4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter describes the anticipated direct and indirect impacts of the Proposed Action and the alternatives as well as potential cumulative impacts. The analysis of potential impacts from the Proposed Action assumed the implementation of the RMGC's environmental protection measures that would be implemented in association with the proposed project (Section 2.5, RMGC's Environmental Protection Measures). Monitoring and mitigation measures developed in response to anticipated impacts are recommended by the BLM for individual resources, as discussed at the end of each resource section. This chapter also identifies residual impacts, which are the impacts that would remain after mitigation measures have been implemented.

Specific impacts to social and economic values would occur with the implementation of either the simultaneous or the sequential mining scenarios. Impacts related to these scenarios are described in detail in Section 4.9, Social and Economic Values. Impacts to other resources as a result of the implementation of these scenarios would be the same or similar. In addition, impacts associated with surface disturbance and water management activities have been described in detail for specific resources that would be affected by these activities.

The proposed project may result in cumulative effects associated with other past and present actions and RFFAs in the area. For resources where project-specific impacts are identified, the cumulative effects associated with the proposed project were evaluated together with other past and present actions and RFFAs. The period of potential cumulative impact is defined as the approximately 13-year life of the proposed project plus 3 years for reclamation. The cumulative effects analysis for each resource addressed the potential cumulative effects within resource-specific cumulative effects study areas.

This chapter is organized by environmental resource. Sections 4.2 through 4.21 describe the potential environmental impacts associated with each resource. The short-term use of the environment relative to the long-term productivity of resources is discussed in Section 4.22. Short-term is defined as the approximately 13-year period of project operations and 3-year period of reclamation. Long-term impacts are defined as impacts that would continue post-reclamation (beyond 16 years). The irreversible or irretrievable commitment of resources is described in Section 4.23.

4.2 Geology and Minerals

Primary issues related to geology and minerals include: the removal and processing of large amounts of earth materials that result in permanent changes to topography and geologic materials; potential for geologic hazards to impact the operations of the proposed project; and impacts to potential future resource availability.

4.2.1 Proposed Action

Direct impacts of the Proposed Action on geologic and mineral resources would include the generation and permanent disposal of approximately 992 Mt of waste rock and 998 Mt of processed ore in the Round Mountain Area, and up to 144 Mt of waste rock and 48 Mt of processed ore in the Gold Hill Area.

The East Smoky Valley Fault Zone, a set of range-front faults that pass through the western part of the proposed project area, has some potential for earthquake-induced ground motion in the event of an earthquake generated from fault movement. USGS ground motion hazard maps indicate that there is a low probability that ground motion due to movement on these faults presents a hazard in the study area. There are no identified geologic conditions that would be exacerbated by proposed project activities and result in geologic hazards. As described in Chapter 2.0, Alternatives Including the Proposed Action, geotechnical monitoring of the pits would be conducted in order to optimize pit design and monitor slope stability for the protection of mine workers. Monitoring of geologic structures through mapping, groundwater monitoring, and slope stability analyses, would be conducted during active mining to assist in optimizing the final pit designs. Pit walls, waste rock dumps, and heap leach pad slopes would be constructed to conform to regulatory standards to minimize instability.

A geotechnical study completed by Knight Piesold (2005) addressed the stability of the proposed tailings impoundment facilities, waste rock dumps, and leach pads that would be developed under the Proposed Action. This study concluded that the expected peak ground acceleration due to an earthquake within 20 miles of the proposed project area would be 13 percent of gravity and would have a 10 percent chance of occurring during the operational life of the proposed project with a recurrent interval of 500 years. Movement on the Toiyabe Range Fault would be the most likely cause of an earthquake with this expected ground acceleration in the proposed project area. The basin analysis also assumed a 6.5 magnitude earthquake 12 miles from the site. Based on this analysis, Knight Piesold (2005) designed the leach pads with a static safety factor of 1.76 and would be capable of withstanding a ground acceleration of 24 percent of gravity. The waste rock dumps would have a static safety factor of 1.51 to 1.56 and be able to withstand a ground acceleration between 30 and 40 percent of gravity. The proposed West Dedicated Leach Pad, with a height of 450 feet, would have a static safety factor of 1.5 to 1.8 and be able to withstand a ground acceleration in the range of 15 to 26 percent of gravity. The maximum foundation settling under the full load of the leach pad would be 5.3 feet near the center of the pad (Knight Piesold 2006). A study by SHB AGRA (1994), reported in BLM (1996), showed that the existing tailings impoundment facilities in the Round Mountain Area would have a maximum embankment settling of 16 inches under the expected maximum credible earthquake event. The studies of Knight Piesold (2005, 2006) and BLM (1996) both concluded that there are no stability concerns for tailings impoundment facilities, waste rock dumps, or leach pads at Round Mountain or Gold Hill related to the maximum expected peak ground acceleration from an earthquake.

Existing geologic information and condemnation drilling results indicate the proposed project would not preclude access to other ore-bearing rock. The geothermal resource, located within the Round Mountain Area and under lease to RMGC, would not be affected by the Proposed Action. Other mineral resources,

such as oil and gas, have a low potential for occurrence within or near the proposed project area and would not be affected by the Proposed Action.

4.2.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on geologic and mineral resources would be the same as described for the Proposed Action, except that up to 20 Mt of ore from Gold Hill would not be hauled to the Round Mountain Area for processing.

4.2.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on geologic and mineral resources would be the same as described for the Proposed Action.

4.2.4 No Action Alternative

Under the No Action Alternative, the Round Mountain Mine would continue to operate under existing authorizations. The proposed expansion of the mine would not be authorized and the additional ore would not be mined.

4.2.5 Cumulative Impacts

The CESA for geology and minerals is shown in **Figure 4.2-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Mines or mining districts within the CESA include the Round Mountain Mine, Manhattan District, Barcelona District, Jefferson Canyon District, and Gold Hill District. Mineral production in the CESA has included gold, silver, and other minerals. Mining activity affects geology and mineral resources through excavating, modifying, or covering natural topographic and geomorphic features and by removing mineral deposits.

Mining disturbance in the CESA has included exploration (e.g., drilling, sampling, and road construction); open-pit and underground mining; development of waste rock dumps, heap leach facilities, and ore stockpiles; ore milling and processing; and tailings disposal. For the purpose of this evaluation, “disturbed” area (or geologic disturbance) is defined to include mine components (e.g., open pits, waste rock areas, leach pads, and tailings impoundment facilities) that permanently alter the natural topographic and geomorphic features in the area, even if reclaimed. In addition to mining, other developments in the CESA include utilities/community development and agricultural. For the purposes of this evaluation, geothermal exploration and development, gravel pits and landfills, utilities/community development, and agriculture are not considered to result in a geologic disturbance as previously defined.

Past and present actions and RFFAs within the CESA have resulted, or would result, in approximately 11,227 acres of cumulative disturbance associated with mining-related activities. An unquantifiable portion of which has, or would, result in a permanent alteration of the natural topography. The proposed project incrementally would increase the geologic disturbance by an additional 4,698 acres (approximately 2 percent of the CESA), of which, approximately 3,356 acres would represent a permanent alteration of topography. As a result, the total geologic disturbance in the CESA would be approximately 15,925 acres (approximately 8 percent of the CESA). Because gold mining is a major activity in this region, it is

reasonable to assume that large-scale mining would continue to increase the cumulative disturbance acreage in the CESA.

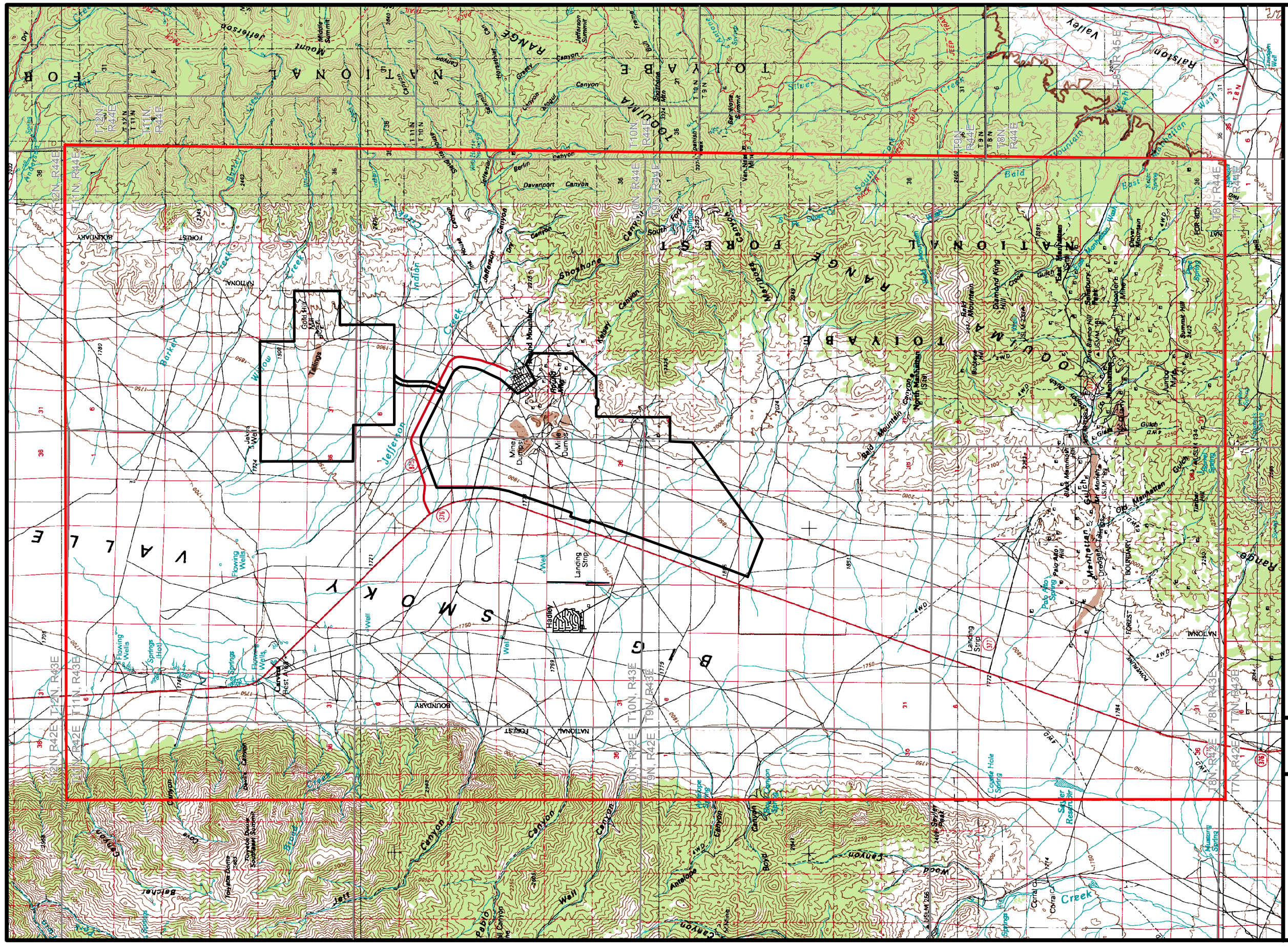
Geologic hazards and geotechnical considerations would be local in nature and specific to individual facilities; therefore, no cumulative impacts associated with geologic hazards would occur. The proposed project would result in an incremental increase in the extraction and recovery of mineral resources within the CESA.

4.2.6 Monitoring and Mitigation Measures

No additional monitoring and mitigation measures are recommended for geology and mineral resources.

4.2.7 Residual Impacts

Residual effects associated with the Proposed Action would include the generation and permanent disposal of up to 1,136 Mt of waste rock and overburden and up to 1,046 Mt of processed ore.


N
0
1
2 Miles
Legend
Proposed Project Boundary
CESA Boundary for Geology and Minerals
Note: Topographic elevations provided in meters, USGS 1929 Vertical Datum.
Round Mountain Expansion Project
Figure 4.2-1
Cumulative Effects Study Area for Geology and Minerals
05/26/2009

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

Primary water resource issues include the following: 1) reduction in surface and groundwater quantity within the proposed project area and CESA due to pit dewatering and long-term evaporation from post-mining pit lakes in the Round Mountain and Gold Hill areas; 2) potential impacts to water quality from the post-mining pit lakes in the Round Mountain and Gold Hill pits; 3) potential impacts to surface and groundwater quality from the expansion of existing waste rock dumps in the Round Mountain Area, the creation of new waste rock dumps in the Gold Hill Area, the expansion and creation of heap leach pads to accommodate additional ore from the Round Mountain and Gold Hill areas, and the expansion of the existing tailings impoundment facility to accommodate additional tailings from Round Mountain and Gold Hill; 4) potential impacts to surface water features from flooding, erosion, and sedimentation associated with the construction and operation of expanded and new facilities in the Round Mountain and Gold Hill areas; and 5) potential impacts to water quantity and quality in the basin alluvial aquifer due to discharge of dewatering water from Gold Hill into the proposed Gold Hill RIB system.

4.3.1 Proposed Action

Potential impacts to water resources under the Proposed Action would be associated with: 1) increased dewatering of the Round Mountain Pit, 2) dewatering of the proposed Gold Hill Pit, 3) post-mining pit lakes at both the Round Mountain and Gold Hill mines, 4) expansion of waste rock dumps at Round Mountain and construction of new waste rock dumps at Gold Hill, 5) construction of new leach facilities at Round Mountain and Gold Hill, 6) construction of a new RIB system west of Gold Hill, and 7) expansion of the tailings impoundment facility at Round Mountain. Elevations for water levels and topographic elevations are presented in terms of the RMGC grid, which is the USGS 1929 vertical datum plus 74.18 feet. Topographic and water elevations that use the USGS 1929 vertical datum will be followed by the term amsl. The USGS 1929 vertical datum is approximately equivalent to the NGVD datum for this area of Nevada.

4.3.1.1 Round Mountain Area

The Round Mountain Pit would be deepened from the currently permitted bottom elevation of 5,065 feet to a final pit bottom elevation of 4,610 feet , requiring additional dewatering of the Round Mountain Area bedrock and alluvium in order to lower the bedrock water levels by 455 feet and alluvial water levels by 40 to 70 feet. This would result in an increase in the maximum dewatering rate for the Round Mountain Pit from the current range of 5,875 to 7,175 gpm (average of 6,200 gpm) to a dewatering range of 6,225 to 7,525 gpm (WMC 2008).

The Round Mountain Area contains five principal hydrostratigraphic units: 1) Quaternary alluvium, 2) Tertiary Stebbins Hill lacustrine sediments, 3) Tertiary volcanics, 4) Paleozoic metasedimentary rocks, and 5) Cretaceous granite on the east wall of the pit. The Quaternary alluvium is currently dewatered by wells near the west wall of the pit at a rate around 3,000 gpm; dewatering at a rate of 4,500 to 5,800 gpm would be required for the expanded pit to lower the water level in the alluvium by 40 to 70 feet to a target elevation of 5,460 feet. Dewatering of the Stebbins Hill unit would continue at a rate of about 25 gpm to maintain slope stability; this rate may decline with time. The Stebbins Hill unit acts as a aquitard between the Quaternary alluvium and the underlying volcanic bedrock. Dewatering of the Tertiary volcanic bedrock and the Paleozoic metasedimentary bedrock would be increased by 300 gpm to a target rate of 1,300 gpm. The volcanics and the metasedimentary rocks act as a single hydrologic unit during dewatering due to an interconnection caused by extensive fracturing in the Round Mountain Area. The volcanic and metasedimentary bedrock is dewatered through in-pit wells and from the exploration decline in the Round

Mountain Pit. Dewatering of the granite would increase by about 50 gpm to around 400 gpm during the pit expansion to maintain slope stability in the east pit wall.

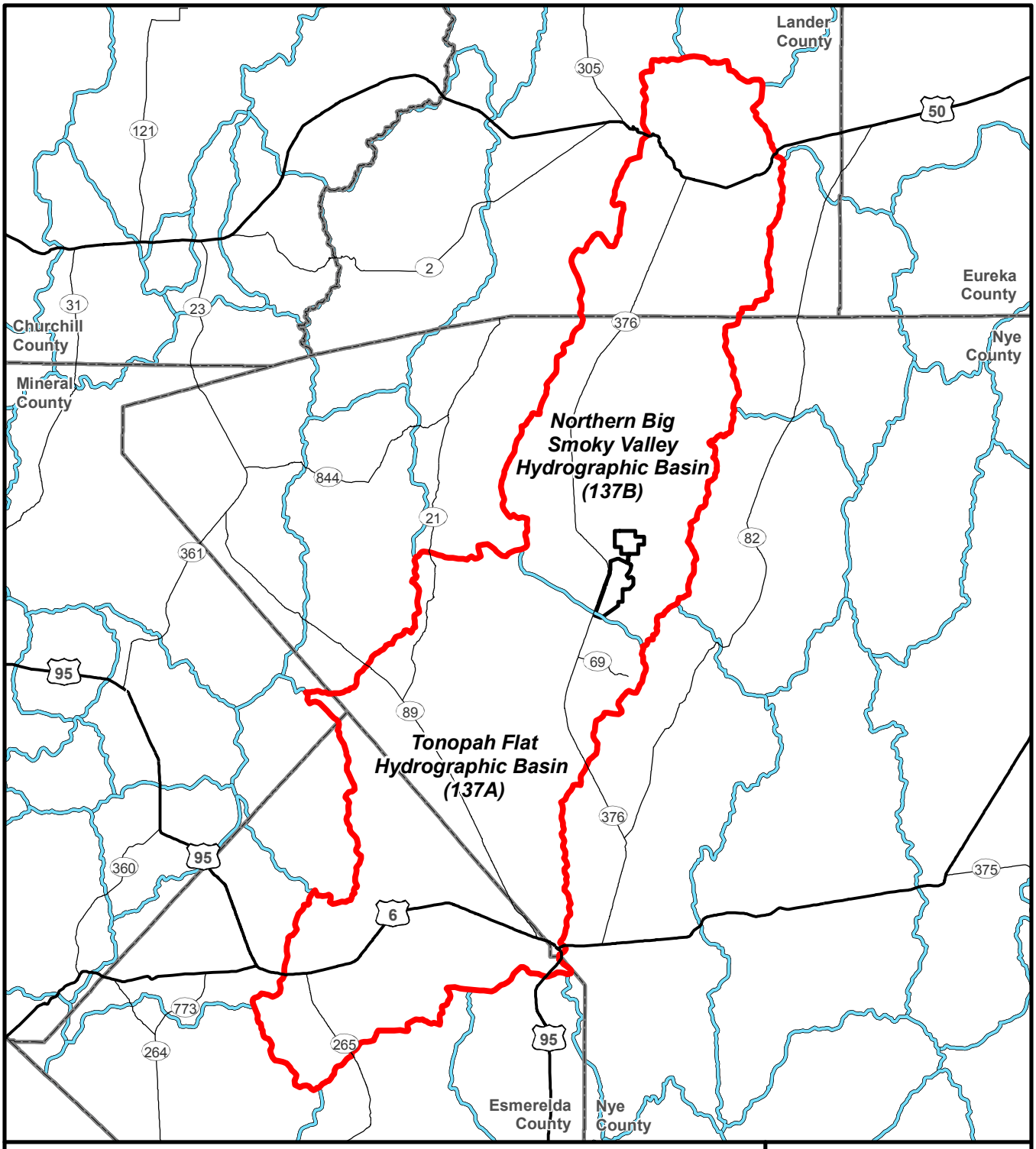
Water Quantity Impacts

Anticipated water quantity impacts associated the Proposed Action include lowering of groundwater levels in the basin alluvial aquifer and the bedrock aquifers in the mine area due to increased dewatering for the expanded and deepened Round Mountain Pit, and long-term drawdown in both alluvial and bedrock water levels due to evaporation from the post-mining pit lake. These potential impacts were evaluated using a numerical groundwater flow model.

Numerical Groundwater Flow Model. Potential water quantity impacts associated with the proposed expansion of the Round Mountain Pit under the Proposed Action were evaluated using a numerical groundwater flow model developed by WMC (2008) using the publicly available code MODFLOW-SURFACT (Hydrogeologic 2002). Groundwater flow modeling was used to evaluate potential dewatering impacts to the basin-fill Quaternary alluvium in the southern half of Northern Big Smoky Valley and the northern third of the adjacent basin to the south, Tonopah Flat. The groundwater flow model also was used to estimate impacts to bedrock aquifers in the Round Mountain Area and the CESA, especially eastward from the proposed project area including the Toquima Range. The numerical flow model also was used to estimate groundwater inflow to the post-mining pit lake and potential long-term groundwater impacts to the basin alluvium and bedrock aquifers due to evaporation of water from the post-mining pit lake.

This section summarizes key features of the numerical groundwater flow model design, calibration, and predictive scenarios. A detailed report on the groundwater model can be found in Chapter 7 of WMC (2008). The groundwater model developed by WMC (2008) included information from earlier models developed by Hydrosearch (HSI 1994), WMC (2004, 2005), and the groundwater model for the entire Northern Big Smoky Valley developed by the USGS (Handman and Kilroy 1997).

Basin and Project Area Conceptual Model. Numerical groundwater models are based on a conceptual model of the area to be modeled. For the Round Mountain Area, the region modeled (i.e., model domain) consists of the southern half of Northern Big Smoky Valley (Nevada hydrographic basin 137B), western slope of the Toquima Range, eastern slope of the Toiyabe Range, and northern third of Tonopah Flat (Nevada hydrographic basin 137A) (**Figures 4.3-1** and **4.3-2**). Northern Big Smoky Valley is a closed to semi-closed basin; water flows into the basin from the slopes of the Toiyabe and Toquima ranges, but only flows out through the alluvial basin sediments southward to Tonopah Flat. The amount of discharge to Tonopah Flat is relatively minor, making the Northern Big Smoky Valley essentially a closed basin. Groundwater recharge to the basin comes from mountain-front runoff, where stream flow from the mountains enters the alluvial fan sediments of the basin and infiltrates to recharge groundwater. Recharge to bedrock in the mountains comes from infiltration of snow melt and rainfall. Discharge from the basin is through evapotranspiration (ET) from native plants and agricultural crops and well pumpage. Irrigation pumping in the basin returns some of the pumped water to groundwater as irrigation return flow, but the remainder is lost through crop use and ET. Geothermal water and hot springs are found along the western side of the basin near Darroughs Hot Springs and are controlled by major faults that intersect deep bedrock groundwater. A shallow groundwater divide separates the Northern Big Smoky Valley from Tonopah Flat (Handman and Kilroy 1997; WMC 2008). This divide does not coincide with the topographic divide between these two basins and is evident mainly in the divergence of flow directions in the upper alluvial aquifer (**Figure 4.3-2**).



Legend

- Proposed Project Boundary
- CESA Boundary for Water Quality and Quantity (Surface and Ground) and Water Use
- Hydrographic Basins

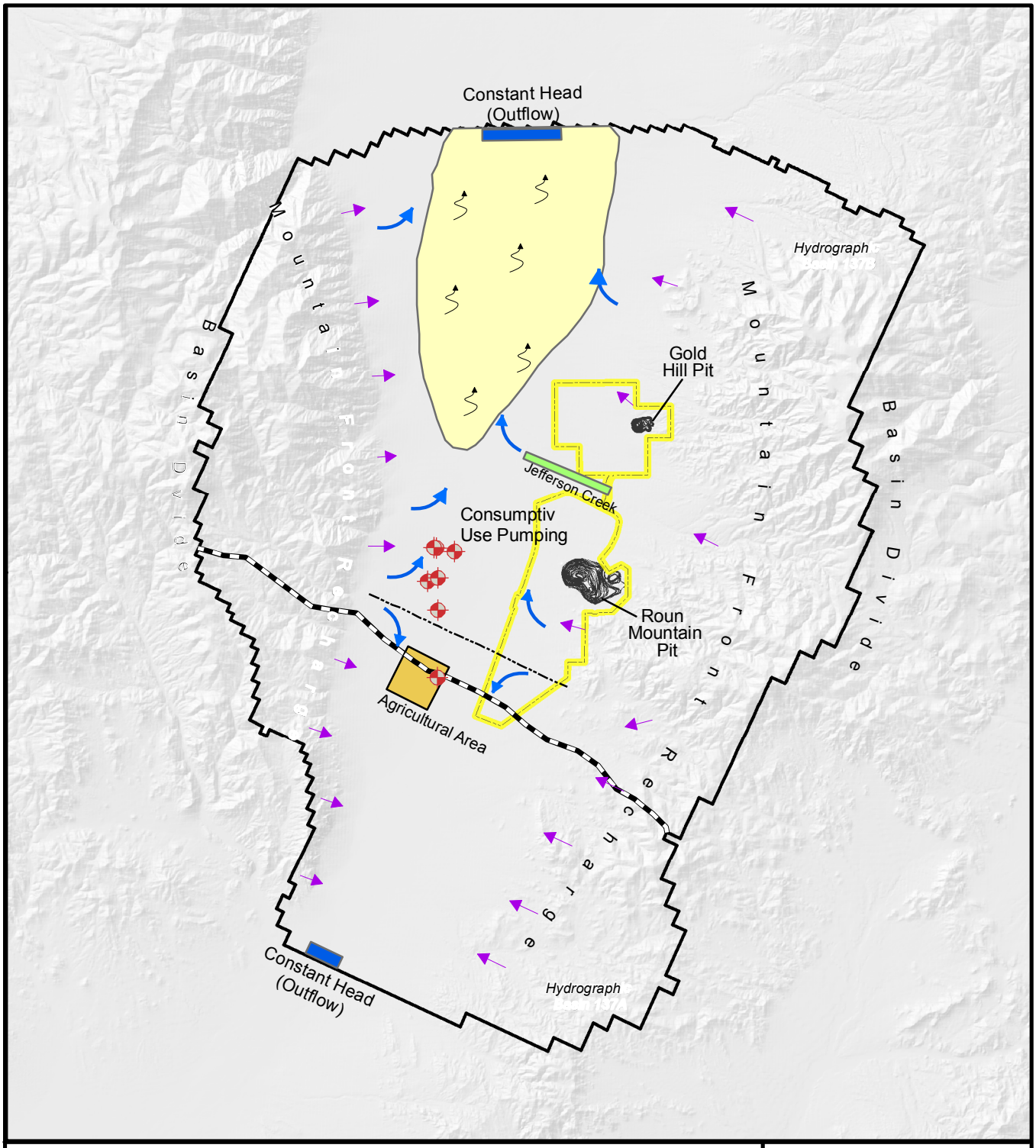
N

0 5 10 20 Miles

Round Mountain Expansion Project

Figure 4.3-1
Cumulative Effects Study Area for Water Quality and Quantity (Surface and Ground) and Water Use

04/21/2009



Legend

- Proposed Project Boundary
- Jefferson Creek Recharge
- Hydrographic Basin Boundary
- Groundwater Divide
- Model Domain
- Pumping Well
- Phreatophyte Zone
- Mountain Front Recharge
- Groundwater Flow

N

0 1.25 2.5 5 Miles

Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-2

Groundwater Model Domain

04/23/2009

In the Round Mountain Area, the geology is dominated by five stratigraphic units, as discussed in Section 3.2, Geology and Minerals. The Quaternary alluvium contains the most groundwater and requires the most dewatering. The bedrock Tertiary volcanics and Paleozoic metasediments act as a single hydrologic unit due to the extensive fracturing in the mine area. The Cretaceous granite is found along the eastern wall of the Round Mountain Pit and dominates the western slope of the Toquima Range near the proposed project area. The Round Mountain Area is broken into structural blocks by volcanic caldera faults and the basin range-front faults found along the western side of the mine area (**Figure 3.2-1**). There are two delineated or inferred calderas in the Round Mountain Area, and three additional delineated or inferred calderas in the Gold Hill Area. In addition, faulting and volcanic dike intrusion along the eastern side of the proposed project area have resulted in fracturing and compartmentalization of the granite and creation of a stair-stepped water level pattern in the granite with water levels increasing in elevation eastward. The complex faulting, fracturing, and dike intrusion common in the Round Mountain Area have resulted in compartmentalization of the groundwater in the bedrock hydrostratigraphic units. Groundwater flow between structural compartments depends on the groundwater gradient, degree of pumping for dewatering, and permeability of the bedrock units and faults that bound the structural compartments.

Numerical Model Design

Grid and Boundary Conditions: The numerical groundwater model developed by WMC (2008) consists of 166 rows, 135 columns, and 5 layers that represent the Round Mountain Area block model. The model has 112,050 cells, 89 percent of which are active cells, and a grid spacing of 300 by 300 feet in the Round Mountain Area. The vertical datum for elevations was the Round Mountain Mine grid , which is the USGS 1929 vertical datum plus 74.18 feet. Mountain crests surrounding Northern Big Smoky Valley were modeled as groundwater divides and represented in the model as no-flow zones. The southern boundary of the model has a constant head boundary to allow for water to flow in the alluvial aquifer between Northern Big Smoky Valley and Tonopah Flat. The northern boundary of the model has constant head cells to allow for groundwater in the alluvium to flow northward from the model domain into the northern half of Northern Big Smoky Valley. Faults and dikes are represented in the model using the Horizontal Flow Barrier Package of MODFLOW (Macdonald and Harbaugh 1988; Hseih and Freckleton 1993). The model grid and boundary conditions are illustrated in **Figure 4.3-3**.

Model Layers: The groundwater model has five layers that are designed to represent the five hydrostratigraphic zones in the Round Mountain Area and to incorporate the geology of the Round Mountain Area block model (WMC 2008). These layers are illustrated in **Figure 4.3-4**. The uppermost layer represents the valley Quaternary alluvium and the Tertiary volcanics in the Round Mountain Area, as well as the upper part of the granite in the Toquima Range and the Paleozoic metasedimentary rocks and Tertiary volcanics in the Toiyabe Range. Layers 2 through 4 generally represent the deeper sections of the Tertiary volcanics along with the Paleozoic metasedimentary rocks in the Round Mountain Area. The layers approximately match the stratigraphy in the Round Mountain Area (**Figure 3.3-19**) and provide a reasonable representation of the detailed stratigraphy of the proposed project area and the regional stratigraphy of the Northern Big Smoky Valley and adjacent mountain ranges.

Recharge and Discharge: Recharge and discharge zones for the model domain are shown in **Figures 4.3-5** and **4.3-6**. Recharge to the alluvial basin aquifer comes mainly from mountain-front runoff and is due to the infiltration of stream flow along the alluvial fans at the mountain front. The recharge zones (WMC 2008) for the Northern Big Smoky Valley are based on the study completed by Handman and Kilroy (1997).

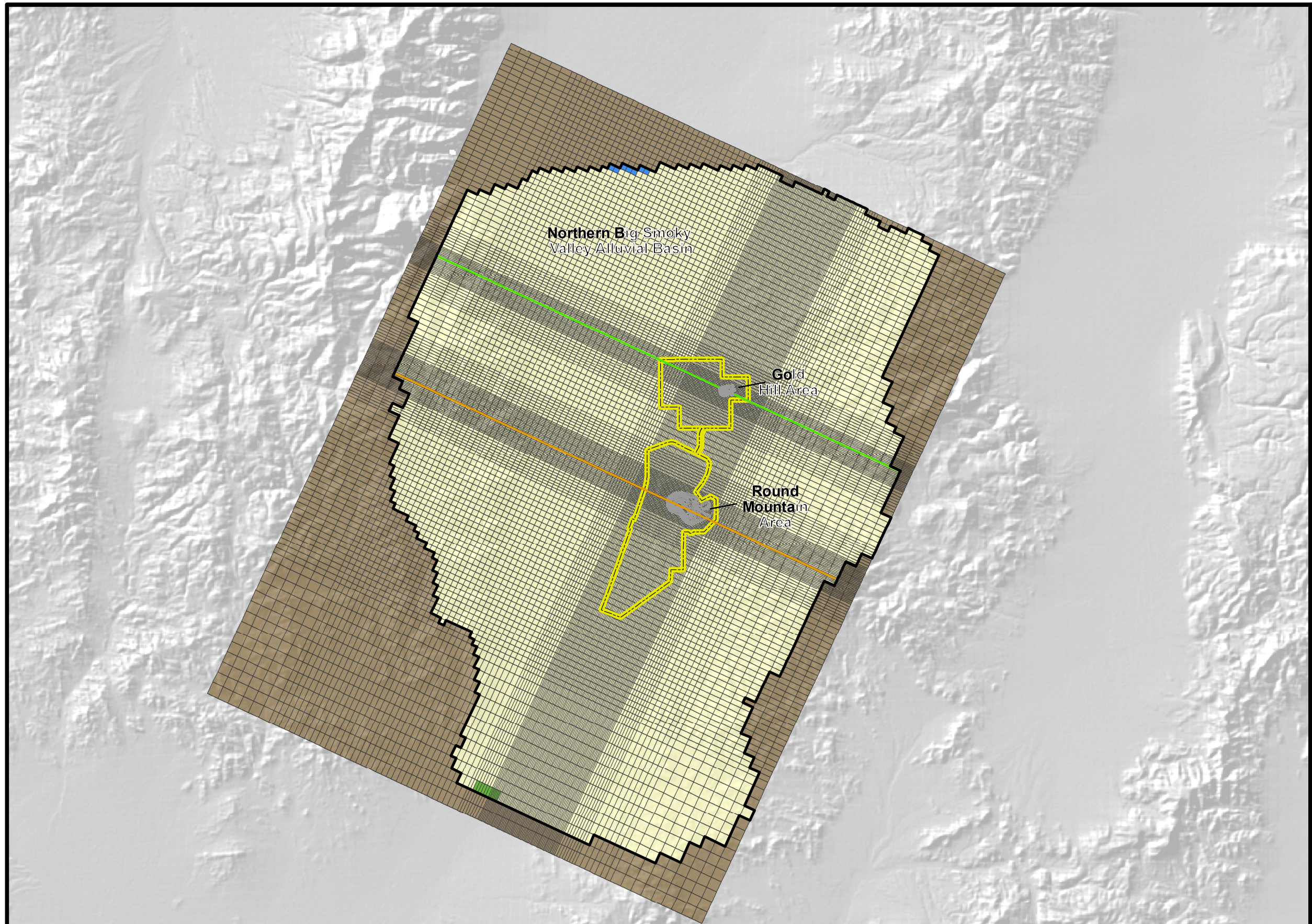
Recharge in the mountain blocks is based on an estimate of precipitation that infiltrates into the bedrock fractures and faults. Recharge for the mountain blocks was adjusted as part of the calibration and ranged from 1 to 5 percent of average annual precipitation, with the higher percentages being used for more fractured bedrock. In addition, recharge from the RIB system in the Round Mountain Area was modeled as 150 gpm up to 2004 and at 450 gpm after 2004. Agricultural return recharge was estimated at 270 ac-ft/yr, representing about 15 to 20 percent of irrigation pumping, and recharge from Jefferson Creek was estimated at 3,610 ac-ft/yr. Discharge from the alluvial basin aquifer is due mainly to ET, the ET zones ET values, and extinction depths that show in **Figure 4.3-6** are based on Handman and Kilroy (1997). **Table 4.3-1** summarizes the steady-state water balance for the model domain. Discharge from springs is summarized in **Table 3.3-6**, Spring and Seep Inventory.

Table 4.3-1
Simulated Groundwater Budget at the Beginning of 1990

Groundwater Budget Component	Simulated Values[1] (ac-ft/yr)
Groundwater Recharge:	
To eastern mountain block, from precipitation	3,770
To western mountain block, from precipitation	940
To eastern pediment slope, from mountain-block runoff and subsurface flow	11,820
To western pediment slope, from mountain-block runoff and subsurface flow	14,010
From Jefferson Creek	3,610
To valley lowland, from precipitation	--
Subtotal (groundwater recharge):	34,200[2]
Other groundwater inflows:	
Inflows from irrigated areas	270
Sub-surface inflow from adjacent hydrographic areas	--
Subtotal (other inflows):	270
Total inflow:	**34,500[2]**
Groundwater discharge:	
Groundwater ET	6,150
Groundwater discharge to Northern Big Smoky Valley outside the model domain	18,830
Groundwater discharge to Tonopah Flat outside the model domain	6,170
Water-supply pumping	2,180
Agricultural pumping	1,210
Total outflow:	**34,500[2]**

[1] Rounded to nearest 10 ac-ft/yr.

[2] Rounded to nearest 100 ac-ft/yr.



Legend

- Proposed Project Boundary
- Extent of Active Cells
- Constant Head Boundary Cells (North)
- Constant Head Boundary Cells (South)
- No Flow Cells
- Gold Hill Cross-section
- Round Mountain Cross-section

Note: Model grid is oriented 25° east of north.
Source: WMC 2008.

