical Datum.

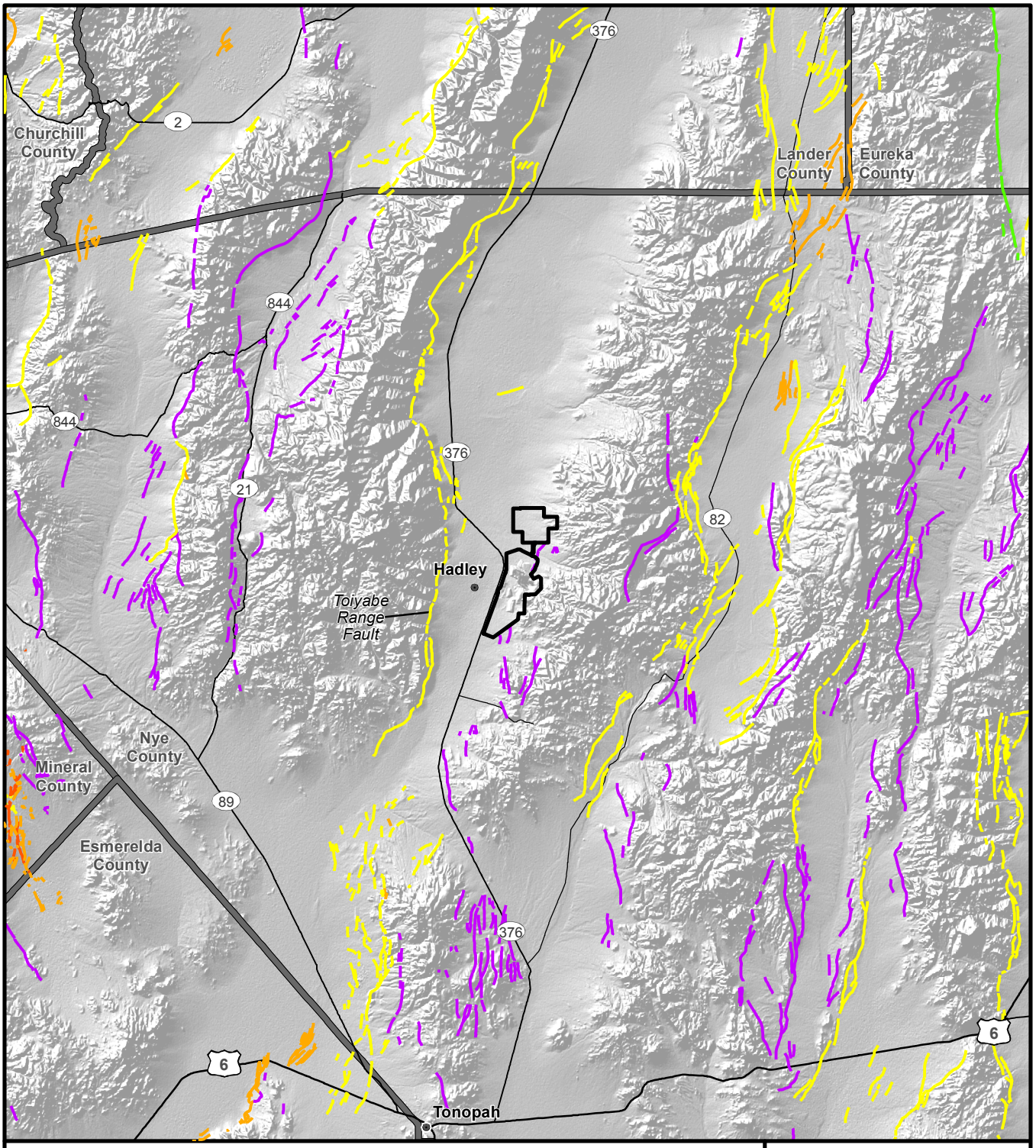
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.2-2

Regional Geologic Cross-sections

04/10/09



Legend

Proposed Project Boundary

Years Before Present of Latest Fault Rupture

- Historical <150
- Latest Pleistocene and Holocene <15,000
- Latest Quaternary <130,000
- Mid-Quaternary <750,000
- Quaternary <1,800,000

Source: dePolo, C. M. 2008; Quaternary Faults in Nevada. Nev. Bureau of Mines and Geology Map 167.

N

0 2.5 5 10 Miles

Round Mountain Expansion Project

Figure 3.2-3

Quaternary Faults of the Northern Big Smoky Valley

04/12/2009

3.2.2.2 Structure

The faulting within the study area is very complex. Five sets of overlapping fault groups have been identified within the study area, which include older, late Paleozoic and late Cretaceous thrust faults that only affect the Paleozoic rocks, a set of north-south trending strike slip faults, faults associated with the caldera complexes, and Basin and Range range-front faults (WMC 2008). The range-front faults have been delineated in the existing Round Mountain Pit and displace both the Tertiary volcanic rocks and the Quaternary alluvial gravels.

The Paleozoic rocks are intricately interleaved by a series of stacked thrust sheets that developed during mountain building events in central Nevada that occurred in the Paleozoic and Mesozoic geologic eras. These thrust sheets generally strike to the northwest and dip back to the west. They were formed during periods of compression in the late Paleozoic (Sonoma Orogeny) and again during the late Cretaceous Sevier Orogeny in Nevada. The folding and thrusting of these Paleozoic rocks created numerous sets of north-trending fractures that transect the thrust faults. Prior to eruption of volcanics and formation of calderas in the mid-Tertiary, the proposed project area was uplifted and eroded. Volcanic tuffs cover the deformed Paleozoic rocks and are locally cut by ring-fracture faults associated with the calderas that produced the tuffs. In the Round Mountain and Gold Hill areas, overlapping nested calderas have produced a complex set of intersecting semi-circular ring-fracture faults. These faults provided the locus for mineralizing fluids generated by hydrothermal activity associated with the waning phases of Tertiary volcanism. Basin and Range extension began in central Nevada around 35 millon years ago, but was most prominent structurally during the late Tertiary (20 to 5 million years ago) and has continued through the Quaternary Period and into the present time at a much reduced scale. Basin and Range normal faults formed as the mountain ranges were uplifted and the alluvial valleys separating the mountain ranges were formed by extension and formation of large fault-bonded grabens. These basin–bounding faults, often referred to as range-front faults, transect the Round Mountain Area along the west side of the existing pit and are found immediately west of the proposed pit in the Gold Hill Area. They are also found along the east side of the Toiyabe Range. Some of these faults, especially the Toiyabe Range Fault, have been active historically and are the source of earthquakes in the Big Smoky Valley (Knight Piesold 2005).

3.2.2.3 Mineralization and Pit Geology

Round Mountain Area

The mineralization at the Round Mountain gold deposit “is a very large, epithermal, low-sulfidation, volcanic-hosted, hot-springs type, precious metal deposit” (Hansen 2006). The existing Round Mountain Pit is within a hydrothermally altered zone that is centered around the pit and is about 4 miles in diameter (BLM 1996). Hydrothermal mineralization occurs when geothermal water related to volcanic activity acquires metals due to reaction with basement rocks and then moves through fractures and faults. As the hydrothermal solution cools, the minerals are deposited in veins along the fractures and faults, and as broad disseminations in more porous rocks. Epithermal refers to lower temperature (below 250 degrees Centigrade) hydrothermal mineralization typical of volcanic-hosted deposits like those at Round Mountain. Mineralization occurs as sulfide deposits, as carbonate and quartz veins, and in oxidized form where the sulfides have been oxidized to iron oxides. Most of the mineralization at Round Mountain is in the volcanic tuffs.

The existing Round Mountain Mine is located on the western margin of the Toquima Caldera Complex and overlies the northeastern ring fracture of the Round Mountain Caldera (WMC 2008). The bedrock outcrop at the existing Round Mountain Mine is dominated by the Tuff of Round Mountain. This ash-flow tuff consists of an upper densely welded rhyolitic tuff member and a lower poorly welded tuff member. The ash-flow tuff overlies argillite and limestone of the Zanzibar Formation, which are exposed in the bottom and northeastern wall of the existing Round Mountain Pit. Granitic intrusive rocks exposed to the east of the existing Round Mountain Area are exposed in the east wall of the Round Mountain Pit. Overlying the Paleozoic rocks and the Tertiary volcanic tuffs in the Round Mountain Area are extensive Quaternary alluvial sediments that consist of poorly cemented gravels in a sandy matrix with interbedded clay horizons (WMC 2008).

The Round Mountain Pit expansion area also contains two northwest-trending faults that intersect the caldera ring fracture zone. These faults include the Automatic Fault Zone and the Fluorite Fault Zone. Northeast-trending Basin and Range normal faults intersect the proposed Round Mountain Pit expansion areas and the proposed Gold Hill Pit, as shown in **Figure 3.2-1**, and in the geologic cross-sections illustrated in **Figure 3.2-2**.

The gold mineral at Round Mountain is called electrum, an alloy of gold and silver (BLM 1996). Also associated with the electrum is quartz, adularia, pyrite, and iron oxides. “Primary sulfide mineralization consists of electrum associated with or internal to pyrite grains. In oxidized zones, gold occurs as electrum associated with iron oxides, or as disseminations along fractures” (Hansen 2006).

Gold Hill Area

Mineralization in the Gold Hill Area appears to be similar to the mineralization at the existing Round Mountain Mine and the veins are controlled by faults and fractures (WMC 2008). The mineralization in the Gold Hill Area occurred when hydrothermal solutions moved through fractures and deposited gold and silver in veins that cut the oldest Paleozoic rocks up through the Tertiary volcanics. The proposed Gold Hill Pit would lie along the southern ring fracture of the Toquima Caldera Complex. The Gold Hill Area is located on the western margin of the Toquima Caldera Complex and straddles the fault boundary between outcropping basement rocks to the east and basin alluvial gravels to the west. Approximately 70 percent of the Gold Hill Area is covered by alluvial gravels (WMC 2008). The bedrock is comprised mainly of members of the Mount Jefferson Tuff. Two prominent structural trends are present in the area: 1) the east-west Surprise zone, which hosts the mineralization in the historic Gold Hill Mine; and 2) the north to north-east trending Basin and Range normal faults. Exploration drilling has encountered Paleozoic sedimentary rocks and Cretaceous granite at depth. Structurally, the Gold Hill Area is situated on the caldera margin of the Mount Jefferson Caldera (WMC 2008). The caldera ring-fracture fault separates Paleozoic sedimentary rocks found in the foot wall of the fault from volcanic tuffs found in the hanging wall. The Mount Jefferson caldera margin structure trends north-northwest and dips 60 degrees to the northeast. Vein mineralization in the Gold Hill Area trends predominantly to the west and dips about 80 to 85 degrees to the south. The Toquima Fault in the Gold Hill Area trends generally northeast and dips 75 degrees to the west. Movement on this fault set up the Gold Hill vein system by creating extensional fractures that trend generally west. Basin and Range normal faults in the Gold Hill Area trend in a northerly direction and contain evidence of past hot-spring activity in the form of sinter deposits.

3.2.3 Mineral Resources

3.2.3.1 Metallic Ore Deposits

The primary mineral resources in the study area are precious metal ore deposits. The deposits were discovered in 1906 and mining at Round Mountain began that same year (Kleinhampl and Ziony 1985). The primary precious metal products were gold and silver. In addition to underground mining, surface placer mining operations contributed an important portion of the metals recovered and was conducted up to the 1960s. Open pit mining of the lode deposits began in the 1970s. Discovery of substantial new reserves in the 1970s contributed to a continuation of mining into the 1980s. A mill was installed in the mid-1990s to process sulfide ores and the mining rate in 1999 was over 300,000 tpd (Hansen 2006). The mining rate in 2005 was 259,000 tpd.

The deposits in the Gold Hill Area were discovered in 1910, but most of the production by underground methods occurred in the 1930s. Other metallic ores in the Round Mountain District contain minor amounts of uranium, tungsten, and mercury. Gold and silver were the primary metals mined at Gold Hill and Manhattan mining districts. Silver was the predominant metal in the Jefferson Canyon District. Mercury and antimony were the primary metals produced in the Barcelona District (Kleinhampl and Ziony 1985).

3.2.3.2 Non-metallic Minerals

Non-metallic mineral deposits known to occur in the study area are turquoise deposits located in the southern Toquima Range and gravel deposits in the valley alluvium (Kleinhampl and Ziony 1985). Sand and gravel deposits in the study area are occasionally used for road construction.

3.2.3.3 Geothermal

Much of the Smoky Valley, from the Round Mountain Area to the Carvers area and northward, is classified as having a ‘medium’ potential for geothermal resources. Sections 25 and 36, Township (T)10 North (N), Range (R)43 East (E) are a Known Geothermal Resource Area. RMGC has held geothermal lease NVN-046200 since 1987. The lease covers 2,559 acres in T9N, R43E, Section 1 and T10N, R43E, Sections 24, 25, and 36. The lease is within the proposed project area in the Round Mountain Area. RMGC installed geothermal wells and used hot water in their mining operation to heat cyanide solutions sprayed on leach pads. Five production wells and one injection well were originally installed. With the advent of cyanide application by drip emitters, the use of spray emitters and the need for heated solution in the wintertime was phased out. RMGC still maintains the geothermal lease and pays royalties to the Minerals Management Service. One production well and one injection well remain in the Round Mountain Area but the wells are no longer used in the mining operation.

3.2.3.4 Oil, Gas, and Coal

No oil and gas or coal deposits are known to occur in the study area.

3.2.4 Geological Hazards

3.2.4.1 Faulting

Several active faults have been reported within or near the study area (Knight Piesold 2005). An active fault is defined as a fault in which movement has occurred within Holocene time or the last 10,000 to 11,000 years before present (Hart and Bryant 1999). A potentially active fault is a fault that has had surface movement within the last 1.6 million years (Quaternary time). Within 20 miles of the project area are 2 faults that have the potential to cause strong earthquakes. The Toiyabe Range Fault is within 10 miles west of the proposed project area and site specific study of this fault indicates activity during mid-Holocene (Knight Piesold 2005). This fault is likely to be the source of an earthquake with a characteristic magnitude of 7.5 with a return period of 4,200 years. The other nearby fault that could generate a strong earthquake is the West Toiyabe Range Fault located about 20 miles northwest of the mine. The West Toiyabe Fault is likely to be the source of a characteristic magnitude 7.4 earthquake with a return probability of 34, 100 years (Knight Piesold 2005).

In the study area, movement on the East Smoky Valley Fault Zone would have the potential to cause ground displacement and generate ground motion in the area. The northern portion of the East Smoky Valley Fault zone intersects the study area and is the major mountain front fault zone on the west side of the Toquima Range (de Polo 2008). The fault zone is a Quaternary fault, and therefore, capable of potential activity. It is not classified as an active fault although it was active during the Quaternary Period (Sawyer 1998). Within about a mile of the proposed project area are a series of unnamed faults that show evidence of past movement as scarps on alluvial fans, scarps on higher piedmont-slope surfaces, and as prominent scarps and lineaments in bedrock (Knight Piesold 2005).

3.2.4.2 Seismicity

The study area is located in an area of lower seismic risk than other parts of Nevada. Seismic activity in the area is common, but the recorded events in the region are not generally of strong magnitude. According to the Nevada Seismological Library earthquake database at University of Nevada, Reno, there have been 50 events with magnitude greater than 3.5 within an approximate 50-mile radius of the study area from 1872 to March 2007 (University of Nevada, Reno Seismic Laboratory 2009). Seven earthquakes with a magnitude of 5.5 to 7.2 were recorded between 1872 and 1939 within 50 miles of the site. Recorded earthquakes within 60 miles of the site included 271 smaller events with a magnitude of 4.9 or less, 23 events with a magnitude of 5.0 to 5.9, and 2 events with a magnitude of 6.0 to 7.9 (Knight Piesold 2005).

USGS seismic hazard data and mapping indicates that ground motion in the study area from a maximum credible event would be approximately 10 to 16 percent of the acceleration of gravity, with a 10 percent probability of exceedance in 50 years (Petersen et al. 2008). Evaluation of the potential seismic ground movement in the proposed project area by Knight Piesold (2005) suggests that the peak horizontal ground acceleration would be 13 percent of gravity with a 10 percent probability of occurring during the operational life of the mine and a return period of 500 years.

3.2.4.3 Other Geological Hazards

No other geological hazards have been identified in the study area.

3.3 Water Quality and Quantity (Surface and Ground) and Water Use

The study area for water resources encompasses the entire area within the projected maximum 10-foot groundwater drawdown isopleth for mine and pit dewatering related to the proposed project. The southern half of the Northern Big Smoky Valley hydrographic basin, the northern one-third of the Tonopah Flat hydrographic basin, and the western side of the Toquima Range are included in the study area. The CESA encompasses all of the Northern Big Smoky Valley hydrographic basin, the northern half of the Tonopah Flat hydrographic basin, and the western half of the Toquima Range, which includes the proposed project area. The Toiyabe Range, which lies along the western side of Northern Big Smoky Valley and Tonopah Flat, is generally outside the range of the projected 10-foot groundwater drawdown isopleth for mine dewatering and is not expected to be affected by mine dewatering activities.

3.3.1 Hydrologic Setting – Northern Big Smoky Valley

The Round Mountain and Gold Hill areas are situated mainly in the southeastern portion of the Northern Big Smoky Valley (i.e., Hydrographic Basin 137B) in Nye County, Nevada (**Figure 3.3-1**). A small part of the proposed project area extends south into the northern part of Tonopah Flat (Hydrographic Basin 137A). The Northern Big Smoky Valley is a north-northeast-trending, elongated basin in central Nevada and is part of the Great Basin Physiographic Province (Handman and Kilroy 1997). The basin extends for approximately 70 miles from Austin, Nevada, at the northern end, to the Town of Round Mountain, at the southern end of the basin. The basin is separated from Tonopah Flat (Hydrographic Basin 137A) to the south by a low ridge that acts as a topographic and surface water divide. This is a “closed” basin in that surface water flows into the valley, but streams do not extend outside of the basin into another watershed. Several intermittent and perennial streams flow into the basin from the Toiyabe Range located along the western edge of the basin and the Toquima Range located on the eastern edge of the basin. Alluvial fans and playa lake sediments occur in the valley. **Figure 3.3-1** illustrates the general geographic setting of Northern Big Smoky Valley.

3.3.1.1 Hydrogeologic Setting

The principal geologic units in the mountains surrounding the valley are Paleozoic sedimentary and metasedimentary rocks, Cretaceous intrusive granites, and Tertiary volcanics. The sedimentary rocks consist of limestones, shales, and sandstones, and the metasedimentary rocks are the metamorphosed equivalent of these sedimentary rocks that are generally found near the intrusive stocks. Tertiary volcanics, consisting of lava flows and extensive ash-flow tuff pyroclastic deposits, overlie the older sedimentary and granitic rocks. These volcanics were erupted from numerous caldera complexes in the Toiyabe and Toquima ranges, including four calderas in the Round Mountain Area (WMC 2008). **Figure 3.3-2** illustrates the general geologic setting of the Northern Big Smoky Valley.

The alluvial sediments of Northern Big Smoky Valley consist of a variety of sands and gravels in the upper parts of the alluvial fans, with sands, silts, and clays dominating the lower parts of the alluvial fans toward the center of the valley (Handman and Kilroy 1997). Along the axial center of the valley, playa deposits and channel deposits are common, as illustrated in **Figure 3.3-3**. Alluvial fan deposits are common near the southeastern end of the valley in the vicinity of Round Mountain. The valley contains alluvial sediments 3,000 to 4,000 feet in thickness (Handman and Kilroy 1997). As illustrated in **Figure 3.3-4**, the valley has two areas of thick alluvial sediments along its axis, one along the Nye County/Lander County line and another northwest of Round Mountain. The basin alluvial sediments decrease in thickness as they extend toward the mountain fronts and are generally about 1,000 to 1,500 feet in thickness in the upper parts of the

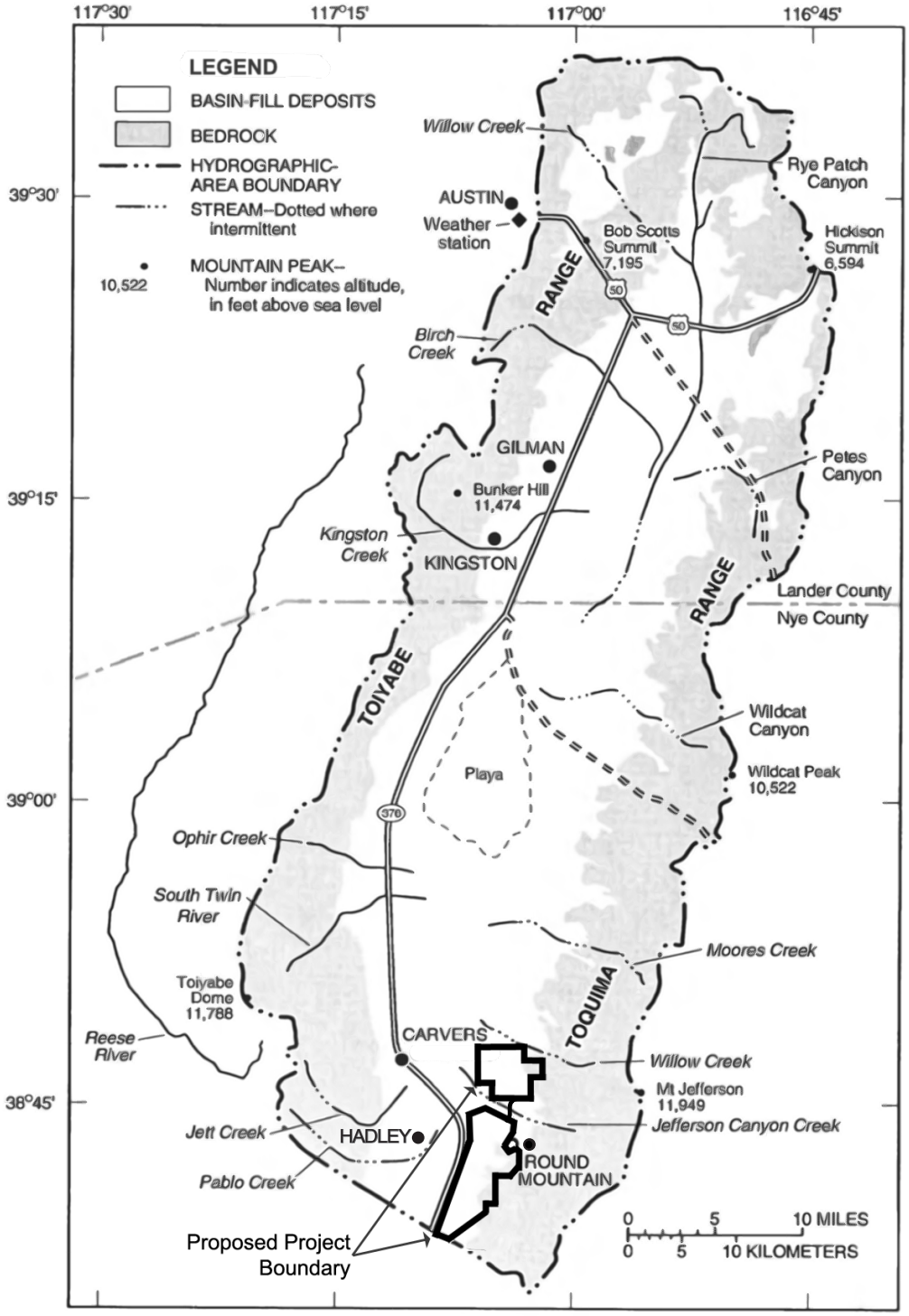


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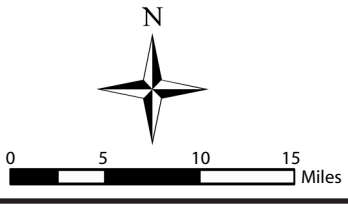
Figure 3.3-1

Hydrologic Resources in Northern Big Smoky Valley, Nevada



Note: Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Source: Handman and Kilroy 1997.

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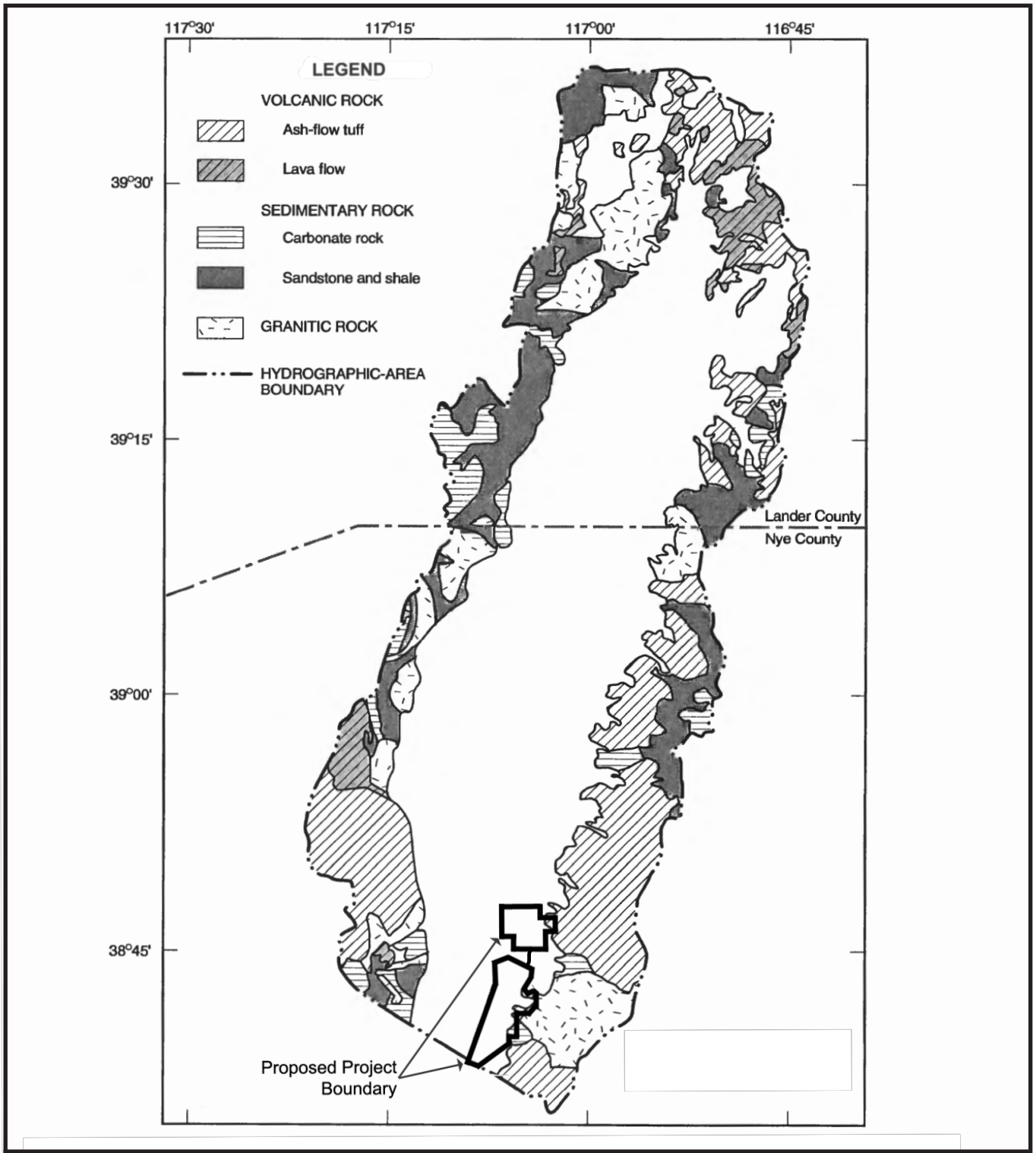

Source: Handman and Kilroy 1997.

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Figure 3.3-2

Distribution of Bedrock Units, Northern Big Smoky Valley, Nevada

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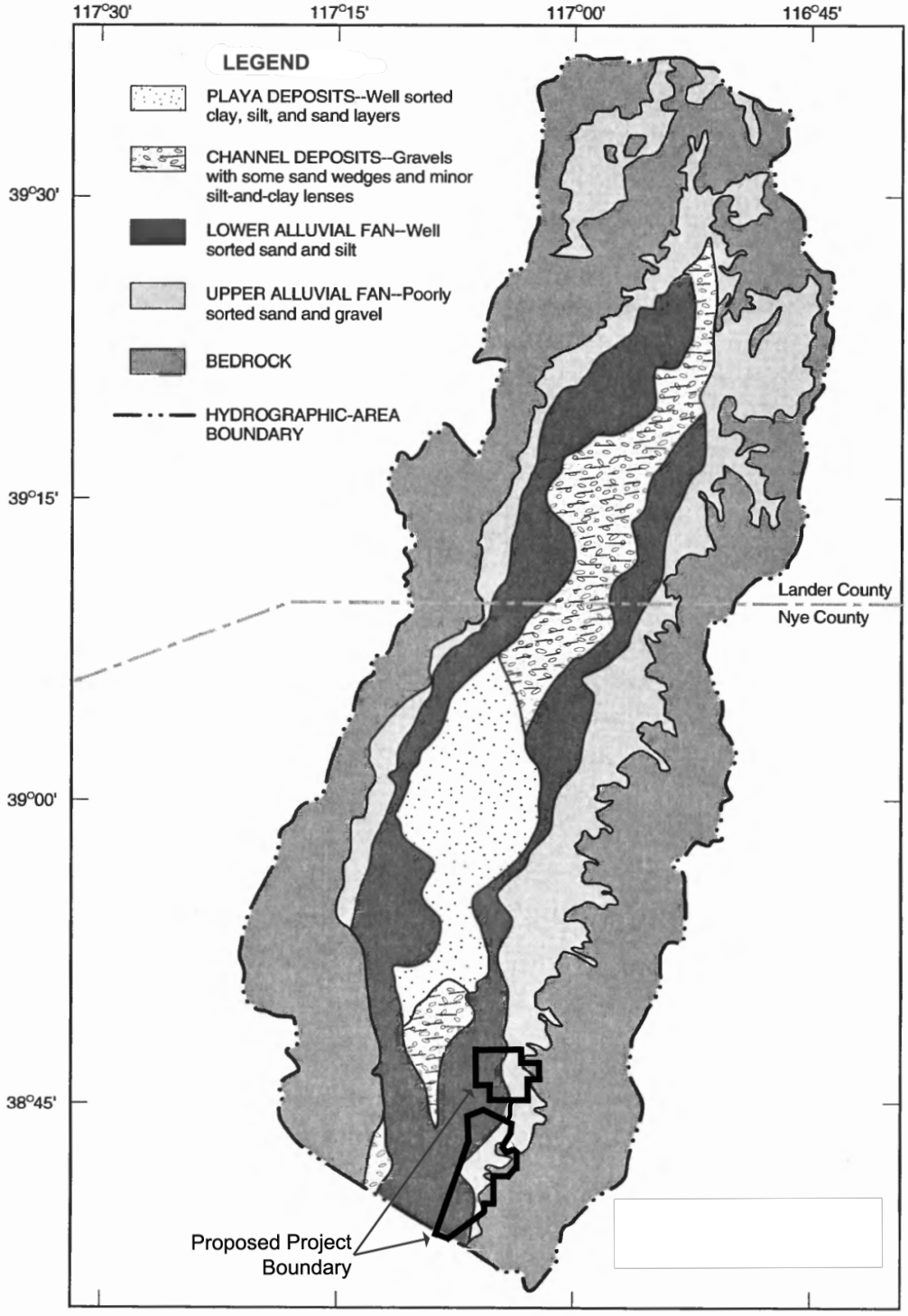

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Figure 3.3-3

Distribution and Type of Basin-fill Deposits, Northern Big Smoky Valley, Nevada

N

0 5 10 15 Miles

Source: Handman and Kilroy 1997.

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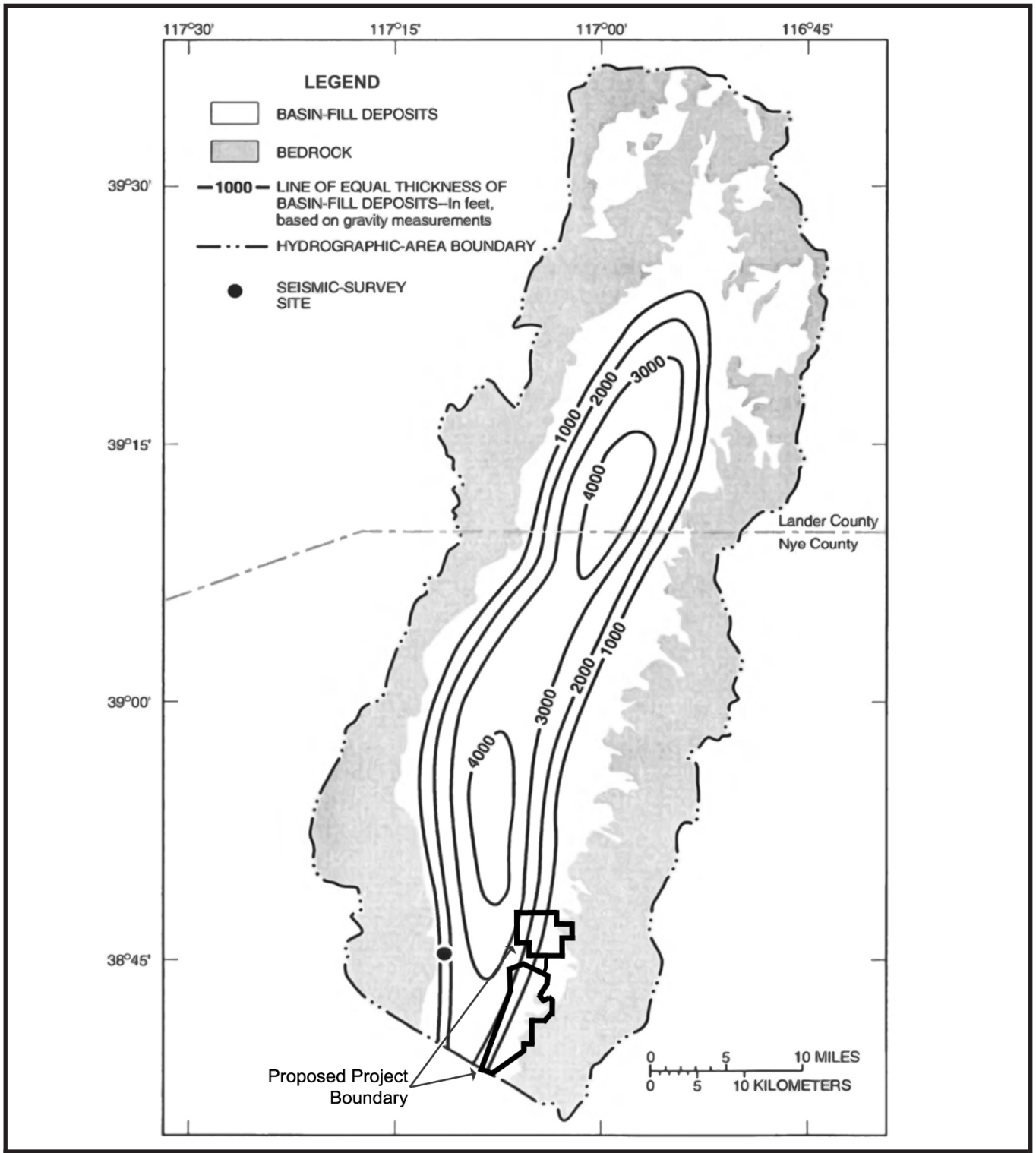

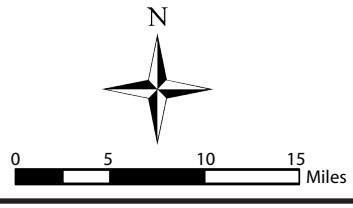

Source: Handman and Kilroy 1997.

Round Mountain Expansion Project

Figure 3.3-4

Generalized Thickness of Basin-fill Deposits Based on Geophysical Surveys, Northern Big Smoky Valley, Nevada

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alluvial fans (**Figure 3.3-4**). West of Round Mountain, the alluvial fan sediments are estimated to be approximately 1,000 to 2,000 feet in thickness (Handman and Kilroy 1997).

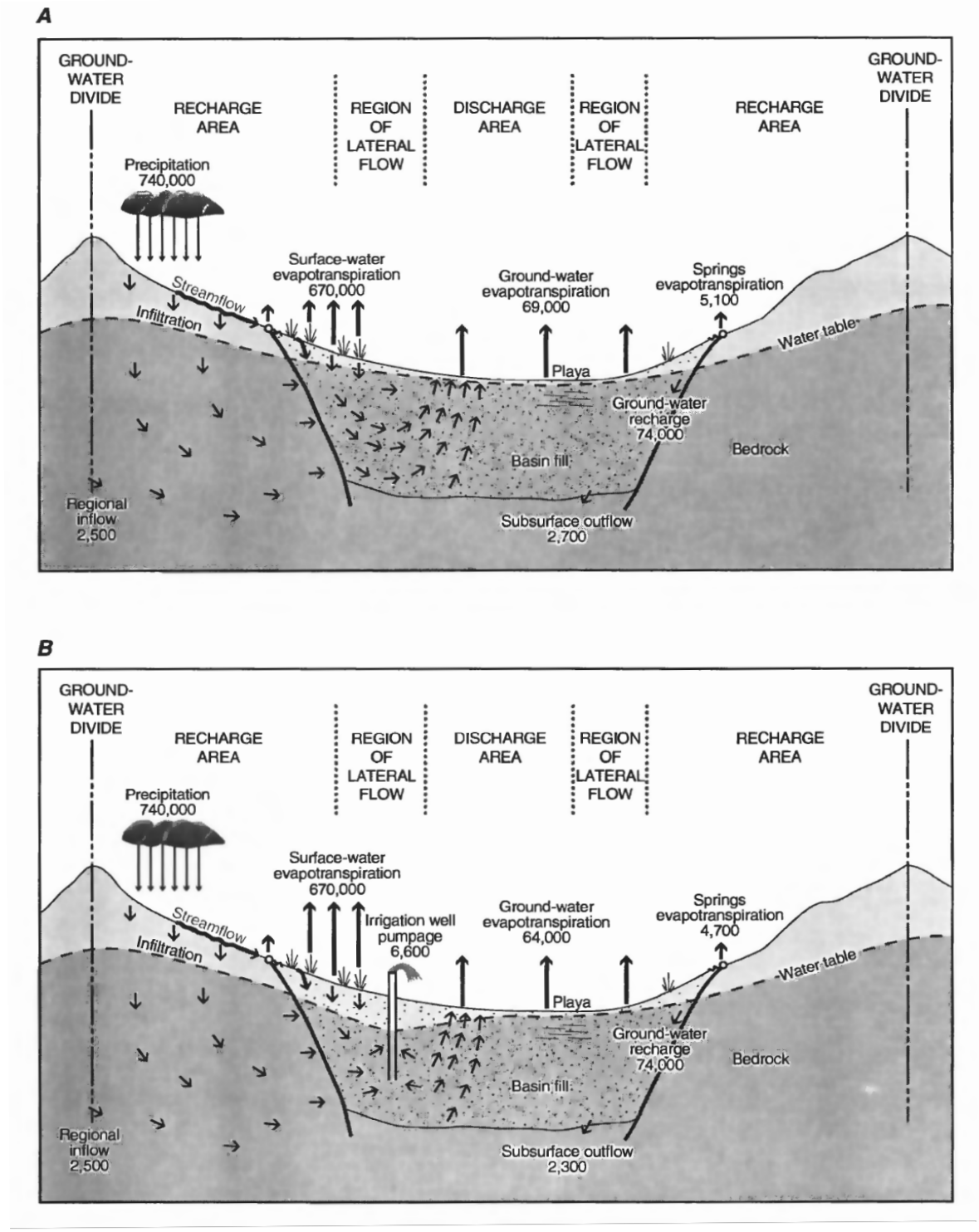
3.3.1.2 Basin Water Budget

Most of the land in Northern Big Smoky Valley is undeveloped public land administered by the BLM in the valley areas and the USFS in the mountainous areas. Private land occurs in localized areas that primarily consist of small communities and agricultural land. The majority of the private land is located on the western side of the Northern Big Smoky Valley. Groundwater use for agricultural irrigation, mining, and domestic supply in 1985 amounted to 6,600 ac-ft/yr (Handman and Kilroy 1997). Groundwater rights, including certificated, permitted, and rights applied for in 1985 (last date for complete summary) amounted to 130,214 ac-ft/yr for irrigation, 231 ac-ft/yr for stock watering, and 40,654 ac-ft/yr for mining (Handman and Kilroy 1997). Approximately 90 percent of irrigation water is used to grow alfalfa, the remaining 10 percent is used to grow grass hay and grain. During 1985, approximately 1,780 ac-ft of groundwater was used for mining operations at the existing Round Mountain Mine, and approximately 4,820 ac-ft was used for agriculture. Approximately 150 ac-ft was used for public and domestic wells in 1985 (Handman and Kilroy 1997). Northern Big Smoky Valley was designated by the Nevada State Engineer as a critical groundwater area in 1983 (Handman and Kilroy 1997). New permits for groundwater development are issued only for preferred uses or with limitations specified by the Nevada State Engineer.

The water budget developed for Northern Big Smoky Valley by Handman and Kilroy (1997) is illustrated in **Figure 3.3-5**. This schematic illustration of the water budget includes the water budget under natural conditions and the water budget with irrigation pumpage. The major source of water input to the valley is from precipitation, which amounts to approximately 740,000 ac-ft/yr. The major loss of water from the valley is from evapotranspiration, which accounts for 670,000 ac-ft/yr. Regional inflow to the valley through bedrock underflow was assumed to be about 2,500 ac-ft/yr (Handman and Kilroy 1997) based on adjacent valleys having higher basin elevations than Northern Big Smoky Valley. This assumed inflow is balanced by an assumed subsurface outflow of 2,300 ac-ft/yr in bedrock toward Tonopah Flat due to the southward gradient in bedrock water levels. Northern Big Smoky Valley is a “closed” basin in regards to surface water flow and flow in the alluvial sediments. Groundwater in the alluvial sediments flows toward the playas located near the valley center. Bedrock groundwater, especially groundwater in the carbonate rocks, is part of the regional Death Valley Flow System (Buqo 2004).

Groundwater Recharge

The main sources of groundwater recharge in the Northern Big Smoky Valley include: 1) infiltration from precipitation; 2) infiltration from streams, ponds, and irrigation ditches; 3) and irrigation return flow and wastewater disposal (Handman and Kilroy 1997). Mean annual precipitation in the Northern Big Smoky Valley ranges from more than 20 inches per year in the mountains above 9,000 feet amsl to less than 8 inches per year at elevations below 6,000 feet amsl. The average precipitation on the valley floor is approximately 6.0 inches per year (Rush and Schroer 1971). Total precipitation amounts to 740,000 ac-ft/yr with about 10 percent of this precipitation available to recharge groundwater (Handman and Kilroy 1997; Rush and Schroer 1971). Most of the precipitation occurs between October and May.



Note: (A) natural and (B) pumping conditions. Values in acre-feet of water per year.

Source: Handman and Kilroy 1997.

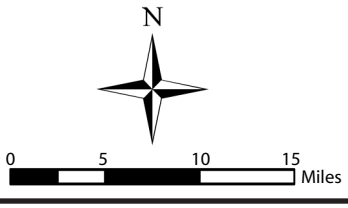


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Figure 3.3-5

Major Elements of Hydrologic Cycle and Average Annual Water Budget, Northern Big Smoky Valley, Nevada

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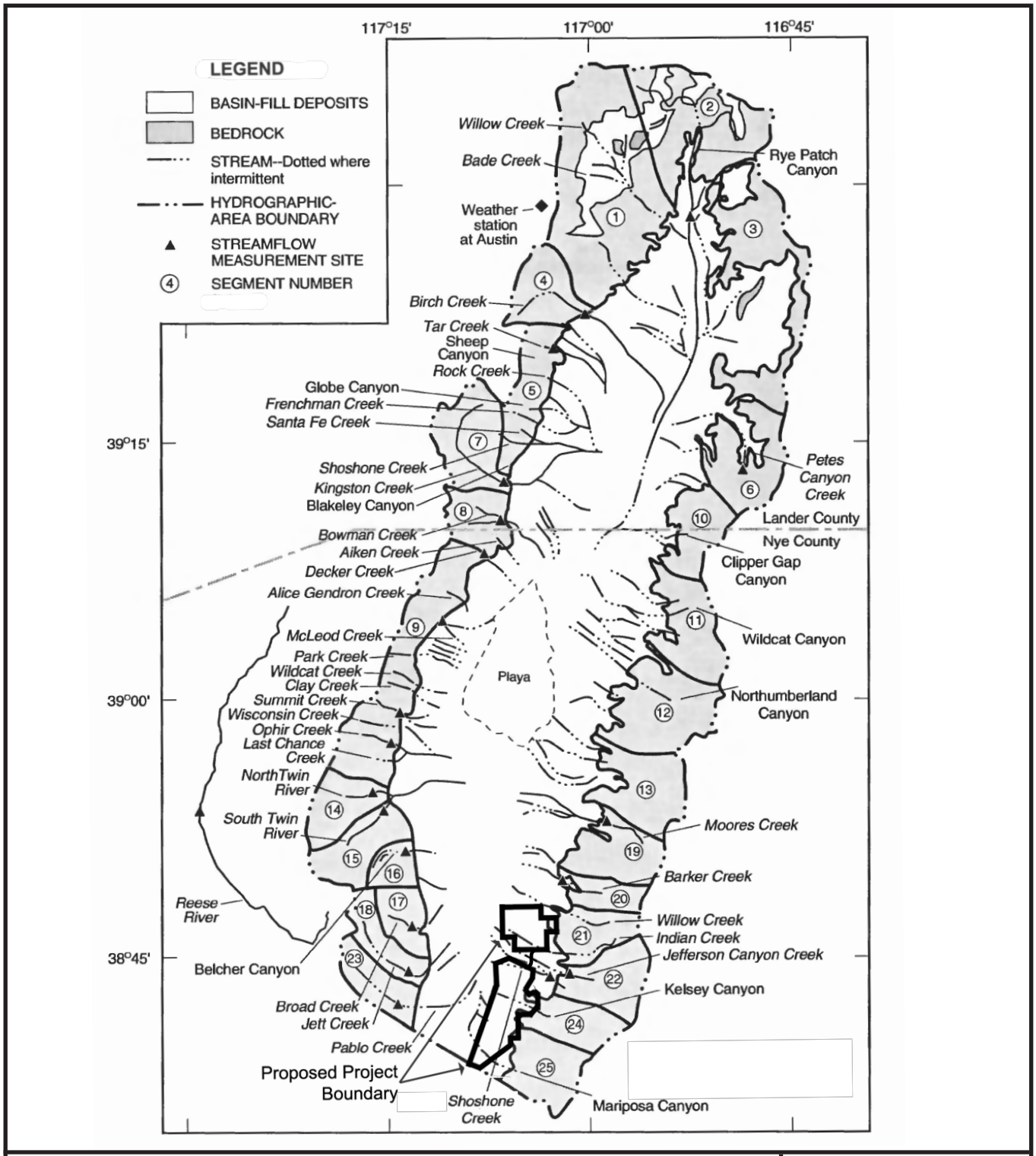
There are approximately 50 streams in the Northern Big Smoky Valley that provide infiltration recharge to groundwater, especially in the basin alluvial sediments (**Figure 3.3-6**). These streams originate within the mountains and terminate within the valley, and most of the streams are located along the western side of the valley, originating in the Toiyabe Range. Many of the streams are perennial in the mountains on the western side of the valley, but are intermittent in the Toquima Range on the eastern side of the valley. Streamflow is greatest from April to June and there is a direct correlation between precipitation and stream flow (Handman and Kilroy 1997). Rush and Schroer (1971) studied 6 major streams in the valley and estimated that the annual recharge from perennial streams would be somewhat less than 1,500 ac-ft/yr. Average seepage losses from perennial streams were estimated at 1.0 cubic foot per second (cfs) per mile for the upper 2 miles of stream bed as the streams entered the alluvial fans from the mountain ranges (Rush and Schroer 1971). **Table 3.3-1** shows the mean annual streamflow of 25 streams in the valley estimated by Handman and Kilroy (1997) and **Table 3.3-2** shows the estimated annual recharge from upland areas in Northern Big Smoky Valley calculated by Handman and Kilroy (1997) using the method of Maxey and Eakin (1949). The total estimated recharge from streamflow, precipitation, and seepage into groundwater is 72,300 ac-ft/yr with 66 percent of the recharge occurring on the western side of the basin and 26 percent of the recharge occurring in the southeastern portion of the basin near Round Mountain.

During 1985, approximately 6,600 ac-ft of groundwater was used for mining, irrigation, stock water, and both public and domestic water supply in Northern Big Smoky Valley (Handman and Kilroy 1997). Except for mining in the Round Mountain Area, this utilization of groundwater is probably similar today. About 15 to 25 percent of this groundwater is assumed to return to groundwater through infiltration (Handman and Kilroy 1997). Domestic use accounts for less than 2 percent of groundwater use in Northern Big Smoky Valley. The estimated annual return flow from irrigation, mining, and stock water use is about 1,100 ac-ft/yr (Handman and Kilroy 1997).

Precipitation that infiltrates into fractured bedrock in the mountains, either adjacent to Northern Big Smoky Valley or in nearby mountain ranges, can flow into basins as subsurface inflow. Some basins have considerable subsurface inflow, especially those in eastern Nevada in the Carbonate Rock Province (Burbey and Prudic 1991). In addition, geothermal water at Spencer Hot Springs, McLeod Ranch, Darroughs Hot Springs, and elsewhere in Northern Big Smoky Valley suggests deep bedrock circulation (**Figure 3.3-7**) (Handman and Kilroy 1997). However, the exact amount of subsurface inflow to Northern Big Smoky Valley is not known because this valley may be somewhat isolated from regional groundwater flow in the carbonate bedrock (Plume 1996). Data from the Round Mountain Area suggests that groundwater within the bedrock units does not flow into the basin alluvial aquifer because of low-permeability units separating the alluvium and the bedrock (WMC 2008). The geothermal water found in hot springs within the valley appears to be limited to deep faults of regional extent, thus limiting the influence of geothermal water on the basin alluvial aquifer. The conceptual model for the proposed project area and the CESA has recharge to the alluvial aquifer coming from mountain-front runoff. Precipitation that infiltrates into the bedrock in the mountain ranges has lower potential to recharge the alluvial aquifer than surface water runoff from the pediment slopes (WMC 2008).

Groundwater Discharge

Groundwater is discharged by evaporation from playas, evapotranspiration by plants and soils, and through springs and wells. No surface water flows out of Northern Big Smoky Valley. Approximately 75 to 85 percent of groundwater applied to cultivated fields is lost to evapotranspiration (Handman and Kilroy 1997).



Source: Handman and Kilroy 1997.

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Figure 3.3-6

Streams, Streamflow-measurement Sites, and Basin Segments, Northern Big Smoky Valley, Nevada

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Table 3.3-1
Mean Annual Streamflow of 25 Selected Streams, Northern Big Smoky Valley, Nevada

Streamflow Measurement Site[1]	Drainage Area[2]	Mean Annual Streamflow[3]		Method of Calculation[4]
		feet^3/second	acre-feet	
Moores Creek	8.5	1.0	720	K
Barker Creek	7.5	1.8	1,300	S
Jefferson Canyon Creek	20.6	1.5	1,100	S
Shoshone Creek	6.1	0.3	220	S
Pablo Canyon Creek	10.7	3.6	2,600	ES
Jett Creek	7.3	2.5	1,800	S
Broad Creek	6.1	1.6	1,200	S
Belcher Creek	5.1	1.6	1,200	S
South Twin River	19.2	7.3	5,300	A
North Twin River	15.2	4.8	3,500	S
Last Chance Creek	3.8	1.2	870	ES
Ophir Creek	3.9	1.5	1,100	S
Summit Creek	2.9	0.9	650	S
Mcleod Creek	2.9	1.4	1,000	S
Decker Creek	2.4	1.3	940	S
Aiken Creek	1.8	1.2	870	ES
Bowman Creek	7.0	2.5	1,800	K
Kingston Creek	23.4	9.9	7,200	B
Blakely Canyon Creek	1.0	0.2	140	EK
Globe Creek	2.0	0.7	510	ES
Sheep Canyon Creek	2.8	0.6	430	S
Tar Creek	2.2	0.3	220	S
Birch Creek	17.5	2.2	1,600	K
Bade Creek	2.6	0.4	290	ES
Willow Creek	8.8	5.7	4,100	ES
Total	**191.3**	**56.0**	**40,660**	**NA[5]**

[1] Clockwise around basin, starting from the east. Streams that drain less than 3 square miles (mi^2) above the mouth of the canyon are intermittent most years; streams that drain more than 10 mi^2 are perennial; intermediate streams are generally perennial at the mouth of the canyon, but may be intermittent downstream.

[2] Size (mi^2) of drainage area above site of stream flow measurement.

[3] Values are rounded.

[4] K – calculated from miscellaneous measurements, correlated with streamflow at Kingston Creek below Cougar Canyon near Austin (USGS streamflow gaging station 10249280); S – calculated from miscellaneous measurements, correlated with streamflow at South Twin River near Round Mountain (USGS streamflow gaging station 10249300); ES – estimated, compared with streamflow at South Twin River near Round Mountain (USGS streamflow gaging station 10249300); A – based on continuous measurements, 1967-86; B - based on continuous measurements, 1966-85; EK – estimated, compare with streamflow at Kingston Creek below Cougar Canyon near Austin (USGS streamflow gaging station 10249280).

[5] NA – Not applicable.

Note: feet^3 – cubic feet.

Source: Handman and Kilroy 1997.

Table 3.3-2
Estimates of Potential Mean Annual Recharge from Upland Areas, Northern Big Smoky Valley, Nevada

Segment Number	Segment Area mi^2	Estimated Recharge[1]		Streams or Channels in Segment[2]
		$feet^3$/ second	acre-feet	
1	92.7	4.6	3,300	Willow Creek, Bade Creek, and three unnamed channels
2	61.6	2.4	1,700	Rye Patch Canyon
3	60.6	1.8	1,300	Five unnamed channels
4	20.8	2.7	2,000	Birch Creek
5	38.1	6.0	4,440	Spanish, Lynch, Tar, Rock, Crooked, Frenchman, Santa Fe, Shoshone, and lower Kingston creeks; Blakely, Globe, and Sheep canyons
6	27.9	1.4	1,000	Petes Canyon Creek
7	23.4	8.0	5,800	Kingston Creek
8	15.5	3.0	2,200	Carsley, Clear, Aiken, and Bowman creeks
9	67.5	11.7	8,500	Decker, Alice Gendron, Decker Bob, McLeod, Park, Wildcat, Clay, Summit, Wisconsin, Ophir, Last Chance, and Hercules creeks
10	25.9	1.8	1,300	Clipper Gap Canyon and five unnamed channels
11	32.4	3.2	2,300	Wildcat Canyon and four unnamed channels
12	41.4	3.1	2,200	Northumberland Canyon and six unnamed channels
13	43.6	2.9	2,100	Eight unnamed channels
14	16.8	5.1	3,700	North Twin River
15	19.2	6.1	4,400	South Twin River
16	16.5	3.8	2,800	Belcher Canyon, Cove Creek, and eight unnamed channels
17	14.4	2.9	2,100	Devils Creek, Board Creek, and four unnamed channels
18	12.6	3.0	2,200	Jett Creek
19	28.1	4.1	3,000	Moores Creek, Anderson Creek, and seven unnamed channels
20	24.1	3.9	2,800	Barker Creek and four unnamed channels
21	18.8	2.5	1,800	Willow and Indian creeks
22	29.8	8.4	6,100	Shoshone Creek, Jefferson Canyon Creek, and three unnamed channels
23	15.4	2.5	1,800	Pablo Creek
24	20.8	2.2	1,600	Kelsey Canyon
25	26.5	2.6	1,900	Mariposa Canyon and three unnamed channels
Total[3]	**794.4**	**99.7**	**72,300**	**NA[4]**

[1] Estimated by method of Maxey and Eakin (1949); values were rounded.

[2] Most named streams are illustrated in **Figure 3.3-6**; unnamed channels are primarily intermittent and ephemeral streams.

[3] Totals were rounded.

[4] NA – Not applicable.

Note: $feet^3$ = cubic feet.

Source: Handman and Kilroy 1997.

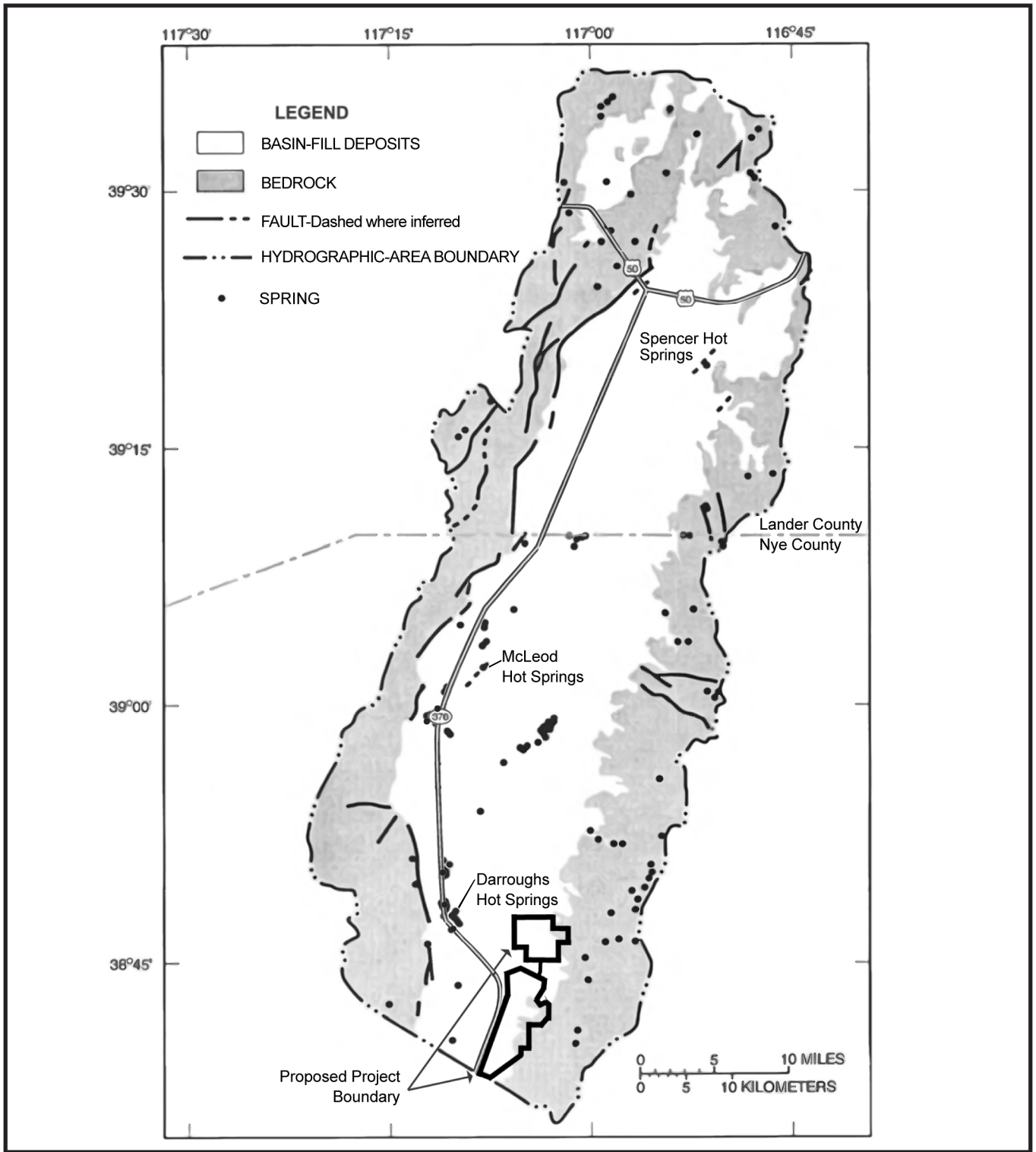

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Figure 3.3-7

Major Faults and Springs, Northern Big Smoky Valley, Nevada

N

0 5 10 15 Miles

Source: Handman and Kilroy 1997.

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Approximately 90 percent of precipitation that falls on the basin floor is lost to evapotranspiration (Handman and Kilroy 1997). The exact amount of water transpirated by plants depends on the depth to the water table and the type of plants. Most phreatophytes (i.e., water-loving plants) have root depths of 15 to 20 feet, but some plants such as big greasewood have root depths to 60 feet (Handman and Kilroy 1997). Phreatophytes found in the Northern Big Smoky Valley consist of greasewood, followed by rabbitbrush and grasses. Phreatophyte distribution in the valley is illustrated in **Figure 3.3-8**. **Table 3.3-3** summarizes the estimated mean annual evapotranspiration rates and total evapotranspiration for the Northern Big Smoky Valley (Handman and Kilroy 1997). The estimated total evapotranspiration is 67,300 ac-ft/yr. Springs in Northern Big Smoky Valley are shown in **Figure 3.3-7**. The total estimated spring flow is about 5,000 ac-ft/yr (Handman and Kilroy 1997).

Table 3.3-3
Estimated Mean Annual Evapotranspiration of Groundwater, Northern Big Smoky Valley, Nevada

Category[1]	Annual Evapotranspiration Rate[2]		Area (acres)	Estimated Depth to Water[3]	Estimated Mean Annual Evapotranspiration[2]
	Mean	Range			
Playa (bare soil)	0.1	0.01-0.6	31,000	1-12	3,100
Greasewood	0.3	0.1-1.0	36,700	10-50	11,000
Rabbitbrush and grass	0.4	0.3-1.1	36,100	5-15	14,400
Grass	0.5	0.3-1.0	8,700	1-12	4,400
Buffaloberry	1.5	1.0-3.2	3,200	1-12	4,800
Wet grass (meadow)	2.0	0.5-2.0	13,400	0-5	26,800
Wet playa (open water)	3.5	--	800	0	2,800
Total	**0.5[4]**	**NA[5]**	**129,900**	**NA[5]**	**67,300**

[1] Predominant vegetation based on volume of foliage. For detailed description of evapotranspiration assemblages and distribution, see **Figure 3.3-8**.
[2] Estimates compiled from Handman and Kilroy 1997; vegetation transects were evaluated for this study; values provided in ac-ft/yr.
[3] Feet below soil surface.
[4] Weighted mean annual rate for areas of ground-water evapotranspiration.
[5] NA – Not applicable.
Source: Handman and Kilroy 1997.