N

0 1.25 2.5 5 Miles

Round Mountain Expansion Project

Figure 4.3-3

Groundwater Model Grid, Domain, and Boundaries

04/23/2009

West

East

Toiyabe Range

Toquima Range

8,000 feet

6,000 feet

4,000 feet

2,000 feet

0 feet

Northern Big Smoky Valley Alluvial Basin

Round Mountain Pit Area

Model Layers

Layer 1
Layer 2
Layer 3
Layer 4
Layer 5

Legend

Ground Surface Elevation

No Flow Cells

Horizontal(Kx) Hydraulic Conductivity (feet/day)

0.006
0.03
0.4
0.5
0.6
3
75

0 10,000 20,000 Feet

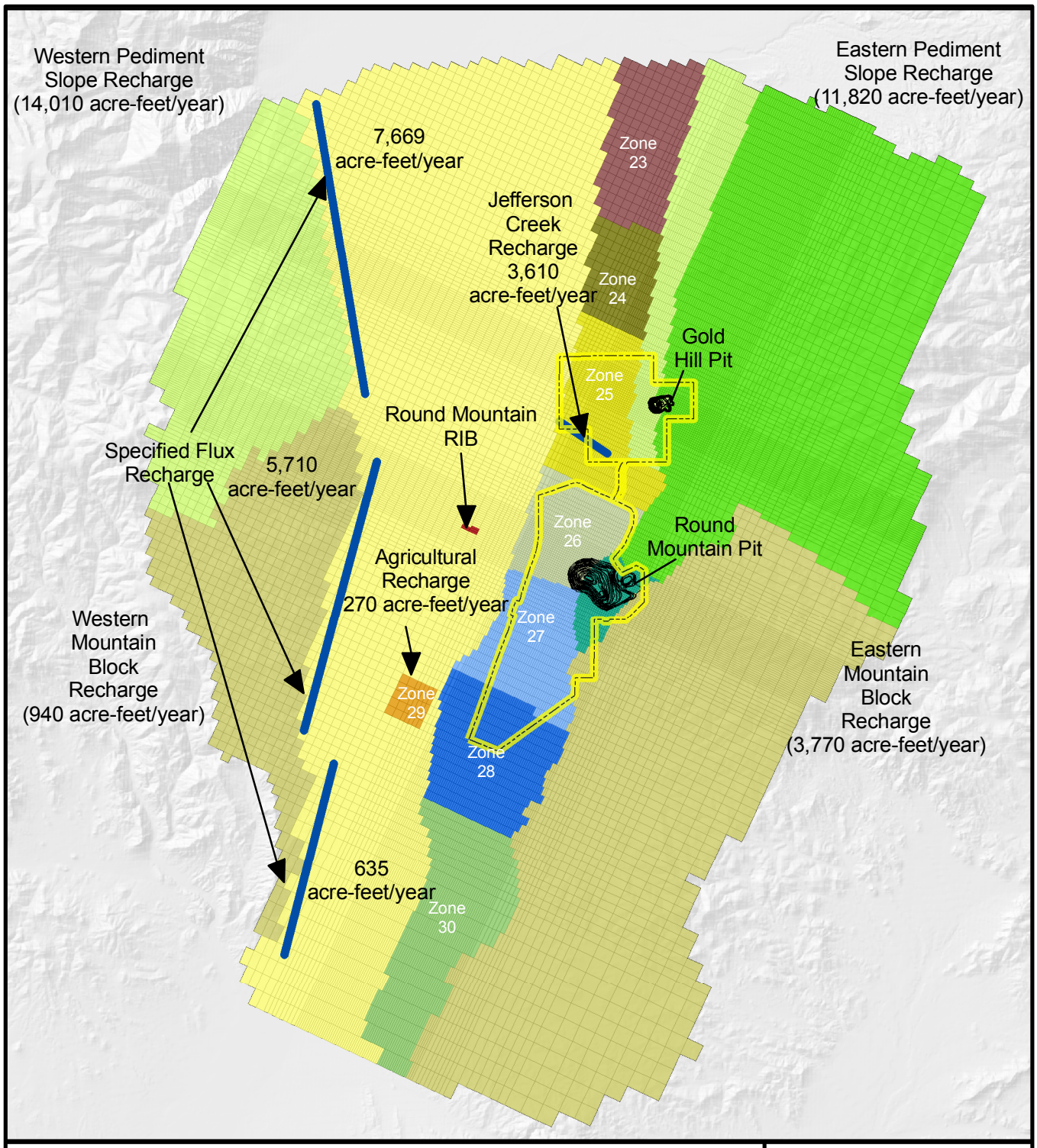
Note: Topographic elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

05/12/09

Round Mountain Expansion Project

Figure 4.3-4

Groundwater Model Layers and Hydraulic Conductivity for the Round Mountain Area



Legend

Proposed Project Boundary

Recharge Areas

Recharge Zones (feet/day)

0	0.001
0.000046	0.0011
0.00007	0.0011
0.00014	0.00111
0.00025	0.00132
0.000342	0.1112
0.00057	
0.00078	

N

0 1 2 4 Miles

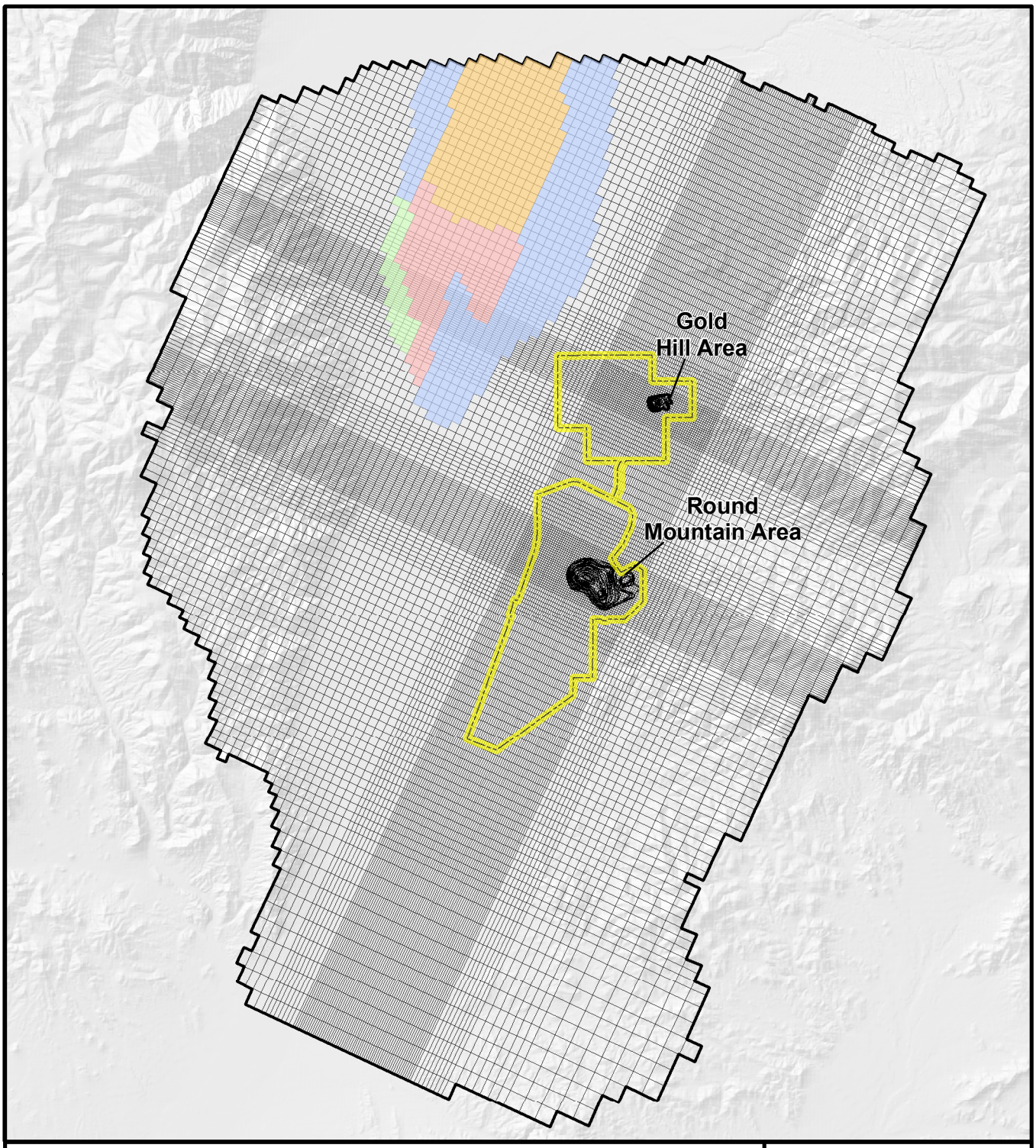
Source: WMC 2008.

02/10/2009

Round Mountain Expansion Project

Figure 4.3-5

Model Simulated Recharge Zones



Legend

Proposed Project Boundary

Evapotranspiration Zones

Zone / ET(feet/day) / Extinction Depth(feet)

- 2 / 0.0105 / 35
- 3 / 0.0105 / 35
- 4 / 0.0105 / 15
- 5 / 0.0105 / 35

N

0 1 2 4 Miles

Source: WMC 2008.

04/20/2009

Round Mountain Expansion Project

Figure 4.3-6

Simulated Evapotranspiration Zones

Input Parameters: The steady-state calibrated hydraulic conductivity zones are shown in **Appendix C**, **Figures C-1** to **C-5**. The calibrated storage coefficients are shown in **Figures C-6** to **C-10**. Layer 1 (**Figure C-1**), the uppermost layer that includes the shallow alluvial basin aquifer, the volcanics and sedimentary rocks in the mountain ranges, and the volcanics and alluvial sediments in the Round Mountain Area, has the central part of the Northern Big Smoky Valley alluvial aquifer modeled with hydraulic conductivity values ranging from 12 to 100 feet per day. The volcanics in the Round Mountain Area were modeled with a hydraulic conductivity of 0.5 feet per day, with the granite modeled as 0.003 feet per day. The alluvial aquifer near the Round Mountain Pit, which will be the main source of water during dewatering and pit refilling, was modeled with an average hydraulic conductivity of 3.0 feet per day. The volcanics of the Toquima Range were modeled with a hydraulic conductivity of 0.01 feet per day and the Paleozoic sedimentary rocks of the Toiyabe Range were modeled as 0.006 feet per day. Layers 2 through 5 (**Figures C-2** to **C-5**) show the deeper volcanic and metasedimentary rock aquifer that occur in the Round Mountain Pit area. Based on modeling results, this aquifer has an average hydraulic conductivity of 0.6 feet per day and the Stebbins Hill unit (Layer 2 only) has a hydraulic conductivity of 2.0×10^{-5} feet per day. The area between Round Mountain and Gold Hill was modeled with a hydraulic conductivity of 0.2 feet per day, and the Paleozoic bedrock at depth beneath the basin alluvial aquifer was modeled with an average hydraulic conductivity of 0.006 feet per day. **Table 4.3-2** gives the range of input parameters used in the model design.

Table 4.3-2
Modeled Hydraulic Parameter Ranges for Northern Big Smoky Valley Hydrostratigraphic Units

Rock Type	Hydraulic Conductivity (Kx) (feet/day)		Specific Yield (Sy)		Specific Storage (Ss) ($foot^{-1}$)	
	Max	Min	Max	Min	Max	Min
Alluvium	1,000	0.05	0.25	0.01	1×10^{-3}	1×10^{-6}
Volcanic bedrock	5	0.001	0.05	0.0025	1×10^{-5}	1×10^{-8}
Metasediments	5	0.001	0.05	0.0025	1×10^{-5}	1×10^{-8}
Granitic bedrock	0.1	0.00001	0.02	0.001	1×10^{-5}	1×10^{-8}

Field measured values for hydraulic conductivity in the volcanic rock aquifer of the Round Mountain Area range from 0.016 to 0.036 feet per day for unfractured volcanics and 0.2 feet per day for fractured volcanics (WMC 2008). The alluvial aquifer near the mine area has conductivity values ranging from 0.8 to 5.0 feet per day (WMC 2008) and transmissivity values of 6,700 to 28,000 gpd/foot, resulting in approximate hydraulic conductivity values of 6 to 15 feet per day based on the saturated thickness in the test area (BLM 1996). The Stebbins Hill unit has a measured hydraulic conductivity of 2.8×10^{-4} feet per day (WMC 2008) and the Paleozoic metasedimentary rock aquifer has a transmissivity range of 10,000 to 30,000 gpd/foot, resulting in an estimated hydraulic conductivity range of 2 to 5 feet per day, based on tests in the Manhattan area (BLM 1996). The basin alluvial aquifer in the central part of the Northern Big Smoky Valley has a transmissivity range of 200,000 to 2,300,000 gpd/foot, resulting in an estimated range for hydraulic conductivity from 120 to approximately 1,000 feet per day, based on the saturated thickness tested (BLM 1996).

The modeled hydraulic conductivity for the alluvial aquifer near the Round Mountain Pit was within the range of measured values. The modeled values for the conductivity of the central basin alluvial aquifer were

generally lower than measured values, while the modeled hydraulic conductivity for the volcanic rock aquifer in the Round Mountain Area was somewhat higher than measured values for the fractured volcanics. The modeled hydraulic conductivity for the Paleozoic metasedimentary rock aquifer was considerably below measured values, primarily because the measured values are from production wells in fractured rock in the Manhattan area, while the groundwater model averaged mostly unfractured rock. The storage coefficient zones shown in **Figures C-6** to **C-10** are based on calibration, except in areas of the basin alluvium and the Round Mountain Area where measured values or transient calibrations were possible. Overall, the distribution of hydraulic conductivity values presents a reasonable representation of the known hydraulic parameters for the model domain. Some aquifers have modeled parameters that may be higher or lower than those measured with field aquifer tests, but this is to be expected given the local nature of aquifer tests and the regional nature of the groundwater model and its distribution of grid spacing.

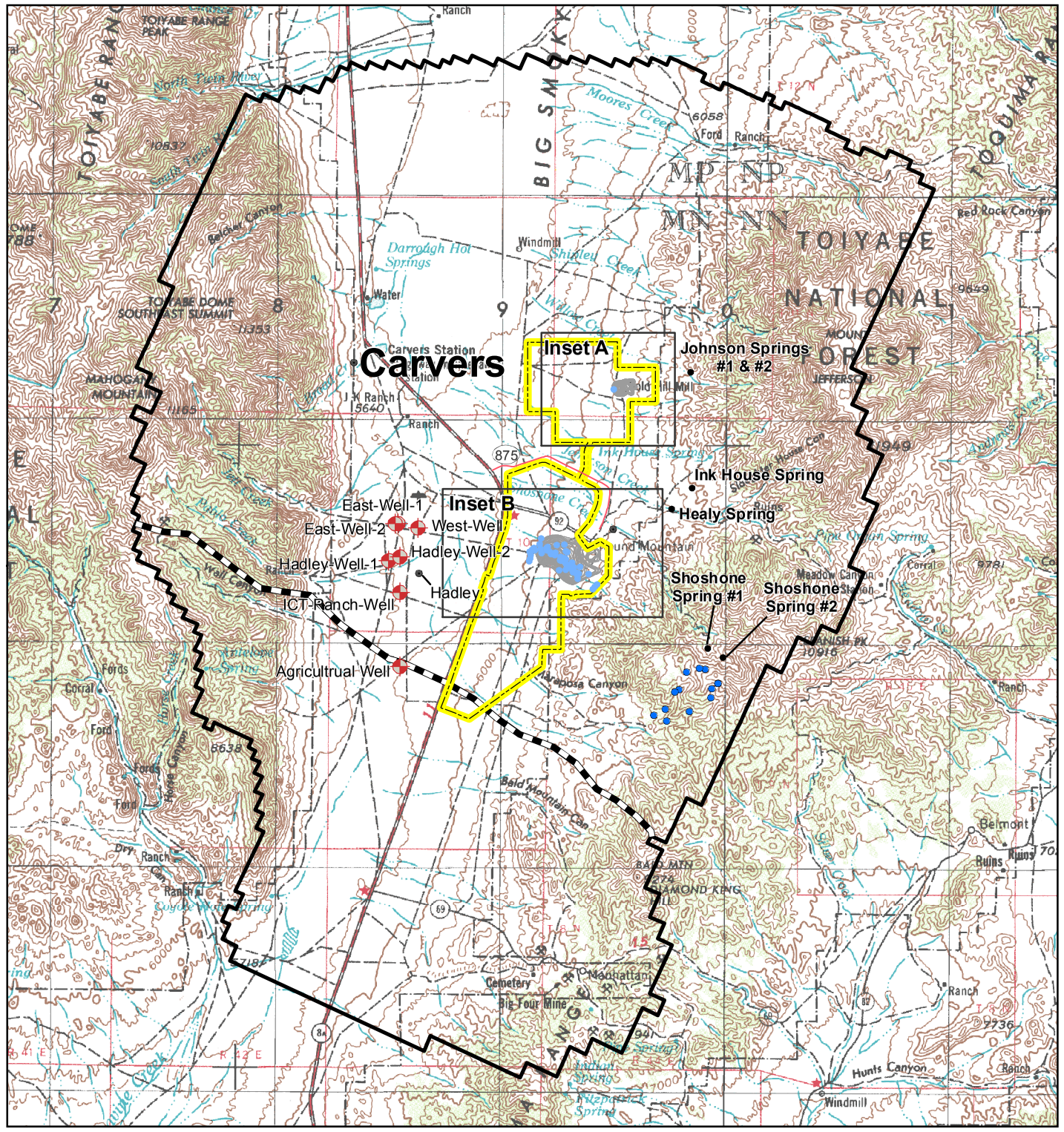
Pumping Wells: The groundwater model included two main periods of pumping in the model design. The first period was the pre-1990 period dominated by agricultural and water supply pumping that preceded the dewatering at Round Mountain. This period was simulated as steady-state pumping and used as an initial condition in the steady-state calibration to the 1990 period. The second period of pumping was the period of transient pumping from 1990 to 2005 that included dewatering at the Round Mountain Pit, the Gold Hill sinter pumping test in 2004, and the agricultural and water supply pumping within the model domain. **Table 4.3-3** summarizes the steady-state agricultural and water supply pumping used in the model. **Figure 4.3-7** shows the location of pumping wells used in the model, and **Figure 4.3-8** summarizes the dewatering history of the Round Mountain Mine from 1990 to 2005. For the transient pumping from 1990 to 2005, a total of 119 stress periods were used in the model, with 95 stress periods used in the transient calibration from 1990 to 2003 and the last 24 stress periods used for the transient verification of the model from January 1, 2004, to December 31, 2005. The details of pumping rates assigned to each pumping well are presented in WMC (2008).

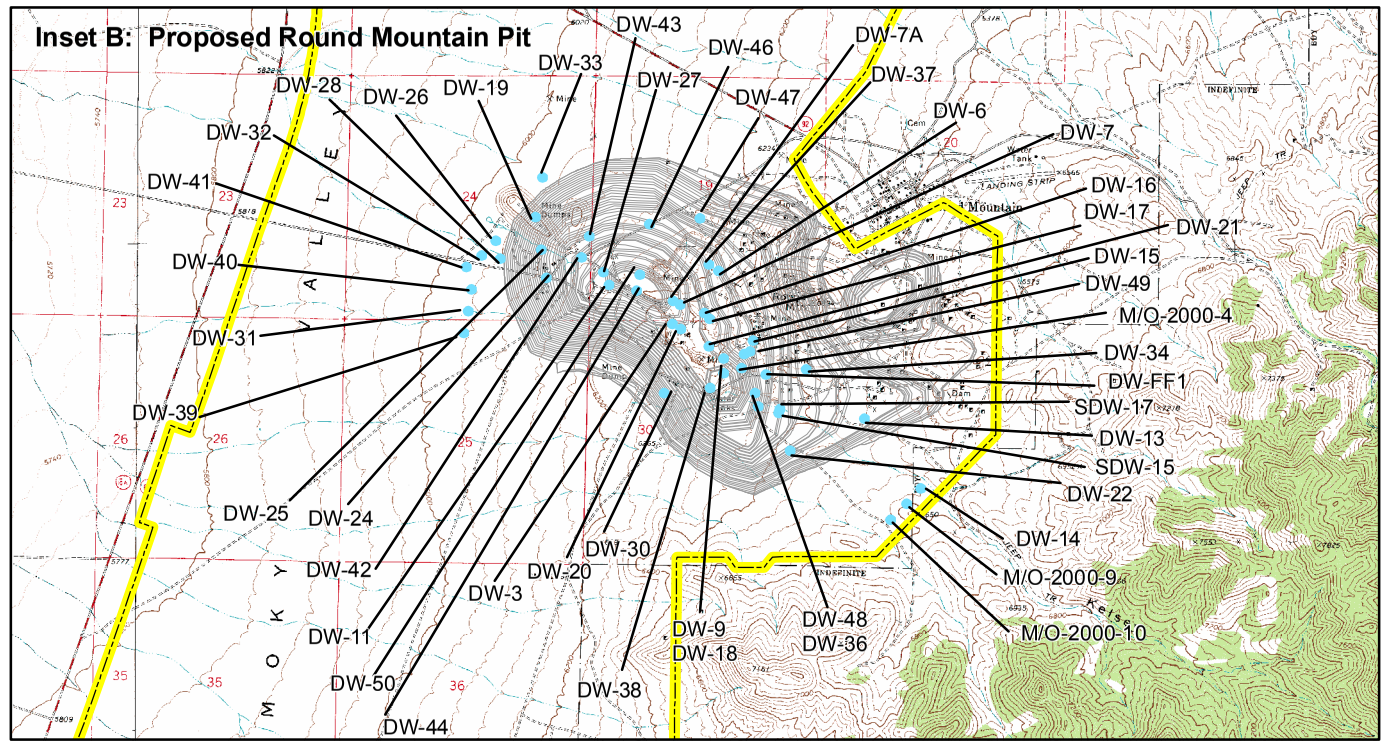
Table 4.3-3
Steady-state Pumping

Location	Easting (foot)[1]	Northing (foot)[1]	Annual Average Pumping Rate (gpm)	Use Type
East Well #2	88,980	115,524	698	Water supply
East Well #1	86,022	116,119	170	Water supply
West Well	85,637	116,166	44	Water supply
Hadley Well #1	86,269	111,292	120	Water supply
Hadley Well #2	84,563	110,729	27	Water supply
ICT Ranch	86,306	106,109	295	Agricultural
Agricultural Well[2]	84,707	95,288	750	Agricultural

[1] RMGC mine grid datum.

[2] Well represents estimated combined pumping rates from multiple agricultural wells supplying alfalfa fields in Section 9, T9N, R43E to the southwest of the Round Mountain Area.





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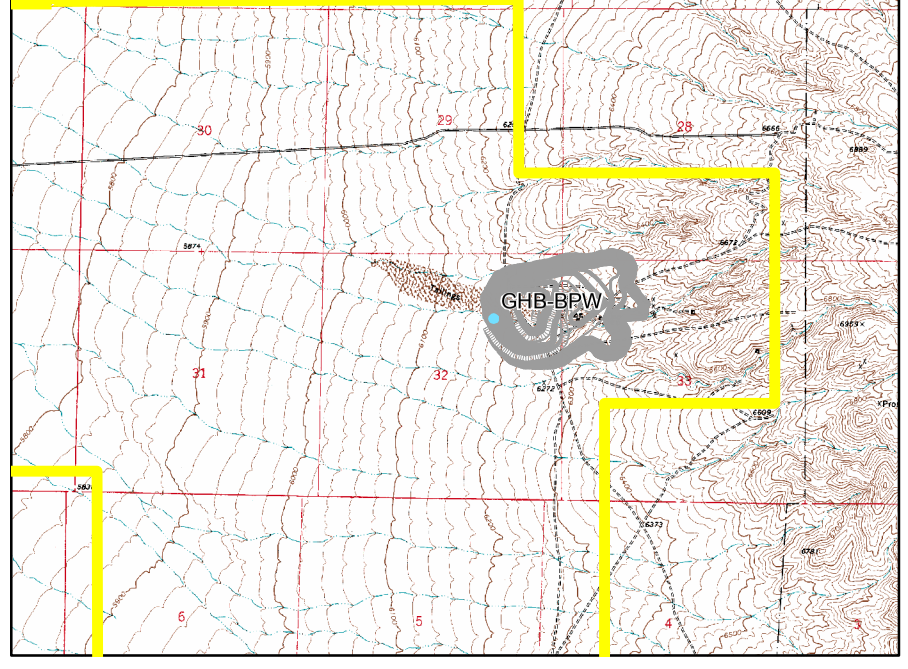


Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Mine Dewatering Wells
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells

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

Source: WMC 2008.

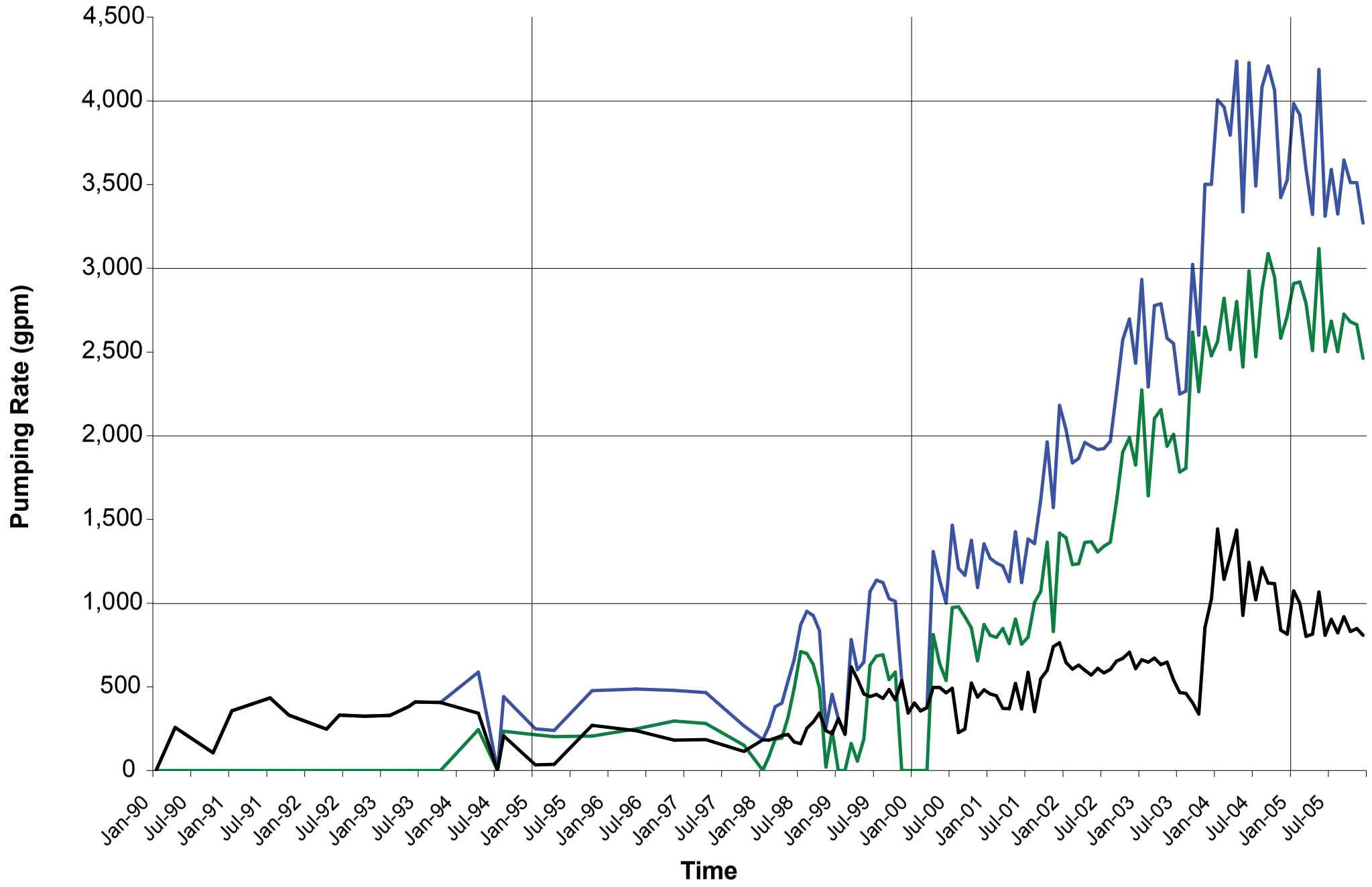
N

Round Mountain Expansion Project

Figure 4.3-7

Simulated Pumping Well Locations

05/25/2009



Legend

- Total
- Basin-fill
- Bedrock

Source: WMC 2008.

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Round Mountain Expansion Project

Figure 4.3-8

Currently Permitted Round Mountain Pit Average Monthly Pumping Rates

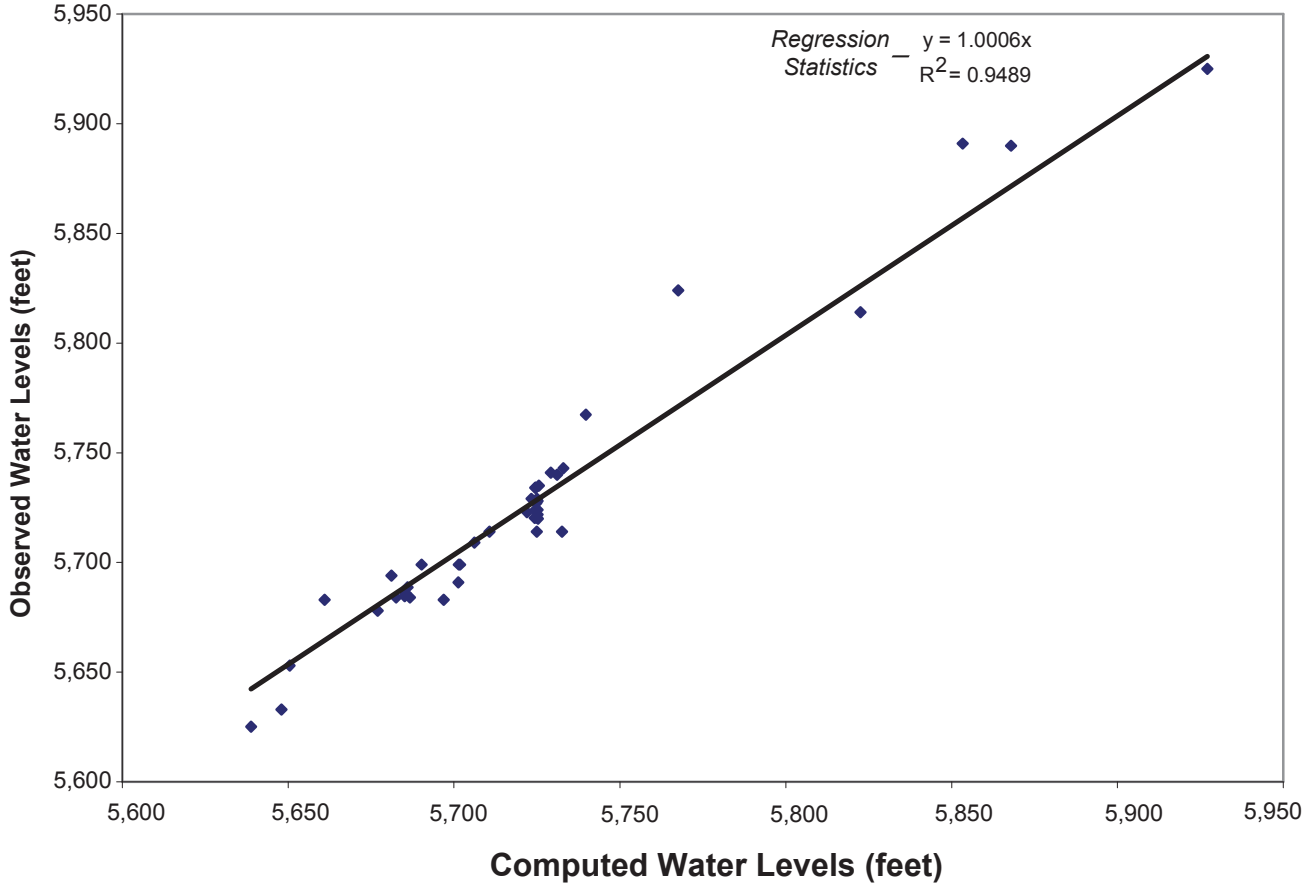
Numerical Model Calibration. Calibration of the groundwater flow model consisted of three steps: 1) steady-state calibration to pre-1990 alluvial water levels, 2) transient calibration to alluvial and bedrock well hydrographs for the period from 1990 to 2003, and 3) a transient verification to alluvial and bedrock well hydrographs for the period from 2004 to the end of 2005.

Steady-State Calibration: Steady-state calibration simulated conditions before the dewatering of the Round Mountain Pit and consisted of calibration to 52 water levels in alluvial monitoring wells near the Round Mountain and Gold Hill areas, flowing wells and springs in Northern Big Smoky Valley, and private irrigation and domestic wells in Northern Big Smoky Valley. Steady-state calibration targets are presented in **Appendix C**, **Table C-1**. **Figure 4.3-9** shows the correspondence of simulated and observed water levels for the calibration targets, and **Figure 4.3-10** shows the location of the target wells and the calibration residuals. The head range in the calibration targets was 5,625 feet to 6,183 feet (558 feet).

The match of observed to simulated heads in the alluvial wells is reasonably good for water elevations below approximately 5,740 feet. Wells with water levels above approximately 5,740 feet are those in the alluvium near the Round Mountain and Gold Hill areas. As illustrated in **Figure 4.3-10**, calibration residuals in the southern part of the model domain are mainly negative and range from 0.5 to 5.3 feet. In the central part of the valley west of the Round Mountain Area, the residuals are mostly positive and range from 2.8 to 9.5 feet. In the northern part of the model domain, the residuals are balanced between positive and negative. Near the Round Mountain Area, the residuals are positive and range from 8.9 to 56.4 feet. In the Gold Hill Area, the residuals are mostly negative and range from 2.1 to 10.3 feet. The overall steady-state calibration had a standard deviation/head range of 4.5 percent, which is within the generally accepted maximum of 10 percent.

Transient Calibration and Verification: The transient calibration was for the period from 1990 to the end of 2003 and utilized both alluvial and bedrock monitoring wells. The model verification was to alluvial and bedrock monitoring wells for the period from 2004 to 2005. The transient calibration had a standard deviation/head range of 8.3 percent, with a head range of 1,256 feet. The water budget for the model domain for 2005 is presented in **Table 4.3-4**. Transient calibration targets are presented in **Appendix C**, **Table C-2**. The calibration target wells and residuals are shown in **Figure 4.3-11**. Residuals for bedrock target wells in the Round Mountain Pit area are positive and range from 13.8 to 390 feet. A single bedrock target east of the mine area had a negative residual of 233.1 feet. The alluvial targets immediately west of the Round Mountain Pit had a balance of positive and negative residuals. For the Gold Hill Area, the transient calibration showed negative bedrock target residuals ranging from 3.3 to 253.6 feet. The alluvium west of the Gold Hill Pit had a mix of positive and negative residuals.

Transient calibration to well hydrographs included 26 alluvial and 17 bedrock hydrographs in the Round Mountain Area, with 10 alluvial and 5 bedrock hydrographs in the Gold Hill Area (WMC 2008). For the alluvial hydrographs in the Round Mountain Area, the transient calibration closely replicated 26 out of 26 wells and the transient verification also matched 26 out of 26 wells. For the bedrock hydrographs, the transient calibration replicated 5 out of 17 wells and the transient verification replicated 3 out of 17 wells. Water level changes in the alluvial wells were slight to moderate, while water level changes in the bedrock wells were substantial.



Legend

- Monitor Well Water Levels

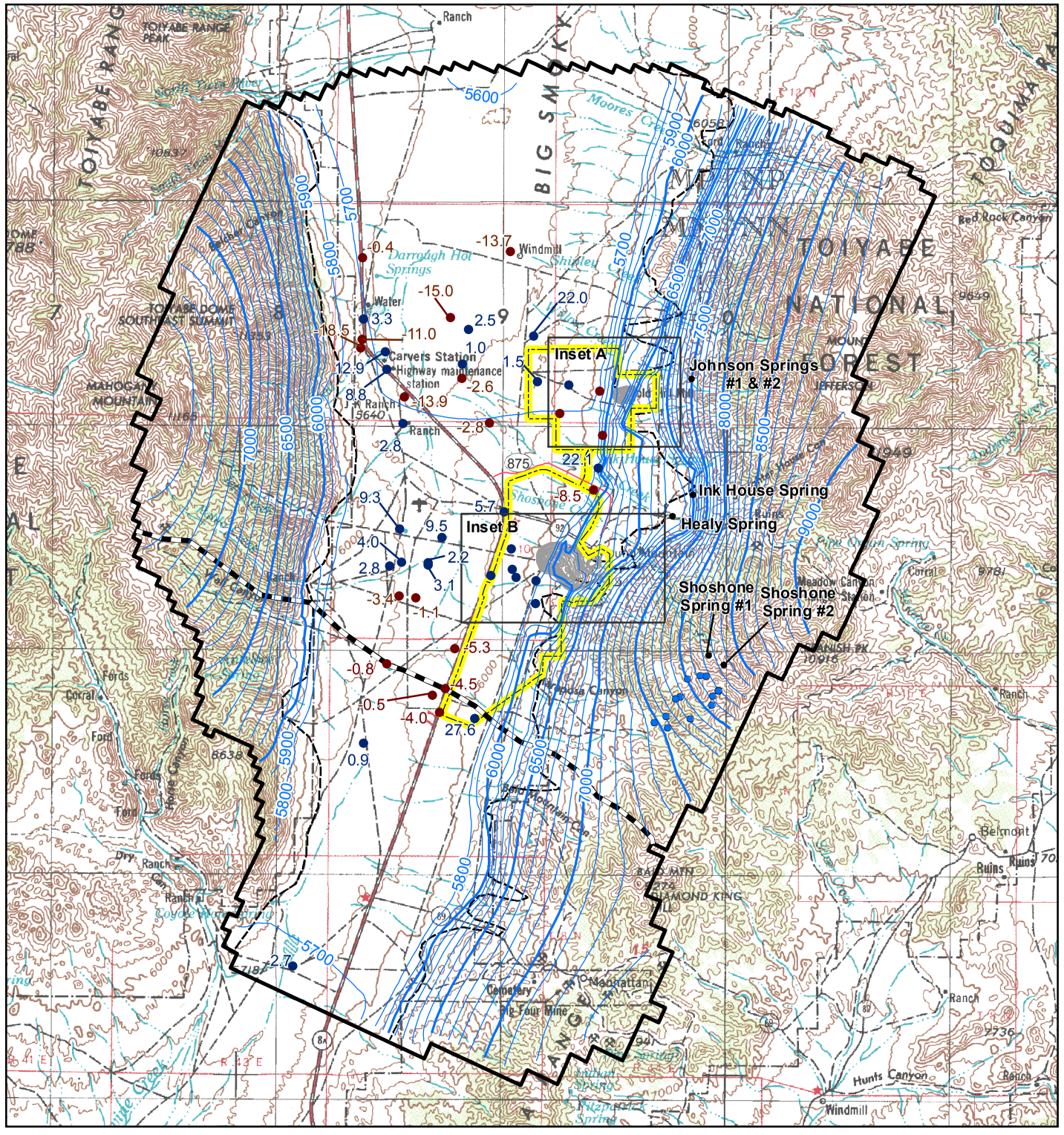
Note: Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

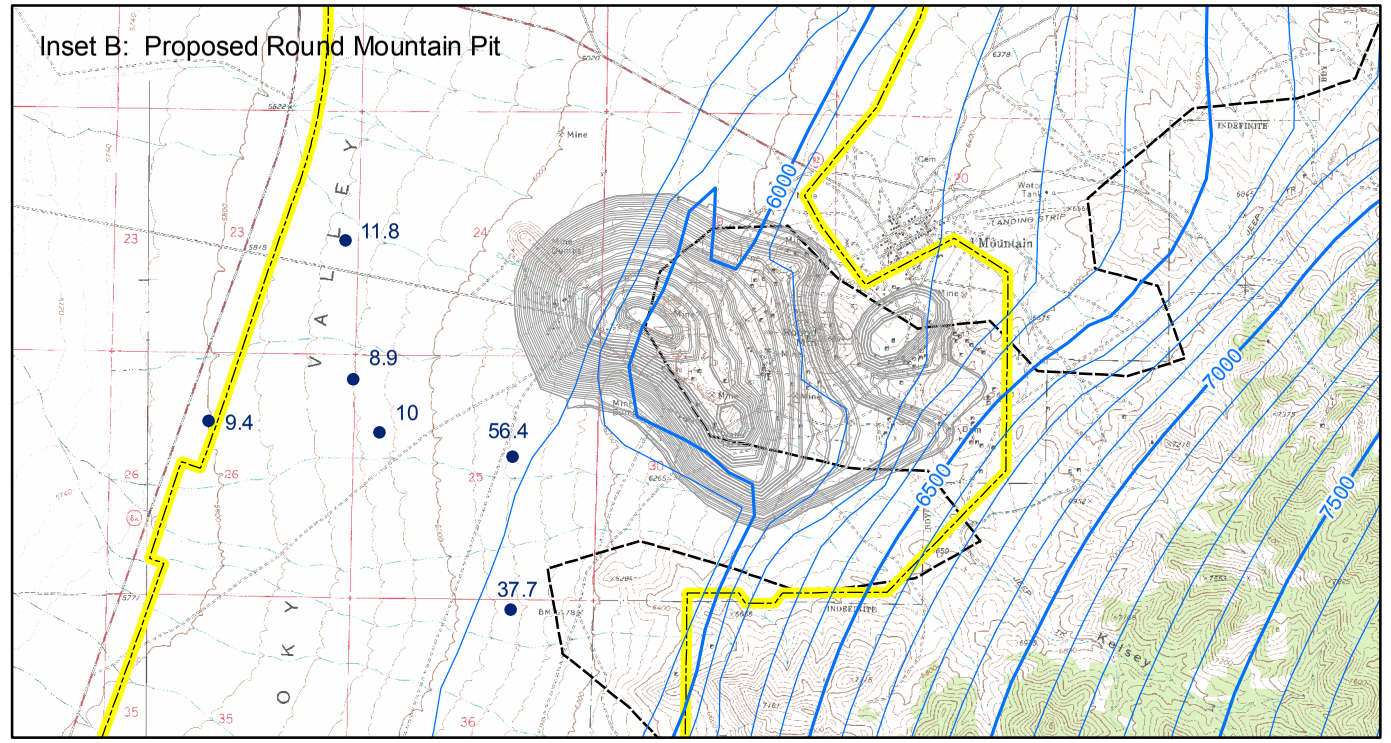
Round Mountain Expansion Project

Figure 4.3-9

Currently Permitted Round Mountain Pit Pre-mining Simulated and Observed Water Levels

04/12/09





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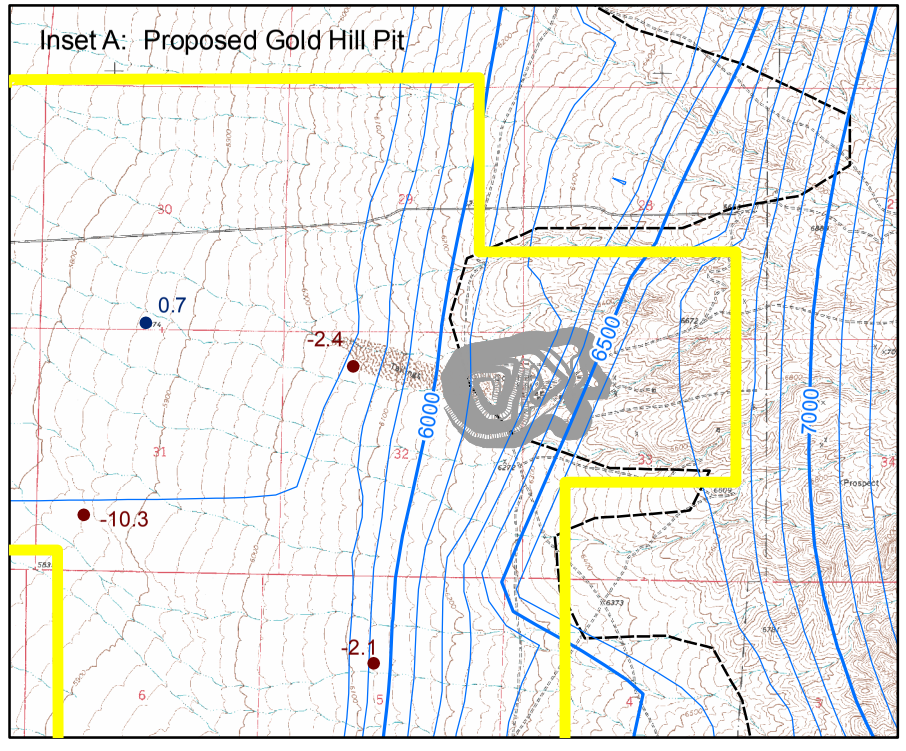


Legend

- Proposed Project Boundary
- Negative Residual (feet)
- Positive Residual (feet)
- 100-foot Contour
- 500-foot Contour
- Alluvial-bedrock Contact
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells

Note: Pre-mining conditions based on 1990 water levels.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

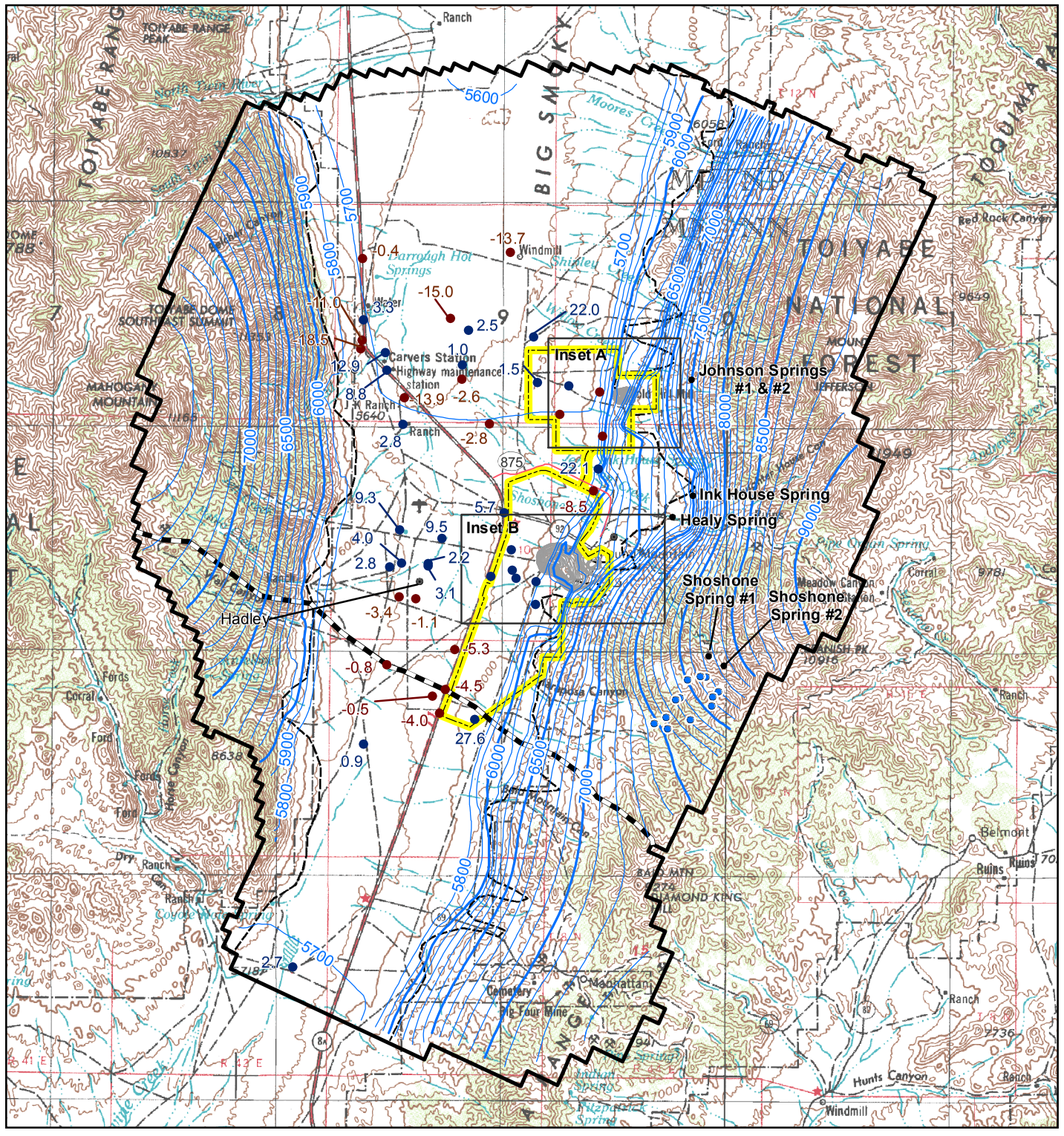
Source: WMC 2008.

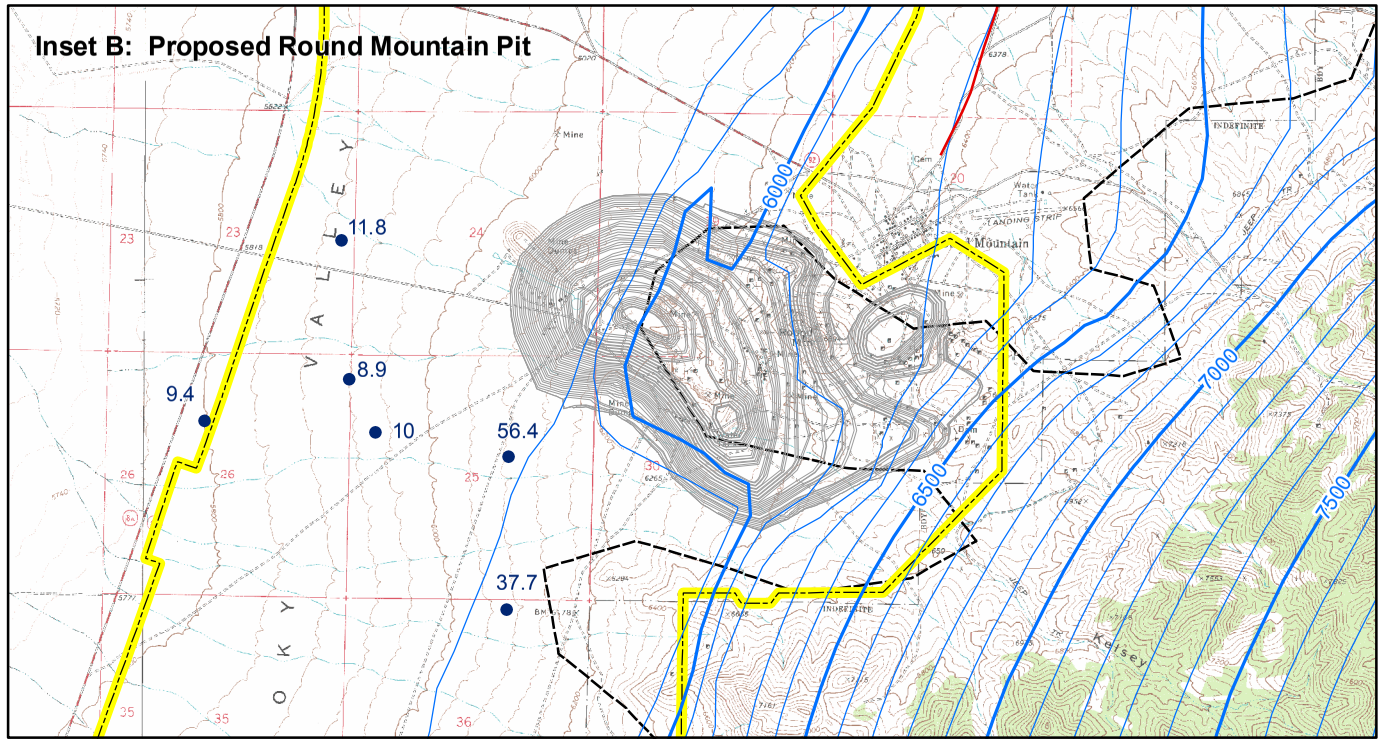
Round Mountain Expansion Project

Figure 4.3-10

Pre-mining Simulated Water Table Levels and Model Residuals

05/25/09





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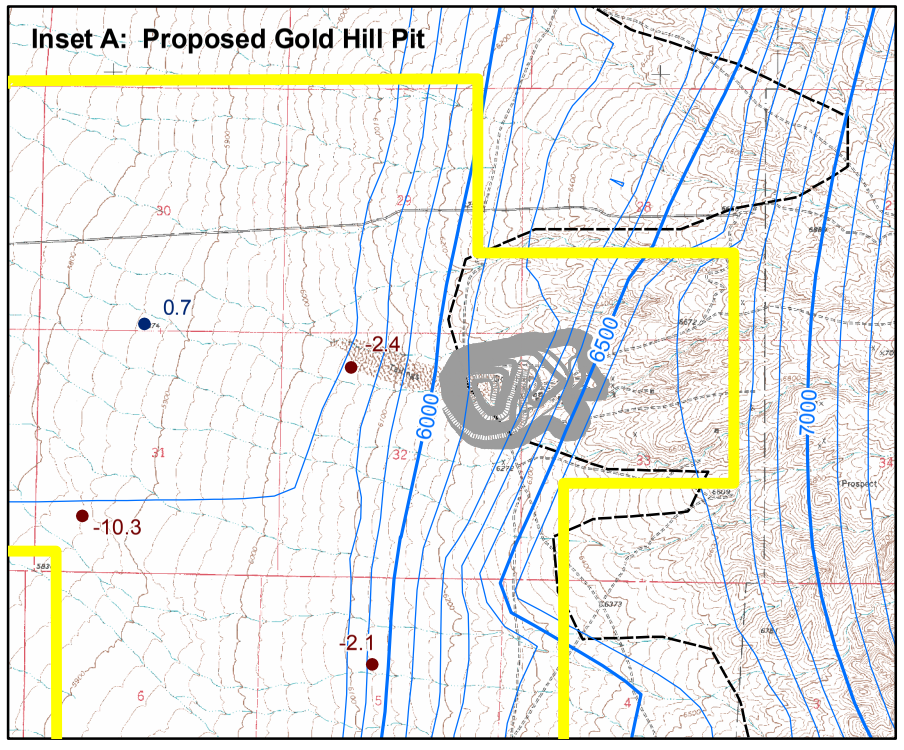


Legend

- Proposed Project Boundary
- Negative Residual (feet)
- Positive Residual (feet)
- Negative Residual, Bedrock (feet)
- Positive Residual, Bedrock (feet)
- 100-foot Contour
- 500-foot Contour
- Extent of Active Model Cells
- Alluvial-bedrock Contact
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography

Note: Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-11

Simulated Water Elevations and Model Residuals for Calibration at the End of 2005

05/25/09

Table 4.3-4
Simulated Groundwater Budget at the End of 2005

Groundwater Budget Component (ac-ft/yr)	Simulated Values[1] (ac-ft/yr)
Groundwater Recharge:	
To eastern mountain block, from precipitation	3,770
To western mountain block, from precipitation	940
To eastern pediment slope, from mountain-block runoff and subsurface flow	11,820
To western pediment slope, from mountain-block runoff and subsurface flow	14,010
From Jefferson Creek	3,610
To valley lowland, from precipitation	--
Subtotal (groundwater recharge):	34,200
Other groundwater inflows:	
From groundwater storage	2,870
Inflows from irrigated areas	270
Inflows from Round Mountain RIB System	1,310
Sub-surface inflow from adjacent hydrographic areas	--
Subtotal (other inflows):	4,450
Total inflow:	**38,600[2]**
Groundwater discharge:	
Groundwater ET	6,210
Groundwater discharge to Northern Big Smoky Valley outside the model domain	18,890
Groundwater discharge to Tonopah Flat outside the model domain	6,060
Water-supply pumping	330
Agricultural pumping	1,860
Dewatering pumping, combined	5,280
Total outflow:	**38,600[2]**

[1] Rounded to nearest 10 ac-ft/yr.

[2] Rounded to nearest 100 ac-ft/yr.

For the Gold Hill Area, the transient calibration closely replicated 10 out of 10 alluvial well hydrographs, as did the transient verification. For the bedrock well hydrographs, the transient calibration replicated 3 out of 5 wells, as did the transient verification. Water levels in the alluvial and bedrock well hydrographs were essentially flat.

Summary: Overall, the calibration to alluvial wells in the Round Mountain Area was reasonably successful. The steady-state calibration to the alluvial wells west of the Round Mountain Pit was only moderately successful, but the transient calibration to alluvial well hydrographs was quite good. The steady-state calibration did not include bedrock well targets. The transient calibration to bedrock well hydrographs was only moderately successful, with only 25 percent or less of the bedrock targets being replicated. The same was true for the transient verification to bedrock well hydrographs in the Round Mountain Area. For the Gold Hill Area, 60 percent of the bedrock hydrographs were replicated for the transient calibration and the verification, but these wells had no appreciable water level changes. The compartmentalization of groundwater in the Round Mountain bedrock due to extensive faults and fractures is the main factor affecting the calibration to bedrock well hydrographs. The grid spacing in the bedrock areas of 300 feet x 300 feet and the reliance on just a few hydraulic conductivity and storage coefficient zones in the pit area also contribute to the matching of bedrock well hydrographs. Although the model had modest success in matching bedrock well hydrographs due to the compartmentalization of bedrock in the mine areas, the model is considered acceptable for estimating impacts due to mine dewatering and for estimating pit refilling after cessation of mining.

Groundwater Impacts at End of Mining (2018). Under the Proposed Action, the Round Mountain Pit would be expanded and deepened as discussed in Section 2.4, Proposed Action, and dewatering would continue until the Year 2018. The target elevation for water levels in the Quaternary alluvium to the west of the final pit would be 5,460 feet, and the target elevation for bedrock water levels would be 4,610 feet, which is 455 feet deeper than the currently permitted pit.

The potential impact of the additional dewatering on groundwater levels and flow patterns in the alluvial and bedrock aquifers was modeled using the numerical groundwater flow model (WMC 2008). Current dewatering wells and expected new dewatering wells were incorporated into the model using the Fracture Well module of MODFLOW-SURFACT (Hydrogeologic 2002). The projected maximum dewatering rates used in the model to estimate future impacts due to the additional dewatering required for the expanded Round Mountain Pit are shown in **Table 4.3-5**. The alluvial aquifer was modeled as being dewatered at a maximum rate of 4,550 gpm through 2018, while the bedrock volcanic, metasedimentary rock, and granite aquifers were modeled as being dewatered at a total rate between 800 and 1,050 gpm (WMC 2008). Dewatering of the alluvial aquifer would be approximately at the same rate for both the expanded pit and the currently permitted pit. Flow to the Round Mountain RIB system was modeled as varying between 690 and 1,600 gpm.

The results of the modeling are shown in **Figure 4.3-12** for groundwater levels at the end of mining and in **Figure 4.3-13** for groundwater drawdown at the end of mining. Water levels at the end of mining suggest that groundwater in the alluvial aquifer would flow from the basin alluvium to the pit at the end of mining, with the 5,700-foot elevation contour being located in the vicinity of SR 376 west of the Round Mountain Area. Bedrock groundwater would flow into the pit area within a radius of about 5,000 feet from the center of the pit. Groundwater drawdown of 20 feet or more in the alluvial aquifer would be limited to the proposed project area at the end of mining. Drawdown around the pit in the bedrock would be approximately 300 feet on average with 500 or more feet of drawdown in the central part of the pit area.

Table 4.3-5
Estimated Maximum Dewatering Rates

Round Mountain Pit Maximum Dewatering Rates (gpm)			Gold Hill Pit Dewatering Rates (gpm)		
Unit	**Empirical Estimate**	**Model Simulated**	**Unit**	**Empirical Estimate**	**Model Simulated**
Alluvium	4,500 - 5,800	4,550	Alluvium	50 - 150	100[3]
Volcanics	1,000 - 1,300	800 - 1,050[1]	Sinter and Welded Tuff[2]	450 - 850	620
Granites	400	--	--	--	--

[1] Combined bedrock and granite pumping.

[2] Empirical and model estimates include dewatering from both units.

[3] Alluvial dewatering expected to be short-lived.

Impacts to the valley alluvial aquifer, up to 2.5 miles west of the Round Mountain Pit, would range from 10 to 20 feet of drawdown at the end of mining. Wells and springs within the 10-foot groundwater drawdown isopleth may experience a decline in water levels between 10 to 20 feet. To the east of the pit area in the bedrock of the Toquima Range, drawdown would be up to 10 feet within about 2 miles of the pit center. Most of this drawdown would be in the Tertiary granite. No springs or wells in the bedrock to the east of the Round Mountain Pit would be affected by drawdown of 10 feet or greater at the end of mining.

Maximum Groundwater Impacts. The maximum extent of groundwater drawdown in the alluvial and bedrock aquifers within and to the east of the Round Mountain Area would occur approximately in Year 2048, about 30 years after the cessation of dewatering (WMC 2008). The maximum drawdown would be the result of dewatering at both the expanded Round Mountain Area and the proposed Gold Hill Area. **Figure 4.3-14** shows the estimated maximum drawdown calculated by the groundwater model, and **Figure 4.3-15** shows the water level elevations at the time of maximum drawdown.

The 20-foot groundwater drawdown isopleth in the alluvial aquifer would extend slightly beyond the proposed project area to the west of the Round Mountain Area (**Figure 4.3-14**). The estimated extent of the 10-foot groundwater drawdown isopleth indicates the drawdown would extend across the Northern Big Smoky Valley to the Toiyabe Range and would encompass most of the southern half of the model domain, which would be about the southern 10 percent of Northern Big Smoky Valley, and a small part of the northern third of Tonopah Flat. Any wells or springs in the basin alluvial aquifer falling within the area encompassed by the 10-foot groundwater drawdown isopleth may experience 10 to 20 feet of drawdown by Year 2048.

For the bedrock aquifers within and to the east of the Round Mountain Area, the estimated maximum drawdown indicates that the 50-, 20-, and 10-foot groundwater drawdown isopleth would extend eastward beyond the Round Mountain Area. The 10-foot groundwater drawdown isopleth would extend about 1 mile east of the proposed project area into the Toquima Range. Most of the drawdown would occur in the Cretaceous granite. No springs would be affected. However, the 10-foot groundwater drawdown isopleth would be within 0.5 mile of Healy Spring. Although the lower reaches of Jefferson Creek would fall within the maximum 10-foot drawdown isopleth, the drawdown would be confined to the bedrock unit and would not

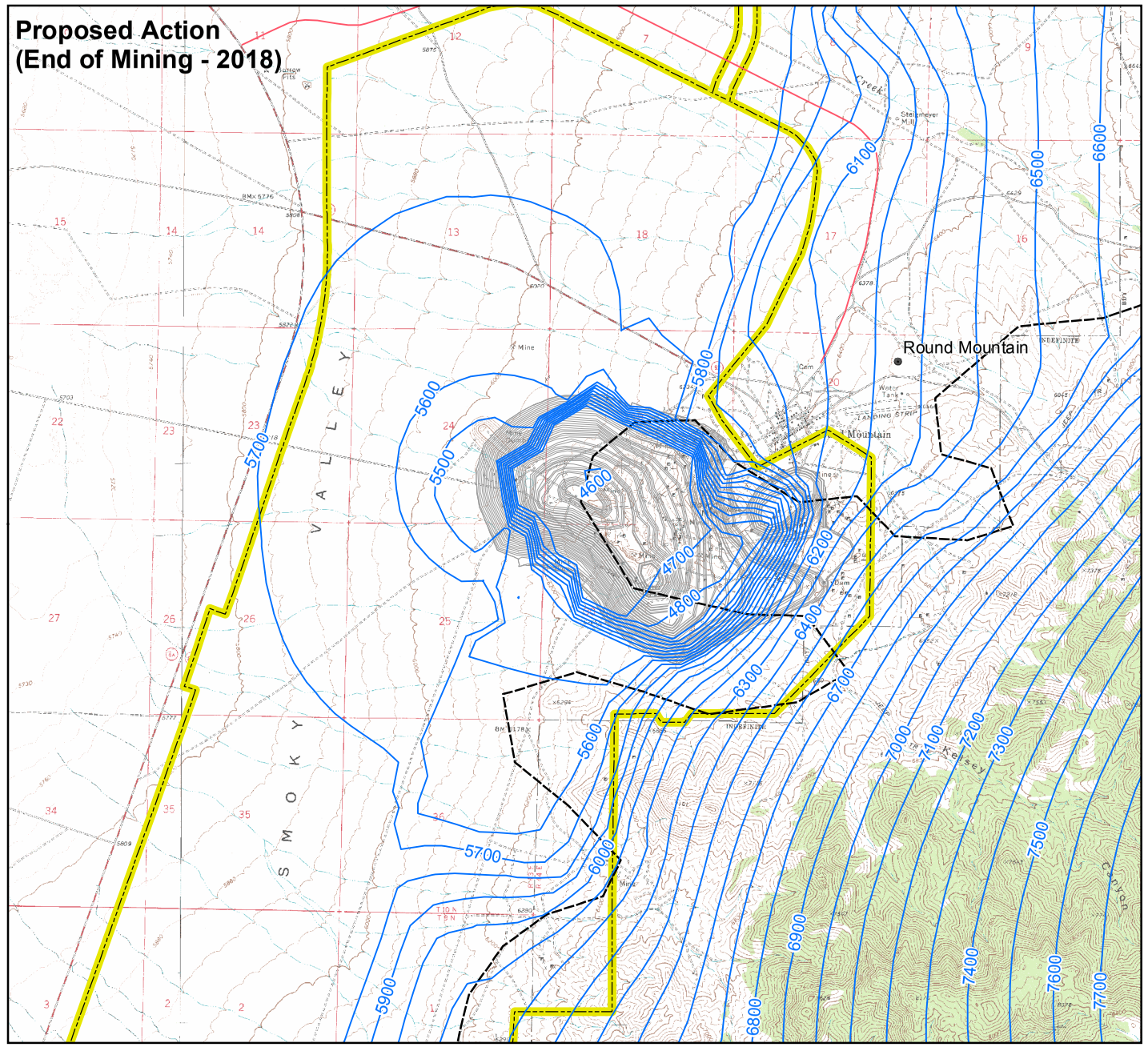
affect flow because Jefferson Creek is fed by precipitation runoff. Drawdown in the Round Mountain Pit area would be approximately 500 feet.

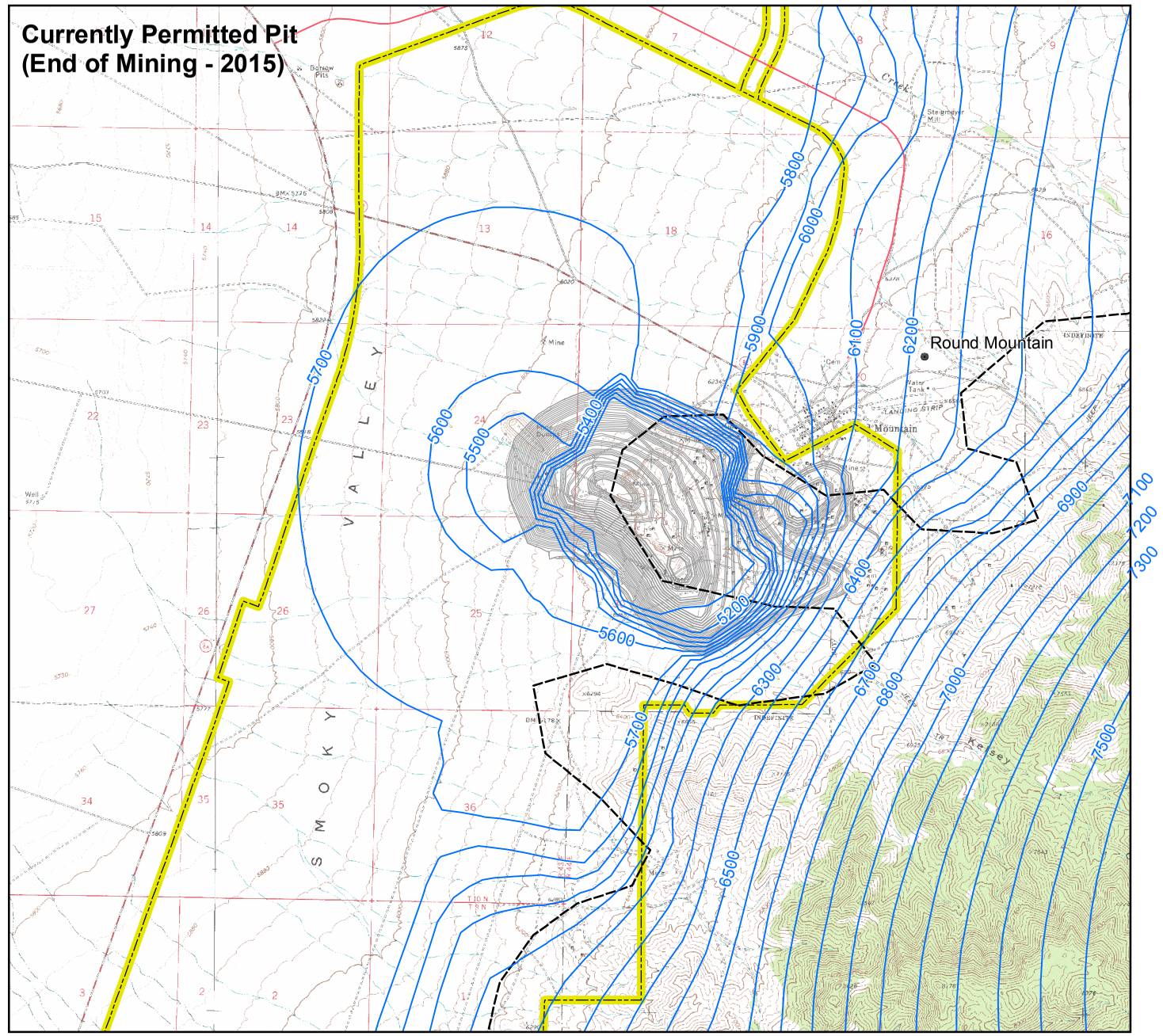
Figure 4.3-15 illustrates the 5,700-foot water elevation contour in the basin alluvial aquifer that would extend to the western proposed project area for the Round Mountain Area. Groundwater in the alluvial aquifer would flow from the central part of the basin toward the Round Mountain Pit. The groundwater elevation contours also suggest that bedrock groundwater within about a 5,000-foot radius of the center of the Round Mountain Pit would flow into the pit from the east, north, and south. Overall, groundwater flow patterns in the basin alluvial aquifer and the bedrock aquifers would be similar to flow patterns at the end of mining. Only the extent of drawdown would increase in both the basin alluvial aquifer and the bedrock aquifers east of the proposed project area.

Impacts to Water Rights. Drawdown west of the project boundary in the alluvial aquifer of Northern Big Smoky Valley would range from 10 to 20 feet at the time of maximum groundwater decline. Water rights that occur within the maximum 10-foot groundwater drawdown isopleth west of the proposed project area may be affected. **Table 4.3-6** lists the water rights that occur within the estimated maximum 10-foot groundwater drawdown isopleth that are held by individuals, agencies, and corporations other than RMGC. These water rights may experience some decline in water quantity. The maximum extent of the 10-foot groundwater drawdown isopleth east of the proposed project area would include the private water rights held for Johnson springs 1 and 2. Healy and Ink House springs lie just outside the maximum extent of the 10-foot groundwater drawdown isopleth and may be affected by 5 to 10 feet of groundwater drawdown. The water rights for these springs may be affected. 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.

Groundwater Impacts at Pit Recovery. As groundwater flows into the expanded Round Mountain Pit after cessation of mining, a pit lake would form and gradually increase in elevation and size until evaporation from the pit lake matches surface and groundwater inflow. The pit lake is expected to reach about 99 percent of its final size 200 years after cessation of mining (WMC 2008). At this time, evaporation from the pit lake would act as a permanent groundwater “pump” removing about 764 gpm of groundwater for an indefinite period of time. Bedrock groundwater would contribute about 200 gpm, and alluvial basin groundwater would contribute the rest (WMC 2008). This long-term loss of groundwater would create drawdown in both the basin alluvial aquifer and the bedrock aquifers.

Figure 4.3-16 illustrates the estimated long-term drawdown expected due to evaporation from the Round Mountain Pit lake under the Proposed Action. Drawdown was modeled at 99 percent recovery of the pit lake. The estimated 10-foot groundwater drawdown isopleth in the basin alluvial aquifer would extend west of the pit but should remain within the proposed project area. The 50-, 20-, and 10-foot groundwater drawdown isopleth in the bedrock aquifers would extend east of the proposed project area into the Toquima Range. The 20-foot isopleth would extend about 1 mile east of the proposed project area and the 10-foot isopleth would extend about 2 miles east of the proposed project area. No major springs in the Toquima Range would be affected. The permanent drawdown in the pit area would be 100 to 150 feet with a maximum of approximately 300 feet near the center of the pit.





Legend

- Proposed Project Boundary
- Groundwater Elevation Contour (100-foot interval)
- Alluvial-bedrock Contact
- Proposed Pit

Note: Drawdown from 1990 to 2048.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

Source: WMC 2008.