Total groundwater withdrawal in 1985 was 6,600 ac-ft. Of this amount, 98 percent was used for irrigation and mining use (Handman and Kilroy 1997). In 1970, about 2,100 ac-ft of groundwater was used for irrigation and mining (Rush and Schroer 1971). Cropland irrigated with groundwater increased from 960 acres in 1968 to 1,474 acres in 1985. Croplands irrigated with groundwater are illustrated in **Figure 3.3-8**. Most of the increase in groundwater use from 1970 to 1985 was due to mining.

Groundwater Levels

Groundwater levels measured and modeled by Handman and Kilroy (1997) in the Northern Big Smoky Valley are illustrated in **Figure 3.3-9** for the upper unconfined groundwater in the alluvial basin fill above an elevation of 5,320 feet amsl, and in **Figure 3.3-10** for the confined deeper aquifer in the alluvial basin fill, which lies between 4,430 and 5,320 feet amsl (USGS 1929 vertical datum). Both of these figures illustrate groundwater flow in the Northern Big Smoky Valley toward the playa between Kingston and Carvers

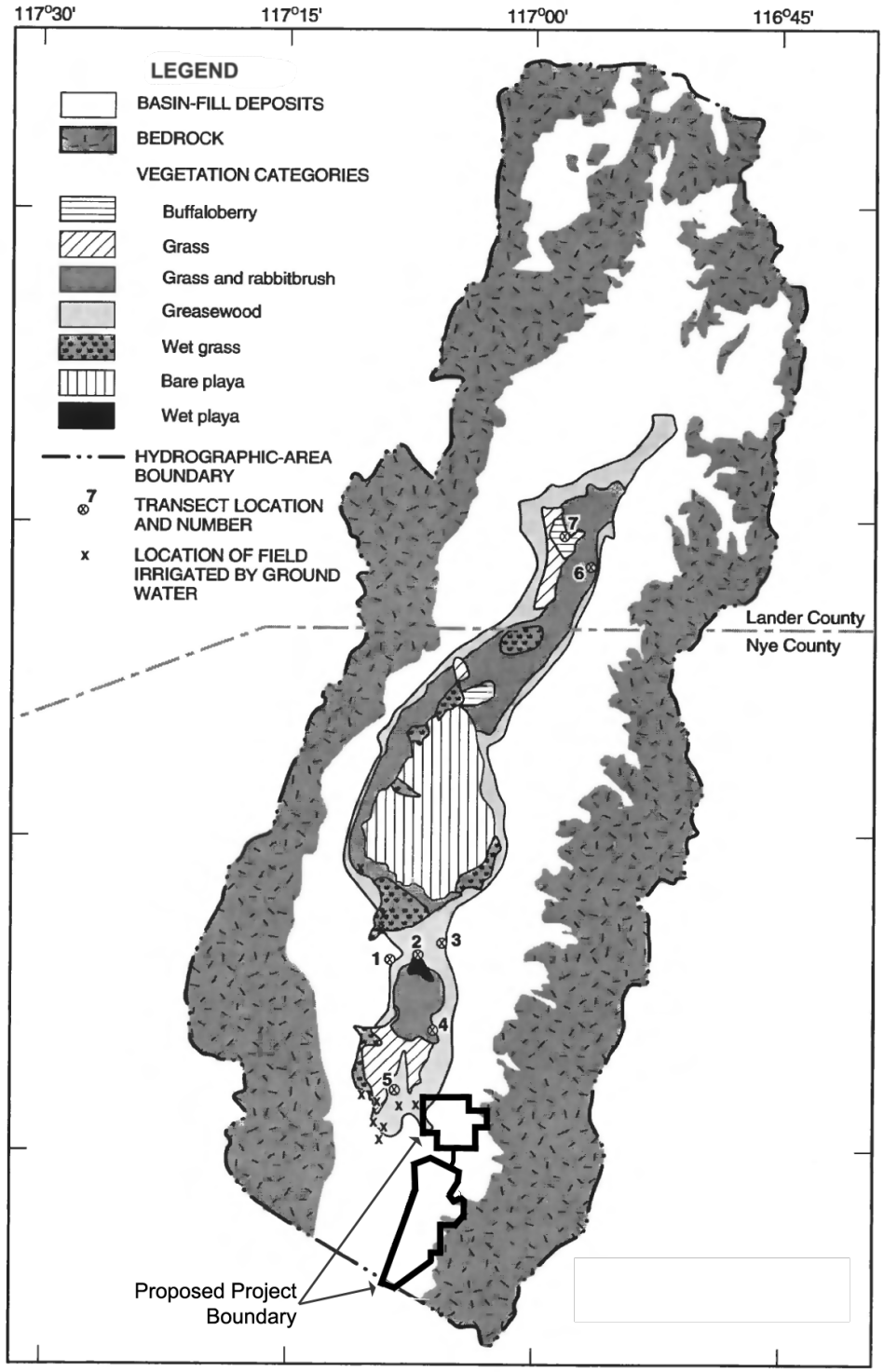

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Figure 3.3-8

Distribution of Surface Geology and Vegetation, Northern Big Smoky Valley, Nevada

N

0 5 10 15 Miles

Source: Handman and Kilroy 1997.

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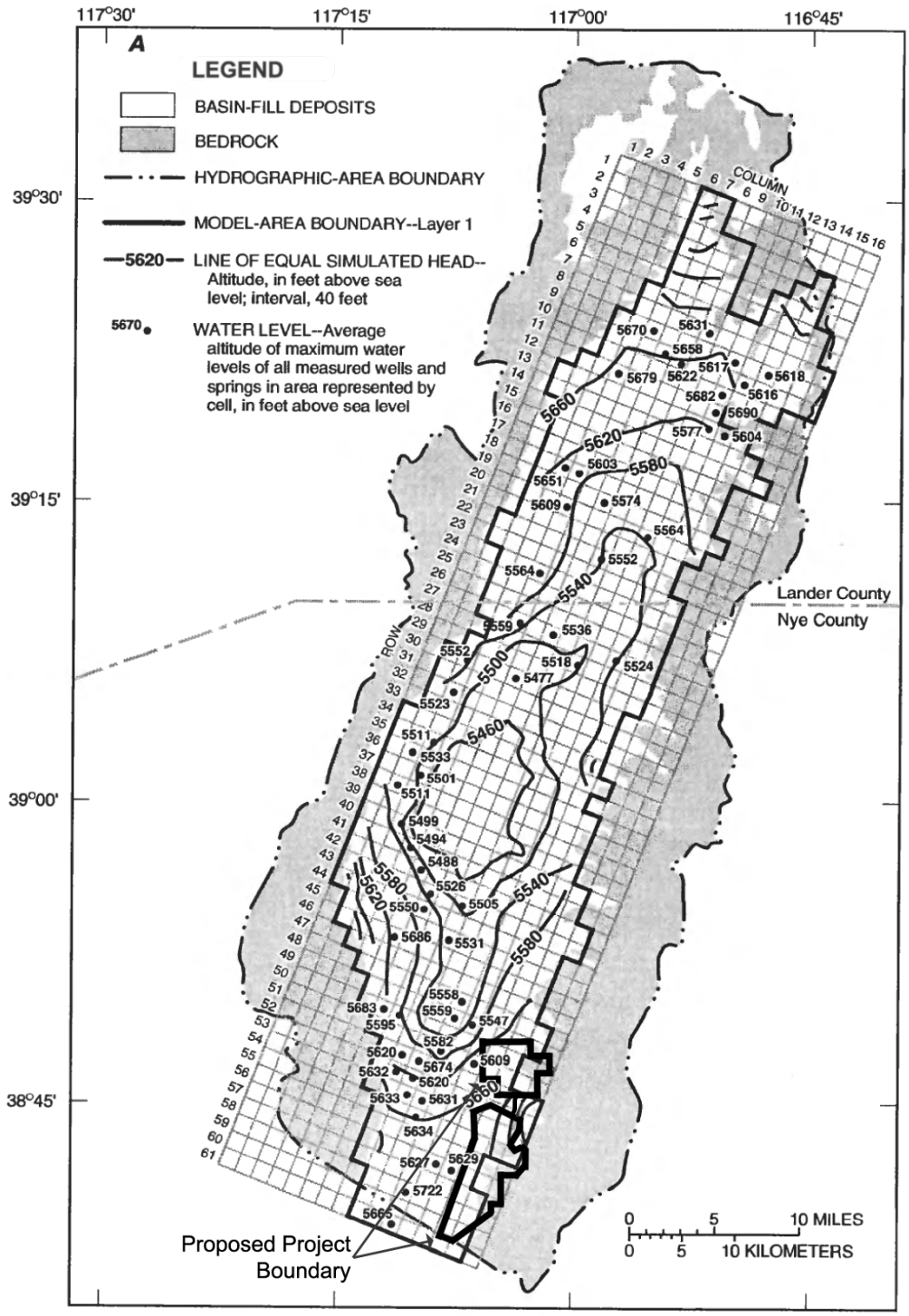

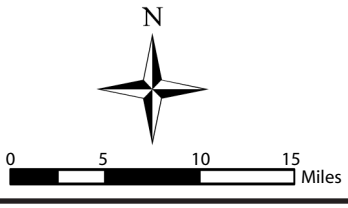

Note: Water elevations provided in feet, USGS 1929 Vertical Datum.
Source: Handman and Kilroy 1997.

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Figure 3.3-9

Measured Water Levels and Simulated Water Levels (Layer 1), Northern Big Smoky Valley, Nevada

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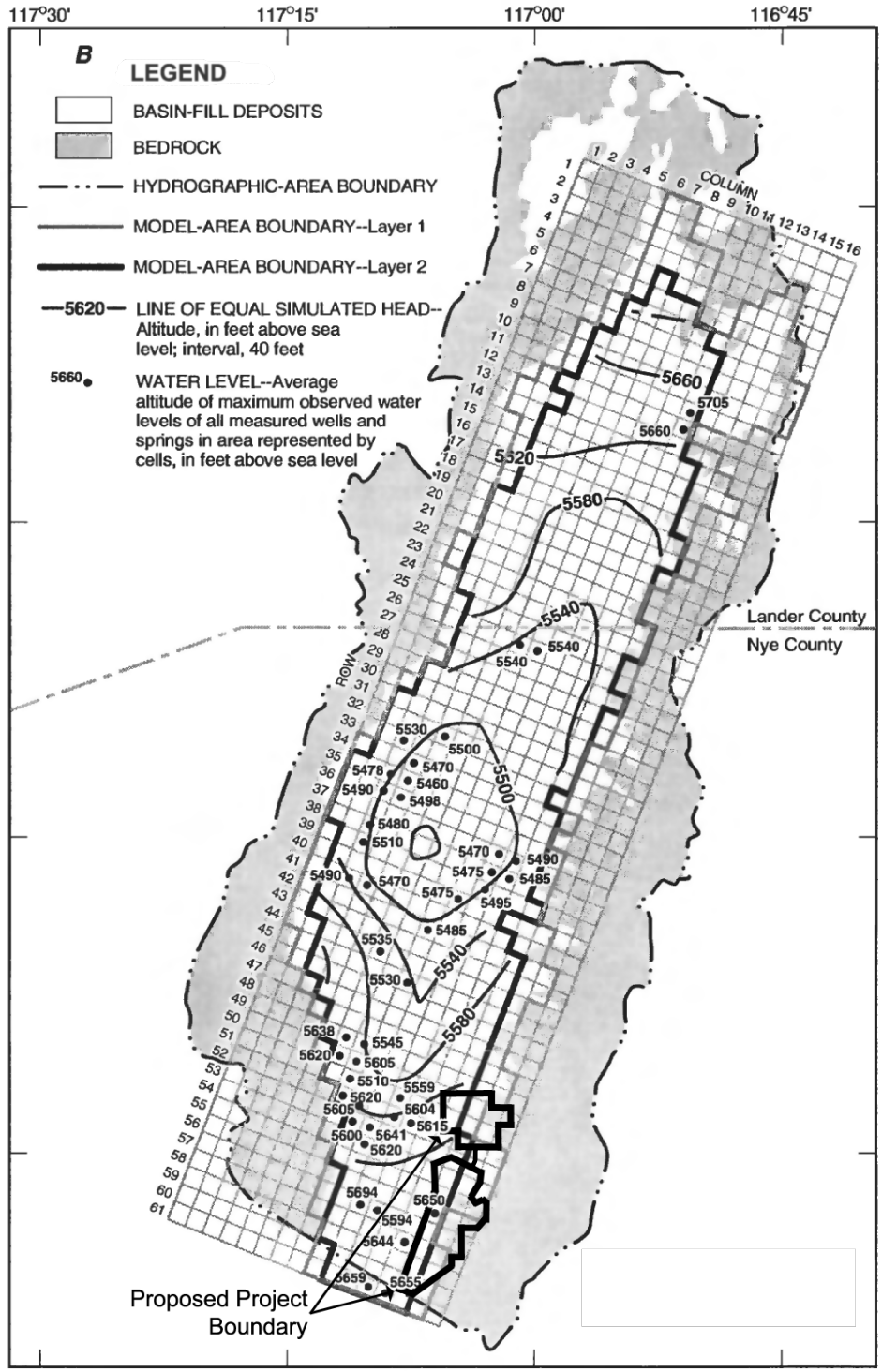

Round Mountain Expansion Project

Figure 3.3-10

Simulated Water Levels (Layer 2), Northern Big Smoky Valley, Nevada

N

0 5 10 15 Miles

Note: Water elevations provided in feet, USGS 1929 Vertical Datum.
Source: Handman and Kilroy 1997.

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(**Figure 3.3-1**). Also, groundwater levels in the deeper confined alluvial aquifer are somewhat higher than those in the upper unconfined alluvial aquifer near the playa, suggesting upward groundwater flow beneath the playa. These groundwater contours are pre-mine dewatering modeled levels based on calibration of a groundwater model to 1985 water levels in the valley by Handman and Kilroy (1997). Average depths to groundwater range from 50 to 100 feet bgs west of Round Mountain to 0 to 15 feet bgs along the axial center of the valley (Rush and Schroer 1971). Current modeled water levels in the valley-fill alluvium of the southern half of Northern Big Smoky Valley are shown in **Figure 3.3-11** (WMC 2008). These modeled water levels are based on a calibrated model developed by WMC (2008) for the Round Mountain Mine and reflect the influence of mine dewatering since 1990 on the valley-fill alluvial aquifer. Water levels in **Figure 3.3-11** and subsequent figures using modeled results from WMC (2008) utilize the RMGC mine grid datum, which is the USGS 1929 vertical datum plus 74.18 feet. Thus, water levels in figures from WMC (2008) are 74.18 feet higher than they would be if the USGS 1929 vertical datum had been used. In comparing WMC (2008) figures to Handman and Kilroy (1997) or other USGS measured or modeled water levels, the difference between the RMGC mine grid datum and the USGS 1929 vertical datum needs to be considered. Groundwater levels using the USGS 1929 vertical datum expressed in feet amsl. Groundwater levels using the RMGC mine grid datum expressed as feet.

3.3.1.3 Water Quality

Rush and Schroer (1971) summarized water quality in both the Northern Big Smoky Valley and Tonopah Flat. Streams in the Northern Big Smoky Valley are generally dominated by calcium bicarbonate and have total dissolved solids (TDS) in the range of 60 to 350 mg/L. The median value for 15 streams was around 175 mg/L. Springs have similar water quality and have TDS in the range of 120 to 380 mg/L with a median value from 14 springs around 230 mg/L. Wells have highly variable water quality, depending on the location of the well relative to the center of the valley and the depth of the well. Twelve wells sampled by Rush and Schroer (1971) had a range of TDS between 105 and 70,000 mg/L. The median value was approximately 336 mg/L. Groundwater from wells along the upper parts of alluvial fans generally is dominated by calcium bicarbonate and has a low TDS. Groundwater near the axial center of the valley has much higher values of TDS and can be dominated by sulfate rather than bicarbonate. Groundwater near the Darroughs Hot Springs is dominated by sodium chloride and hasvery high values of TDS.

3.3.1.4 Aquifer Properties

The groundwater model developed for the Northern Big Smoky Valley by Handman and Kilroy (1997) provided a useful understanding of groundwater flow patterns in the valley. Modeled hydraulic conductivity values were found to vary with location on the alluvial fans and showed a reasonable correlation with land surface elevation on the alluvial fans. At elevations above 5,750 feet amsl, modeled hydraulic conductivity ranged from 10 to 50 feet per day. Near the lowest parts of the valley at elevations below 5,500 feet amsl, the hydraulic conductivity was approximately 3 to 5 feet per day. For intermediate elevations along the alluvial fans, the modeled hydraulic conductivity ranged from approximately 2 to 7 feet per day. In the southeastern portion of the valley near Round Mountain, hydraulic conductivities used in the groundwater model for alluvial sediments were in the range of 8 to 14 feet per day or greater. Hydraulic parameters measured in the alluvial sediments near Round Mountain by WMC (2008) showed transmissivity values ranging from 248 to 1,045 feet squared per day with equivalent hydraulic conductivity values of 1.6 to 15 feet per day. The specific yield of the alluvial sediments in the model of Handman and Kilroy (1997) was 15 percent (Rush and Schroer 1971). Storage coefficients for the confined aquifer modeled beneath the upper unconfined alluvial aquifer were assumed to be approximately 1.0×10^{-6} per foot of thickness. The groundwater model of Handman and Kilroy (1997) had 3 layers, with the uppermost layer (i.e., Layer 1)

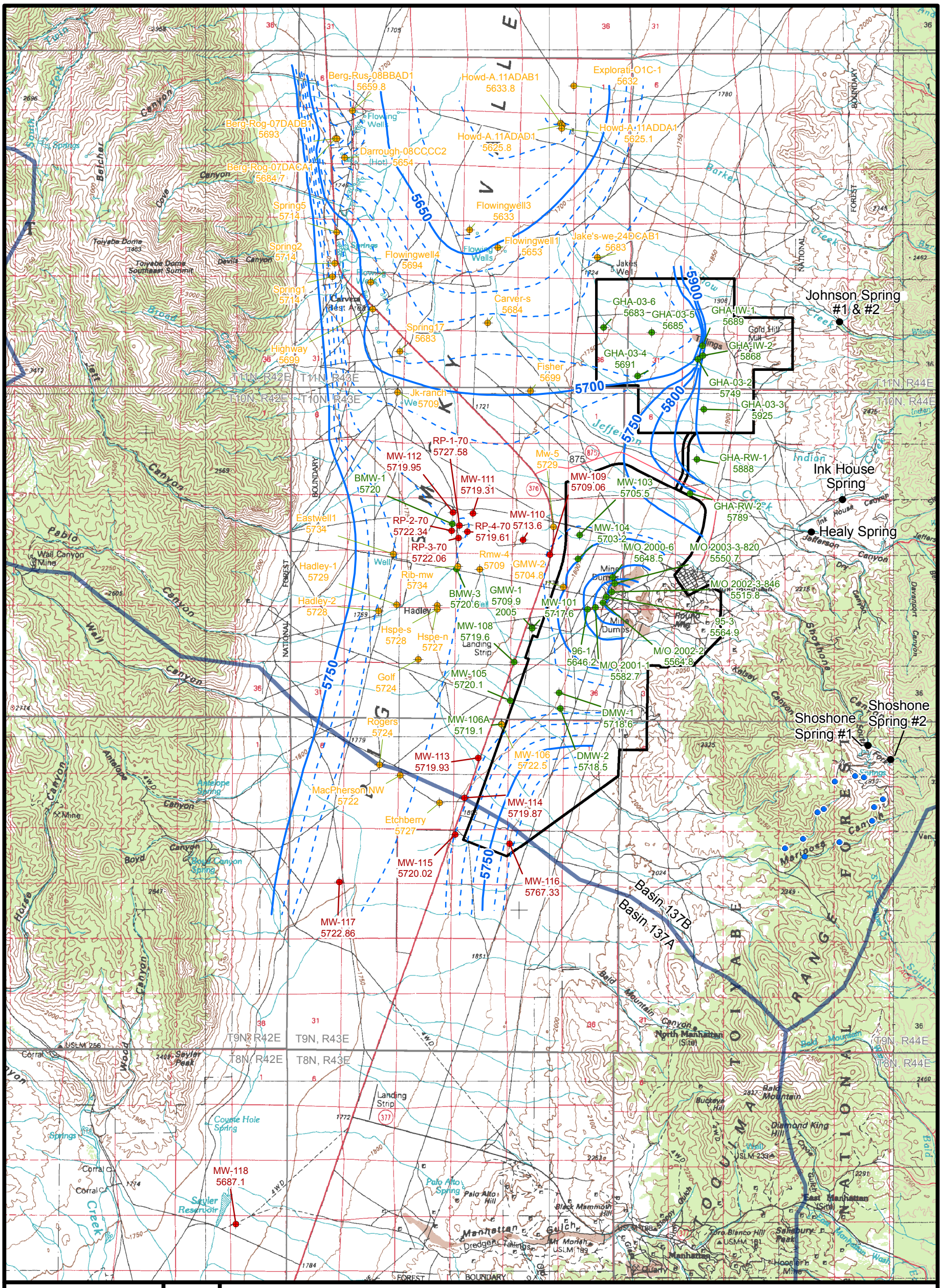
extending from the land surface to 5,320 feet amsl and being an unconfined alluvial aquifer. Layer 2 extended from 5,320 to 4,430 feet amsl and was a confined aquifer. Layer 3 also was a confined aquifer and extended from 4,430 feet amsl to the deepest parts of the valley. Most wells in the valley range in depth from a few feet to about 400 feet. The majority of wells are at depths of less than 250 feet (Handman and Kilroy 1997), placing them in the upper alluvial aquifer. For the area in the southeastern part of Northern Big Smoky Valley near Round Mountain, the groundwater model developed by WMC (2008) for pit dewatering at the Round Mountain Mine provides a more detailed understanding of groundwater flow and uses more recent data than that available to Handman and Kilroy (1997). This model is discussed in Section 3.3.3.

3.3.2 Hydrologic Setting of Tonopah Flat

Tonopah Flat is a partially closed desert basin that lies to the south of Northern Big Smoky Valley and is separated from that valley by a narrow gap in the bedrock west of Manhattan, Nevada, in T9N, R43E. The hydrologic setting of Tonopah Flat is shown in **Figure 3.3-12** taken from Rush and Schroer (1971). The water levels shown in **Figure 3.3-12** are for 1968. Surface water and groundwater flow into Tonopah Flat from Ione Valley (Rush and Schroer 1971) and groundwater flows out of the valley to the southeast to Clayton Valley. Surface water in the valley does not flow out of the valley.

Tonopah Flat occupies about 1,603 mi^2. Elevations range from 4,720 to 5,800 feet amsl (Rush and Schroer 1971). The valley is surrounded by mountain ranges that contain Paleozoic carbonate rocks that are part of the Carbonate Rock Province of eastern and central Nevada (Burbey and Prudic 1991), intrusive granitic rocks, Paleozoic clastic rocks, and extensive Tertiary volcanic flows and ash-flow tuffs. The narrow gap between Tonopah Flat and Northern Big Smoky Valley coincides with a groundwater divide between these two valleys (Rush and Schroer 1971). Therefore, groundwater in the northern part of Tonopah Flat flows southward toward the center of the valley (**Figure 3.3-12**). Similarly, groundwater in the southern part of Northern Big Smoky Valley flows northward toward the center of that valley. The thickness of the valley alluvium ranges from 1,000 feet to around 5,000 feet as shown in **Figure 3.3-13**. The valley alluvium is thickest in the southern part of Tonopah Flat. In the northern part of the valley, the thickness of the valley alluvium is around 1,000 to 2,500 feet west of Manhattan, Nevada. The depth to groundwater is generally greater than 100 feet bgs, except in the area of the San Antonio Ranch (T7N, R42E), where groundwater is often less than 50 feet bgs **(Figure 3.3-14**). The transmissivity of the valley alluvium generally ranges from about 3,350 to 6,700 feet squared per day (Rush and Schroer 1971). In the area of the San Antonio Ranch, the transmissivity can have twice this range.

The water balance for Tonopah Flat is considerably different from that of Northern Big Smoky Valley. Recharge to the valley comes mainly from precipitation, with the Toiyabe Range accounting for 11,000 ac-ft/yr and Royston Valley plus other areas accounting for 1,310 ac-ft/yr of recharge (Rush and Schroer 1971) using the method of Maxey and Eakin (1949). Groundwater inflow from Ione Valley is about 2,000 ac-ft/yr and surface water inflow from Ione Valley accounts for about 360 ac-ft/yr. Groundwater discharge comes from evapotransipiration of native plants and crops totaling about 6,000 ac-ft/yr and an assumed loss of about 8,000 ac-ft/yr through groundwater outflow to Clayton Valley to make up the difference in the balance between recharge and discharge (Rush and Schroer 1971). Irrigation in 1968 used about 930 ac-ft/yr to irrigate 650 acres. Municipal use in 1968 was about 130 ac-ft/yr and mostly in the area around Tonopah, Nevada. Streamflow in Tonopah Flat amounts to about 3,500 ac-ft/yr and the perennial yield of the valley alluvial sediments is estimated at 6,000 ac-ft/yr, which is essentially the loss of water to evapotranspiration (Rush and Schroer 1971). Approximately 2 percent of precipitation recharges groundwater in Tonopah Flat (Rush and Schroer 1971). Stream water quality is good with TDS generally



Legend

- Proposed Project Boundary
- Water Elevation Measured 2006-2007
- Water Elevation Measured 1984-2003
- Water Elevation Measured 2004-2005
- 10-foot Water Table Surface Contour (Q4 2005)
- 50-foot Water Table Surface Contour (Q4 2005)
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

Source: WMC 2008.

N

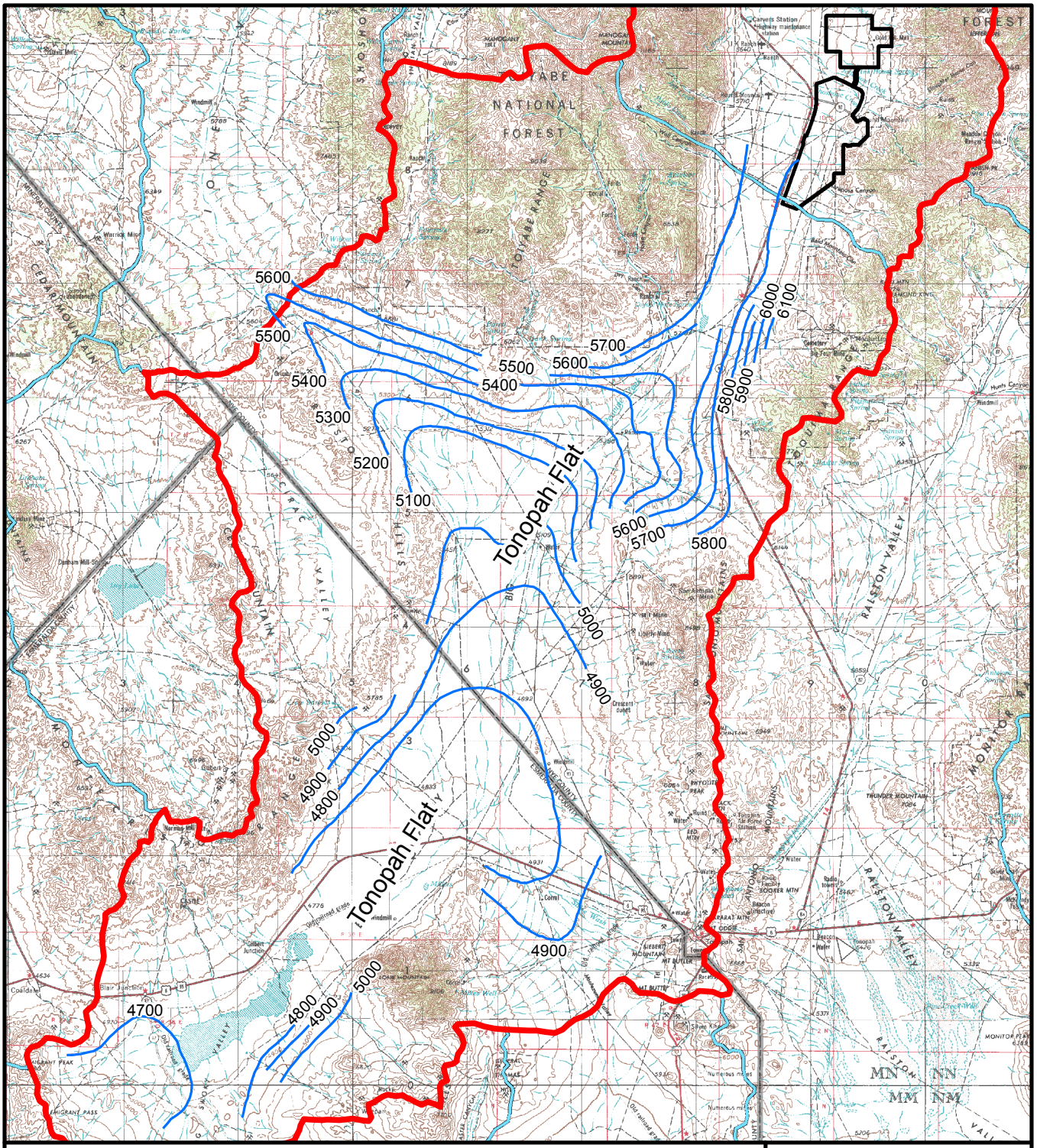
0 1 2 Miles

Round Mountain Expansion Project

Figure 3.3-11

Current Alluvial Ground Water Levels and Springs in the Southern Half Of Northern Big Smoky Valley

05/25/2009



Legend

- Proposed Project Boundary
- Water Level Contour in Feet Above Mean Sea Level
- Hydrographic Basin Boundaries

N

0 2.5 5 10 Miles

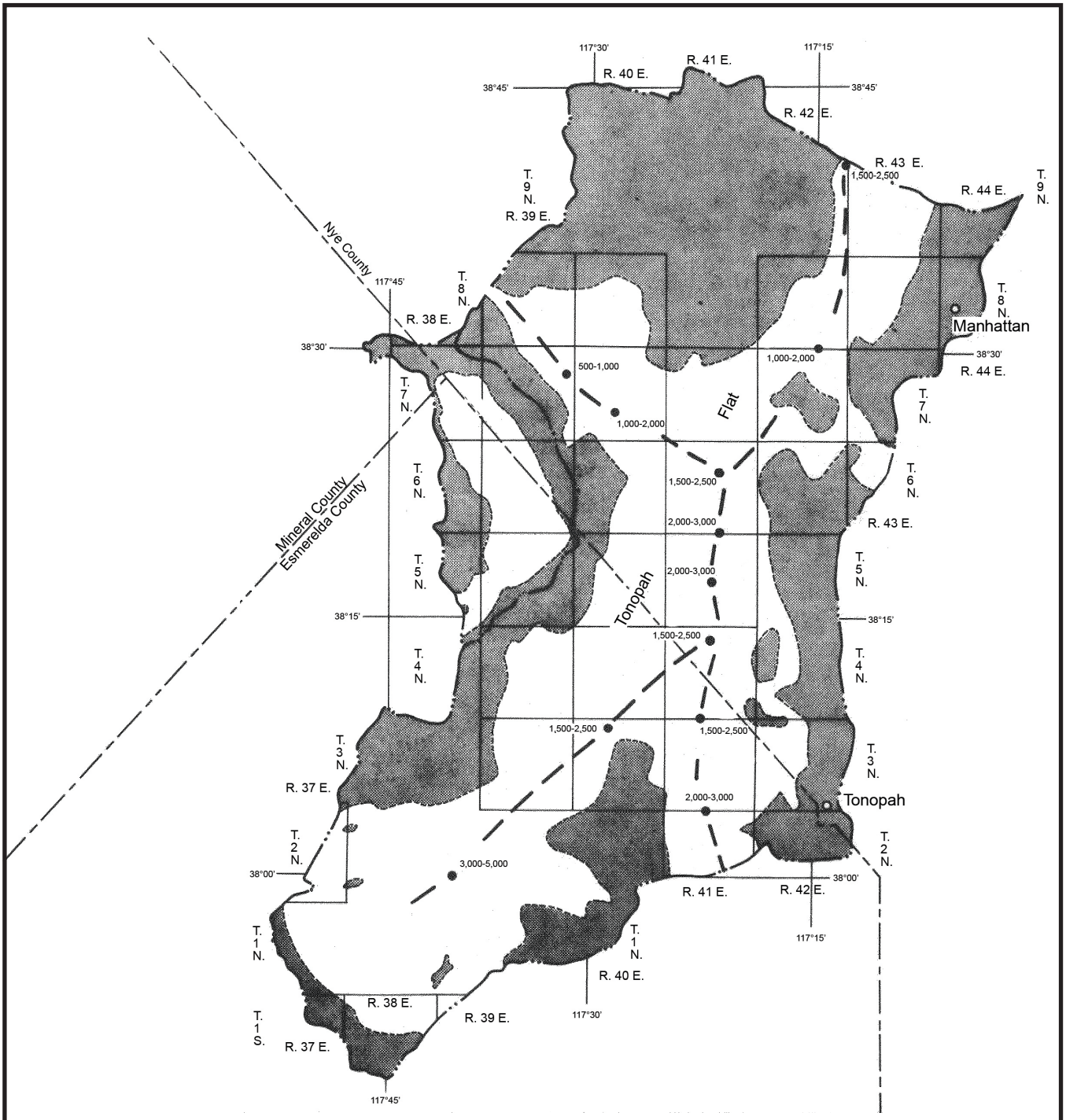
Note: Topographic and water elevations provided in feet, USGS 1929 Vertical Datum.
Source: Rush and Schroer 1971.

Round Mountain Expansion Project

Figure 3.3-12

Ground Water Levels for Tonopah Flat

04/09/2009



Legend

- Alluvium
- Consolidated Rocks
- Axis of Maximum Thickness of Alluvium
- Basin Boundary
- Contact
- 1,500-2,500 Reference Point and Thickness of Alluvium in Feet

N

0 1 Miles

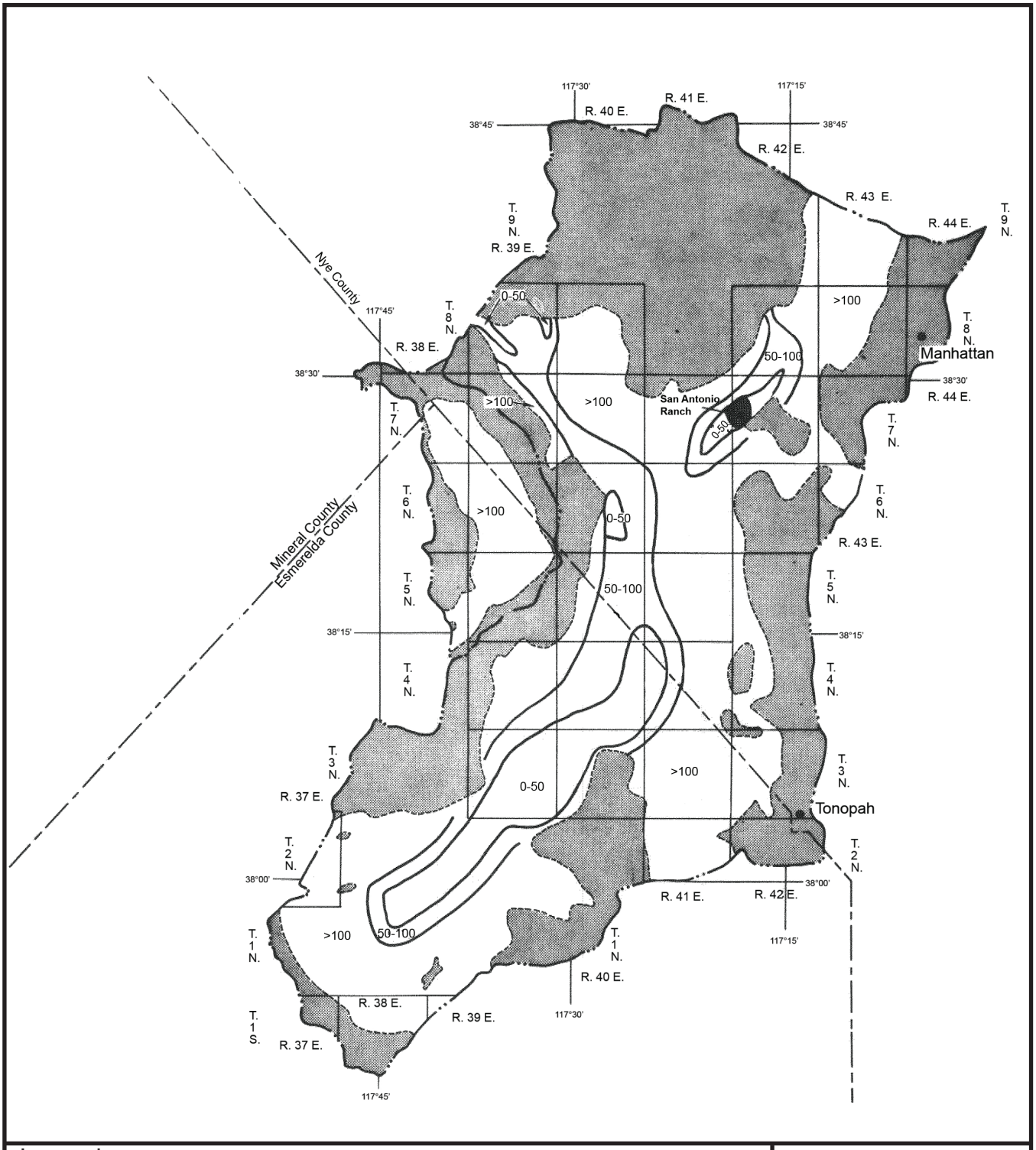
Source: Rush and Schroer 1971.

04/10/09

Round Mountain Expansion Project

Figures 3.3-13

Estimated Thickness of Alluvium Beneath Tonopah Flat



Legend

- Alluvium
- Consolidated Rocks
- Axis of Maximum Thickness of Alluvium
- Basin Boundary
- Contact
- Depth to Groundwater in Feet
- Area of Flowing Wells

N

0 1 Miles

Source: Rush and Schroer 1971.

Round Mountain Expansion Project

Figures 3.3-14

Generalized Depth to Water Beneath Tonopah Flat

04/10/09

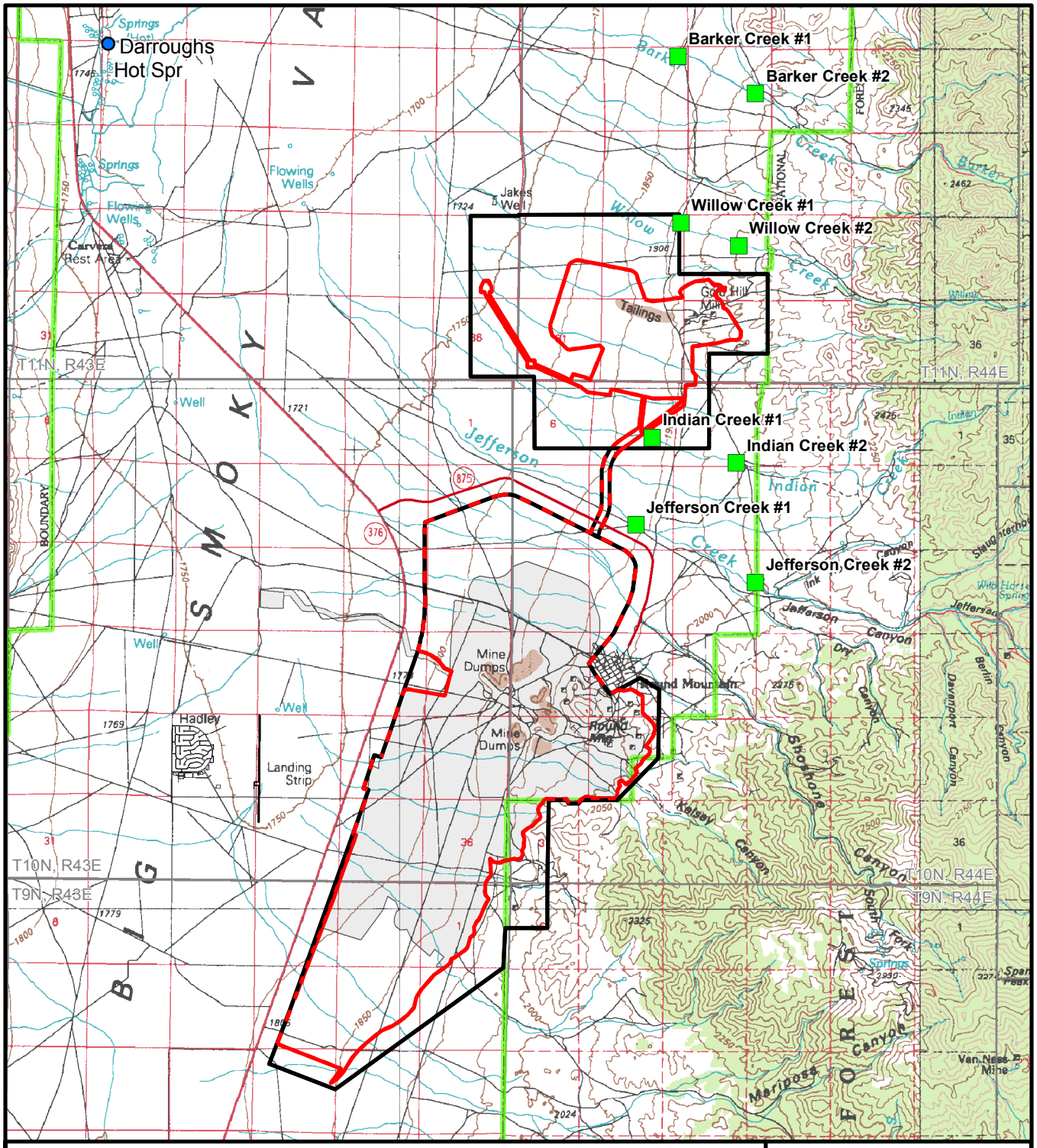
According to Buqo (2004), there are 10,447 permitted, certificated, or vested water rights in Tonopah Flat. Buqo (2004) also divides the aquifers of Nye County, which includes both Tonopah Flat and Northern Big Smoky Valley into three main aquifer systems: 1) valley-fill alluvial aquifers; 2) volcanic rock aquifers; and 3) regional carbonate aquifers. He further divides the regional carbonate aquifer system into six separate subsystems, separating the main carbonate sequences and the intervening clastic aquitards into separate aquifer subsystems. For the purpose of this report, the regional carbonate aquifer system in both Tonopah Flat and Northern Big Smoky Valley has been treated as if it were one single aquifer. The estimated maximum committed groundwater demand for Tonopah Flat through March of 1999 is about 26,724 ac-ft/yr (Buqo 2004). Most of this water is allocated to either irrigation or mining.

3.3.3 Hydrologic Setting of the Round Mountain and Gold Hill Areas

The proposed project area is located along the western flank of the southern Toquima Range in the southeastern portion of the Northern Big Smoky Valley (**Figure 3.3-15**). The proposed project consists of expansion of the existing Round Mountain Mine and development of a mine in the Gold Hill Area, which lies to the north of the Round Mountain Area. Chapter 2.0 provides specific information regarding the proposed project. The geology of the Round Mountain Area is discussed in detail in Section 3.2, Geology and Minerals, which summarizes the geologic features of the Round Mountain and Gold Hill areas that affect surface water and groundwater flow and water quality, including expected post-mining pit lake water quality.

3.3.3.1 Surface Water Hydrology

The study area is situated along the southeastern section of the Northern Big Smoky Valley at the base of the southern Toquima Range. Streams and springs within 5 miles of the proposed project area are illustrated in **Figure 3.3-16**. Drainages associated with Shoshone and Kelsey canyons intersect the Round Mountain Area and Willow and Indian creeks intersect the Gold Hill Area. **Table 3.3-4** summarizes the surface water flow in the main drainages within and near the Round Mountain and Gold Hill areas (WMC 2008). As this table shows, all the streams in the proposed project vicinity have good water quality, with the specific conductance being generally below 360 micromhos per centimeter (µmhos/cm) (TDS around 250 mg/L or less) and pH values between 6.5 and 8.5 standard units. Flow rates vary considerably, based on the season. Stream monitoring stations that can have high flow rates include Jefferson Creek #1, Jefferson Creek #2, Willow Creek #2, and Indian Creek #1. Jefferson Creek #1, Jefferson Creek #2, and Indian Creek #1 monitoring stations lie between the Round Mountain and Gold Hill areas. The Willow Creek #2 Monitoring Station lies immediately north of the proposed Gold Hill Pit. Vegetation along the streams varies with elevation. High in the Toquima Range, the vegetation is mainly juniper and pinyon. Along the lower reaches of the streams within the Toquima Range, common species include cottonwood (*Populus* spp.), quaking aspen (*Populus tremuloides*), water birch (*Betula occidentalis*), wild rose (*Rosa* sp.), and willow (*Salix* spp.) (WMC 2008). Within the valley, sagebrush (*Artemisia* spp.), rabbitbrush (*Chrysothamnus* sp.), greasewood (*Sarcobatus vermiculatus)*, and various grasses planted for agricultural use comprise the predominant vegetation. Healy Spring and Ink House Spring are used for water supply by the Town of Round Mountain.



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Surface Water Monitoring Stations
- National Forest Boundary

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.

Source: WMC 2008.

N

0 0.5 1 2 Miles

Round Mountain Expansion Project

Figure 3.3-15

Surface Water Monitoring Stations

05/25/2009

Table 3.3-4
Stream Inventory

Monitoring Point	Elevation (feet amsl)	Geomorphic Setting	GeologicUnit/Control	Comments	Sample Dates	Flow Rate (gpm)	Temp.[1]	pH[2]	Specific Conductance (µmhos/cm)	Water Quality Sample
Barker Creek #1	6,070	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is at upgradient edge of road crossing	4/21/04 6/09/04 10/11/04 4/12/05 12/12/05	0 0 0 0 0	- - - - -	- - - - -	- - - - -	No No No No No
Barker Creek #2	6,430	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is located directly across from staked field location	4/23/04 6/09/04 10/11/04 4/12/05 12/12/05	18 20 0 68 10	48.3 59.1 - 53.2 47.5	8.14 7.13 - 7.33 6.75	147 105 - 112 135	Yes Yes No Yes Yes
Willow Creek #1	6,230	Mountain stream channel bottom	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is at upgradient edge of road crossing	4/21/04 6/09/04 10/11/04* 4/12/05 12/12/05	0 0 0 92 0	- - - 60.3 -	- - - 8.26 -	- - - 189 -	No No No Yes No
Willow Creek #2	6,560	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is at the upgradient edge of road crossing	4/23/04 6/09/04 10/11/04* 4/12/05 12/12/05	13 20 2-3 274 2-3	51.1 60.7 57.1 53.5 47.4	7.74 7.70 7.67 7.92 6.78	142 229 215 172 225	Yes Yes Yes Yes Yes
Indian Creek #1	6,300	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is at upgradient edge of road crossing	4/21/04 6/09/04 10/11/04 4/26/05 12/12/05	0 0 0 125 0	- - - 56.2 -	- - - 8.15 -	- - - 170 -	No No No Yes No

Table 3.3-4 (Continued)

Monitoring Point	Elevation (feet amsl)	Geomorphic Setting	GeologicUnit/Control	Comments	Sample Dates	Flow Rate (gpm)	Temp.[1]	pH[2]	Specific Conductance (µmhos/cm)	Water Quality Sample
Indian Creek #2	6,580	Stream channel bottom within alluvial fan	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is at upgradient edge of road crossing	4/23/04 6/09/04 10/11/04 4/12/05 12/12/05	0 0 0 92 0	- - - 56.5 -	- - - 7.8 -	- - - 191 -	No No No Yes No
Jefferson #1	6,250	Mountain stream channel bottom	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is about 30 feet further upgradient than the upgradient edge of road crossing	4/21/04 6/09/04 10/11/04 4/12/05 12/12/05	1,100 35 0 1,500 297	65.4 56.7 - 57.5 48.8	8.39 7.86 - 8.16 6.81	258 291 - 156 273	Yes Yes No Yes Yes
Jefferson #2	6,590	Mountain stream channel bottom	Cobble-lined channel and other sediments of Quaternary alluvium derived from Tertiary volcanics	Undeveloped; sample point is on the upgradient edge of road crossing	4/23/04 6/09/04 10/11/04 4/12/05 12/12/05	1,200 15 9 1,500 NS	67.1 56.0 60.1 57.7	7.43 7.40 8.12 8.12	221 253 266 140	Yes Yes Yes Yes
Mariposa Canyon – Main Drainage #1	~8,199	Stream channel bottom within rockbound canyon	Pebbly gravel channel alluvial sediments of Quaternary age, derived from granite	Undeveloped, head of intermittent stream flow	9/14/06	3	52.2	6.88	309	No
Mariposa Canyon – Main Drainage #2	~7,880	Fracture-controlled bedrock channel	Fractured granitic bedrock	Undeveloped, head of intermittent stream flow	9/14/06	1	57.6	6.76	334	No
Mariposa Canyon – Main Drainage #3	7,582	Channel bed	Pool in alluvium	Undeveloped	8/17/06	>0	57.6	6.66	360	No

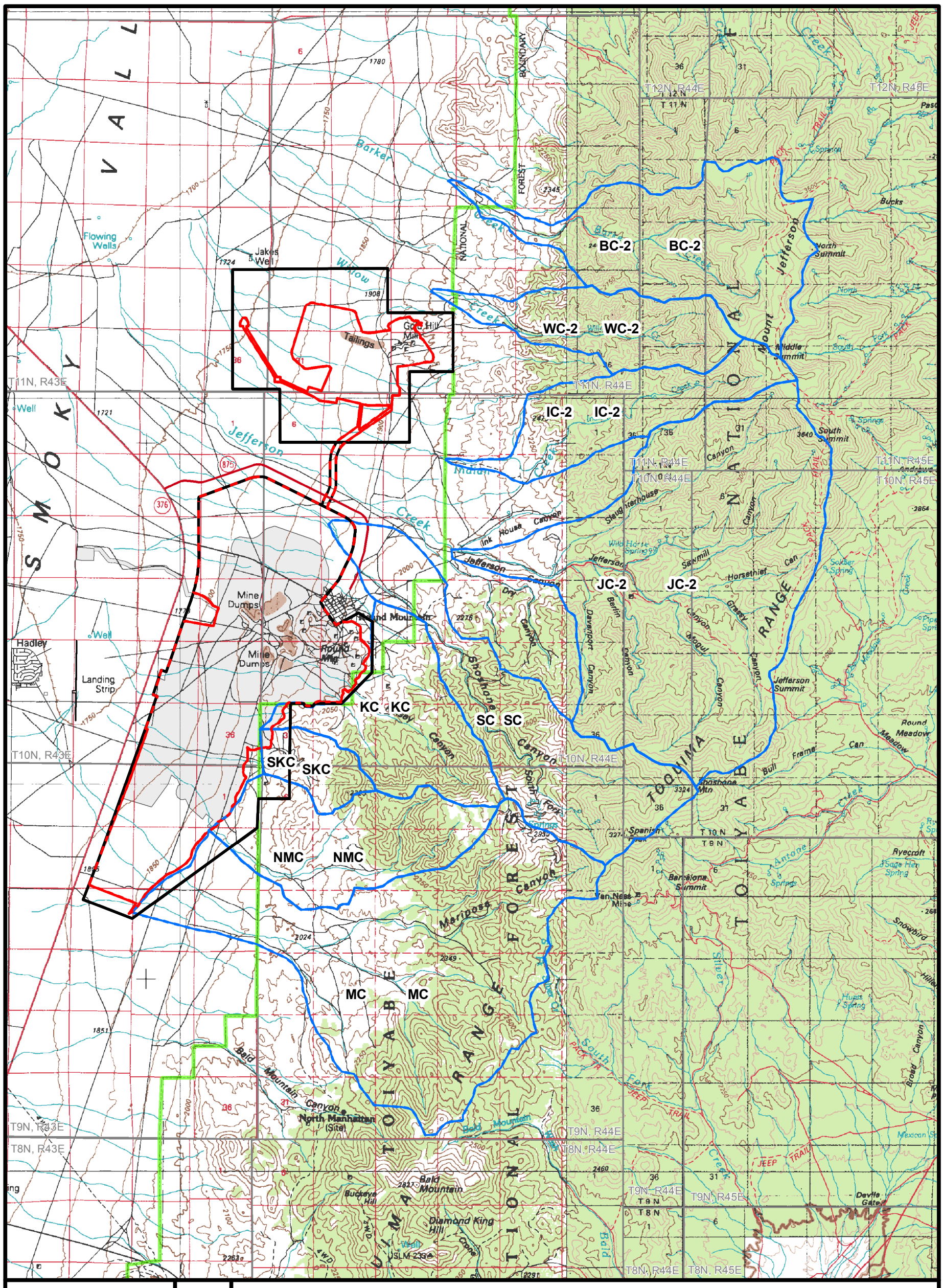
Table 3.3-4 (Continued)

Monitoring Point	Elevation (feet amsl)	Geomorphic Setting	GeologicUnit/Control	Comments	Sample Dates	Flow Rate (gpm)	Temp.[1]	pH[2]	Specific Conductance (µmhos/cm)	Water Quality Sample
Mariposa Canyon – Main Drainage #4	7,008	Stream channel bottom, incised in alluvial fan deposits	Pebbly gravel channel alluvial sediments of Quaternary age, derived from granite	Undeveloped, short reach in intermittent stream flow	8/18/06	>0	57.6	6.68	309	No
Mariposa Canyon First Tributary #1	8,942	Channel bed incised in alluvium	Boulders, sand and gravel overlain by thin organic soil	Undeveloped; water infiltrates into alluvium	8/11/06	3	51.3	7.0	63	No
Mariposa Canyon First Tributary #2	8,527	Fracture-controlled bedrock channel	Fractured granitic bedrock	Undeveloped	8/11/06	>0	61.5	7.7	128	No
Mariposa Canyon First Tributary #3	7,789	Stream channel bottom, incised in valley fill alluvium	Bouldery sand and gravel alluvium, derived from granite bedrock	Undeveloped	8/11/06	1	63.0	7.3	258	No

[1] (°F) degrees Fahrenheit.

[2] pH is standard units.

Source: WMC 2008.



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Watersheds Used for HEC Model
- National Forest Boundary

N

0 1 2 Miles

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-16
Storm Flow
Drainage Areas

05/25/2009

Storm flows at the upper surface water monitoring stations in the major streams near the proposed project area were calculated by WMC (2008) using the USACE HEC-HMS program and are presented in **Table 3.3-5**. The drainage areas for these calculated storm flows are illustrated in **Figure 3.3-16**. Jefferson Creek has the highest peak flow at 17,239 cfs for the 100-year flood event. Kelsey Creek, which has a 100-year flood event of 1,820 cfs and a 10-year flood event of 413 cfs, is the closest creek to the existing Round Mountain Pit. The Willow Creek #2 Monitoring Station, which is located immediately north of the proposed Gold Hill Pit, has a 100-year flood of 3,471 cfs and a 10-year flood of 1,543 cfs.

Table 3.3-5
Round Mountain Expansion Areas – Creek Storm Flow Estimates

Basin	Return Period (year)	Rainfall Depth (inches)	Basin Area (mi^2)	Lag Time (minutes)	Peak Flow (cfs)	Runoff Volume (acre-feet)
Barker Creek Station (BC2)	100	3.9	7.2	30.1	5,772	782
	10	2.5			2,561	362
	2	1.6			857	141
Willow Creek Station (WC2)	100	3.7	4.1	24.0	3,471	409
	10	2.4			1,543	191
	2	1.5			469	69
Indian Creek Station (IC2)	100	3.8	4.6	27.1	3,795	480
	10	2.5			1,750	231
	2	1.6			589	90
Jefferson Creek Station (JC2)	100	3.8	19.6	24.2	17,239	2,043
	10	2.2			6,095	768
	2	1.5			2,230	329
Shoshone Creek (SC)	100	3.4	7.1	25.8	3,410	444
	10	2.1			928	151
	2	1.4			153	44
Kelsey Creek (KC)	100	2.9	4.4	17.8	1,820	198
	10	1.8			413	61
	2	1.2			34	14
South of Kelsey Creek (SKC)	100	2.9	1.3	16.4	904	86
	10	1.8			318	33
	2	1.2			84	12
North of Mariposa Canyon (NMC)	100	3.4	4.9	32.8	1,640	262
	10	2.2			442	91
	2	1.4			39	19
Mariposa Canyon (MC)	100	2.6	14.5	27.6	4,412	622
	10	1.6			1,042	195
	2	1.1			154	56

Source: WMC 2008.

Springs and seeps were inventoried within the proposed project vicinity and the survey data are presented in **Table 3.3-6** (WMC 2008). The springs had water quality similar to streams with pH values in the range of 6.5 to 8.0 standard units, except for the flooded mine workings in Mariposa Canyon, which have pH values of approximately 3.0 standard units. Specific conductance ranges from approximately 150 to 425 µmhos/cm (TDS 100 to 300 mg/L), except for the flooded mine workings in Mariposa Canyon, where the specific conductance is approximately 800 to 825 µmhos/cm (TDS 560 to 570 mg/L). Johnson springs 1 and 2 had TDS values in the range of 125 to 142 mg/L for Johnson Spring 1 and 98 to 121 mg/L for Johnson Spring 2. The spring water was calcium-sodium bicarbonate water with calcium in the range of 15 to 21 mg/L and sodium in the range of 11 to 15 mg/L. Sulfate was less than 15 mg/L. Healy Spring had TDS values ranging from 145 to 205 mg/L with calcium around 40 mg/L and sodium around 14 mg/L. Alkalinity was in the range of 120 to 130 mg/L and sulfate was below 50 mg/L. Ink House Spring had the highest TDS range, with values from 220 to 230 mg/L. Calcium and sodium were comparable, with calcium around 39 mg/L and sodium around 33 mg/L. Alkalinity was 184 mg/L and sulfate was below 15 mg/L. Flow rates in the springs range from less than 5 to 120 gpm, with most springs having flow rates below 20 gpm. The high flow rate springs are developed springs used for irrigation. Johnson springs 1 and 2 can flow at rates around 45 to 50 gpm following spring snow melt, but flow at rates of 1 to 2 gpm during the fall. Healy Spring can flow at rates around 30 gpm in the spring, but flows at rates of 1 to 3 gpm in the fall. Ink House Spring has flow rates of 1 gpm or less on a year-round basis. Surface water quality in terms of major components for streams and springs is summarized in **Figure 3.3-17** (WMC 2008). The Jefferson Canyon streams and Healy Spring have more sulfate than other streams or springs in the study area. Healy Spring and Ink House Spring are used for water supply by the Town of Round Mountain. None of the springs had thermal water. The temperatures measured for the springs by WMC (2008) were comparable to temperatures measured for stream water, suggesting that spring water is local meteoric water within 5 miles of the study area.

3.3.3.2 Groundwater Hydrology

The proposed project would involve expanding the existing Round Mountain Pit and developing a new pit in the Gold Hill Area. Each of these areas has a distinctive hydrogeologic setting. The existing Round Mountain Mine has been in operation since 1976. Pumping of groundwater began in 1990. Groundwater levels before pumping commenced were discussed in the Round Mountain Mill and Tailings Facility EIS (BLM 1996).

Hydrogeology of the Round Mountain Area

Hydrogeologic Units. Five hydrogeologic units were identified in the Round Mountain Mine Area that may be affected by pit expansion and increased dewatering in the mine area. These five units include: 1) Quaternary alluvium; 2) Tertiary Stebbins Hill lacustrine deposits; 3) Tertiary volcanic bedrock; 4) Paleozoic metasedimentary rocks; and 5) Cretaceous granite. These units are illustrated on **Figure 3.3-18** and illustrated in the hydrogeological cross-sections in **Figures 3.3-19** through **3.3-21**. The southern and southeastern walls of the proposed pit expansion areas would be composed of welded tuffs found in the Tertiary volcanic bedrock. Along the northern and northeastern walls of the proposed pit expansion areas, the volcanic bedrock rests on Paleozoic metasediments and Cretaceous granite. Along the western wall of the proposed pit expansion areas, up to 600 feet of Quaternary alluvium overlie the Tertiary Stebbins Hill formation. The Cretaceous granite is exposed mainly in the southeastern pit wall.