N

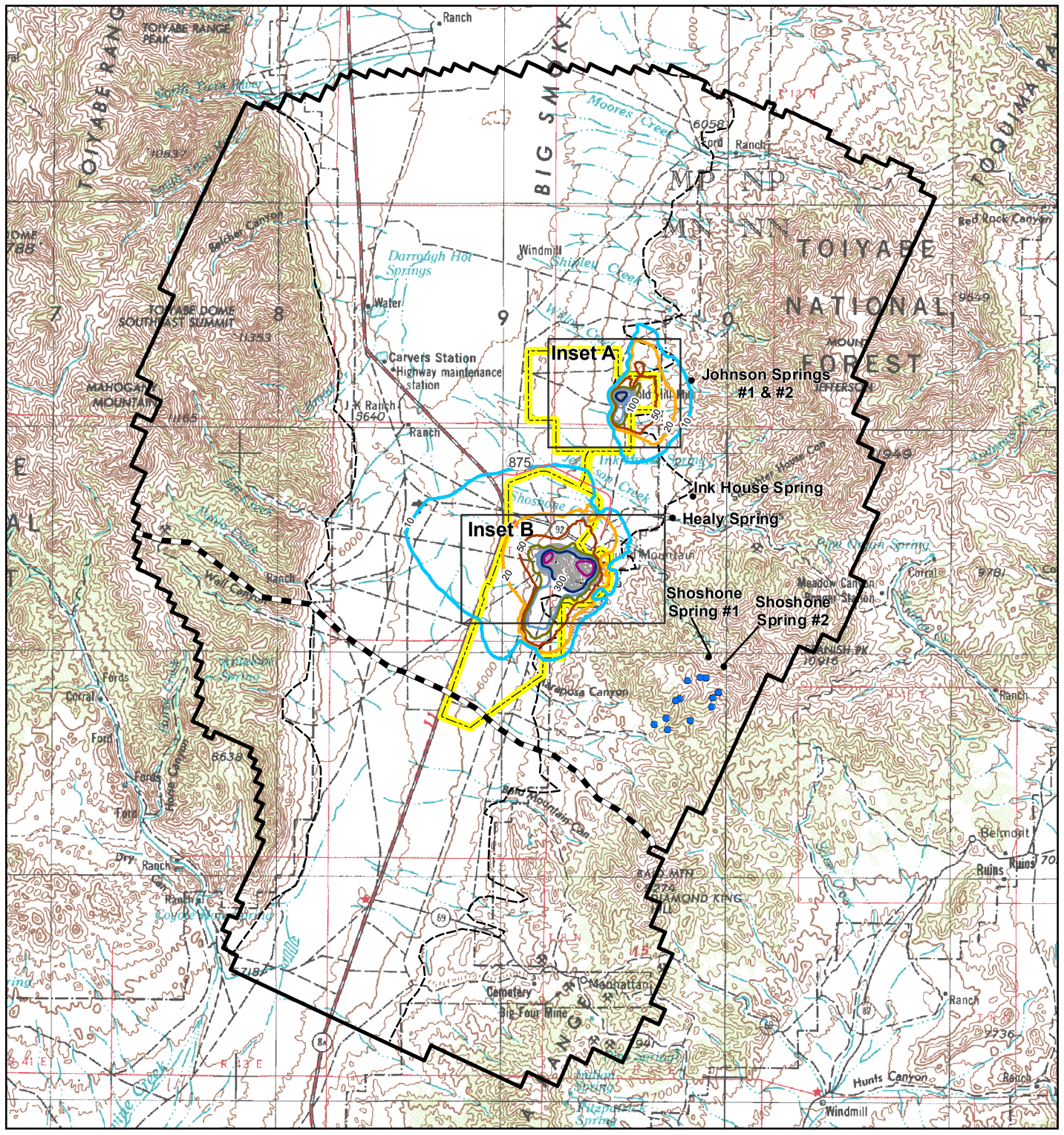
0 0.5 1 Miles

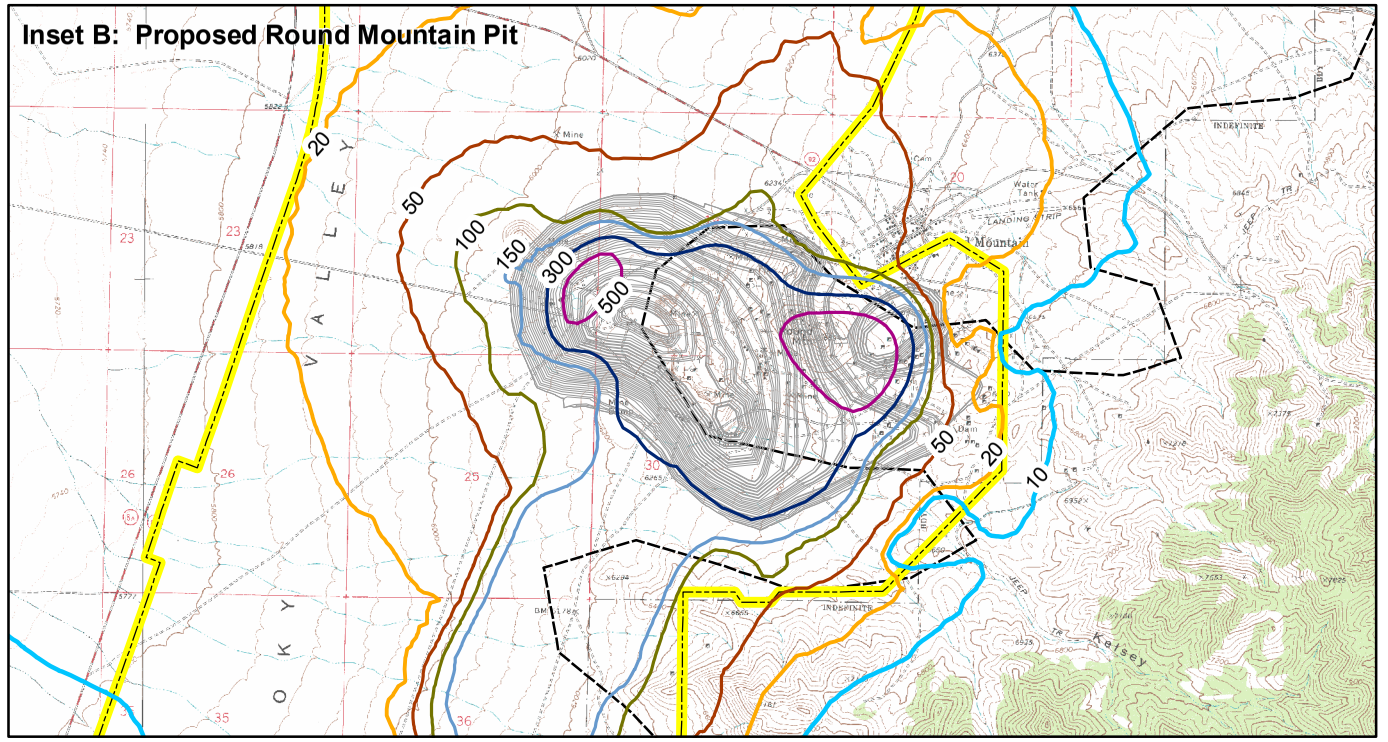
Round Mountain Expansion Project

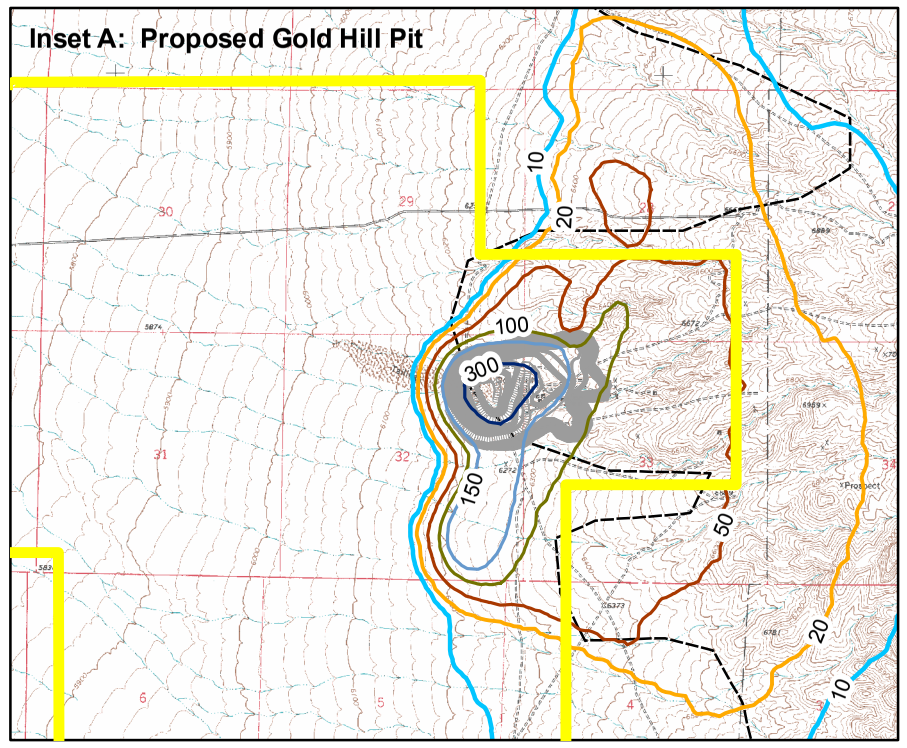
Figure 4.3-12

Round Mountain Pit
Current and Proposed Action
Simulated Water Elevations
at the End of Mining

04/30/2009







Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Alluvial-bedrock Contact
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells

Selected Isopleth Drawdown

- 10-foot Isopleth
- 20-foot Isopleth
- 50-foot Isopleth
- 100-foot Isopleth
- 150-foot Isopleth
- 300-foot Isopleth
- 500-foot Isopleth

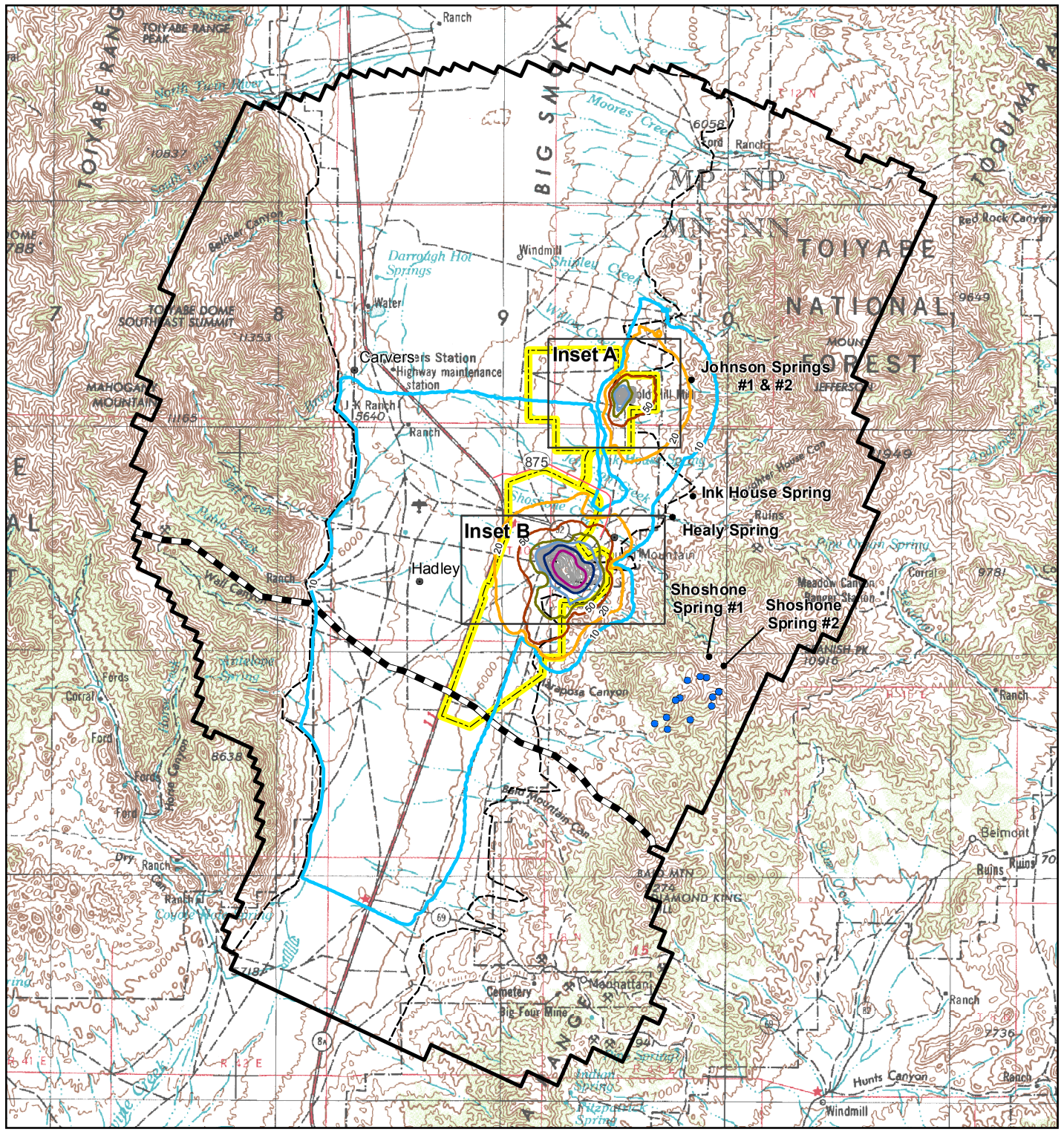
Note: Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

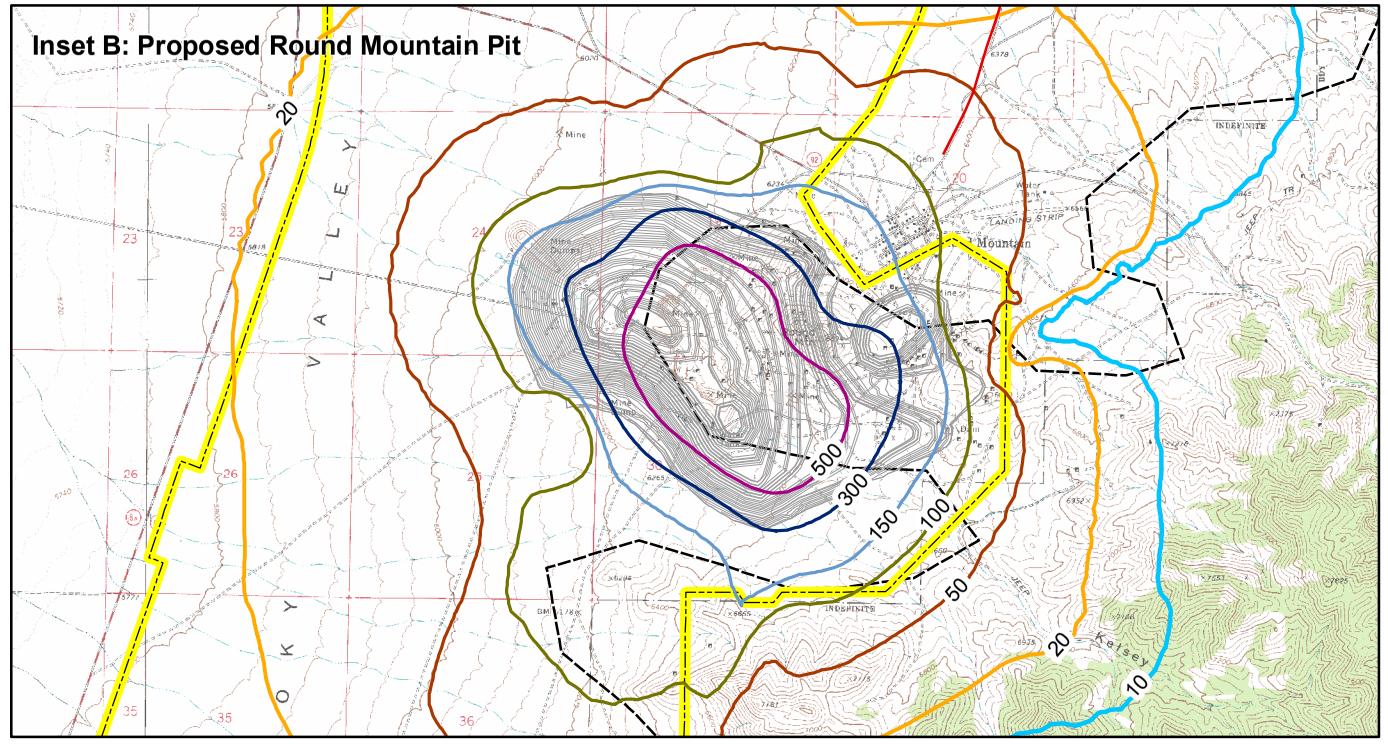
Round Mountain Expansion Project

Figure 4.3-13

Proposed Action Groundwater Drawdown at the End of Mining (2018)

05/26/09





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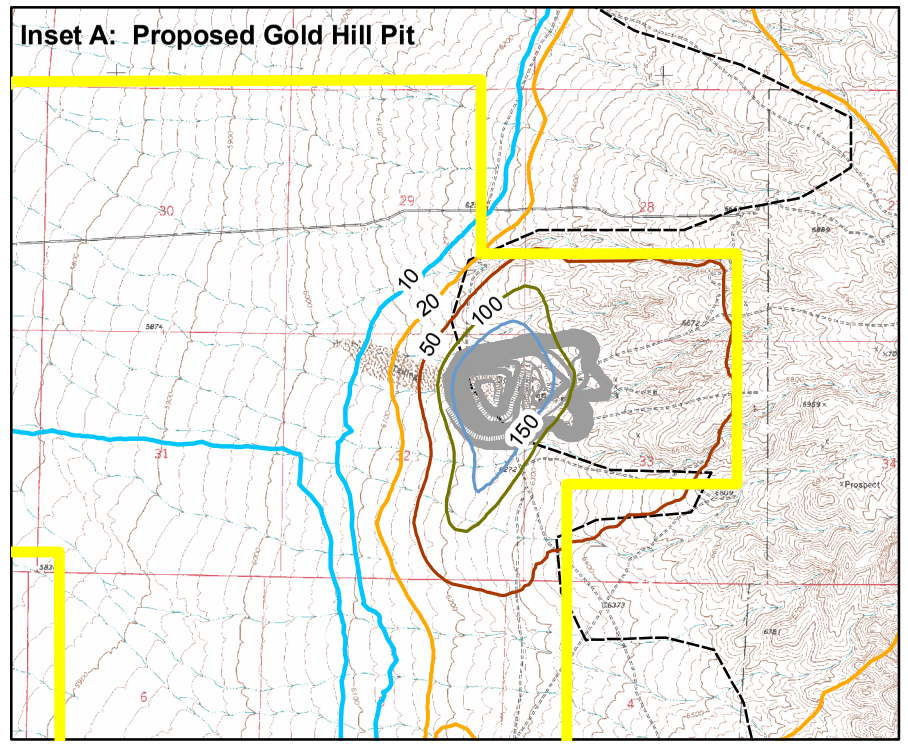


Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Alluvial-bedrock Contact
- Extent of Active Model Cells

Selected Isopleth Drawdown

- 10-foot Isopleth
- 20-foot Isopleth
- 50-foot Isopleth
- 100-foot Isopleth
- 150-foot Isopleth
- 300-foot Isopleth
- 500-foot Isopleth

Note: Drawdown from years 1990 to 2048.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

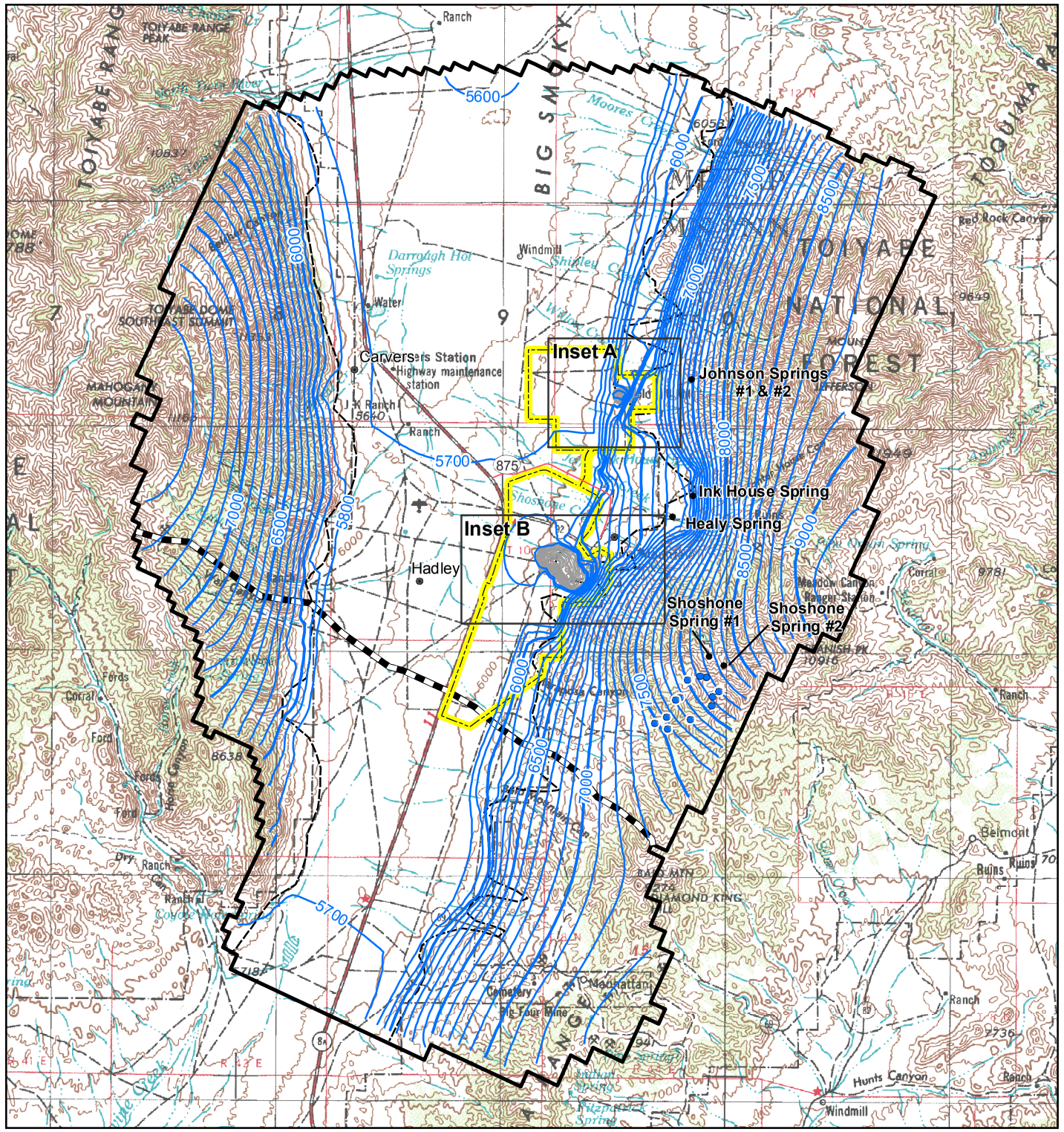
Source: WMC 2008.

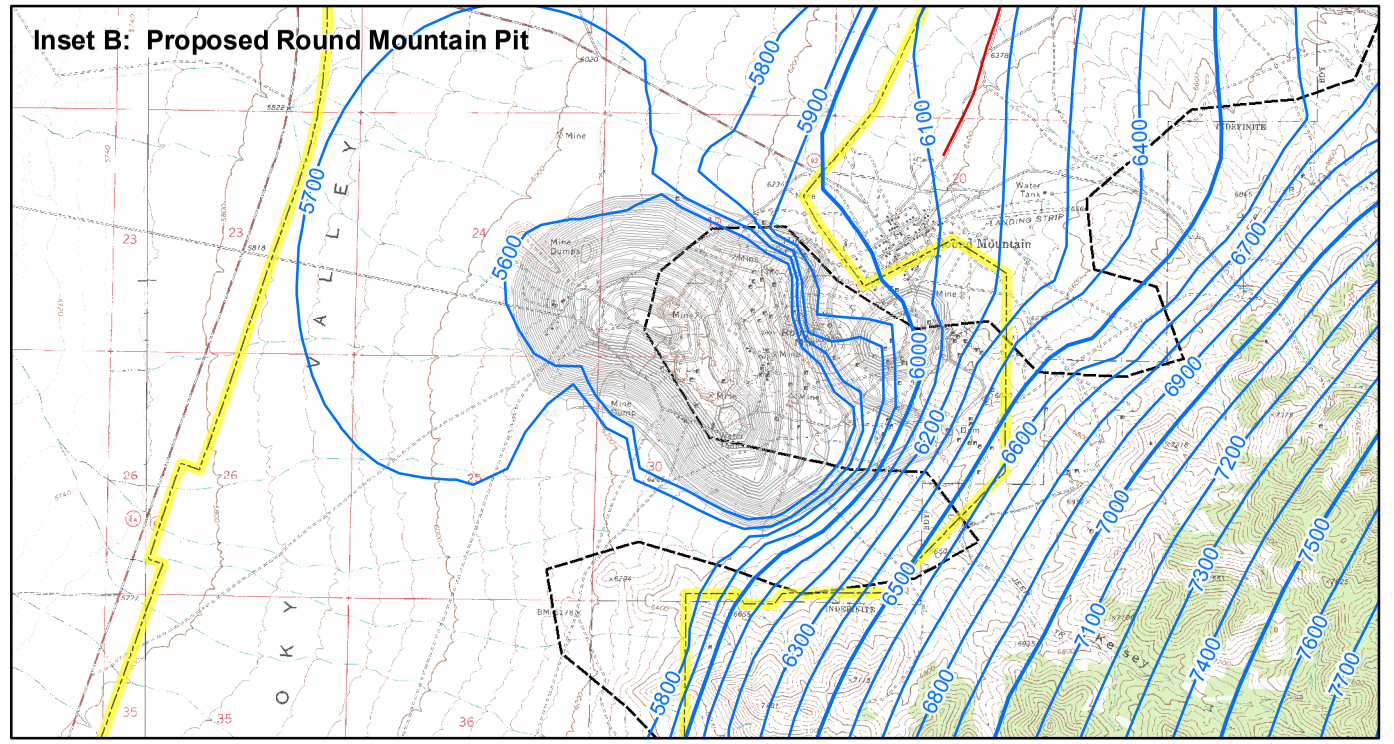
Round Mountain Expansion Project

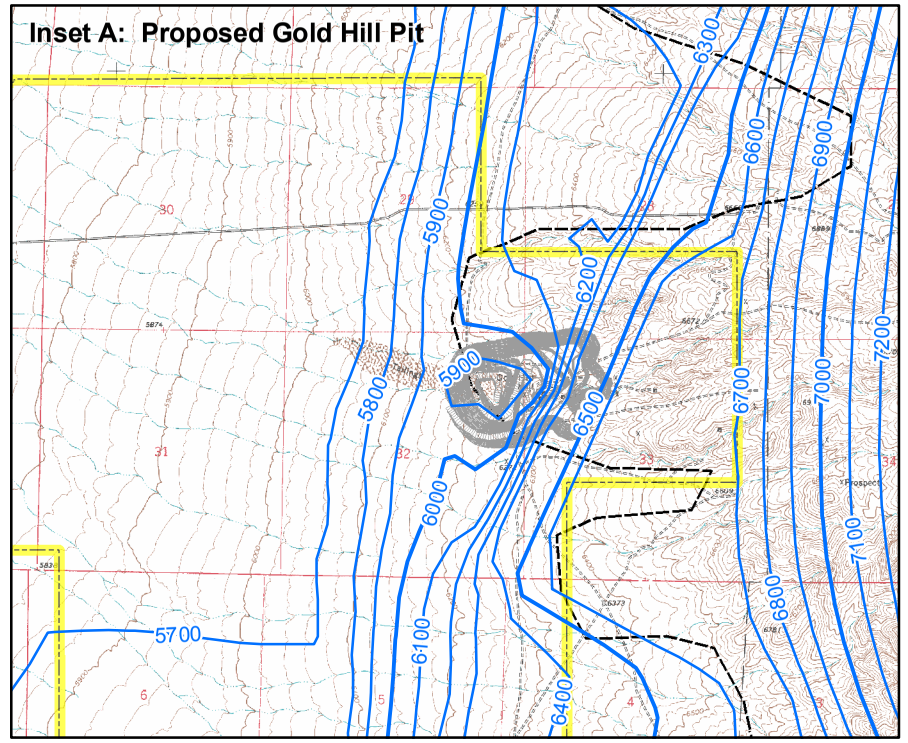
Figure 4.3-14

Proposed Action
Total Drawdown at Time of Maximum Drawdown Extent

05/25/2009







Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells
- Alluvial-bedrock Contact
- 500-foot Contour
- 100-foot Contour

Note: Water levels in year 2048.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-15

Proposed Action
Water Levels at Time of Maximum Drawdown Extent

05/25/2009

Table 4.3-6
Water Rights Not Held by RMGC Within the Estimated Maximum 10-Foot Groundwater Drawdown Isopleth,

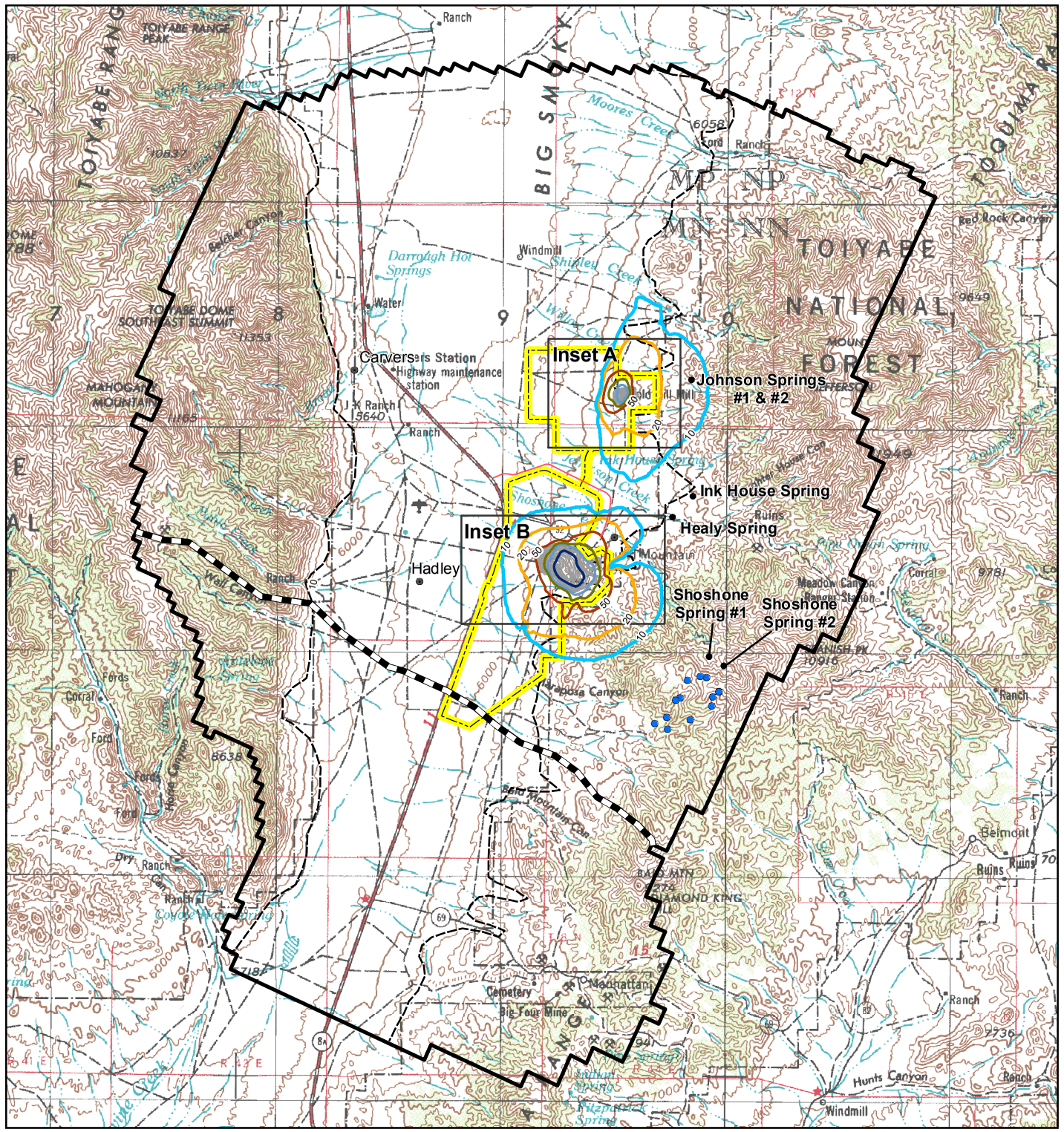
WDNR Application No.	Owner	Quarter Quarter	Section	Township	Range	Use[1]	Source	Comment
V03376	USFS	NESW	13	9N	42E	STK	Boyd Canyon Spring	
13374	RO Inc.	SESW	5	9N	43E	STK	Well	
27966	R.F. and K.A. Beck	NWNW	9	9N	43E	IRR	Well	
27967	R.F. and K.A. Beck	NESE	9	9N	43E	IRR	Well	
40112	Truckee River Ranch, LLC	SWSE	5	9N	43E	STK	Well	
46687	R.F. and K.A. Beck	NWNW	2	10N	43E	IRR	Well	
52312	D. and G. Hoag	NWSE	4	10N	43E	QM	Well	
52683	C. Stevens	NWSE	4	10N	43E	QM	Well	
52856	K. and B. Berg	NESW	4	10N	43E	IRR	Well	
76789	EDK Enterprises, LLC	SESW	4	10N	43E	COM	Well	
38752	K. and A. Berg	NENE	5	10N	43E	IRR	Well	
12356	M&O Partnership	SWSW	22	10N	43E	STK	Well	
50828	Unincorporated Town. Round Mountain	NWNW	28	10N	43E	QM	Well	
21043 (26891)	Unincorporated Town. Round Mountain	SWSW	28	10N	43E	IRR	Well	
50829	Unincorporated Town. Round Mountain	NWNE	29	10N	43E	QM	Well	
17416	Unincorporated Town. Round Mountain	SWSW	11	10N	44E	MUN	Ink House Spring	Outside of drawdown area, but potentially affected by drawdown.

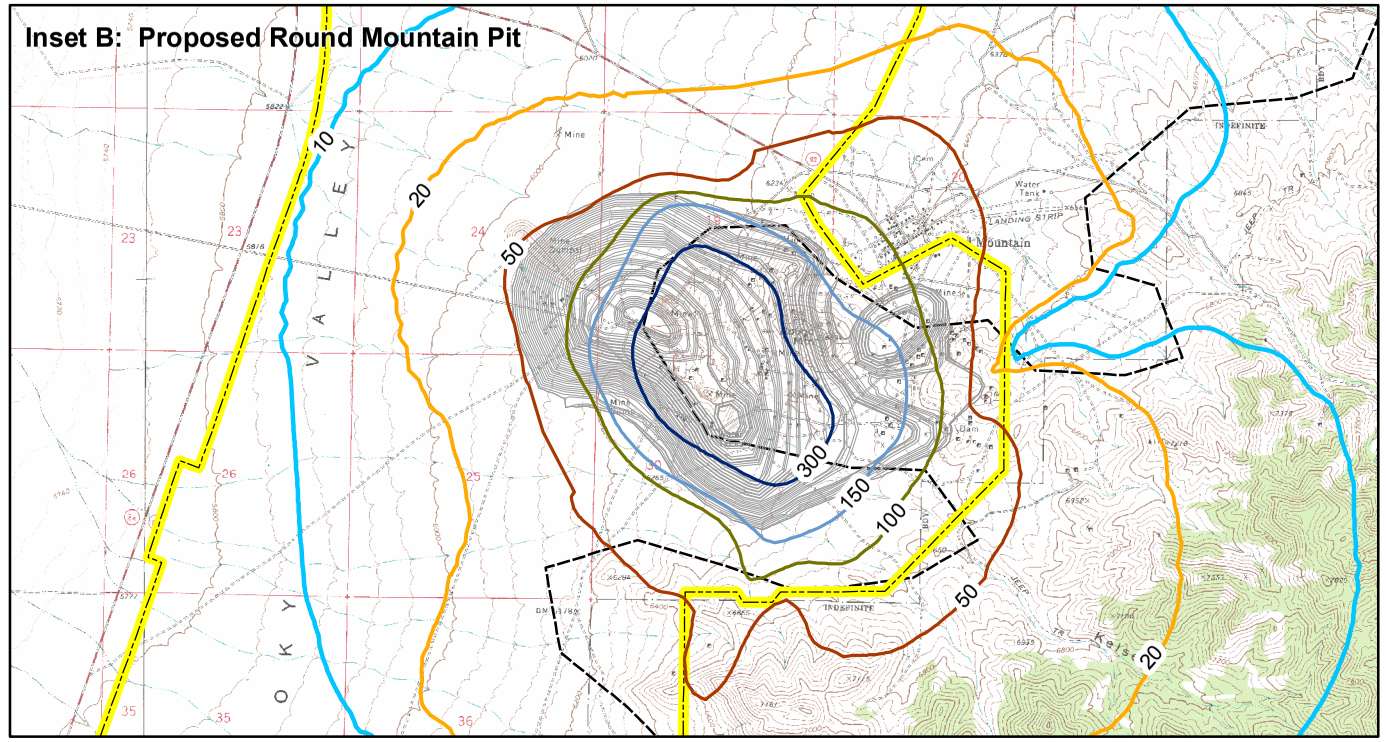
TABLE 4.3-6 (Continued)

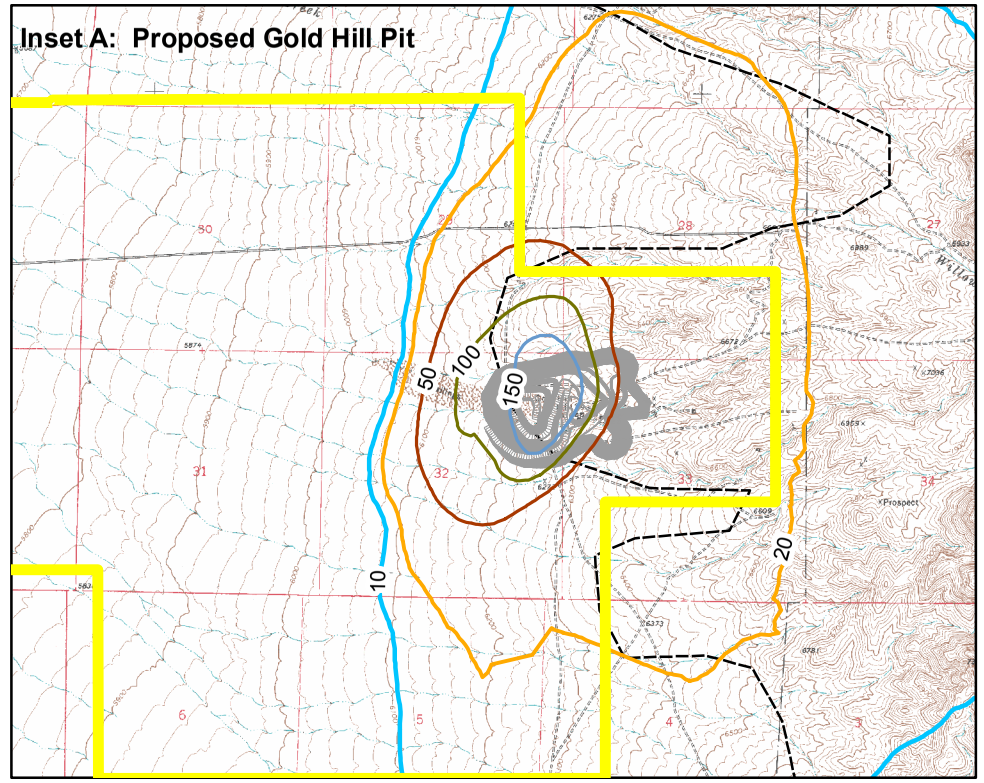
WDNR Application No.	Owner	Quarter Quarter	Section	Township	Range	Use[1]	Source	Comment
17334	Unincorporated Town. Round Mountain	NESE	15	10N	44E	MUN	Healy Spring	Outside of drawdown area, but potentially affected by drawdown.
47776	Unincorporated Town. Round Mountain	SENW	20	10N	44E	QM	Well	
67147	B. and S. Johnson	SWSW	26	11N	44E	IRR	Unnamed Spring (per WDNR database)	One of the Johnson Springs.
V02981	USBLM	SWSE	30	11N	43E	STK	Broad Creek and Tributary	
46914	D.L. Berg	NWNE	32	11N	43E	QM	Well	
46873	D.H. and S.L. Fannin	NENE	32	11N	43E	IRR	Well	
13675	D. Berg	NESE	33	11N	44E	STK	Gold Hill Spring	No spring was found at the permitted locations.
55479	C. Stonier	SWNW	33	11N	43E	IRR	Well	
52081	C. Stonier	SWNW	33	11N	43E	QM	Well	
55480	C. Stonier	SWNW	33	11N	43E	QM	Well	

[1] STK – Livestock watering
IRR – Irrigation
COM – Commercial
QM – Quasi – municipal
MUN – Municipal

Source: Nevada Division of Water Resources 2009.







Legen

- Proposed Project Boundary
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- Inventoried Mariposa Canyon Springs
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- Alluvial-bedrock Contact

Selected Isopleth Drawdown

- 10-foot Isopleth
- 20-foot Isopleth
- 50-foot Isopleth
- 100-foot Isopleth
- 150-foot Isopleth
- 300-foot Isopleth
- 500-foot Isopleth

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

Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-16

Proposed Action
Drawdown at Time of 99%
Pit Lake Recovery

05/25/2009

Figure 4.3-17 illustrates the estimated groundwater elevations in the basin alluvial aquifer and the bedrock aquifers at 99 percent pit lake recovery. Alluvial groundwater would flow into the pit at a rate of about 564 gpm under the base case modeling scenario. This water would come from the basin alluvial aquifer in the southern part of the Northern Big Smoky Valley. Bedrock groundwater would flow to the pit from an area within a radius of about 5,000 feet of the pit center. The estimated groundwater inflow rate for the base case modeling scenario is about 200 gpm. This loss of groundwater from both the basin alluvial aquifer and the bedrock aquifers to the east, south, and north of the expanded Round Mountain Pit would continue indefinitely.

Water Quality Impacts

Water quality impacts for the expanded Round Mountain Pit would be related to formation of a pit lake and potential seepage from the waste rock dumps, leach pads, and tailings impoundment facility after cessation of mining and reclamation of the mine site. Each of these potential sources of water quality impacts is addressed in this section.

Pit Lake Geochemical Model. A pit lake geochemical model was developed for the currently permitted pit at Round Mountain Pit, the proposed expanded pit at Round Mountain, and the proposed Gold Hill Pit. The same basic modeling approach was applied to all three pits. Key factors considered in the model design were: 1) pit wall lithology, alteration, oxidation, and mineralization; 2) bedrock groundwater quality that would flow into the pit; 3) pit wall runoff and reactions with pit wall rocks; 4) evaporation of water from the surface of the pit lake; 5) precipitation falling on the pit lake; 6) surface water inflow; 7) depth of the pit lake and pit lake overturn; and 8) mineral phase precipitation within the pit lake. **Figure 4.3-18** illustrates the conceptual design of the pit lake geochemical model used for the Round Mountain Pit lake.

Pit Lake Water Quality Modeling Process. The pit lake model utilized the groundwater model for estimation of groundwater inflow rates over time; kinetic HCT data and MWMP results to estimate solute mass release rates; USGS geochemical modeling code PHREEQC (Parkhurst and Appelo 1999) for modeling chemical reactions; the MINTEQ.V4 (Allison et al. 2000) thermodynamic database for mineral phase properties; and the adsorption model of Dzombak and Morel (1990) for sorption of ions onto precipitating ferrihydrite (i.e., iron oxyhydroxide). The main steps used in the modeling of pit lakes as thoroughly mixed batch reactors were the following (WMC 2008):

1. Development of charged-balanced pit inflow waters.
2. Selection of time steps of 2, 10, 25, 100, and 200 years.
3. Mixing of individual components of pit wall runoff in proportion to the exposed surface area of each lithology interacting with runoff along the pit wall to estimate pit wall runoff chemistry.
4. Addition of constituent load to represent individual components of the flushed pit wall chemistry in proportion to the relative exposure of each lithology within the damaged rim to estimate average chemistry of water flushed from the pit wall as a result of flushing during pit filling with groundwater inflow and rising pit lake level.
5. Mixing of pit wall runoff, pit wall flushing solutions, influent groundwater, influent surface water, and rainfall water chemistry according to proportions in pit lake water balance for each time period.

6. Evaporation of pure water based on exposed surface area at each time step and average annual evaporation rate.
7. Equilibration of the pit lake water with likely mineral phases and atmospheric gases for each time period. Mineral phases included ferrihydrite, gibbsite, gypsum, fluorite, calcite, and barite. Atmospheric gases were oxygen and carbon dioxide.
8. Adsorbed and precipitated species included antimony, arsenic, barium, lead, cadmium, copper, nickel, calcium, phosphate, zinc, beryllium, and sulfate. A moderately oxidizing pE (i.e., oxidation potential) of 4.0 was fixed using the partial pressure of oxygen for pit lake water. The pH of rainwater was 5.6.
9. Site-specific groundwater and geochemical data were used for model inputs.
10. Charge balancing of input water chemistry used sodium or chloride. All pre-charge balanced waters had an analytical error of less than 5 percent.

The results from the kinetic HCT tests and the MWMP results were scaled based on particle size surface area to represent the expected condition for pit wall flushing. Because kinetic HCT and MWMP tests use a ground rock sample in order to accelerate reaction time in the laboratory, the scaling of the laboratory results for the expected particle size in the pit walls was utilized to better represent expected conditions in the pit walls (WMC 2008). The result was a pit lake solution chemistry for a given time period. This procedure was then repeated for each time step and modeling scenario. The water balance for each modeling scenario was taken from the pit filling model runs developed by the groundwater model (WMC 2008).

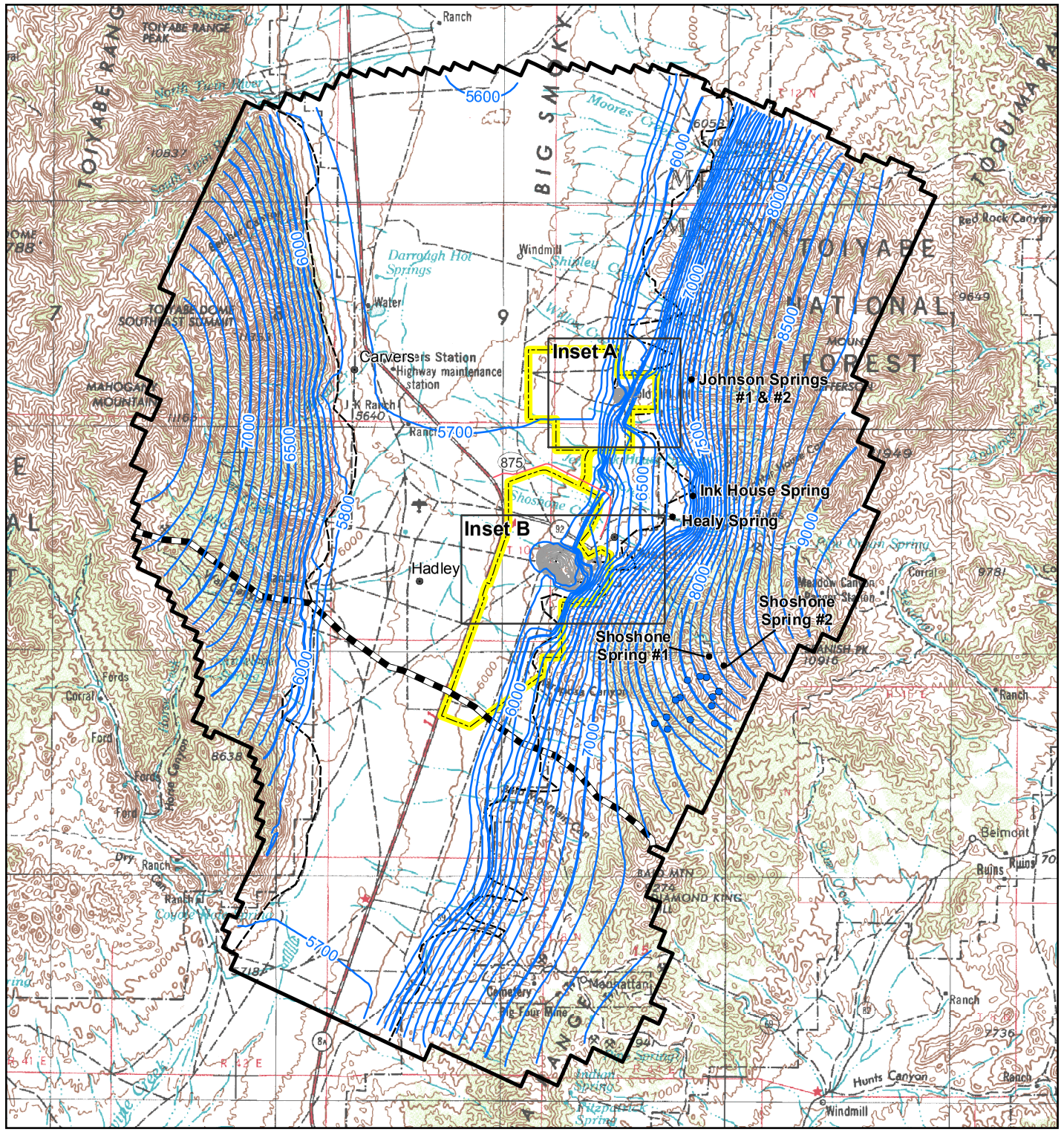
Pit Lake Modeling Scenarios. For the currently permitted Round Mountain Pit, the expanded Round Mountain Pit, and the proposed Gold Hill Pit, eight different modeling scenarios were developed to cover the range of expected variations in factors that affect pit lake water quality. These eight scenarios are summarized in **Table 4.3-7** and provide a sensitivity analysis of the potential final pit lake water quality. Details on each of these sensitivity runs is provided in WMC (2008).

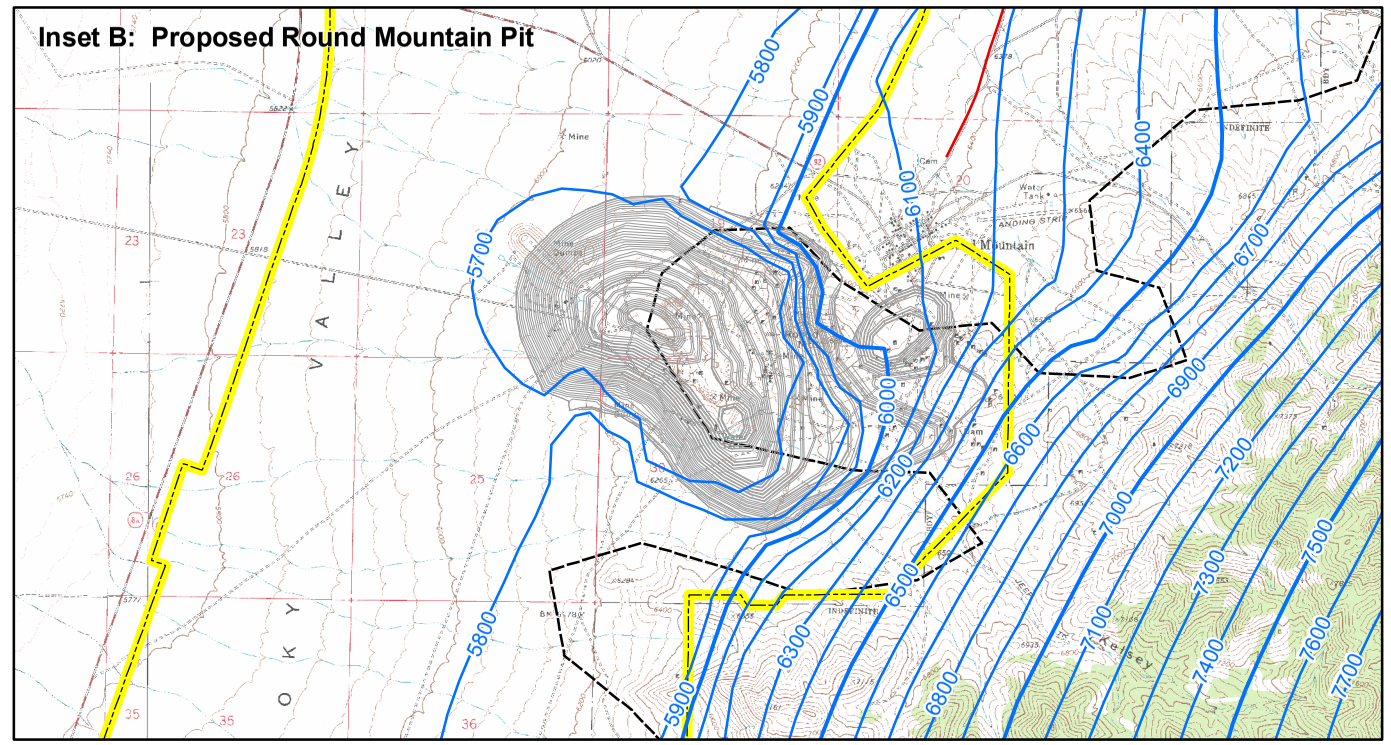
Base Case Scenario: Average groundwater inflow rates were used, the pE was constrained to 4.0 and the saturation index (SI) for fluorite, calcite, and barite were set at 0.5 following the suggestion of Eary (1999). The base case scenario is the expected scenario for final pit lake water quality in both the currently permitted and the expanded Round Mountain Pit (WMC 2008).

Fluoride Sensitivity: This scenario is identical to the base case scenario, except that the SI for fluorite was set at either 1.0 or 0.0 to represent high or low fluoride concentrations.

High Groundwater Inflow: This scenario utilizes the high groundwater inflow modeling case for the currently permitted and expanded Round Mountain Pit to evaluate the effect of higher groundwater inflow rates on the final pit lake water quality. Except for groundwater inflow rate, this scenario is similar to the base case scenario.

Groundwater TDS Sensitivity: This scenario evaluates the potential effect on pit lake water quality of a variation in the TDS of the influent groundwater quality for both the currently permitted and expanded Round Mountain Pit. Each case was similar to the base case scenario, except for variation in the influent groundwater chemistry.





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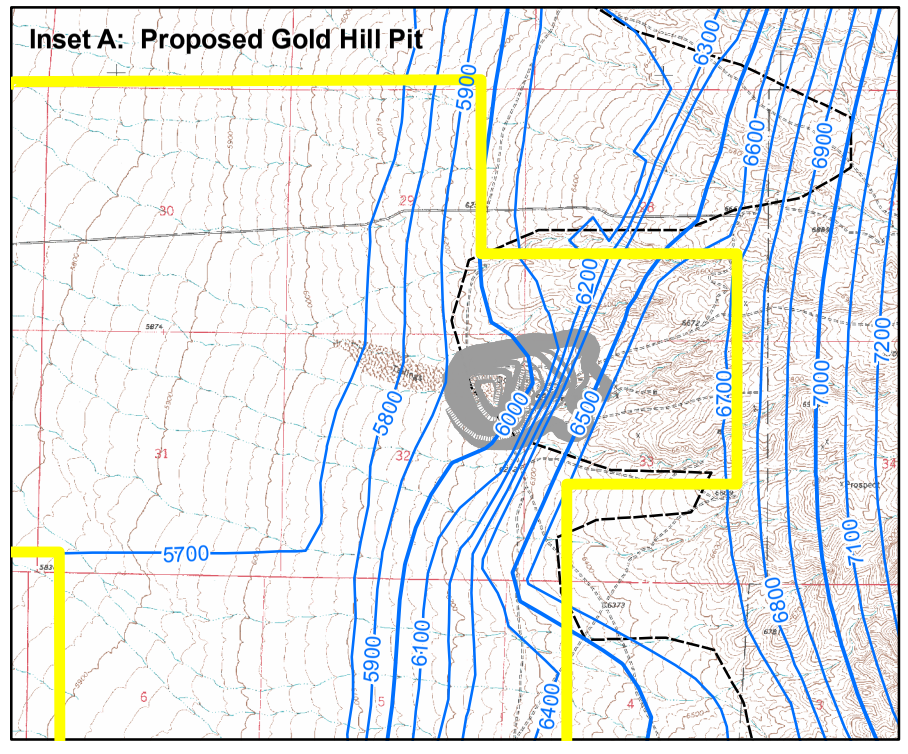


Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells
- Alluvial-bedrock Contact
- 500-foot Contour
- 100-foot Contour

Note: Water levels in year 2218.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

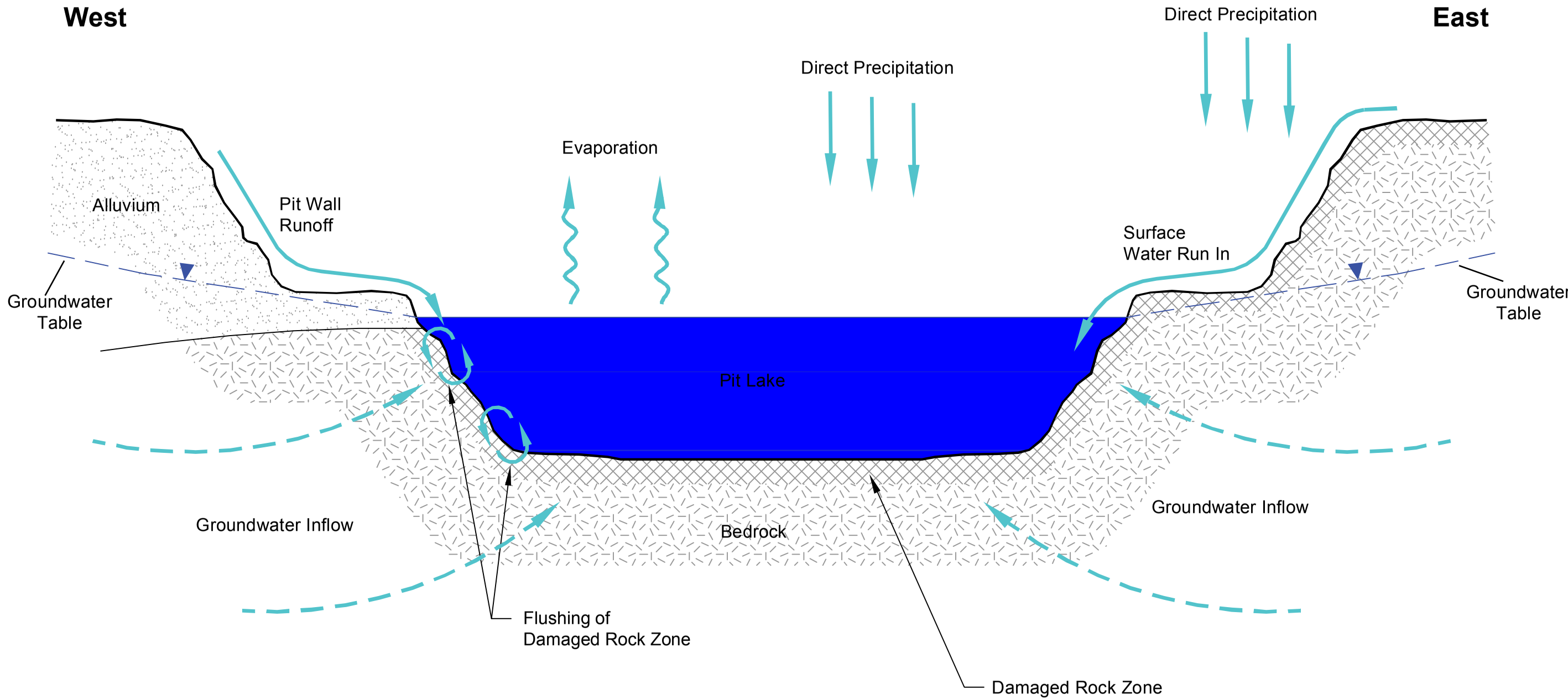
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-17

Proposed Action
Water Levels at Time of
99% Pit Lake Recovery

05/25/2009



Source: WMC 2008.

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Round Mountain Expansion Project

Figure 4.3-18

Proposed Action
Round Mountain Pit Lake
Conceptual Model

Table 4.3-7
Round Mountain Pit Lake Modeling Scenarios

Simulations For Currently Permitted and Expanded Pits	Description
Base case scenario	Average groundwater inflow rate Average groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0.5
Fluoride sensitivity – low	Average groundwater inflow rate Average groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0
Fluoride sensitivity – high	Average groundwater inflow rate Average groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 1
High groundwater inflow sensitivity	High groundwater inflow rate Average groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0.5
Groundwater sensitivity (TDS) – low	Average groundwater inflow rate Low TDS groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0.5
Groundwater sensitivity (TDS) – high	Average groundwater inflow rate High TDS groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0.5
High pit wall mass loading sensitivity	Average groundwater inflow rate Average groundwater chemistry 10 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0.5
Scaling sensitivity	Average groundwater inflow rate Average groundwater chemistry 3 pore volumes flushed from pit wall pE = 4 Fluorite SI = 0.5

High Pit Wall Mass Loading Sensitivity: This sensitivity analysis evaluated the effect on final pit lake water quality for the currently permitted and expanded Round Mountain Pit of elevated mass loading from the pit walls, by setting the loading at 10 pore volumes. The base case scenario used three pore volumes. The base case scenario was used except for the variation in mass loading from the pit wall.

Scaling Sensitivity: A sensitivity run was conducted to evaluate the effect on final pit lake water quality of reducing the scaling for particle size area by 50 percent. Because the laboratory and field-scale particle surface areas span over an order of one magnitude, the geometric mean of the two values was used (WMC 2008). Except for the scaling variation, the base case scenario was used.

Geochemical Model Input. Site-specific data for the currently permitted and expanded Round Mountain Pit were used along with laboratory data from the kinetic HCT and MWMP tests as input for the pit lake water quality modeling. The plan areas for current and proposed expanded pit were estimated from topographic and geologic maps. The surface area used was the surface area viewed perpendicular to the pit wall angle. Actual pit wall surface areas were not averaged across benches, but were estimated by applying a 10-foot grid (25-foot grid at Gold Hill) to the entire pit area with an overlay of geology (WMC 2008). Surface areas for each exposed lithotype were calculated for each modeled pit lake stage. The pit wall runoff was calculated based on the exposed area above the pit lake for each modeled stage using a weighted averaging approach for the different lithologies exposed in the pit wall.

Groundwater quality used for pit inflow groundwater is presented in **Appendix D**, **Table D-1**. The inflow water compositions used for sensitivity analysis are presented in **Table D-2**. Groundwater inflow consisted of contributions from the Quaternary alluvium, Tertiary granite, and Tertiary volcanics. The water quality used for groundwater inflow was estimated based on average compositions from dewatering and monitoring wells near the Round Mountain Pit. Most of the groundwater flowing into the currently permitted and expanded Round Mountain Pit would be derived from the Quaternary alluvial aquifer.

The pit wall runoff and the pit wall mass loading water compositions were estimated from MWMP and kinetic HCT results, and converted to equivalent pore volumes (WMC 2008). The final 4 weeks of kinetic HCT results were used as the best estimate for long-term weathering chemistry for all major lithologies involved in pit wall runoff calculations. MWMP data were used when HCT results were not available.

Laboratory data from kinetic HCT tests and MWMP tests were scaled based on estimated grain surface areas to be more representative of actual conditions in the pit wall. Scaling calculations involve correcting constituent concentrations by dividing the mass of solute by the grain surface area per pore volume flushed, to arrive at a mass of solute per unit surface area per pore volume flushed. For the kinetic HCT tests, the specific surface area for the grains was estimated at 17.7 square meters per kilograms (m^2/kg), with a bulk density of 1.85 grams per cubic centimeter (g/cm^3) and a porosity of 0.3 using the program GRAIN 3.0 (MDAG Publishing, www.mdag.com). For the pit wall damaged rock zone (DRZ), the specific surface area was conservatively estimated at 0.27 m^2/kg, with a bulk density of 2.4 g/cm^3 and a porosity of 0.1 by assuming the DRZ had a particle size distribution similar to ROM waste material for comparable mining operations in Nevada (WMC 2008). For the scaling sensitivity modeling scenario, the specific surface area of the DRZ was increased to 2.22 m^2/kg. The volume of rock that contributes to mass loading was estimated by assuming a DRZ of 1.8 meters thick (Siskind and Fumanti 1974). HCT and MWMP results were normalized and then converted to field scale values using the submerged pit wall surface area, density, and porosity. After scaling, the charge balance for each solution was checked and adjusted as needed using the concentration of sodium and chloride and the modeling code PHREEQC.

Predicted Pit Lake Water Quality. The base case scenario predicted pit lake water quality during the filling of the expanded Round Mountain Pit is presented in **Table 4.3-8**. The water balance for the base case scenario filling scenario is presented in **Table 4.3-9**. The base case scenario is the expected pit filling scenario for the expanded Round Mountain Pit (WMC 2008). Under the base case scenario, groundwater

inflow would dominate the pit refilling and would decline from an initial value around 1,806 gpm to a final inflow rate of about 764 gpm at 200 years after mining. Flow from the Quaternary alluvium would dominate the groundwater inflow and would range from an initial value of approximately 1,650 gpm to a final value of approximately 190 gpm. Under the high groundwater inflow case, groundwater inflow would range from an initial value of 2,196 gpm to a final value of 656 gpm, with flow from the Quaternary alluvium ranging from an initial value of 2,100 gpm to a final value of 385 gpm (WMC 2008). Groundwater from the alluvium would constitute 75 to 80 percent of the groundwater inflow and thus would dominate the chemistry of the pit lake (WMC 2008). Stage-volume-area curves and pit filling curves for the base case scenario and the high groundwater inflow case are illustrated in **Figures 4.3-19** and **4.3-20**.

The predicted water quality in the expanded Round Mountain Pit lake under the base case scenario would be dominated by sodium, calcium, and alkalinity (i.e., bicarbonate), making the water a sodium-calcium-bicarbonate water throughout the filling of the pit and in the final pit lake at 200 years. The pH would be approximately 8.0 standard units, and sulfate would be below 200 mg/L. The TDS would not exceed 500 mg/L until year 200, when the value would reach 575 mg/L as a result of evapoconcentration. Fluoride would range from 7.6 to 9.6 mg/L and exceed Nevada drinking water, irrigation water, and stock water standards. Arsenic would range from 0.08 to 0.20 mg/L and would exceed Nevada drinking water and irrigation water standards. The TDS at 200 years would be slightly above Nevada drinking water standards. Alkalinity would reach 247 mg/L by year 200 and exceed Nevada water quality standards for wildlife propagation. All other constituents would not exceed Nevada water quality standards.

Other pit lake water quality modeling scenarios developed as part of the sensitivity analysis of the predicted pit lake water quality are presented in **Tables D-3** through **D-9** in **Appendix D**. Only the high TDS groundwater case shows any appreciable deviation from the base case scenario, since the alluvial groundwater dominates the chemistry of the final pit lake. Under the high TDS groundwater case, the TDS ranges from an initial value of 641 mg/L to a final value of 1,484 mg/L at year 200. Sulfate ranges from an initial value of 336 mg/L to a final value of 776 mg/L. Sodium reaches 456 mg/L at year 200 in the high TDS case, compared to 163 mg/L in the base case scenario. The pit lake water at year 200 would exceed Nevada drinking water standards for TDS and sulfate. Fluoride and arsenic would exceed Nevada water quality standards in a manner similar to the base case scenario.

Overall, the water quality predicted for the expanded Round Mountain Pit lake would be within Nevada water quality standards for all constituents except TDS, sulfate, fluoride, arsenic, and alkalinity. The water would be dominated by sodium-calcium bicarbonate and would continue to increase in sodium, and become more alkaline with time beyond year 200 after cessation of mining due to evapoconcentration of sodium and other constituents that do not precipitate or adsorb to precipitation ferrihydrite (iron oxyhydroxide). An ecological risk assessment of the expected pit lake water suggested no adverse impacts to wildlife (Section 4.17, Wildlife and Fisheries Resources).

Waste Rock Dumps. Under the Proposed Action, the North Waste Rock Dump would be expanded by 700 acres to accommodate the expected additional waste rock (Section 2.4, Proposed Action). The expansion of this facility would follow the currently approved and permitted design for the North Waste Rock Dump. Following mine closure, the waste rock dump would be reclaimed in accordance with the revised Waste Rock Management Plan for the Round Mountain Area (SRK 2009a). Reclamation would include regrading of the surface of the waste rock dump and covering with growth media as needed. The waste rock would not be capped with an infiltration barrier.

Table 4.3-8
Round Mountain Pit Lake Chemistry Results - Base Case Scenario

Parameter/ Analyte	Pit Lake (Time 2 yr)	Pit Lake (Time 10 yr)	Pit Lake (Time 25 yr)	Pit Lake (Time 100 yr)	Pit Lake (Time 200 yr)
pH	7.9400	7.9700	8.0000	8.1400	8.2900
pE	4.0000	4.0000	4.0000	4.0000	4.0000
Alkalinity, as $CaCO_3$	104.0000	111.0000	120.0000	172.0000	247.0000
Chloride	21.0000	22.0000	23.0000	34.0000	50.0000
Fluoride	7.6000	8.1000	8.8000	9.6000	9.2000
Nitrate, as N	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]
Sulfate, as SO_4^{2-}	66.0000	70.0000	76.0000	108.0000	160.0000
Aluminum	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]
Antimony	0.0020	0.0020	0.0020	0.0040	0.0050
Arsenic	0.0800	0.0800	0.0900	0.1300	0.2000
Barium	0.0070	0.0070	0.0080	0.0120	0.0180
Beryllium	0.0002[1]	0.0002[1]	0.0002[1]	0.0002[1]	0.0002[1]
Boron	0.2300	0.2400	0.2600	0.3800	0.5600
Cadmium	0.0005[1]	0.0005[1]	0.0005[1]	0.0005[1]	0.0005
Calcium	18.7000	19.8000	21.2000	27.8000	34.7000
Chromium	0.0060[1]	0.0060[1]	0.0060[1]	0.0060[1]	0.0060[1]
Cobalt	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]
Copper	0.0030[1]	0.0030[1]	0.0030[1]	0.0030[1]	0.0030[1]
Iron	0.0600[1]	0.0600[1]	0.0600[1]	0.0600[1]	0.0600[1]
Lead	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]
Lithium	0.0040[1]	0.0040[1]	0.0050	0.0090	0.0150
Magnesium	0.9000	0.9000	0.9000	1.5000	2.3000
Manganese	0.0070	0.0070	0.0070	0.0110	0.0180
Mercury	0.0002[1]	0.0002[1]	0.0002[1]	0.0002[1]	0.0002
Molybdenum	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]
Nickel	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]
Phosphorus	0.0500[1]	0.0500[1]	0.0500[1]	0.0500[1]	0.0500[1]
Potassium	2.8000	3.0000	3.2000	4.6000	6.8000
Selenium	0.0010[1]	0.0010[1]	0.0010[1]	0.0010	0.0020
Silver	0.0050[1]	0.0050[1]	0.0050[1]	0.0050[1]	0.0050[1]
Sodium	68.0000	72.0000	78.0000	112.0000	163.0000
Strontium	0.0020	0.0030	0.0030	0.0060	0.0110
Thallium	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]
Tin	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]
Zinc	0.0200	0.0200	0.0200	0.0300	0.0400
TDS	248.0000	263.0000	284.0000	401.0000	575.0000

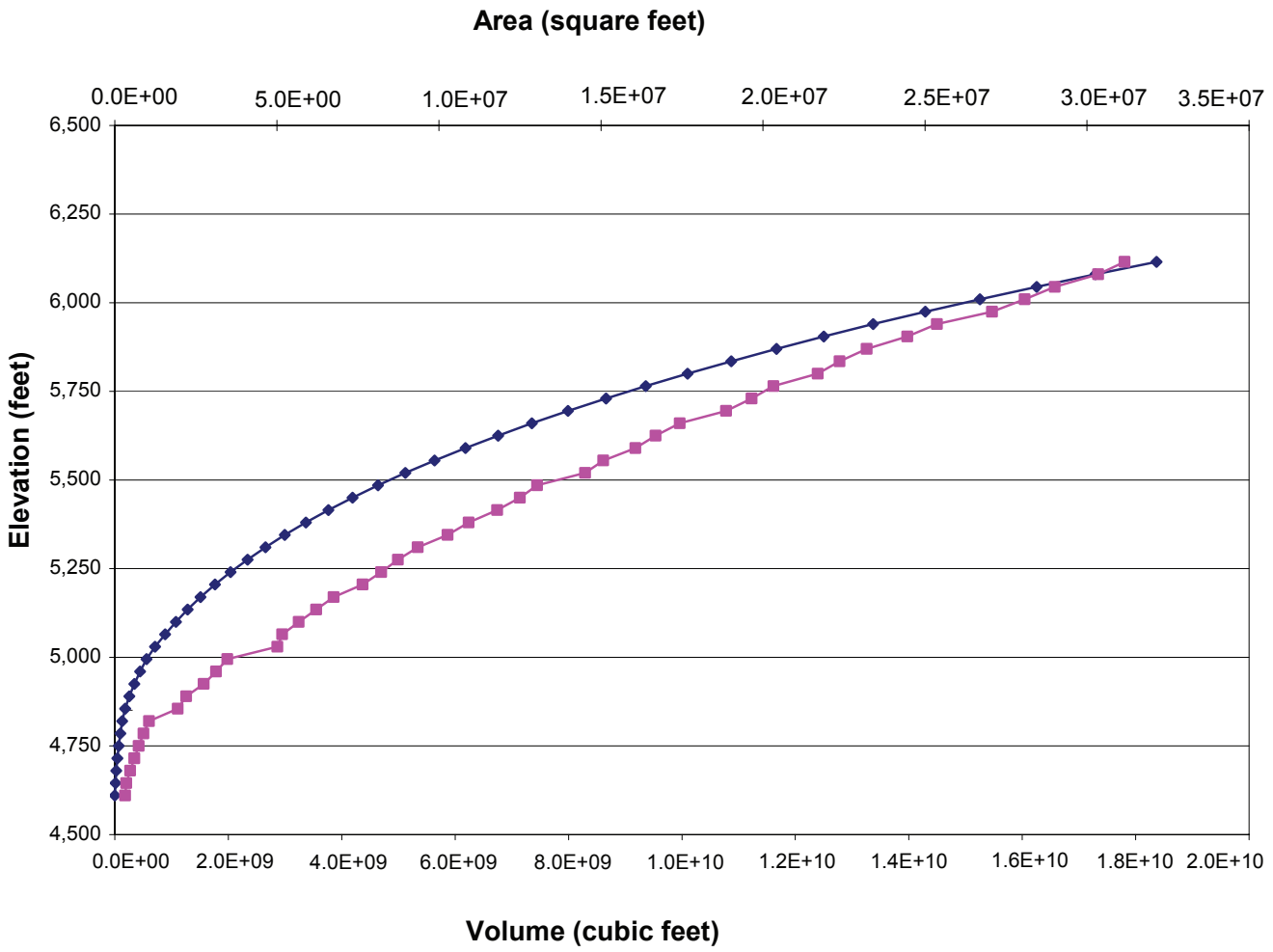
[1] Analyte concentration result is below typical analytical detection limits. Value shown is the detection limit.

Note: All concentrations are in mg/L except for pE and pH (pH in standard units).
TDS calculated as the sum of all dissolved constituents (alkalinity was converted to Bicarbonate (HCO_3) - then multiplied by 0.4917 to account for volatilization of CO_2).

Table 4.3-9
Pit Lake Water Balance Summaries Expanded Pit - Base Case Scenario

Time (years)	Stage (foot)	Volume ($foot^3$)	Area ($foot^2$)	Precipitation (gpm)	Groundwater Inflow (gpm)	Surface Water Inflow (gpm)	Pit Wall Runoff (gpm)	ET[1] (gpm)	Total Inflow (gpm)	Total Outflow (gpm)	Net Inflow (gpm)
1	4,790	1.01E+8	8.87E+5	7	1,806	15	36	49	1,864	49	1,815
2	4,886	2.46E+8	1.94E+6	15	1,806	15	35	107	1,871	107	1,764
3	4,943	3.92E+8	2.74E+6	22	2,076	15	35	151	2,147	151	1,996
4	4,990	5.44E+8	3.12E+6	25	2,096	15	34	172	2,170	172	1,997
5	5,030	7.05E+8	3.47E+6	27	2,112	15	34	191	2,189	191	1,997
6	5,054	8.31E+8	5.02E+6	40	2,117	15	33	277	2,205	277	1,928
7	5,077	9.47E+8	5.17E+6	41	2,115	15	33	285	2,204	285	1,919
8	5,101	1.08E+9	5.68E+6	45	2,115	15	32	313	2,208	313	1,895
9	5,123	1.21E+9	5.68E+6	45	2,113	15	32	313	2,205	313	1,892
10	5,144	1.34E+9	6.21E+6	49	2,110	15	32	343	2,206	343	1,863
13	5,191	1.66E+9	6.75E+6	53	2,101	15	32	372	2,201	372	1,829
15	5,232	1.97E+9	7.64E+6	60	2,092	15	31	422	2,199	422	1,777
20	5,303	2.58E+9	8.74E+6	69	2,069	15	30	482	2,183	482	1,701
25	5,361	3.16E+9	1.03E+7	81	2,023	15	29	566	2,148	566	1,581
30	5,408	3.68E+9	1.09E+7	86	1,930	15	28	602	2,059	602	1,457
40	5,479	4.55E+9	1.25E+7	99	1,680	15	27	689	1,821	689	1,132
50	5,528	5.24E+9	1.45E+7	115	1,460	15	25	800	1,615	800	815
63	5,569	5.84E+9	1.51E+7	119	1,252	15	25	831	1,411	831	579
75	5,596	6.27E+9	1.61E+7	127	1,102	15	24	886	1,268	886	382
100	5,627	6.77E+9	1.67E+7	132	922	15	24	920	1,093	920	173
125	5,640	7.01E+9	1.67E+7	132	842	15	24	920	1,013	920	92
150	5,647	7.13E+9	1.67E+7	132	799	15	24	920	970	920	49
175	5,651	7.20E+9	1.67E+7	132	776	15	24	920	947	920	26
200	5,653	7.23E+9	1.67E+7	132	764	15	24	920	935	920	14

[1]ET of 46.5 inches per year assumed for this scenario.