Table 3.3-6
Spring and Seep Inventory

Sample Point	Elevation (feet amsl)	Geomorphic Setting	Geologic Unit/Control	Comments	Sample Date	Flow Rate (gpm)	Temp.[1]	pH[2]	Specific Conductance (µmhos/cm)	Water Quality Sample
Slaughter House Canyon	7,080	Hillside	Cobbles and other sediments derived from Tertiary Volcanics	Undeveloped	5/13/04 10/11/04	0 0	- -	- -	- -	No No
Healy Spring	6,720	Hillside adjacent to Jefferson Creek	Originating from volcanics and flows though a thin veneer of locally derived alluvium	Developed, collected, contained, and piped to the Round Mountain townsite for public water supply	5/13/04 10/11/04 4/12/05 12/12/05	15 1 30 3	64.2 58.4 59.3 53.7	7.21 7.55 7.71 6.76	347 291 288 276	Yes Yes Yes Yes
Ink House Spring	6,920	Hillside adjacent to dry mountain stream channel	Originating from volcanics and flows though a well developed soil cover	Developed, collected, contained, and piped to the Round Mountain townsite for public water supply	5/13/04 10/11/04 4/12/05 12/12/05	<1 0 1 1	69.3 - 65.2 57.0	7.73 - 7.90 6.74	413 - 355 362	Yes No Yes Yes
Johnson #1[3]	8,040	Trench	Most likely originates from volcanic rock outcrop immediately north of sample point	Developed; sample point located near outcrop on northern most extension of trench	5/18/04 10/11/04 4/12/05 12/12/05	45 1 120 0	68.8 63.0 58.2 -	6.82 7.27 6.92 -	225 181 177 -	Yes Yes Yes No
Johnson #2[3]	7,800	Trench	Most likely originates from volcanic rock outcrop associated with Johnson #1	Developed; sample point located at pipe discharge routing water away from trenching	5/18/04 10/11/04 4/12/05 12/12/05	50 2 48 -	58.6 57.2 51.4 51.8	6.62 6.82 6.64 6.63	163 165 151 176	Yes Yes Yes Yes

Table 3.3-6 (Continued)

Sample Point	Elevation (feet amsl)	Geomorphic Setting	Geologic Unit/Control	Comments	Sample Date	Flow Rate (gpm)	Temp.[1]	pH[2]	Specific Conductance (µmhos/cm)	Water Quality Sample
Shoshone #1	8,800	Hillside	Originating from fractures in the Cretaceous granite	Undeveloped; soil was wet; water ponded on surface	5/19/04	2	48.1	6.23	102	Yes
Shoshone #2	8,920	Hillside	Originating from fractures in the Cretaceous granite	Undeveloped; water collected along roadside and routed though and sampled from an HDPE culvert	5/19/04	0	-	-	-	No
Mariposa Canyon – Main Drainage #1	8,999	Flooded mine workings	Fractures in Cretaceous granite	Water does not discharge from mine workings	9/14/06	0	48.7	3.02	801	No
Mariposa Canyon – Main Drainage #2	8,999	Flooded mine workings	Fractures in Cretaceous granite	Discharge from HDPE pipe, ponded on mine dump	9/14/06	<1	48.9	3.12	825	No
Mariposa Canyon – Main Drainage #3	8,730	Channel bed	Fractures in Cretaceous granite	Undeveloped, infiltrates into alluvium	9/14/06	<1	57.0	6.69	248	No
Mariposa Canyon – Main Drainage #4	8,642	Hillside	Fractures in Cretaceous granite	Undeveloped, infiltrates into alluvium	9/14/06	0	59.9	7.36	272	No
Mariposa Canyon – Main Drainage #5	~7,880	Channel bed	Fractures in Cretaceous granite	Undeveloped, head of intermittent stream flow	9/14/06	1	57.6	6.76	334	No
Mariposa Canyon – Main Drainage #6	7,426	Channel bed	Pool in alluvium	Undeveloped	8/18/06	0	59.0	6.78	325	No
Mariposa Canyon First Tributary #1	9,154	Hillside	Originating from granite, flows though well developed soil cover	Undeveloped; water flows into short stream	8/11/06	5	52.2	7.14	115	No

Table 3.3-6 (Continued)

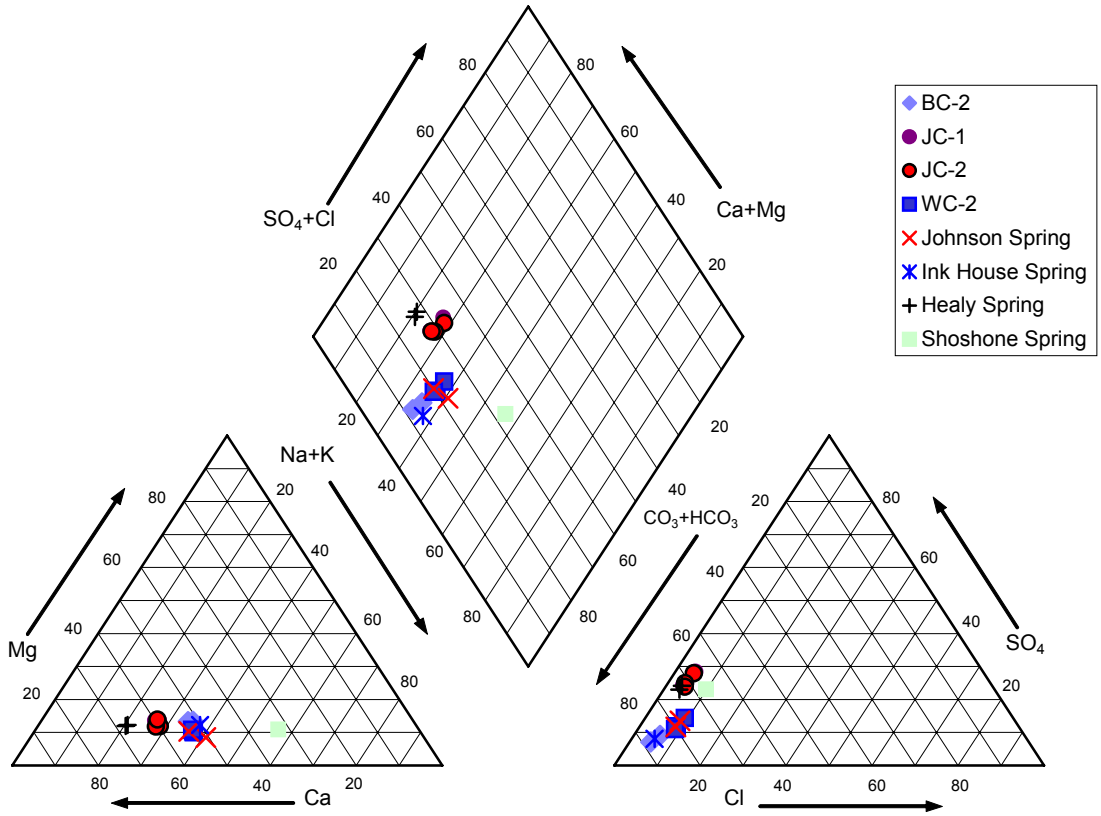
Sample Point	Elevation (feet amsl)	Geomorphic Setting	Geologic Unit/Control	Comments	Sample Date	Flow Rate (gpm)	Temp.[1]	pH[2]	Specific Conductance (µmhos/cm)	Water Quality Sample
Mariposa Canyon First Tributary #2	9,016	Hillside	Flows though well developed soil cover.	Undeveloped; water flows into short stream	8/11/06	3	48.7	6.97	45	No
Mariposa Canyon First Tributary #3	8,689	Hillside, adjacent to drainage	Fractures in granite	Undeveloped; head of short flowing reach	8/11/06	3	57.4	6.85	155	No
Mariposa Canyon First Tributary #4	8,091	Channel bed	Spring in alluvium	Undeveloped, infiltrates into alluvium	8/11/06	0	58.5	7.02	199	No
Mariposa Canyon First Tributary #5	8,071	Fracture-controlled bedrock channel	Fractures in granite, passing into alluvium	Undeveloped; infiltrates into alluvium	8/11/06	>0	59.9	7.3	182	No
Mariposa Canyon First Tributary #6	7,571	Fracture-controlled bedrock channel	Sandy gravel and boulder alluvium partly filling bedrock channel	Undeveloped; pool in sandy gravel alluvium	8/11/06	0	70.2	7.4	272	No
Mariposa Canyon First Tributary #7	7,316	Fractured bedrock slabs	Fractures in granite	Undeveloped; infiltrates into alluvium	8/11/06	0	64.9	7.7	425	No

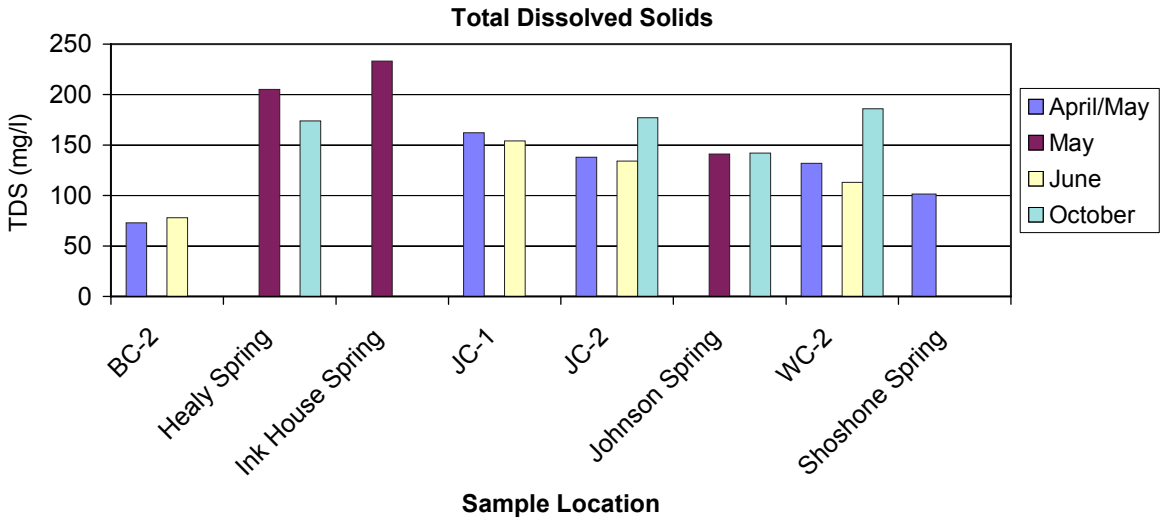
[1] °F.

[2] pH in standard units.

[3] Johnson springs #1 and #2 may be a spring complex with 2 discharge points from the same source.

Source: WMC 2008.





Round Mountain Expansion Project

Figure 3.3-17

Round Mountain and Gold Hill Surface Water Chemistry

Note: TDS = Total Dissolved Solids.
Source: WMC 2008.

01/13/09

Legend

- 2005 End-of-Year Pit Configuration
- Currently Permitted Pit Configuration
- Proposed Pit Configuration
- 96-1 Alluvial Well
- 96-1 Bedrock Well
- Known Faults
- Hydrogeologically Significant Faults
- Dumps and Lean Ore Stockpiles
- Mill and Other Stockpiles

Hydrogeologic Units

- *Qal* — Alluvium (RMG rock type 51); Alluvium, Gold Placer (RMG rock type 52)
- *Tshs* — Stebbins Hill Unit, Undivided (RMG rock type 33)
- *Tmv* — Densely Welded Rhyolite tuff (RMG rock type 1); Transitional Unit, Moderately Welded Rhyolite Tuff (RMG Rock Type 9); Non-Welded, Pumice-Rich Tuff (RMG Rock Type 2); Moderately Welded, Lithic tuff (RMG Rock Type 3); Non-Welded Lithic Tuff With Abundant Granite Clasts (RMG rock type 28)
- *Kg* — Cretaceous Granite (RMG Rock Type 8)
- *Pms* — Paleozoic Metasedimentary Rocks (RMG Rock Type 4)

N

0 ' 1,100' 2,200' Feet

Figure 3.3-19

Note: See detailed cross-sections provided in through **3.3-21**.

Topographic elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

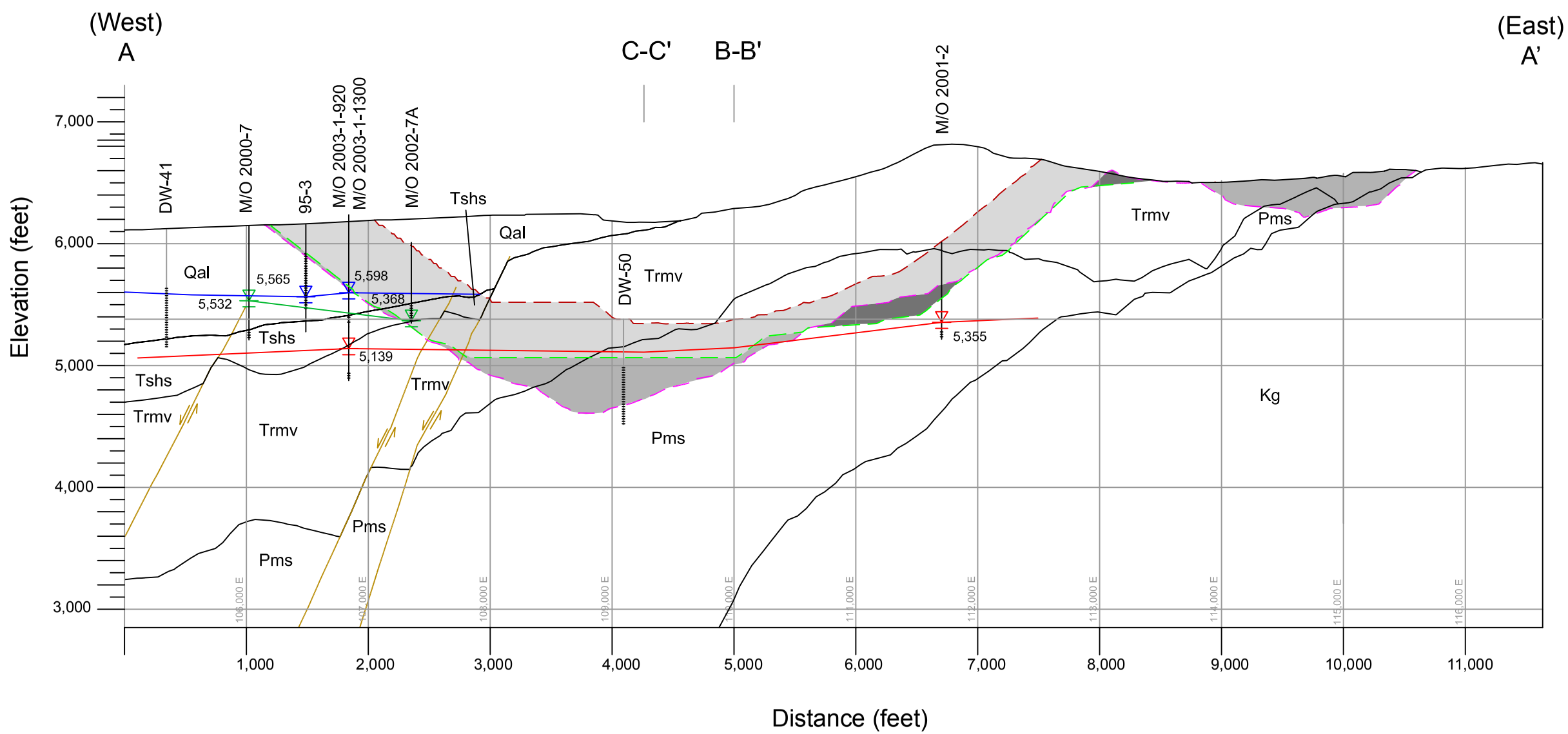
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-18

Round Mountain Pit Geology

04/30/09



Legend

- Faults
- Hydrogeologic Unit Boundary
- Currently Permitted Pit Configuration
- Proposed Pit Configuration
- Overlap of Currently Permitted and Proposed Pit Configurations
- Well, With Screened Interval Shown
- Alluvial Water Level (December 2005)
- Stebbins Hill Water Level (December 2005)
- Volcanic/Metasedimentary Water Level (December 2005)

Hydrogeologic Units

Qal - Alluvium Unit

Tshs - Stebbins Hill Bedrock Unit

Trmv - Volcanic Bedrock Unit

Kg - Granite Bedrock Unit

Pms - Metasedimentary Bedrock Unit

Note: See **Figure 3.3-18** for location of cross-section. Topographic and water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

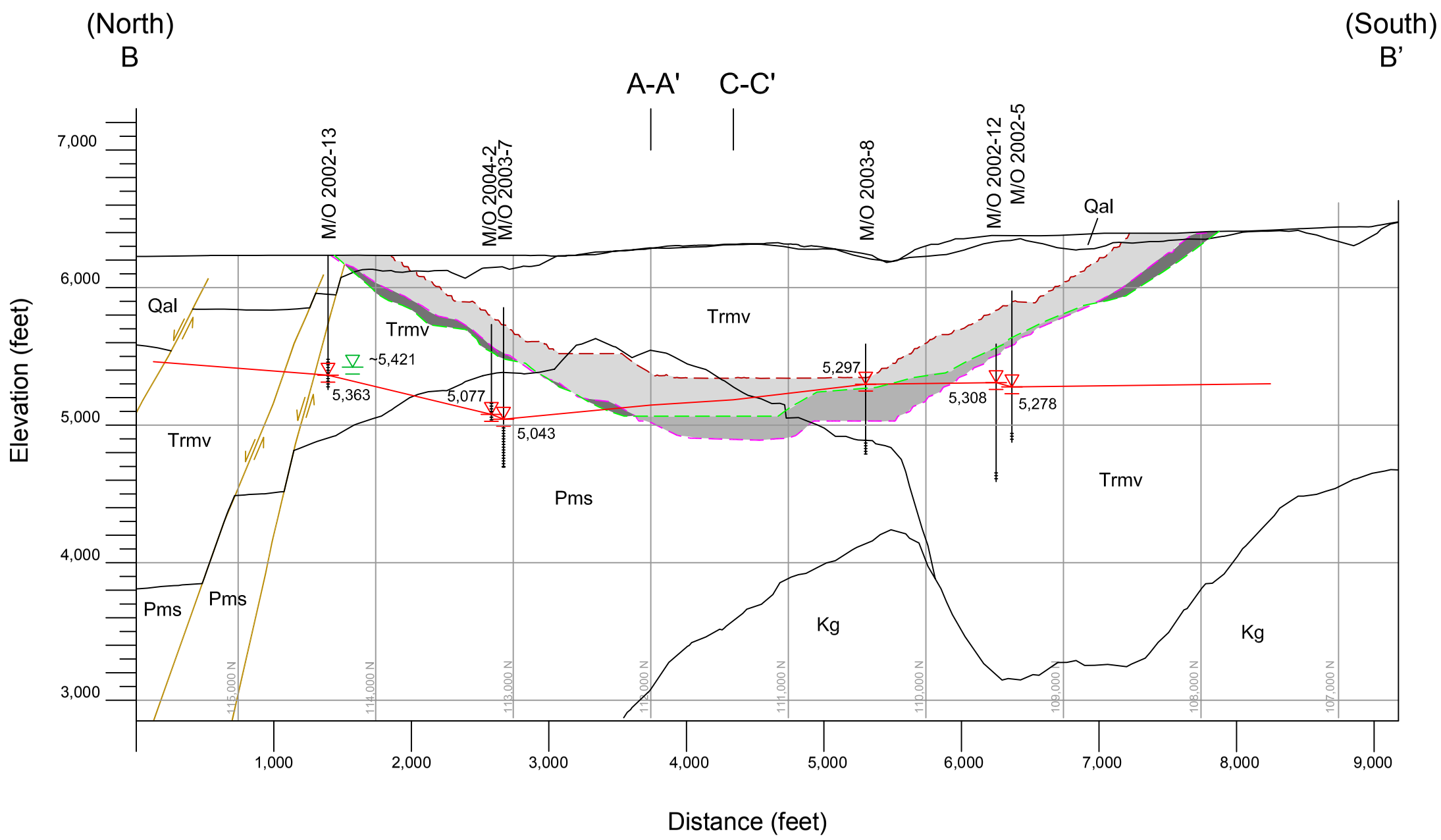
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-19

Round Mountain Pit Hydrogeologic Cross-section (A-A')

04/12/09



Legend

- Faults
- Hydrogeologic Unit Boundary
- Currently Permitted Pit Configuration
- Proposed Pit Configuration
- Overlap of Currently Permitted and Proposed Pit Configurations
- Well, With Screened Interval Shown
- Stebbins Hill Water Level (December 2005)
- Volcanic/Metasedimentary Water Level (December 2005)

Hydrogeologic Units

Qal - Alluvium Unit

Trmv - Volcanic Bedrock Unit

Kg - Granite Bedrock Unit

Pms - Metasedimentary Bedrock Unit

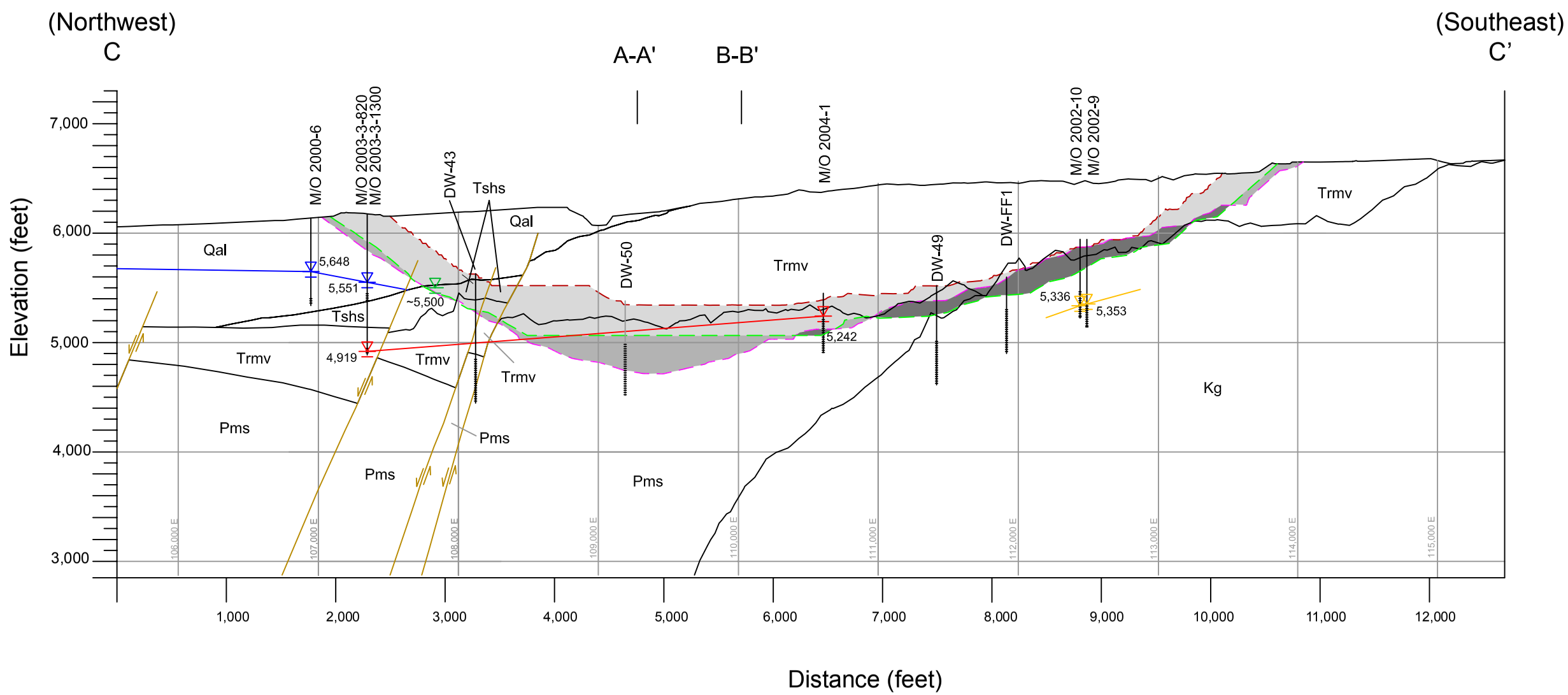
Note: See **Figure 3.3-18** for location of cross-section.
Topographic elevations provided in feet,
USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-20

Round Mountain
Pit Hydrogeologic
Cross-section (B-B')

04/30/09



Legend

- Faults
- Hydrogeologic Unit Boundary
- Currently Permitted Pit Configuration
- Proposed Pit Configuration
- Overlap of Currently Permitted and Proposed Pit Configurations
- Well, With Screened Interval Shown
- Alluvial Water Level (December 2005)
- Stebbins Hill Water Level (December 2005)
- Volcanic/Metasedimentary Water Level (December 2005)
- Granite Water Level December 2005)

Hydrogeologic Units

Qal - Alluvium Unit
Tshs - Stebbins Hill Bedrock Unit
Trmv - Volcanic Bedrock Unit
Kg - Granite Bedrock Unit
Pms - Metasedimentary Bedrock Unit

Note: See **Figure 3.3-18** for location of cross-section. Topographic and water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-21

Round Mountain Pit Hydrogeologic Cross-section (C-C')

04/12/09

Quaternary Alluvium. The alluvium is approximately 600 to 700 feet in thickness near the center of the western highwall and increases in thickness to the west away from the Round Mountain Pit and towards the center of the Northern Big Smoky Valley. The alluvium consists of gravels and sands derived from the volcanic bedrock and the Cretaceous granite exposed in the Toquima Range to the east of the existing Round Mountain Mine. Local zones in the alluvium that are interpreted to be valley fill contain placer gold (WMC 2008). Current water levels in the alluvium and within the cone of depression near the existing Round Mountain Pit range from 5,515 to 5,648 feet. Pre-mining water levels in this area ranged from 5,730 to 5,740 feet (WMC 2008), suggesting around 200 feet of drawdown since 1990. The alluvium is not hydraulically connected to the Tertiary volcanic bedrock tuffs because of the low vertical permeability (2.8×10^{-4} to 2.8×10^{-5} feet per day) of the intervening Stebbins Hill Formation. Pumping tests conducted in the alluvium indicate relatively high permeability with transmissivity values ranging from 248 to 1,045 feet squared per day (WMC 2008). Transmissivity values up to 3,740 feet squared per day have been reported (BLM 1996). These transmissivity values are approximately equivalent to hydraulic conductivity values of 1.6 to 15 feet per day. The porosity of the alluvium is between 5 and 20 percent (WMC 2008).

Tertiary Stebbins Hill Formation. The Stebbins Hill Formation consists of interbedded fine-grained lacustrine deposits and volcaniclastic sandstones and siltstones. Siliceous deposits within the formation have been interpreted as volcanic sinter deposits (WMC 2008). This unit separates the Quaternary alluvium from the Tertiary volcanic bedrock that dominates the Round Mountain Area. Water levels in this formation range from 5,368 to 5,685 feet. The Stebbins Hill Formation is only exposed in the west wall of the existing Round Mountain Pit. The vertical hydraulic conductivity based on permeability tests in 4 piezometers was around 2.8×10^{-4} feet per day (WMC 2008).

Tertiary Volcanic Bedrock. The volcanic bedrock consists of welded and non-welded pyroclastic tuffs and tuffaceous sedimentary rocks. The hydraulic conductivity of the volcanic bedrock is low, except in highly fractured areas. Water levels range from 5,040 to 5,350 feet within the Round Mountain Pit expansion areas and up to 5,600 feet outside of the Round Mountain Pit expansion areas. As a result of continued dewatering since 1990, water levels in the volcanic bedrock are 450 to 630 feet below the water table in the overlying Quaternary alluvium. Transmissivity values calculated for the highly fractured areas of the Tertiary volcanics near the range-front faults range from 4 to 48 feet squared per day. These values equate to hydraulic conductivity ranges from 0.02 to 0.3 feet per day (WMC 2008). The drainable porosity of the volcanics is low, with a maximum porosity of about 2 percent based on dewatering experience at the existing Round Mountain Pit (WMC 2008).

Paleozoic Metasedimentary Rocks. The Paleozoic metasedimentary rocks include both carbonate rocks and siliceous metasediments such as slates and siltstones. The hydraulic conductivity of these units is low, except in fractured areas near faults. Water levels correspond to those in the overlying Tertiary volcanic bedrock. Transmissivity was not measured directly in the Round Mountain Area (WMC 2008), but aquifer tests in the same formation 9 miles to the south in the Manhattan District yielded values ranging from 1,337 to 4,010 feet squared per day (BLM 1996). This corresponds to a range in hydraulic conductivity of 2 to 5 feet per day (WMC 2008). These values are higher than those measured for the overlying Tertiary volcanics and probably represent highly fractured areas in the Manhattan District (WMC 2008).

Cretaceous Granite. The granite intrudes the Paleozoic metasedimentary rocks and consists of medium-grained plutonic rocks. The hydraulic conductivity is low, except in fractured areas near faults. Water levels range from 5,340 to 5,635 feet (WMC 2008). These water levels are higher than those in the overlying volcanic bedrock and result in a local upward gradient in the Round Mountain Area (WMC 2008).

Groundwater Levels. Groundwater levels measured in December 2005 for the existing Round Mountain Pit are illustrated in **Figures 3.3-19** through **3.3-21**. **Figure 3.3-18** illustrates the geology of the Round Mountain Pit and the location of alluvial monitoring wells. **Figures 3.3-19** through **3.3-21** illustrate the current water levels in geologic cross-sections of the Round Mountain Pit. Water levels in the Quaternary alluvium are generally above those in the Tertiary volcanics and the Paleozoic metasediments. Water levels in the volcanics and the metasediments are comparable in the cross-sections.

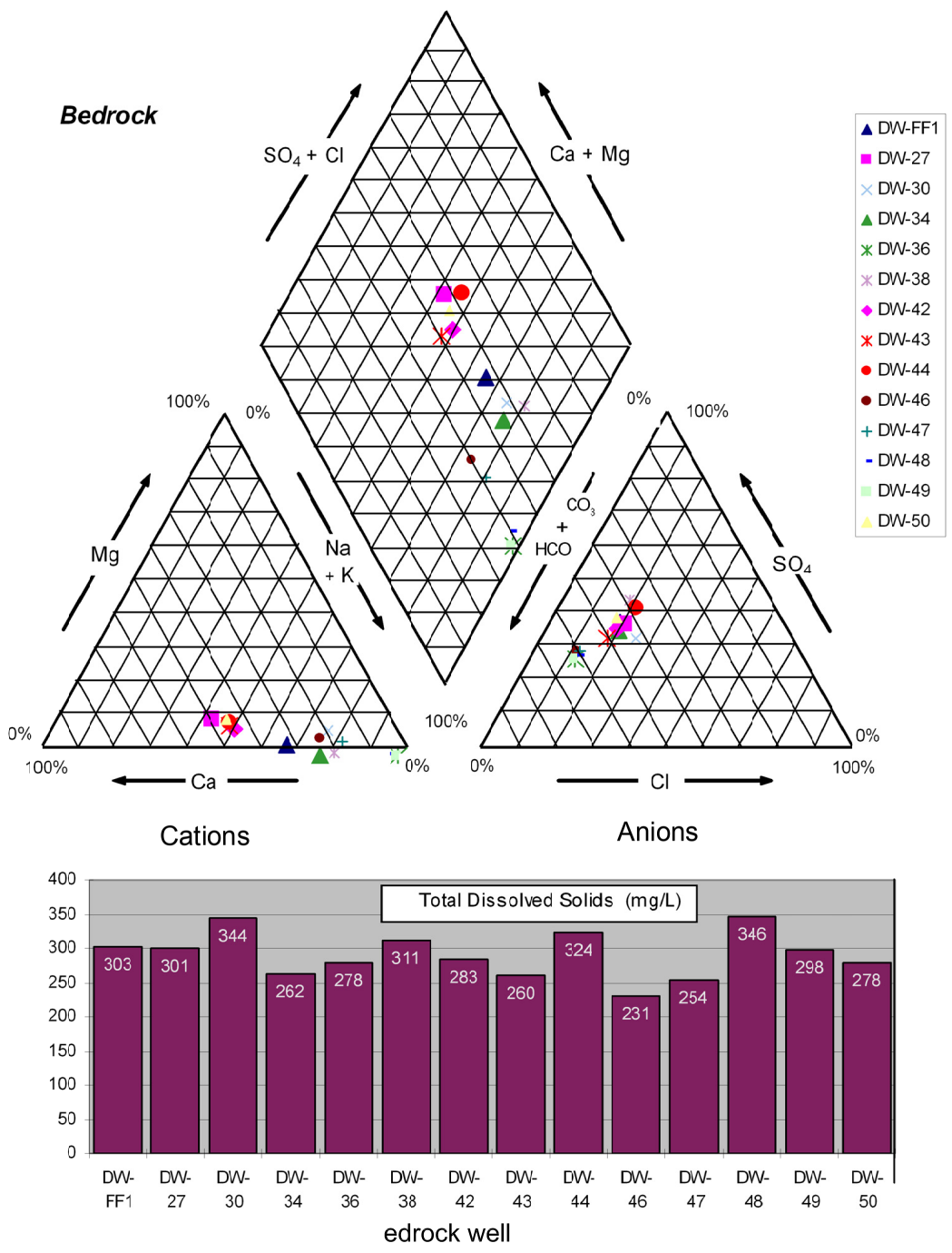
Figure 3.3-11 shows the current alluvial water levels in the southern part of Northern Big Smoky Valley and in the vicinity of the existing Round Mountain Pit and the proposed Gold Hill Pit. Groundwater levels west of the Round Mountain Area show the effect of dewatering since 1990 and especially since 1996. Within a radius of approximately 2.5 miles west, south, and north from the existing Round Mountain Pit, groundwater in the Quaternary alluvium of the basin flows toward the existing Round Mountain Pit. In 1990, prior to the commencement of dewatering at the existing Round Mountain Pit, groundwater in the basin alluvium in the southern part of the Northern Big Smoky Valley flowed from the Round Mountain Area west-northwest toward the center of the valley (BLM 1996). By 2005, the groundwater flow in the basin alluvium near Round Mountain had been reversed due to dewatering of the alluvium at the existing Round Mountain Pit.

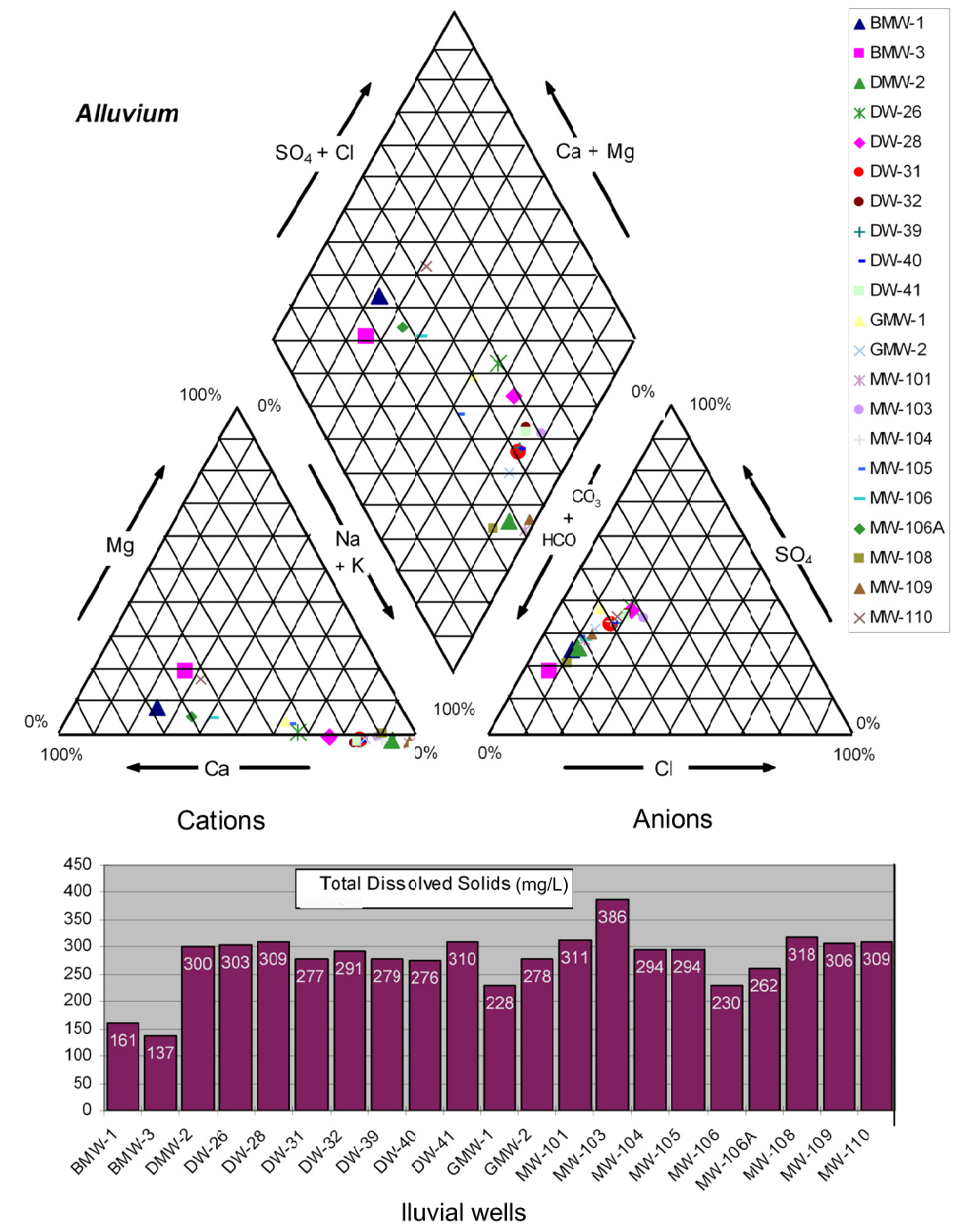
Groundwater Quality. Groundwater quality in the Round Mountain Area has been compiled from 14 wells screened in the bedrock units (i.e., volcanics, metasediments, granite) and 20 monitoring wells screened in the Quaternary alluvium. The major ion chemistry is displayed in trilinear Piper diagrams (**Figure 3.3-22**).

Appendix A contains the tables of analyses for major ions and trace metals compiled by WMC (2008) for bedrock groundwater (**Table A-1**) and for alluvial groundwater (**Table A-2**). The two main constituents of concern for groundwater in the Round Mountain Area are arsenic and fluoride. Both constituents are elevated in bedrock and alluvial groundwater.

For bedrock units, groundwater quality for major ions is presented in **Figure 3.3-22**. The bedrock water quality typically has a slightly alkaline pH and an average TDS value of less than 350 mg/L. The volcanic bedrock has groundwater characterized as the sodium-potassium-calcium bicarbonate-sulfate type, while the metasediments and the granite bedrock units have groundwater characterized as the more alkaline sodium-potassium bicarbonate type. Mean TDS values range from 231 mg/L to 346 mg/L with 1 well showing a maximum TDS of 1,624 mg/L. Chloride is generally below 50 mg/L, while sulfate is below 100 mg/L. Sodium can range up to approximately 94 mg/L, with potassium below 8 mg/L, and calcium ranging from 2 to 45 mg/L. Fluoride in the volcanic bedrock wells is below the Nevada MCL of 4 mg/L, but greater than 4 mg/L in the granite bedrock. Maximum value for fluoride is 20.5 mg/L. Arsenic in bedrock groundwater exceeds the Nevada MCL of 0.05 mg/L and ranges up to 0.417 mg/L, with most values being below 0.15 mg/L. Antimony ranges up to 0.035 mg/L, but generally is below the Nevada MCL. Other metals are within Nevada MCL limits. Thus, arsenic and fluoride are the metals of concern in bedrock groundwater because they consistently exceed the Nevada MCL.

For alluvium, groundwater quality for major ions is presented in **Figure 3.3-22**. Alluvial groundwater typically has a slightly alkaline pH and TDS concentrations generally below 400 mg/L, with most values ranging from 160 to 311 mg/L. Wells screened in the pediment alluvial material near the existing Round Mountain Mine have groundwater of the sodium-potassium bicarbonate type; wells screened farther to the west into the southern part of the Northern Big Smoky Valley have groundwater characterized by calcium bicarbonate. The major ion chemistry of alluvial groundwater near the Round Mountain Mine is similar to that of the underlying bedrock. Sulfate concentrations range up to 91 mg/L. Chloride ranges up to 25 mg/L. Sodium is





Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-22

Average Round Mountain Groundwater Chemistry

12/04/08

generally below 100 mg/L with potassium ranging up to 6.0 mg/L and calcium ranging up to 34 mg/L. Arsenic and fluoride exceed the Nevada MCL in all alluvial wells screened near the existing Round Mountain Mine, but not in alluvial wells in the valley. Arsenic ranges up to 0.123 mg/L. Fluoride ranges up to 20.5 mg/L. Elevated fluoride and arsenic are found in an area southwest of the west wall of the Round Mountain Pit. Antimony also was elevated above the Nevada MCL in two wells located southwest of the Round Mountain Pit.

Hydrogeology of the Gold Hill Area

The Gold Hill Area is an area of historic gold mining that lies approximately 2.5 miles north of the existing Round Mountain Mine. The hydrogeology and groundwater chemistry in the Gold Hill Area are somewhat different from that present in the Round Mountain Area.

Hydrogeologic Units. Four main hydrogeologic units occur in the proposed pit area in the Gold Hill Area. These units in descending (i.e., higher to lower) order include: 1) Quaternary basin-fill alluvium that consists of gravels and sands; 2) an ash-fall tuff of Tertiary age that separates the volcanic units from the alluvial gravels; 3) a Tertiary volcanic sinter unit; and 4) Tertiary volcanic bedrock consisting of welded and non-welded ash-flow tuffs. The Paleozoic metasediments and the Cretaceous granite common in the Round Mountain Area exist approximately 2 to 3 miles southeast of the Gold Hill Area. The hydrogeology of the Gold Hill Area is illustrated in **Figures 3.3-23** through **3.3-26**.

Quaternary Alluvium. The hydraulic properties of the alluvium were measured with slug tests and pumping tests. The alluvium in the western portion of the proposed Gold Hill Pit area has a low permeability. However, the permeability of alluvium increases to the west of the proposed Gold Hill Pit area. The transmissivity of the alluvium in the western portion of the proposed Gold Hill Pit area ranges from 0.6 to 7.0 feet squared per day. These values equate to a hydraulic conductivity range of 0.003 to 0.03 feet per day (WMC 2008). Alluvium located several thousands of feet farther west has transmissivity values that range from 65 to 330 feet squared per day. These values translate to an estimated hydraulic conductivity between 2.0 and 7.0 feet per day (WMC 2008). The drainable porosity of the alluvium is estimated to range from 5 to 20 percent (WMC 2008). Groundwater levels in the alluvium currently range from 5,961 feet along the range front fault to 5,685 feet approximately 2,000 to 3,000 feet westward into the valley.

Tertiary Ash-Fall Tuff. The ash-fall tuff has a very low permeability and yielded no water during exploratory drilling. Consequently, there are no estimates for its hydraulic conductivity.

Tertiary Volcanic Sinter. A pumping test of the sinter unit in Well GHB-BPW had a transmissivity of 49,000 feet squared per day, which is equivalent to a hydraulic conductivity of approximately 800 feet per day (WMC 2008). The sinter is quite permeable due to fracturing and the porous nature of the deposit. Because of its high permeability, the sinter would act as a drain during dewatering of the proposed Gold Hill Pit. Groundwater levels in the sinter are approximately 6,183 feet.

Tertiary Volcanic Bedrock. The transmissivity of the volcanic bedrock is variable and depends on the degree of fracturing and faulting. Calculated estimates for the transmissivity of this unit in fractured areas range from 0.7 to 97.0 feet squared per day. These transmissivity values are based on pumping tests and are roughly equivalent to hydraulic conductivity values ranging from 0.003 to 1.0 feet per day. The drainable porosity of the volcanic bedrock has been estimated to range for 0.5 to 2.0 percent (WMC 2008).

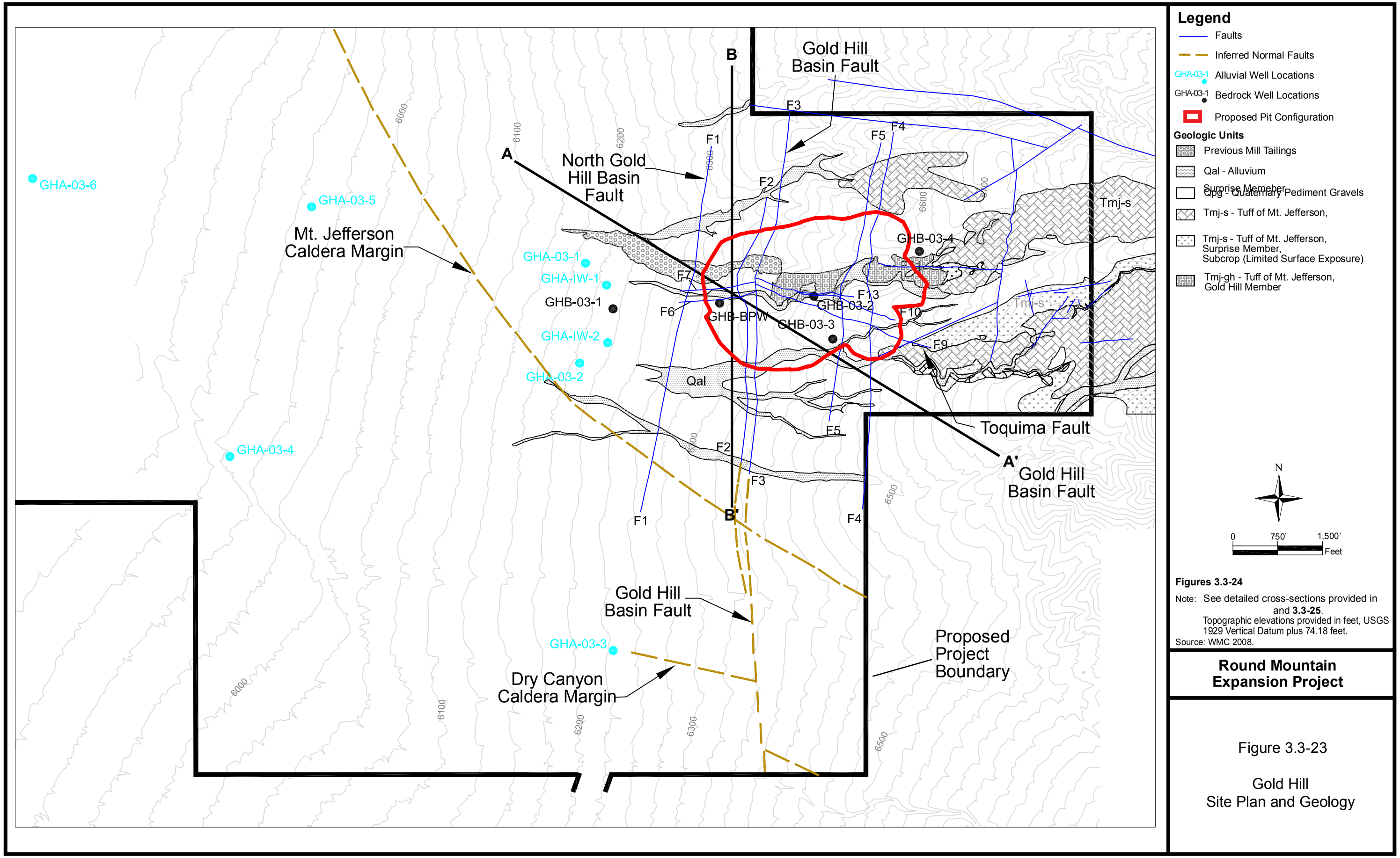
Groundwater levels in the volcanic bedrock along the eastern portion of the proposed Gold Hill Pit are currently in the range of 6,380 to 6,180 feet.

The eastern high wall of the proposed Gold Hill Pit would be comprised mostly of the Tertiary volcanic bedrock, which is primarily a welded tuff. Approximately 200 feet of unsaturated Quaternary alluvium is expected to overlie the volcanic bedrock on the eastern high wall. The western high wall of the proposed Gold Hill Pit would be comprised of Quaternary alluvium ranging in thickness from approximately 400 to 500 feet. The water table in the alluvium is approximately 200 to 250 feet bgs at present, so that 200 to 300 feet of saturated Quaternary alluvium would have to be dewatered to accommodate mining operations. Beneath the alluvium in the western high wall would be 200 to 300 feet of saturated Tertiary ash-fall tuff, and below the ash-fall tuff would be approximately 100 feet of saturated Tertiary volcanic sinter. The lower 200 to 300 feet of the western high wall would be saturated Tertiary volcanic bedrock.

Groundwater Flow. Recharge to groundwater in the bedrock units at the proposed Gold Hill Pit would originate from groundwater flow in the mountainous areas located to the east. The permeability of the Tertiary volcanic bedrock is relatively low, except in fractured areas. The estimated pre-mining steady state groundwater flow into the proposed Gold Hill Pit would be approximately 10 to 30 gpm (WMC 2008). This estimate is based on an average transmissivity of 10 to 35 feet squared per day and a gradient of 0.04 foot/foot over a cross-sectional width of 3,500 feet. Currently, bedrock groundwater levels are above those in the overlying Quaternary alluvium, allowing for upward flow from the bedrock to the alluvium. Groundwater flow in the sinter also would be similar to groundwater flow in the volcanic bedrock. Groundwater flow in the Quaternary alluvium would occur from east to west since recharge to the alluvium would come from stream infiltration during periods of runoff from mountainous areas. **Figure 3.3-11** shows the current groundwater contours and gradients in the Gold Hill Area for the Quaternary alluvium. Current bedrock and alluvial water levels in the Gold Hill Area are illustrated in **Figure 3.3-26**. As illustrated in this figure, groundwater flow in the bedrock is affected by the north-south trending faults that predominate in the area of the proposed Gold Hill Pit.

Groundwater Chemistry of the Gold Hill Area. Groundwater chemistry in the Gold Hill Area is affected by rock type, past mining activity, and stream flow recharge to the alluvium. Groundwater in the volcanic bedrock currently flows from east to west across the proposed Gold Hill Pit area. Groundwater quality varies along this flow path. Groundwater quality data for the Gold Hill Area is provided in **Appendix A**.

Monitoring of bedrock groundwater quality began in March 2004 and has continued to the present with the routine sampling of five monitoring wells screened in the bedrock hydrogeologic units (WMC 2008). General bedrock water quality for the major ions is illustrated in **Figure 3.3-27**. Tables in **Appendix A** summarize the groundwater quality data for the bedrock units in the Gold Hill Area (**Table A-3**). The TDS is generally below 500 mg/L, and the groundwater can be characterized as the sodium-calcium-bicarbonate type with a neutral to slightly alkaline pH (WMC 2008). Chloride is generally below 40 mg/L, sulfate below 160 mg/L, sodium ranges from 64 to 147 mg/L, and calcium is usually below 60 mg/L. TDS ranges up to 476 mg/L. Fluoride is usually below 10 mg/L, but ranges from less than 1.0 to 7.8 mg/L. Arsenic and antimony are consistently above the Nevada MCL for each constituent. Average arsenic values range up to 0.208 mg/L with a maximum arsenic value of 0.291 mg/L; average antimony values range up to 0.055 mg/L with a maximum antimony value at 0.196 mg/L. All other metals are below the Nevada MCL.



Figures 3.3-24

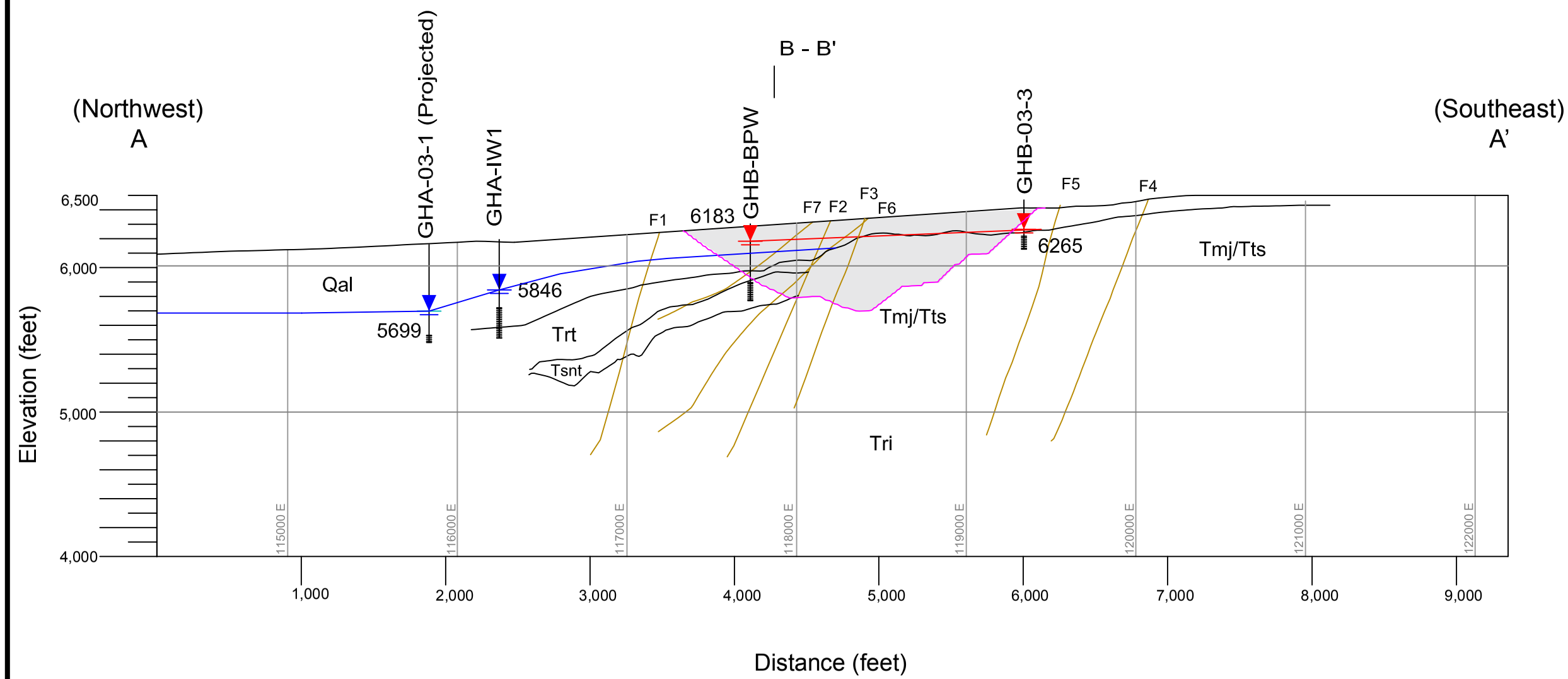
Note: See detailed cross-sections provided in and **3.3-25**.
Topographic elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-23

Gold Hill
Site Plan and Geology

04/23/09



Legend

- Faults (F1 - F7)
- Hydrogeologic Unit Boundary
- Alluvial Water Level
- Bedrock
- Well, With Screened Interval Shown
- Proposed Pit Configuration

Hydrogeologic Units

Qal - Alluvium Unit
Trt - Ash Fall Tuff Unit
Tsnt - Sinter Unit
Tmj/Tts - Mt. Jefferson Tuff (Undivided)
Tri - Rhyolite Intrusive

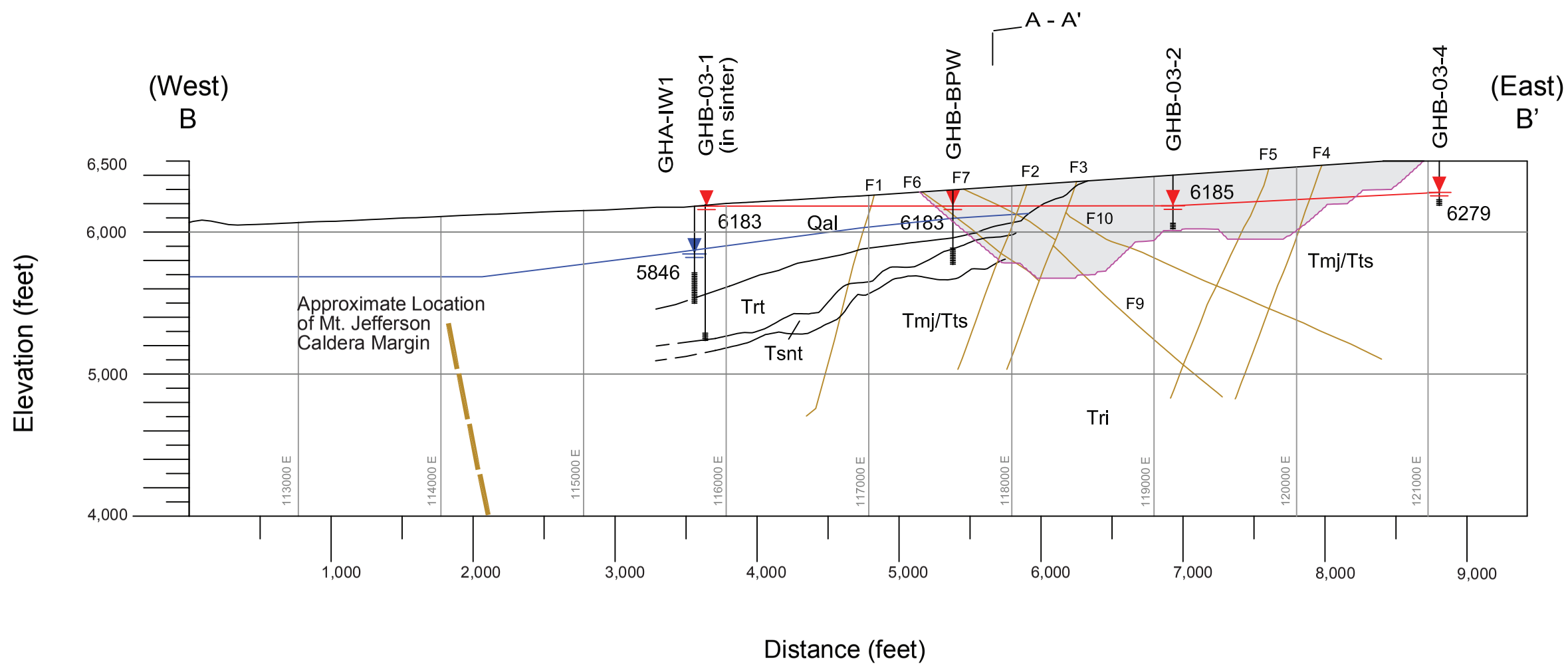
Note: See **Figure 3.3-23** for location of cross-section. Topographic and water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-24

Gold Hill Hydrogeologic Cross-section (A-A')

04/12/09



Legend

- Faults
- Hydrogeologic Unit Boundary
- Alluvial Water Level
- Bedrock
- Well, With Screened Interval Shown
- Proposed Pit Configuration

Hydrogeologic Units

Qal - Alluvium Unit
Trt - Ash Fall Tuff Unit
Tsnt - Sinter Unit
Tmj/Tts - Mt. Jefferson Tuff (Undivided)
Tri - Rhyolite Intrusive

Note: See **Figure 3.3-23** for location of cross-section. Topographic and water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

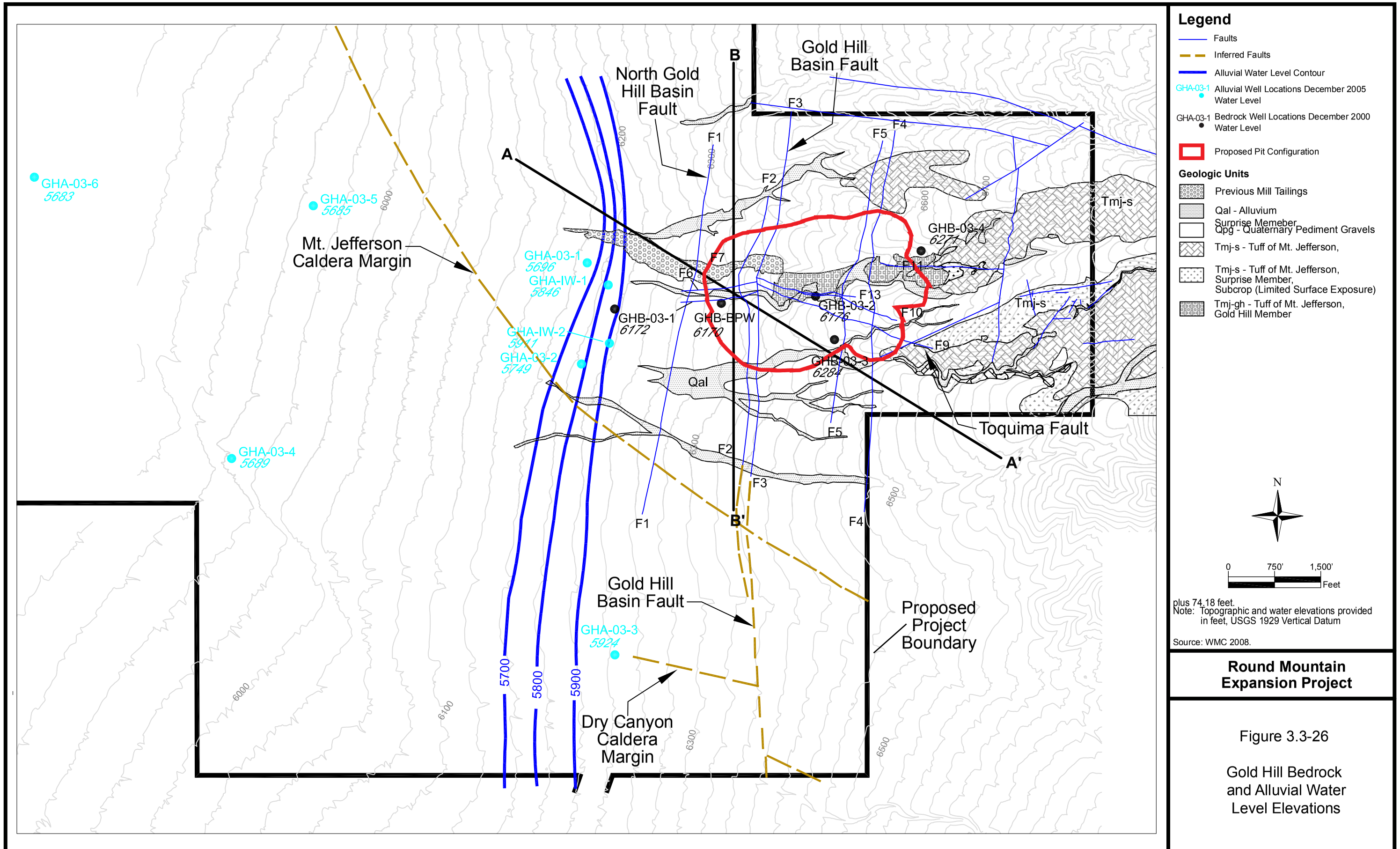
Source: WMC 2008.