Legend

- Stage-volume Curve
- Stage-area Curve

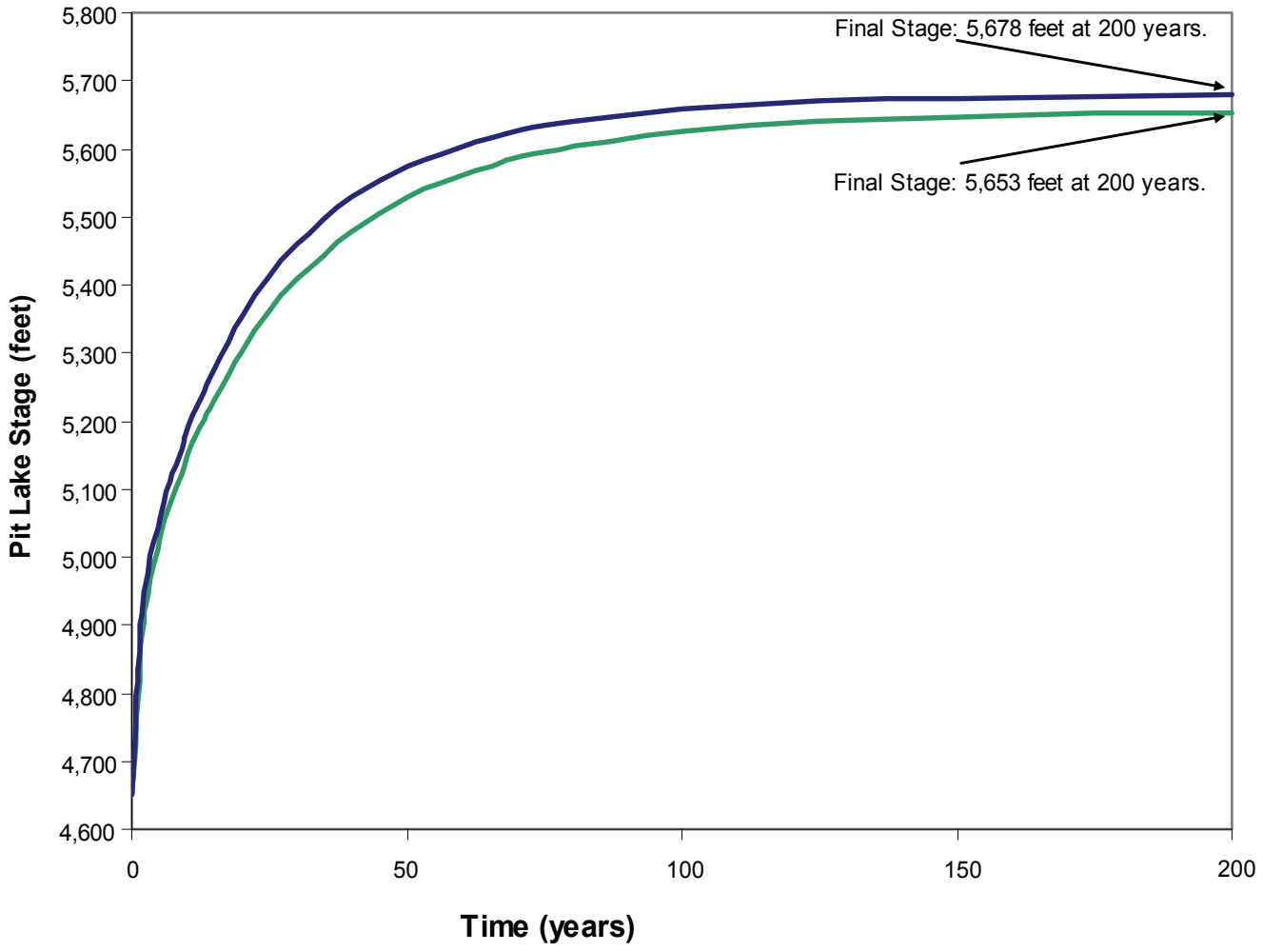
Note: Elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-19

Proposed Action
Round Mountain Pit
Stage-volume and
Stage-area Curves

04/10/09



Legend

- Base Case Scenario
- High Groundwater Inflow Case

Note: Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-20

Proposed Action
Round Mountain Pit
Predicted Pit Lake Elevation

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Waste rock has existed on site at the Round Mountain Area for the past 15 to 30 years without any seepage of leachate water being recorded from the base of the waste rock dumps. A field study of the waste rock showed that no wetting front has been established in the waste rock due to infiltration of rainfall (SRK 2009b). The high evaporation rate (46.5 inches/year) coupled with the low precipitation rate (6.65 inches per year) at the Round Mountain Area limits the potential for infiltration of precipitation. In addition, the amount of dedicated waste rock (PAG waste rock) generated at the Round Mountain Area is very low and is expected to continue to be low during the mining of the expanded pit under the Proposed Action (Chapter 3.0, Affected Environment). In addition, the expanded North Waste Rock Dump would be reclaimed in accordance with the Waste Rock Management Plan outlined in Chapter 2.0, Alternatives Including the Proposed Action. For these reasons, seepage of acidic leachate or leachate elevated in metals from the expanded North Waste Rock Dump is not expected.

Leach Pads. Under the Proposed Action, a North Dedicated Leach Pad would be constructed and would encompass approximately 538 acres. The West Dedicated Leach Pad would be expanded by approximately 38 acres and the Reusable Pad would be expanded by approximately 8 acres. Dedicated leach pads in the Round Mountain Area contain two liners including a HDPE synthetic liner over a compacted liner consisting of low permeability material (BLM 1996). The Reusable Pad has a three-layer asphalt liner system.

Following mine closure, the leach pads would be drained and reclaimed in accordance with the approved Reclamation Plan. Because the leach pads contain multiple liner systems and drain down pipes, any seepage through the leach pads after reclamation due to infiltration of precipitation would be captured and mitigated. Drain down and rinsing of the leach pads is expected to reduce the level of constituents.

Tailings Impoundment Facility. Under the Proposed Action, up to three additional cells may be added to the existing tailings impoundment facility in the Round Mountain Area. This would include an additional 886 acres of tailings. The current tailings impoundment facility at Round Mountain is constructed in accordance with NAC 445A. The additional cells would be constructed under the existing approved design and permit. The tailings impoundment facility at Round Mountain is lined and would be drained following mine closure. The impoundment is designed as zero discharge and therefore, is not expected to have the potential for seepage after mine closure and reclamation. No impacts to water resources are anticipated.

4.3.1.2 Gold Hill Area

Under the Proposed Action, an open-pit gold mine would be developed in the Gold Hill Area, as discussed in detail in Section 2.4, Proposed Action.

Water Quantity Impacts

Water quantity impacts at the proposed Gold Hill Area would consist of groundwater drawdown in the Quaternary alluvium and Tertiary bedrock volcanics due to pit dewatering, and long-term groundwater drawdown in the bedrock aquifers caused by evaporation from the post-mining pit lake. In addition, the proposed RIB system would add water to the Quaternary alluvium during mining.

Groundwater Impacts at the End of Mining. Groundwater drawdown related to dewatering of the proposed Gold Hill Pit is illustrated in **Figure 4.3-13**. Drawdown in the pit area is expected to be approximately 300 feet with a drawdown in bedrock water levels of approximately 150 feet surrounding the pit perimeter. There would be 10 feet of drawdown at Johnson springs 1 and 2. To the west, the 10-foot

groundwater drawdown isopleth would not extend beyond the proposed project area in the Quaternary alluvium.

Groundwater elevations at the end of mining are illustrated in **Figure 4.3-21**. Groundwater in the bedrock volcanics is expected to be at an elevation of approximately 5,675 feet in the pit center and 6,000 feet to the west of the pit. East of the pit in the volcanic bedrock of the Toquima Range, groundwater levels would be approximately 6,400 feet. Flow toward the pit would come from the bedrock over a radius of about 1,000 to 1,500 feet from the pit center.

Although there may be approximately 10 feet of potential drawdown in bedrock water levels near Johnson springs 1 and 2, a reduction in flow is not expected except possibly during the dry season, when flows are around 1 to 2 gpm from groundwater seepage, rather than from infiltrating precipitation.

Maximum Groundwater Impacts. Maximum groundwater impacts would occur around Year 2040 as illustrated in **Figure 4.3-14** for drawdown and in **Figure 4.3-15** for water levels. At maximum drawdown, the Johnson springs 1 and 2 would experience 20 feet of drawdown, and the 10-foot groundwater drawdown isopleth would approach Ink House Spring, suggesting the possibility for 5 to 10 feet of drawdown at that spring. Drawdown in the pit area would be approximately 150 feet. The 10-foot groundwater drawdown isopleth would not extend beyond the proposed project area to the west in the Quaternary alluvium.

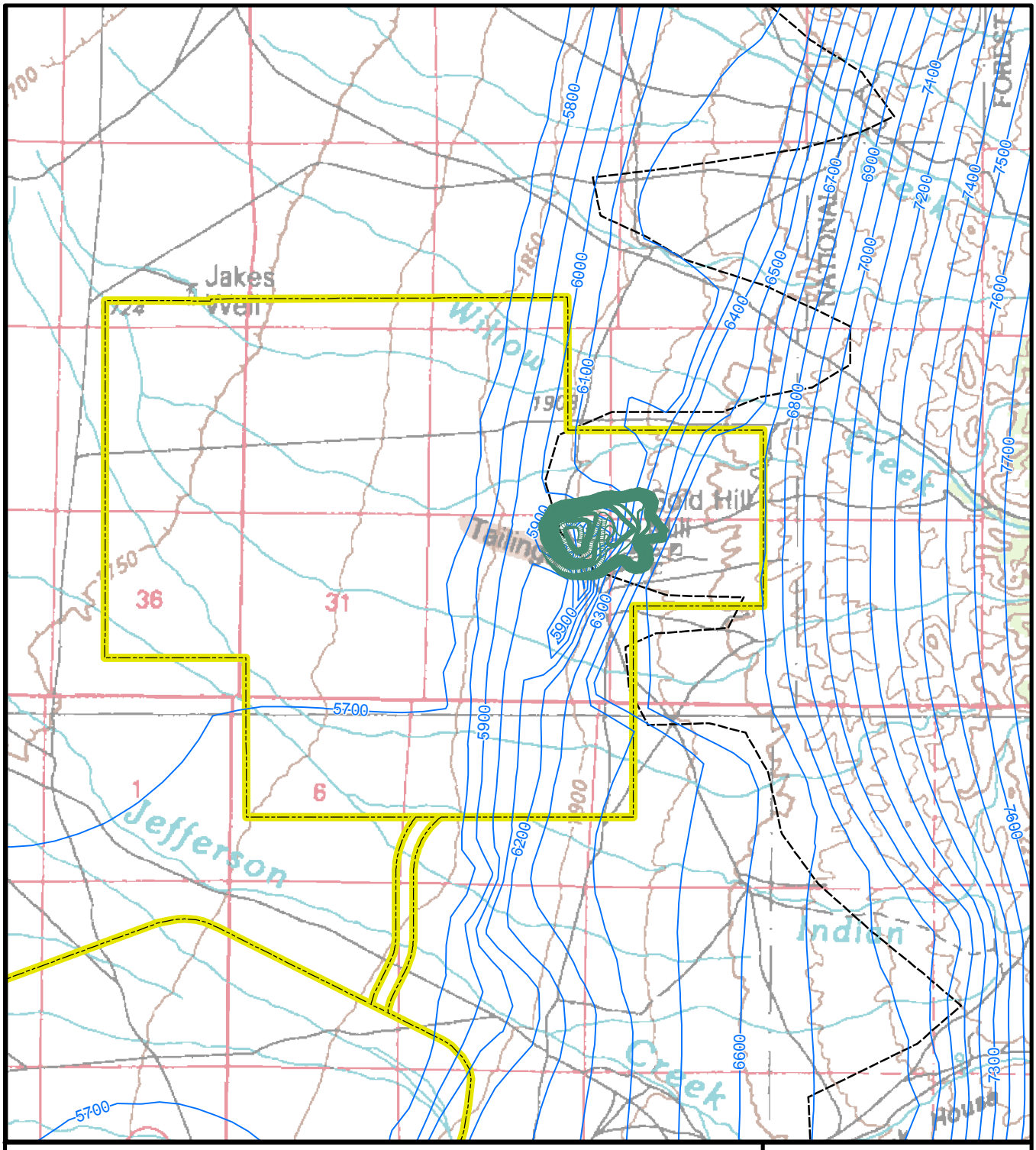
Water levels in the bedrock of the pit area would be approximately 5,900 feet and to the west of the pit water levels in the alluvium would be comparable. To the east of the pit, water levels in the volcanic bedrock would be approximately 6,010 feet. Groundwater in the bedrock volcanics would flow toward the pit within a radius of about 2,000 feet of the pit center.

The estimated 20 feet of bedrock groundwater drawdown at Johnson springs 1 and 2 may result in a reduction in flow, especially during the dry season. Although the source of water for these springs should not change, the potential reduction in groundwater gradient may lead to a reduction in flow during the period when the springs depend on groundwater seepage alone.

Groundwater Impacts at Pit Recovery. When the pit lake in the Gold Hill Pit has reached about 99 percent of its final volume, approximately 200 years after the cessation of mining, drawdown in the pit area would be approximately 150 feet compared to current water levels (**Figure 4.3-16**). The permanent drawdown in the area of Johnson springs 1 and 2 would be in the range of 10 to 20 feet, possibly resulting in a reduction in flow during the dry season. The 10-foot groundwater drawdown isopleth west of the pit would not extend beyond the proposed project area in the Quaternary alluvium.

Water levels in the pit area would be approximately 6,000 feet (**Figure 4.3-17**). West of the pit, water levels would be around 5,900 feet and east of the pit in the bedrock volcanics, the groundwater level would be approximately 6,020 feet.

Figure 4.3-22 presents a more detailed view of expected water levels in the post-mining pit lake when the pit lake reaches its final elevation approximately 200 years after cessation of mining. The west-to-east cross-section (i.e., cross-section B-B') illustrates the possible flow pattern of groundwater in the bedrock volcanics when the pit fills and when the pit lake reaches its final elevation. West of the pit in the bedrock volcanics, the groundwater elevation would be approximately 5,850 feet at pit recovery. East of the pit in the volcanics, the groundwater level would be approximately 6,200 feet. The pit lake final elevation under the base case scenario would be approximately 5,950 feet. Initially, the proposed Gold Hill Pit may be a terminal



Legend

- Proposed Project Boundary
- Groundwater Elevation Contour (100-foot interval)
- Alluvial-bedrock Contact
- Proposed Pit

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

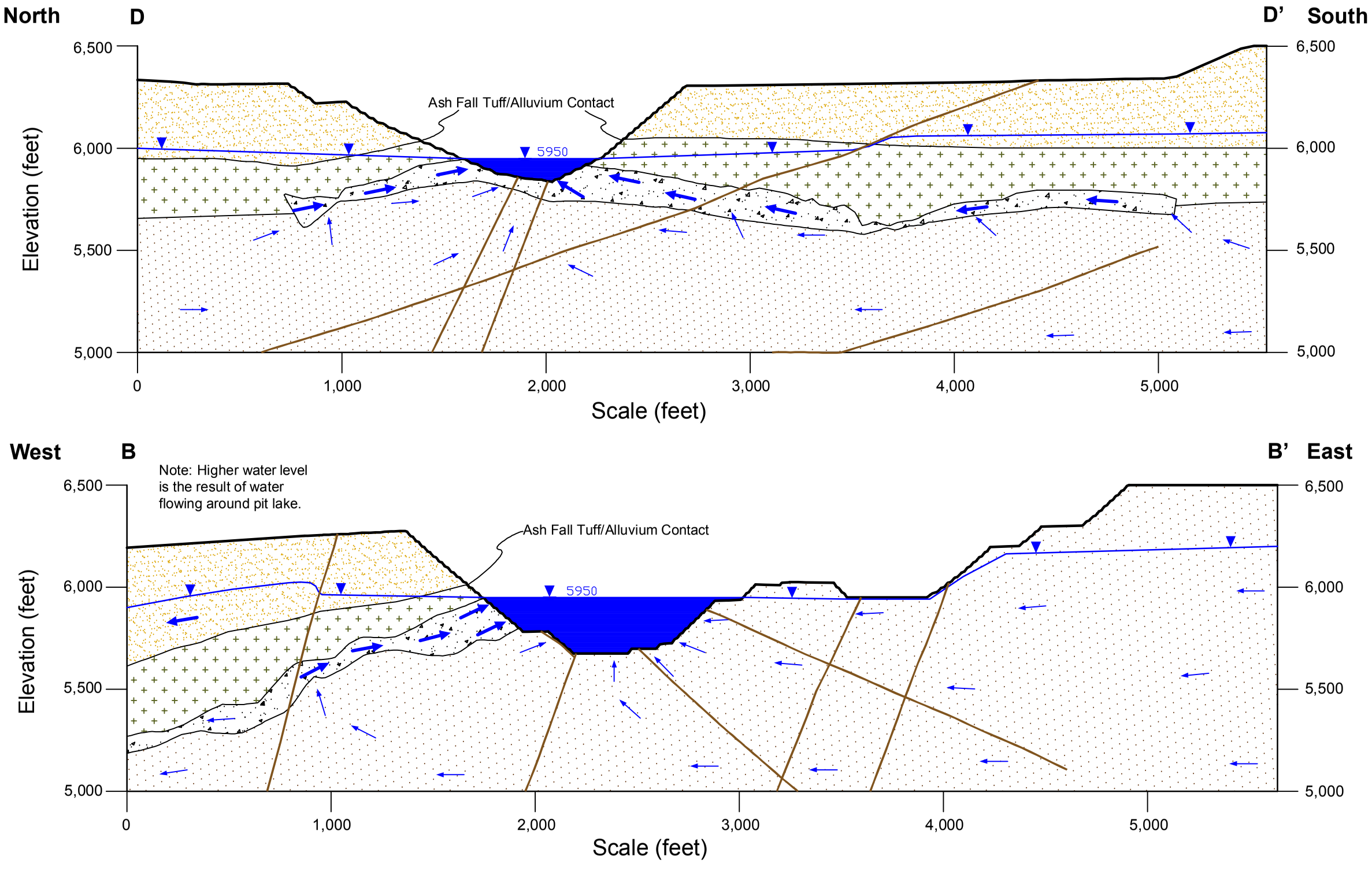
0 0.25 0.5 1 Miles

Round Mountain Expansion Project

Figure 4.3-21

Proposed Action
Gold Hill Pit
Simulated Water Elevations at End of Mining

04/10/2009



Legend

- Groundwater Level
- Groundwater Flow Direction
- Fault
- Quaternary Alluvium
- Ash Fall Tuff Unit
- Sinter Deposits
- Mt. Jefferson Tuff and Rhyolite Intrusive (Undivided)

Note: Elevations provided in feet, USGS 1929 Vertical Datum Plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-22

Proposed Action
Gold Hill Pit
Conceptual Groundwater Inflows

04/10/09

pit with groundwater flowing into the pit from all directions in the bedrock. But when the pit lake approaches its final elevation, about 200 years after cessation of mining, the pit lake could become a flow-through pit lake with groundwater in the bedrock volcanics flowing into and through the pit from east to west with an approximate gradient of 0.07 feet/feet. The final pit lake elevation is expected to be below the bedrock/alluvial contact, thus limiting any potential flow through the pit to the volcanic bedrock along the west wall. The BLM would review the pumping and dewatering hydrologic data for the Gold Hill Pit near the end of mining and determine if the pit lake would be terminal or flow-through based on the more extensive data that would be available near the end of mining. Any monitoring or mitigation measures required would be implemented by the BLM at that time.

RIB System. Up to three RIBs are proposed to accommodate surplus water from Gold Hill Pit dewatering. The locations of these basins are illustrated in **Figure 2.4-1**.The expected maximum discharge to the RIB system would be approximately 500 gpm. The average discharge would be approximately 250 gpm (WMC 2008). RIB #1 would have an area of 6,250 square feet and an average hydraulic conductivity in the alluvium of 496 feet per day. RIB #2 would have an area of 32,000 square feet and an average hydraulic conductivity of 27 feet per day. RIB #3 would comprise 23,000 square feet and have an average hydraulic conductivity of 49 feet per day. The hydraulic conductivity values for each basin are geometric means of vertical infiltration studies completed by WMC (2008) using test basins in the areas proposed for the final RIB system. Any water that is discharged to the Gold Hill RIB system would eventually replenish a portion of the groundwater in the Quaternary alluvium removed by dewatering in the Round Mountain Area. During mining, discharge of water to the RIB system could be expected to generate a groundwater mound beneath the RIB system. Modeling conducted for the Round Mountain RIB system (WMC 2006a,b, 2005) showed that with a discharge of up to 3,000 gpm and averaging about 320 gpm from 1996 to 2006, a groundwater mound extending about 1,000 feet to the west of the center of the RIB system would be generated by year 2015. Discharge to the proposed Gold Hill RIB system would be considerably less than that for the Round Mountain system, so that the expected groundwater mound should be considerably less in areal extent than the Round Mountain RIB system mound. The Gold Hill RIB system would be expected to add about 250 gpm of discharge water to the alluvial aquifer during mining operations. The discharge to the RIB system would be expected to cease around year 2018 and the groundwater mound developed beneath the RIB system would be expected to dissipate within 1 to 2 years.

Water Quality Impacts

Water quality impacts in the proposed Gold Hill Area would be associated with the pit lake that would form in the mine pit after cessation of mining, potential seepage from the proposed waste rock dumps, potential seepage from the proposed heap leach pad, and potential impacts to groundwater quality from discharge to the RIB system during pit dewatering.

Predicted Pit Lake Water Quality. Pit lake water quality for the proposed Gold Hill Pit was modeled following a procedure similar to that used for the expanded Round Mountain Pit. **Figure 4.3-23** illustrates the conceptual model for pit refilling at the end of mining. A 25-foot grid was used to determine pit slope areas using the pit design topographic map. The chemistry of the expected groundwater inflow was obtained from the upgradient monitoring well (i.e., GHB-03-04). **Table 4.3-10** presents the base case scenario inflow groundwater quality, and **Table 4.3-11** contains the range of groundwater inflow water quality values used in the sensitivity analyses. The low and high TDS sensitivity runs were based on one analysis for each case in monitoring well GHB-03-04. All of the groundwater inflow would come from the bedrock volcanics, with approximately 60 to 70 percent coming from the Tertiary Sinter unit and 30 to

40 percent coming from the Mount Jefferson Tuff (WMC 2008). Pit wall runoff would be comprised of about 39 percent from the Quaternary alluvium, 55 percent from the Mount Jefferson Tuff, 4 percent from the Tertiary Sinter, and 2 percent from the Tertiary Rhyolite Ash Fall unit. For the Mount Jefferson Tuff that would be exposed in the final pit wall, approximately 66 percent would be PAG rock based on HCT tests.

Table 4.3-10
Input Solution Chemistries Used for Gold Hill Pit Lake Chemistry Models – Base Case Scenario

Data Source[1]	Groundwater[1]	Scaled Pit Wall Runoff and Submergence[2]					
	Base Case Average	Volcanics PAG	Volcanics NAG	Volcanics Uncertain	Alluvium	Sinter	Ash Fall
	GHB-03-4	HC-5, HC-6	HC-8	HC-4, HC-7	HC-9	HC-2	HC-1, HC-10
Constituent							
pH	7.10	3.24000	6.31000	5.77000	6.13000	3.07000	5.1400
Alkalinity	177.00	0.00000	2.86000	0.72000	0.72000	0.00000	0.7200
Aluminum	0.00	0.29000	0.00100	0.02100	0.00800	0.08900	0.0180
Antimony	0.03	0.00070	0.00020	0.00700	0.00040	0.00020	0.0002
Arsenic	0.05	0.13100	0.00070	0.00100	0.00400	0.00300	0.0060
Barium	0.04	0.00200	0.00200	0.00200	0.00300	0.00070	0.0030
Beryllium	0.00	0.00160	0.00000	0.00060	0.00000	0.06000	0.0007
Bismuth	0.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000
Boron	0.60	0.00000	0.00120	0.00120	0.00120	0.00120	0.0024
Cadmium	0.00	0.00020	0.00000	0.00006	0.00000	0.00000	0.0000
Calcium	57.00	12.01000	0.79000	0.61000	0.04000	0.14000	0.9400
Chloride	40.90	0.11000	0.02000	0.03000	0.03000	0.02000	0.1100
Chromium	0.00	0.00200	0.00000	0.00000	0.00000	0.00020	0.0000
Cobalt	0.00	0.01000	0.00000	0.00100	0.00000	0.00070	0.0009
Copper	0.00	0.00200	0.00040	0.00100	0.00560	0.01500	0.0140
Fluoride	1.00	0.06000	0.00300	0.01200	0.01300	0.01200	0.0350
Iron	0.44	1.78000	0.00060	0.00120	0.00200	1.22700	0.0070
Lead	0.00	0.00040	0.00000	0.00010	0.00000	0.00040	0.0000
Lithium	0.06	0.00900	0.00040	0.00130	0.00010	0.00010	0.0016
Magnesium	10.70	0.58000	0.05000	0.09000	0.00500	0.01000	0.0600
Manganese	0.20	0.18700	0.00030	0.12000	0.00030	0.00300	0.0330
Mercury	0.00	0.00200	0.00430	0.00030	0.00020	0.00000	0.0002
Nickel	0.00	0.03400	0.00000	0.00090	0.00000	0.00065	0.0006
Nitrate	0.00	0.00200	0.00500	0.00300	0.00800	0.00400	0.0070
Phosphorous	0.00	0.03500	0.00100	0.00000	0.00800	0.00300	0.0020

Table 4.3-10 (Continued)

Data Source	Groundwater[1]	Scaled Pit Wall Runoff and Submergence[2]					
	Base Case Average	Volcanics PAG	Volcanics NAG	Volcanics Uncertain	Alluvium	Sinter	Ash Fall
	GHB-03-4	HC-5, HC-6	HC-8	HC-4, HC-7	HC-9	HC-2	HC-1, HC-10
Potassium	2.400	0.49000	0.14000	0.19000	0.03000	0.07000	0.1200
Selenium	0.000	0.00020	0.00000	0.00000	0.00000	0.00000	0.0000
Silver	0.000	0.00000	0.00000	0.00000	0.00000	0.00010	0.0000
Sodium	96.400	0.27000	0.10000	0.09000	0.32000	0.03000	0.4500
Strontium	0.470	0.20700	0.01200	0.00900	0.00045	0.00200	0.0210
Sulfate	160.400	40.30000	0.07000	2.33000	0.04000	7.50000	2.8000
Thallium	0.000	0.00009	0.00006	0.00000	0.00000	0.00030	0.0000
Tin	0.000	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000
Titanium	0.000	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000
Vanadium	0.000	0.00030	0.00000	0.00010	0.00070	0.00000	0.0000
Zinc	0.012	0.08000	0.00000	0.00800	0.00060	0.00400	0.0040

[1] GHB – Gold Hill monitoring well.
[2] HC = Humidity cell sample.

Note: All units are provided in mg/L, except for pH, which is in standard units.
Input concentrations are dissolved concentrations.
Input concentrations were set to 0 where constituent was below analytical detection.

Table 4.3-11
Input Solution Chemistries Used For Gold Hill Pit Lake Chemistry Sensitivity Analyses

Data Source	Groundwater[1]		Scaled Pit Wall Runoff and Submergence[2]					
	Low TDS	High TDS	HC-5, HC-6	HC-8	HC-4, HC-7	HC-9	HC-2	HC-1, HC-10
	GHB-03-04 (6/28/2005)	GHB-03-04 (4/20/2004)	Volcanics PAG	Volcanics NAG	Volcanics Uncertain	Alluvium	Sinter	Ash Fall
Constituent								
pH	6.770	7.800	3.2400	6.3100	5.7000	6.1300	3.070	5.1400
Alkalinity	177.000	179.000	0.0000	23.1488	5.8599	5.8114	0.0000	5.8356
Aluminum	0.000	0.000	2.3512	0.0102	0.1712	0.0634	0.7216	0.1463
Antimony	0.022	0.014	0.0057	0.0016	0.0610	0.0034	0.0016	0.0020
Arsenic	0.057	0.048	1.0611	0.0058	0.0087	0.0358	0.0257	0.0448
Barium	0.034	0.042	0.0184	0.0185	0.1494	0.0230	0.0060	0.0252
Beryllium	0.000	0.000	0.0156	0.0000	0.0050	0.0000	0.0005	0.0054
Bismuth	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Boron	0.590	0.550	0.0000	0.0097	0.0097	0.0097	0.0097	0.0194
Cadmium	0.000	0.000	0.0017	0.0000	0.0005	0.0000	0.0000	0.0000

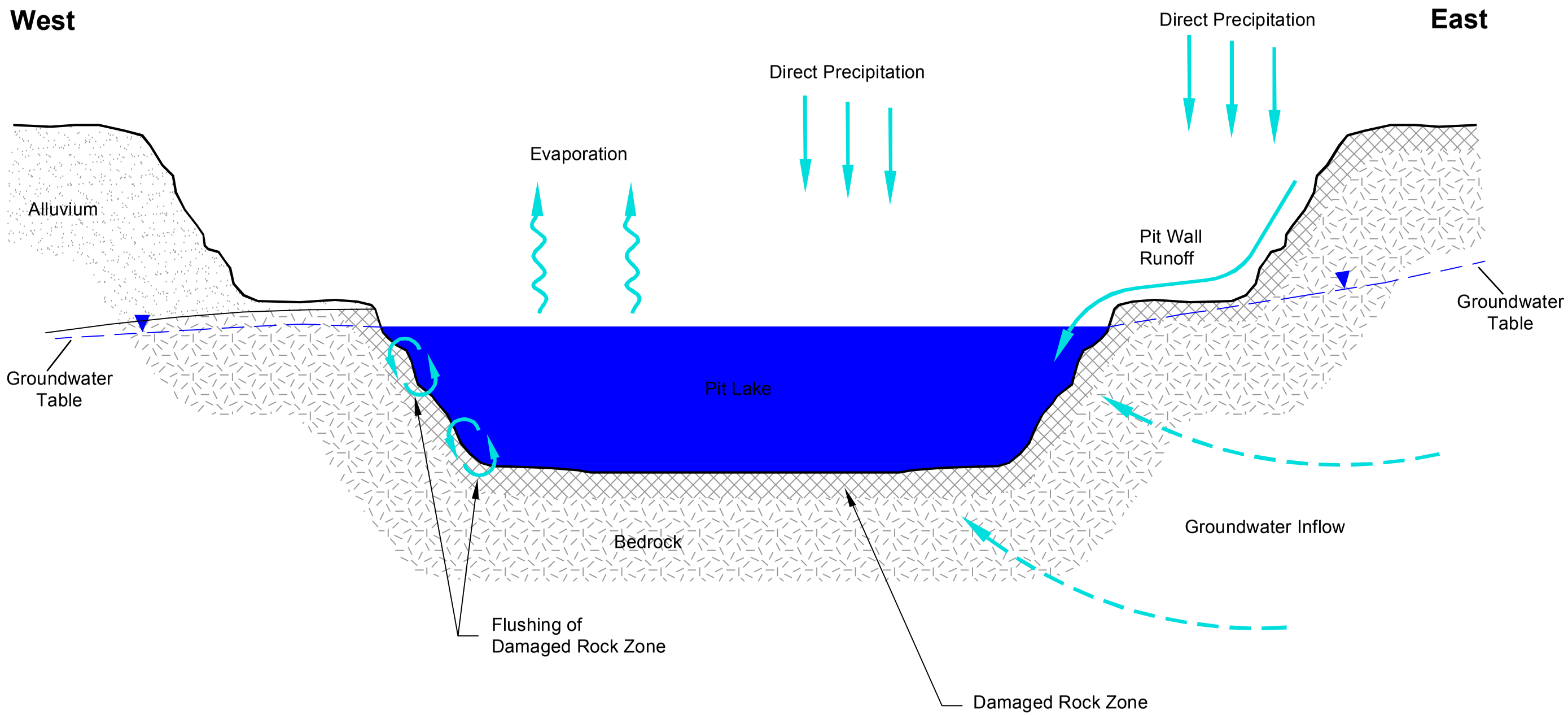
Table 4.3-11 (Continued)

	Groundwater[1]		Scaled Pit Wall Runoff and Submergence[2]					
	Low TDS	High TDS	HC-5, HC-6	HC-8	HC-4, HC-7	HC-9	HC-2	HC-1, HC-10
Data Source	GHB-03-04 (6/28/2005)	GHB-03-04 (4/20/2004)	Volcanics PAG	Volcanics NAG	Volcanics Uncertain	Alluvium	Sinter	Ash Fall
Constituent								
Calcium	57.000	58.600	97.1718	6.3926	4.9712	0.3066	1.1090	7.5660
Chloride	42.500	43.100	0.8620	0.1840	0.2785	0.2470	0.1840	0.8499
Chromium	0.000	0.000	0.0015	0.0000	0.0000	0.0000	0.0015	0.0000
Cobalt	0.000	0.000	0.1114	0.0000	0.0070	0.0000	0.0054	0.0072
Copper	0.000	0.000	0.0155	0.0032	0.0071	0.0045	0.1245	0.1159
Fluoride	0.880	0.990	0.5097	0.0242	0.0942	0.1017	0.0969	0.2809
Iron	0.495	0.446	14.4196	0.0048	0.0097	0.0199	9.9278	0.0581
Lead	0.000	0.000	0.0036	0.0000	0.0012	0.0000	0.0029	0.0000
Lithium	0.062	0.062	0.0731	0.0033	0.1041	0.0010	0.0012	0.0130
Magnesium	10.700	10.900	4.7242	0.4383	0.7049	0.0416	0.1075	0.5160
Manganese	0.196	0.218	1.5085	0.0026	0.9925	0.0023	0.0227	0.2690
Mercury	0.000	0.000	0.0019	0.0348	0.0023	0.0019	0.0000	0.0019
Nickel	0.000	0.000	0.2736	0.0000	0.0075	0.0000	0.0053	0.0048
Nitrate	0.000	0.000	0.1574	0.0387	0.0274	0.0673	0.0349	0.0567
Phosphorous	0.000	0.000	0.2857	0.0121	0.0000	0.0639	0.0266	0.0131
Potassium	2.400	2.400	3.9421	1.1139	1.5134	0.2421	0.5860	0.9734
Selenium	0.000	0.000	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000
Silver	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000
Sodium	96.400	98.700	2.1793	0.8475	0.6974	2.5861	0.2470	3.6685
Strontium	0.470	0.470	1.6785	0.0988	0.0729	0.0036	0.0123	0.1667
Sulfate	139.000	194.000	326.1661	0.5957	18.8460	0.3293	60.5356	23.0132
Thallium	0.000	0.000	0.0007	0.0005	0.0000	0.0000	0.0020	0.0000
Tin	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Titanium	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vanadium	0.000	0.000	0.0024	0.0000	0.0012	0.0055	0.0000	0.0000
Zinc	0.000	0.000	0.6441	0.0000	0.0671	0.0046	0.0291	0.0296

[1] GHB – Gold Hill monitoring well.

[2] HC = Humidity cell sample.

Note: All units are provided in mg/L, except for pH, which is in standard units.
Input concentrations are dissolved concentrations.
Input concentrations were set to 0 where constituent was below analytical detection.



Source: WMC 2008.

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Figure 4.3-23

Gold Hill Pit Lake
Conceptual Model

Table 4.3-12 presents the base case scenario water balance for the Gold Hill post-mining pit lake. Predominant groundwater inflow would be approximately 100 gpm and then decline to 68 gpm by year 200, the time when the pit lake would reach about 99 percent of its final elevation. **Figure 4.3-24** illustrates the stage-volume-area filling curves and **Figure 4.3-25** presents the pit filling elevation curves for the modeled Gold Hill Pit lake. Under the base case scenario, which is considered to be the most likely scenario for the filling of the Gold Hill Pit (WMC 2008), the final pit lake elevation would be approximately 5,950 feet.

The expected chemical evolution of the Gold Hill Pit lake during filling is presented in **Table 4.3-13**. The pH would be in the range of 8.0 to 8.2 standard units. The alkalinity would range from 158 to 236 mg/L, which would exceed the Nevada wildlife propagation maximum of 130 mg/L. Chloride levels would range from 61 to 359 mg/L and would continue to increase beyond year 200 due to evapoconcentration. Sulfate levels would range from 156 to 934 mg/L and would exceed Nevada drinking water standards by year 200. Antimony levels would range from 0.03 to 0.17 mg/L and would exceed Nevada drinking water standards. Arsenic levels would range from 0.03 to 0.15 mg/L and would exceed Nevada drinking water and irrigation water standards. Boron levels would range from 0.53 to 3.21 mg/L and would exceed Nevada irrigation water standards. Fluoride levels would start around 0.95 mg/L and reach 5.75 mg/L by year 200, exceeding Nevada drinking water, irrigation water, and stock water standards. Manganese levels would reach 1.23 mg/L by year 200 and exceed Nevada drinking water and irrigation water standards. TDS would range from 472 to 2,159 mg/L at year 200 and exceed Nevada drinking water standards. The pit lake water would be alkaline sodium bicarbonate water and the alkalinity would increase after year 200 due to evapoconcentration. Fluoride, antimony, manganese, and boron are derived mainly from the bedrock groundwater that flows into the pit. The arsenic primarily originates from the pit wall flushing during pit filling and pit wall runoff (WMC 2008).