Round Mountain Expansion Project

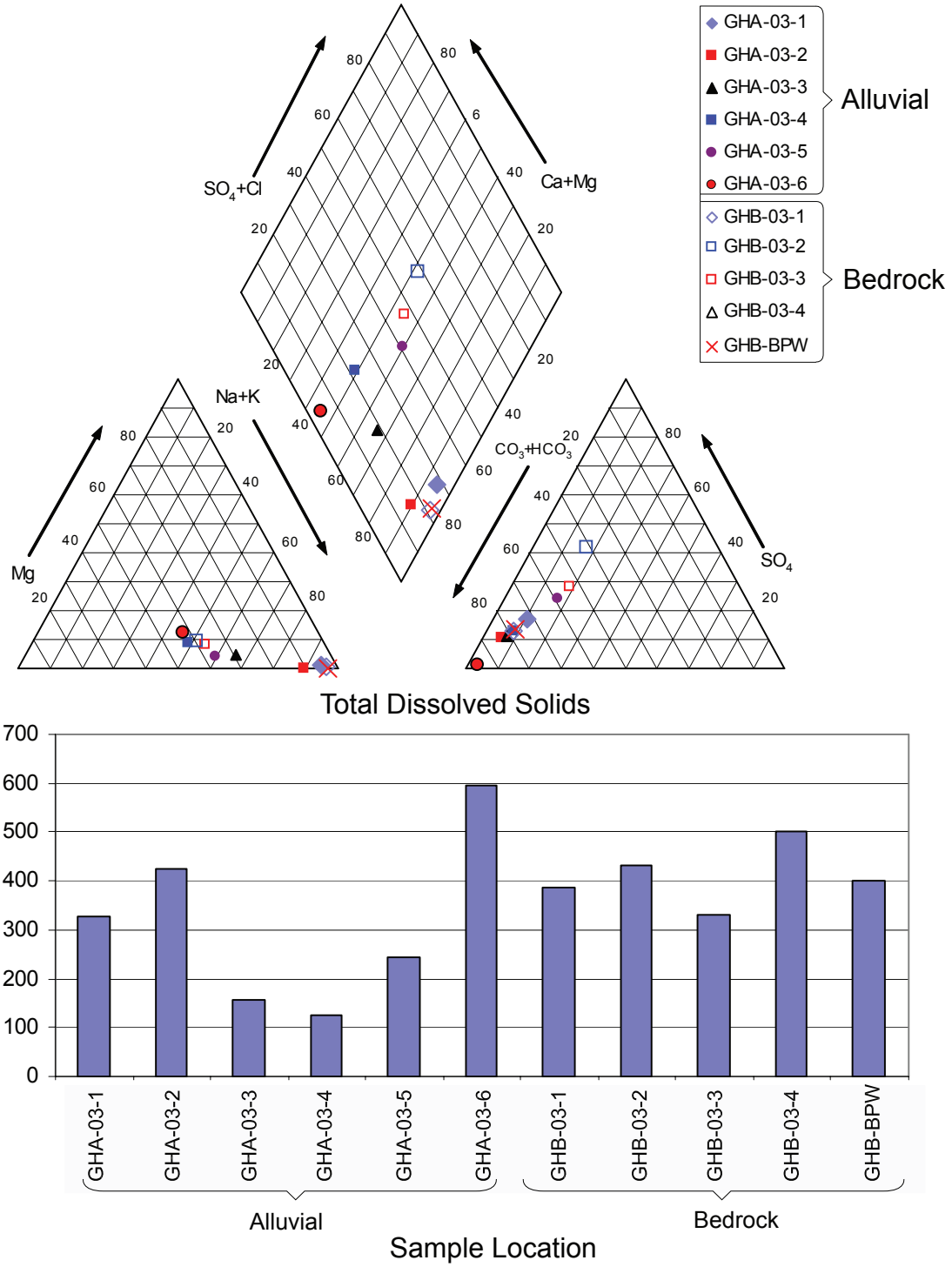
Figure 3.3-25

Gold Hill Hydrogeologic Cross-section (B-B')

04/12/09


Legend
Faults
Inferred Faults
Alluvial Water Level Contour
GHA-03-1 Alluvial Well Locations December 2005 Water Level
GHA-03-1 Bedrock Well Locations December 2000 Water Level
Proposed Pit Configuration
Geologic Units
Previous Mill Tailings
Qal - Alluvium
Surprise Memeber
Qpg - Quaternary Pediment Gravels
Tmj-s - Tuff of Mt. Jefferson,
Tmj-s - Tuff of Mt. Jefferson, Surprise Member, Subcrop (Limited Surface Exposure)
Tmj-gh - Tuff of Mt. Jefferson, Gold Hill Member
N
0 750' 1,500'
Feet
plus 74.18 feet.
Note: Topographic and water elevations provided in feet, USGS 1929 Vertical Datum
Source: WMC 2008.
Round Mountain Expansion Project
Figure 3.3-26
Gold Hill Bedrock and Alluvial Water Level Elevations
Gold Hill Basin Fault
North Gold Hill Basin Fault
Mt. Jefferson Caldera Margin
Toquima Fault
Gold Hill Basin Fault
Dry Canyon Caldera Margin
Proposed Project Boundary
A
A'
B
B'
F1
F2
F3
F4
F5
F6
F7
F9
F10
F11
F13
Qal
Tmj-s
GHA-03-6 5683
GHA-03-5 5685
GHA-03-1 5696
GHA-IW-1 5846
GHA-IW-2 5977
GHA-03-2 5749
GHA-03-4 5689
GHA-03-3 5924
GHB-03-1 6172
GHB-BPW 6170
GHB-03-2 6176
GHB-03-3 6284
GHB-03-4 6271
5700
5800
5900
6000
6100
6200
6300
6400
6500
6600

04/23/09



Round Mountain Expansion Project

Figure 3.3-27

Gold Hill Average Groundwater Chemistry

Source: WMC 2008.

12/04/08

Three wells are screened in the Tertiary volcanic bedrock, mainly the welded tuff unit. Average concentrations for bicarbonate range from 160 to 282 mg/L with pH values between 6.9 and 8.4 standard units. Average TDS values range from 324 to 476 mg/L with sulfate ranging from 69 to 160 mg/L. The average concentration of arsenic is approximately 0.208 mg/L, well above the Nevada MCL of 0.05 mg/L.

The average concentration of antimony is approximately 0.055 mg/L, above the Nevada MCL of 0.006 mg/L. The average concentration of manganese ranges from 0.14 to 0.20 mg/L, exceeding the Nevada MCL of 0.05 mg/L. Similarly, iron ranges from below the Nevada MCL of 0.3 to 0.437 mg/L. Mercury ranges from 0.0002 to 0.00035 mg/L, and molybdenum values range up to 1.3 mg/L.

Two wells are screened in the Tertiary volcanic sinter unit. Sulfate and chloride concentrations in these wells are approximately 40 and 19 mg/L, respectively. Fluoride concentrations range from 7.4 to 8.3 mg/L, well above the Nevada MCL of 4.0 mg/L. Average bicarbonate concentrations are approximately 280 mg/L. Antimony and arsenic are above their Nevada MCL values, with average antimony values at 0.011 mg/L and average arsenic values at 0.07 mg/L. Average values for manganese and molybdenum are 0.02 and 0.015 mg/L in this unit, respectively.

Table A-4 in **Appendix A** and **Figure 3.3-27** summarize the groundwater quality data for the Quaternary alluvium in the Gold Hill Area. The alluvial groundwater can be characterized as sodium-calcium-bicarbonate water with a slightly alkaline pH (WMC 2008). Average TDS values range from 117 to 428 mg/L in the wells screened in this unit, while average sulfate values range from 4 to 44 mg/L. Average chloride ranges from 5 to 22 mg/L and average bicarbonate ranges from 79 to 449 mg/L. Average values for arsenic are above the Nevada MCL of 0.05 mg/L and range from 0.019 to 0.23 mg/L. Average values for antimony range from 0.006 to 0.009 mg/L and slightly exceed the Nevada MCL of 0.006 mg/L. Fluoride ranges from less than 1.0 to 9.5 mg/L.

Infiltration from streams and past mining activity can affect groundwater quality in the Gold Hill Area (WMC 2008). Alluvial groundwater quality south of the proposed Gold Hill Pit in the area of Indian and Jefferson creeks has lower TDS values than alluvial groundwater in the area of the proposed pit and also lower metal values. Alluvial groundwater in the western portion of the proposed Gold Hill Pit area has elevated pH values (approximately 8.0 standard units) and higher average TDS and sulfate values. Metal values also are elevated above the averages for the alluvial groundwater in the proposed pit area due to past mining and historic tailings (WMC 2008).

Two monitoring wells located approximately 4,500 feet west of the proposed pit and into the valley have TDS values of 245 and 428 mg/L, sulfate values of 44 and 4.8 mg/L, and bicarbonate values of 136 and 449 mg/L. Fluoride values for these wells range from 0.6 and 1.8 mg/L. In well GHA-03-05, arsenic averages 0.032 mg/L and antimony is below detection. In well GHA 03-06, iron averages 12.48 mg/L, manganese averages 3.84 mg/L, and aluminum averages 0.935 mg/L (WMC 2008). These wells are examples of the variations in alluvial groundwater chemistry in the Gold Hill Area, which may be due to past mining and hot spring activities, and infiltration of stream flow.

3.3.3.3 Water Rights

Water rights currently on record for the southern part of Northern Big Smoky Valley that may be potentially affected by groundwater withdrawal at the Round Mountain Mine and the proposed Gold Hill Mine are available from the BLM, Tonopah Field Office. Water rights that occur within the projected maximum 10-foot groundwater drawdown isopleth in the alluvial aquifer due to combined dewatering at Round Mountain and

Gold Hill are discussed in Section 4.3, Water Quality and Quantity (Surface and Ground) and Water Use. Many of the water rights in the southern part of Northern Big Smoky Valley belong to RMGC.

Public Water Reserves No. 107 ("PWR 107"), an executive order issued by President Calvin Coolidge in 1926, reserved certain water rights on public lands so as to provide water for animal and human consumption while simultaneously preventing the monopolization and control of large tracts of land. PWR 107 withdrew waters from "Every smallest legal subdivision of the public-land surveys which [was] vacant unappropriated unreserved public land and contain[ed] a spring or water hole, and all land within one quarter of a mile of every spring or water hole located on unsurveyed public land." In addition, PWR 107 applies only to those water resources that are considered "important" and have sufficient flow for consumption. No Public Water Reserves No. 107 ("PWR 107") water reserves occur within the maximum extent of the 10-foot groundwater drawdown isopleth. Additionally, within the same area, no springs or water holes that could potentially meet PWR criteria occur.

3.3.4 Geochemistry of the Round Mountain and Gold Hill Areas

The proposed project would include the development or expansion of mine pits, waste rock dumps, leach pads and tailings, as discussed in detail in Section 2.4, Proposed Action. Geochemical characterization of waste rock, ore, and tailings material is required by the BLM and the NDEP to estimate the potential impact on surface and groundwater resources from possible seepage through the tailings, leach pads, waste rock, and from post-mining pit lakes. Standard methods for characterization of waste rock, ore, and tailings include the static acid-base accounting procedure (static ABA), whole rock geochemical analysis with comparison to average crustal rocks, MWMP tests to determine which constituents may leach from waste rock and tailings as a result of rain water or snow melt infiltration, and kinetic humidity cell tests (HCT) that estimate the long-term potential for waste rock and tailings to generate acidic effluent that may be elevated in constituents considered potentially harmful to the environment. The HCT and MWMP tests are utilized when modeling the post-mining pit lake water quality.

3.3.4.1 BLM Criteria for Geochemical Evaluation of Waste Rock and Tailings

The recommended protocols for evaluating the acid-generating potential and metal leaching potential of waste rock, ore, and tailings are outlined in BLM (2008). Two methods are required by the BLM depending on the potential for acid generation of the rock sample. The static ABA method is required for all waste rock, ore, and tailings by both the BLM and the NDEP and consists of estimating the acidification potential (AP) and the acid neutralization capacity of a rock sample. The AP of a rock sample is based on the amount of sulfur present in the rock, especially sulfide sulfur. The acid neutralization capacity is based on the amount of reactive carbonate material in the rock sample. The difference between acid neutralizing capacity and the AP is the net neutralizing potential (NNP). Kinetic testing using the HCT method is required only if the static ABA evaluation determines that the rock sample would be PAG. Mineralogical examination of waste rock, ore, and tailings is usually conducted in conjunction with these tests to determine what minerals in the rocks can react to produce acidic effluent, or neutralize the effluent, and their potential for reaction in a rock sample versus a crushed sample. The NDEP requires estimation of potential leachate chemistry using the MWMP test and this is often conducted along with the required BLM static ABA and kinetic HCT tests.

<u>Static ABA Method</u>

The static ABA method estimates the AP of a rock sample based on the stoichiometry of pyrite oxidation. The sulfur content of the sample is often measured using a LECO induction furnace following the method of

Sobek et al. (1978). The speciation of the sulfur in the sample is determined using USEPA Method 600 in which sulfate and sulfide sulfur are differentiated based on their respective solubilities in hydrochloric or nitric acid. The AP of the sample is then calculated by converting the sulfide sulfur to equivalent tons of calcium carbonate ($CaCO_3$) per kiloton (t/Kt) of sample. The AP can also be based on total sulfur, in which case the total sulfur of the sample is assumed to be sulfide sulfur and the calculation of AP is based on total sulfur. The neutralization potential (NP) of the rock sample is based on the capacity of minerals in the sample, mainly carbonate minerals, to buffer acidity using the Modified Sobek method (Sobek et al. 1978) approved by the USEPA. The NP also is expressed as tons of t/Kt $CaCO_3$ of sample.

The next step is to determine if the NP is greater or less than the AP. This is done by calculating the NNP of the sample using the equation: NNP = NP-AP. The ratio of the NP to AP, expressed as NP:AP, also is calculated. The BLM (2008) protocol defines a NAG sample as one where the NNP is greater than 20 t/Kt $CaCO_3$, or the NP:AP ratio is greater than 3:1. Any waste rock, ore, or tailings sample that does not meet at least one of these two criteria is assumed to fall in the uncertain category and is required to be further evaluated using the kinetic HCT method. Rocks that are classified as NAG require no further evaluation for acid generating-potential. Rocks with an NNP less than 20 t/Kt or an NP:AP less than 3:1 are classified as uncertain and must be tested further with the kinetic HCT method. The kinetic HCT method would determine if the material being tested is PAG, or NAG, and would also estimate the potential concentration of metals in an effluent that may be generated by the material when the material is exposed to water and oxygen in a natural setting, such as a waste rock dump or tailings facility.

MWMP Method

The MWMP test follows the American Society for Testing and Materials (ASTM) E2242-02 protocol and utilizes a 24-hour single pass column leach of crushed material with a 1:1 water:rock ratio. The water used in the leaching test is distilled, deionized water and represents the infiltration of rain water or snow melt through a column of rock. The rock samples are crushed in order to expose more surface area of the material to the water passing through the column and the rock material. The MWMP test approximates the leachate that may result from the first flush of natural water through a waste rock or tailings pile at a mine site by balancing the short time of the test (24 hours) with crushing of the rock sample to expose more surface area of the material to reaction with the water. The results of a MWMP test are used as a guide to estimate the potential leachate that may emanate from either waste rock or tailings material due to infiltration of rain water or snow melt.

Kinetic HCT Method

The kinetic HCT method evaluates waste rock, ore, and tailings material for the potential to generate an acidic effluent elevated in metals by attempting to simulate the long-term oxidation and flushing of the material under natural situations of wetting and drying. The HCT method follows the ASTM D5744-96 (1996) protocol where about 1.0 to 1.5 kilograms (kg) of crushed material is placed in a column and undergoes weekly flushing with distilled water at a 1:1 water to rock ratio. The resulting leachate is analyzed each week and the test is run for a minimum of 20 weeks and longer, if needed, until the composition of the leachate has stabilized. The acidity and composition of the early leachates are a guide to the potential first flush from a waste rock or tailings pile, while the longer term leachates represent a situation where the material is subjected to prolonged wetting and drying at the mine site over many years. The kinetic HCT method is considered the “defining” protocol for evaluating the potential of waste rock, ore, and tailings to generate acidic effluent.

Whole Rock Chemistry

The whole rock chemical evaluation of waste rock, ore, and tailings is based on the aqua regia digestion of crushed rock material following the USEPA Method 3050 (USEPA 1996) and analysis of the resulting solution following USEPA Method 6010B (USEPA 1996). The purpose of this evaluation is to determine which constituents are elevated relative to an average crustal rock. Constituents that are elevated are ones of potential concern in leachates from waste rock and tailings.

3.3.4.2 Geochemistry of the Round Mountain Mine Area

Geochemical evaluation of the Round Mountain Pit expansion areas consisted of two phases (WMC 2008). The first phase included a compilation of existing geochemical data associated with the currently permitted Round Mountain Mine. The second phase included the collection and analysis of additional samples of ore, waste rock, and tailings material to supplement the first phase data and to include the rock types involved in the proposed expansion of the Round Mountain Pit.

Phase I Geochemical Testing Results (Historical Data)

The Round Mountain Mine has operated since 1976. During the 30 years the mine has been operating, no acidic pit wall runoff or acidic mine drainage has been observed from waste rock, tailings, or leach pads due to the low sulfur content and ubiquitous carbonate mineralization present in the Round Mountain deposit (WMC 2008). Whole rock chemistry from samples analyzed over the past 30 years has shown that rocks in the Round Mountain Mine deposit are elevated in antimony, arsenic, and molybdenum with respect to average crustal rock. Background water quality in the mine area reflects this mineralization (WMC 2008).

Historical geochemical data on the Round Mountain Mine comes from many sources and consists of about 352 analyzed samples, of which 248 have a complete data set and identified lithotype or location (WMC 2008). The analytical data from these 248 samples along with 129 MWMP analyses and 10 HCT evaluations comprise the data set for the historical geochemistry of the Round Mountain Mine (WMC 2008). The rock types at the Round Mountain Mine have been divided into lithotypes as shown in **Table 3.3-7**.

The Phase I static ABA results for waste rock are summarized in **Table 3.3-8**. Samples with a NNP or a NP:AP ratio that places them in the uncertain category are grouped with the PAG samples in this table for the purpose of evaluating static ABA results. The bulk of the historic waste rock samples come from lithotypes 1 through 3 (volcanic tuffs), lithotype 4 (Paleozoic carbonate rocks), and lithotypes 8 (granite), 9 (volcanic tuff), and 33 (Stebbins Hill tuff and sediments). Alluvium comprises only 3 percent of the waste rock samples. Using the NNP criteria, 81 percent of the waste rock samples would be classified as PAG. Using the NP:AP ratio criteria, only 41 percent would be classified as PAG and 59 percent would be classified as NAG. The main lithotypes with PAG rocks were lithotype 3 (volcanic tuff) with 13 percent PAG samples out of 23 samples tested, lithotype 9 (rhyolite tuff) with 57 percent PAG rocks out of 21 samples tested, and lithotype 33 (Stebbins Hill Unit) with 88 percent PAG rocks out of 8 samples tested (WMC 2008). Based on the test results for all 103 historic waste rock samples, 59 percent were classified as NAG and 41 percent were classified as PAG (19 percent PAG; 22 percent Uncertain) where the PAG classification includes rocks that fall in the uncertain category.

Table 3.3-7
Round Mountain Lithotypes

Lithotype	Description
1	Densely welded rhyolite tuff
2	Non-welded, pumice-rich rhyolite tuff
3	Moderately welded lithic tuff
4	Paleozoic sedimentary rocks (Gold Hill and Zanzibar Limestone)
7	Dumps and lean ore stockpiles
8	Cretaceous granite (Shoshone Granite)
9	Transitional unit, moderately welded rhyolite tuff
28	Lithic tuff composed of abundant granitic clasts with a Type 2 matrix
33	Stebbins Hill Unit, undifferentiated, includes lake sediments and tuff
51	Alluvium, granitic clasts predominant
52	Placer alluvium, Type 1 clasts predominant, gold-bearing alluvium

Source: WMC 2008.

Table 3.3-8
Phase I Historic Static ABA Results

Lithotype	Total Samples	NP:AP Interpretation				NNP Interpretation			
		NAG		PAG		NAG		PAG	
		Samples	% NAG	Samples	% PAG	Samples	% NAG	Samples	% PAG
1	13	13	100	0	0	1	8	12	92
2	11	7	64	4	36	2	18	9	82
3	23	10	43	13	57	12	52	11	48
4	18	14	78	4	22	5	28	13	72
7	0	0	0	0	0	0	0	0	0
8	6	4	67	2	33	0	0	6	100
9	21	9	43	12	57	0	0	21	100
28	0	0	0	0	0	0	0	0	0
33	8	1	13	7	88	0	0	8	100
51	1	1	100	0	0	0	0	1	100
52	2	2	100	0	0	0	0	2	100

Source: WMC (2008). Table compiled from Tables 6.3 through 6.5 of WMC (2008).

When all 248 samples that include waste rock and ore are combined, 79 percent of the samples are PAG by the NNP (PAG 10 percent, Uncertain 69 percent) criteria, and 46 percent of the samples are PAG (PAG 25 percent, Uncertain 21 percent) by the NP:AP criteria. However, HCT tests completed for 10 of the samples that span the major lithotypes mined showed that none of the PAG samples were acid-generating (WMC 2008). The HCT tests also showed that 4 percent of the historic waste rock samples had the potential to release aluminum, arsenic, iron, manganese, sulfate, antimony, beryllium, and thallium at concentrations above Nevada drinking water guidelines (WMC 2008). Thus, the historic static ABA and HCT data for the Round Mountain Mine show that although some lithotypes contain PAG rocks using the static ABA classification method, these rocks are NAG when subjected to the more reliable and definitive kinetic HCT method of evaluation. These results are consistent with the absence of observed acid rock drainage from waste rock or tailings at the Round Mountain Mine over the past 30 years.

Phase II Geochemical Testing Results (Round Mountain Expansion Data)

The proposed expansion of the current Round Mountain Pit would involve the mining of an additional 261 Mt of rock beyond what is currently permitted. The same lithologic types would be mined under the proposed expansion of the Round Mountain Pit as are currently being mined. However, the percentage of different lithotypes would change in the waste rock, as shown in **Table 3.3-9**. Lithotype 1 would decrease, and lithotypes 2 and 3 would increase in the proposed expansion waste rock. These are all volcanic tuffs. Lithotype 4 (i.e., Paleozoic carbonates) would remain about the same, while lithotypes 7 through 9 would increase and lithotype 51 (alluvium) would decrease. This shift in the proportion of lithotypes to be mined under the proposed expansion of the Round Mountain Pit would result in an increase in the percentage of PAG rocks to be mined from 15 percent under the currently permitted operations to about 18 percent under the proposed expansion (WMC 2008). **Table 3.3-10** summarizes the tonnages and lithotypes of waste rock and ore expected to be mined under the proposed expansion of the Round Mountain Pit.

Samples were collected from the lithotypes to be mined under the proposed expansion of the Round Mountain Pit for geochemical analysis and evaluation for potential acid mine drainage. A total of 219 samples were collected from pit wall lithotypes (106 samples), drill core (96 samples) and the southwest part of the existing Round Mountain Tailings impoundment (17 samples) for geochemical characterization (WMC 2008). Thirteen samples (11 pit wall and 2 composite) were prepared and submitted for HCT analysis. Splits from the HCT samples were used for MWMP testing and mineralogical examination. The 17 samples collected from the southwest quadrant of the existing tailings impoundment at Round Mountain were collected from 5 locations along a transect extending from the beach toward the center of the facility using 1-foot long core tubes.

Static ABA Results

The static ABA test results for the Phase II Round Mountain expansion lithotypes expected to be in waste rock are summarized in **Table 3.3-9**. A total of 141 samples were analyzed for characterization of waste rock. Lithotypes 1 through 3 (volcanic tuffs) and lithotype 4 (Paleozoic carbonates) are expected to comprise about 72 percent of the waste rock generated by the proposed Round Mountain Pit expansion. Using the NP:AP ratio method for evaluating static ABA results, lithotype 1 would be NAG, lithotype 2 would be about 59 percent NAG, lithotype 3 would be 63 percent PAG, and lithotype 4 would be 55 percent NAG. Except for lithotype 1, the NP:AP ratio method of evaluation suggests that the 4 main lithotypes to be found in the waste rock under the proposed expansion would be approximately 50 percent NAG and approximately 50 percent PAG. Using the NNP method of evaluation, these same 4 lithotypes would be approximately

Table 3.3-9
Phase II Static ABA Results

Lithotype	Total Samples	Percent of Total Waste Rock Proposed Expansion	Percent of Total Current Mine Plan	NP:AP Interpretation				NNP Interpretation			
				NAG		PAG		NAG		PAG	
				Samples	% NAG	Samples	% PAG	Samples	% NAG	Samples	%PAG
1	23	16	24.6	23	100	0	0	2	9	21	91
2	27	23	22.1	16	59	11	41	11	41	16	59
3	32	22	7.2	12	38	20	63	13	41	19	59
4	22	11	12.7	12	55	10	45	9	41	13	59
7	4	5	0.8	2	50	2	50	0	0	4	100
8	4	7	3.5	1	25	3	75	0	0	4	100
9	12	9	6.2	11	92	1	8	4	33	8	67
28	2	0	0.0	0	0	2	100	0	0	2	100
33	4	<1	1.5	3	75	1	25	0	0	4	100
51	7	6	20.8	7	100	0	0	1	14	6	86
52	4	<1	0.7	3	75	1	25	1	25	3	75

Source: WMC 2008.

Table 3.3-10
Round Mountain Expansion Plan Tonnages and Phase II Sampling Summary

Waste Rock						
		Rock Mass				
Lithotype	Description	Oxide[1] S<0.25% (Mt)	Sulfide[1] S>0.25% (Mt)	Total (Mt)	Number of Samples	Samples per 5 Mt of Material
1	Densely welded rhyolite tuff	27.000	1.0	28.000	23.0	4
2	Non-welded, pumice-rich, rhyolite tuff	24.000	16.0	40.000	27.0	3
3	Moderately welded, lithic tuff	2.000	37.0	39.000	32.0	4
4	Paleozoic sedimentary rocks (Gold Hill and Zanzibar Limestone)	0.000	19.0	19.000	22.0	6
7	Dumps and lean ore stockpiles	9.000	0.0	9.000	4.0	2
8	Cretaceous granite (Shoshone Granite)	4.000	9.0	12.000	4.0	2
9	Transitional unit, moderately welded tuff	11.000	4.0	15.000	12.0	4
28	Lithic tuff, abundant granitic clasts with Type 2 matrix	0.000	0.0	0.000	2.0	NA
33	Stebbins Hill Unit, undifferentiated, lake sediments and tuff	0.500	0.0	0.500	4.0	41
51	Alluvium, granitic clasts predominate	11.000	0.0	11.000	7.0	3
52	Placer alluvium, Type 1 clasts predominate, gold-bearing alluvium	0.238	0.0	0.238	4.0	84
Total		**89.400**	**84.2**	**173.600**	**141.0**	**4**
Ore						
1	Densely welded rhyolite tuff	10.000	1.0	11.000	6.0	3
2	Non-welded, pumice-rich, rhyolite tuff	13.000	5.0	18.000	19.0	5
3	Moderately welded, lithic tuff	4.000	14.0	18.000	8.0	2
4	Paleozoic sedimentary rocks (Gold Hill and Zanzibar Limestone)	34.000	0.0	34.000	21.0	3
7	Dumps and lean ore stockpiles	0.000	0.0	0.000	2.0	>5
8	Cretaceous granite (Shoshone Granite)	0.000	0.0	0.000	0.0	NA
9	Transitional unit, moderately-welded rhyolite tuff	7.000	0.0	7.000	3.0	2
28	Lithic tuff, abundant granitic clasts with Type 2 matrix	0.000	0.0	0.000	0.0	NA
33	Stebbins Hill Unit, undifferentiated, lake sediments and tuff	0.100	0.0	0.100	1.0	36
51	Alluvium, granitic clasts predominate	0.000	0.0	0.000	1.0	36
52	Placer alluvium, Type 1 clasts predominate, gold-bearing alluvium	0.288	0.0	0.288	0.0	0
Total		**67.500**	**20.1**	**87.600**	**61.0**	**3**

[1] For sampling purposes, sulfide was defined operationally as >0.25 percent total sulfur. Oxide is non-sulfide. This cut-off is based on operational practices at the time of sampling and should be distinguished from the revised material classifications proposed for future waste rock management that are based on all available data, including those generated by this study.

NA = Not Applicable.

Source: WMC 2008.

60 percent PAG and 40 percent NAG. Thus, the bulk of the expected waste rock under the proposed Round Mountain expansion would be approximately 50 percent PAG and approximately 50 percent NAG.

When compared to the historic static ABA results for Round Mountain Pit waste rock (**Table 3.3-8**), lithotypes 1 through 4 in the historic data show a greater percentage of NAG rocks under the NP:AP interpretation and a higher percentage of PAG rocks under the NNP interpretation. Overall, the main lithotypes expected in waste rock from the proposed Round Mountain expansion appear to have similar static ABA test results to those found in the historic data and thus found in the existing waste rock facilities at the Round Mountain Mine.

Kinetic HCT Results

Thirteen samples of potential waste rock and ore, including three tailings samples, were submitted for kinetic HCT analysis as part of the proposed Round Mountain expansion. The results for pH, sulfate, and alkalinity are summarized in **Table 3.3-11**. Most samples had a pH value of greater than 6.0 standard units. One ore sample had a pH of 5.61 standard units (HCT-1) and 1 tailings sample had a pH of 4.19 standard units (HCT-15). The ore sample had a final pH less than 6.0 standard units, but all tailings and all but 1 waste rock sample had a final pH of greater than 7.0 standard units, suggesting that expected waste rock from the proposed Round Mountain expansion does not have the potential for acid rock drainage (ARD) generation.

The main lithotypes expected in the waste rock from the proposed Round Mountain expansion were represented in the kinetic HCT analyses. Data presented in WMC (2008) show thatthe carbonate rocks (lithotype 4) had maximum TDS values below 100 mg/L with sulfate below 50 mg/L. Maximum arsenic values ranged up to 0.0835 mg/L and 2 samples exceeded Nevada drinking water standards for arsenic, but not stock or irrigation water standards for the maximum arsenic value observed during the course of the HCT runs. Maximum fluoride ranged from 0.5 to 1.13 mg/L and exceeded irrigation water standards in 1 sample. Other constituents were within Nevada drinking water, stock, and irrigation water standards. All constituents were within Nevada wildlife propagation standards (**Table 3.3-12**).

The volcanic tuffs had TDS values ranging up to 210 mg/L with maximum arsenic up 0.165 mg/L and maximum fluoride up to 2.12 mg/L. Exceedence of Nevada drinking water and irrigation water standards for maximum arsenic values occurred in two samples, exceedence of Nevada irrigation water standards for maximum fluoride occurred in three samples, and exceedence of Nevada stock water standards for fluoride occurred in two samples. Other constituents were within Nevada water standards for drinking water, stock and irrigation water, and wildlife propagation.

The one sample of alluvium had low TDS and sulfate values, but showed exceedence of Nevada drinking water standards for the maximum arsenic and mercury values, and exceedence of Nevada irrigation water standards for the maximum fluoride value. The 3 tailings samples had TDS values that ranged from 389 to 554 mg/L and showed exceedence of Nevada drinking water standards for the maximum arsenic and antimony values, exceedence of Nevada irrigation and stock water standards for boron, and exceedence of Nevada irrigation water standards for fluoride. Other constituents were within Nevada drinking water, stock and irrigation water, and wildlife propagation standards.

Table 3.3-11
Round Mountain Expansion HCT Sample Summary and Test Status

Sample ID	HCT No.	Lithotype	Waste/ Ore	ABA[1,2]	Test Status	Percent of Total Waste Rock Represented by Sample[3]	pH[5]			Sulfate (mg/L)			Alkalinity (mg/L)		
							Min	Max	Final[4]	Min	Max	Final	Min	Max	Final
110167 + 110103	1	3	Ore	PAG	Complete (wk 56)	–	5.61	7.51	5.64	28.4	352.0	52.6	8.0	36.0	14.0
110148 + 110178	2	4	Ore	PAG	Complete (wk 56)	–	6.45	8.26	7.32	0.6	11.3	1.2	6.0	22.0	10.0
111302	3	51	Waste	NAG	Complete (wk 56)	6.3	6.70	8.61	7.08	0.0	11.8	0.2	4.0	22.0	12.0
111304	4	4	Waste	PAG	Complete (wk 56)	11.0	6.64	8.77	7.15	1.8	82.3	5.8	8.0	28.0	12.0
111308	5	2	Waste	NAG	Complete (wk 56)	7.7	6.05	8.43	7.29	0.0	8.1	0.2	6.0	18.0	10.0
120110	6	9	Waste	NAG	Complete (wk 56)	8.7	6.82	8.75	7.28	0.0	181.4	0.3	6.0	24.0	6.0
120127	7	1	Waste	NAG	Complete (wk 56)	8.0	7.03	8.88	7.21	0.0	14.9	0.2	8.0	28.0	12.0
120136	8	1	Waste	NAG	Complete (wk 56)	8.0	6.77	8.66	7.48	0.0	8.7	0.3	6.0	18.0	12.0
120153	9	2	Waste	PAG	Complete (wk 56)	7.7	7.16	8.56	7.16	0.3	38.5	0.7	14.0	38.0	18.0
120168	10	2	Waste	NAG	Complete (wk 56)	7.7	6.36	8.75	7.51	0.0	10.5	0.0	4.0	12.0	10.0
120171	11	4	Ore	PAG	Complete (wk 56)	–	6.07	8.07	7.01	2.8	20.1	2.38	4.0	18.0	6.0
120187	12	3	Waste	PAG	Complete (wk 56)	11.0	6.93	8.99	6.93	2.1	32.0	3.7	6.0	42.0	12.0
120188	13	3	Waste	PAG	Complete (wk 56)	11.0	7.11	8.90	7.29	0.4	21.7	3.2	20.0	50.0	30.0
Group 1 Tail	14	Tailings	–	PAG	Complete (wk 99)	–	5.87	8.72	7.37	2.7	513.0	20.3	6.0	58.0	30.0
Group 2 Tail	15	Tailings	–	PAG/NAG	Complete (wk 99)	–	4.19	8.72	7.48	2.3	185.0	11.7	8.0	48.0	20.0
Group 3 Tail	16	Tailings	–	PAG	Complete (wk 99)	–	6.10	8.68	7.71	1.1	264.5	16.2	4.0	42.0	16.0

[1] Inert category has been combined with NAG to be reported as NAG.
[2] Uncertain category has been combined with PAG to be reported as PAG.
[3] Does not add up to 100 percent. Remainder is represented using MWMP data. Percentage calculations divided equally where more than 1 HCT sample exists for a given lithotype.
[4] This represents the latest 4-week composite value representing long-term, chemically stable conditions.
[5] pH in standard units.
Source: WMC 2008.

Table 3.3-12
Water Quality Criteria and Standards for Nevada

Parameter[1] (mg/L)	Drinking Water Standards		Municipal or Domestic Supply	Aquatic Life[2]		Agriculture		
	Primary	Secondary		1-Hour Average	96-Hour Average	Irrigation	Stock Water	Wildlife Propagation
Antimony	0.006	--	0.146	--	--	--	--	--
Arsenic	0.050	--	0.05	0.34 As(III)	0.18 As(III)	0.1	0.2	--
Barium	2.000	--	2.0	--	--	--	--	--
Beryllium	0.004	--	0	--	--	0.1	--	--
Boron	--	--	--	--	--	0.75	5.0	--
Cadmium[3]	0.005	--	0.005	0.0062[4]	0.0015[4]	0.01	0.05	--
Chromium	0.100	--	0.10	0.015 Cr(VI)	0.01 Cr(VI)	0.1	1.0	--
Copper[3]	1.300	--	--	0.0253[4]	0.0161[4]	0.2	0.5	--
Iron	--	0.3 [0.6][5]	--	1.0	1.0	5.0	--	--
Lead[3]	0.050	--	0.05	0.0022[4]	0.0016[4]	5.0	0.1	--
Magnesium	--		125/150	--	--			
Manganese	--	0.05[0.1]	--	--	--	0.2	--	--
Mercury	0.002	--	0.002	0.002	0.000012	--	0.01	--
Molybdenum	--	--	--	0.019	0.019			
Nickel[3]	0.100	--	0.0134	1.919[4]	0.213[4]	0.2	--	--
Selenium	0.050	--	0.05	0.020	0.005	0.002	0.05	--
Silver	0.050	--	--	0.0089[4]	0.0089[4]	--	--	--
Thallium	0.002	--	0.013	--	--	--	--	--
Zinc[3]	--	5.0	--	0.159[4]	0.144[4]	2.0	25.0	--
Cyanide (WAD)	--	--	0.2	0.022	0.0052	--	--	--
Alkalinity	--	--	--	Less than 25% change		--	--	30-130
Chloride	--	250[400][5]	250[400]	--	--	--	1,500	1,500
Color (PCU)	--	15	75	--	--	--	--	--
Dissolved Oxygen	--	--	Aerobic	5.0	5.0	--	Aerobic	Aerobic
Fluoride	4.000	2.0	--	--	--	1.0	2.0	--
Nitrate as N	10.000	--	10	90(w)[6]	90(w)	--	100	100
pH (standard units)	--	6.5-8.5	5.0-9.0	6.5-9.0	6.5-9.0	4.5-9.0	5.0-9.0	7.0-9.2
Sulfate	--	250[500]	250[500]	--	--	--	--	--
Temperature °C	--	--	--	Site-specific determination		--	--	--
TDS	--	500[1,000]	500[1,000]	--	--	--	3,000-7,000	--
TSS	--	--	--	25-80	25-80	--	--	--
Turbidity (NTU)	--	--	--	50(w);10(c)	50(w); 10(c)	--	--	--

[1] PCU = photoelectric color units; NTU = nephelometric turbidity units; TSS = total suspended solids; °C = degrees Celsius.
[2] Aquatic life standards are presented in mg/L rather than g/L.
[3] Dissolved fraction only.
[4] Parameter dependent on hardness; a hardness value of 175 mg/L was used to calculate the criteria for hardness-dependent metals.
[5] Numbers in brackets [ ] are mandatory secondary standards for public water systems.
[6] (w) refers to warm water and (c) is for cold water. No letter designation indicates criteria are common to both warm and cold water.
Source: NAC 445.119; NAC 445A.144 2008.

Overall, the kinetic HCT test results on waste rock and tailings expected to be generated by the proposed Round Mountain expansion suggest that exceedences of Nevada water standards for arsenic, antimony, boron, and fluoride are possible. However, the maximum values for these constituents were used as the basis for evaluating possible exceedences, and these maximum values occur only during one of the 50 plus weeks of testing. Therefore, it is likely that any effluent that may originate in the waste rock or tailings would not exceed Nevada water standards for stock water or irrigation water, and would not present a threat to the environment should such an effluent reach the surface as a result of an exceptionally heavy and prolonged period of precipitation.

MWMP Results

Thirty-three samples of waste rock and ore were submitted for MWMP analyses as part of the Round Mountain expansion. Tailings were not tested with the MWMP method (WMC 2008). The MWMP test uses a 1:1 water to rock ratio to leach crushed rock material to determine the potential effluent that may result from a flushing of a waste rock dump due to the infiltration of precipitation. This test provides a rough estimate of the “first flush” of constituents from readily leachable phases in the rock material. The MWMP results are used as a guide to determine the potential water quality of effluent that may be produced by a waste rock dump as a result of heavy rainfall or snow melt.

Table 3.3-13 summarizes the MWMP results for expected waste rock lithologies. The TDS for all lithologies tested was below 1,000 mg/L and sulfate was generally greater than alkalinity, making the potential effluent waters sulfate dominated. For the alluvium, arsenic at 0.37 mg/L would exceed Nevada drinking water, stock water, and irrigation water standards. Selenium at 0.02 mg/L would exceed Nevada irrigation water standards and fluoride at 3.5 mg/L would exceed Nevada irrigation and stock water standards (**Table 3.3-12**). Nevada wildlife propagation standards would not be exceeded for any constituent.

The granite effluent had a pH of 4.9 standard units which is lower than the Nevada water quality standards. Antimony exceeded drinking water standards and arsenic at 5.59 mg/L exceeded Nevada drinking water, stock, and irrigation water standards. Iron and manganese exceeded drinking water standards and manganese exceeded irrigation water standards. Selenium exceeded irrigation water standards and sulfate exceeded drinking water standards for the granite. The volcanic tuffs showed exceedences of Nevada drinking water standards for antimony, arsenic, selenium, and sulfate. Arsenic and selenium also exceeded Nevada stock water and irrigation water standards for some volcanic tuff samples. Fluoride exceeded irrigation and stock water standards for some of the volcanic tuff samples. The Paleozoic sedimentary rocks (lithotype 4) exceeded Nevada drinking water standards for antimony, arsenic, and iron in some samples. Irrigation water standards for selenium and fluoride were exceeded for some carbonate samples.

Overall, an effluent generated by a flush of rainfall or snow melt through a waste rock dump composed of lithologies expected to be mined under the proposed Round Mountain expansion could potentially be elevated in arsenic, antimony, fluoride, selenium, and possibly sulfate and iron and exceed one or all of Nevada drinking water, stock water, and irrigation water standards. This effluent water, should it occur, would be expected to pond on the surface near the waste rock dump and eventually evaporate. Wildlife propagation standards would not be exceeded by the effluent expected as a result of the MWMP tests.

Table 3.3-13
Round Mountain Expansion Phase II - MWMP Results Summary[1]

Analyte	Units	Alluvium (Type 51/52) Pit wall (2 samples)	Cretaceous Granite (Type 8) Core (1 sample)	Welded Rhyolite Tuff (Type 1) Pit wall (4 samples)	Mod. Welded Lithic Tuff (Type 9) Pit wall (2 samples)	Non-welded Rhyolite Tuff (Type 2) Pit wall (8 samples)	Welded Lithic Tuff (Type 3) Core (1 sample)	Welded Lithic Tuff (Type 3) Pit wall (8 samples)	Paleozoic Sediments (Type 4) Core (1 sample)	Paleozoic Sediments (Type 4) Pit wall (5 samples)	Dumps and Lean Ore Stockpiles (Type 7) (1 sample)
Aluminum	(mg/L)	1.270	1.450	0.260	0.320	0.110	0.020	0.050	1.810	0.100	0.600
Antimony	(mg/L)	0.010	0.020	0.020	0.004	0.020	0.020	0.020	0.020	0.030	0.020
Arsenic	(mg/L)	0.370	5.590	0.260	0.110	0.290	0.013	0.020	0.080	0.130	0.460
Barium	(mg/L)	0.086	0.019	0.010	0.030	0.018	0.069	0.033	0.080	0.011	0.040
Beryllium	(mg/L)	0.001	0.023	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	(mg/L)	0.560	0.050	0.110	0.190	0.040	0.020	0.040	0.450	0.060	0.280
Calcium	(mg/L)	6.700	113.000	6.600	26.600	38.200	208.000	86.000	6.000	22.800	4.700
Cobalt	(mg/L)	0.008	0.077	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003
Iron	(mg/L)	0.540	1.740	0.080	0.110	0.100	0.030	0.030	0.360	0.160	0.350
Lead	(mg/L)	0.002	0.005	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Lithium	(mg/L)	0.040	0.280	0.03	0.040	0.040	0.150	0.120	0.010	0.060	0.020
Magnesium	(mg/L)	1.000	17.000	1.000	3.000	3.000	12.000	8.000	1.000	4.000	1.000
Manganese	(mg/L)	0.017	1.740	0.008	0.021	0.044	0.182	0.282	0.006	0.033	0.025
Molybdenum	(mg/L)	0.030	0.004	0.040	0.060	0.280	0.190	0.150	0.020	0.050	0.110
Nickel	(mg/L)	0.005	0.018	0.005	0.005	0.005	0.005	0.007	0.005	0.005	0.005
Potassium	(mg/L)	7.000	60.000	4.000	6.000	21.000	29.000	25.000	18.000	38.000	4.000
Selenium	(mg/L)	0.020	0.020	0.020	0.020	0.070	0.020	0.090	0.020	0.030	0.020
Sodium	(mg/L)	84.000	68.000	24.000	45.000	24.000	65.000	53.000	33.000	12.000	76.000
Strontium	(mg/L)	0.070	0.620	0.060	0.220	0.360	3.230	0.910	0.040	0.140	0.040
Titanium	(mg/L)	0.025	0.003	0.004	0.003	0.003	0.003	0.003	0.022	0.007	0.018
Vanadium	(mg/L)	0.055	0.003	0.024	0.003	0.003	0.003	0.005	0.003	0.003	0.015
Zinc	(mg/L)	0.005	0.520	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Alkalinity	(mg/L)	109.000	1.000	55.000	38.000	57.000	127.000	87.000	50.000	51.000	113.000
pH	(s.u.)	8.200	4.900	7.500	7.300	7.600	8.100	7.700	7.700	7.200	8.300
Chloride	(mg/L)	12.300	1.300	2.300	18.100	5.500	1.300	3.500	4.000	0.900	7.600
Fluoride	(mg/L)	3.500	0.500	1.800	2.500	1.100	0.300	2.100	1.300	1.000	2.400
Phosphorus	(mg/L)	0.088	0.025	0.121	0.025	0.029	0.025	0.025	0.025	0.025	0.230
Sulfate, SO_4	(mg/L)	74.000	584.000	10.000	114.000	103.000	609.000	265.000	63.000	68.000	49.000
NO_2+NO_3-N	(mg/L)	2.800	0.100	1.200	2.800	2.600	0.100	4.200	0.100	0.200	2.900

[1] Values shown represent averages of measured values. Non-detects were included at half of the detection limit. The following analytes were not detected in any samples: Bismuth, Cadmium, Chromium, Copper, Gallium, Murcury, Scandium, Thallium, Tin, Silver, Cyanide .

[2] NS = No standard.

s.u. = standard units.

Source: WMC 2008.

Whole Rock Chemistry Results

Whole rock chemistry analyses are completed on lithologies that would be mined to determine what constituents may be noticeably elevated above average crustal values for that lithologic type in order to anticipate potential problems with managing waste rock, tailings, or to provide an estimate of the final pit lake water quality. The whole rock analytical results are not an indication of a potential exceedence, but rather a guide to identification of constituents that should be examined carefully in the kinetic HCT and MWMP tests. The main mineralized lithologies, including the volcanic tuffs (lithotypes 1 through 3) and the Paleozoic carbonates (lithotype 4), show elevated levels of antimony, arsenic, lead, lithium, manganese, mercury, molybdenum, and zinc above average crustal values for their respective rock types. In some but not all samples, barium, beryllium, cadmium, calcium, cobalt, iron, magnesium, and thallium were elevated above average crustal abundances. In addition, lithotypes 7, 8, 9, 33, 51, and 52 (**Table 3.3-7**) showed elevated levels in some samples for antimony, arsenic, and molybdenum (WMC 2008). Most of the lithotypes showed normal, log-normal, or uniform distribution of minor elements. The Round Mountain Mine is situated in an epithermal, volcanic-hosted mineral district and the whole rock chemistry results reflect the nature of that type of mineralization as well as the chemistry of the volcanic tuffs erupted from calderas present in the Round Mountain District prior to mineralization.

Summary

The geochemical tests conducted on the expected waste rock lithotypes and tailings under the proposed Round Mountain expansion suggest that generation of ARD is not likely from either the waste rock or tailings. Should an effluent seep from the waste rock due to infiltration of rain water under an extreme precipitation event, the composition of the effluent may be elevated in arsenic, fluoride, antimony, selenium, and possibly iron, manganese, and sulfate concentrations above one or more Nevada water standards for drinking water, stock water, or irrigation water. The effluent should not exceed the Nevada water standards for wildlife propogation. For the tailings, an effluent may be elevated in arsenic, antimony, boron, or fluoride above Nevada water standards for stock water, irrigation water, or drinking water.

3.3.4.3 Geochemistry of the Gold Hill Area

The proposed Gold Hill Mine and pit would be located about 2.5 miles north of the Round Mountain Mine (**Figure 2.4-1**) in an area that is hydrogeologically and geochemically different from the Round Mountain Area. The main rock types would be: 1) Quaternary alluvium (Qal) consisting of gravels and sands of various origins; 2) Tertiary rhyolite tuffs (Trt) erupted from the calderas in the area; 3) a Tertiary sinter (Tsin) deposit; and 4) the extensive Mount Jefferson Tuff (Tmj) erupted from the Mount Jefferson caldera within which the Gold Hill Area lies (**Figure 3.3-23**). The Quaternary alluvium has a lower permeability than the alluvium found at Round Mountain due to a greater degree of cementation. The volcanic tuffs that dominate the Gold Hill Area and the Gold Hill deposit are mineralized to a greater degree with sulfides than the rocks found at Round Mountain.

Gold Hill is a proposed mining area, and as such, there is no existing pit or historical geochemical data. Sampling for estimation of waste rock geochemical characteristics has relied on drill core and has been conducted by RMGC in two phases (WMC 2008). The first phase consisted of characterization of the various rock types and alteration types observed in the drill core for the Gold Hill deposit. Phase I testing included static ABA tests, kinetic HCT tests, and MWMP tests along with the standard whole rock geochemical analyses. Phase II testing was completed to fill in data gaps indicated by the Phase I testing (WMC 2008). Sampling was conducted in a manner consistent with that used for the Round Mountain Area

and a total of 209 samples were used for geochemical characterization of waste rock, with a minimum of five samples per 5 Mt of material (WMC 2008). The sampling locations are shown in **Figure 3.3-28**.

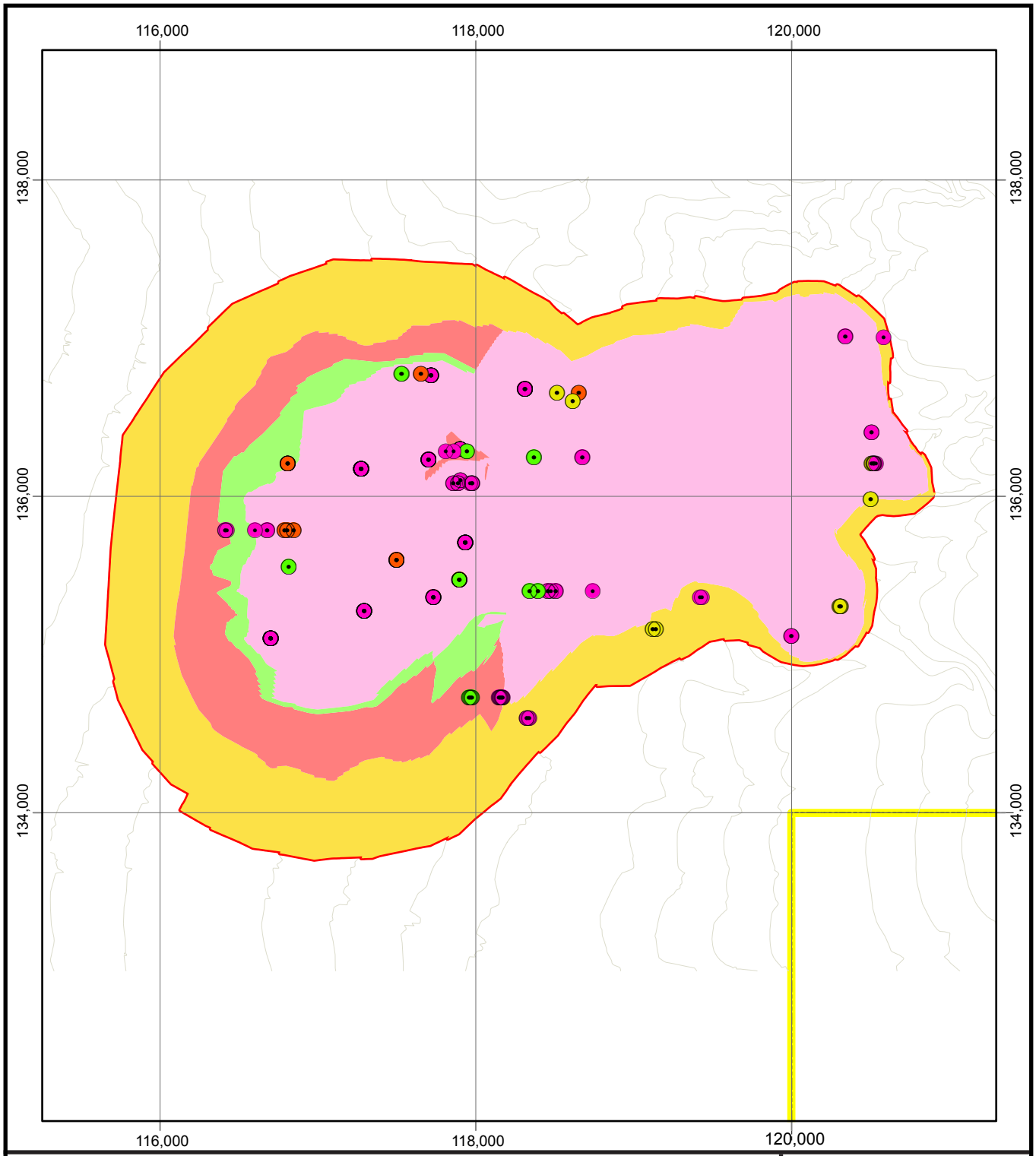
Static ABA Results

Table 3.3-14 presents a summary of the Phase I and Phase II static ABA test results for waste rock that would be generated by the proposed mining of the Gold Hill Area. The Quaternary alluvium would total about 46 Mt and comprise about 39 percent of the waste rock. The Tertiary Mount Jefferson Tuff would total about 65 Mt and comprise about 55 percent of the waste rock generated.

The Quaternary alluvium would be mostly NAG using the NP:AP criteria for acid-generating capability. But using the NNP criteria, the Quaternary alluvium would be predominately PAG as shown in **Table 3.3-14**. This discrepancy is due to the low neutralizing capacity of the alluvium, which results in a low NNP that is generally below 20 t/Kt $CaCO_3$. The neutralizing capacity of the alluvium (NP) does exceed the acid-generating capacity (AP) by a ratio of 3:1 in most cases, thus resulting in the classification of the alluvium as NAG under that criteria. The summary data presented in **Table 3.3-14** are based on a total of 47 samples analyzed in the Phase I and Phase II ABA studies (WMC 2008). These data are presented in detail in the appendices to the Waste Rock Management Plan (SRK 2009a). The NP for the alluvium ranges from non-detect (less than 0.01 t/Kt) to 7.75 t/Kt in the Phase I study (11 samples) and from 4.3 to 39.3 t/Kt in the Phase II study (36 samples). The AP ranges from 0.31 to a maximum of 5.31 t/Kt in both studies combined. The NNP ranges from –0.3 to 9.99 t/Kt in the Phase I study and from 4.0 to 38.9 t/Kt in the Phase II study. The NP:AP ratio ranges from 0 to 33.2 t/Kt in the Phase I study and from 13.9 to 126.8 t/Kt in the Phase II study. Overall, both studies show that 43/47 samples have NNP values less than 20t/Kt and that only 2/47 samples have NP:AP ratios less than 3:1. Because of the generally low AP value of the alluvium, it is unlikely that the alluvium would become acid-generating. This has been confirmed by HCT tests. The low NP value of the alluvium becomes important when the alluvium is considered for use as either a cover or base to a waste rock dump that contains a large percentage of encapsulated PAG waste rock.

The Tertiary Mount Jefferson Tuff, however, is mostly PAG under both the NNP and the NP:AP criteria in **Table 3.3-14**. The Mount Jefferson Tuff would comprise about 55 percent of the waste rock to be generated by the mining of the Gold Hill deposit. The Phase I ABA data on the Mount Jefferson Tuff comprised 29 samples of waste rock and ore with an NP ranging from less than 0.01 to 9.81 t/Kt and the AP ranging from 0.31 to 53.1 t/Kt. The NNP values ranged from –47.9 to 6.59 t/Kt, with most values falling between –10 and +10 t/Kt. The NP:AP ratios ranged from 0.1 to 28.7. Out of the 29 samples, 13 had negative NNP values and 4 had NNP values less than –20 t/Kt. Eighteen of the samples had NP:AP ratios less than 3:1. The Phase II ABA data on the Mount Jefferson Tuff comprised 104 samples of waste rock and ore with NP values from 0.3 to 22.5 t/kt and AP values from 0.3 to 167.69 t/Kt. The NNP values ranged from –162.78 to 10.69 t/Kt and the NP:AP ratios ranged from 0.1 to 35.5. All of the samples had NNP values less than 20 t/Kt, with 72 samples having negative NNP values and 35 samples having NNP values less than –20 t/Kt. Eighty-seven of the 104 samples had NP:AP ratios less than 3:1. These data suggest that the Mount Jefferson Tuff should be mostly acid-generating because 83.6 percent of the Phase II samples had an NP:AP ratio less than 3:1 and all of those samples had an NNP less than 20 t/Kt. This has been confirmed by HCT tests.

The other two lithotypes to be mined and disposed of in waste rock would total less than 6 percent of the waste rock and would be PAG by the NNP criteria and NAG by the NP:AP criteria in **Table 3.3-14**. The Tertiary Rhyolite Tuff in the Phase I ABA study consisted of 14 samples of waste rock and ore with NP values ranging from 0.01 to 17.5 t/Kt and AP values ranging from 0.31 to 10.6 t/Kt. NNP values ranged from



Legend

- Proposed Project Boundary
- Proposed Pit Boundary

Core Sample

- Alluvium
- Rhyolite Tuff
- Sinter
- Mt. Jefferson Tuff

Projected Pit Wall Lithology

- Alluvium
- Rhyolite Tuff
- Sinter
- Mt. Jefferson Tuff

N

0 250 500 1,000 Feet

Source: WMC 2008.

Round Mountain Expansion Project

Figure 3.3-28

Gold Hill Geochemistry Sampling Locations

05/12/09

Table 3.3-14
Gold Hill Waste Rock Static ABA Results

Waste Rock Lithology	Abbreviation	Rock Mass (Mt)	Percent of Waste Rock	Total Samples Analyzed	NP/AP Interpretation				NNP Interpretation			
					NAG		PAG		NAG		PAG	
					No.	% NAG	No.	% PAG	No.	% NAG	No.	% PAG
Alluvium - all types	Qal	46	38.66	47	45	95.74	2	4.26	5	10.64	42	89.36
Tertiary Rhyolite Tuff	Trt	3	2.52	72	65	90.28	7	9.72	6	8.33	66	91.67
Tertiary Sinter	Tsin	5	4.20	19	16	84.21	3	15.79	3	15.79	16	84.21
Tertiary Mount Jefferson Tuff	Tmj	65	54.62	71	18	25.35	53	74.65	1	1.41	70	98.59
Total Waste Rock		**119**		**209**								

Source: Compiled from WMC 2008 (tables 6.9, 6.10, 6.13).

–5.4 t to 17.19 t/Kt. All 14 samples had NNP values below 20 t/Kt and 10 of the 14 samples had NP:AP ratios greater than 3:1. In the Phase II ABA study, 59 samples of waste rock and ore were used (SRK 2009) and the NP values ranged from 0.31 to 41.5 t/Kt with AP values ranging from 0.31 to 64.4 t/Kt. The NNP values ranged from negative 64.08 to 41.19 t/Kt with 57/59 samples having an NNP less than 20 t/Kt. Only 7 of the samples had an NP:AP ratio less than 3:1. These data suggest that the Tertiary Rhyolite Tuff can be either acid-generating or non-acid generating, depending on the nature of the sample. Under the BLM's criteria, the Tertiary Rhyolite Tuff would be classified as mostly NAG because the NP:AP ratio is greater than 3:1 in most samples. The presence of samples in both the Phase I and Phase II sample sets that would fall into the BLM's uncertain category requires that the Rhyolite Tuff be evaluated using the kinetic HCT method.

The Tertiary Sinter comprised 8 samples in the Phase I ABA study and 41 samples of waste rock and ore in the Phase II ABA study (SRK 2009a). In **Table 3.3-14**, the Tertiary Sinter is mostly PAG by the NNP criteria and mostly NAG by the NP:AP criteria. The NNP for the Phase I samples ranged from –28.4 to 26.05 t/Kt with 7/8 samples having an NNP less than 20 t/Kt. Similarly, the NNP for the Phase II samples ranged from –23.39 to 22.09 t/Kt with 40/41 samples having an NNP less than 20 t/Kt. Four of the eight samples in the Phase I study had NP:AP ratios less than 3:1 and 14/41 samples in the Phase II study had NP:AP ratios less than 3:1. These data suggest the Tertiary Sinter has the potential to be acid-generating. Under the BLM's criteria, the Tertiary Sinter would be classified as NAG for most samples because the NP:AP ratio is greater than 3:1 in 66 percent of the Phase II samples and 50 percent in the Phase I samples. Many of the samples in both the Phase I and the Phase II studies fall into the BLM's uncertain category, requiring that the Tertiary Sinter have further evaluation using the HCT method.

Kinetic HCT Results

Ten kinetic HCT tests were conducted to assess the long-term acid-generating potential of the ore and waste to be mined at Gold Hill. These HCT test results are summarized in **Table 3.3-15** for pH, sulfate, and alkalinity. Six of the 10 samples were from the Tertiary Mount Jefferson Tuff as projected waste rock (4 samples) or ore (2 samples). Four of the 6 (66.7 percent) Mount Jefferson Tuff samples were acid generating with final pH values below 4.0 standard units. The 4 waste rock samples showed 3 out of 4 (75 percent) as acid generating with the final pH below 4.0 standard units. Two Tertiary Rhyolite Tuff samples were tested and 1 out of 2 (50 percent) was acid generating. The Tertiary Sinter sample also was acid generating. The 1 sample of Quaternary alluvium tested was not acid generating with a final pH above 7.0 standard units. The maximum alkalinity generated by the alluvium sample was 90 mg/L, which is comparable to the alkalinity generated by Round Mountain waste rock samples (**Table 3.3-9**).

The Tertiary Rhyolite Tuff had iron values as high as 0.15 mg/L, with antimony up to 0.0166 mg/L and arsenic up to 0.47 mg/L. Sulfate was below 50 mg/L and TDS was below 250 mg/L. Alluvium had antimony values up to 0.0206 mg/L and arsenic up to 0.187 mg/L. Sulfate was below 50 mg/L and TDS was below 150 mg/L. The Mount Jefferson Tuff projected waste rock samples were highly variable with antimony up to 0.117 mg/L, arsenic as high as 23.9 mg/L but generally with maximum values below 0.15 mg/L, and pH values ranging from initial values near 7.5 standard units to final values near 3.5 standard units. Sulfate ranged up to 1,250 mg/L, but was generally below 500 mg/L; and TDS ranged up to 1,990 mg/L, but was usually below 500 mg/L. The Mount Jefferson Tuff waste rock exceeded Nevada drinking water, stock water, and irrigation water standards for antimony and arsenic in all samples and exceeded Nevada water standards in one or more categories for sulfate and TDS in some samples.

Table 3.3-15
Gold Hill HCT Results Summary

Sample ID	HCT #	Rock Type	Waste/ Ore	ABA[1,2]	Test Duration (weeks)	% Waste Represented[3]	pH[4]			Sulfate (mg/L)			Alkalinity (mg/L)		
							Min	Max	Final[5]	Min	Max	Final	Min	Max	Final
GHABA-16	HC-1	Tert. Rhyolite Tuff	Waste	PAG	56	1.3	3.45	7.62	3.62	29	158	96.5	ND	38	ND
GHABA-26	HC-2	Tert. Sinter	Ore	PAG	56	–	2.45	6.23	2.89	51.4	329	167	ND	4	ND
GHABA-30	HC-3	Mount Jeff Tuff	Ore	PAG	21	–	2.15	2.61	2.25	1110	3750	1270	ND	ND	ND
GHABA-44	HC-4	Mount Jeff Tuff	Waste	PAG	126	13.7	3.08	7.93	3.31	16.8	327	63.5	ND	58	ND
GHABA-49	HC-5	Mount Jeff Tuff	Waste	PAG	21	13.7	2.55	4.73	2.65	470	2195	775	ND	6	ND
GHABA-50	HC-6	Mount Jeff Tuff	Waste	PAG	126	13.7	2.82	8.06	3.29	20.9	545	123	ND	44	ND
GHABA-51	HC-7	Mount Jeff Tuff	Waste	PAG	36	13.7	6.7	8.27	6.85	1.1	2.38	4.6	16	90	16
GHABA-36	HC-8	Mount Jeff Tuff	Ore	NAG	28	–	7.3	8.55	7.9	ND	92.5	0.8	41	116	41
GHABA-3	HC-9	Alluvium	Waste	NAG	28	39	6.7	7.7	7.6	0.5	22.4	3.3	12	90	12
GHABA-13	HC-10	Tert. Rhyolite Tuff	Waste	NAG	28	1.3	7.05	8.67	7.9	1.6	102	5.2	14	184	18

[1] Inert category has been combined with NAG to be reported as NAG.
[2] Uncertain category has been combined with PAG to be reported as PAG.
[3] "%Waste Represented" does not add up to 100 percent because of multiple tests for a single lithotype. Percentage calculations divided equally where more than 1 HCT sample exists for a given lithotype.
[4] pH in Standard Units.
[5] "Final" is the latest 4-week composite value representing long-term, chemically stable conditions.
Source: WMC 2008.

Overall, the kinetic HCT tests confirm the potential acid-generating nature of the Tertiary Mount Jefferson Tuff lithotype. Seventy-five percent of the waste rock samples tested were acid generating (**Table 3.3-15**). For the Tertiary Rhyolite Tuff lithotype, only 2 samples were tested and the sample with pyritic sulfide around 0.34 percent was acid generating, while the sample with very low sulfide was non-acid generating. These results combined with the Static ABA results suggest that the Tertiary Rhyolite Tuff can be acid generating, depending on the nature of the alteration in the rock. Only one sample of the Tertiary Sinter was tested, which was an ore sample that proved to be acid generating. The HCT tests are not conclusive for waste rock to be generated from the Tertiary Sinter. The alluvium to be mined and potentially used in the waste rock dumps as cover or base material was shown to be non-acid generating based on one HCT test. Constituents in the kinetic HCT tests that were elevated above one or more Nevada water standards included antimony, arsenic, beryllium, cadmium, iron, lead, manganese, nickel, sulfate, TDS, and thallium (WMC 2008).

MWMP Results

A total of 35 samples from the 4 lithotypes to be mined in the Gold Hill Area were submitted for MWMP analyses. **Table 3.3-16** summarizes the results of the MWMP tests. Six samples of the Quaternary alluvium were submitted for analysis. Antimony ranged from 0.03 to 0.84 mg/L and averaged around 0.048 mg/L, exceeding Nevada drinking water standards (**Table 3.3-12**). Arsenic ranged from 0.1 to 0.55 mg/L and averaged 0.33 mg/L, exceeding Nevada drinking water, irrigation, and stock water standards. Fluoride ranged from 4.7 to 9.98 mg/L, averaging 7.6 mg/L and exceeded Nevada drinking water, irrigation water, and stock water standards. All other constituents were within Nevada water standards.

The Tertiary Rhyolite Tuff had 7 samples analyzed with antimony ranging from 0.04 to 0.06 mg/L and averaging 0.048 mg/L, thus exceeding Nevada drinking water standards. Arsenic ranged from 0.2 to 2.39 mg/L and averaged 0.68 mg/L, exceeding Nevada drinking water, irrigation water, and stock water standards. Fluoride ranged from 1.57 to 12.2 mg/L and averaged 4.9 mg/L, exceeding Nevada drinking water, irrigation water, and stock water standards. All other constituents were within Nevada water standards. The Tertiary Sinter also exceeded Nevada drinking water standards for antimony and arsenic, and Nevada irrigation and stock water standards for fluoride.

The Tertiary Mount Jefferson Tuff averaged 0.133 mg/L antimony, exceeding Nevada drinking water standards. Arsenic ranged up to 24.0 mg/L, averaging about 1.8 mg/L and exceeding Nevada drinking water, irrigation water, and stock water standards. TDS averaged 767 mg/L and exceeded Nevada drinking water standards. Sulfate ranged up to 2,690 mg/L and averaged 445 mg/L, exceeding Nevada drinking water standards. Fluoride ranged from 0.25 to 9.4 mg/L, averaging about 1.6 mg/L and thus exceeding Nevada irrigation water standards but not stock water standards. Iron ranged up to 18.0 mg/L, except for 1 anomalous sample at 581 mg/L. Excluding the anomalous sample, the average for iron would be around 2.46 mg/L and iron would exceed Nevada drinking water standards. Including the anomalous sample, the average for iron would be 36.48 mg/L and iron would exceed Nevada irrigation water standards also.

Overall, the MWMP test results suggest that should waste rock from the Gold Hill Area generate an effluent that would reach the surface or reach groundwater, this effluent may exceed Nevada drinking water standards for antimony, arsenic, and fluoride and may also exceed Nevada irrigation and stock water standards for arsenic and fluoride. The design of the waste rock dumps and the percentages of different lithotypes placed in the waste rock would ultimately determine the composition of any potential effluent.

Table 3.3-16
Gold Hill MWMP Results Summary

Analyte	Units	Alluvium (6 samples)	Upper Rhyolite Tuff (7 samples)	Chalcedonic Quartz Sinter (5 samples)	Mount Jefferson Tuff (17 samples)
Aluminum	mg/L	0.3300	0.170	0.060	1.990
Antimony	mg/L	**0.0480**	**0.048**	**0.044**	**0.133**
Arsenic	mg/L	**0.3300**	**0.680**	**0.070**	**1.800**
Barium	mg/L	0.0100	0.030	0.010	0.050
Beryllium	mg/L	0.0000	0.000	0.000	0.005
Bismuth	mg/L	0.0000	0.000	0.000	0.014
Boron	mg/L	0.3230	0.267	0.121	0.168
Cadmium	mg/L	0.0000	0.000	0.000	0.002
Calcium	mg/L	8.5000	6.700	4.100	75.000
Chromium	mg/L	0.0000	0.000	0.004	0.004
Cobalt	mg/L	0.0000	0.000	0.005	0.333
Copper	mg/L	0.0070	0.013	0.006	0.050
Gallium	mg/L	0.0000	0.000	0.000	0.036
Iron	mg/L	0.1100	0.090	0.130	**36.480**
Lead	mg/L	0.0000	0.009	0.000	0.005
Lithium	mg/L	0.1200	0.160	0.180	0.210
Magnesium	mg/L	0.6000	0.400	0.200	7.000
Manganese	mg/L	0.0100	0.010	0.140	0.700
Mercury	mg/L	0.0002	0.000	0.004	0.001
Molybdenum	mg/L	0.0380	0.031	0.027	2.156
Nickel	mg/L	0.0090	0.009	0.000	0.038
Potassium	mg/L	1.8000	1.500	1.800	7.700
Scandium	mg/L	0.0000	0.000	0.000	0.002
Selenium	mg/L	0.0000	0.000	0.007	0.012
Sodium	mg/L	71.0000	85.000	69.000	102.000
Strontium	mg/L	0.1100	0.110	0.080	0.970
Thallium	mg/L	0.0000	0.000	0.000	0.001
Titanium	mg/L	0.0090	0.021	0.003	0.003
Vanadium	mg/L	0.0160	0.010	0.008	0.009
Zinc	mg/L	0.0050	0.010	0.003	0.166
Alkalinity, Total (as $CaCO_3$)	mg/L	110.0000	115.000	107.000	72.000
pH	s.u.	8.0000	8.200	8.000	7.100
Sulfate	mg/L	31.0000	50.000	42.000	445.000
TDS	mg/L	245.0000	276.000	215.000	**767.000**
Chloride	mg/L	10.4000	9.300	3.600	4.300
Fluoride	mg/L	7.6000	4.900	2.400	1.600
Nitrate-N	mg/L	1.3000	1.700	0.600	0.600
Nitrite-N	mg/L	1.6000	1.200	0.800	NA
NO_2+NO_3-N	mg/L	NA	NA	NA	0.700

Values shown represent averages of measured values. Non-detects were included at one-half the detection limit.
NA indicates no samples were analyzed for this parameter.
Silver, tin, and cyanide were not detected in any samples.
s.u. = standard units.
Bold = Exceedences of new water standards.
Source: WMC 2008.

Whole Rock Chemistry Results

Whole rock chemical analysis of the Quaternary alluvium showed elevated levels above average crustal abundances for antimony, arsenic, manganese, mercury, molybdenum, and silver. For the Tertiary Rhyolite Tuff, antimony, arsenic, barium, beryllium, cadmium, lead, manganese, mercury, molybdenum, silver, and strontium were elevated above average crustal abundances. The Tertiary Sinter showed elevated levels for antimony, arsenic, cadmium, chromium, gallium, lithium, manganese, mercury, molybdenum, and silver above average crustal abundances. The Tertiary Mount Jefferson Tuff showed elevated levels in antimony, arsenic, barium, beryllium, cadmium, gallium, lead, lithium, manganese, mercury, molybdenum, silver, strontium, thallium, and zinc (WMC 2008).

Summary

The static ABA tests suggest that the Tertiary Mount Jefferson Tuff is PAG. This was confirmed with the kinetic HCT tests. The Mount Jefferson Tuff would comprise about 55 percent of the waste rock to be generated by mining in the Gold Hill Area. The Tertiary Rhyolite Tuff and the Tertiary Sinter are also PAG. The Quaternary alluvium is not acid-generating, but has a low capacity for acid neutralization. Should an effluent be generated by infiltration of rain water or snow melt into a waste rock pile composed of the lithologies to be mined at Gold Hill, the composition of the effluent may be elevated above Nevada drinking water, irrigation water, and stock water standards for antimony, arsenic, and fluoride. The effluent may also have elevated levels of sulfate, iron, and TDS.

3.4 Cultural Resources

The study area for cultural resources includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor), which also includes the area of potential effect (APE). Under Section 106 of the National Historic Preservation Act of 1986 (NHPA), the APE is defined as "those areas in which impacts are planned or are likely to occur. Specifically, the APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. Additionally, the APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (36 CFR 800.16[d])."

The APE should include:

- All alternative locations for all elements of the proposed project;
- All locations where the proposed project may result in ground disturbance;
- All locations from which elements of the proposed project (e.g., a facility or land disturbance) may be visible or audible;
- All locations where the proposed project may result in changes in traffic patterns, land use, public access, etc.; and
- All areas where there may be direct or indirect effects.

Only those cultural resources located in the APE were reviewed to determine if they would be subject to impacts that could affect their eligibility for the NRHP based on NRHP criteria for evaluation.

The CESA for cultural resources is two-fold. The CESA for Native American sites and artifacts is defined as the proposed project area. The CESA also includes BLM-administered lands to the east and west of the Transportation/Utility Corridor and between the Round Mountain and Gold Hill areas in T10N, R44E. The CESA is approximately 10.5 miles from north to south and approximately 4 miles from east to west. Few cultural surveys have been completed outside of the study area. Therefore, there was no scientific basis to define a larger CESA.

The CESA for historic sites and artifacts is defined as the proposed project area and the Big Smoky Valley from SR 377, approximately 4.5 miles south of the proposed project area to the north boundary line of T11N, R43E and R44E, approximately 4.5 miles north of the proposed project area in the Gold Hill Area. The CESA is approximately 19 miles from north to south and from 6 to 10 miles east to west across the valley. Historic structures and features are more prevalent within the CESA than either to the north or south in the Big Smoky Valley.

For the cultural resources viewshed analysis, the visual APE is the same as the CESA for historic sites and artifacts.

3.4.1 Regulatory Framework

Federal historic preservation laws provide a legal environment for documentation, evaluation, and protection of archaeological and historic sites that may be affected by Federal undertakings, or by private undertakings operating under Federal license or on Federally managed lands. NEPA states that Federal undertakings shall take into consideration impacts to the natural environment with respect to an array of resources, and that alternatives must be considered. The courts have made clear that archaeological and historic sites (i.e., cultural resources) are regarded as part of the natural environment. The NHPA of 1966, as amended, established the Advisory Council on Historic Preservation (ACHP) and the NRHP. The NHPA mandates that Federal agencies consider an undertaking's effects on cultural resources that are listed on or eligible for the NRHP, and Section 106 of the NHPA establishes a 4-step review process by which NRHP-eligible properties are given consideration during the conduct of Federal undertakings. The 4 steps are: 1) initiate the Section 106 process by defining the undertaking and determining if the undertaking has the potential to affect NRHP-eligible properties; 2) identify NRHP-eligible properties; 3) determine whether the undertaking would have an adverse effect on identified NRHP-eligible properties; and if so, 4) take appropriate steps to avoid or mitigate such adverse effects.

Regulations in 36 CFR 800 outline the process through which historic preservation legislation under the NHPA is administered. 36 CFR 800.14 allows Federal agencies to adopt program alternatives to 36 CFR 800 and to tailor the Section 106 process to better fit agency procedures. The most common program alternative is a Programmatic Agreement (PA) negotiated between the agency and the ACHP. The National Programmatic Agreement (NPA) among the BLM, ACHP, and the National Conference of State Historic Preservation Officers was adopted as the program alternative for the BLM. The NPA is thus the National BLM authority for meeting requirements of the NHPA. Day-to-day Section 106 compliance is guided by statewide protocols developed by state BLM offices and SHPOs. In Nevada, the State Protocol Agreement (as amended through January 2008) between the BLM and the Nevada SHPO defines how the BLM and SHPO are to interact and cooperate under the NPA, and provides direction for implementing Section 106 of the NHPA. Additionally, BLM Handbook H-8120 provides direction to BLM for conducting Section 106 reviews, and for mitigation of adverse effects of proposed undertakings on NRHP-eligible properties.

3.4.2 Eligibility Criteria for Listing Cultural Resources on the NRHP

The NRHP, maintained by the National Park Service (NPS) on behalf of the Secretary of the Interior, is the nation's inventory of NRHP-eligible properties. The NPS has established three main standards that a resource must meet to qualify for listing on the NRHP: age, integrity, and significance. To meet the age criteria, a resource generally must be at least 50 years old. To meet the integrity criteria, a resource must "possess integrity of location, design, setting, materials, workmanship, feeling, and association" (36 CFR 60.4). Finally, a resource must be significant according to one or more of the following criteria:

- Criterion a – Be associated with events that have made a significant contribution to the broad patterns of U.S. history; or

- Criterion b – Be associated with the lives of persons significant in U.S. history; or

- Criterion c – Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or

- Criterion d – Have yielded, or may likely yield, information important in prehistory or history.

3.4.3 Investigations in the Study Area

Over the last several years, numerous Class I and Class III cultural resources investigations have been conducted within and adjacent to the proposed project area. Class I investigations are a review of reports containing the results of previously conducted inventories, as well as library and archival sources for regional prehistory and history. Class III investigations are intensive field surveys of areas in which potential impacts are anticipated or are likely to occur. Approximately 100 percent of the proposed project area has been investigated at the Class III level of intensity.

The results of the inventories have been documented in survey reports that have been submitted to the BLM for review. The reports contain the cultural and historical overview of the area; the location, type, and significance of identified cultural resources; archaeological field methods; artifact analysis; eligibility recommendations for each identified site; and proposed mitigation for NRHP-eligible sites that would be affected by the proposed project. Contents of the survey reports, in particular the description and location of recorded prehistoric and historic resources, are confidential and are not accessible for public review.

Cultural resources investigations conducted to date within the proposed project area are summarized below.

In spring 1987, a Class III inventory was conducted on two adjoining parcels within the proposed expansion area of the Smoky Valley Common Operation (Burke and Furnis 1987). The 2 parcels included 1 direct disturbance area totaling approximately 6,000 acres and a smaller area outside of the direct disturbance area totaling approximately 130 acres. The smaller parcel encompassed the Round Mountain townsite. In addition to the Round Mountain townsite, a total of 156 sites were recorded during the inventory. The majority of recorded sites included the remains of historic period trash scatters or structures associated with the scatters. Thirteen of the 156 sites were identified as prehistoric sites. Three of the 156 recorded sites were recommended as eligible for the NRHP.

During May 22 through 29, 1996, and June 5 through 12, 1996, Western Cultural Resource Management, Inc. (WCRM) conducted a Class III cultural resources inventory of BLM-administered lands totaling approximately 2,984 acres (Kolvet et al. 1997). The inventory was conducted as part of a baseline study for an Environmental Assessment (EA) for RMGC. Fifty-two newly recorded sites and 311 isolated finds were identified as a result of the inventory. In addition, a small segment of a previously recorded site was re-recorded and five loci were relocated. Of the 52 newly recorded sites, 23 were prehistoric and 29 were historic. Five of the 52 newly recorded sites were recommended as eligible for the NRHP and a small segment of the previously recorded site was considered a contributing element to the overall NRHP-eligibility of the site. The remaining sites were recommended as not eligible for the NRHP. By definition, isolated finds are not eligible for the NRHP. Avoidance or, if avoidance was not feasible, mitigation was recommended for the NRHP-eligible sites.

During the periods of May 9 to 16 and May 23 to 27, 2001, WCRM conducted a Class III cultural resources inventory of 1,900 acres of BLM-administered lands for the proposed Gold Hill Exploration Project (Stoner

et al. 2001). One previously recorded site, 13 newly recorded sites, and 81 isolated finds were identified as a result of the inventory. The previously recorded site consisted of the Gold Hill Mine and Mill and the 13 newly recorded sites included 1 prehistoric site and 12 historic sites. Three of the 14 sites located during the inventory were recommended as eligible for the NRHP. The remaining 11 sites were recommended as not eligible for the NRHP. By definition, isolated finds are not eligible for the NRHP. Avoidance, or if avoidance was not feasible, mitigation was recommended for the NRHP-eligible sites.

Between June 3 and 20, 2003, WCRM conducted a Class III inventory of 3 additional parcels totaling approximately 3,573 acres that were subsequently added to the previously proposed Gold Hill Project area (Peterson et al. 2004). The results of the Class III inventory were appended to the original Gold Hill survey report (Stoner et al. 2001). Two of the three parcels were on BLM-administered lands and the remaining parcel was on USFS land. A total of 58 sites and 143 isolated finds were recorded during the inventory. Of the 58 sites, 42 were prehistoric, 9 were historic, and 7 had both prehistoric and historic components. Fourteen of the 58 sites were recommended as eligible for the NRHP. The remaining 44 sites were recommended as not eligible for the NRHP. By definition, isolated finds are not eligible for the NRHP. Avoidance, or if avoidance was not feasible, mitigation was recommended for the NRHP-eligible sites.

In November 2003, a treatment plan was developed for three sites which were determined contributing elements to the proposed Gold Hill Mining District: Gold Hill Mine and Mill, Surprise Shaft, and Toquima Shaft (Stoner and Mehls 2003). The Gold Hill Mining District was proposed based on NRHP-eligibility recommendations made by Stoner et al. (2001) and review of that document by the BLM. Treatment was proposed and completed to allow further exploration and was done under a ROD/finding of no significant impact (FONSI).

On December 13, 2004, WCRM conducted a Class III inventory of one 77-acre parcel in the Gold Hill Area (Peterson et al. 2006). One historic site, one small prehistoric site, and three isolated features were recorded during the inventory. None of the resources discovered during the inventory were recommended as eligible for the NRHP. No further work was recommended.

From August 9 through September 6, 2006, portions of the proposed project area were inventoried to Class III levels of intensity (Ringhoff and Stoner 2006). The Class III inventory covered 5 irregularly shaped parcels totaling approximately 3,133 acres located around the RMGC operations. Approximately 50 acres of private land belonging to RMGC are located within 1 of the survey parcels near the Town of Round Mountain. The remaining areas encompassed within the survey parcels are BLM-administered lands. As a result of the Class III inventory, 38 sites were recorded and 3 previously recorded sites were revisited and existing site documentation was updated. A total of 225 isolated artifacts and features also were recorded. Of the 41 previously and newly recorded sites, 9 are prehistoric, 25 are historic, and 7 contain both prehistoric and historic components. Two historic sites and the historic component of one multi-component site are recommended as eligible for the NRHP. The remaining sites are recommended as not eligible for the NRHP. By definition, isolated finds are not eligible for the NRHP. Avoidance or, if avoidance is not feasible, mitigation is recommended for the NRHP-eligible sites.

Between April 18 and May 3, 2007, WCRM conducted an intensive Class III inventory of approximately 685 acres of BLM-administered land in the proposed project area (Stoner et al. 2007). The inventory was monitored by a member of the Yomba Shoshone Tribe and members of the Duckwater Shoshone Tribe and other Western Shoshone representatives. Twenty-seven archaeological sites and 65 isolated finds were documented during the inventory. Of the 27 sites, 14 are prehistoric, 11 contain features identified by the Native American monitors, and 2 are historic. Due to their lack of diagnostic artifacts, low artifact density,

and low likelihood of containing buried deposits, 25 of the sites were recommended as not eligible for the NRHP. No further work is recommended for these sites. Two sites were evaluated as eligible for the NRHP, one under Criterion d and the other under Criteria a and c. Avoidance or, if avoidance is not feasible, mitigation is recommended for the NRHP-eligible sites.

As a result of the previously conducted cultural resources investigations, 186 sites were identified in the proposed project area. Of these 186 sites, 28 are NRHP-eligible sites. The majority of the NRHP-eligible sites are prehistoric lithic scatters or camps and historic sites associated with mining. Seven of the NRHP-eligible sites would be directly affected by the proposed expansion. The seven NRHP-eligible sites include four prehistoric sites, one historic mill complex, Toquima Shaft, and the Gold Hill Mine and Mill.

3.5 Native American Traditional Values

The study area for Native American Traditional Values includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor). The CESA for Native American Traditional Values cannot be easily defined by a physical area or location. Native Americans lived in the Big Smoky Valley and in the surrounding Toiyabe and Toquima ranges. A village is known to have existed in Jefferson Canyon east of the study area. The CESA, is defined as the proposed project area and the Big Smoky Valley from SR 377, approximately 4.5 miles south of the proposed project area to the north boundary line of T11N, R43E and R44E, approximately 4.5 miles north of the Gold Hill Area. The CESA is approximately 19 miles from north to south and from 6 to 10 miles east to west across the valley.

Federal law and agency guidance require the BLM to consult with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on BLM-administered lands. This consultation includes the identification of places (i.e., physical locations) of traditional cultural importance to Native American tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Additionally, some of these locations may be considered sacred to particular Native American individuals or tribes.

In 1992, the NHPA was amended to explicitly allow that “properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the NRHP.” If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property. The term “traditional cultural property” first came into use within the Federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1989) defines a traditional cultural property as “one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that a) are rooted in that community’s history and b) are important in maintaining the continuing cultural identify of the community.” To qualify for nomination to the NRHP, a traditional cultural property must be more than 50 years old, must be a place with definable boundaries, must retain integrity, and must meet certain criteria as outlined for cultural resources in the NHPA.

In addition to the NRHP eligibility, some places of cultural and religious importance also must be evaluated to determine if they should be considered under other Federal laws, regulations, directives, or policies which include, but are not limited to, Executive Order (EO) 13007 of 1996, American Indian Religious Freedom Act (AIRFA) of 1978, and the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990.

EO 13007 requires Federal agencies to accommodate access to and ceremonial use of Native American sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It also requires agencies to develop procedures for reasonable notification of proposed actions or land management policies that may restrict access to or ceremonial use of, or adversely affect, sacred sites.

AIRFA established a Federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

NAGPRA established a means for Native Americans, including Indian Tribes, to request the return of human remains and other sensitive cultural items held by Federal agencies or Federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and sensitive cultural items on Federal or tribal lands.

3.5.1 Native American Communication/Coordination

On September 10, 2003, the BLM sent letters to official tribal representatives of the Timbisha, Duckwater, Yomba, and Ely Shoshone tribes to inform them of the proposed Gold Hill Project and to request any comments or questions they may have regarding the project. Letters also were sent to a Fallon Paiute/Shoshone tribal member and Ely Shoshone tribal member whose families originally were from the Round Mountain Area. Follow-up letters were sent to the same tribal representatives and tribal individuals on June 25, 2004, to inform them of two archaeological surveys conducted by RMGC in the Gold Hill Project area and to provide them with the results of the surveys. In addition, the letters included information on-site eligibility determinations and proposed mitigation for NRHP-eligible sites identified during the surveys.

On September 27, 2004, the BLM sent a memo to the official tribal representatives listed above indicating that RMGC was in the process of preparing an EIS for the proposed Gold Hill Project and requesting any comments the tribes may have concerning the project. A follow-up letter was sent to the tribal representatives and interested tribal individuals from the Fallon Paiute/Shoshone and Ely Shoshone on April 28, 2005, inviting them to participate in a field trip to the study area on June 21, 2005. The Fallon Paiute/Shoshone tribal member and some of her family members participated in the field visit; no official tribal representatives or tribal members from the Timbisha, Duckwater, Yomba, or Ely Shoshone were able to attend the field visit.

At the request of Western Shoshone descendents of the Big Smoky Valley and other lineal descendents of families from Smoky Valley, an intensive Class III survey of an area of concern was conducted between April 18 to 26 and May 1 to 3, 2007. On May 7, 2007, the BLM, RMGC, and a number of Native Americans who are lineal descendents of families who once lived in Smoky Valley met to discuss the results of the survey, potential effects to significant sites, and ways to protect at-risk sites.

On September 14, 2007, the BLM sent letters to official tribal representatives of the Yomba, Ely, Timbisha, and Duckwater Shoshone tribes, and previously contacted individuals. The letters were a continuation of the coordination efforts between the BLM and tribal representatives and individuals regarding RMGC's proposed amendment to their POO for expansion of the Round Mountain Mine. A detailed description of the proposed modifications to the existing mine was included in the letters. The recipients of the letters were offered the opportunity to express their concerns about the proposed project and identify any areas of concern within or near the proposed project area.

3.6 Hazardous Materials and Solid Waste

The study area and CESA for hazardous materials includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor) and the main transportation route to the site from RMGC to SR 376, north to U.S. 50, then west to SR 305, then north to Interstate (I)-80 at Battle Mountain. Another likely transportation route is from Las Vegas, Nevada via SR 95.

The affected environment for hazardous materials includes air, water, soil, and biological resources. These resources potentially could be affected by an accidental release of hazardous materials during transportation to and from the study area and during storage and use within the study area.

3.6.1 Project-related Hazardous Materials

The mining and ore processing operations for the proposed project would include the use of the following materials classified as hazardous:

- Diesel fuel, gasoline, oils, greases, anti-freeze, and solvents used for equipment operation and maintenance;
- Sodium cyanide, sodium hydroxide, nitric acid, flocculants, lime, collector and frothing agents, and antiscalants used in mineral extraction processes;
- Ammonium nitrate and high explosives used for blasting in the open pits; and
- Chemicals used in the existing assay laboratory.

3.6.2 Regulatory Definitions of Hazardous Materials

“Hazardous materials,” which are defined in various ways under a number of regulatory programs, can represent potential risks to both human health and the environment when not properly managed. The term hazardous materials include the following materials that may be utilized or disposed of in conjunction with mining operations:

- Substances covered under Occupational Safety and Health Administration (OSHA) and MSHA Hazard Communication Standards (29 CFR 1910.1200 and 30 CFR 42): The types of materials that may be used in mining activities and that would be subject to these regulations would include almost all of the materials identified in Section 3.6.1, Project-related Hazardous Materials.
- “Hazardous materials” as defined under USDOT regulations at 49 CFR, Parts 170-177: The types of materials that may be used in mining activities and that would be subject to these regulations would include sodium cyanide, explosives, cement, fuels, some paints and coatings, and other chemical products.
- “Hazardous substances” as defined by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR Table 302.4: The types of materials that may contain hazardous substances that are used in mining activities and that would be subject to these

requirements would include sodium cyanide, solvents, solvent-containing materials (e.g., paints, coatings, degreasers), acids, and other chemical products.

- "Hazardous wastes" as defined in the RCRA: Procedures in 40 CFR 262 are used to determine whether a waste is a hazardous waste. The types of materials used in mining activities and that could be subject to these requirements could include liquid waste materials with a flash point of less than 140°F, spent solvent containing wastes, corrosive liquids, and lab assay wastes. Hazardous wastes are regulated under Subtitle C of RCRA.

- Any "hazardous substances" and "extremely hazardous substances" as well as petroleum products such as gasoline, diesel, or propane, that are subject to reporting requirements if volumes on hand exceed threshold planning quantities under Sections 311 and 312 of Superfund Amendments and Reauthorization Act (SARA). The types of materials that may be used in mining activities and that could be subject to these requirements would include fuels, coolants, acids, and solvent-containing products such as paints and coatings.

- Petroleum products defined as "oil" in the Oil Pollution Act of 1990. The types of materials used in mining activities and that would be subject to these requirements include fuels, lubricants, hydraulic oil, and transmission fluids.

In conjunction with the definitions noted above, the following lists provide information regarding management requirements during transportation, storage, and use of particular hazardous chemicals, substances, or materials:

- The SARA Title III List of Lists or the Consolidated List of Chemicals Subject to Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act (CAA).

- The USDOT listing of hazardous materials in 49 CFR 172.101.

Certain types of materials, while they may contain potentially hazardous constituents, are specifically exempt from regulation as hazardous wastes. Used oil, for example, may contain toxic metals, but would not be considered a hazardous waste unless it meets certain criteria. Other wastes that might otherwise be classified as hazardous are managed as "universal wastes" and are exempted from hazardous waste regulation as long as those materials are handled in ways specifically defined by regulation. An example of a material that could be managed as a universal waste is lead-acid batteries. As long as lead-acid batteries are recycled appropriately, requirements for hazardous waste do not apply.

Pursuant to regulations promulgated under CERCLA, as amended by SARA, release of a reportable quantity of a hazardous substance to the environment must be reported within 24 hours to the National Response Center (40 CFR Part 302). The NAC (445A.347) also requires immediate reporting of a release of a reportable quantity of a hazardous substance to the Nevada Division of Emergency Management. In addition, under the State of Nevada WPCP program, all releases of a reportable quantity must be reported as soon as possible, but not later than 24 hours after the event, to the NDEP Bureau of Corrective Actions. Nevada regulates the storage and handling of certain defined "highly hazardous substances" under NAC 459.952-459.9542.

Incidental spills of hazardous substances have occurred during previous mining and mineral processing operations within the study area. All reported spills have been mitigated, and contaminated materials have been managed in accordance with Federal and state regulations.

3.6.3 Regulatory Definition of Solid Waste

Solid waste consists of a broad range of materials that include garbage, refuse, wastewater treatment plant sludge, non-hazardous industrial waste, and other materials (i.e., solid, liquid, or contained gaseous substances) resulting from industrial, commercial, mining, agricultural, and community activities (USEPA 2006). Solid wastes are regulated under different subtitles of RCRA and include hazardous waste and non-hazardous waste. Non-hazardous wastes are regulated under RCRA Subtitle D. In Nevada, solid waste rules are found in the NAC. Disposal of solid waste is regulated under NAC 444.570 444.7499; disposal of hazardous waste is regulated under NAC 444.850-444.8746.

3.6.4 Uncontrolled Hazardous Materials

Mining in the study area began in 1906 and there is the potential concern for uncontrolled releases of hazardous materials to have occurred in association with historic mining and milling activities. Federal and state incident databases were reviewed to determine the presence of sites in the study area that could pose potential concerns. USEPA databases that were reviewed included Superfund, RCRA Corrective Action, Brownfields cleanup (USEPA 2007). NDEP cleanup and leaking underground storage tank incident lists also were reviewed (NDEP 2008a,b). Only one recorded spill and cleanup incident was found in the database review. At the existing Round Mountain Mine an undisclosed amount of material had leaked from a tank and cleanup and remediation was conducted to the satisfaction of the NDEP and the site was closed in 2004. No other sites or incidents were documented in the databases that were reviewed.

3.6.5 Solid Waste Facilities

The existing Round Mountain Mine has two active waivered Class III landfills, which are located in the North Waste Rock Dump (RMGC 2006). One landfill is used to dispose of industrial and municipal solid wastes including paper, wood, construction waste, punctured aerosol cans, and drained oil filters. The other landfill is permitted for the disposal of used tires. Additional landfill cells have been permitted at the South Waste Rock Dump area, but would not be constructed until needed.

The existing Round Mountain Mine also operates two petroleum waste bioremediation facilities (RMGC 2006). One facility manages oily sludge from vehicle wash bays and the other is used to manage petroleum contaminated solids from other operations. The facilities consist of cells with engineered liners (i.e., compacted clay and/or plastic).

3.7 Air Quality

The study area and CESA for air quality includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor) and its corresponding local airshed. The cumulative impact analysis also includes a discussion of potential visibility impacts to Class I areas located within 100 km of the proposed project area.

Nevada is characterized by a series of mountain ranges separated by broad valleys. The eastern part of the state has an average elevation ranging from 5,000 and 6,000 feet amsl. Nevada has several mountain ranges, most of them are 50 to 100 miles long, running generally north-south. Nevada has great climatic diversity, ranging from scorching lowland desert in the south to cool mountain forests in the north. Its varied and rugged topography, mountain ranges, and narrow valleys range in elevation from approximately 1,500 to more than 10,000 feet amsl. Large local variations of temperature and rainfall are common. The principal climatic features are bright sunshine; low annual precipitation (averaging less than 9 inches in the valleys and deserts); heavy snowfall in the higher mountains; clean, dry air; and exceptionally large daily ranges of temperature.

Nevada lies on the eastern side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the state. One of the greatest contrasts in precipitation found within a short distance in the U.S. occurs between the western slopes of the Sierra Range in California and the valleys immediately east of this range. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascends the western slopes of the Sierra Range, the air cools, condensation takes place, and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed, and very little precipitation occurs. The effects of this major mountain barrier are felt not only in western Nevada, but throughout the state, including the lowlands of Nevada, which are largely desert or steppes.

Air quality is defined by the concentration of various pollutants and their interactions in the atmosphere. Pollution effects on receptors have been used to establish a definition of air quality. Measurement of pollutants in the atmosphere is expressed in units of ppm or micrograms per cubic meter ($\mu g/m^3$). Both long-term climatic factors and short-term weather fluctuations are considered part of the air quality resource because they control dispersion and affect concentrations. Physical effects of air quality depend on the characteristics of the receptors and the type, amount, and duration of exposure. Air quality standards specify acceptable upper limits of pollutant concentrations and duration of exposure. Air pollutant concentrations within the standards generally are not considered to be detrimental to public health and welfare.

The relative importance of pollutant concentrations can be determined by comparison with appropriate national and state Ambient Air Quality Standards (AAQS). National and state AAQS are presented in **Table 3.7-1**. An area is designated by the USEPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the national AAQS. An area is not in attainment if violations of national AAQS for that pollutant occur. Areas where insufficient data are available to make an attainment status designation are listed as unclassifiable and are treated as being in attainment for regulatory purposes.

Table 3.7-1
National and Nevada Ambient Air Quality Standards

Nevada Standards			National Standards	
Pollutant	**Averaging Time**	**Concentration[1]**	**Primary[1]**	**Secondary[1]**
Ozone (O_3)	1-Hour	235	235	235
O_3	8-Hour	157	157	157
Carbon Monoxide (CO)	1-Hour	40,000	40,000	40,000
CO less than 5,000 feet amsl	8-Hour	10,000	10,000	10,000
CO at or greater than 5,000 feet amsl	8-Hour	6,670		
Sulfur Dioxide (SO_2)	3-Hour	1,300	None	1,300
SO_2	24-Hour	365	365	None
SO_2	Annual Average	80	80	None
Nitrogen Dioxide (NO_2)	Annual Average	100	100	100
Particulate matter with aerodynamic diameter of 10 microns or less (PM_{10})	24-Hour	150	150	150
PM_{10}	Annual Average	50	NA	NA
Particulate matter with aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$)	24-Hour	35	35	35
$PM_{2.5}$	Annual Average	15	15	15

[1] $\mu g/m^3$.
Source: NDEP 2007a.

The existing air quality of the study area is typical of the largely undeveloped regions of the western U.S. For the purposes of statewide regulatory planning, this area has been designated as in attainment for all pollutants that have an AAQS. Current sources of air pollutants in the region include several precious metals mines that are sources for PM_{10} and $PM_{2.5}$.

No areas in Nevada are currently designated as nonattainment of the $PM_{2.5}$ standard. There is a lack of sufficient data to develop a comprehensive emissions inventory for $PM_{2.5}$ from mine sources; nevertheless, an acceptable surrogate for primary $PM_{2.5}$ emissions from fugitive dust sources is to use a percentage of the PM_{10} emissions.

A recent study conducted by the Midwest Research Institute (MRI) for the USEPA recommends that the $PM_{2.5}$ /PM_{10} ratios for fugitive dust should be in the range of 0.1 to 0.15 (MRI 2006). It is recommended that the results of this study be used to revise the AP-42 $PM_{2.5}$ emission factors for the following four fugitive dust source categories: paved roads, unpaved roads (public and industrial), aggregate handling and storage piles, and industrial wind erosion. Emission estimates for other fugitive dust producing activities, such as construction and demolition, would also be affected since they are based on these four source categories.

Modeling was not performed for the criteria pollutant $PM_{2.5}$. $PM_{2.5}$ typically is not modeled for near-field impacts due to secondary formation of $PM_{2.5}$.

The USEPA has finalized the New Source Review (NSR) implementation rule for the $PM_{2.5}$ national ambient air quality standard, with an effective date in July, 2008. The rule must be implemented beginning on the effective date in delegated Prevention of Significant Deterioration (PSD) states and $PM_{2.5}$ non-attainment areas, but would not take effect in State Implementation Plan (SIP)-approved PSD states until an approved SIP revision is in place. SIP approved states would have 3 years from the effective date to submit their revised $PM_{2.5}$ PSD programs. USEPA would continue to allow the use of the PM_{10} surrogate policy for determining compliance with the $PM_{2.5}$ National AAQS, even in PSD delegated states.

3.7.1 Background Values for Criteria Pollutants

As shown in **Table 3.7-2**, the PM_{10} background concentrations are on-site measurements. However, there is no on-site monitoring for the other pollutants; therefore, their background concentrations are adopted from other USEPA/NDEP monitoring stations in the vicinity. Although there are no monitoring stations near the proposed project area, USEPA/NDEP do have stations that measure CO, NO_2, and SO_2 that are within or just outside relatively highly populated or urban areas. The measurements at these stations are conservatively high for use as background concentrations for the proposed project area. Upon review of the various monitoring stations in Nevada, the pollutant measurements from Boulder City (CO and SO_2) and Jean (NO_2) monitoring stations are selected as background concentrations for this analysis. These stations are the farthest distance from their respective nearest urban areas and thus considered to be representative for the modeling analysis. Boulder City is located 21 miles southeast of Las Vegas, and Jean is located 30 miles southwest of Las Vegas.

For purposes of this analysis, monitoring data from most of the western states were reviewed, and the most suitable surrogates considered for each pollutant. Not all monitoring sites monitor for all of the criteria pollutants. **Table 3.7-2** lists the pollutant, timeframe, monitor location, years of data reviewed, and background value selected for use in the modeling effort.

Table 3.7-2
Background Concentrations

Pollutant	Averaging Period	Highest Measurement ($\mu g/m^3$)	Available Data	Monitoring Site	Reference
CO	1-Hour 8-Hour	1,716 1,602	1999 - 2003	Boulder City, Clark County, Nevada	USEPA Air Data[1]
NO_2	Annual	13.2	1998 - 2006	Jean, Clark County, Nevada	USEPA Air Data[1]
PM_{10}	24-Hour[2] Annual	39 15	1994 - 1996	Round Mountain Monitoring (South Sampler)	RMGC
SO_2	3-Hour 24-Hour Annual	49.7 13.1 2.6	2001 - 2003	Boulder City, Clark County, Nevada	USEPA Air Data[1]

[1] http://www.epa.gov/air/data/index.html.

[2] 2nd high 24-hour measurement.

Source: Air Sciences 2008a.

3.7.2 Climate and Meteorology

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, wind (speed and direction), and stability. Mixing height is the height above ground within which rising warm air from the surface would mix by convection and turbulence. Local atmospheric conditions, terrain configuration, and source location determine dilution of pollutants in this mixed layer. Mixing heights vary diurnally, with the passage of weather systems, and with season. For the study area, the mean annual morning mixing height is estimated to be approximately 1,000 feet; however, during the winter months the mean morning mixing height is approximately 80 feet (Holzworth 1972). The mean annual afternoon mixing height exceeds 7,400 feet.

Morning atmospheric stability conditions tend to be stable because of the rapid cooling of the layers of air nearest the ground. Afternoon conditions, especially during the warmer months, tend to be neutral to unstable because of the rapid heating of the surface under clear skies. During the winter, periods of stable afternoon conditions may persist for several days in the absence of synoptic (i.e., continental scale) storm systems to generate higher winds with more turbulence and mixing. A high frequency of inversions at lower elevations during the winter can be attributed to the nighttime cooling and sinking air flowing from higher elevations to the low lying areas in the basins. Although winter inversions are generally quite shallow, they tend to be more stable because of reduced surface heating.

Wind speed has an important effect on area ventilation and the dilution of pollutant concentrations from individual sources. Light winds, in conjunction with large source emissions, may lead to an accumulation of pollutants that can stagnate or move slowly to downwind areas. During stable conditions, downwind usually means down valley or toward lower elevations. Climate data from Elko indicate that the potential for air pollution episodes to last 5 or more days is nearly zero (Holzworth 1972). A potential air pollution episode is defined as a period of time with wind speeds less than 4 miles per hour and mixing heights less than 3,300 feet.

The latitude of the study area places it within the belt of prevailing westerly winds that circle the globe around the earth's northern hemisphere. However, the proposed project would be located in complex terrain where the winds are affected by local topographic features.

Because of the typically dry atmosphere, bright sunny days and clear nights frequently occur. This in turn allows rapid heating of the ground surface during daylight hours and rapid cooling at night. Since heated air rises, and cooled air sinks, winds tend to blow uphill during the daytime and down slope at night. This upslope and down slope cycle generally occurs in all the geographical features, including mountain range slopes and river courses. The larger the horizontal extent of the feature, the greater the volume of air that moves in the cycle. The complexity of terrain features cause complex movements in the cyclic air patterns, with thin layers of moving air embedded within the larger scale motions. The lower level, thermally driven winds also are embedded within larger scale upper wind systems (i.e., synoptic winds). Synoptic winds in the region are predominantly west to east, characterized by daily weather variations that enhance or diminish the boundary layer winds, and significantly channeled by regional and local topography.

The precipitation climate in the proposed project vicinity is classified as arid with elevations below 6,500 feet receiving the least amount of precipitation, 5 to 9 inches per year is common, while the mountainous areas are significantly wetter, receiving 11 to over 16 inches of precipitation annually. An arid climate is

characterized by low rainfall, low humidity, clear skies, and relatively large annual and diurnal temperature ranges.

Most precipitation accumulates as snow on the mountain ranges. During the spring snowmelt period, water flows from the mountain ranges into the basin fill deposits. As water flows from areas of bedrock outcrop in the mountains towards the valley, it rapidly infiltrates into the basin fill deposits along the range fronts. Thus, most recharge into the basin fill deposits occurs along the margins of the valleys or at higher elevations and not in the central portion of the valleys. However, some streams may flow into the central valley during times of high runoff causing water to accumulate in the playas.

3.7.2.1 Site Data Sources

Local weather conditions have been recorded at two temperature and wind stations and two rainfall stations located near the study area. The rainfall-recording stations include the Belfort Rain Station and the Met One Rain Gage; the temperature/wind stations include the North and South stations. The Belfort Rain Station has a period of record from December 1993 to March 2006 and the Met One Rain Gage has a period of record from October 2000 to March 2006. Both the North and South stations have periods of record from January 1990 to December 2001. In addition to these stations, the Western Regional Climate Center (WRCC) maintains data records from the Smoky Valley Station No. 267620 at Carvers about 6 miles west of the proposed project area. WRCC Smoky Valley Station is located at an elevation of 5,620 feet, so climate conditions at this station are similar to conditions throughout the base of Big Smoky Valley and in the study area.

Average temperatures at the Smoky Valley Station range from about 30°F in January to the 70s in July and August. **Table 3.7-3** shows the maximum, average, and minimum temperatures at the station during the period of record 1949 through October 2006. Summers are typically hot and dry except in the higher mountain ranges. The average annual precipitation is approximately 6.6 inches at the Big Smoky Valley site. Average relative humidity ranges from a low of 17 percent in the summer during the day to a high of 77 percent in spring during the night (National Oceanographic and Atmospheric Administration [NOAA] 1990). Net evaporation exceeds precipitation in the study area.

3.7.2.2 Precipitation

The Met One Rain Gage has a period of record from October 2000 to March 2006. Complete yearly records are available for the years 2001 through 2005. The average annual precipitation at the Met One Rain Gage based upon the 5 years of complete records is 5.37 inches (WMC 2008).

The Belfort Rain Station has a period of record from December 1993 to March 2006. Although complete annual records are available for the years 1994 to 1999 and 2002 to 2005, data recorded in or before 1998 are considered suspect due to problems with this station. Data from the year 1999 also are suspect because 3 consecutive months (i.e., October through December) have no measurable precipitation. Therefore, the usable and complete data years for this station are 2002 through 2005. The average annual precipitation at the Belfort Rain Station based upon 4 years of complete records is 3.88 inches (WMC 2008).

A summary of monthly precipitation and temperature data from the WRCC Smoky Valley Station is provided in **Table 3.7-3**. Because this has the longest period of record, it is most useful for evaluating baseline climatic conditions. Precipitation data collection began at the WRCC Smoky Valley Station in 1949, and data

collection continues today. Average annual precipitation during the period of record (1949 to 2006) is 6.6 inches.

Table 3.7-3
Monthly Climate Summary – Big Smoky Valley, Nevada[1]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature[2]	43.8	49.5	55.7	63.6	73.5	83.2	90.9	88.9	81.1	69.4	54.1	44.3	66.5
Average Min. Temperature[2]	16.2	20.9	25.0	30.4	38.6	46.4	53.5	51.2	42.8	32.6	22.9	16.2	33.1
Average Temperature[2]	30.0	35.2	40.3	47.0	56.1	64.8	72.3	70.0	61.9	51.0	38.5	30.0	49.8
Average Total Precipitation[3]	0.58	0.62	0.67	0.57	0.56	0.49	0.56	0.65	0.48	0.46	0.55	0.45	6.64
Average Total Snow Fall[3]	1.5	0.9	1.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.8	5.9
Average Snow Depth[3]	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] Meteorological data recorded from September 1, 1949 to October 31, 2006.
[2] °F.
[3] Inches.
Source: WRCC 2007.

The maximum annual precipitation total occurred in 1983 when 13.8 inches of precipitation was recorded. The minimum annual precipitation depth is 2.51 inches, which occurred in 1953. The wettest 5-year period occurred from 1980 to 1984 when 45.96 inches of precipitation was recorded. The driest 5-year period occurred from 1958 to 1962 when only 19.39 inches of precipitation was recorded.

A comparison between the annual precipitation in 2001 at the Met One Rain Gage and WRCC stations indicates the Met One Station recorded 6.37 inches and the WRCC Station recorded 6.48 inches of precipitation. Based on these data, it appears that precipitation in the study area is very similar to the WRCC Smoky Valley Station located in Carvers (WMC 2008).

3.7.2.3 Temperature

Temperatures in Big Smoky Valley are cool in the winter, with January having the lowest mean temperature of about 30°F and warm in the summer, with July having the highest mean temperature of about 72°F. Dry air present across the Great Basin allows for large fluctuations in daily high and low temperatures as evident in the summary data listed in **Table 3.7-3**. The maximum recorded temperature at the WRCC Smoky Valley Station is 103°F on July 10, 2002. The minimum recorded temperature is -31°F, which was recorded on December 26, 1988. Daily temperature data are being recorded at the North and South Meteorological Stations at the existing Round Mountain Mine. The average temperature at the North Meteorological Station for the period of record is 50.5°F and at the South Meteorological Station is 51.3°F (WMC 2008).

3.7.2.4 Wind

Wind speed, direction, and variability of wind direction (i.e, sigma theta) were recorded at the North and South Meteorological Stations at the existing Round Mountain Mine. Wind data collected at these stations indicate generally light winds in the study area. The average wind speed at the North Meteorological Station for the period of record is 7 miles per hour and at the South Meteorological Station is about 9 miles per hour. Data presented in the Final EIS for the Round Mountain Mill and Tailings Facility (BLM 1996) indicates that the predominant wind direction is north-south, although wind directions from the recent data are quite variable (WMC 2008).

3.7.2.5 Evaporation

Climate studies measure evaporation from an exposed water surface contained in a large pan. No pan-evaporation data have been collected in the proposed project area. In order to estimate evaporation, WRCC pan-evaporation data from other sites across Nevada were used and interpreted to estimate pan evaporation. The WRCC has pan-evaporation values available for 14 stations in Nevada. The pan-evaporation rates range from a low 37.11 inches per year at the Fallon Experimental Station to a high of 119.4 inches per year at the Las Vegas Airport (WMC 2008).

Five pan-evaporation stations with climatic characteristics similar to the study area are listed in **Table 3.7-4**. The Central Nevada Field Laboratory (CNFL) Station, which lies about 46 miles north-northwest of the study area, was considered to be the most directly comparable setting to the Round Mountain and Gold Hill areas. Accordingly, the CNFL pan-evaporation value of about 66.4 inches per year has been used for the study area.

Table 3.7-4
Comparison of Pan-evaporation Rates at Selected Nevada Sites

Station	Mean Annual Temperature[1]	Elevation[2]	Pan Evaporation[3]
Reno	50.4	4,400	59.4
Rye Patch Dam	50.7	4,160	59.4
Topaz Lake	49.7	5,020	69.0
Winnemucca	48.9	4,300	60.4
CNFL	45.2	5,960	66.4

[1] °F.
[2] Feet amsl.
[3] Inches per year.
Source: WRCC 2007.

To determine actual shallow-pool evaporation, the pan-evaporation is multiplied by a factor of 0.70. This results in an estimated open-water evaporation rate of about 46.5 inches per year.

3.7.3 Climate Change

Ongoing scientific research has identified the potential impacts of anthropogenic (i.e., man-made) greenhouse gas (GHG) emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations."

Global mean surface temperatures have increased nearly 1.8°F from 1890 to 2006. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24°N) have exhibited temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970 alone. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

In 2001, the IPCC indicated that by the year 2100, global average surface temperatures would increase 2.5 to 10.4°F above 1990 levels. The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature would not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict.

As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and document trends (USEPA 2008).

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially CO_2 and methane) from fossil fuel development, large wildfires, and activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs would have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 can influence climate for 100 years.

It may be difficult to discern whether global climate change is already affecting resources in the proposed project area. In most cases, there is more information about potential or projected effects of global climate change on resources. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change may not be measurably discernible within the reasonably foreseeable future.

3.8 Paleontological Resources

The study area and CESA for paleontological resources is the same as described for Section 3.2, Geology and Mineral Resources.

3.8.1 Affected Environment

Paleontological resources identified on public lands are considered by the BLM as constituting a fragile and non-renewable scientific record of the history of life on earth, and are thus considered to represent an important and critical component of America's natural heritage.

3.8.1.1 Regulatory Framework

The BLM manages paleontological resources under a number of Federal laws. These laws include:

1. FLPMA Sections 310 and 302(b), which direct the BLM to manage public lands to protect the quality of scientific and other values;

2. Mineral Materials Act of 1947 (30 United States Code [USC] 601) as implemented through 43 CFR 3622, which regulates the amount of petrified wood that can be collected for personal, non-commercial purposes without a permit and 43 CFR 8365.1-5, which prohibits the willful disturbance, removal, or destruction of scientific resources or natural objects.

In addition, the BLM has a Paleontological Resource Management Program, which is intended to provide a consistent and comprehensive approach to the management of paleontological resources, including the identification, evaluation, protection, and use of these resources. This program is described in the BLM Paleontological Resources Management Manual and Handbook H-8270-1 (BLM 1998).

The State of Nevada has no regulation governing the collection or preservation of fossils (NAC 2008).

3.8.1.2 Paleontological Investigations in the Study Area

The BLM Paleontology Resources Management Manual establishes a classification system for ranking paleontological areas as to their potential for noteworthy occurrences of fossils (BLM 1998). The handbook has been recently updated to adopt the Potential Fossil Yield Classification (PFYC) system to identify and classify fossil resources on Federal lands (BLM 2007a). The PFYC system is summarized briefly as follows:

> "Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources".
>
> Using the Potential Fossil Yield Classification (PFYC) system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mappable level. It is not intended to be

> applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.
>
> The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions."

The BLM intends for the PFYC System to be used as a guideline as opposed to rigorous definitions. The PFYC system has five classes of geologic units ranging from Class 1 (low to no potential) to Class 5 (very high potential). Class 1 includes igneous and metamorphic rocks.

The rocks in the proposed project area consist of metamorphosed Paleozoic sedimentary rocks, Cretaceous igneous rocks, Tertiary volcanic rocks, and both Tertiary and Quaternary alluvial sediments. All but the alluvial sediments would be placed in PFYC Class 1. No paleontologic resources have been found in the study area (BLM 1996).

3.9 Social and Economic Values

The study area and CESA for social and economic values include Tonopah and Nye County and the Big Smoky Valley communities of Round Mountain, Hadley, Carvers with limited attention to the State of Nevada, as appropriate. The rationale for the study area is that nearly 92 percent of the current RMGC workforce live in Nye County. Approximately 82 percent live in the Round Mountain/Hadley, Carvers, and Manhattan communities and over 8 percent live in Tonopah. Approximately 3 percent live in Austin; most of the remainder of the workforce are scattered throughout Nevada, although 8 percent claim primary residences in 5 other states. The primary distribution results from a combination of proximity, housing availability, and availability of public and private services.

The CESA is a combination of the immediate land area in the Big Smoky Valley adjacent to the proposed project area and affected communities within Nye County. The CESA land area in the Big Smoky Valley is bounded by SR 377, 4.5 miles south of the proposed project to the north boundary line of T11N, R43E and R44E, 4.5 miles north of the Gold Hill Area. This area includes the communities of Carvers, Hadley, and Round Mountain. Other communities in Nye County including Manhattan, Belmont, and Tonopah also are part of the CESA. Nye County government is partly supported by tax revenues from the existing Round Mountain Mine and all of Nye County is indirectly part of the CESA.

3.9.1 Population and Demography

Nye County has the largest land area of any county in Nevada, but it is the 7th largest by population with an estimated 44,795 people in 2006 (Nevada State Demographer 2007). Nevada has been one of the country's fastest growing states in recent years and Nye County is one of the fastest growing counties in the state. This is primarily because Pahrump, a city with nearly 82 percent of the county's population, and the southern part of the county are near the burgeoning Las Vegas area. Rural areas of the county, including the Big Smoky Valley and Tonopah, are in a much different situation. The Big Smoky Valley, including the towns of Round Mountain and Carvers, had its largest periods of growth in the 1980s and early 1990s; however, by the mid-1990s these communities were losing population (**Table 3.9-1**). Round Mountain's population in 2007 was estimated at 831, which is 20 percent below its population level at the 2000 census (Nevada State Demographer 2007). The City of Tonopah similarly grew rapidly in the 1980s, but the population is now estimated to be down 8 percent from 2000 and more than 30 percent from 1990. However, the County Planning Department estimates the population of the entire Big Smoky Valley at 1,767 and Tonopah at 2,870 (Nye County 2008).

Ethnically and racially, Nye County is notably less diverse than the state as a whole, with substantially fewer Black, Asian, and Hispanic residents. The county does have a higher percentage of Native Americans than the state does, with 2.3 percent, compared with 1.3 percent for the entire state (2006 estimates). Blacks represent 1.2 percent of the county population compared with 6.9 percent for the state; figures for Asians are 1.5 percent and 6.5 percent, respectively. People of Hispanic origin, of any race, comprise only 8.9 percent of the Nye County population, compared with 24.0 percent of the state (Nevada State Demographer 2006).

Table 3.9-1
Population Characteristics

Area	Year					Average Annual Change[1]			
	1980	1990	2000	2006	2007	1980-1990	1990-2000	2000-2006	2006-2007
Big Smoky Valley[2]	574	1,971	NA	1,745	1,767	13.1	--	--	1.3
Round Mountain[2,3]	NA	NA	1,036	787	831	--	--	(4.5)	5.5
Manhattan[2]	NA	NA	123	122	140	--	--	(0.1)	14.5
Tonopah	1,952	3,740	2,827	2,600	2,610	6.7	-2.8	(1.4)	0.4
Nye County	9,048	17,781	32,485	44,795	46,308	7.0	6.2	5.5	3.4
Nevada	800,508	1,201,833	1,998,257	2,626,050	2,718,337	4.1	5.2	4.7	3.6

[1] Percent.

[2] Estimates for unincorporated areas were not started until 1996.

[3] Includes the subdivision of Hadley.

Sources: Nevada State Demographer 2007; U.S. Census Bureau 2000; Nye County 2008.

3.9.2 Income

Despite the fact that mining wages and salaries are typically higher than average, per capita personal income (PCPI) in the study area is below the state level. Data from 2000 indicated a state average of $30,433; Nye County's average was $24,200, or 79.5 percent of the state level. By 2005, Nye County PCPI had risen to $28,761, which was 80 percent of the state average of $35,744 and 83 percent of the national average of $34,471. Nye County's PCPI ranked 12th in the state out of 17 counties. Nye County's average annual PCPI growth rate for the decade from 1995 to 2005 was 3.9 percent, slightly higher than the state's 3.7 percent rate, but lower than the national rate of 4.1 percent.

An estimated 11.9 percent of Nye County's population was considered to be living in poverty in 2004 according to Census estimates (U.S. Census Bureau 2006). This rate was higher than the statewide rate of 11.1 percent, but lower than the national estimate of 12.7 percent. The rate for children and youth under 18 in Nye County was much higher at 19.0 percent, which put the county higher than both the State of Nevada (15.3 percent) and the U.S. (17.8 percent) (U.S. Census Bureau 2006).

3.9.3 Economy and Employment

Nye County was created in 1864 based on its mineral wealth. Mining is still an important contributor to the county's economy. The county's other major economic base is Federal, State of Nevada, and Nye County government employment, including contractors paid by the Federal government. Nye County residents work at the Nevada Test Site, Nevada Test and Training Ranges, and at the proposed Yucca Mountain Nuclear Storage Facility (Nevada Department of Employment, Training, and Rehabilitation [NDETR] 2007). **Table 3.9-2** provides a comparison of Nye County employment by major industry with statewide employment by the same sectors. The percentage difference between the natural resources and mining

sector, professional and business services, and government sectors illustrates the significance of these economic activities on the county's economy.

Table 3.9-2
Non-agricultural Wages and Salary Employment[1] by Sector
2007

	Nevada		Nye County	
	Employees	**%**	**Employees**	**%**
Private Employment				
Goods Producing	**194,224**	**15.1**	**2,303**	**18.3**
Natural Resources and Mining	14,498	1.1	1,220	9.7
Construction	129,849	10.1	905	7.2
Manufacturing	49,877	3.9	178	1.4
Service Providing	**938,112**	**72.8**	**8,293**	**65.7**
Trade, Transportation, Warehouse, and Utilities	237,746	18.4	1,749	13.9
Information	16,049	1.2	76	0.6
Financial Activities	63,489	4.9	316	2.5
Professional and Business Services	158,576	12.3	2,867	22.7
Educational and Health Services	93,745	7.3	870	6.9
Leisure and Hospitality	339,218	26.3	2,188	17.3
Other Services	29,289	2.3	227	1.8
Subtotal	**1,132,336**	**87.9**	**10,596**	**84.0**
Public Employment				
Service Providing	**156,591**	**12.1**	**2,020**	**16.0**
Government	156,591	12.1	2,020	16.0
Subtotal	**156,591**	**12.1**	**2,020**	**16.0**
TOTAL	**1,288,927**	**100.0**	**12,616**	**100.0**

[1] 4th Quarter 2007 Averages.

Source: NDETR 2008.

RMGC is the 2nd largest private employer and the 3rd largest of all employers in the county, following only National Securities Technologies (a subsidiary of Bechtel Corporation and a major military/defense contractor) and the Tonopah-based Nye County School District. The remaining top five employers in the county include the county government, based in Tonopah, and Wackenhut Security Services (NDETR 2007).

Mining is especially prominent in the Big Smoky Valley, where the RMGC Mine employs approximately 730 people, either directly or through contractors. Employment by industry sector has not been estimated

separately for the Big Smoky Valley recently, but mining employment was estimated at over 60 percent of the valley's total employment in 1993 (BLM 1996). Based on the continuing and modestly increasing employment at the existing Round Mountain Mine, together with the scarcity of other major development in the valley, it is likely that the percentage of valley employment in mining remains at least at that level.

Nye County's workforce was estimated at 19,630 workers in July 2008, of which 17,810 employees were employed. The remaining 1,820 unemployed individuals represented a 9.3 percent unemployment rate. This level was notably higher than the 6.6 percent statewide unemployment rate and the 5.7 percent national rate (NDETR 2008). Unemployment rates at all levels had increased substantially from July 2007 when unemployment rates for Nye County, Nevada, and the U.S. were 7.2, 4.9, and 4.7 percent, respectively. The change in Nye County resulted from an 8.5 percent increase in the labor force (1,540 new workers) compared with only a 6.1 percent increase in employment (1,020 new jobs). By February 2009, unemployment rates at all three levels had risen further. Nye County's rate remained the highest at an estimated 12.9 percent, but the statewide rate was up to 10.1 percent and the national rate was up to 8.1 percent (NDETR 2009a,b). For Nye County, the 12.1 percent unemployment rate represented 2,370 workers without jobs despite a 1,290 worker decline in the labor force to 18,340 workers.

3.9.4 Housing

Consistent housing data are difficult to obtain for the Big Smoky Valley because the sources use different geographic boundaries. The Census Bureau provides data for a "census county division" (CCD) that encompasses an area of approximately 2,500 mi^2 from the north Nye County line southward 50 miles, including the Big Smoky Valley and the Monitor Valley (U.S. Census Bureau 2000). It provides a reasonable approximation of housing in the study area because the only notable residential concentrations are Round Mountain, Hadley, Carvers, and Manhattan. Data for the area are from the 2000 census. Although these data were collected 7 years ago, they are the only available vacancy rate data for the area.

The other main source of housing data is Nye County Assessor's data. These data are more geographically focused on Round Mountain/Hadley, and the Carvers area in Tax Districts 10 and 11. The data are updated annually for tax assessment purposes and are the most current available.