The results of the additional modeling scenarios conducted as part of the sensitivity analysis of the Gold Hill pit lake water quality are presented in **Appendix D**, **Tables D-10** to **D-16**. Because volcanic bedrock groundwater chemistry dominates the final pit lake water quality of the Gold Hill Pit and also because there is very little variation in groundwater quality in the monitoring well GHB-03-04 that was used for the influent groundwater chemistry, the results of the other modeling scenarios are similar to those of the base case scenario. For the high TDS scenario, TDS can range up to 2,262 mg/L at year 200 and sulfate has a maximum of 1,126 mg/L. Other constituents have a similar range as the base case scenario. The low TDS scenario has a TDS at year 200 of 2,123 mg/L with sulfate having a maximum of 811 mg/L. The low groundwater inflow scenario has TDS at 1,512 in year 200 and sulfate at a maximum of 629 mg/L. Exceedences of Nevada water quality standards identified in the base case scenario predictions were also predicted in each of the sensitivity analysis scenarios.

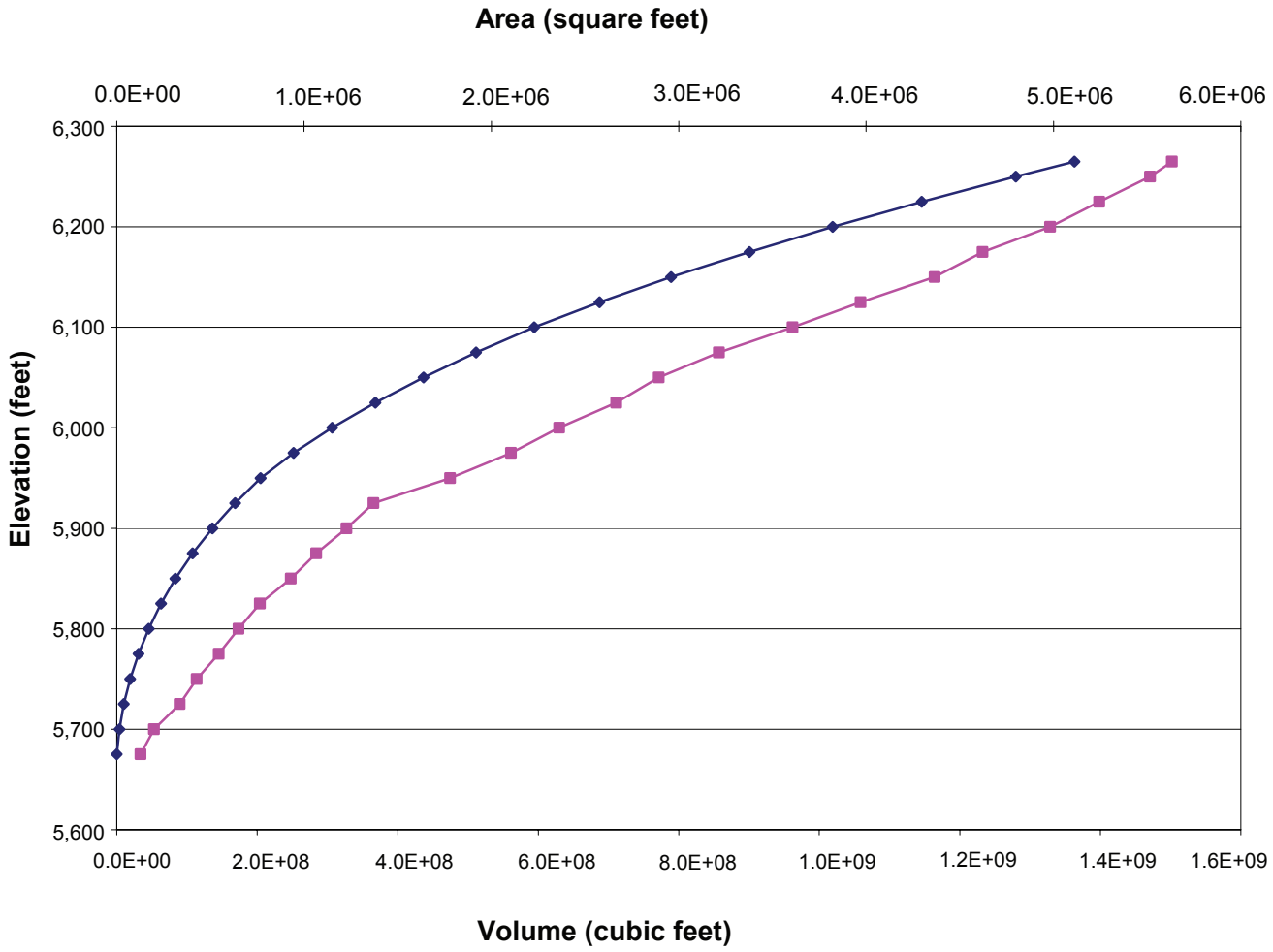
In summary, pit lake water quality in the proposed pit would exceed one or more Nevada water quality standards for TDS, alkalinity, sulfate, antimony, arsenic, boron, manganese, and especially fluoride. The water would be alkaline and consist primarily of sodium bicarbonate. The alkalinity and TDS, boron, sulfate, and chloride levels would be expected to increase with time beyond year 200 due to evapoconcentration. Based on an ecological risk assessment, water quality at year 200 would not adversely impact human, terrestrial, or avian life (Section 4.17, Wildlife and Fisheries Resources).

Waste Rock. The two waste rock dumps in the proposed Gold Hill Area would be designed in a manner similar to the existing waste rock dumps in the Round Mountain Area (Chapter 2.0, Alternatives Including the Proposed Action). The designated waste rock (i.e., PAG waste rock) would be encapsulated within the waste rock dumps with a cover and base of alluvial material approximately 20-feet thick. The outer slopes of the waste rock dumps would have an average of 24 feet of non-designated cover over the designated waste

Table 4.3-12
Pit Lake Water Balance Summaries Gold Hill Pit - Base Case Scenario

Time (years)	Stage (feet)	Volume (feet^3)	Area (feet^2)	Precipitation (gpm)	Groundwater Inflow (gpm)	Surface Water Inflow (gpm)	Pit Wall Runoff (gpm)	ET[1] (gpm)	Total Inflow (gpm)	Total Outflow (gpm)	Net Inflow (gpm)
1	5,684.2	6.53E+5	1.27E+5	1	25	0	11	7	37	7	30
2	5,701.0	1.81E+6	1.99E+5	2	76	0	11	11	88	11	77
3	5,774.1	5.01E+6	4.27E+5	3	111	0	11	24	125	24	101
4	5,793.6	5.87E+6	5.45E+5	4	117	0	11	30	132	30	102
5	5,801.8	6.24E+6	6.50E+5	5	115	0	11	36	131	36	95
6	5,809.7	6.59E+6	6.50E+5	5	112	0	11	36	128	36	92
7	5,817.0	6.91E+6	6.50E+5	5	110	0	11	36	126	36	90
8	5,823.8	7.22E+6	6.50E+5	5	108	0	11	36	124	36	88
9	5,830.3	7.54E+6	7.64E+5	6	106	0	10	42	122	42	80
10	5,836.0	7.84E+6	7.64E+5	6	105	0	10	42	121	42	79
11	5,840.6	8.07E+6	7.64E+5	6	103	0	10	42	120	42	78
12	5,843.6	8.23E+6	7.64E+5	6	108	0	10	42	125	42	83
15	5,849.1	8.52E+6	7.64E+5	6	109	0	10	42	126	42	84
25	5,867.3	9.68E+6	9.29E+5	7	107	0	10	51	125	51	73
27	5,872.9	1.00E+7	9.29E+5	7	103	0	10	51	121	51	69
42	5,898.2	1.15E+7	1.07E+6	8	84	0	10	59	102	59	44
52	5,909.9	1.23E+7	1.23E+6	10	80	0	10	68	99	68	32
65	5,922.6	1.31E+7	1.23E+6	10	75	0	10	68	95	68	27
77	5,930.2	1.37E+7	1.45E+6	11	72	0	10	80	93	80	13
100	5,942.0	1.47E+7	1.62E+6	12	68	0	10	89	90	89	1
127	5,950.3	1.54E+7	1.65E+6	13	68	0	10	91	91	91	0
152	5,950.3	1.54E+7	1.65E+6	13	68	0	10	91	91	91	0
177	5,950.3	1.54E+7	1.65E+6	13	68	0	10	91	91	91	0
200	5,950.3	1.54E+7	1.65E+6	13	68	0	10	91	91	91	0

[1] ET of 46.5 inches per year assumed for this scenario.



Legend

- Stage-volume Curve
- Stage-area Curve

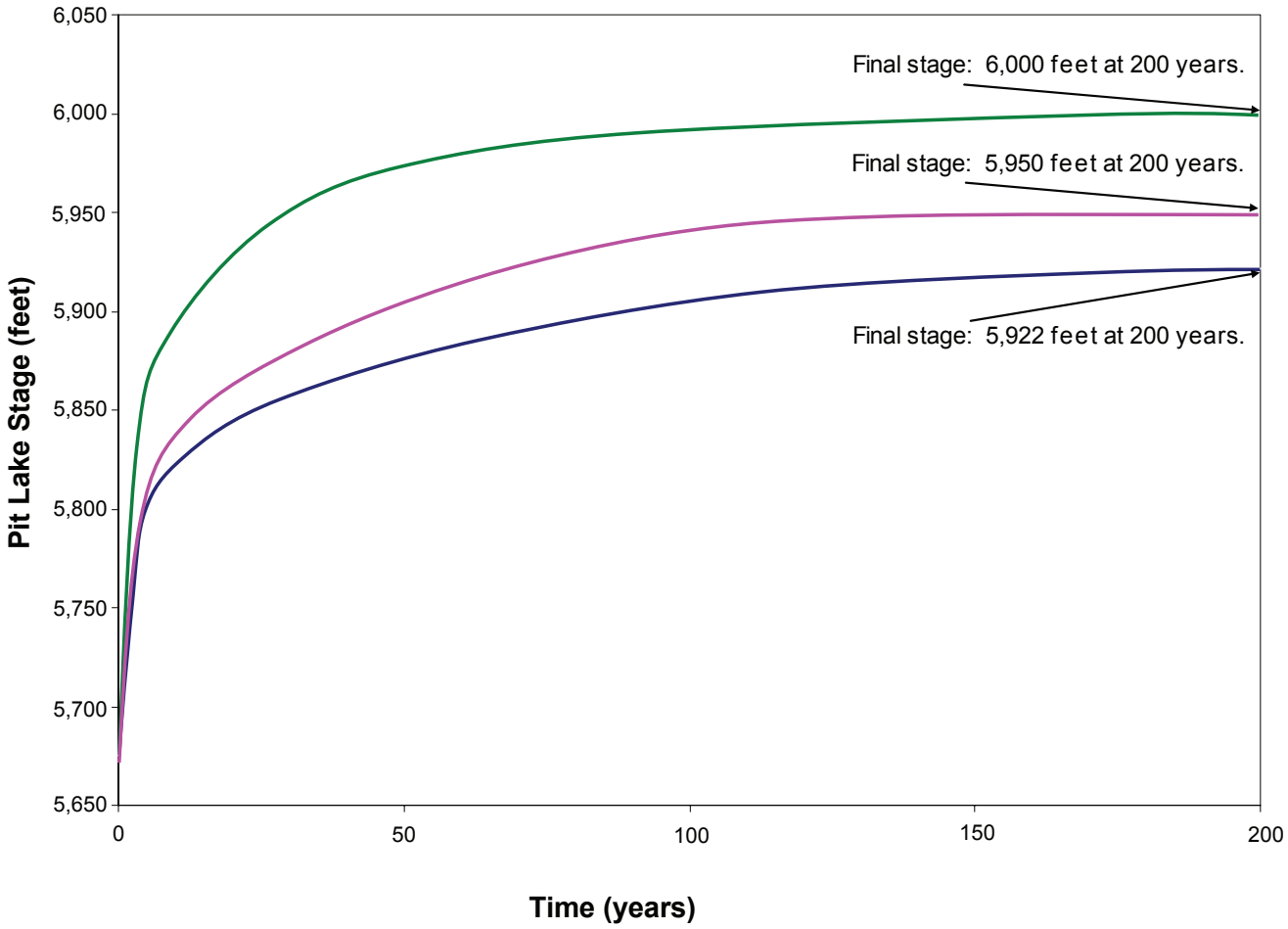
Note: Elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-24

Proposed Action
Gold Hill Pit
Stage-volume and
Stage-area Curves

04/10/09



Legend

- Lower Infilling Case
- Base Case Scenario
- Higher Infilling Case

Note: Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

Round Mountain Expansion Project

Figure 4.3-25

Proposed Action
Gold Hill Pit
Predicted Pit Lake
Elevation Filling Curve

04/10/09

Table 4.3-13
Gold Hill Pit Lake Chemistry Results – Base Case Scenario

Parameter/ Analyte	Pit Lake (Time 2 year)	Pit Lake (Time 10 year)	Pit Lake (Time 25 year)	Pit Lake (Time 100 year)	Pit Lake (Time 200 year)
pH	8.0900	8.1600	8.1600	8.1800	8.2100
pE	4.0000	4.0000	4.0000	4.0000	4.0000
Alkalinity, as $CaCO_3$	158.0000	190.0000	195.0000	207.0000	236.0000
Chloride	61.0000	77.0000	86.0000	150.0000	359.0000
Fluoride	0.9500	1.2100	1.3600	2.3900	5.7500
Nitrate, as N	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]
Sulfate, as SO_4^{2-}	156.0000	198.0000	222.0000	388.0000	934.0000
Aluminum	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]
Antimony	0.0300	0.0400	0.0400	0.0700	0.1700
Arsenic	0.0300	0.0400	0.0400	0.0700	0.1500
Barium	0.0360	0.0410	0.0370	0.0250	0.0150
Beryllium	0.0002[1]	0.0002[1]	0.0002[1]	0.0002[1]	0.0002[1]
Boron	0.5300	0.6700	0.7600	1.3400	3.2100
Cadmium	0.0005[1]	0.0005[1]	0.0005[1]	0.0005[1]	0.0005[1]
Calcium	55.2000	65.4000	65.9000	71.1000	83.9000
Chromium	0.0060[1]	0.0060[1]	0.0060[1]	0.0060[1]	0.0060[1]
Cobalt	0.0020	0.0020	0.0010	0.0020	0.0100
Copper	0.0030[1]	0.0030[1]	0.0030[1]	0.0030[1]	0.0030[1]
Iron	0.0600[1]	0.0600[1]	0.0600[1]	0.0600[1]	0.0600[1]
Lead	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]
Lithium	0.0600	0.0800	0.0900	0.1500	0.3600
Magnesium	10.1000	12.9000	14.5000	25.5000	61.3000
Manganese	0.2200	0.2700	0.2900	0.5100	1.2300
Mercury	0.0003	0.0003	0.0002	0.0003	0.0008
Molybdenum	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]
Nickel	0.0100[1]	0.0100[1]	0.0100[1]	0.0100[1]	0.0100
Phosphorus	0.0500[1]	0.0500[1]	0.0500[1]	0.0500[1]	0.0500[1]
Potassium	2.3000	3.0000	3.3000	5.8000	14.0000
Selenium	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]
Silver	0.0050[1]	0.0050[1]	0.0050[1]	0.0050[1]	0.0050[1]
Sodium	90.0000	116.0000	131.0000	229.0000	552.0000
Strontium	0.4700	0.5900	0.6600	1.1600	2.7800
Thallium	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]	0.0001[1]
Tin	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]	0.0010[1]
Zinc	0.0100	0.0200	0.0200	0.0200	0.0600
TDS	472.0000	589.0000	642.0000	1,000.0000	2,159.0000

[1] Analyte concentration result is below typical analytical detection limits. Value shown is the detection limit.

Note: All concentrations are in mg/L except for pE and pH (pH in standard units).

TDS calculated as the sum of all dissolved constituents (alkalinity was converted to HCO_3- then multiplied by 0.4917 to account for volatilization of CO_2).

rock. Approximately 70 Mt of designated waste rock would be encapsulated by 42 Mt of alluvial material or non-designated waste rock (SRK 2009a). Infiltration modeling by SRK (2009a) has indicated that the 20-foot alluvial cover proposed for the Gold Hill waste rock dumps should be sufficient to prevent infiltration of precipitation under the most probable range of precipitation events. However, this infiltration model has not been field-tested for adequate calibration. Therefore, a field infiltration test of the proposed alluvial cover for the Gold Hill waste rock dumps would be conducted to determine sufficient cover depth to prevent precipitation from contacting designated (PAG) waste rock in the interior of the Gold Hill waste rock dumps. A field pilot test of infiltration into the proposed alluvial cover for the waste rock dumps would be conducted over a period of 5 years prior to the end of mining. This field pilot test is described in Section 4.3.1.2, Gold Hill Area. This field pilot test of infiltration into the proposed alluvial cover is discussed under Section 2.5, RMGC's Environmental Protection Measures.

A study of the existing North and South Waste Rock dumps in the Round Mountain Area (SRK 2009b) has shown that the average gravimetric moisture content is 5 to 7 percent and that no wetting front is present in either waste rock dump. The historic data on the Round Mountain waste rock dumps cover a 30-year period and have no recorded evidence of seepage from the waste rock dumps. The reclaimed waste rock dumps would be covered with growth media where needed.

Leach Pad. The proposed leach pad in the Gold Hill Area would be constructed in a manner similar to the leach pads currently in use and also proposed for the expanded Round Mountain Area. The double liner consisting of synthetic HDPE and a compacted base of low permeability material would significantly reduce the potential for seepage. Closure and reclamation activities would be completed, which would further reduce the chance for seepage from the leach pad.

RIB System. The proposed Gold Hill RIB system would consist of up to 3 rapid infiltration basins that would receive an average of about 250 gpm of discharge from the dewatering of the Gold Hill Pit. The maximum expected discharge to the basins would be about 500 gpm. The discharge water quality would be similar to that currently found in the volcanic bedrock of the Gold Hill Area. About 70 percent of the discharge water is expected to come from the Tertiary Sinter unit, with the other 30 percent coming from the remainder of the volcanic bedrock (WMC 2008).

Table 4.3-14 presents a comparison of mean water quality for the Tertiary volcanic bedrock of the Gold Hill Area and mean water quality for the Quaternary alluvial aquifer to the west of Gold Hill. Data in this table come from **Table A-3** and **Table A-4**, **Appendix A** (WMC 2008). Except for antimony, boron, lithium, molybdenum, sodium, sulfate, chloride, and TDS, the water quality of the Tertiary Sinter unit (70 percent of the discharge water) and the remaining Tertiary volcanic bedrock is similar to that of the alluvial groundwater west of the Gold Hill Pit area and in the area of the proposed Gold Hill RIB system. Water discharged to the Gold Hill RIB system may be slightly elevated in the constituents shown in bold in **Table 4.3-14**, but this elevation in concentration is slight when compared to the range in mean water quality for the alluvial aquifer. Thus, no impact to alluvial water quality is expected from infiltration of discharge water in the Gold Hill RIB system.

Table 4.3-14
Gold Hill Rapid Infiltration Basins – Mean Water Quality Parameters

Constituent	Alluvial Groundwater[1]	Expected Discharge Water Sinter[1]	Volcanic Bedrock[1]
Aluminum	0.031-0.209	NC	ND - 0.03
Antimony	0.006-0.009	0.015	0.004-0.055
Arsenic	0.019-0.23	0.067	0.052-.208
Barium	0.006-0.180	0.014	0.014-0.04
Beryllium	ND	ND	ND
Bismuth	ND	ND	ND
Boron	0.085-0.425	0.369	0.369-0.562
Cadmium	ND	ND	ND
Calcium	4.4-74.1	4.12	4.28-52.4
Chromium	ND	ND	ND
Cobalt	ND	ND	ND
Copper	ND	NC	ND
Gallium	ND	ND	ND
Iron	0.049-12.48	NC	0.077-0.437
Lead	ND	ND	ND
Lithium	0.008-0.337	0.462	0.036-0.462
Magnesium	0.51-13.3	0.23	0.27-10.67
Manganese	0.01-3.84	0.02	0.02-0.2
Mercury	ND-0.0003	ND	ND
Molybdenum	0.019-0.021	0.015	0.015-1.3
Nickel	ND	ND	ND
Potassium	1.05-2.43	1.6	1.76-2.36
Scandium	ND	ND	ND
Selenium	ND	ND	ND
Silver	ND	ND	ND
Sodium	19.2-136.0	147.3	64.0-144.0
Strontium	0.028-.637	0.1	.088-.473
Thallium	ND	ND	ND
Tin	ND	ND	ND
Titanium	ND	ND	ND
Vanadium	0.006-0.093	ND	ND
Zinc	0.012-0.026	NC	ND
Alkalinity	77-281	282	158-273
pH	7.0-10.0	7.7	7.1-8.2
Sulfate	10.1-44.3	39.8	37.5-130.9
TDS	117-406	399	324-422
Chloride	5.1-22.9	18.7	18.8-38.7
Fluoride	0.2-9.5	8	0.7-7.8

[1] ND = too few detects to calculate a mean; NC = no mean calculated because fewer than 3 detects.

Source: WMC 2008.

4.3.2 Gold Hill Process Alternative

4.3.2.1 Water Quantity Impacts

Water quantity impacts to groundwater would be the same as the Proposed Action. Less haulage between the Gold Hill and Round Mountain areas may result in less surface disturbance and thus, less potential for surface erosion and sedimentation, potentially reducing the impacts to surface drainages within the proposed project area.

4.3.2.2 Water Quality Impacts

Water quality impacts to groundwater would be the same as the Proposed Action. Less haulage between the Gold Hill and Round Mountain areas may mean less potential for sediment reaching drainages and, thus, less potential for impacts to surface water quality for drainages within the proposed project area.

4.3.3 County Road Overpass Alternative

4.3.3.1 Water Quantity Impacts

Water quantity impacts to groundwater would be the same as the Proposed Action.

4.3.3.2 Water Quality Impacts

Groundwater quality impacts would be the same as described for the Proposed Action. The increased surface disturbance of 1.7 acres may result in a slightly increased potential for surface erosion and sedimentation and, thus, impacts to surface water quality.

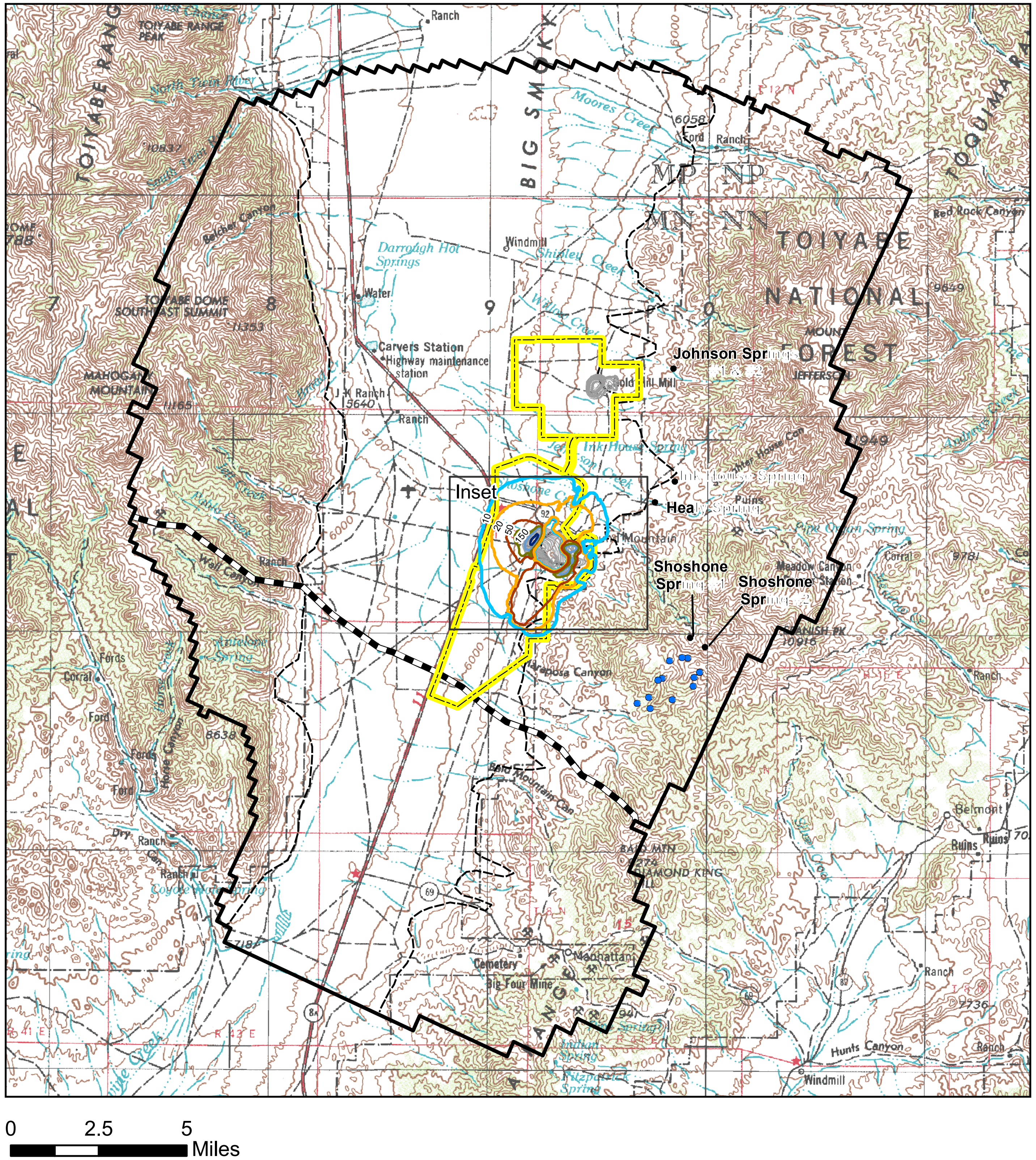
4.3.4 No Action Alternative

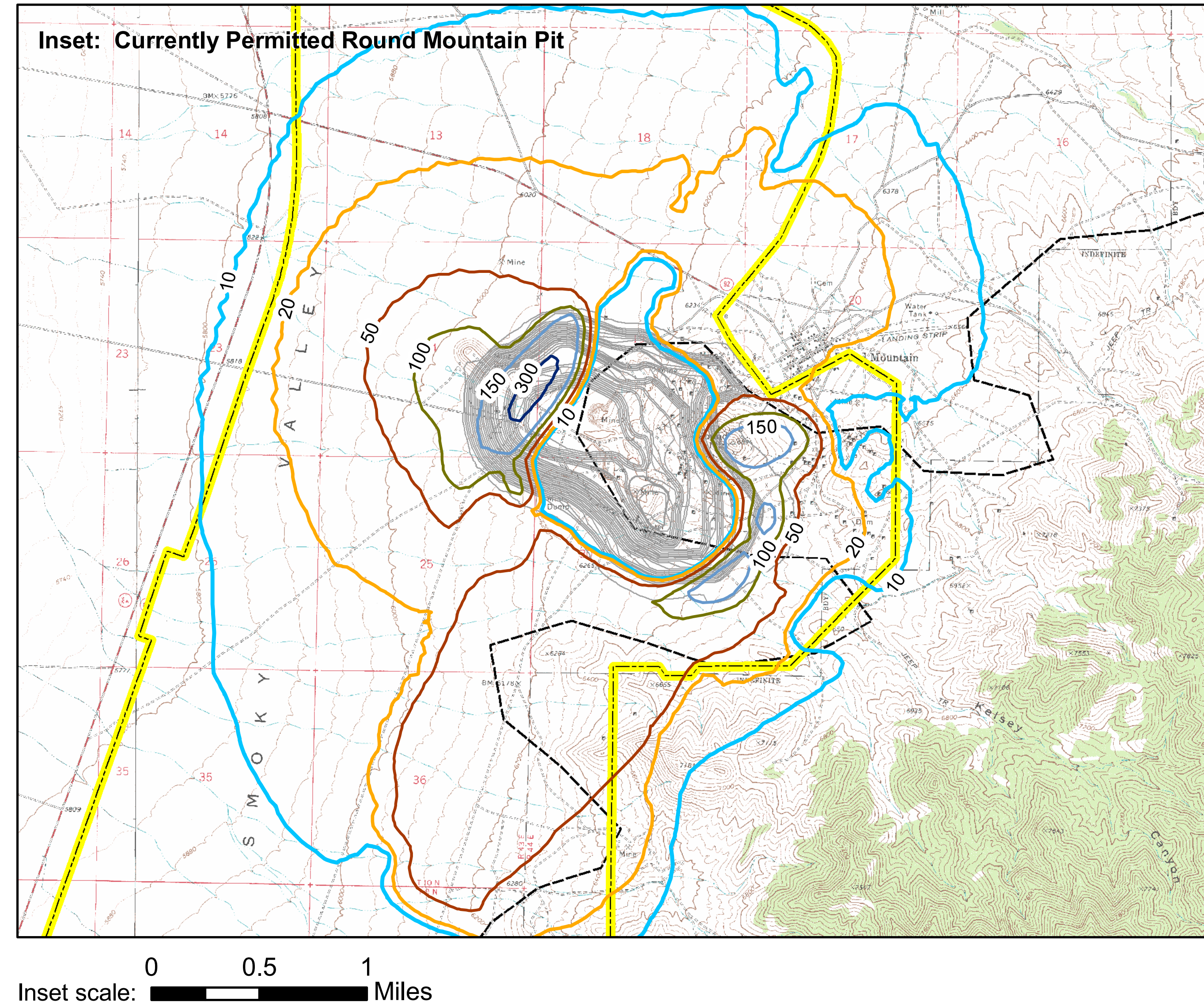
4.3.4.1 Water Quantity Impacts

Under the No Action Alternative, the currently permitted Round Mountain Pit would be mined through approximately Year 2015. Water quantity impacts would consist of drawdown in the Quaternary alluvial aquifer west of the Round Mountain Pit and drawdown in the Tertiary and Paleozoic bedrock surrounding the mine area to the north, south, and east. In addition, there would be a period of maximum drawdown around Year 2040 and long-term drawdown in all aquifers caused by evaporation from the post-mining pit lake that would form in the Round Mountain Pit.

Groundwater Impact at End of Mining

Groundwater drawdown expected at the end of mining is illustrated in **Figure 4.3-26**. The 10-foot groundwater drawdown isopleth would extend approximately 2 miles west, north, and south of the pit center. This would place the 10-foot groundwater drawdown isopleth slightly west of the proposed project area in the Quaternary alluvium and slightly east of the proposed project area in the bedrock aquifers. No springs would be affected, and impacts due to drawdown in all aquifers would be limited mostly to areas within the current proposed project area.





Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Alluvial-bedrock Contact
- Extent of Active Model Cells

Selected Isopleth Drawdown

- 10-foot Isopleth
- 20-foot Isopleth
- 50-foot Isopleth
- 100-foot Isopleth
- 150-foot Isopleth
- 300-foot Isopleth

Note: Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.
Source: WMC 2008.

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Round Mountain Expansion Project

Figure 4.3-26

Currently Permitted Pit Water Table Drawdown at the End of Mining (2015)

05/25/2009

Maximum Groundwater Impacts

Maximum drawdown in all aquifers would be expected around Year 2040 (WMC 2008) and is illustrated in **Figure 4.3-27**. The 20-foot groundwater drawdown isopleth in the Quaternary alluvial aquifer would extend slightly west of the proposed project area. The 10-foot groundwater drawdown isopleth in the Quaternary alluvial aquifer would extend across the valley to the contact between the alluvial aquifer and the Toiyabe Range. In the Tertiary and Paleozoic bedrock aquifers, both the 20-foot and the 10-foot groundwater drawdown isopleth would extend east of the proposed project area. Healy Spring may experience drawdown between 5 and 10 feet. Groundwater flow in the Quaternary alluvial aquifer would be toward the pit from a distance of approximately 8,000 to 10,000 feet west of the pit center (**Figure 4.3-28**). In the bedrock aquifers, groundwater flow would be toward the pit within a radius of about 4,000 feet from the pit center.

Groundwater Impacts at Pit Recovery

The currently permitted pit is expected to fill with water and reach 99 percent of the final pit lake elevation about 200 years after cessation of mining (WMC 2008). The pit lake is expected to be a terminal pit lake, meaning that groundwater would flow into the pit from all directions. Long-term drawdown in all aquifers at pit recovery is illustrated in **Figure 4.3-29**. The 10-foot groundwater drawdown isopleth in the Quaternary alluvium would extend to the western portion of the proposed project area. The 50-, 20-, and 10-foot isopleths would extend eastward beyond the proposed project area into the bedrock of the Toquima Range. The 10-foot groundwater drawdown isopleth in the bedrock aquifers would approach Healy Spring, suggesting that Healy Spring may experience approximately 10 feet of drawdown in the long term. Groundwater flow at pit recovery is illustrated in **Figure 4.3-30**. Groundwater flow in the Quaternary alluvium would be toward the pit from a distance of about 5,000 to 6,000 feet west of the pit center, which is within the proposed project area. Groundwater flow in the bedrock aquifers would be toward the pit within a radius of about 4,000 feet of the pit center. The approximate 10-foot groundwater drawdown in bedrock groundwater levels may result in a minor reduction in flow at Healy Spring during the dry season.

4.3.4.2 Water Quality Impacts

Water quality impacts associated with the currently permitted pit at Round Mountain would be associated with the post-mining pit lake and any seepage from the waste rock dumps, leach pads, or tailings impoundment facility after cessation of mining.

Predicted Pit Lake Water Quality

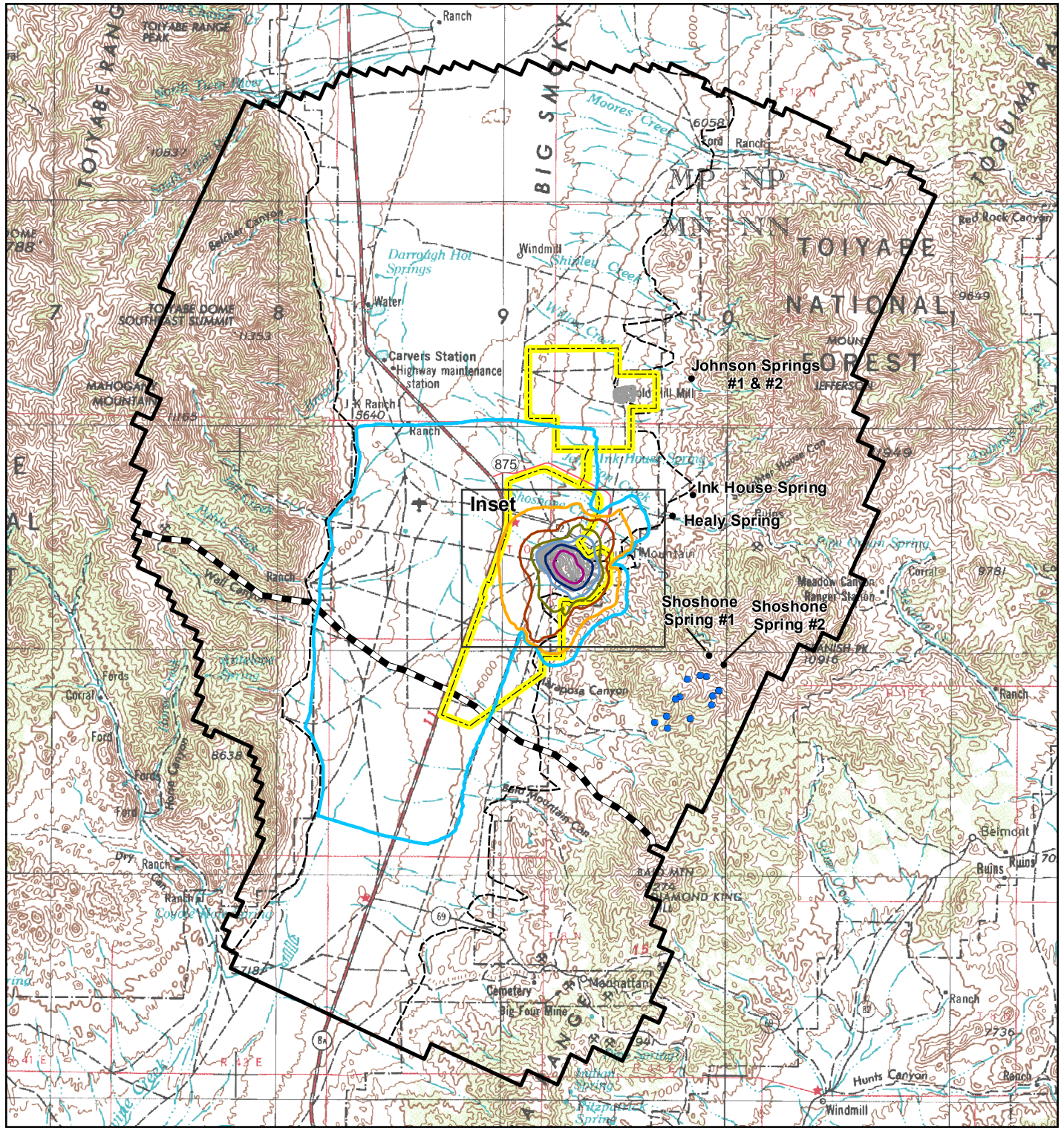
The post-mining pit lake water quality for the currently permitted pit at Round Mountain was estimated using the same procedures and modeling code as used for the Proposed Action. The predicted pit lake water quality would be similar to that estimated for the post-mining pit lake under the Proposed Action because the rock types that would remain in the pit wall are the same and most of the groundwater inflow would come from the Quaternary alluvium.