The 2000 census indicated that 872 housing units occur in the Round Mountain CCD. At the time, 669 units were occupied and 203 units (23.3 percent) were vacant. However, many of the vacant units were seasonal, recreational, or for occasional use only. The census indicated that vacancy rates were 2.2 percent for homeowner units, and 15.2 percent for rental units (U.S. Census Bureau 2000). Nye County had a 76 percent home ownership rate in 2000, compared with just 61 percent for Nevada as a whole.

The county assessor counted 428 housing units in the Town of Round Mountain in mid-2008, most of which are in Hadley (Nye County Assessor 2008). There are an additional 395 housing units in Tax Districts 10 and 11, which include Carvers and most of the rural housing in the vicinity (Rivero 2008). Approximately 454 lots are present in Hadley including those in the recreational vehicle (RV) park; 26 vacant lots remain within the subdivision (Nye County Assessor 2008; Kelley 2007). Approximately 15 occupied residences remain in the Town of Round Mountain (Sweeney 2007).

Round Mountain/Hadley is a community comprised mostly of mobile homes or mobile conversions, including 414 of the total 428 units (97 percent). Tax Districts 10 and 11 also are dominated by mobile homes and conversions, but not to the same extent. They have 110 residential structures, including 3 duplexes, for a total of 113 out of the 395 units (29 percent). Hadley was originally a RMGC-owned town,

and RMGC still owns and leases out approximately one-quarter of the properties in the town, but a substantial majority of the lots in the community are now owned by residents (Kelley 2007). Properties in Carvers are individually owned.

3.9.5 Community Facilities and Services

3.9.5.1 Public Utilities

The Town of Round Mountain provides water and sewage treatment services to Hadley and water only to the Round Mountain townsite. Water for Hadley comes from 2 wells with capacity to pump 1,800 gpm into the 1-million-gallon storage facility. The town has experienced no problems supplying water even in the hottest summer months (Sweeney 2007). Two springs producing 40 gpm and a well supply water for the Town of Round Mountain. The springs provide most of the needed water for the 15 remaining taps in the area; the well is used sparingly to avoid the need for additional treatment facilities (Sweeney 2007).

The Hadley sewage treatment system was designed with a capacity of 160,000 gallons per day (gpd), but continues to operate well below that level. When the Round Mountain mill was built, the town accommodated 500 construction workers with no significant problems (Sweeney 2007). Sewage at the Town of Round Mountain is handled with individual septic systems. Most Carvers residents obtain water from individual wells and treat their sewage with individual septic systems. Approximately one-third of Carvers residents obtain water from the Shoshone Estates Water System, but have individual septic systems and the Carvers RV Mobile Home Park has common systems for both water and sewage treatment (Berg 2009). Solid waste is disposed of at a county operated landfill approximately 0.25 mile northeast of SR 376 on the north side of County Road 875 into the Town of Round Mountain. Electricity and phone service are provided to Big Smoky Valley residents by NVEnergy and Nevada Bell, respectively.

3.9.5.2 Public Safety

Law enforcement in Big Smoky Valley is provided by the Nye County Sheriff's Department. Calls are dispatched from Tonopah through the substation at Hadley. A mutual aid agreement with Lander County provides for emergency back-up if needed.

The Town of Round Mountain provides fire protection for the community. The Round Mountain Fire Department has a paid chief, but the 15 fire fighters are all volunteers (Sweeney 2007). The department responds to motor vehicle accidents in its service area with a fire rescue unit. Services are dispatched out of the town's security building in Hadley. An informal aid agreement with RMGC provides for emergency assistance from mine personnel and equipment when needed. The existing Round Mountain Mine has its own ambulance and fire fighting equipment, intended primarily for use on RMGC property, but they do provide emergency back-up off site when it is necessary and appropriate to do so.

A volunteer fire department and Nye County Ambulance Service are located in Carvers and Hadley. Ambulance volunteers are all Emergency Medical Technician (EMT) certified.

The nearest hospital is Nye Regional Medical Center in Tonopah. Local medical service is provided to mine workers and their families by the Smoky Valley Outpatient Clinic, operated by RMGC at the mine site. A physician's assistant, a medical assistant, a registered nurse, and a medical clerk provide services, supervised by a physician from the Regional Medical Center. Families not affiliated with the mine have to go outside the Smoky Valley for all medical services.

3.9.5.3 Education

Schools in the study area are operated by the Nye County School District with administrative offices in Tonopah and Pahrump. The district serves the entire county and had an official 2007-08 enrollment of 6,532 pupils from pre-kindergarten through 12th grade. District wide, elementary student to teacher ratios were 15:1 for kindergarten and ranged from 18:1 to 24:1 for grades 1 through 5 (Nye County School District 2008).

The district's most recent annual budget called for expenditures of slightly over $102 million, including $13.1 million for capital projects and over $16.5 million for debt service (Nye County School District 2008).

Round Mountain has an elementary school for grades K-5 and a middle/high school for grades 6 through 12, both of which are located in Hadley. Enrollment figures for 2007-2008 were 175 students in the elementary school and 193 students in the middle/high school. Round Mountain schools serve the entire Big Smoky Valley north to the county line (Nye County School District 2008).

3.9.6 Public Finance

The two main general governmental entities influencing the study area are Nye County and the Town of Round Mountain. The county has a professional county manager and a five member Board of Commissioners, who oversee the operations of the county, including administration, law enforcement, courts, and public works. They also administer the budgets of smaller communities, including Beatty, Gabbs, and Manhattan. Round Mountain has a town manager and a three-member governing board.

Local government finance in Nevada is a complex combination of locally derived and state shared revenues. Local revenues are primarily ad valorem property taxes on real and personal property and the net proceeds of mines in the jurisdiction. State shared revenues include sales, motor vehicle, fuel, and gaming taxes. State revenue sharing addresses significant economic disparities between the relatively wealthy urban centers of Reno and Las Vegas and the lower income levels commonly associated with rural agricultural and mining communities.

Nye County has approved a deficit budget for the most recent fiscal year (i.e., 2007-08), which includes estimated revenues of approximately $76.4 million and estimated expenditures of approximately $80.4 million. The budget assumes the $4.0 million shortfall would be covered by drawing down reserves. The 2 largest revenue sources for the county are projected to be property taxes at $18.7 million and intergovernmental transfers of $37.9 million. **Table 3.9-3** illustrates the major features of the county budget.

Nye County has experienced a substantial increase in its property tax base in recent years, due in part to the rapid growth in the Pahrump area. The county anticipates exceeding its ad valorem revenue cap for the current fiscal year and budgeted a nearly $5.8 million for an ad valorem tax abatement as a result. While the county benefits from tax on net proceeds of mines, it is less than 5 percent of the anticipated property tax revenue from other sources. Net proceeds of mines actually declined by 12 percent from fiscal year 2004-2005 to fiscal year 2006-2007 and are projected to decline further while total assessed value increased by over 33 percent. Nye County's ad valorem tax rate is $1.3528 per $100 of assessed value.

Table 3.9-3
Nye County and The Town of Round Mountain Budgets
Fiscal Year 2007-2008

	Governmental Fund Types and Expendable Trust Funds	
	Nye County	**The Town of Round Mountain**
Revenues		
Property Taxes	18,708,572	207,013
Other Taxes	0	0
Licenses and Permits	470,000	3,000
Intergovernmental Resources	39,721,649	339,588
Charges for Services	8,964,204	20,500
Fines and Forfeits	479,500	2,000
Miscellaneous	8,076,876	14,000
Total Revenues	**76,420,801**	**586,101**
Expenditures		
General Government	23,391,793	433,633
Judicial	6,375,990	0
Public Safety	16,419,355	183,730
Public Works	8,577,880	162,774
Sanitation	0	0
Health	3,681,635	0
Welfare	1,957,324	0
Culture and Recreation	416,813	379,682
Community Support	531,494	0
Intergovernmental Expenditures	202,956	0
Capital Projects	15,273,827	0
Contingencies	0	31,033
Utility Enterprises	0	0
Hospitals	0	0
Transit Systems	0	0
Airports	0	0
Other Enterprises	0	0
Debt Service – Principal	2,202,194	0
Interest Cost	390,920	0
Contingency	1,023,973	0
Total Expenditures	**80,446,154**	**1,190,852**
Excess Revenues Over (Under) Expenditures	**-4,025,353**	**-604,751**

Source: Nye County 2006; RMGC 2008a.

The Town of Round Mountain's budget also projects a deficit for fiscal year 2007-2008, although at a much higher percentage of its total budget. The town's largest revenue sources also are property taxes and intergovernmental transfers. The Town of Round Mountain benefits from having the existing Round Mountain Mine in its taxing district. Taxes on net proceeds of minerals provide nearly 16 percent of the town's total anticipated revenues for the year and over 44 percent of its property tax revenues. The Town of Round Mountain's ad valorem tax rate is $0.3164 per $100 of assessed value.

3.10 Recreation

The study area for recreation includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor) and the immediate surrounding land.

The CESA for recreation is defined as a block of land encompassing the Big Smoky Valley and adjacent land in the Toiyabe and Toquima ranges from 15 miles south to 39 miles north of the Town of Round Mountain. The CESA also includes some recreational sites near to but outside the CESA. Within the CESA, canyons with road access, recreational areas and recreational sites in the Smoky Valley, and two mountain ranges could be affected by the proposed project. Of the above elements, those that are proximal to the study area would have the highest potential to be affected. Notable recreational areas and sites within the CESA include the following:

- Peavine Canyon and campground in the southern Toiyabe Range;
- Arc Dome Wilderness;
- Toiyabe Crest National Recreational Trail;
- Kingston Recreation Site, the Kingston Ranger Station and Kingston Creek, and Grove Lake;
- Spencer Hot Springs in the northern Smoky Valley;
- Toquima Cave in the northern Toquima Range;
- Diana's Punch Bowl, a hot springs in the Monitor Valley; and
- The historic towns of Belmont and Manhattan in the southern Toquima Range.

There are no developed recreation facilities in close proximity to the proposed project area. Four developed campgrounds occur in the mountains of the Toiyabe National Forest, three of which are in the Toiyabe Range and one in the Toquima Range. Kingston Campground (CG) is located in the Toiyabe Range approximately 30 miles north of the study area. It has 12 camp sites and can accommodate trailer camping as well as tent camping. Kingston CG is accessible from the Big Smoky Valley. Columbine CG is approximately 9 miles northwest of the study area; it also is in the Toiyabe Range and 1 of the closest developed campgrounds to the study area, but it is located on the western side of the Arc Dome Wilderness and is accessible only from the Reese River Valley, not from Big Smoky Valley. Columbine CG has only three units and does not accommodate trailer camping. Peavine CG is approximately 8 miles west of the study area (17 miles by road) in the Toiyabe Range. It has 10 camp sites and accommodates both trailer and tent campers. Peavine is accessible from the lower Big Smoky Valley. Pine Creek CG is the only developed campground in the study area located in the Toquima Range. Pine Creek CG is approximately 10 miles east of the study area, but is only directly accessible from Monitor Valley on the eastern side of the Toquima Range. Pine Creek is the largest campground in the study area with 21 sites, at least some of which can accommodate both trailers and tents.

State parks do not occur in the study area, but the Belmont Court House State Historical Site is located in the southeastern corner of the study area at the Town of Belmont, which is on the southeastern edge of the

Toquima Range and is accessible from the Monitor Valley. The partially restored courthouse was the seat of Nye County government until 1905.

The nearest developed recreation facilities to the study area are town and school district facilities in Hadley, and SR 376 rest area in Carvers. The Carvers rest area is essentially a roadside picnic area with temporary parking and restrooms. Hadley facilities include a park, ballfield, golf course, swimming pool, tennis courts, community center, and gym.

In addition to the developed campgrounds, camping also occurs in several canyons providing access into the mountains. Some of these include Wall Canyon, Jett Canyon, and South Twin in the Toiyabe Range and Mariposa, Shoshone Canyon, and Jefferson Canyon in the Toquima Range. Undeveloped camping areas are often associated with trailheads. There is likely some camping occurring on BLM-administered lands as well as on the Toiyabe National Forest.

Eighteen or more designated trailheads occur in the study area, half of which are accessible from the Big Smoky Valley side of the two mountain ranges. The nearest of these to the study area is at the mouth of Jett Canyon, directly across the valley to the west. The Toiyabe Crest National Recreation Trail loops through the Toiyabe National Forest and Arc Dome Wilderness directly west of the proposed project area. The southern terminus of the trail is at South Twin; the northern terminus is at the Kingston Trailhead. Numerous trails wind throughout the mountainous portions of the study area, many of which do not have designated trailheads.

Hunting, fishing, horseback riding, hiking, picnicking, camping, and off-road vehicle use are popular activities in the area or CESA. Several ghost towns and historic mining sites also occur in the area that attract history buffs. Hunting pressure in the study area is believed to be low, limited by difficult access, limited wildlife values, and a low number of hunting tags in the area. Some deer hunting does occur and a small number of bighorn sheep tags are issued annually by NDOW. There is also some predator hunting, primarily for coyotes and mountain lions. The Toiyabe Range has more hunting tags issued, although the Toquima Range is more popular for deer hunting (Williams 2007). Most of the BLM-administered land in the Big Smoky Valley is open to off-highway vehicles, with the exception of a narrow strip of land west of SR 376 and north of Carvers, which has seasonal restrictions on competitive events. Data on recreation use in the study area and CESA are not available, but use levels are estimated to be low most of the time.

3.11 Wilderness

The study area for wilderness includes the Arc Dome Wilderness in the Toiyabe Range on the west flank of Big Smoky Valley and the Alta Toquima Wilderness in the Toquima Range to the east. However, based on air quality impacts, the study area also includes the Table Mountain Wilderness approximately 20 miles to the east of the proposed project area.

The CESA for wilderness is defined as the Arc Dome Wilderness in the Toiyabe Range 8 miles to the west and northwest of the Gold Hill and Round Mountain areas and the Alta Toquima Wilderness only 2 miles to the east of the Gold Hill Area and 5 miles northeast of the Round Mountain Area.

There are no designated wilderness or wilderness study areas on BLM-administered public lands in the study area. There are two designated wilderness areas on USFS-managed public lands near the proposed project area. The 115,000-acre Arc Dome Wilderness in the Toiyabe Range is the largest wilderness in Nevada. It has 90 miles of trails, including a 32-mile stretch of the Toiyabe Crest National Recreation Trail. The wilderness boundary runs within 1 mile of SR 376 near Carvers and is approximately 5.5 miles from the proposed project area. There are several access routes to the wilderness from both the Big Smoky Valley side and from the Reese River Valley on the west side. The primary access points and routes from Big Smoky Valley include Ophir Summit, North and South Twin Rivers, Tom's Canyon, and Peavine Canyon. Other, more difficult routes, are up Jett, Pablo, and Wall canyons. The Arc Dome Wilderness is known for rugged scenery and numerous large and small wildlife species, including a band of desert bighorn sheep.

The Alta Toquima Wilderness encompasses 35,860 acres in the Toquima Range on the eastern side of Big Smoky Valley. The wilderness boundary is located 2 miles east of the proposed project area. The wilderness contains Mount Jefferson, the highest peak in the area at 11,941 feet amsl. It also contains the 4,953-acre Mount Jefferson Research Natural Area and the Alta Toquima Archaeological Site, the highest known Native American village site in North America. The Alta Toquima Wilderness also is notable for rugged, high elevation topography and a large band of reintroduced desert bighorn sheep. The wilderness is accessible from all sides, but the primary access points are Moore's Creek to the north, Pasco Canyon and Pine Creek to the east, and Jefferson Summit and Windy Pass to the south. In addition to the designated wilderness, an additional 34,207 acres have been identified by the USFS as "wilderness capable" through the Forest Plan Revision process, meaning the areas have attributes that could qualify for future designation as part of the wilderness if additional wilderness studies were initiated (USFS 2006). "Wilderness capable" areas have no official status under the Wilderness Act (Williams 2007). Existing RMGC operations are visible from the "wilderness capable" area as well as from some locations in the designated wilderness, especially from high points in the terrain.

3.12 Visual Resources

The study area for visual resources encompasses the viewshed from which the proposed project facilities would comprise a notable feature in the viewers landscape. Due to the magnitude of visible land forms, the viewshed extends beyond the typical 15 mile limit to approximately 20 miles. The CESA encompasses an area from which the proposed project facilities would be visible. This area includes the crest of the Toiyabe and Toquima ranges, north to the Lander County line, and south approximately 12 miles to the topographic divide crossing SR 376.

The BLM is responsible for identifying and protecting scenic values on public lands under several provisions of the FLPMA and NEPA. The BLM Visual Resource Management (VRM) system was developed to facilitate the effective discharge of that responsibility in a systematic, interdisciplinary manner. The VRM system provides the methodology to inventory existing scenic quality; assign visual resource inventory classes based on a combination of scenic values, visual sensitivity, and viewing distances; and assign visual management objectives. Four visual resource classes have been established to: 1) serve as an inventory tool portraying the relative value of existing visual resources and 2) serve as a management tool portraying visual management objectives for the respective classified lands. Management objectives for each of the visual resource classes are listed as follows:

Class I Objective. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective. The objective to this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III Objective. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV Objective. The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Rehabilitation Areas. Areas in need of rehabilitation from a visual standpoint are flagged during the inventory process. The level of rehabilitation is determined through the RMP process by assigning the VRM class approved for that particular area.

The VRM system also includes a contrast rating procedure for evaluating the potential visual consequences of a proposed project or management activity. The VRM system provides the basic approach for evaluating direct visual impacts as well as potential cumulative visual impacts associated with the proposed project.

The area of influence is defined as the viewshed of the proposed project, or the area from which the proposed project can be seen. The viewshed includes an area bounded by mountain ranges on the east and west and less well-defined topographic rises in the Big Smoky Valley floor approximately 30 miles to the north near the Lander County line, and south of the study area on SR 376 at a distance of approximately 12 miles. The results of the inventory process were used by the BLM to determine the visual management classes for lands in the study area. Landscape characteristics contributing to the inventory process for the study area are described below, followed by discussion of VRM class designations for the visual area of influence.

The proposed project is located in the Basin and Range Physiographic Province, as defined by Fenneman (1938). The province is characterized by extensive vistas, alternating valleys and north-south trending mountain ridges.

The topography of the Big Smoky Valley in the proposed project vicinity is nearly flat in the valley floor and moderately sloping from the bottom of the valley to the edge of the foothills to the east. The existing Round Mountain Mine is situated at the edge of the Toquima Range where the irregularly rounded pyramidal forms of the foothills rise up from the valley floor toward the summit of Mount Jefferson and Shoshone Mountain. Elevations within the viewshed of the study area range from approximately 5,540 feet amsl in the valley, to 10,900 feet amsl on top of Shoshone Mountain and, 11,949 feet amsl at the summit of Mount Jefferson. Surface soils and rocks in the proposed project vicinity generally range from dark umber to buff to grayish-tan hues of light-to-medium-to-dark values. The proposed project lies on the valley floor near the foothills between Mariposa Canyon and Willow Creek.

The existing Round Mountain Mine exhibits strong color and landform contrast with the natural surroundings and moderate to strong line and surface texture contrast. The browns, light tans, and golds of the recently mined waste rock on dumps and fine material on leach pads contrast moderately to strongly in comparison with the surrounding natural landforms and vegetation.

Vegetation in the proposed project area consists of saltbrush community on the alluvial fans/pediments and sagebrush community in the eastern foothills of the Toquima Range. Grasses are short and typically sparse, reflecting the arid conditions of the region. A narrow band of riparian vegetation occurs along Jefferson Creek, which is located between the Round Mountain and Gold Hill areas. Vegetation colors in the valley during the growing season range from silvery gray-green to medium olive and during the dormant seasons vegetation colors range from silvery gray-green provided by shrubs to tans, buffs, umber, and golds provided by grasses and forbs. Forested and pinyon-juniper woodland areas located in the nearby foothills and mountains have darker, bluer-green, and dark olive vegetation colors.

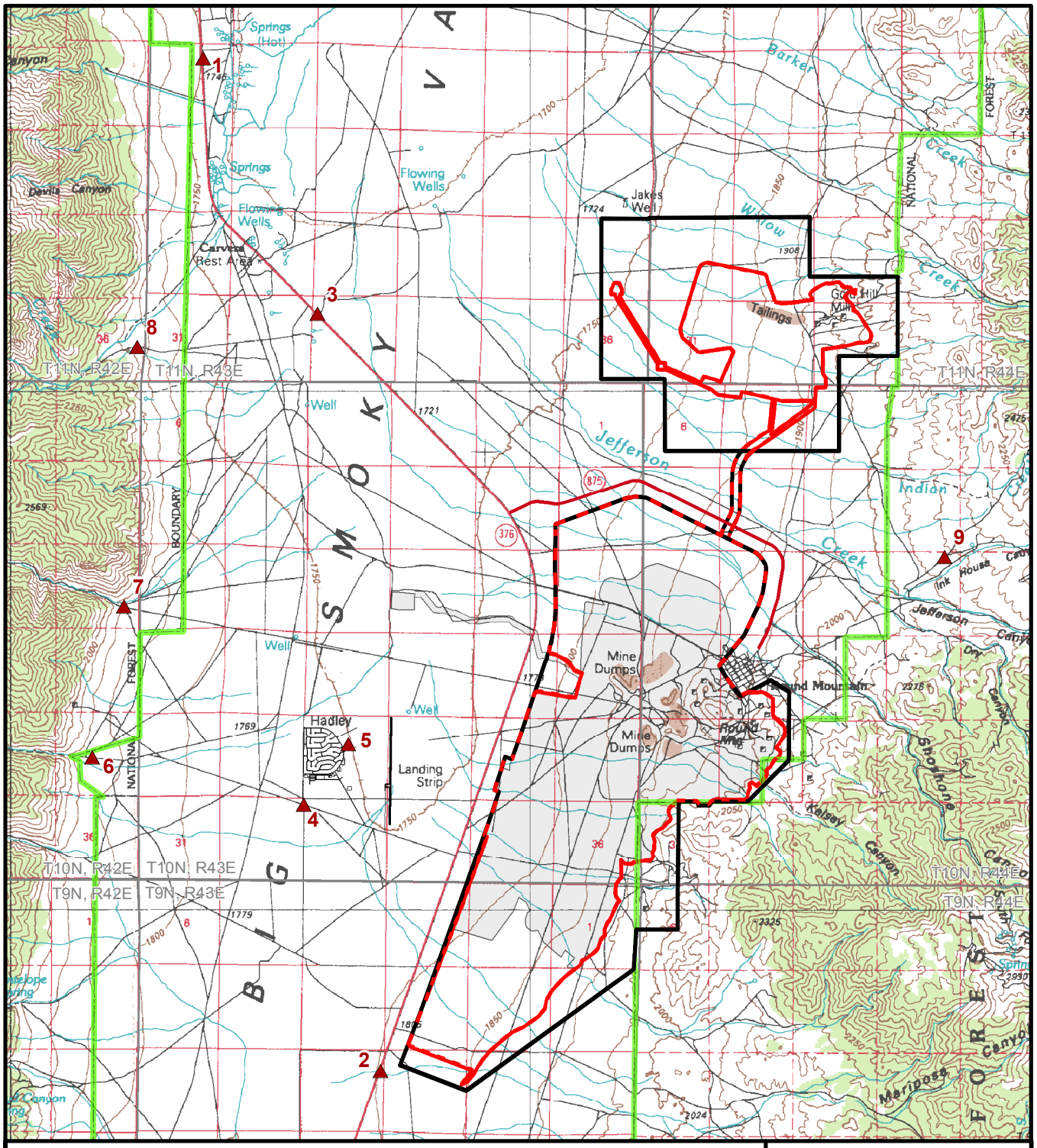
Structures in the visual area of influence are geometric in form, limited mainly to ranch, second-home, and year-around residences in the Big Smoky Valley and in Round Mountain, Hadley, and Carvers. The residential communities are comprised of low-lying clusters of small buildings with little vertical relief except for a few taller trees in Carvers, Hadley, and Round Mountain. The residential communities are more notable for color contrast than for discernible structural character. Although larger structures associated with the existing Round Mountain Mine are present in the proposed project vicinity, the majority of these structures are screened by waste rock dumps and leach pads from public view.

The Toiyable Dome Summit area of the Toiyabe Range located west of the Big Smoky Valley and the Mount Jefferson area, and Alta Toquima Wilderness of the Toquima Range located east of the of the study area have been designated as having outstanding scenery (i.e., Class A). The north and south areas of the

Toquima Range were designated as having moderately high scenic value (i.e., Class B). The remainder of the Big Smoky Valley floor was designated as having common scenic quality (i.e., Class C).

The BLM has identified one VRM class (i.e., IV) and a visual rehabilitation area (i.e., existing disturbance in the Round Mountain Area) within the proposed project vicinity. The existing Round Mountain Mine and the Round Mountain townsite are located in the rehabilitation area. Designation of a visual rehabilitation area indicates the area should be managed to improve the existing visual condition. In this case, the rehabilitation area is targeted for management to the standards of VRM Class IV, in keeping with other areas of the valley floor having similar visual characteristics. Mountainous areas to the east of the study area are rated as Class II areas commensurate with their higher scenic quality ratings.

Nine Key Observation Points (KOPs) have been identified in the visual area of influence, which are illustrated in **Figure 3.12-1**. KOP locations are utilized for analyzing detailed landscape character in the proposed project vicinity and for comparing those with the characteristics of the proposed project. Factors considered in selecting KOPs include angle of observation, number of viewers, length of time the proposed project is in view, relative project size, season of use, and light conditions (BLM 2007b).



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Key Observation Point
- National Forest Boundary

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.

N

0 0.5 1 2 Miles

Round Mountain Expansion Project

Figure 3.12-1

Key Observation Points within the Project Vicinity

05/25/2009

3.13 Soils and Watershed

The study area for soils and watershed would encompass the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor). The CESA for soils and watershed is defined as the proposed project area and the Smoky Valley from SR 377, approximately 4.5 miles south of the proposed project area, to the north boundary line of T11N, R43E and R44E, approximately 4.5 miles north of the Gold Hill Area. The CESA is approximately 19 miles north to south and from 6 to 10 miles east to west across the valley. The cumulative impact assessment would include surface disturbances and water management activities associated with the proposed project and interrelated actions.

The soils formed by alluvial processes mainly from volcanic and sedimentary parent material. The alluvial fans are typically coarse textured with gravelly and cobbly surfaces and stratified gravelly and cobbly horizons. These soils are highly alkaline, low in organic matter, and often have saline or sodic subsoils. The valley floor is comprised of finer textured materials forming from alluvial sediments. These soils are often saline-alkali affected.

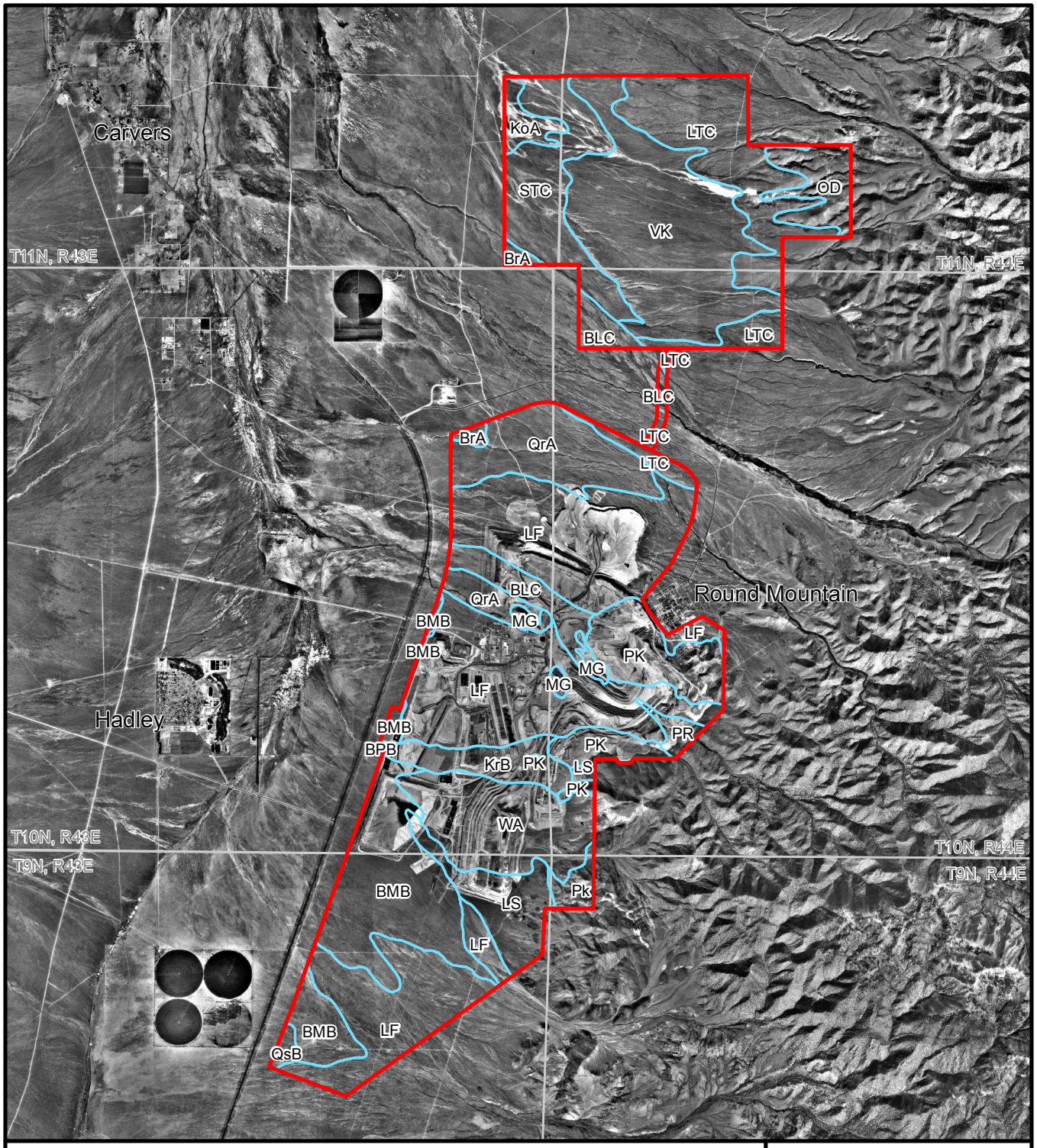
The soils information for the study area is based on Soil Survey Geographic (SSURGO) database review and analyses (U.S. Department of Agriculture Natural Resources Conservation Service [USDA NRCS] 2007). The distribution of soils within the proposed project area is illustrated in **Figure 3.13-1**.

The study area lies within the Great Basin Section of the Basin and Range Province of the Intermountain Plateaus (USDA NRCS 2006a). The study area is located in an internally drained valley with broad alluvial fans, bordered by steep mountain ranges and smaller local isolated mountains and hills.

3.13.1 Soils

The soils in the study area are highly varied and range in depth from shallow (i.e., less than 20 inches) to very deep (i.e., greater than 60 inches). The shallow soils lie to the east of the study area at the base of the Toquima Range. The study area is dominated by soils that have low organic matter content reflecting poor nutrient status. Soils along ridge tops and slopes tend to be shallow with coarser textures. These soils are typically rocky and have coarse textured surfaces. The alluvial fans along the valley bottoms include deep, coarse textured soils whereas floodplains include deep, fine textured soils, which formed in alluvium from mixed bedrock types. The valley floor exhibits poorly drained soils with high water tables, often richer in organic matter than the soils of the upland slopes and farms.

Table 3.13-1 summarizes the physical and chemical characteristics and reclamation suitabilities of soil map units that occur within the proposed project area. Both the Round Mountain and Gold Hill areas have been previously disturbed by historic and recent mining activities. The proposed Round Mountain Mine expansion area is dominated by four soil types. The Lathrop and Bluewing soils are very deep and occur on fan pediments in the southern portion of the study area. These soils are moderately susceptible to wind and water erosion. Lathrop soils are well drained and have a gravelly loam surface and clay loam upper subsoil that overlies a very cobbly sand. Bluewing soils consist of an extremely gravelly coarse sand that is excessively drained. Laxal soils occur to a smaller extent on the lower southeastern portion of the study area. These soils have a gravelly loam surface overlying a stratified, very gravelly loamy coarse sand to very gravelly sandy loam.



Legend

Proposed Project Boundary

Soil Map Unit Boundaries

Notes: Soil map units are listed in **Table 3.13-1.**
Mined areas have been altered
from displayed soil map unit to MG (Mine Dump).

Source: NRCS 2007.

N

0 0.5 1 2 Miles

Round Mountain Expansion Project

Figure 3.13-1

Soil Types within the Proposed Project Boundary

05/25/2009

Table 3.13-1

Physical and Chemical Characteristics of Soils within the Proposed Project Area

MUID	Map Unit Name	Horizon	Acres	Depth		Geomorphic Description	Erosion Hazard of Barren Surface		Topsoil Suitability	Limiting Factors[4]	RSD[5]
				Top	Bottom		Wind[2]	Water[3]			
VK	Vigus-Koyen association: Vigus (60%), 0 to 8 percent slopes	H1	2,037	0	7	Fan piedmonts, fan remnants	Moderate	Slight	Poor	Na, A, OM, D, R	13
		H2		7	13						
		H3		13	60						
VK	Vigus-Koyen association: Koyen (25%), 2 to 4 percent slopes	H1		0	3	Fan piedmonts, inset fans	Moderate	Severe	Fair	OM, Na, C, R	17
		H2		3	17						
		H3		17	44						
		H4		44	60						
WA	Wardenot gravelly fine sandy loam, 0 to 8 percent slopes	H1	993	0	5	Alluvial fans, piedmonts	Moderate	Slight	Fair	OM, Na, R, D, SD	0
		H2		5	60						
BLC	Bluewing very gravelly sand, 0 to 8 percent slopes	H1	446	0	8	Fan piedmonts, inset fans	Moderate	Slight	Poor	SD, D, OM, R	0
		H2		8	60						
BMB	Bluewing gravelly loamy sand, 0 to 4 percent slopes	H1	1,553	0	8	Fan piedmonts, inset fans	Moderate	Moderate	Poor	SD, D, OM, R	0
		H2		8	60						
BPB	Broe gravelly fine sand, 0 to 4 percent slopes	H1	1	0	2	Fan piedmonts, fan remnants	Severe	Moderate	Poor	E, OM, R	24
		H2		2	24						
		H3		24	60						
BrA	Broyles fine sandy loam, 0 to 2 percent slopes	H1	73	0	13	Fan piedmonts, fan remnants	Moderate	Severe	Poor	Na, A, OM, S, R	13
		H2		13	60						
KOa	Koyen sand, 0 to 2 percent slopes	H1	152	0	4	Fan skirts, piedmonts	Severe	Moderate	Poor	E, OM, R, C, Na	14
		H2		4	14						
		H3		14	60						

Table 3.13-1 (Continued)

MUID	Map Unit Name	Horizon	Acres	Depth[1] Top	Depth[1] Bottom	Geomorphic Description	Erosion Hazard of Barren Surface Wind[2]	Erosion Hazard of Barren Surface Water[3]	Topsoil Suitability	Limiting Factors[4]	RSD[5]
KrB	Koyen fine sandy loam,	H1	374	0	4	Fan skirts,	Moderate	Severe	Fair	OM, Na,	14
	2 to 4 percent slopes	H2		4	14	piedmonts				C, R	
		H3		14	60						
LF	Lathrop-Bluewing association:	H1	4,381	0	3	Fan	Moderate	Moderate	Poor	A, OM,	13
	Lathrop (80%),	H2		3	13	piedmonts,				SD, D,	
	0 to 4 percent slopes	H3		13	32	fan remnants				R, Na	
		H4		32	60						
LF	Lathrop-Bluewing association: Bluewing (15%),	H1		0	3	Fan piedmonts,	Moderate	Moderate	Poor	SD, D,	0
	0 to 8 percent slopes	H2		3	60	inset fans				OM, R	
LS	Laxal-Rock outcrop complex: Laxal Outcrop (70%),	H1	525	0	10	Inset fans,	Moderate	Severe	Poor	A, OM, D, R,	10
	2 to 8 percent slopes	H2		10	60	piedmonts				S, C	
LTC	Lyda very gravelly fine sandy	H1	1,462	0	4	Fan	Moderate	Slight	Poor	D, A,	12
	loam,	H2		4	12	piedmonts,				OM, Na,	
	2 to 8 percent slopes	H3		12	14	fan remnants				R, Clay	
OD	Old Camp-Rock outcrop complex:	H1	358	0	1	Hills	Moderate	Moderate	Poor	D, BR,	0
	Old Camp (40%),	H2		1	4					OM, R,	
	30 to 50 percent slopes	H3		4	8					Slope	

Table 3.13-1 (Continued)

MUID	Map Unit Name	Horizon	Acres	Depth[1] Top	Depth[1] Bottom	Geomorphic Description	Erosion Hazard of Barren Surface Wind[2]	Erosion Hazard of Barren Surface Water[3]	Topsoil Suitability	Limiting Factors[4]	RSD[5]
OD	Old Camp-Rock outcrop complex:	H1		0	3	Fan	Moderate	Moderate	Poor	D, BR,	0
	Pintwater (20%),	H2		3	17	piedmonts,				OM, R,	
	15 to 50 percent slopes	H3		17	21	Fan remnants				Slope	
PK	Pintwater-Rock outcrop complex:	H1	928	0	3	Hills	Moderate	Moderate	Poor	D, BR,	0
	Pintwater (50%),	H2		3	17					OM, R,	
	15 to 50 percent slopes	H3		17	21					Slope	
PR	Pumel-Rock outcrop complex:	H1	88	0	2	Hills	Moderate	Moderate	Poor	D, BR,	0
	Pumel (70%),	H2		2	5					OM, C,	
	2 to 15 percent slopes	H3		5	9					R, Slope	
QrA	Quima coarse sandy loam,	H1	952	0	5	Fan piedmonts,	Moderate	Slight	Fair	OM, R	60
	0 to 2 percent slopes	H2		5	60	fan remnants					
QsB	Quima fine sandy loam,	H1	49	0	5	Fan piedmonts,	Moderate	Moderate	Fair	OM, R	60
	2 to 4 percent slopes	H2		5	60	fan remnants					
STC	Stumble loamy fine sand,	H1	895	0	8	Piedmonts,	Severe	Moderate	Poor	SD, E,	60
	0 to 8 percent slopes	H2		8	60	sand sheets				OM, D	
MG	Mine dumps		112						Poor		0

[1] Inches.

[2] Wind erosion hazard class based on Wind Erodibility Group Rating.

[3] Water erosion hazard class determined from Soil Erodibility Factor (kilowatt [kw] and slope.

[4] Na = Sodium Content; A = High Alkalinity; OM = Low Organic Matter; D = Droughty; C = High Carbonates; E = Erosion; S = Salinity; R = Rock Fragments; BR = Depth to Bedrock; SD = Too Sandy

[5] RSD = Recommended Soil Salvage Depth in inches.

Note: Map units acreages are based on the mapped historic soils, where soils have been affected by mining operations, the map unit has been altered to mine dumps.

Source: USDA-Soil Conservation Service (SCS) 1980.

The subsoil is saline, which could negatively affect re-vegetation potential if salvaged. The northwestern portion of the study area is dominated by Quima coarse sandy loam. This is a very deep, well drained, alluvial soil derived from granitic rocks. The northeastern portion of the study area is the Lathrop-Bluewing association.

The finer-textured alluvial overburden material from the Round Mountain Pit has been recovered and used successfully as growth media. Additional growth media in the Round Mountain Area consists of sandy and gravelly soil materials that would be stripped and stockpiled. These materials are similar in texture to selected pit alluvium. Revegetation efforts on the north, south, and off-load dumps have demonstrated successful growth media handling and reseeding practices that fulfill the criteria identified in the reclamation permit.

The proposed Transportation/Utility Corridor includes Lyda very gravelly fine sandy loam and Bluewing very gravelly sand soils. Lyda soils have a fair rating for roadfill. The limiting feature is the shrink-swell capacity due to the clay loam subsoil. Bluewing soils have a good rating as a source of roadfill.

The Gold Hill Area is dominated by the Vigus-Koyen Association. The Vigus soil comprises 60 percent of the association. The Vigus soil is derived from mixed alluvium and is well drained. It has a gravelly fine sandy loam topsoil over a fine sandy loam upper subsoil. The lower subsoil is a stratified, gravelly loamy sand to sandy loam and is sodic, which could negatively affect re-vegetation potential if salvaged. Koyen soils are derived from mixed alluvium and are well drained. The soil texture at the surface is a fine sandy loam overlying an upper sandy loam subsoil. The lower subsoil transitions from a stratified gravelly loamy sand to a loam subsoil. Stumble loamy fine sand covers the western portion of the Gold Hill Area. Stumble soils are derived from eolian sands and are somewhat excessively drained. The Lyda very gravelly fine sandy loam and Old Camp-Rock Outcrop complex occur in the eastern portion of the Gold Hill Area. Lyda soils are derived from mixed alluvium and are well drained. These soils have a very gravelly fine sandy loam surface overlying a very gravelly clay loam subsoil, which includes a root restrictive duripan at 8 to 14 inches. Old Camp soils are derived from residuum and colluvium derived from volcanic rocks. These are shallow soils that occur on steep slopes along the extreme eastern portion of the Gold Hill Area. Slopes range from 30 to 50 percent. The surface texture is very gravelly fine sandy loam overlying a very gravelly clay loam subsoil.

The Gold Hill Pit alluvium differs from the Round Mountain Pit alluvium due to different geologic parent materials. Limited testing performed by RMGC on the Gold Hill alluvium revealed fine textured lower alluvium with sodic properties. A sample from the upper alluvium demonstrates saline-sodic properties. Another sample, although droughty (coarse-textured) did not reveal chemically undesirable results. The upper alluvium samples were identified as loamy sands, so textural differences were not evident.

3.13.2 Watershed

The Big Smoky Valley forms a semi-enclosed internally drained valley basin, trending north-northeast by south-southwest. The watersheds within the study area are found in the Central Region – Hydrographic Basin 10. The watersheds are designated as Northern Big Smoky Valley – 137B and Tonopah Flat – 137A.

The study area is located on an alluvial fan drained by numerous ephemeral drainages that originate in the Toquima Range to the east and terminate within the Big Smoky Valley, which slopes gently downward to the north. These drainages typically flow during precipitation events. The flow often infiltrates the alluvial fans before reaching the valley floor. The surface drainage of the study area displays the shallow, radial pattern of channel distributaries typical of alluvial fans near mountain faults in the Basin and Range Province (National Research Council [NRC] 1996). Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, provides detailed information regarding surface waters within the proposed project vicinity.

3.14 Vegetation

The study area for vegetation is the maximum 10-foot groundwater drawdown isopleth (**Figure 4.3-14**), which includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor).

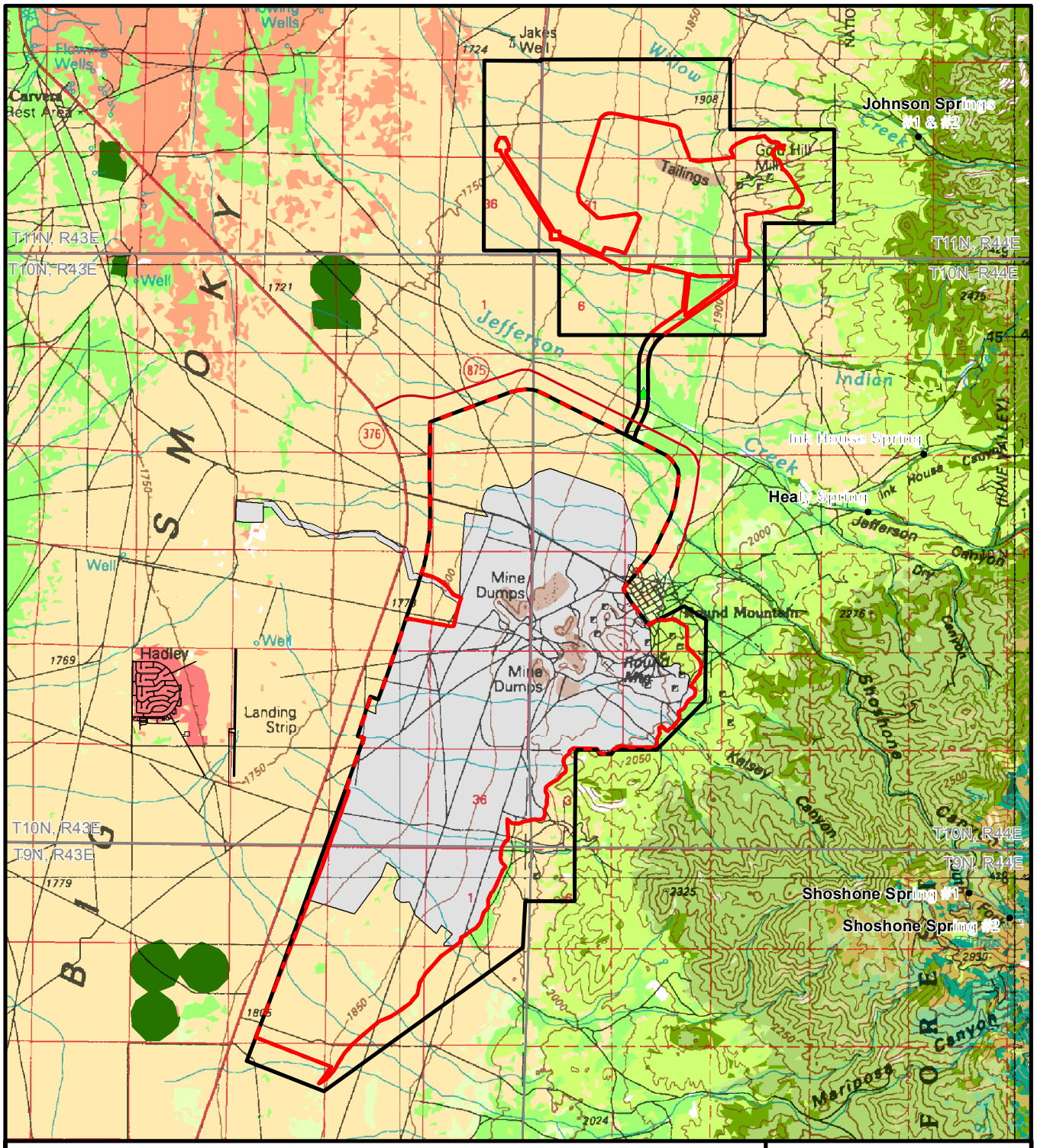
The CESA for vegetation is defined as the Big Smoky Valley from SR 377, approximately 4.5 miles south of the proposed project area, to the north boundary line of T11N, R43E and R44E, approximately 4.5 miles north of the proposed project area. The CESA is approximately 19 miles north to south and from 6 to 10 miles east to west across the valley. The cumulative impact assessment would include surface disturbances and water management activities associated with the proposed project, interrelated actions, and riparian habitat within the modeled 10-foot groundwater drawdown area for the proposed project.

The study area is located entirely within the Big Smoky Valley Basin floristic region. This region is characterized by large, extensive valleys located between the Toquima Range to the east and the Toiyabe Range to the west. Vegetation types, acreage calculations, and community characterizations were compiled based on aerial photograph interpretation, Southwest Regional Gap Analysis Project (SWReGAP) Land Cover descriptions, NRCS soil survey ecological site characterizations, and the results of site-specific vegetation studies, which were conducted in 2001 and 2003 for the Gold Hill Exploration Project and in 2006 for the proposed project (USDA NRCS 1980; JBR Environmental Consultant, Inc. (JBR) 2001; Reynolds and Fox 2006, 2003; USGS 2004). These studies included the delineation of plant communities based on aerial photograph interpretation and on-site vegetation analysis. Vegetation assessments were completed within these plant communities to determine plant composition and estimate foliar cover, forage production, and other vegetative parameters.

Six vegetation types and one land use type occur in the study area. The vegetation types include salt-desert shrubland, sagebrush shrubland, pinyon-juniper woodland, riparian habitats, barren lands, and invasive annual grassland. The land use type is developed lands (i.e., industrial/commercial). Distribution of vegetation types in these areas are strongly influenced by variations in landscape position, soil type, moisture, elevation, and aspect. Descriptions of these vegetation types are provided in the following text. Species nomenclature is consistent with the USDA NRCS Plants Database (USDA NRCS 2006b). **Figure 3.14-1** illustrates the vegetation types present within the study area. **Table 3.14-1** summarizes acreages for each vegetation/land use type within the proposed project area.

3.14.1 Salt-desert Shrubland

Salt-desert shrubland is the most dominant vegetation type within the study area, occurring on lower elevational slopes, saline basins, alluvial slopes, and plains. Substrates are often saline and calcareous, medium to fine-textured, alkaline soils, but include some course-textured material. This type is characterized by an open to moderately dense shrubland dominated by shadscale saltbush (*Atriplex confertilfolia*), spiny hopsage (*Grayia spinosa*), greasewood (*Sarcobatus vermiculatus*), bud sagebrush (*Picrothamnus desertorum*), winterfat (*Krascheninnikovia lanata*), and littleleaf horsebrush (*Tetradymia glabrata*). The understory is comprised of galleta grass (*Pleuraphis jamesii*), Indian ricegrass (*Achnatherum hymenoides*), and a small variety of forbs including scalebud (*Anisocoma acaulis*), primrose (*Camissonia* sp., *Oenothera* sp.), Steve's dustymaiden (*Chaenactis stevoides*), and annual buckwheat (*Eriogonum* sp.) (JBR 2001; Reynolds and Fox 2006; 2003, USDA NRCS 2006b; USGS 2004).



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/ Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Agriculture
- Townsite
- Pinyon-Juniper Woodland
- Sagebrush Shrubland
- Big Sagebrush Shrubland
- Greasewood Flat
- Salt Desert Scrub
- Montane Sagebrush Steppe
- Semi-Desert Grassland
- Mountain Mahogany Woodland and Shrubland
- Semi-Desert Shrub Steppe
- Subalpine Limber-Bristlecone Pine Woodland
- Riparian
- Inventoried Springs

N

0 0.5 1 Miles

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.
Sources: Reynolds and Fox 2003 and 2006; USGS 2004.

Round Mountain Expansion Project

Figure 3.14-1

Vegetation Types within the Proposed Project Boundary

05/25/2009

Table 3.14-1
Vegetation Cover Types within the Proposed Project Area

Vegetation Cover Type	Total Acreage
Salt-desert shrubland	8,719.0
Sagebrush shrubland	1,607.8
Pinyon-juniper woodland	0.1
Riparian	0.2
Invasive annual grassland	1.4
Developed	5,047.5
Barren	3.2
Total	**15,379.2**

Source: USGS 2004.

3.14.2 Sagebrush Shrubland

Sagebrush shrubland occupies lower elevational areas of the Great Basin and Inter-Mountain Basin Ecoregions. Soils are typically deep, well-drained, and non-saline. These shrublands are dominated by black sagebrush (*Artemisia nova*), low sagebrush (*A. arbuscula*), and Douglas rabbitbrush (*Chrysothamnus viscidiflorus*). The herbaceous component contributes less than 25 percent of the vegetation in this type and is comprised of Sandberg bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), squirreltail (*Elymus elymoides*), needle-and-thread grass (*Hesperostipa comata*), and a variety of forbs including shortstem lupine (*Lupinus brevicaulis*), desert sand verbena (*Abronia villosa*), Torrey's blazingstar (*Mentzelia torreyi*), rayless shaggy fleabane (*Erigeron aphanactis*), King's starwort (*Arenaria kingii*), and thickstem wild cabbage (*Caulanthus crassicaulis*) (JBR 2001; Reynolds and Fox 2006, 2003; USDA NRCS 2006b; USGS 2004).

3.14.3 Pinyon-juniper Woodland

Pinyon-juniper woodland is present along the extreme eastern boundary of the study area. This vegetation cover type is characterized as a lower elevational community of the Great Basin Ecoregion occurring on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Dominant overstory species include single leaf pinyon (*Pinus monophylla*) and one-seed juniper (*Juniperus osteosperma*). Common understory species include low sagebrush (*Artemisia arbuscula*), black sagebrush (*A. nova*) and bunchgrasses such as needle-and-thread grass, and cushion buckwheat (*Eriogonum ovalifolium*) (JBR 2001; Reynolds and Fox 2003; USDA NRCS 2006b; USGS 2004).

3.14.4 Riparian

Riparian areas are generally defined as the vegetated transitional zones that lie between aquatic and terrestrial (or upland) environments. Riparian areas usually occur as belts along streams, rivers, lakes, marshes, bogs, and other waterbodies. As a transitional zone between aquatic and upland environments, riparian systems often exhibit characteristics of both; but are not as dry as upland environments nor as wet

as aquatic or wetland systems. Generally, only perennial and intermittent streams can support riparian areas that serve the entire suite of riparian ecological functions. Ephemeral streams rarely possess the hydrologic conditions that allow true riparian vegetation to grow.

Small segments of riparian vegetation within the study area are associated with Jefferson and Willow creeks, and Ink House and Healy springs, which are located approximately 0.5 mile east of the 10-foot groundwater drawdown area. This cover type is dominated by an overstory of willow, including narrowleaf willow (*Salix exigua*), Pacific willow (*S. lucida* ssp. *lasiandra*), yellow willow (*S. lutea*), and Lemmon's willow (*S. lemmonii*). Dominant understory species included silver buffaloberry (*Shepherdia argentea*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), golden currant (*Ribes aureum*), Woods' rose (*Rosa woodsii*), bitterbrush (*Purshia tridentata*), rubber rabbitbrush (*Ericameria nauseosa*), and creeping wildrye (*Leymus triticoides*) (Reynolds and Fox 2006, 2003; USDA NRCS 2006b; USGS 2004). No wetlands are associated with Jefferson Creek or are found within the project boundary.

A jurisdictional determination was received by RMGC on September 9, 2003, from the Sacramento District Office of the USACE for the proposed project area. Based on completion of a site reconnaissance, the Sacramento District concluded that Jefferson Creek and its associated ephemeral drainages are part of a closed basin and, thus, not currently regulated by the USACE under Section 404. Therefore, the proposed project would not be required to obtain a USACE permit to proceed with project implementation.

3.14.5 Invasive Annual Grassland

Invasive annual grasslands are areas dominated by exotic annual grass species such as cheatgrass (*Bromus tectorum*). This species usually forms a virtual monoculture by excluding other plants through growth habit and increased fire frequency.

3.14.6 Developed

This land use type is characterized by existing mine operations within the study area and is generally sparsely vegetated (USGS 2004).

3.14.7 Barren

This vegetation cover type comprises a very small component of the study area (i.e., less than 1 acre) and is characterized as barren areas of bedrock, desert pavement, scarps, talus, volcanic material, or other accumulations of earthen material. This cover type also includes playas. Generally, vegetation covers less than 15 percent of the total area within this cover type (USGS 2004).

Refer to Section 3.15, Noxious Weeds and Invasive Species, for a detailed discussion on noxious weeds and invasive species identified for the proposed project.

3.15 Noxious Weeds and Invasive Species

The study area for noxious weeds and invasive species includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor).

The CESA for noxious weeds and invasive species is defined as the Big Smoky Valley from SR 377, approximately 4.5 miles south of the proposed project area, to the north boundary line of T11N, R43E and R44E, approximately 4.5 miles north of the proposed project area. The CESA is approximately 19 miles north to south and from 6 to 10 miles east to west across the Big Smoky Valley. The cumulative impact assessment would include surface disturbances associated with the proposed project and interrelated actions.

A “noxious weed” is defined by the State of Nevada as any species of plant that is, or is likely to be, detrimental or destructive and difficult to control or eradicate (NRS 555.010-555.220). Noxious weeds have become a growing concern in the U.S. and in southern Nevada based on their ability to increase in cover relative to surrounding vegetation and exclude native plants from an area. The spread of noxious weeds has resulted in substantial economic impacts in the State of Nevada. As a result, the state has enacted laws requiring the control of noxious weed species (NRS 555.005, NAC 555.010). In addition, the Federal Noxious Weed Act of 1974, as amended (7 USC 2801 *et seq*) requires cooperation with state, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. Recognizing these regulations, the BLM established a goal that NEPA documents consider and analyze the potential for the spread of noxious weed species and provide preventative or rehabilitation measures for each management action involving surface disturbance.

The BLM considers plants invasive if they spread aggressively and have been introduced into an environment where they did not evolve. As a result, invasive species usually have no natural enemies to limit their reproduction and spreading (Westbrooks 1998). The invasion of some noxious weed species can result in substantial changes to vegetation composition, structure, or ecosystem function (Cronk and Fuller 1995).

A list of the noxious and invasive weed species designated by the state and BLM Tonopah Field Office is provided in **Table 3.15-1**. Under NRS 555.010-555.220, noxious weeds are classified into three categories including A, B, and C. Each category has specific control requirements, with the most stringent requirements for those species found in Category A. Category A includes noxious weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; and whose control is required by the state for all infestations. Category B includes noxious weed species which are established in scattered populations in some counties of the state; actively excluded where possible; and whose control is required by the state in areas where populations are not well established or previously unknown to occur. Category C includes noxious weeds currently established and generally widespread in many counties of the state; and whose abatement remains at the discretion of the State Quarantine Officer. RMGC would be required under the aforementioned regulations to control listed noxious weeds and invasive species occurring within the proposed project area.

Table 3.15-1

Designated Noxious Weed Species Potentially Occurring within the Proposed Project Area

Common Name	Scientific Name	Nevada State Noxious Weed Species List by Category	Battle Mountain District Office and Tonopah Field Office Invasive and Noxious Weed List
Russian knapweed	*Acroptilon repens*	B	Noxious
Camel thorn	*Alhagi camelorum*	A	Invasive
Mayweed chamomile	*Anthemis cotula*	A	--
Giant reed	*Arundo donax*	A	--
Sahara mustard	*Brassica tournefortii*	B	--
Cheatgrass	*Bromus tectorum*	--	Invasive
Whitetop or hoary cress	*Cardaria draba*	C	Noxious
Musk thistle	*Carduus nutans*	B	Noxious
Purple starthistle	*Centaurea calcitrapa*	A	--
Diffuse knapweed	*Centaurea diffusa*	B	Noxious
Iberian star	*Centaurea iberica*	A	--
Spotted knapweed	*Centaurea maculata*	A	Noxious
Malta starthistle	*Centaurea melitensis*	A	--
Yellow starthistle	*Centaurea solstitialis*	A	Noxious
Squarrose knapweed	*Centaurea virgata* var. *squarrosa*	A	--
Rush skeletonweed	*Chondrilla juncea*	A	Invasive
Western water hemlock	*Cicuta dougalsii*	--	Invasive
Water hemlock	*Cicuta maculata*	C	--
Canada thistle	*Cirsium arvense*	C	Noxious
Bull thistle	*Cirsium vulgare*	--	Invasive
Poison hemlock	*Conium maculatum*	C	Invasive
Field bindweed	*Convolvulus arvensis*	--	Invasive
Common crupina	*Crupina vulgaris*	A	--
Field dodder	*Cuscuta campestris*	--	Invasive
Houndstongue	*Cynoglossum officinale*	A	--
Larkspur (Geyer, Plains, and Tall)	*Delphinium* spp.	--	Invasive
Anchored water hyacinth	*Eichhornia azurea*	--	Invasive
Water hyacinth	*Eichhornia crassipes*	--	Invasive
Russian olive	*Elaeagnus angustifolia*	--	Invasive
Leafy spurge	*Euphorbia esula*	B	Noxious
Goat's rue	*Galega officinalis*	A	--
Broom snakeweed	*Gutierrezia sarothrae*	--	Invasive
Halogeton	*Halogeton glomeratus*	--	Invasive
Foxtail barley	*Hordeum jubatum*	--	Invasive
Hydrilla	*Hydrilla verticillata*	A	Invasive

Table 3.15-1 (Continued)

Common Name	Scientific Name	Nevada State Noxious Weed Species List by Category	Battle Mountain District Office and Tonopah Field Office Invasive and Noxious Weed List
Black henbane	*Hyoscyamus niger*	A	--
Klamath weed	*Hypericum perforatum*	A	--
Dyer's woad	*Isatis tinctoria*	A	Invasive
Juniper	*Juniperus* spp.	--	Invasive
Kochia	*Kochia scoparia*	--	Invasive
Tall whitetop or perennial pepperweed	*Lepidium latifolium*	C	Noxious
Dalmatian toadflax	*Linaria dalmatica*	A	--
Yellow toadflax	*Linaria vulgaris*	A	--
Purple loosestrife	*Lythrum salicaria*	A	Invasive
Purple loosestrife	*Lythrum virgatum*	--	Invasive
Eurasian water-milfoil	*Myriophyllum spicatum*	A	--
Scotch thistle	*Onopordum acanthium*	B	Noxious
Silky or Lambert's crazyweed	*Oxytropis sericea*	--	Invasive
African rue	*Peganum harmala*	A	--
Green fountaingrass	*Pennisetom setaceum*	A	--
Water lettuce	*Pistia stratiotes*	--	Invasive
Sulfur cinquefoil	*Potentilla recta*	A	--
Austrian fieldcress	*Rorippa austriaca*	A	--
Curly dock	*Rumex crispus*	--	Invasive
Russian thistle	*Salsola iberica*	--	Invasive
Mediterranean sage	*Salvia aethiopis*	A	--
Giant salvinia	*Salvinia molesta*	A	--
Carolina horse-nettle	*Solanum carolinense*	B	--
White horse-nettle	*Solanum elaeagnifolium*	B	--
Sow thistle	*Sonchus arvensis*	A	--
Johnson grass	*Sorghum halepense*	C	--
Austrian peaweed	*Sphaerophysa salsula* (= *Swainsona salsula*)	A	--
Medusahead	*Taeniatherum caput-medusae*	B	Invasive
Saltcedar or tamarisk	*Tamarix ramosissima*	C	Invasive
Puncturevine	*Tribulus terrestris*	C	Noxious
Common cocklebur	*Xanthium strumarium*	--	Invasive
Syrian bean caper	*Zygophyllum fabago*	A	--

-- = Species not classified as noxious or invasive as per the cooperating agency.

Source: Nevada Department of Agriculture, Plant Industry Division 2006; BLM Battle Mountain District Office and Tonopah Field Office, no date.

Baseline vegetation studies, which included field assessments and subsequent documentation of noxious weed and invasive plant species occurrences, were conducted within the Gold Hill and Round Mountain areas in 2003 and 2006 (Reynolds and Fox 2006, 2003). No noxious weed or invasive species were identified within the survey area in 2003; however, saltcedar and Russian olive populations were observed in the survey area in 2006. Saltcedar populations were identified adjacent to Jefferson Creek, near the existing Round Mountain Waste Rock Dump, and at the south end of the Town of Round Mountain. A Russian olive population was identified along Jefferson Creek. Also, Russian knapweed and hoary cress occur within the CESA around the town of Carvers (Deverse 2009).

3.16 Range Resources

The study area for range resources is the maximum 10-foot groundwater drawdown isopleth (**Figure 4.3-15**), which includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor). The proposed project area is bordered on the north, south, and west by BLM-administered lands utilized for livestock grazing. Implementation of the proposed project would expand the mine permit area, thus removing areas currently being grazed, and as such, may affect grazing management of additional areas through changes in access and/or water supply.

The CESA for Range Management is defined as the proposed project area, the entirety of the Smoky and Francisco grazing allotments, and the northern 245 acres within the San Antone Grazing Allotment as defined by the study area. The Smoky Grazing Allotment consists of approximately 125,247 acres with a current average stocking rate of 22.7 acres/animal unit month (AUM) based on a total of 5,523 AUMs. The Francisco Allotment consists of approximately 16,896 acres with a current average stocking rate of 14 acres/AUM based on a total of 1,209 AUMs. The San Antone Allotment consists of approximately 442,555 acres with a current average stocking rate of 32.5 acres/AUM based on a total of 13,580 AUMs. No wild horse or burro herds are present within these allotments.

The study area is located within the southern portion of the Smoky Allotment, the northern portion of the San Antone Allotment, and the entirety of the Francisco Allotment (**Figure 3.16-1**). Within the study area, the Smoky Allotment encompasses approximately 30,888 acres and extends from a southern boundary approximately 5.5 miles south of the intersection of CR 875 and SR 376 to a northern boundary approximately 3.5 miles north of the intersection. The allotment is approximately 9 miles wide at its widest point near the northern end and narrows to a width of 2.5 to 3 miles at the southern end near the Round Mountain Mine. Within the study area, the San Antone Allotment encompasses approximately 245 acres and extends southward from the Smoky Allotment approximately 0.5 mile. Within the study area, the Francisco Allotment encompasses approximately 16,896 acres, is bordered to the north, south, and east by the Smoky Allotment and to the west by the Humbolt-Toiyabe National Forest. These allotments are bounded to the east and west by the Humboldt-Toiyabe National Forest, with the Francisco Allotment located southwest and northwest of the Smoky and San Antone allotments, respectively (BLM 1997).

A total of three livestock operations hold grazing permits within the study area, including one operation in the Smoky Allotment, one operation in the Smoky and San Antone Allotment, and one operation in the Francisco Allotment. An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair for 1month. **Table 3.16-1** summarizes permitted uses among each permittee for the aforementioned allotments.

Water-related range improvements located within the study area are illustrated in **Figure 3.16-1**. Water sources for livestock within the study area include a water tank to which water is hauled by RO Livestock during its period of grazing use; Upper Rodgers Well; Francisco Well; and Francisco Water Haul. Some springs exist a short distance east of the study area in the Humboldt-Toiyabe National Forest, and a few of the mountain drainages (e.g., Jefferson and Willow creeks) occasionally flow enough in the spring during wet years to provide water for livestock within the Smoky Allotment. Seeps, springs, and creeks within the proposed project vicinity that also may be available water sources for livestock are illustrated in **Figures 3.3-4** and **3.3-6**.

Table 3.16-1
Permits Within the Affected Grazing Allotments

Allotment	Permittee	Livestock		Grazing Period		Type of Use	AUMs
		Kind	Number	Begin	End		
Smoky	Truckee River Ranches	Cattle	587 587	March 1 November 1	June 30 February 28	Active Active	2,354 2,316
	Russel Berg	Cattle	71	March 1	February 28	Active	852
San Antone	Truckee River Ranches	Cattle	1,697 1,697	March 1 November 1	June 30 February 28	Active	6,807 6,695
Francisco	D. Osterhoudt	Cattle	152 152	March 1 July 16	April 15 February 28	Active Active	230 1,139

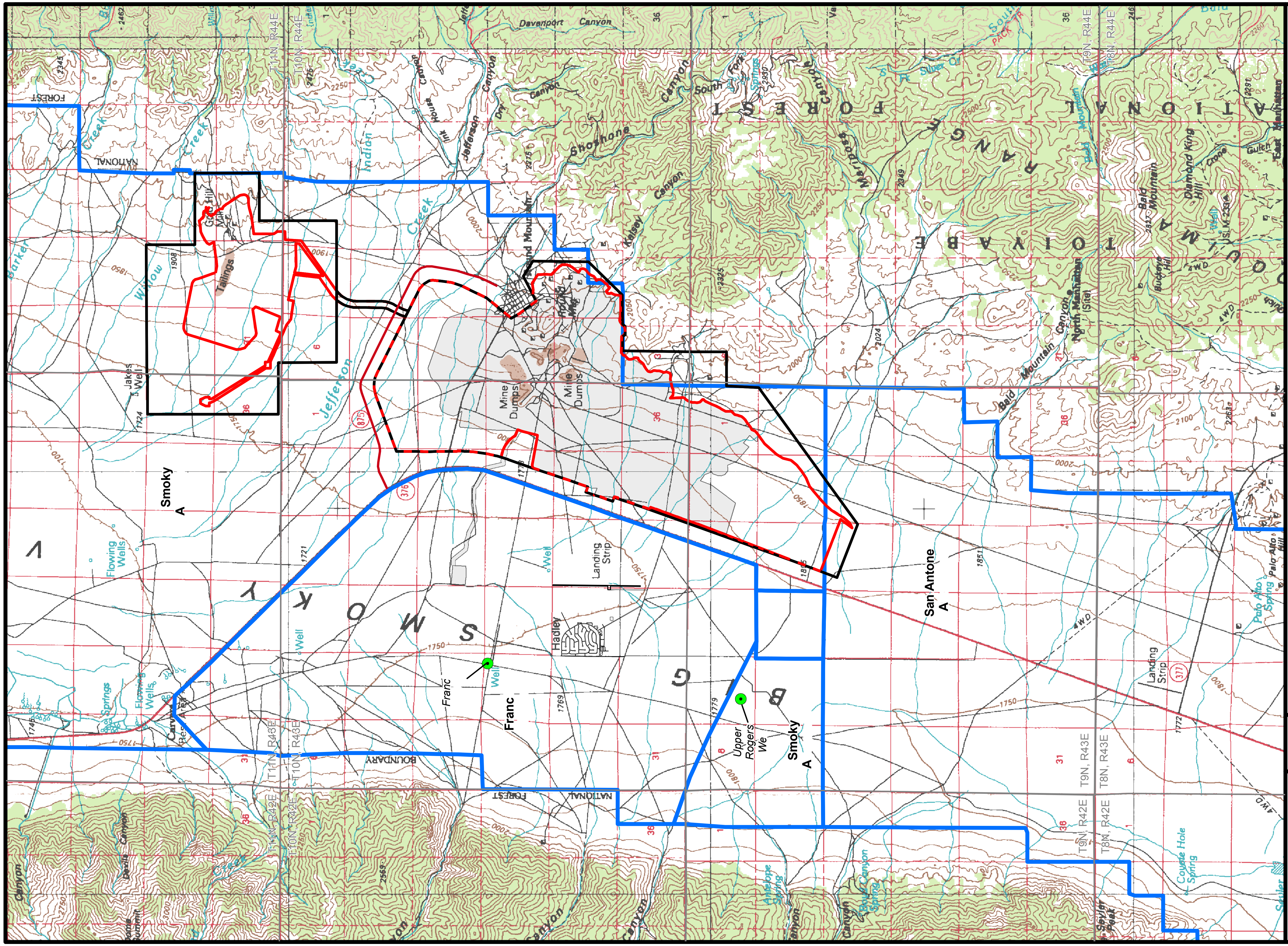
Source: BLM 2007c.

Table 3.16-2 lists the range improvements within the study area for the Smoky, San Antone, and Francisco allotments. Besides the current and projected loss of AUMs to the Smoky and San Antone allotments, conflicts between mining and grazing operations on the allotments are negligible (BLM 2007c). Numerous cattle/vehicle collisions are reported annually along the Pablo Canyon Road, providing access to the town of Hadley. A cattle fence was constructed by RMGC along this road to prevent future accidents.

Table 3.16-2
Range Improvements within the Study Area

Range Improvement Name	Legal Location				
	Meridian	Township	Range	Section	Subdivision
Smoky Allotment					
Francisco Allotment FC	Mount Diablo	010 N	043 E	011	SWSE
Francisco Cattle Guard	Mount Diablo	010 N	043 E	011	SWSE
Round Mountain Dump Cattle Guard	Mount Diablo	010 N	043 E	011	SWNW
Carvers-Hadley MW&SD	Mount Diablo	011 N	043 E	032	--
Smokey Study Plot FC	Mount Diablo	009 N	043 E	010	SWNW
Upper Rodgers Well	Mount Diablo	009 N	043 E	005	SESW
Water Haul Tank Trough	Mount Diablo	009 N	043 E	010	--
Francisco Allotment					
Francisco Well	Mount Diablo	010 N	043 E	020	NWNE
Francisco Water Haul	Mount Diablo	009 N	043 E	006	--
Francisco Allotment FC	Mount Diablo	010 N	043 E	011	SWSE
Senita Courts Cattle Guard	Mount Diablo	010 N	043 E	004	NENE
Francisco Pasture Cattle Guard	Mount Diablo	010 N	043 E	021	NE1
Francisco Divide Fence	Mount Diablo	010 N	043 E	023	NESW
Francisco Cattle Guard	Mount Diablo	010 N	043 E	018	SESW
Temp Fence/Francisco	Mount Diablo	010 N	043 E	027	--

Source: BLM 2007d.



Legend
- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Water-related Range Improvements
- Allotment Boundary

N

0 1 2 Miles

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.
Source: BLM 2007c.

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Figure 3.16-1
Water-related Range Improvements in the Smoky, San Antone, and Francisco Allotments within the Range Resources Study Area

05/26/2009

3.17 Wildlife and Fisheries Resources

The study area for wildlife and fisheries is the maximum 10-foot groundwater drawdown isopleth (**Figure 4.3-14**), which includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor).

The CESA for wildlife and fisheries is defined as the Big Smoky Valley from Northumberland Road to the southern tip of the Big Smoky Valley, and bordered to the east and west primarily by USFS lands (based on pronghorn range in the Big Smoky Valley). Cumulative impacts would include surface disturbance and water management activities associated with the proposed project, interrelated actions, and riparian habitat within the modeled 10-foot groundwater drawdown area for the proposed project.

As discussed in Section 3.14, Vegetation, six vegetation cover types and one land use cover type are located within the study area. The vegetation cover types include salt-desert shrubland, sagebrush shrubland, pinyon-juniper woodland, riparian, invasive annual grassland habitats, and barren land. The land use cover type is composed of developed lands (i.e., industrial/commercial). Salt-desert shrubland is the most common vegetation type within the study area. A variety of terrestrial wildlife species are associated with all of these upland communities, with greater species diversity occurring in areas exhibiting greater vegetative structure and soil moisture.

Available water for wildlife consumption is limited in the study area. Water sources, particularly those that maintain a reliable source of open water and provide a multi-story canopy, support a greater diversity and population density of wildlife species than other habitat types in the region. Currently, no open water areas occur within the study area and limited riparian habitat occurs along portions of Jefferson and Willow creeks, which bisect the study area, and at Ink House and Healy springs, which are located approximately 0.5 mile east of the 10-foot groundwater drawdown area.

Information regarding wildlife species and habitat within the study area and CESA was obtained from a review of existing published sources, BLM and NDOW file information, Nevada Natural Heritage Program (NNHP) database information, and site-specific field surveys within the study area (JBR 2001; Reynolds and Fox 2006, 2003; Wildlife Resource Consultants 2004). All survey reports are available from the Battle Mountain District Office. These surveys examined the existing use of the study area by terrestrial and aquatic vertebrates and special status species.

3.17.1 Terrestrial Wildlife

3.17.1.1 Habitat

Wildlife species and habitats found within the study area are typical of the Great Basin Desert region. The study area occurs primarily within the low elevation desert shrub and sagebrush communities in the Big Smoky Valley. Within the study area, wildlife habitat is primarily composed of salt-desert shrubland, sagebrush shrubland, pinyon-juniper woodland, and riparian habitats.

Water sources in the study area are limited to Jefferson and Willow creeks, which originate on USFS lands in the Toquima Range to the east of the study area. Although these creeks are intermittent through the study area, it is likely that these creeks provide a valuable water resource to local wildlife when flowing. As discussed above, riparian habitat in the study area is limited to portions of Jefferson and Willow creeks, and at Ink House and Healy springs, which are located approximately 0.5 mile east of the 10-foot groundwater

drawdown area. Riparian habitat supports a higher diversity of wildlife than other habitat types in the study area.

3.17.1.2 Big Game Species

Mule deer and pronghorn are the primary big game species in the study area (NDOW 2007a). Pronghorn have expanded their range throughout the Big Smoky Valley and now inhabit the study area year-round (NDOW 2003). Population numbers for both species in game management units 161 and 173 for Nye County have been relatively stable since 2000 (NDOW 2006). Population numbers fluctuate slightly from year to year based on habitat conditions. Water availability and amount of quality summer habitat are the limiting factors within the study area. Water availability, forage quality, cover, and weather patterns typically determine the level of use and movement of big game species through the study area. Mule deer tend to use the study area sporadically and typically use the Jefferson Creek drainage while in the area (Reynolds and Fox 2006). **Figure 3.17-1** illustrates mule deer winter range located within the study area. Approximately 729 acres of mule deer winter range is located in the eastern portion of the proposed project area. Winter use in the study area depends on weather and forage availability. Pronghorn typically use the western portion of the study area and water resources when available (NDOW 2007a). However, the entire study area is considered year-round pronghorn range. Use of the study area by pronghorn is highly dependent on water and forage availability. Desert bighorn sheep is a BLM sensitive species and is discussed in detail in Section 3.18, Special Status Species.

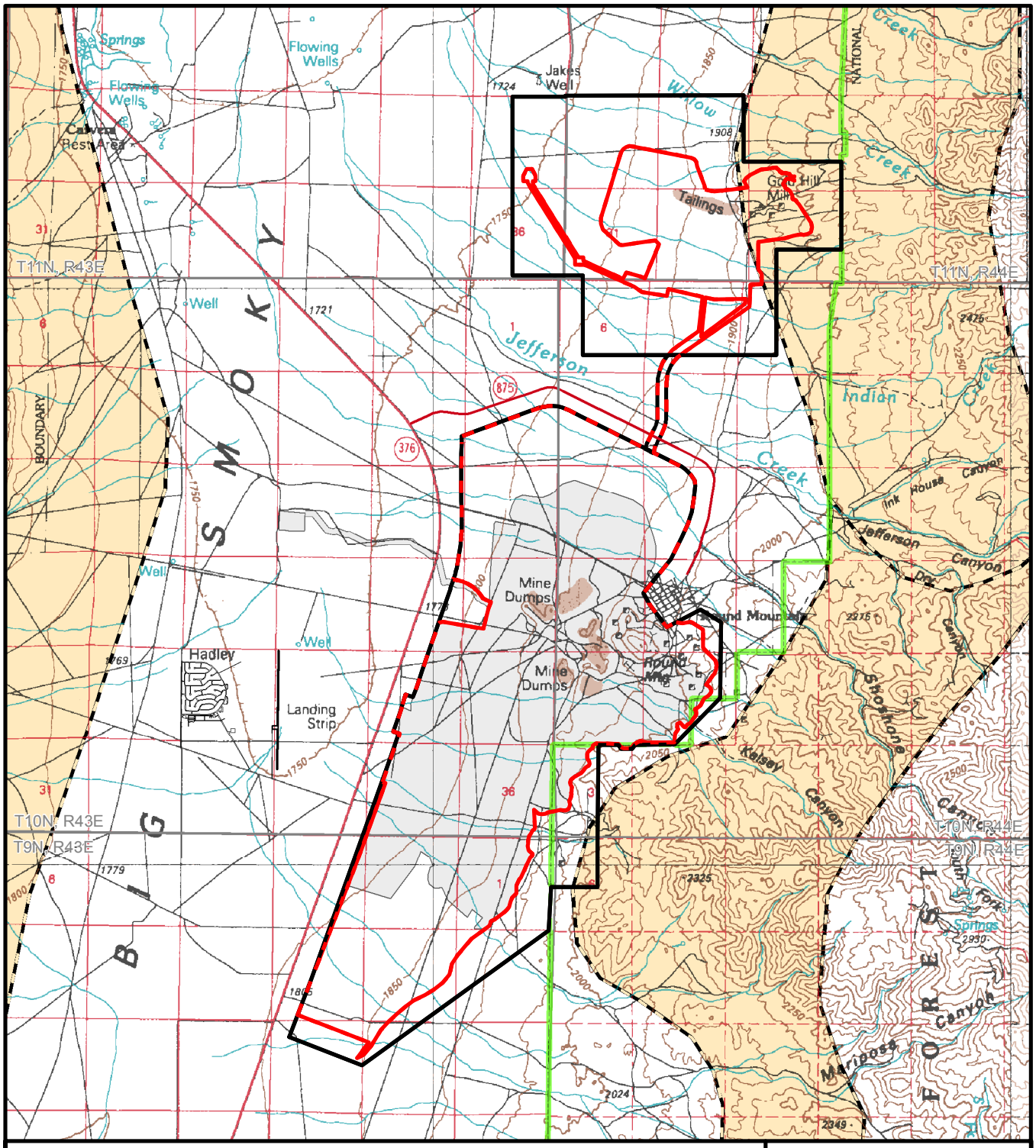
The mountain lion also is classified as a big game species. Mountain lions are fairly common in central Nevada and occupy the higher elevations surrounding the study area (JBR 2001). They often travel between mountain ranges and valleys depending on prey availability. Scat has been found in the northeast portion on the study area (JBR 2001).

3.17.1.3 Small Game Species

Upland game birds may occupy portions of the study area, although habitat is limited. Species that may occur in the study area are greater sage-grouse, chukar, and mourning dove. Chukar inhabit the mine site and suitable chukar habitat exists along the rock outcrops in the eastern portion of the study area. Fecal droppings were found in several locations within the study area (JBR 2001). Mourning doves were observed in the southeastern portion of the study area during biological surveys (JBR 2001). Mourning doves are found in wide range of habitats in close proximity to water and are most likely to occur within the study area during spring, summer, and early fall. The greater sage-grouse is a BLM sensitive species and is discussed in detail in Section 3.18, Special Status Species.

The pygmy rabbit is a game species that has been documented within the study area (Reynolds and Fox 2006). Although the pygmy rabbit is considered a game species in Nevada, it also is a BLM sensitive species and is discussed in Section 3.18, Special Status Species. Other small game mammal species that could occur within the study area are cottontail and black-tailed jackrabbit. Black-tailed jackrabbits were observed within the study area during biological surveys (JBR 2001).

Furbearers that may occur within the study area include coyote, badger, gray fox, kit fox, bobcat, long-tailed weasel, short-tailed weasel, spotted skunk, and striped skunk (Hall 1995). Coyote scat and tracks and several badgers were observed within the study area (JBR 2001). Either kit fox or gray fox scat was found in the western portion of the study area (Reynolds and Fox 2003). Kit fox are known to occur in the southern portion of the Round Mountain Mine (Reynolds and Fox 2003).



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Mule Deer Winter Range
- National Forest Boundary

Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.

Source: NDOW 2007b.

N

0 0.5 1 2 Miles

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Figure 3.17-1

Mule Deer Winter Range

05/25/2009

Due to the lack of appropriate habitat, no waterfowl or shorebird concentrations are likely to occur within the study area. Historically, waterfowl used the existing RIB located 3 miles northwest of the Round Mountain Mine (BLM 1996). However, no waterfowl or shorebirds were observed within the study area during surveys, conducted in 2001, 2003, and 2004. Waterfowl are frequently seen near the Town of Hadley, at the sewage treatment facility, and golf course ponds.

3.17.1.4 Nongame Species

A diversity of nongame species (e.g., small mammals, passerines, raptors, and reptiles) occupy a wide range of trophic levels and habitat types within the study area. Habitats found within the study area (e.g., desert shrublands, sagebrush shrublands) support a variety of resident and seasonal nongame species. Nongame mammals include the deer mouse, brush mouse, whitetail antelope ground squirrel, Townsend's ground squirrel and woodrat (JBR 2001; Reynolds and Fox 2003). Rodent populations provide a large prey base for the area's predators.

Nongame birds encompass a variety of passerine and raptor species including migratory bird species that are protected under the Migratory Bird Treaty Act (16 USC 703-711) and EO 13186 (66 FR 3853) (see Migratory Birds section).

Passerine or songbird species occupy the entire range of habitats found within the study area. However, due to the higher level of plant diversity and structure, more abundant potential nest sites, and greater food base, the riparian areas along Jefferson and Willow creeks, as well as the area around Ink House and Healy springs which are located immediately outside of the 10-foot groundwater drawdown isopleth, supports the highest diversity of wildlife species within the study area.

Several raptor species have been documented within the study area including the golden eagle, prairie falcon, peregrine falcon, American kestrel, red-tailed hawk, ferruginous hawk, great-horned owl, short-eared owl, and western burrowing owl (JBR 2001; Reynolds and Fox 2006, 2003). Details on sensitive raptor species such as golden eagle, bald eagle, and ferruginous hawk are discussed further in Section 3.18, Special Status Species. Data on other raptors are presented below.

No known nests, other than great-horned owl, were found within the proposed project area. Great-horned owls likely nested in the eastern portion of the proposed project area as a group of six owls were observed there in June 2006 (Reynolds and Fox 2006). Red-tailed hawks were observed within the study area but no nests were recorded in the proposed project area.

Other important nongame species include several bat species. The eastern portion of the proposed Gold Hill Area includes 11 mine workings that have been verified as supporting both breeding and hibernating bat species (JBR 2001; Wildlife Resource Consultants 2004). An acoustic bat survey was conducted at Gold Hill in June 2004 to determine what species occur in the study area. Bats that potentially occur in the study area are listed in **Table 3.17-1**. Since many of the bats identified for the proposed project are currently BLM sensitive species and/or Nevada Protected Species, the survey methods, area examined, and results are presented in detail in Section 3.18, Special Status Species.

Table 3.17-1
Bat Species Potentially Occurring in the Study Area

Common Name	Scientific Name	Status[3]
Townsend's big-eared bat[1]	*Corynorhinus townsendii*	SOC; NV-PSS; BLM
Spotted bat	*Euderma maculatum*	SOC; BLM; NV-PST
California myotis[1]	*Myotis californicus*	BLM
Small-footed myotis[1]	*Myotis ciliolabrum*	SOC; BLM
Long-eared myotis[1]	*Myotis evotis*	SOC; BLM
Fringed myotis	*Myotis thysanodes*	SOC; BLM; NV-SP
Cave myotis[1]	*Myotis velifer*	BLM
Long-legged myotis	*Myotis volans*	SOC; BLM
Brazilian free-tailed bat[1]	*Tadarida brasiliensis*	BLM; NV-SP
Western pipistrelle[2]	*Parastrellus hesperus*	BLM
Big brown bat[2]	*Eptesicus fuscus*	BLM
Pallid bat[2]	*Antrozous pallidus*	BLM; NV-SP
Little brown bat[2]	*Myotis lucifugus*	BLM
Hoary bat[2]	*Lasiurus cinereus*	BLM

[1] Species identified on site using acoustic analysis (Wildlife Resource Consultants 2004).
[2] Species identified by RMGC using acoustic analysis (NDOW 2009b).
[3] Status:
SOC = Federal Species of Concern.
BLM = Nevada BLM Sensitive.
NV-PSS = Nevada-Protected State Sensitive.
NV-PST = Nevada-protected State Threatened
NV-SP = Nevada State Protected

Sources: BLM 2007c; NNHP 2003; USFWS 2003; Williams 2004.

Other nongame species in the study area include reptiles such as the Great Basin whiptail, long-nosed leopard lizard, desert horned lizard, western fence lizard, side-blotched lizard, common collard lizard, sagebrush lizard, Great Basin gopher snake, striped whipsnake and Great Basin rattlesnake (JBR 2001; Reynolds and Fox 2006). Amphibian presence is limited in the study area due to intermittent flows in Jefferson and Willow creeks.

3.17.1.5 Migratory Birds

Pursuant to EO 13186, a draft Memorandum of Understanding among the BLM, USFS, and USFWS was drafted in order to promote conservation and protection of migrating birds. Specific measures to protect migratory bird species and their habitats have not been identified within EO 13186, but instead, the EO provides guidance to agencies to promote best management practices for the conservation of migratory birds. As a result, the BLM Nevada State Office prepared Migratory Bird Best Management Practices for the Sagebrush Biome in order to assist BLM field offices in the consideration of migratory birds in land management activities (BLM [no date]).

Breeding bird surveys were conducted June 4 to 7, 2001; May 19 to 22, 2003; July 17 to 19, 2003; June 12 to 16, 2006; and June 25 to 29, 2006, within the proposed project area. A total of 32 avian species were observed and recorded and are presented in **Table 3.17-2**. As shown, a number of these species are associated with a variety of habitat types, and many occur within the study area year-round. Details on sensitive species such as sage thrasher, Brewer's sparrow, pinyon jay, and loggerhead shrike is discussed further in Section 3.18, Special Status Species.

Table 3.17-2
Inventory of Bird Species Potentially Occurring Within the Study Area

Common Name	Scientific Name	Habitat Type[1]	Observed in Study Area[2]
Turkey vulture[3]	*Cathartes aura*	JW/WBS, WBS/G, AGLT	Y
Golden eagle[3,4]	*Aquila chrysaetos*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G, AGLT	Y
Northern harrier[3,4]	*Circus cyaneus*	LS/G, AGLT	N
Red-tailed hawk[3,4]	*Buteo jamaicensis*	LS/G, MMS, JW/WBS, WBS/G, AGLT	Y
Ferruginous hawk[3]	*Buteo regalis*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G, AGLT	Y
American kestrel[3]	*Falco sparverius*	JW/BS, JW/WBS, WBS/G	Y
Prairie falcon[3,5]	*Falco mexicanus*	LS/G, MMS, JW/BS, WBS/G, AGLT	Y
Peregrine falcon[3]	*Falco peregrinus*	LS/G, MMS, JW/BS, WBS/G, AGLT	Y[5]
Greater sage-grouse[3]	*Centrocercus urophasianus*	LS/G, BBS/GBW, WBS/G	Y
Chukar	*Alectoris chukar*	MMS	Y
Mourning dove[4]	*Zenaida macroura*	JW/BS	Y
Short-eared owl[3]	*Asio flammeus*	LS/G, BBS/GBW, WBS/G, W/G, AGLT	Y
Great horned owl[3]	*Bubo virginianus*	MMS, PPJW/MM, JW/BS, JWWBS, AGLT	Y
Western burrowing owl[3]	*Athene cunicularia hypugea*	LS/G, BBS/GBW, WBS/G, W/G, AGLT	Y
Common poorwill	*Phalaenoptilus nuttallii*	LS/G, BBS/GW, JW/BS, JW/WBS, WBS/G	Y
Common nighthawk[3]	*Chordeiles minor*	JW/BS, AGLT	Y
Black-chinned hummingbird	*Archilochus alexandri*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G, AGLT	Y
Western wood-pewee	*Contopus sordidulus*	MMS, PPJW/MM, JW/BS, JW/WBS	Y
Say's phoebe	*Sayomis saya*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G	Y
Gray flycatcher[4]	*Empidonax wrightii*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G	N
Horned lark[4]	*Eremophila alpestris*	WBS/G, W/G, AGLT	Y
Violet-green swallow	*Tachycineta thalassina*	MMS, PPJW/MM, JW/BS, JW/WBS	Y
Pinyon jay[3,4]	*Gymnorthinus cyanocephalus*	MMS, PPJW/MM, JW/BS, JW/WBS,	N
Black-billed magpie[4]	*Pica hudsonia*	MMS, PPJW/MM, JW/BS, JW/WBS, AGLT	Y
Common raven[4]	*Corvus corax*	LS/G, MMS, PPJW/MM, JW/BS, JW/WBS, WBS/G	Y
Rock wren[4]	*Salpinctes obsoletus*	LS/G, PPJW/MM	Y

Table 3.17-2 (Continued)

Common Name	Scientific Name	Habitat Type[1]	Observed in Study Area[2]
Blue-gray gnatcatcher	*Polioptila caerulea*	MMS, JW/WBS, WBS/G	Y
Mountain bluebird	*Sialia currucoides*	PPJW/MM, WBS/G, AGLT	Y
Hermit thrush	*Catharus guttatus*	PPJW/MM, JW/BS, JW/WBS	Y
Loggerhead shrike[3,4]	*Lanius ludovicianus*	LS/G, BBS/GBW, WBS/G, W/G, AGLT	N
Sage thrasher[3,4]	*Oreoscoptes montanus*	LS/G, MMS	N
Solitary vireo	*Vireo solitarius*	PPJW/MM	Y
Yellow-rumped warbler	*Dendroica coronata*	MMS, PPJW/MM, JW/BS, JW/WBS	Y
Wilson's warbler	*Wilsonia pusilla*	MMS, PPJW/MM, JW/BS, JW/WBS	Y
Spotted towhee[4]	*Pipilo maculates*	MMS, PPJW/MM, JW/BS	Y
Lark sparrow[4]	*Chondestes grammacus*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G, AGLT	N
Black-throated sparrow[4]	*Amphispiza bilineata*	LS/G, BBS/GBW, WBS/G, W/G	Y
Sage sparrow[4]	*Amphispiza belli*	WBS/G, AGLT	Y
Brewer's sparrow[3,4]	*Spizella breweri*	MMS, JW/BS, JW/WBS, WBS/G, W/G	Y
Western meadowlark[4]	*Sturnella neglecta*	LS/G, WBS/G, W/G, AGLT	N
Brewer's blackbird[4]	*Euphagus cyanocephalus*	LS/G, MMS, BBS/GBW, PPJW/MM, JW/BS, JW/WBS, WBS/G, W/G, AGLT	N
Western tanager	*Piranga rubra*	MMS, JW/WBS	Y

[1] LS/G = low sagebrush/grassland.
MMS = mixed mountain.
BBS/GBW = Basin big sagebrush/Great Basin wildrye.
PPJW/MM = pinyon pine and juniper woodland/mountain mahogany.
JW/BS = juniper woodland/black sagebrush.
JW/WBS = juniper woodland/Wyoming big sagebrush.
WBS/G = Wyoming big sagebrush/grassland.
W/G = winterfat/grassland.
AGLT = altered grazing land type.

[2] Surveys conducted June 2001, May and July 2003, June 2006, and summer 2008.

[3] Species of Special Concern.

[4] Detected on the Darroughs Hot Springs breeding bird survey route in 2000, 2002, and/or 2004.

[5] A peregrine falcon was observed within the Big Smoky Valley north of the study area.

Sources: Alcorn 1988; JBR 2001; NDOW 2009a; National Geographic Society (NGS) 1983; Reynolds and Fox 2006, 2003; Stokes 1996.

3.17.2 Fisheries

No fisheries resources occur within the study area due to lack of suitable habitat (i.e., perennial water sources). Reconnaissance of the study area by JBR (2001) and Reynolds and Fox (2006, 2003) determined that Jefferson and Willow creeks are intermittent through the study area and would not support fish. The closest fish populations are found in upper Willow and Barker creeks on USFS lands.

3.18 Special Status Species

The study area and CESA for special status plant species is the same as discussed for vegetation. The study area and CESA for special status wildlife species is the same as discussed for wildlife and fisheries

Special status species are those species for which state or Federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are Federally listed species that are protected under the Endangered Species Act (ESA), species of concern as identified by the USFWS, and species designated as state sensitive by the BLM. In addition, there is a Nevada State protected animal list (NAC 501.100-503.104) the BLM has incorporated, in part, into the BLM's sensitive species list.

In accordance with the ESA, as amended, the lead agency (BLM) in coordination with the USFWS must ensure that any action that they authorize, fund, or carry out would not adversely affect a Federally listed threatened or endangered species. In addition, as stated in Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6-121), it also is BLM policy "to conserve listed species and the ecosystems on which they depend, and to ensure that actions requiring authorization or approval by the BLM are consistent with the conservation needs of special status species and do not contribute to the need to list any special status species, either under the provisions of the ESA or other provisions" identified in 6840 Policy. The BLM has been under informal consultation with the USFWS, as outlined by Section 7 of the ESA. The following discussion summarizes known data for the sensitive wildlife and plant species identified for the proposed project by the applicable agencies.

A total of 39 special status species (30 terrestrial, 4 aquatic, 1 invertebrate, and 4 plant species) were identified as potentially occurring within the study area (BLM 2007e; NDOW 2007a,c,d; NNHP 2006, 2003; USFWS 2003). These species, their associated habitats, and their potential for occurrence within the study area are summarized in **Table 3.18-1**. Occurrence potential within the study area and CESA was evaluated for each species based on their habitat requirements and known distribution. In support of this document, baseline information and surveys have been collected within or near the proposed project area (BLM 1996; JBR 2001; NNHP 2006, 2003; Reynolds and Fox 2006, 2003). Based on these evaluations, three special status species have been eliminated from detailed analyses based on their habitat requirements or known distributions as discussed in **Table 3.18-1**. These species include the San Antonio pocket gopher, northern goshawk, and bald eagle. The remaining 36 special status species identified as potentially occurring within the study area are described below.

3.18.1 Mammals

3.18.1.1 Special Status Bat Species

Federal, state, and BLM sensitive bat species that have been identified as potentially occupying appropriate habitat types within or near the study area are presented in **Table 3.18-1**. Bat species that could occur within the study area or CESA include Western pipstrelle, big brown bat, pallid bat, little brown bat, hoary bat, Townsend's big-eared bat, small-footed myotis, long-eared myotis, fringed myotis, long-legged myotis, spotted bat, cave myotis, California myotis, and Brazilian free-tailed bat (BLM 2007e; JBR 2001; NDOW 2009b, 2007a,d; Reynolds and Fox 2006, 2003; Wildlife Resource Consultants 2004). Rock outcrops, caves, mine workings, and abandoned buildings could provide day roost sites; caves and mines may be used for hibernacula, maternity roosts, or bachelor roosts. Surveys conducted within the proposed project

Table 3.18-1
Special Status Species Identified for the Proposed Project

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
MAMMALS				
Pygmy rabbit *Brachylagus idahoensis*	BLM; SOC	Range: Throughout Nevada, but limited to areas dominated by sagebrush. Habitat: Requires dense sagebrush for cover as well as appropriate soils for burrowing.	High. The study area contains suitable sagebrush habitat and pygmy rabbits have been observed within the proposed project area.	No.
Pallid bat *Antrozous pallidus*	BLM; NV-SP	Range: Throughout Nevada. Habitat: Found in a variety of habitats from desert scrub to forests. Roosts in a variety of structures including mines, caves, buildings and trees. Intolerant of roosts in excess of 40°C.	High. Suitable foraging and roosting habitat occurs within the study area. This species has been detected during acoustic surveys within the proposed project area.	No.
Townsend's big-eared bat *Corynorhinus townsendii*	BLM; NV-PSS; SOC	Range: Throughout Nevada. Habitat: Highly associated with caves and mines. Very susceptible to disturbance at roost sites. Periodically moves to alternate roosts and actively forages and drinks throughout the winter. Typically forages in open forest habitats.	High: The study area has suitable roosting and foraging habitat for this species. This species has been detected within the Gold Hill Area.	No.
Big brown bat *Eptesicus fuscus*	BLM	Range: Throughout Nevada. Habitat: Found in a variety of habitats including forests, shrublands, and agricultural and urban areas. Roosts in a variety of structures including mines, caves, buildings and trees. More tolerant of human habitation than other bat species. Roosts in groups up to several hundred individuals.	High. Suitable foraging and roosting habitat occurs within the study area. This species has been detected during acoustic surveys within the proposed project area.	No.
Spotted bat *Euderma maculatum*	BLM; SOC; NV-PST	Range: Throughout Nevada, but limited to areas with cliff-roosting habitat. Habitat: Found in a variety of habitats from desert scrub to coniferous forests. May use caves and mines for roost sites in winter. Forages in open areas along riparian vegetation.	Moderate: Suitable roosting sites located within the study area. Suitable foraging areas occur in the proposed project area.	No.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Hoary bat *Lasiurus cinereus*	BLM	Range: Patchy distribution throughout Nevada. Habitat: Tree-associated species. Found primarily in forested upland habitats, as well as in forest riparian zones, and agriculture habitats. May occur in park and garden settings in urban areas. A solitary rooster that typically roosts in trees.	High. Marginal roosting and foraging habitat occurs within the study area. However, this species has been detected during acoustic surveys within the proposed project area.	No.
California myotis *Myotis californicus*	BLM	Range: Throughout Nevada, but mainly found in the southern half of the state at lower elevations. Habitat: Found in a variety of habitats from desert scrub to forests. Roosts in a variety of structures including mines, caves, buildings and trees. Actively forages throughout the winter.	High: The study area has suitable roosting and foraging habitat for this species. It has been detected within the Gold Hill Area.	No.
Small-footed myotis *Myotis ciliolabrum*	BLM; SOC	Range: Throughout Nevada. Habitat: Found in a variety of habitats from desert scrub to pine-fir forests. Roosts in caves, mines and trees. Forages in open areas.	High: Suitable roosting and foraging habitat occurs within the study area. This species was detected at the Gold Hill Area.	No.
Long-eared myotis *Myotis evotis*	BLM; SOC	Range: Throughout Nevada, primarily at higher elevations. Habitat: Primarily a forest-associated species. Roosts in caves, mines and under bridges. May forage within mine and cave structures, gleaning moths from the rock walls.	High: Suitable roosting and foraging habitat occurs within the study area. This species was detected at the Gold Hill Area.	No.
Little brown bat *Myotis lucifugus*	BLM	Range: Found primarily in the northern part of Nevada. Habitat: Found at higher elevations in coniferous forest. Requires a nearby water source. Roosts in trees, buildings, caves, and mines. One of the species most commonly found in human structures.	High. Suitable roosting and foraging habitat occurs mainly east of the study area in the higher elevations of the Toiyabe Range. However, this species has been detected during acoustic surveys within the proposed project area.	No.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Fringed myotis *Myotis thysanodes*	BLM; SOC: NV-SP	Range: Central and southern Nevada. Habitat: Desert scrub to high elevation coniferous forests. Roosts in caves, mines, trees, and building. Hibernacula are usually caves and mines. Forages among vegetation gleaning insects.	Moderate: Suitable foraging areas occur in the study area. Suitable roosting sites occur within the proposed project area.	No.
Cave myotis *Myotis velifer*	BLM	Range: Known from only one location in Nevada near Lake Mead National Recreation Area. Habitat: Found primarily in low elevation desert scrub habitats. Roosts in caves, mines, and occasionally buildings and bridges. Forages in the open over vegetation.	High: Suitable roosting and foraging habitat exists within the study area. This species was possibly detected within the Gold Hill Area during the acoustic bat surveys.	No.
Long-legged myotis *Myotis volans*	BLM; SOC	Range: Throughout Nevada, but absent from the low desert. Habitat: Pinyon-juniper and other higher elevation forest habitats. Night roosts and hibernacula located in caves and mines. Forages in open areas at canopy height.	Moderate: Suitable foraging areas occur in the study area. Suitable roosting sites occur within the proposed project area.	No.
Western pipistrelle *Parastrellus hesperus*	BLM	Range: Throughout most of Nevada. More common in the western and southern portions. Habitat: Lower and Upper Sonoran desert habitats of blackbrush, creosote, salt desert shrub and sagebrush, with occasional occurrence in Ponderosa pine and pinyon-juniper, usually in association with rock features such as granite boulders and canyons. Roosts in mainly in rock crevices.	High. Suitable roosting and foraging habitat occurs within the study area. This species has been detected during acoustic surveys within the proposed project area.	No.
Brazilian free-tailed bat *Tadarida brasiliensis*	BLM; NV-SP	Range: Throughout Nevada. Habitat: Found in a wide variety of habitats from desert scrub to high elevation mountain forests. Often travels great distances to forage and often forages at high altitudes.	High: Suitable habitat is located within the study area. This species was possibly detected during the acoustic bat surveys.	No.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Desert bighorn sheep *Ovis canadensis nelsoni*	BLM	Range: Throughout the central, southwestern and southern parts of Nevada. Habitat: Found in all habitats from desert-shrub to pinyon-juniper forests to subalpine-alpine. Forages on a wide variety of forbs and grasses. May migrate to water sources during periods of warm weather and drought.	Low. Suitable habitat is located within the study area. The nearest population is located on Mount Jefferson directly east of the proposed project area on USFS land.	No.
San Antonio pocket gopher *Thomomys umbrinus curtatus*	BLM; SOC	Range: Inhabits a small valley north of Tonopah, Nevada. Habitat: Inhabits a wide variety of soils from soft sands to hard clays. Forages above ground at night and overcast days. Active both day and night throughout the year.	None.	Yes. Species is known from a single location approximately 20 miles south of the proposed project area.
BIRDS				
Northern goshawk *Accipiter gentilis*	BLM; NV-PSS	Range: Limited to the northern two-thirds of the state. Habitat: Deep conifer-dominated mixed forests. May exhibit seasonal migrations depending on prey availability. Preferred nesting habitat is aspen stands along perennial streams.	None.	Yes. No suitable habitat exists within or near the proposed project area.
Golden eagle *Aquila chrysaetos*	BLM	Range: Throughout Nevada. Habitat: Mountain or hilly terrain. Nests usually occur on cliffs or in trees. Forages in open country.	High. Species was observed flying over the proposed project area during field surveys. Suitable foraging habitat exists within the study area. Suitable nesting habitat is located in the eastern portion of the study area. The nearest known nest site occurs >1 mile east of the proposed project area on USFS land.	No.
Short-eared owl *Asio flammues*	BLM	Range: Throughout Nevada. Habitat: Open country from desert-scrub to sagebrush-grasslands. Nests and roosts on the ground. Forages primarily at dawn and dusk.	High. A dead specimen was found within the proposed project area during surveys and another was observed flying near the Gold Hill Area. No known nests occur within the proposed project area.	No.
Western burrowing owl *Athene cunicularia hypugea*	BLM; SOC	Range: Throughout Nevada. Habitat: Open country from desert scrub to grasslands. Often found in or around prairie dog colonies. Nests in burrows.	High: This species may have been observed near the Gold Hill Area during field surveys. Suitable foraging habitat exists within the study area. No known nests have been recorded within the study area.	No.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Ferruginous hawk *Buteo regalis*	BLM; NV-PSS; SOC	Range: Throughout Nevada mainly in sagebrush grasslands. Habitat: Dry, open country. Nests usually occur in trees at the interface between pinyon-juniper and sagebrush grasslands. Forages over sagebrush grasslands.	High:Suitable foraging habitat occurs within the study area. No known nests occur in the proposed project area. However, a pair of ferruginous hawks was observed on 3 separate occasions by NDOW biologists during the summer of 2008. It is believed this pair has a nest in the study area or CESA.	No.
Greater sage-grouse *Centrocercus urophasianus*	BLM; SOC	Range: Throughout Nevada in areas with sagebrush. Habitat: Sagebrush grasslands. Leks are located in open areas in close proximity to escape cover. Nests are located in sagebrush habitat, typically within 2 miles of the lek. Broods are raised in wet, grassy areas near sagebrush.	High: Limited sagebrush habitat occurs within the study area. However, fecal pellets were identified during field surveys within the proposed project area. No known leks occur within the proposed project area. However, 1 lek occurs approximately 7 miles north of the proposed project area.	No.
Prairie falcon *Falco mexicanus*	BLM	Range: Throughout Nevada. Habitat: Dry, open country including desert scrub and sagebrush grasslands. Usually nests on cliffs in proximity to suitable foraging habitat.	High: Species was observed north of the study area. However, no nests were identified. Suitable nesting habitat would be limited to rock outcrops located in the eastern portion of the study area.	No.
Peregrine falcon *Falco peregrinus*	BLM; NV-PSE	Range: Southwestern and extreme southeastern Nevada. Habitat: Open country near cliffs. Typically migrates south of U.S. during winter months. Nests on cliffs and rock ledges. Forages in open areas.	Moderate: Suitable foraging habitat occurs within the study area. No known nests occur within the study area.	No.
Pinyon jay *Gymnorthinus cyanocephalus*	BLM	Range: Throughout Nevada. Habitat: Pinyon-juniper woodlands. Less frequently found in pine forests and sagebrush grasslands. Distribution is determined by availability of food resources. Nests in loose colonies.	High: Suitable foraging habitat exists in the eastern portion of the study area.	No.
Bald eagle *Haliaeetus leucocephalus*	NV-SPE	Range: Throughout Nevada. Habitat: Generally nest and roost in close proximity to large water bodies including rivers, lakes, and reservoirs.	Low: No suitable nesting or roosting habitat occurs within the study area.	Yes. Occurrence by this species within the study area and CESA would be limited to migrating individuals.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Loggerhead shrike *Lanius ludovicianus*	BLM; NV-PSS	Range: Throughout Nevada. Habitat: Open country including desert scrub and sagebrush grasslands. Nests and forages in brushy areas.	High: Suitable nesting habitat occurs within the study area.	No.
Sage thrasher *Oreoscoptes montanus*	NV-PSS	Range: Throughout Nevada in areas with sagebrush. Habitat: Sagebrush grasslands. Less frequently in pinyon-juniper and mountain mahogany/shrub habitats.	High: Suitable nesting habitat occurs within the study area.	No.
Brewer's sparrow *Spizella breweri*	NV-PSS	Range: Throughout Nevada. Habitat: Sagebrush flats and meadows. Found less frequently in mountain shrub habitats. Nests near the ground in sagebrush and other shrubs.	High: Species was observed within the proposed project area during surveys. Suitable nesting habitat occurs within the study area.	No.
AMPHIBIANS				
Columbia spotted frog *Rana luteiventris*	FC; BLM; NV-SP	Range: Central (Nye County) and northeastern (Elko and Eureka counties) Nevada, usually at elevations between 5,600 and 8,700 feet. Habitat: Aquatic habitats including perennial streams, ponds, springs, lakes, and marshes. May travel to uplands during wet weather.	Moderate: Known populations occur in the Toiyabe Range to the west of the proposed project area. No known records of this species exist within the proposed project area, although marginal habitat occurs along Jefferson Creek.	No.
FISH				
Big Smoky Valley tui chub *Gila bicolor* spp.	BLM; SOC: NV-PSS	Range: Big Smoky Valley between the Toiyabe and Toquima mountain ranges in Nevada. Habitat: Perennial spring-fed streams in the Big Smoky Valley.	Low: No known records of this species occurs in the proposed project area. No suitable habitat occurs within the proposed project area due to the intermittent flow of Jefferson Creek. Nearest known location of this species is approximately 15 miles north of the proposed project area on the Charnock Ranch.	No.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Lahontan cutthroat trout *Oncorhynchus clarki henshawi*	FT	Range: Northern and northwestern Nevada. Found in Pyramid, Walker, and Independence lakes as well as Lake Tahoe; Humboldt, Carson, Truckee, Walker, and Marys River basins; Donner and Prosser creeks. Also present in the Big Smoky Valley. Habitat: Streams and lakes with well oxygenated water in the above basins.	Low: This species does not occur within the proposed project area, but a known population occurs in Moores Creek approximately 6 miles north of the proposed project area.	
Big Smoky Valley speckled dace *Rhinichthys osculus lariversi*	BLM; NV-PSS	Range: Big Smoky Valley between the Toiyabe and Toquima mountain ranges in Nevada. Habitat: Perennial spring-fed streams in the Big Smoky Valley.	Low: No known records of this species occur in the proposed project area. No suitable habitat occurs within the proposed project area. However, this species has been documented approximately 4 miles west of the proposed project area.	No.
Invertebrates				
Big Smoky wood nymph *Cercyonis oetus alkalorum*	BLM; SOC	Range: Known only from the Big Smoky Valley between the Toiyabe and Toquima mountain ranges in Nevada. Habitat: Grassy alkaline flats.	Low: No suitable habitat occurs within the proposed project area. However, this species is known to occur at the northern end of the Big Smoky Valley.	No.
Plants				
Eastwood's milkweed *Asclepias eastwoodiana*	BLM; SOC	Range: Endemic to southern Lander, northern and central Nye, Esmeralda, and Lincoln counties. Habitat: Low hills and gulches in valley bottoms, sometimes in shallow gullies of gravelly clay slopes. Elevational Range: 4,680 to 7,080 feet amsl. Flowering Period: Late spring.	Moderate. Suitable habitat occurs in the study area. However, this species was not found during surveys conducted within the proposed project area.	No.

Table 3.18-1 (Continued)

Common Name/ Scientific Name	Status[1]	Range and Habitat Requirements	Potential for Occurrence in or Near the Study Area	Eliminated from Detailed Analysis
Sanicle biscuitroot *Cymopterus ripleyi* var. *saniculoides*	BLM; SOC	Range: Endemic to Lincoln and Nye counties. Habitat: Loose sandy to gravelly, often somewhat alkaline soils on volcanic tuff deposits and mixed valley alluvium, typically in small drainage-ways, in blackbrush, mixed-shrub, sagebrush, and lower pinyon-juniper communities. Elevational Range: 3,150 to 6,720 feet amsl. Flowering Period: Late winter to spring.	Moderate. Suitable habitat occurs in the study area. However, this species was not found during surveys conducted within the proposed project area.	No.
Nevada dune penstemon *Penstemon arenarius*	BLM; SOC	Range: Endemic species known only in Churchill, Mineral, and Nye counties. Habitat: Deep loose sandy soils of valley bottoms, aeolian deposits, and dune skirts, often in alkaline areas, sometimes on road banks and other recovering disturbances crossing such soils, in shadscale communities. Dependent on sand dune habitats or deep sand profiles. Elevational Range: 3,920 to 5,960 feet amsl. Flowering Period: Late spring.	Moderate. Suitable habitat occurs in the study area. However, this species was not found during surveys conducted within the proposed project area.	No.
Cacti, yucca, Christmas trees	NV-SP	Range: Varies based on species. Habitat: Varies based on species. Elevational Range: Varies based on species.	High. Known cacti and yucca populations occur in the study area.	No.

[1]Status: FT = Federally Threatened Species; SOC = Federal Species of Concern; FC = Federal Candidate Species; NV = PSS-Nevada Protected State Sensitive; BLM = BLM Sensitive Species; NV-PST = Nevada-protected State Threatened; NV-PSE = Nevada-protected State Endangered; NV-SP = Nevada State Protected

Sources: Arizona Game and Fish Department (AGFD) 1993; Alcorn 1988; Altenbach et al. 2002; Bradley et al. 2006; Ehrlich et al. 1988; Gray 1998; Hall 1995; Harvey et al. 1999; Herron et al. 1985; Johnsgard 1990; McQuivey 1978; NGS 1983; NatureServe 2006; Stokes 1996; USFWS MPR 2007; USFWS 2007a,b; Wildlife Resource Consultants 2004.

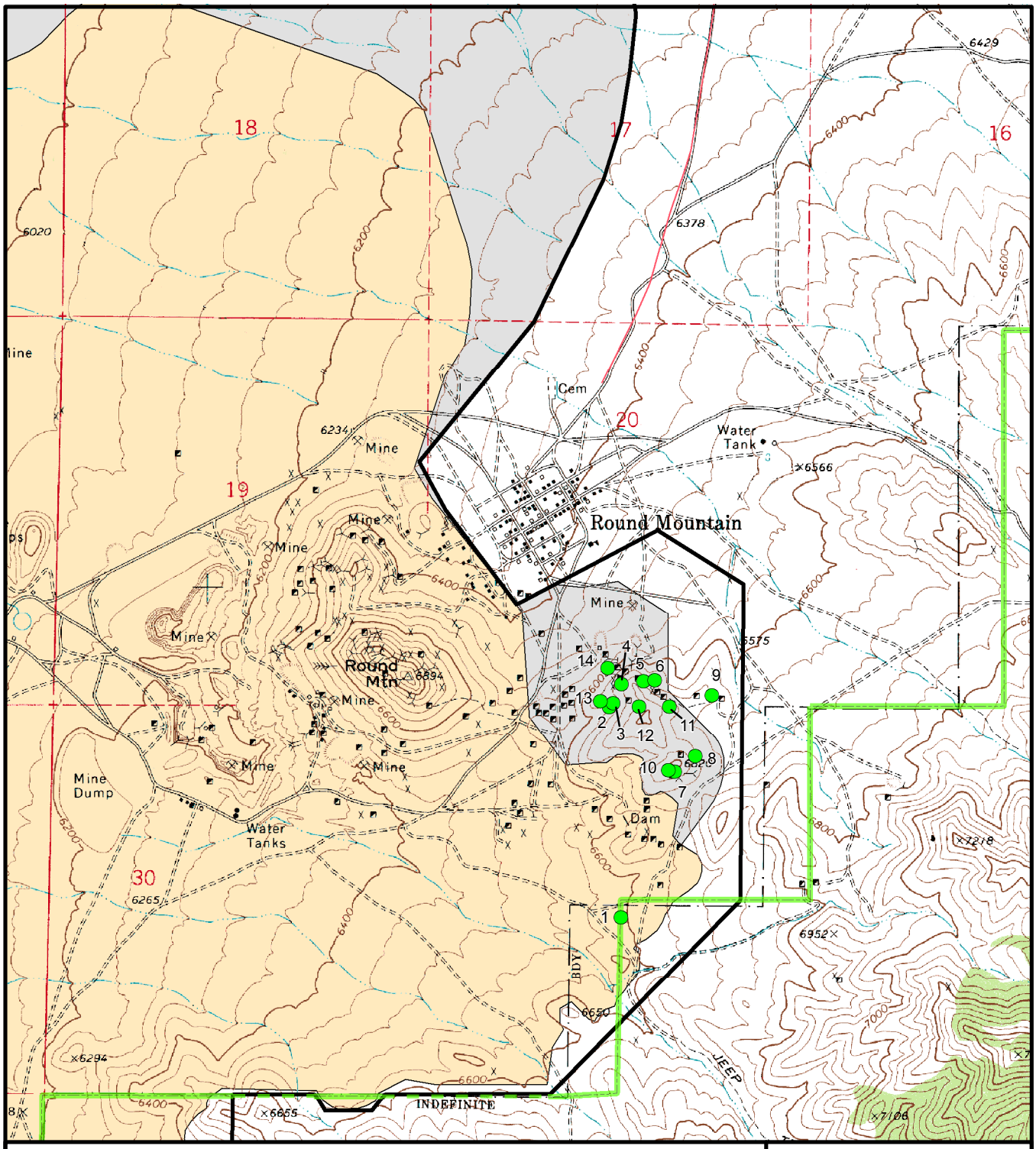
area in 2001 and 2006 identified 19 mine workings in the Gold Hill Area and 14 mine workings in the Round Mountain Expansion Area (**Figures 3.18-1** and **3.18-2**). Surveys conducted in the Gold Hill Area in June 2001 and 2004 found bats using 11 of the mine workings based on observations of individuals or presence of scat (**Table 3.18-2**). Pettersson ultrasonic bat detectors were placed at 8 of the 19 mine workings to identify species present. Species identified included the Townsend's big-eared bat, small-footed myotis, long-eared myotis, and California myotis. A possible Brazilian free-tailed bat and cave myotis may also have been recorded (Wildlife Resource Consultants 2004). The 14 mine workings in the Round Mountain Expansion Area (**Table 3.18-3**) have not been surveyed (visual or acoustic) for bats. RMGC previously installed a tower for wind monitoring equipment and placed an ultrasonic bat detector on this tower at the request of NDOW. Five species of bats (pallid bat, big brown bat, hoary bat, little brown bat, western pipistrelle) were detected using this bat detector (NDOW 2009b). Other potential roosting habitat within the study area includes forested habitat and rock outcrops. Pinyon-juniper woodlands adjacent to the proposed project area may provide roosting habitat for some bat species. Higher elevation forest habitats and cliffs are present east of the study area in the Toquima Range and may provide potential roosting habitat for bats.

Pallid Bat

The pallid bat is a year-round resident in Nevada. Found primarily at low and mid elevations (1,300 to 8,400 feet), this species occupies a variety of habitats such as pinyon-juniper, blackbrush, creosote, sagebrush, and salt desert scrub (Bradley et al. 2006). This species feeds primarily on large ground-dwelling arthropods (e.g., scorpions, centipedes, grasshoppers), but also feeds on large moths (Bradley et al. 2006). The pallid bat is a colonial species, roosting in groups of up to 100 individuals (AGFD 1993). Roost sites consist of rock outcrops, mines, caves, hollow trees, buildings, and bridges (AGFD 1993; Bradley et al. 2006). The pallid bat is intolerant of roost sites in excess of 40°C (Bradley et al. 2006). Suitable roosting and foraging habitat occurs within the study area. Additionally, this species has been documented during acoustic surveys within the proposed project area (NDOW 2009b). The potential for this species to occur within the study area is considered high.

Townsend's Big-eared Bat

The Townsend's big-eared bat is found throughout Nevada from low desert to high mountain habitats. In Nevada, the Townsend's big-eared bat primarily occurs in pinyon-juniper, mountain mahogany, white fir, blackbrush, sagebrush, salt desert scrub, agricultural lands, and urban habitats (Altenbach et al. 2002). This species prefers caves, mines, and buildings that maintain stable temperatures and airflow for nursery colonies, bachelor roosts, and hibernacula (Harvey et al. 1999). This species does not make major migrations and appears to be relatively sedentary, not traveling far from summer foraging grounds to winter hibernation sites (Harvey et al. 1999). Its distribution seems to be determined by suitable roost and hibernation sites, primarily caves and mines. This bat is believed to feed entirely on moths (Harvey et al. 1999) and gleans insects from foliage and other surfaces (Altenbach et al. 2002). This species was recorded in the Gold Hill Area. Scat was found in 4 internally surveyed mine workings (8, 12, 13, 17) and the species was identified during acoustic surveys at mine working 11. The potential for this species to occur within the study area is considered high.



Legend

- Proposed Project Boundary
- Proposed New Disturbance
- Authorized Disturbance
- Mine Working Locations
- National Forest Boundary

N

0 0.25 0.5 Miles

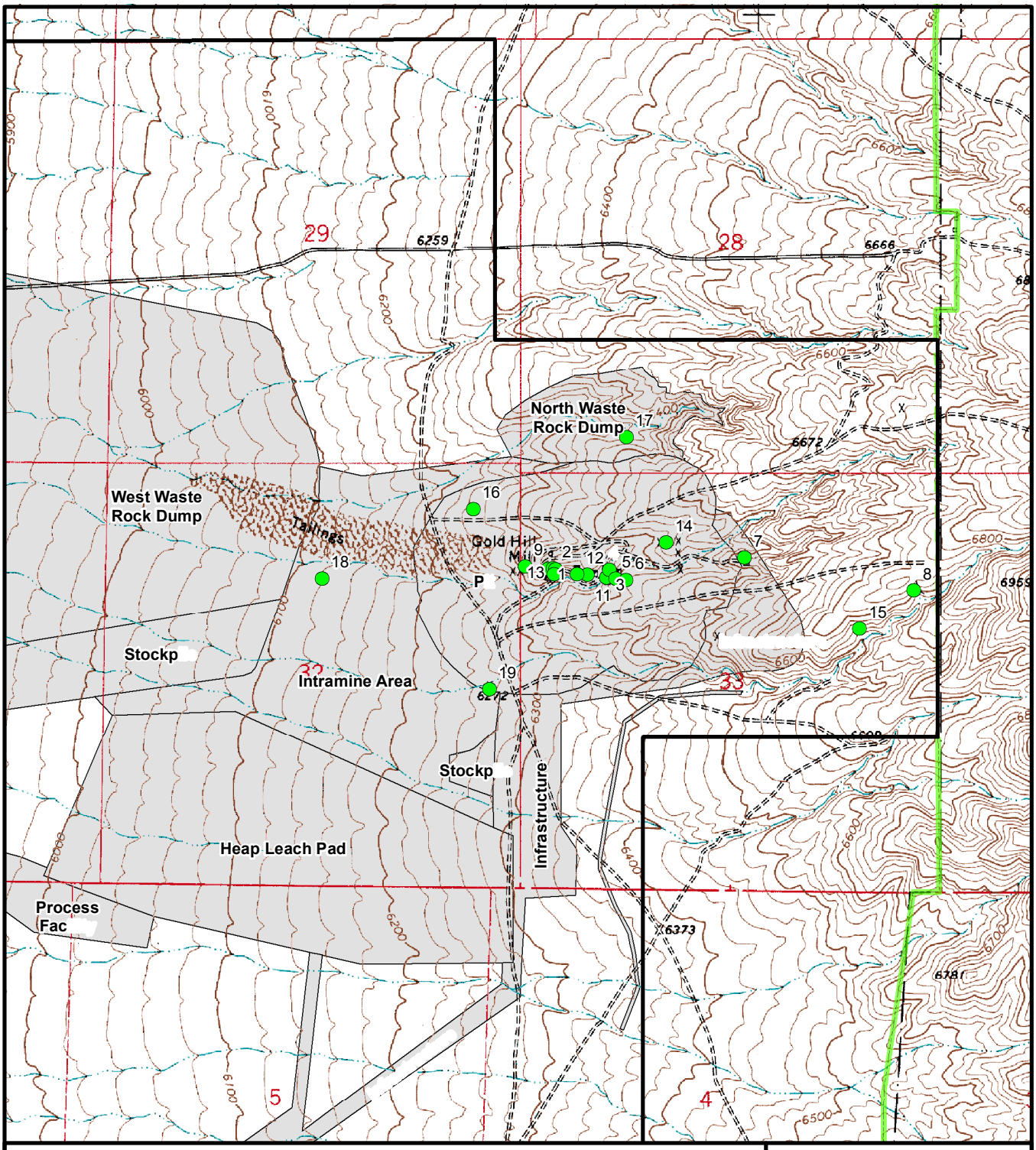
Note: Elevations provided in feet, USGS 1929 Vertical Datum.
Source: Reynolds and Fox 2006; RMGC 2009a.

Round Mountain Expansion Project

Figure 3.18-1

Mine Working Locations in the Round Mountain Area

05/08/2009



Legend

- Proposed Project Boundary
- Proposed New Disturbance
- Mine Working Locations
- National Forest Boundary

N

0 0.25 0.5 Miles

Note: Elevations provided in feet, USGS 1929 Vertical Datum.
Source: RMGC 2009a.

Round Mountain Expansion Project

Figure 3.18-2

Mine Working Locations in the Gold Hill Area

05/08/2009

Table 3.18-2

Sensitive Bat Species Survey Results for the Gold Hill Mine Workings

Mine Working Identification Number	UTM Coordinates (NAD 27)	Survey Date	Bats Present	Species Observed
1	E 495574 N 4291331	June 4, 2001	N	NA
2	E 495593 N 4291332	June 4, 2001	Y	Unknown species
3	E 495797 N 4291296	June 5, 2001 June 7, 2004	Y	*M. evotis, M. ciliolabrum,* and other *Myotis* spp.[1]
4	E 495808 N 4291326	June 6, 2001 June 7, 2004	Y	*M. californicus* and other *Myotis* spp.[1]
5	E 495833 N 4291293	Not surveyed[2]	NA	NA
6	E 495872 N 4291287	Not surveyed[2]	NA	NA
7	E 496326 N 4291374	June 5, 2001 June 7, 2004	Y	Unknown species
8	E 496975 N 4291248	June 7, 2004	Y	*C. townsendii*
9	E 495485 N 4291339	June 6, 2001 June 7, 2004	Y	Unknown species
10	E 495602 N 4291328	June 4, 2001	N	NA
11	E 495723 N 4291307	June 4, 2001 June 7, 2004	Y	*C. townsendii, M. californicus, M. ciliolabrum, M. evotis,* and other *Myotis* spp.[1]
12	E 495684 N 4291309	June 8, 2004	Y	*C. townsendii, Myotis* spp.[1]
13	E 495596 N 4291310	June 4, 2001 June 8, 2004	Y	*C. townsendii, T. brasiliensis* (possible), and other *Myotis* spp.[1]
14	E 496026 N 4291431	June 5, 2001 June 7, 2004	Y	*Myotis* spp.[1]
15	E 496767 N 4291102	Not surveyed[2]	NA	NA
16	E 495287 N 4291560	Not surveyed[2]	NA	NA
17	E 495873 N 4291834	June 7, 2004	Y	*C. townsendii*
18	E 494708 N 4291293	Not surveyed[2]	NA	NA
19	E 495349 N 4290870	Not surveyed[2]	NA	NA

[1] Identified to genus only.

[2] Mine workings deemed not likely to be used by bats (JBR 2001).

Sources: JBR 2001; Wildlife Resource Consultants 2004.

Table 3.18-3
Mine Workings Identified with Suitable Bat Habitat in the Round Mountain Expansion Area

Mine Working Identification Number	UTM Coordinates (NAD 27)	Mine Working Type
1	E 494470 N 4282833	Adit
2	E494421 N 4283708	Adit
3	E 494437 N 4283723	Adit
4	E 494472 N 4283803	Adit
5	E 494563 N 4283815	Adit
6	E 494610 N 4283820	Adit
7	E 494694 N 4283439	Adit
8	E 494778 N 4283504	Adit
9	E 494848 N 4283757	Shaft
10	E 494667 N 4283445	Shaft
11	E 494670 N 4283710	Shaft
12	E 494544 N 4283710	Shaft
13	E 494385 N 4283731	Shaft
14	E 494414 N 4283869	Shaft

Source: Reynolds and Fox 2006.

Big Brown Bat

The big brown bat is a year-round resident in Nevada. This species is found from low to high elevations (980 to 9,800 feet) and occupies a variety of habitats including pinyon-juniper, blackbrush, creosote, sagebrush, and salt desert scrub (Bradley et al. 2006). This species gleans insects over water and open landscapes, as well as in both forested and edge settings (Bradley et al. 2006). The big brown bat is a colonial species, roosting in groups up to several hundred. Roost sites include caves, mines, buildings, bridges, and trees. This species is known to be more tolerant of human habitation than other bat species. Suitable roosting and foraging habitat occurs within the study area. Additionally, this species has been

documented during acoustic surveys within the proposed project area (NDOW 2009b). The potential for this species to occur within the study area is considered high.

Spotted Bat

The spotted bat is rare throughout the western U.S., including Nevada. Although limited data is currently available on this species, it is thought that its distribution is linked to the availability of suitable cliff roosting habitat. This species is found within a wide variety of habitats from low elevation desert scrub to high elevation coniferous forest habitats, including pinyon-juniper, sagebrush, riparian, and urban habitats (Altenbach et al. 2002). This species has been reported roosting in horizontal rock crevices in cliffs, along washes, or in rock outcrops (AGFD 1993; Altenbach et al. 2002; Harvey et al. 1999). It is believed that this bat forages nocturnally for insects over open water, marshes, and open woodlands (e.g., pinyon-juniper). Although previous surveys have not observed this species, there is suitable winter and foraging habitat located within the study area. The potential for this species to occur within the study area is considered moderate.

Hoary Bat

The hoary bat is a summer resident in Nevada found at low to mid elevations (1,870 to 8,200 feet) in forest habitats including riparian and upland forests (Bradley et al. 2006). This species is also found in valley basins containing pure stands of Rocky Mountain juniper as well as agricultural areas (Bradley et al. 2006). The hoary bat forages primarily at high altitudes over the tree canopy and follows watercourses for foraging and drinking (Bradley et al. 2006). This species roosts in trees within foliage but may roost in caves and beneath rock ledges (Bradley et al. 2006). This species has been documented during acoustic surveys within the proposed project area (NDOW 2009b). The potential for this species to occur within the study area is considered high.

California Myotis

The California myotis is a year-round resident found throughout Nevada at low and middle elevations (689 to 8,957 feet amsl). This species occurs in a variety of habitats from Lower Sonoran desert scrub to forests. The California myotis gleans insects above open habitat. This species typically roosts singly or in small groups, although some mines are known to shelter colonies of over 100 individuals. Roost sites include mines, caves, buildings, rock crevices, hollow trees, and under exfoliating bark (Altenbach et al. 2002). This species was recorded in the Gold Hill Area during acoustic surveys at mine workings 4 and 11. The potential for this species to occur within the study area is considered high.

Small-footed Myotis

The small-footed myotis is found throughout Nevada from approximately 3,500 to 5,900 feet amsl. This species inhabits a variety of habitats including desert scrub, grassland, sagebrush steppe, blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agricultural lands, and urban areas (Altenbach et al. 2002). Day and maternity roosts of western small footed myotis have been found in crevices in cliffs, boulders, and on talus slopes. Summer roosts are highly variable and include buildings, mines, under the bark on trees, and crevices in cliffs and boulders (AGFD 1993; Harvey et al. 1999). This species prefers

small protected dry crevices. Night and hibernation roosts are located in small caves and abandoned mine workings. Buildings also are used as temporary night roosts between flights. Western small-footed myotis forage for insects over rocky bluffs, in clearings, near rocks, and over forests (AGFD 1993; Altenbach et al. 2002; Harvey et al. 1999). This species was recorded in the Gold Hill Area during acoustic surveys at mine workings 3 and 11. The potential for this species to occur within the study area is considered high.

Long-eared Myotis

The long-eared myotis is found throughout Nevada from approximately 2,260 to 6,790 feet amsl but primarily is found at higher elevations. The long-eared myotis primarily is associated with coniferous forests, including pinyon-juniper woodlands, but the species also utilizes sagebrush and desert scrub habitats. Day roosts include hollow trees; under loose tree bark; crevices in rock cliffs and fissures in the ground; and occasionally in caves, abandoned mines, and buildings. Night roosts primarily occur in caves, mines, and abandoned buildings (AGFD 1993; Altenbach et al. 2002; Harvey et al. 1999). This species is known to roost singly or in small groups. This species gleans insects (primarily small moths) over vegetation and open water (e.g., rivers, streams, and ponds) (Altenbach et al. 2002). Areas of rock outcrops as well as abandoned mines and buildings could provide suitable roost sites for this species. This species was recorded in the Gold Hill Area during acoustic surveys at mine workings 3 and 11. The potential for this species to occur within the study area is considered high.

Little Brown Bat

The little brown bat is probably a year-round resident found primarily in the northern parts of Nevada at higher elevations. This species is often associated with coniferous forests. Foraging occurs in open areas among vegetation, along water margins, and above open water. Roost sites include hollow trees, rock outcrops, buildings, and occasionally in mines and caves (Bradley et al. 2006). Suitable roosting and foraging habitat occurs mainly east of the proposed project area at higher elevations in the Toiyabe Range. However, this species has been documented during acoustic surveys within the proposed project area (NDOW 2009b). The potential for this species to occur within the study area is considered high.

Fringed Myotis

The fringed myotis is found in the central and southern portions of Nevada and probably in portions of northern Nevada. This species occupies a wide range of habitats ranging from desert scrub communities to higher elevation coniferous forests. However, oak and pinyon woodlands appear to be the most commonly used habitat (Harvey et al. 1999). This small myotis typically is found from approximately 1,380 to 7,090 feet in elevation (Altenbach et al. 2002). Fringed myotis use mines, caves, rock crevices, and buildings for day roosts. Temporary night roosts have been found in mines, and large maternity colonies have been located in caves and buildings (AGFD 1993; Altenbach et al. 2002; Harvey et al. 1999). Little is known about the migration habits of the fringed myotis, but individuals have been documented hibernating in caves. This species gleans small insects (mainly moths) from foliage during foraging. Although previous surveys have not observed this species, there is suitable roosting and foraging habitat located within the proposed project area. The potential for this species to occur within the study area is considered moderate.

Cave Myotis

The cave myotis is known from a single location in Nevada near Lake Mead National Recreation Area (Altenbach et al. 2002). This species occupies lower elevation desert scrub habitats. Cave myotis use caves, mines, and occasionally buildings and bridges for day roosts. Night roosts consist of the same structures but locations near the entrance are preferred (Altenbach et al. 2002). Hibernacula are generally in caves and mines. This species is primarily a summer resident in Nevada. The cave myotis forages over open areas and over vegetation. This species was possibly recorded in the Gold Hill Area during acoustic surveys. The potential for this species to occur within the study area is considered high.

Long-legged Myotis

The long-legged myotis occupies pinyon-juniper and montane coniferous forest habitats in Nevada ranging from approximately 3,050 to 11,220 feet amsl. Individuals typically day roost singly or in small groups in buildings, rock crevices, caves, abandoned mines, or in hollow trees, particularly large diameter snags or live trees within lightning scars (AGFD 1993; Altenbach et al. 2002; Harvey et al. 1999). Night roosts and hibernacula are often in caves and mines. Foraging typically occurs in open areas, often at canopy height (Altenbach et al. 2002). Although previous surveys have not observed this species, there is suitable roosting and foraging habitat located within the proposed project area. The potential for this species to occur within the study area is considered moderate.

Western Pipistrelle

The western pipistrelle is a year-round resident in Nevada, occupying low and mid elevations (680 to 8,200 feet) in desert habitats of blackbrush, creosote, salt desert scrub, and sagebrush, with occasional occurrence in ponderosa pine and pinyon-juniper, usually in association with rock features such as granite boulders and canyons (Bradley et al. 2006). This species gleans insects over open habitats. This species roosts both singly or in small groups in mines, caves, or occasionally in buildings and vegetation. Suitable roosting and foraging habitat occurs within the study area. Additionally, this species has been documented during acoustic surveys within the proposed project area (NDOW 2009b). The potential for this species to occur within the study area is considered high.

Brazilian Free-tailed Bat

The Brazilian free-tailed bat is found throughout Nevada in a wide variety of habitats ranging from desert scrub to high elevation mountain habitats (Altenbach et al. 2002). This species roosts in a variety of structures including cliff faces, caves, mines, buildings, bridges, and hollow trees. Some caves are used as long term transient stopover roosts during migration (Altenbach et al. 2002). The Brazilian free-tailed bat is known to travel long distances to foraging areas and often forages at high altitudes. This species was possibly recorded in the Gold Hill Area during acoustic surveys at mine working 13. The potential for this species to occur within the study area is considered high.

3.18.1.2 Pygmy Rabbit

The pygmy rabbit is distributed throughout the northern Great Basin, primarily in rocky habitats dominated by dense stands of big sagebrush and rabbitbrush, particularly in floodplain habitats. Pygmy rabbits usually remain near dense cover, where rabbits excavate burrows and create trail systems in the understory

(JBR 2001). Sagebrush is important forage for this rabbit and is consumed year-round. This species was recorded within the proposed project area along Jefferson Creek in 2006 (Reynolds and Fox 2006). The potential for this species to occur within the study area is considered high.

3.18.1.3 Desert Bighorn Sheep

The desert bighorn sheep is distributed throughout Nevada and inhabits a wide variety of habitats from desert scrub to pinyon-juniper forests to subalpine-alpine (McQuivey 1978). This species forages on a variety of grasses and forbs. Desert bighorn sheep have been observed in the proposed project vicinity and a resident population inhabits the Toquima Range to the east of the study area. Approximately 1,222 acres of desert bighorn sheep range occurs within the proposed project area. **Figure 3.18-3** illustrates the desert bighorn sheep range in the study area. The use of the study area by desert bighorn sheep is highly dependent on weather and forage availability. They typically inhabit the high elevation habitats of Mount Jefferson directly east of the study area (NDOW 2000). This population maintains large herd sizes and rarely moves out of the Mount Jefferson vicinity (NDOW 2000). The population is considered stable and had increased in numbers since its reestablishment to Mount Jefferson in 1982 (NDOW 2006, 2000). The potential for this species to occur within the study area is considered high.

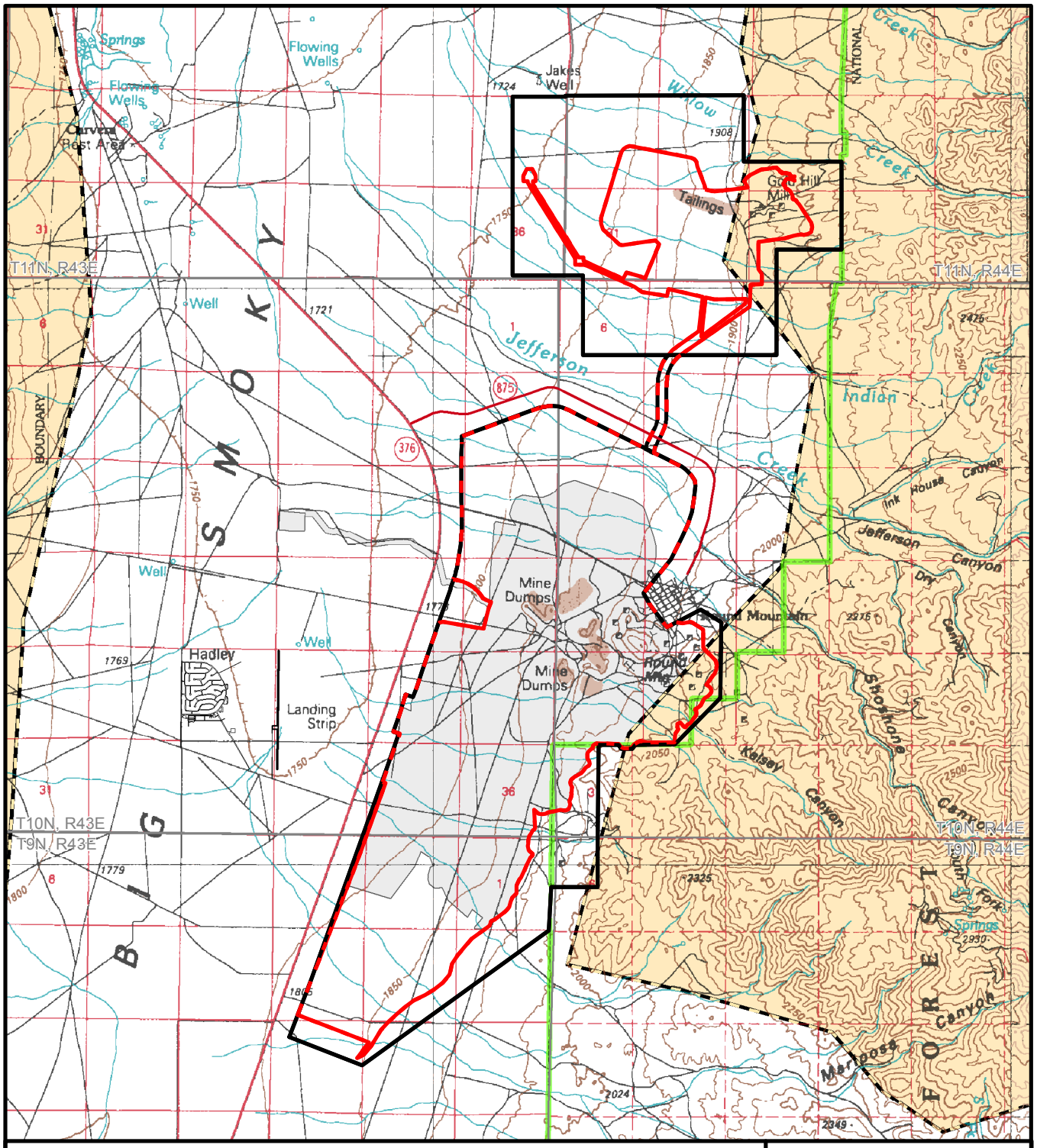
3.18.2 Birds

3.18.2.1 Golden Eagle

The golden eagle is a year-long resident and is considered to be a common breeder throughout Nevada; however, eagle densities and nesting activity are greatest in the northern third of Nevada (Herron et al. 1985). Nesting golden eagles prefer suitable cliffs that overlook sagebrush flats, piyon-juniper forests, salt desert shrub, or other habitat capable of supporting a suitable prey base. Highest densities of nesting eagles typically are found along river systems where cliffs border the entire length of the river, and lower densities are found in piyon-juniper habitat and salt desert shrub communities (Herron et al. 1985). Wintering golden eagles tend to congregate in broad valleys interspersed with agricultural croplands or sagebrush and desert shrub communities. This species has been recorded within the study area and suitable nesting habitat exists in the eastern portion of the proposed project area. The nearest documented golden eagle nest is located >1 mile east of the study area on USFS land (Reynolds and Fox 2003). Suitable foraging habitat exists within the study area. The potential for this species to occur within the study area is considered high.

3.18.2.2 Short-Eared Owl

Short-eared owls are year-round residents of Nevada, although few nest sites have been identified. The species tend to nest in meadow and wetland habitats (Herron et al. 1985). Short-eared owls forage in open areas and are known to roost on the ground. This species has been recorded within the study area. A dead short-eared owl was found in the Jefferson Creek drainage. In addition, an individual was possibly seen foraging near a mine working west of the mill site (JBR 2001). Based on the amount of pellets and whitewash in the immediate area, it is likely the species nested within the proposed project area (Reynolds and Fox 2006). Suitable nesting and foraging habitat exists within the study area. The potential for this species to occur within the study area is considered high.



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Desert Bighorn Sheep Range
- National Forest Boundary

Note: Elevations provided in meters, USGS 1929 Vertical Datum.
Source: NDOW 2007b.

N

0 0.5 1 2 Miles

Round Mountain Expansion Project

Figure 3.18-3

Desert Bighorn Sheep Range

05/25/2009

3.18.2.3 Burrowing Owl

The burrowing owl is known to breed throughout Nevada. The majority of the breeding population is known to migrate from northern Nevada during the winter months. However, observations of this owl have been recorded throughout Nevada during all months of the year (Herron et al. 1985). Breeding by burrowing owls is strongly dependent on the presence of burrows constructed by prairie dogs, ground squirrels, or badgers. Prime burrowing owl habitat must be open, have short vegetation, and contain an abundance of burrows. This species was possibly detected flying in the Gold Hill Area during surveys (JBR 2001). However, no known nest sites occur within the proposed project area. Suitable foraging habitat exists within the study area. The potential for this species to occur within the study area is considered high.

3.18.2.4 Ferruginous Hawk

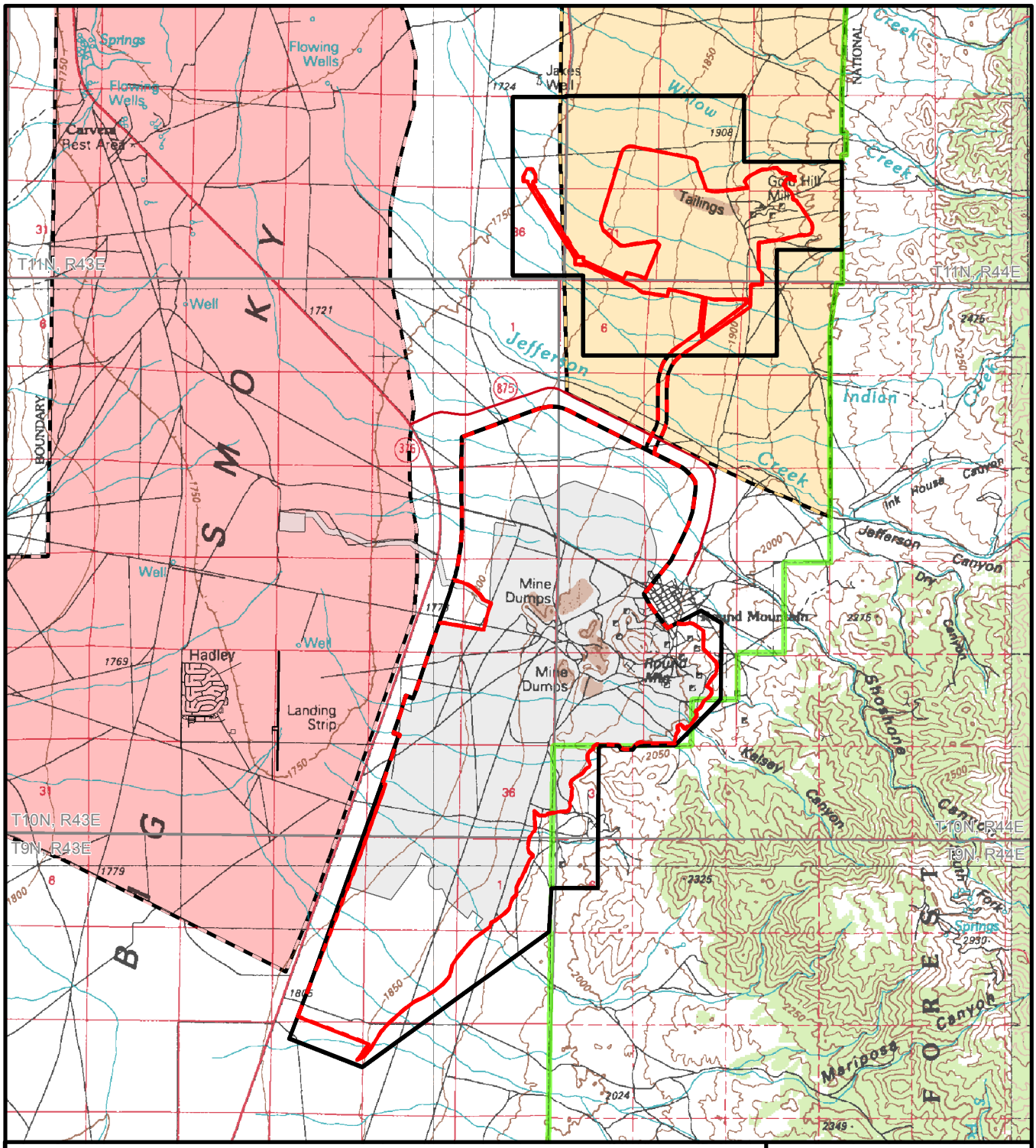
The ferruginous hawk is a common breeder in many areas of Nevada. This species often nests in trees, on promontory points, rocky outcrops, cut banks, or on the ground. Preferred breeding habitat in most of the state is scattered juniper forests at the interface between pinyon-juniper and desert shrub communities that overlook broad valleys used for foraging (Herron et al. 1985). There is suitable foraging habitat located within the study area and NDOW biologists observed a pair of ferruginous hawks in the study area during the summer of 2008 on 3 separate occasions. It is believed this pair has established a breeding territory in the study area or CESA (NDOW 2009c). The potential for this species to occur within the study area is considered high.

3.18.2.5 Greater Sage-grouse

The greater sage-grouse is found throughout Nevada in sagebrush dominated habitats. Sagebrush is a key component of greater sage-grouse habitat on a year-long basis (USFWS MPR 2007). Sagebrush provides forage and nesting, security, and thermal cover for this species. Moist areas that provide succulent herbaceous vegetation during the summer months are used extensively as brood rearing habitat. Open, often elevated areas within sagebrush habitats usually serve as breeding areas (i.e., strutting grounds or lek sites) (USFWS MPR 2007). During winter, greater sage-grouse often occupy wind exposed areas where sagebrush is available (e.g., drainages, southern or western slopes, or exposed ridges). No known leks occur within the study area. However, 1 lek exists approximately 7 miles north of the proposed project area. Approximately 4,332 acres of occupied winter, spring, and brood rearing habitat occurs within the proposed project area. **Figure 3.18-4** illustrates occupied winter, spring, and brood rearing habitat as well as potential winter, spring, and brood rearing habitat in the study area. Fecal pellets were recorded in the northeastern and northwestern portions of the proposed project area (JBR 2001; Reynolds and Fox 2003). The potential for this species to occur within the study area is considered high.

3.18.2.6 Prairie Falcon

Prairie falcons are found throughout the Great Basin and are permanent residents of Nevada. Habitat requirements include steep cliff ledges and outcrops for nesting that border semi-arid valleys (BLM 2005). The highest nesting densities in Nevada occur in northern counties, particularly located in or near the mouth of narrow canyons, overlooking riparian vegetation and agricultural lands (Herron et al. 1985). This species has been recorded within the proposed project area during surveys (Reynolds and Fox 2006). Suitable foraging habitat exists within the study area and suitable nesting habitat exists in the eastern portion of the study area. The potential for this species to occur within the study area is considered high.



Legend

- Proposed Project Boundary
- Proposed Action
- Proposed Project Boundary/Proposed Action Overlap Areas
- Permitted Disturbance (No Action Alternative)
- Potential Winter, Spring, and Brood Rearing Habitat
- Occupied Winter, Spring, and Brood Rearing Habitat
- National Forest Boundary

Note: Elevations provided in meters, USGS 1929 Vertical Datum.
Source: NDOW 2009c, 2007b.

N

0 0.5 1 2 Miles

Round Mountain Expansion Project

Figure 3.18-4

Greater Sage-grouse Habitat

05/25/2009

3.18.2.7 Peregrine Falcon

The peregrine falcon is found in southwestern and extreme southeastern Nevada. This species prefers tall cliffs with an unobstructed view for both nesting and perching. Peregrine falcons nest on cliffs and rock ledges usually in close proximity to a water source (Johnsgard 1990). This species typically migrates south of the U.S. during winter months. Peregrine falcons forage in open areas for birds and occasionally small mammals (Johnsgard 1990). Although previous surveys have not observed this species, there is suitable foraging habitat located within the study area. However, no known nest sites occur within or near the study area. This species has been observed north of the study area near the Moores Creek Road (NDOW 2009b). The potential for this species to occur within the study area is considered moderate.

3.18.2.8 Pinyon Jay

The pinyon jay ranges throughout the western U.S. and is a permanent resident of Nevada. This species is strongly associated with pinyon-juniper forest habitat and can be found following the pinyon-juniper belt extending from the Humboldt River south to the Mojave Desert. Pinyon jays are semi colonial nesters and occur in large groups where food is abundant (NGS 1983). Although previous surveys have not observed this species, there is suitable foraging habitat located in the eastern portion of the study area. However, due to the lack of suitable nesting habitat (i.e., pinyon-juniper woodlands) in the study area, it is unlikely that this species would nest in the study area. The potential for this species to occur within the study area is considered high.

3.18.2.9 Loggerhead Shrike

The loggerhead shrike is a common resident throughout Nevada. This species is found in open grasslands along valley floors and foothills of the Great Basin. In Nevada, it is commonly found in scrub habitat types such as sagebrush and greasewood. Loggerhead shrikes prefer shrubs or small trees for nesting, but nesting also can occur in pinyon-juniper woodlands. This species can be found perching on wire, fences, or poles (NGS 1983). Although previous surveys have not observed this species, there is suitable nesting and foraging habitat within the study area. The potential for this species to occur within the study area is considered high.

3.18.2.10 Sage Thrasher

The sage thrasher is found throughout Nevada in sagebrush grasslands and less commonly in mountain shrub habitats (NGS 1983). This species nests in or under shrubs such as sagebrush, rabbitbrush, and mountain mahogany. Although previous surveys have not observed this species, there is suitable nesting and foraging habitat within the study area. The potential for this species to occur within the study area is considered high.

3.18.2.11 Brewer’s Sparrow

The Brewer’s sparrow is found throughout Nevada in low elevation habitats such as desert scrub and sagebrush grasslands. This species occurs less frequently in mountain shrub habitats. This species nests near the ground under sagebrush and other shrubs (NGS 1983). This species has been recorded within the

proposed project area during surveys (Reynolds and Fox 2006). Suitable nesting and foraging habitat exists within the study area. The potential for this species to occur within the study area is considered high.

3.18.3 Amphibians

3.18.3.1 Columbia Spotted Frog

The Columbia spotted frog occurs primarily in Central Nevada (Nye County) and northeastern Nevada (Elko and Eureka counties), usually at elevations between 5,600 and 8,700 feet amsl (USFWS 2007a). This species prefers quiet aquatic habitats including perennial streams, ponds, springs, lakes, and marshes (USFWS 2007a). The Columbia spotted frog may travel to uplands during wet weather, expanding localized populations. The nearest known population is located east of the study area on USFS land. Although previous surveys have not observed this species within the proposed project area, there is marginal habitat along Jefferson Creek (Reynolds and Fox 2006). The potential for this species to occur within the study area is considered moderate.

3.18.4 Fish

3.18.4.1 Big Smoky Valley Tui Chub

The Big Smoky Valley tui chub occurs between the Toiyabe and Toquima mountain ranges in Nevada. This species preferred habitat is perennial spring-fed streams. This species has not been recorded within the study area and no suitable habitat occurs within the study area. The nearest known record for this species is approximately 15 miles north of the proposed project area. The potential for this species to occur within the study area is considered low.

3.18.4.2 Lahontan Cutthroat Trout

The Lahontan cutthroat trout occurs primarily in northern and northwestern Nevada. This species is known from Pyramid, Walker, and Independence lakes as well as Lake Tahoe; Humboldt, Carson, Truckee, Walker, and Marys River basins; and Donner and Prosser creeks (USFWS 2007b). This species also is known from several locations within the Big Smoky Valley. The Lahontan cutthroat trout prefers streams and lakes with well oxygenated water in these basins. The nearest population is located approximately 6 miles northeast of the proposed project area in Moores Creek on USFS land (NDOW 2007e). This species has not been recorded within the proposed project area and no suitable habitat occurs within the proposed project area. The potential for this species to occur within the study area is considered low.

3.18.4.3 Big Smoky Valley Speckled Dace

The Big Smoky Valley speckled dace occurs between the Toiyabe and Toquima mountain ranges in Nevada. This species prefers perennial spring-fed streams. This species has not been recorded within the proposed project area and no suitable habitat occurs within the proposed project area. However, this species has been documented approximately 4 miles west of the proposed project area. The potential for this species to occur within the study area is considered low.

3.18.5 Invertebrates

3.18.5.1 Big Smoky Wood Nymph

The Big Smoky Valley wood nymph is known only from the Big Smoky Valley between the Toiyabe and Toquima mountain ranges in Nevada. The preferred habitat for this species is grassy alkaline flats. No suitable habitat occurs within the proposed project area. However, this species is known to occur at the north end of the Big Smoky Valley. The potential for this species to occur within the study area is considered low.

3.18.6 Plants

3.18.6.1 Eastwood's Milkweed

The Eastwood's milkweed is a Nevada endemic species known from southern Lander, and northern and central Nye, Esmeralda, and Lincoln counties. This species inhabits open areas on a wide variety of alkaline soils including calcareous knolls, sand, and carbonate or basaltic gravels, or shale outcrops. The milkweed is generally associated with shadscale, mixed-shrub, sagebrush, and lower pinyon-juniper communities. Frequently found in small washes or other moisture-accumulating microsites, this species inhabits elevations ranging from 4,680 to 7,080 feet amsl (NNHP 2001a). Species-specific surveys were conducted within suitable habitat within the proposed project area in 2006. While suitable habitat was present for this species, no populations were identified. However, based on the presence of suitable habitat within the proposed project area, the potential for this species to occur is considered moderate.

3.18.6.2 Sanicle Biscuitroot

The Sanicle biscuitroot is a Nevada endemic species known to occur only in Lincoln and Nye counties. This species inhabits loose sandy to gravelly, often somewhat alkaline soils on volcanic tuff deposits and mixed valley alluvium, typically in small drainages with blackbrush, mixed-shrub, sagebrush, and lower pinyon-juniper communities. This species has been recorded at elevations between 3,150 and 6,720 feet amsl with a flowering period extending from late winter to spring (NNHP 2001b). Based on literature review, a cursory field review, and agency consultation, suitable habitat for this species is present scattered throughout the proposed project area. However, surveys have not documented this species within the proposed project area. Based on the presence of suitable habitat within the proposed project area, the potential for this species to occur is considered moderate.

3.18.6.3 Nevada Dune Penstemon

The Nevada dune penstemon is a Nevada endemic species known to occur only in Churchill, Mineral, and Nye counties. This species inhabits deep loose sandy soils of valley bottoms, aeolian deposits, and dune skirts, often in alkaline areas, sometimes on road banks and other recovering disturbances crossing such soils, in shadscale communities. Dependent on sand dune habitats or deep sand profiles, this species has been recorded at elevations between 3,920 and 5,960 feet amsl with a flowering period in late spring (NNHP 2001c). Based on literature review, a cursory field review, and agency consultation, suitable habitat is present for this species within the proposed project area. However, surveys have not documented this species within the proposed project area. Based on the presence of suitable habitat within the proposed project area, the potential for this species to occur is considered moderate.

3.18.6.4 Cacti, Agave, Yucca, Christmas Trees

In addition to the aforementioned regulation, state law under NRS 527.060-527.120 regulates the commercial harvest, possession, and transportation of any cactus, evergreen tree, or member of the *Yucca* or *Agave* genera. Species-specific surveys were conducted throughout the Gold Hill and Round Mountain areas in 2003 and 2006, subsequently (Reynolds and Fox 2006, 2003). Numerous species were identified throughout the survey areas in widely scattered locations. Species of cacti encountered included saint cactus (*Echinocereus engelmannii* var. *chrysocentrus*), Mohave prickly pear (*Opuntia erinacea* var. *utahensis*), plains prickly pear (*Opuntia polycantha* var. *rufispina*), sand cholla (*Opuntia pulchella*), foxtail cactus (*Coryphantha vivipara* var. *rosea*), and hedgehog thistle (*Pediocactus simpsonii* var. *simpsonii*). Based on the presence of cacti species and suitable habitat, the potential for these species to occur within the proposed project area would be considered high.

3.19 Access and Land Use

The study area for land use and access includes the proposed project area (Round Mountain and Gold Hill areas, and the Transportation/Utility Corridor) and the Big Smoky Valley within approximately 3 miles north and south of the proposed project area. The CESA includes T9N, R43E; T10N and T11N, R43E and R44E; plus the easterly 6 sections of T9N, R42E; and Section 6 of T9N, R44E.

3.19.1 Land Use

Nye County has a land area of approximately 18,159 mi^2, 95 percent of which is administered by Federal government agencies including the BLM (10,555 mi^2), Department of Defense Test Range (3,593 mi^2), units of the Humboldt-Toiyabe National Forest (2,742 mi^2), and Department of Energy test sites. Approximately 5 percent of the county is privately owned and a very small portion, less than 0.1 percent, is owned by the State of Nevada. Nearly 25 mi^2 of the Big Smoky Valley are private land, much of it attributable to the availability of water for agriculture. In the case of the Round Mountain Mine property, most of the private ownership is attributable to patented mining claims. The remainder of the valley floor is BLM land; both the Toiyabe Range to the west and the Toquima Range to the east are parts of the Humboldt–Toiyabe National Forest.

The study area is within the administrative boundaries of the BLM-Tonopah Planning Area (BLM 1997), which will be updated and revised in the next several years. USFS lands in the proposed project vicinity are currently managed according to the Toiyabe National Forest Land and RMP (USFS 1986). A forest plan revision was initiated, but activity on the revision has been suspended (Lucich 2009).

Of particular relevance to the land use discussion, the RMP has specified objectives for “lands and rights-of-way” and for “locatable minerals.” The lands and ROWs objective is:

> “To make lands available for community expansion and private economic development and to increase the potential for economic diversity” (BLM 1997).

To that end, almost 50,000 acres of public land in the CESA have been identified as disposal areas, meaning they are available for sale or trade to private entities (**Figure 3.19-1**). As an example, the BLM recently finalized the sale of the Hadley airport to RMGC.

The RMP objective for locatable minerals is:

> “To provide opportunity for exploration and development of locatable minerals such as gold, silver, copper, lead, zinc, molybdenum, etc., consistent with the preservation of fragile and unique resources in areas identified as open to the operation of the mining laws” (BLM 1997).

All of the BLM-administered public lands in the Big Smoky Valley are open to development of locatable minerals.

Nye County has no land use plans or zoning regulations applicable to the Big Smoky Valley (Harris 2007). There are regulations governing procedures for subdividing land throughout the county, but uses are not controlled in most of the county including the Big Smoky Valley. Nye County adopted a Policy for Public

Lands addressing the county's priorities for management of Federal lands within its boundaries (Nye County 1985). The general statement of the county's objective for public lands states:

> "Manage and utilize public lands on the basis of multiple use and sustained yield concept, and in a manner that would conserve natural resources; protect and preserve the quality of the environment, and ecological, scenic, historical and archeological values; protect and preserve wildlife habitat, and certain lands in their natural condition; and provide for long-term benefit, including economic benefits, for the people of Nye County and future generations."

The Policy for Public Lands emphasizes the county's support for, and dependence on, mineral resources development. Specifically, the mineral resources objective states:

> "Recognize that the development of Nevada's mineral resources is desirable and necessary to the nation, the State and Nye County. Retain existing mining areas and promote the exploration and development of potential mineral deposits."

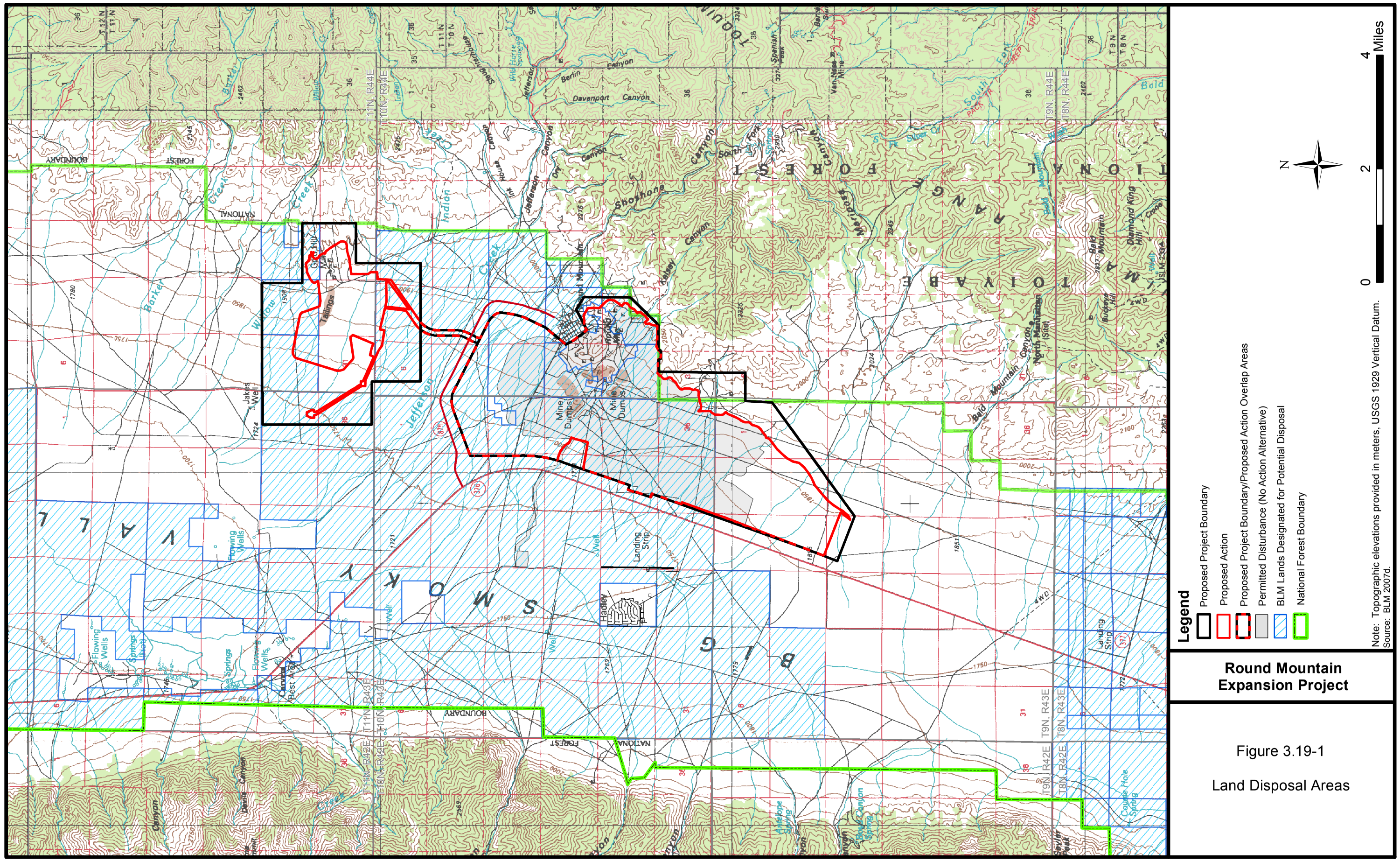
Existing land use in the study area includes open space, grazing, mining, some hay production, dispersed recreation (particularly in the Humboldt-Toiyabe National Forest) and small community and rural acreage residential development. The existing Round Mountain Mine is the dominant contributor to the local economy.

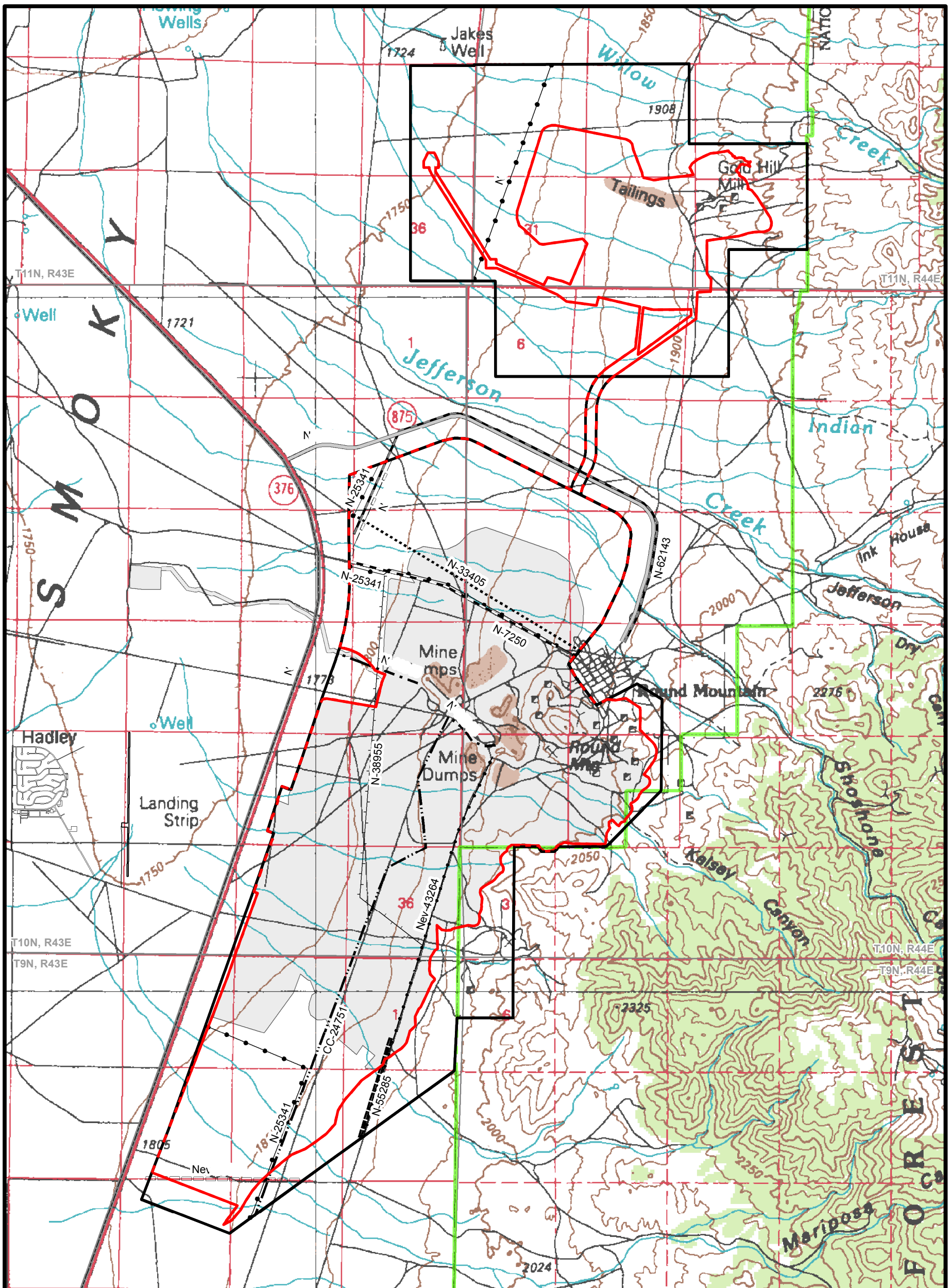
Hadley, a subdivision of Round Mountain, is the primary residential community in the study area. Round Mountain has an estimated population of approximately 790, only 25 of whom still reside in the Round Mountain townsite with the remainder living in Hadley (Nevada State Demographer 2007; Sweeney 2007). Hadley is located approximately 2 miles west of the existing Round Mountain Mine and has a golf course, gas station/convenience store, general store/market, community center, park, community schools, and an air strip. Carvers is an unincorporated community approximately 5 miles northwest of the existing Round Mountain Mine. Carvers is a mixture of small town lots and larger acreages with a number of commercial establishments including a restaurant/bar, tire/auto repair shop, hardware store, and gas station.

There is no prime or unique farmland in the proposed project vicinity. However, there are irrigated hay fields located north and southwest of the existing Round Mountain Mine with the closest being approximately 1.25 miles west of the proposed project area.

Existing ROWs and other land use authorizations in the study area are summarized in **Table 3.19-1** and illustrated on **Figure 3.19-2**. Information on these authorizations was derived from BLM Master Title Plats. Most of the authorizations are for utility ROWs, either electric transmission lines or telephone/fiber optic communication lines.

There are no Indian Reservations within the study area.


Legend
Proposed Project Boundary
Proposed Action
Proposed Project Boundary/Proposed Action Overlap Areas
Permitted Disturbance (No Action Alternative)
BLM Lands Designated for Potential Disposal
National Forest Boundary
Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.
Source: BLM 2007d.
Round Mountain Expansion Project
Figure 3.19-1
Land Disposal Areas
0
2
4
Miles
N
05/25/2009



Legend

- Proposed Project Boundary
- Permitted Disturbance (No Action Alternative)
- Proposed Action
- Proposed Project Boundary/ Proposed Action Overlap Areas
- National Forest Boundary

- CC-24751
- N-11845
- N-20778
- N-25341
- N-33405
- N-38955
- N-55285
- N-60887
- N-60961
- N-62143
- N-7250
- Nev-43264
- Nev-63690

N

0 1 2 Miles

Note: Table 3.19-1 provides descriptions of the rights-of-way in the proposed project boundary. Topographic elevations provided in meters, USGS 1929 Vertical Datum.

Source: BLM 2007d.

Round Mountain Expansion Project

Figure 3.19-2
Rights-of-Way

05/25/2009

Table 3.19-1
Land Use Authorizations and ROWs Within the Study Area

Serial Number	Grantee	Use	Township	Range	Section	ROW Width (feet)
N-3759	Town of Round Mountain	Water Plant	10N	44E	16, 20, 21	20
CC-9123	Round Mountain Gold Corp.	Water Plant	10N	43E	23, 24	50
CC-20778	Nevada Department of Transportation	State Highway 376	9N 10N 11N	43E 43E 43E	3, 9, 10, 15, 16 3, 4, 10, 11, 14, 23, 26, 27, 34, 35 29, 30, 32, 33	200
CC-24751	NVEnergy	Power Transmission Line	9N 10N	43E 43E	1, 2, 11, 14 24, 25, 36	10
N-38955	NVEnergy	Power Transmission Line	10N 10N	43E 44E	13, 24, 25, 36 18-20	12.5
Nev-43264	NVEnergy	Power Transmission Line	9N 10N	43E 43E	1, 12 25, 36	50
N-45089	Round Mountain Gold Corp.	Water Facility	10N	43E	23, 24	25
N-46314	Nevada Bell	Telephone & Telegraph	10N	43E	23, 24	5
N-46445	Nevada Bell	Telephone & Telegraph	10N	43E	13, 24	20
N-48110	NVEnergy	Power Transmission Line	10N	43E	24	Power Station
N-54310	Round Mountain Gold Corp.	Water Facility	10N	43E	23, 24	7.5
N-55147	NVEnergy	Power Transmission Line	10N	43E	23, 24	12.5
N-55285	Round Mountain Gold Corp.	Roads	9N 10N	43E 43E	1, 12 36	8
N-60887	Nye County Road Department	County Road 875	10N 10N	43E 44E	11, 12 7, 8, 17, 20	50
N-60961	NVEnergy	Power Transmission Line	10N 10N	43E 44E	2, 13 7, 8, 17, 20	15
N-62143	Nevada Bell	Telephone & Telegraph	10N 10N	43E 44E	12, 13, 14, 23 7, 8, 17, 20	10

Source: BLM 2007d.

3.19.2 Access

The study area is served by a sparse network of roadways typical of rural Nevada. U.S. Route 50, “The Loneliest Road In America,” is the primary east-west traffic artery across central Nevada, connecting the north end of the Big Smoky Valley with Reno, Nevada, to the west and Ely, Nevada, to the east, going on to join up with I-70 in central Utah. U.S. Route 50 is approximately 50 miles north of the study area. U.S. Route 6 crosses to the south of the Big Smoky Valley, passing through the City of Tonopah, connecting to Bishop, California, to the southwest and Ely, Nevada, to the northwest. U.S. Route 6 is almost 50 miles south of the study area.

SR 376 is the primary north-south highway through the length of the Big Smoky Valley. SR 376 is a paved, two-lane highway designated as a “rural major connector” by the NDOT (NDOT 2006). SR 376 runs parallel to the west edge of the proposed project area in the Round Mountain vicinity.

There are a limited number of improved side roads connecting to SR 376 in the proposed project vicinity. County Road 875, an asphalt paved two-lane road, provides access to Round Mountain. Pablo Canyon Road provides access to Hadley. It is maintained by Nye County and paved as far as Hadley. In addition to the paved roads, there is a network of lesser roads throughout the valley varying from well maintained gravel roads to crude two-track roads. These roads provide local access to both public and private lands, including access points to the Humboldt-Toiyabe National Forest and the wilderness areas on both sides of the Big Smoky Valley.

Existing traffic conditions on SR 376 near the proposed project area are at level of service (LOS) “A.” (See Section 4.19-1 for a discussion of LOS.) Traffic volumes on SR 376 between CR 875 and Carvers averaged 1,150 vehicles per day in 2005, which was nearly the same as the 10-year average for the location (NDOT 2006). There was only minor variation in traffic levels from year to year over the past decade. Traffic volumes on SR 376 near U.S. Route 6 averaged 490 vehicles per day in 2005, which was slightly below the 10-year average for that location. Peak hour traffic volumes are estimated at less than 10 percent of hourly roadway capacity.

3.20 Noise

The study area and the CESA for noise effects from the proposed project includes an area within approximately a 10-mile radius of the proposed project area. Because of the size of the proposed project area, the study area is approximately 30 miles long from north to south. As a practical matter, however, it is narrower east to west because of the terrain barriers provided by the Toiyabe Range to the west and the Toquima Range to the east.

Describing the environment potentially affected by noise from the proposed project involves identifying noise-sensitive receptors and existing noise sources in the vicinity, characterizing terrain features that may affect noise transmission, and determining existing noise levels.

The study area is located in a relatively remote area with four small communities and a few individual ranches and rural residences. The Carvers community is located approximately 3 miles west of the proposed project area with residential acreages extending 2 miles south from the core of the community. The original Round Mountain town site lies adjacent to the northeastern edge of the existing Round Mountain Pit and is surrounded on three sides by the proposed project area. Hadley, a subdivision of Round Mountain and the largest of the study area communities, is approximately 2 miles west of the existing tailings impoundment facilities. The Town of Manhattan is approximately 7 miles south of the proposed project area. Although technically within the study area, Manhattan is unlikely to be affected by proposed project noise because it lies in Manhattan Gulch, a narrow valley screened by higher terrain from the proposed project area. Other than the Round Mountain townsite, the nearest residence to the proposed project is a ranch approximately 1 mile west of the southwestern corner of the proposed project area. In addition, there is a rural residence approximately 1.5 miles northeast of the proposed project area and another ranch approximately 2.7 miles north-northwest of the proposed project area.

In addition to the residential areas, there also are two designated wilderness areas in the noise study area. The Alta Toquima Wilderness boundary is 2 miles east of the proposed project area and the Arc Dome Wilderness boundary is approximately 5.5 miles west of the proposed project area.

Natural sounds, including wind, insects, and birds are the principal contributors to ambient noise in outlying portions of the study area. Variations in wind speeds, in particular, can have a dramatic effect on noise levels in the area. Ranching, harvesting hay, dispersed recreation, and mining activities in the area generate occasional vehicular noise, although the traffic is very light. The principal sources of noise near the existing Round Mountain Mine are industrial type heavy equipment associated with mining activities. In addition, blasting from the mine typically occurs once each day. Military aircraft flyovers, which occur occasionally and often at low altitudes, produce noise at extremely high levels relative to all other noise sources in the study area when they occur.

Terrain in the study area varies from nearly flat to extremely steep and rugged. The floor of the Big Smoky Valley is 7 to 10 miles wide in the vicinity of the proposed project with a base elevation of approximately 5,740 feet amsl. Steep, complex mountainous terrain rises sharply on both sides of the valley with the Toiyabe and Toquima ranges on the west and east flanks of the valley, respectively. Round Mountain, from which both the town and the mine got their names, was the source of the ore for the mine for several years. The mountain itself no longer exists, its former location is now the Round Mountain Pit, which lies on the east side of the valley at the base of the Toquima Range. The proposed Gold Hill Pit would be similarly situated approximately 5 miles to the north. There are several high peaks in the Toiyabe Range, the tallest

of which is 11,775-foot-high Arc Dome. The Toquima Range, to the east, also has multiple peaks, with the tallest being the south summit of Mount Jefferson at 11,941 feet amsl.

Noise levels in the study area were determined from measurements taken at several locations in the vicinity of the proposed project, including several locations in or near Round Mountain and in Hadley. Measurement data also were compared with data obtained from previous monitoring in the area conducted in 1994 pursuant to the 1996 EIS for the mill and tailings impoundment facilities. Noise levels are generally very low in outlying areas. As would be expected in a rural area, levels were highest in high activity areas near the existing mine.

Background noise, approximated by the sound level exceeded 90 percent of the time during a given period (L_{90}) in the measurement data (**Appendix B**), is very low in outlying portions of the study area, ranging from the high 20s decibels on the A-weighted scale (dBA) to the mid-30s dBA, which is equivalent to a library reading room (see **Appendix B** and Glossary) (**Table 3.20-1**). Background levels in close proximity to existing mining activities were somewhat higher, ranging from 39.7 to 50.2 dBA, which would be similar to a quiet urban environment. Average equivalent continuous sound levels (L_{eq}) ranged from the mid- to upper-40s dBA in outlying areas, although these levels were influenced by wind in several cases. The measured L_{eq} for areas close to existing mining, measured at the fence line on the north edge of the Round Mountain Pit, ranged from 50.0 to 54.5 dBA. These measurements reflected the high levels of activity, including primarily loading and movement of haul trucks near the edge of the mining operation. Noise from blasting and from the warning sirens that preceded it were barely audible above background noise on the 2 days that noise monitoring occurred. This was a result of the location of the blasting fairly deep in the pit and the modern electronic detonators used, which are much quieter than primacord detonators (Fenne 2007).

As one factor of the field measurement of noise in the proposed project area, a meter was set in Round Mountain to measure throughout a 24-hour period. The meter was located at the meteorological monitoring site approximately 100 meters from the existing mine fence. During the monitoring period, haul trucks were being loaded and were moving material along the north side of the pit at an estimated 200 feet below the pit rim. The resulting day-night average sound level calculated from the measurements was 54.9 dBA. **Table 3.20-1** illustrates typical noise levels associated with several common indoor and outdoor activities, which would be helpful for understanding noise emission levels from the proposed project.

Table 3.20-1
Typical Values of Sound Level of Common Noise Sources

Sound Pressure Level (dBA)	Common Indoor Noise Levels	Common Outdoor Noise Levels
110	Rock band	--
105	--	Jet flyover at 1,000 feet
100	Inside New York subway train	--
95	--	Gas lawn mower at 3 feet
90	Food blender at 3 feet	--
80	Garbage disposal at 3 feet, or shouting at 3 feet	Noisy urban daytime
70	Vacuum cleaner at 10 feet	Gas lawn mower at 100 feet
65	Normal speech at 3 feet	Commercial area, heavy traffic at 300 feet
60	Large business office	--
50	Dishwasher in next room	Quiet urban daytime
40	Small theater, large conference room	Quiet urban nighttime
35	--	Quiet suburban nighttime
33	Library	--
28	Bedroom at night	--
25	Concert hall (background)	Quiet rural nighttime
15	Broadcast and recording studio	--
5	Threshold of hearing	--

Source: BLM 2002.

3.21 Environmental Justice

The study area and CESA for environmental justice address the Big Smoky Valley communities of Round Mountain, Hadley, Carvers, and Manhattan with limited attention to Tonopah and Nye County, as appropriate. State of Nevada data were used as the basis for determining whether at risk populations are present in the study area.

EO No. 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" (59 FR 7629), is "intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority communities and low-income communities access to public information on, and an opportunity for participation in, matters relating to human health and the environment." It requires each Federal agency to achieve environmental justice as part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including social and economic effects, of its programs, policies, and activities on minority and low-income populations.

Environmental justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or a treaty right has granted access to a specific location.

Currently, the BLM relies on the "Environmental Justice Guidance Under NEPA" prepared by CEQ (guidance) (1998), in implementing EO 12898 for NEPA documents. USEPA guidelines (CEQ 1998) for evaluating potential adverse environmental effects of projects require specific identification of minority populations when either: 1) a minority population exceeds 50 percent of the population of the affected area, or 2) a minority population represents a meaningfully greater increment of the affected population than of the population of some other appropriate geographic unit, such as the State of Nevada, as a whole.

EO 12898 requires identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. The EO provisions apply to programs involving Native Americans. These requirements were addressed in preparing this EIS by ensuring broad distribution of public information on the proposed project through public scoping meetings. The public was invited by the BLM to participate in two public scoping meetings, which were held in Hadley and the City of Tonopah on January 16 and 17, 2007, respectively. At the meetings, BLM and RMGC representatives discussed the proposed project and answered questions. In addition, project maps and literature pertaining to the NEPA process were available for review. Government-to-government consultation between the BLM and the tribal groups concerning the proposed project was initiated on September 14, 2007, and is currently ongoing. For an expanded discussion of Native American consultation conducted for the proposed project, see Section 3.5, Native American Traditional Values.

The baseline data presented below are based on information obtained from the 2000 U.S. Census Bureau. Data obtained from the U.S. Census Bureau website were compiled and released in 2000. Since that time, some of the data, in particular population and income levels, have been revised by local and state government agencies based on estimated projections. Estimated 2007 population and income levels are presented in Section 3.9, Social and Economic Values, to describe the social and economic conditions in the proposed project vicinity. Population and income levels also are included as part of the environmental

justice analysis; however, for consistency, only 2000 data on population and income levels were used because the 2005 estimates do not include all of the data needed for this analysis.

3.21.1 Minority Populations

Ethnically and racially, Nye County is notably less diverse than the state as a whole, with substantially fewer Black, Asian, and Hispanic residents. The county does have a higher percentage of American Indian, Eskimo or Aleuts than the state does, with 2.3 percent, compared with 1.3 percent for the entire state (2006 estimates). Blacks represent 1.2 percent of the county population compared with 6.9 percent of the state; figures for Asian or Pacific Islanders are 1.5 percent and 6.5 percent, respectively. People of Hispanic origin, of any race, comprise only 8.9 percent of the Nye County population, compared with 24.0 percent of the state (Nevada State Demographer 2006).

In accordance with the guidance, minority populations should be identified when either:

- The minority population of the affected area exceeds 50 percent; or
- The minority population of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

The population of American Indians does not exceed 50 percent for the county. The population of American Indians in Nye County could be considered “meaningfully greater” than the minority population in the general population. However, the numbers are at a scale to suggest that they are likely related to the Duckwater and Yomba Indian Reservations. The Duckwater Reservation is 75 miles and 3 mountain ranges removed from the Big Smoky Valley. The Yomba Reservation is 30 miles northwest of the proposed project area, west of the Toiyabe Range in the Reese River Valley. Consequently, the minority population threshold is not believed to be a consideration for the proposed project.

3.21.2 Low-Income Populations

According to the USEPA guidance, low-income populations in an affected area should be identified using the annual statistical poverty thresholds from the Bureau of the Census’ Current Population Reports on Income and Poverty. In identifying low-income populations, a community may be considered as either a group of individuals living in geographic proximity to one another or a set of individuals (such as migrant workers or Native Americans) where either type of group experiences common conditions of environmental exposure or effect.

Nye County’s median household income was $41,025 in 2004, which was 86.9 percent of the Nevada median ($47,231) and 92.5 percent of the U.S. median ($44,334) for the same year (U.S. Census Bureau 2006).

An estimated 11.9 percent of Nye County’s population was considered to be living in poverty in 2004 according to Census estimates (U.S. Census Bureau 2006). This rate was higher than the statewide rate of 11.1 percent, but lower than the national estimate of 12.7 percent. The rate for children and youth under 18 in Nye County was much higher at 19.0 percent, which put the county substantially higher than both the State of Nevada (15.3 percent) and the U.S. (17.8 percent) (U.S. Census Bureau 2006).