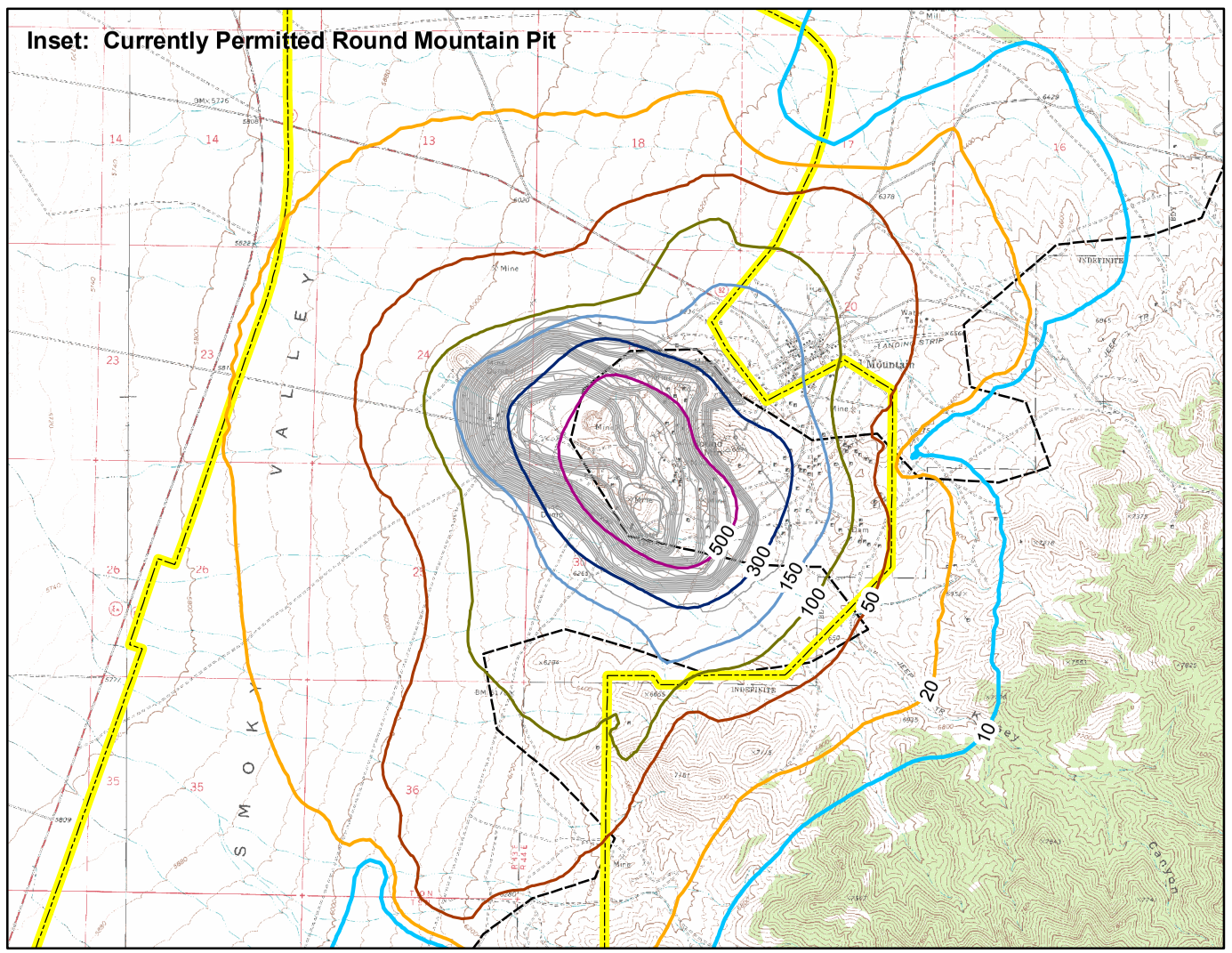
The expected water balance for the post-mining pit lake under the currently permitted pit is provided in **Table 4.3-15** for the base case scenario and in **Table 4.3-16** for the high groundwater inflow rate case. Under the base case scenario, groundwater inflow would begin at a rate of about 1,734 gpm and reach a steady-state inflow rate of about 853 gpm at year 200. Most of this groundwater would come from the alluvial aquifer. This groundwater inflow would be balanced by evaporation from the pit lake at steady state.

Table 4.3-15
Pit Lake Water Balance Summaries Current Pit - Base Case Scenario

Time (years)	Stage (foot)	Volume ($foot^3$)	Area ($foot^2$)	Precipitation (gpm)	Groundwater inflow (gpm)	Surface Water Inflow (gpm)	Pit Wall Runoff (gpm)	ET[1] (gpm)	Total Inflow (gpm)	Total Outflow (gpm)	Net Inflow (gpm)
1	5,100	1.31E+8	3.54E+6	28	1,734	15	29	195	1,806	195	1,611
2	5,130	2.70E+8	4.17E+6	33	1,933	15	29	230	2,010	230	1,780
3	5,159	4.17E+8	4.86E+6	38	1,986	15	28	268	2,067	268	1,800
4	5,182	5.44E+8	5.50E+6	43	2,001	15	28	303	2,087	303	1,784
5	5,200	6.44E+8	5.50E+6	43	2,004	15	28	303	2,090	303	1,787
6	5,218	7.59E+8	6.26E+6	49	2,002	15	27	345	2,094	345	1,749
7	5,236	8.79E+8	6.26E+6	49	1,998	15	27	345	2,089	345	1,744
8	5,253	1.00E+9	7.03E+6	55	1,995	15	27	387	2,092	387	1,705
9	5,268	1.13E+9	7.03E+6	55	1,990	15	27	387	2,087	387	1,700
10	5,283	1.25E+9	8.21E+6	65	1,986	15	26	453	2,092	453	1,639
13	5,316	1.53E+9	8.87E+6	70	1,974	15	25	489	2,085	489	1,596
15	5,345	1.80E+9	8.87E+6	70	1,960	15	25	489	2,070	489	1,581
20	5,391	2.31E+9	1.16E+7	92	1,898	15	23	639	2,028	639	1,389
25	5,427	2.76E+9	1.26E+7	100	1,804	15	22	696	1,941	696	1,245
30	5,456	3.18E+9	1.44E+7	114	1,713	15	21	795	1,863	795	1,068
40	5,501	3.86E+9	1.54E+7	121	1,541	15	20	848	1,698	848	849
50	5,535	4.39E+9	1.62E+7	128	1,396	15	19	893	1,559	893	666
63	5,565	4.90E+9	1.71E+7	135	1,252	15	19	943	1,421	943	478
75	5,586	5.27E+9	1.71E+7	135	1,143	15	19	943	1,312	943	369
100	5,611	5.74E+9	1.79E+7	142	1,005	15	18	989	1,180	989	191
125	5,626	5.99E+9	1.83E+7	145	925	15	18	1,010	1,102	1,010	92
150	5,633	6.12E+9	1.83E+7	145	886	15	18	1,010	1,063	1,010	53
175	5,637	6.20E+9	1.83E+7	145	864	15	18	1,010	1,041	1,010	31
200	5,639	6.24E+9	1.83E+7	145	853	15	18	1,010	1,030	1,010	20

[1] ET of 46.5 inches per year assumed for this scenario.





Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells
- Alluvial-bedrock Contact

Selected Isopleth Drawdown

- 10-foot Isopleth
- 20-foot Isopleth
- 50-foot Isopleth
- 100-foot Isopleth
- 150-foot Isopleth
- 300-foot Isopleth
- 500-foot Isopleth

Note: Drawdown from 1990 to 2040.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

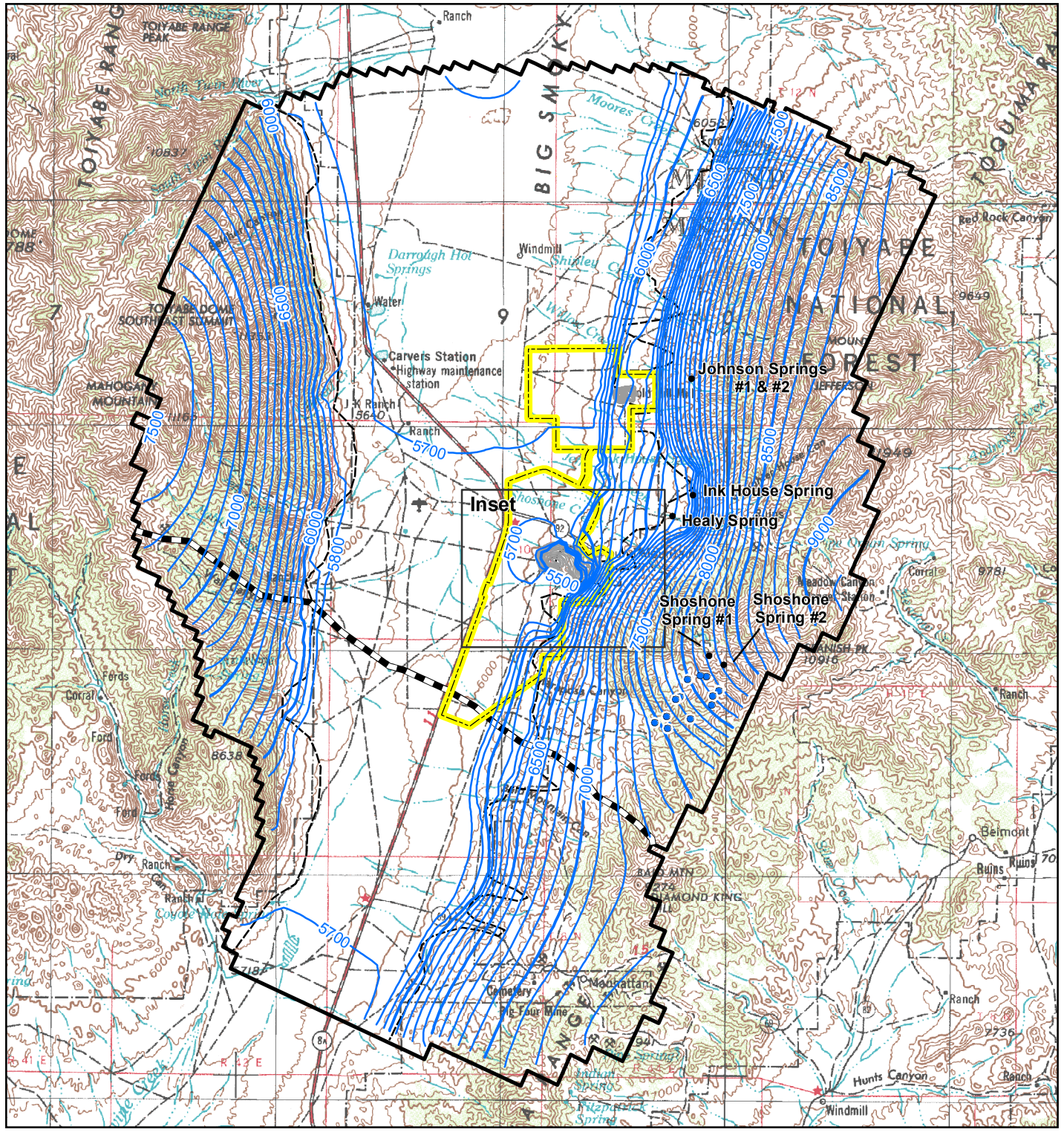
Source: WMC 2008.

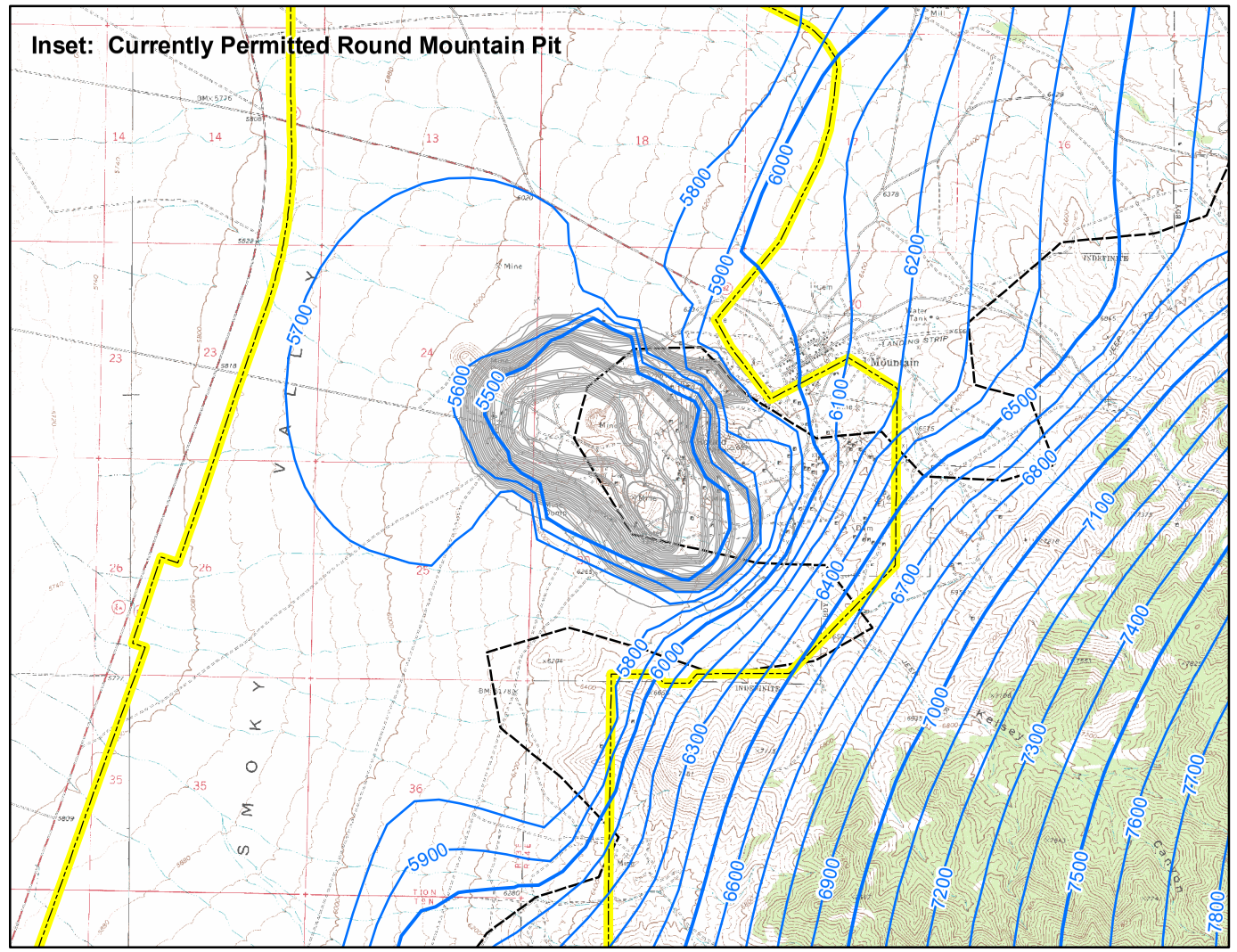
Round Mountain Expansion Project

Figure 4.3-2

Currently Permitted Pit Total Drawdown at Time of Maximum Drawdown Extent

05/25/2009





Inset scale:

Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Pit Topography
- Extent of Active Model Cells
- Alluvial-bedrock Contact
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- 500-foot Contour
- 100-foot Contour

Note: Water levels in year 2040.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

Source: WMC 2008.

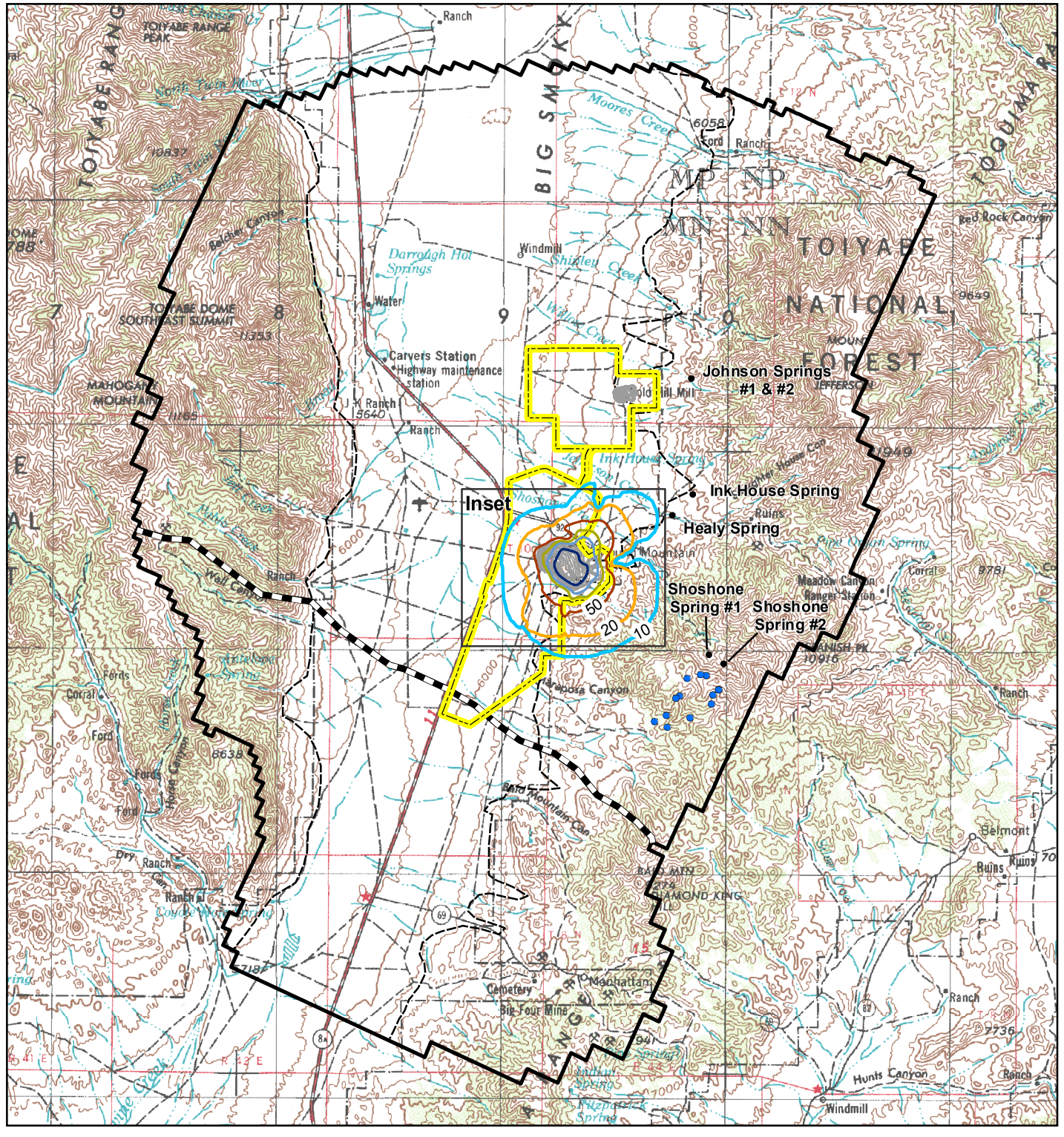
N

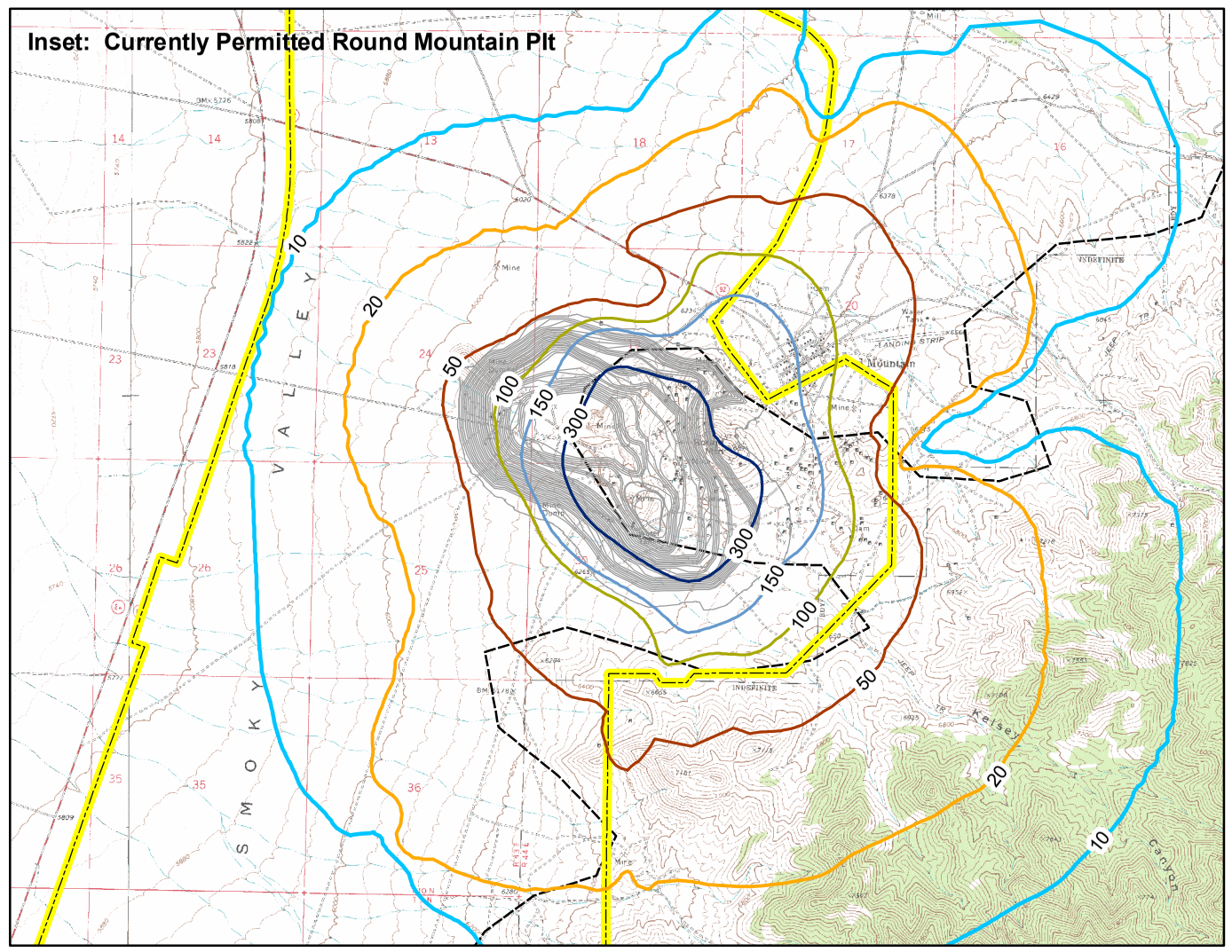
Round Mountain Expansion Project

Figure 4.3-28

Currently Permitted Pit Water Levels at Time of Maximum Drawdown Extent

05/25/2009





Inset scale:

Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- Pit Topography
- Extent of Active Model Cells
- Alluvial-bedrock Contact

Selected Isopleth Drawdown

- 10-foot Isopleth
- 20-foot Isopleth
- 50-foot Isopleth
- 100-foot Isopleth
- 150-foot Isopleth
- 300-foot Isopleth
- 500-foot Isopleth

Note: Drawdown from 1990 to 2215.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

Source: WMC 2008.

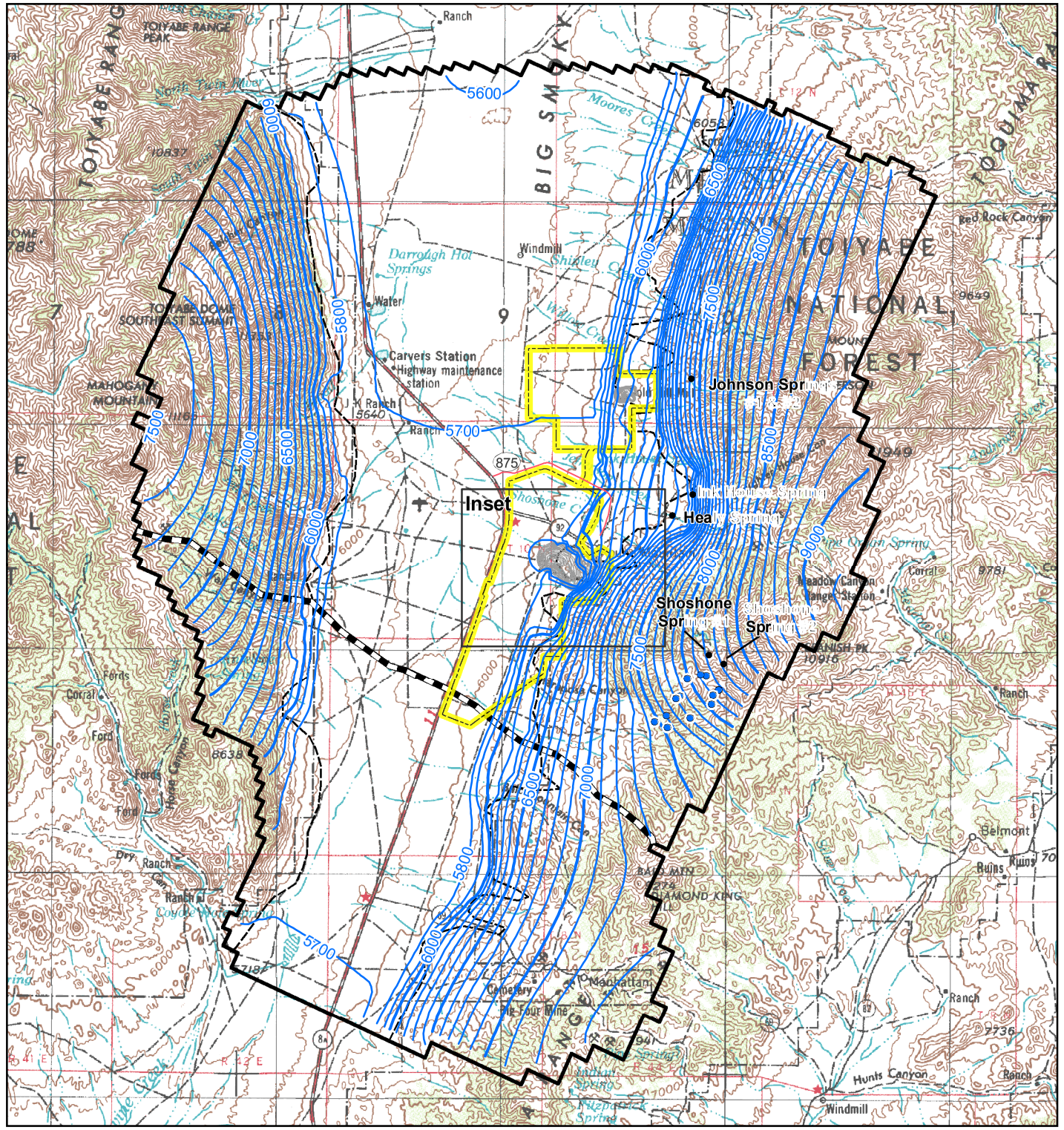
N

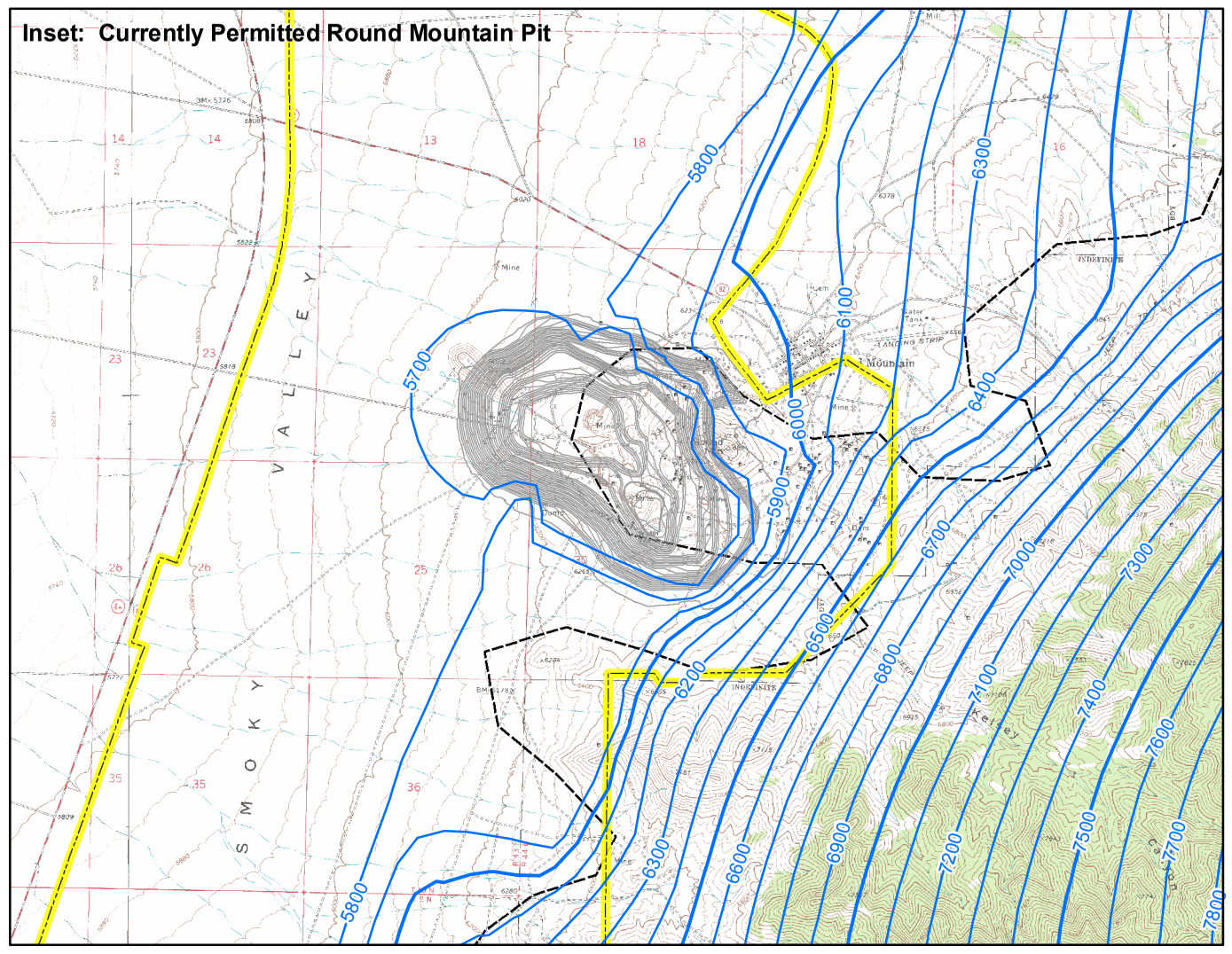
Round Mountain Expansion Project

Figure 4.3-29

Currently Permitted Pit Drawdown Extent at Time of 99% Pit Lake Recovery

05/25/2009





Legend

- Proposed Project Boundary
- Hydrographic Basin Boundary
- Pit Topography
- Extent of Active Model Cells
- Alluvial-bedrock Contact
- Inventoried Springs
- Inventoried Mariposa Canyon Springs
- 500-foot Contour
- 100-foot Contour

Note: Water levels in year 2015.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.
Water elevations provided in feet, USGS 1929 Vertical Datum plus 74.18 feet.

Source: WMC 2008.

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Round Mountain Expansion Project

Figure 4.3-30

Currently Permitted Pit Water Levels at Time of 99% Pit Lake Recovery

05/25/2009

Table 4.3-16
Pit Lake Water Balance Summaries Current Pit - Higher Infilling Scenario

Time (years)	Stage (foot)	Volume ($foot^3$)	Area ($foot^2$)	Precipitation (gpm)	Groundwater inflow (gpm)	Surface Water Inflow (gpm)	Pit Wall Runoff (gpm)	ET[1] (gpm)	Total Inflow (gpm)	Total Outflow (gpm)	Net Inflow (gpm)
1	5119	2.16E+8	4.17E+6	33	2,207	15	29	197	2,284	197	2,087
2	5,155	3.96E+8	4.86E+6	38	2,393	15	28	229	2,475	229	2,245
3	5,185	5.62E+8	5.50E+6	43	2,437	15	28	260	2,523	260	2,263
4	5,207	6.93E+8	6.26E+6	49	2,446	15	27	296	2,538	296	2,242
5	5,230	8.39E+8	6.26E+6	49	2,445	15	27	296	2,536	296	2,241
6	5,252	9.96E+8	7.03E+6	55	2,443	15	27	332	2,540	332	2,208
7	5,272	1.16E+9	7.03E+6	55	2,438	15	27	332	2,535	332	2,203
8	5,291	1.31E+9	8.21E+6	65	2,433	15	26	388	2,539	388	2,151
9	5,308	1.46E+9	8.21E+6	65	2,427	15	26	388	2,532	388	2,144
10	5,324	1.61E+9	8.87E+6	70	2,420	15	25	419	2,530	419	2,112
13	5,360	1.97E+9	1.01E+7	80	2,385	15	24	477	2,505	477	2,027
15	5,390	2.30E+9	1.16E+7	92	2,312	15	23	548	2,441	548	1,894
20	5,438	2.91E+9	1.26E+7	100	2,133	15	22	596	2,270	596	1,673
25	5,475	3.46E+9	1.44E+7	114	1,968	15	21	681	2,118	681	1,437
30	5,505	3.92E+9	1.54E+7	121	1,815	15	20	727	1,972	727	1,245
40	5,552	4.69E+9	1.62E+7	128	1,552	15	19	765	1,715	765	950
50	5,585	5.27E+9	1.71E+7	135	1,345	15	19	808	1,514	808	706
63	5,614	5.77E+9	1.79E+7	142	1,153	15	18	847	1,328	847	480
75	5,633	6.14E+9	1.83E+7	145	1,016	15	18	866	1,194	866	328
100	5,656	6.56E+9	1.83E+7	145	853	15	18	866	1,031	866	165
125	5,665	6.75E+9	1.94E+7	153	787	15	17	915	972	915	58
150	5,669	6.83E+9	1.94E+7	153	760	15	17	915	945	915	30
175	5,671	6.87E+9	1.94E+7	153	746	15	17	915	931	915	16
200	5,672	6.89E+9	1.94E+7	153	739	15	17	915	924	915	9

[1] ET of 39.8 inches per year assumed for this scenario.

For the high groundwater inflow scenario, groundwater inflow would begin at about 2,207 gpm and reach a steady state value of approximately 739 gpm at year 200.

The predicted water quality for the base case scenario is presented in **Table 4.3-17**. The pH would be in the range of 8.0 to 8.3 standard units, and the alkalinity would range from 112 to 265 mg/L at year 200 and would exceed Nevada wildlife propagation standards by year 100. Fluoride levels would range from 8.0 to 9.9 mg/L and would exceed Nevada drinking water, stock water, and irrigation water standards. Sulfate levels would range from 71 to 188 mg/L, and antimony levels would be under the Nevada drinking water standard of 0.006 mg/L until year 200. Arsenic levels would range from 0.09 to 0.23 mg/L and would exceed Nevada drinking water, irrigation water, and stock water standards by year 200. Boron levels would range from 0.25 to 0.66 mg/L; sodium levels would range from 72 to 191 mg/L; and TDS would range from 265 to 650 mg/L, exceeding Nevada drinking water standards by year 200. The pit lake water would be dominated by a sodium-bicarbonate-sulfate water and would increase in sodium, bicarbonate, and sulfate over time after year 200. Based on an ecological risk assessment, the expected pit lake water quality would not have the potential to adversely affect human, terrestrial, or avian life (Section 4.17, Wildlife and Fisheries Resources).

The modeling results for various sensitivity scenarios are provided in **Appendix D**, **Tables D-17** to **D-23**. Only the high TDS scenario shows any substantial difference from the base case scenario, with TDS ranging from 670 to 1,722 mg/L. Sulfate levels range from 348 to 900 mg/L, and sodium levels range from 204 to 529 mg/L. Because of the dominance of alluvial groundwater in the filling of the post-mining pit lake under the No Action Alternative, the final pit lake water quality does not show appreciable variation among the various sensitivity scenarios modeled by WMC (2008).

Waste Rock

Under the No Action Alternative, waste rock would be managed in accordance with the approved Waste Rock Management Plan and the guidelines presented in BLM (1996), as discussed in Chapter 2.0, Alternatives Including the Proposed Action. No impacts to water resources are anticipated.

Leach Pads

Leach pads in the currently permitted Round Mountain Area are designed as zero-discharge facilities and would be managed in accordance with NDEP regulations and the guidelines presented in BLM (1996), as discussed in Chapter 2.0, Alternatives Including the Proposed Action. No impacts to water resources are anticipated.

Tailings Impoundment Facility

The tailings impoundment facility in the currently permitted Round Mountain Area is designed as zero-discharge facility and would be managed in accordance with NDEP regulations and the guidelines presented in BLM (1996), as discussed in Chapter 2.0, Alternatives Including the Proposed Action. No impacts to water resources are anticipated.

Table 4.3-17
Round Mountain Current Permitted Pit Lake Chemistry Results – Base Case Scenario

Parameter/ Analyte	Pit Lake (Time 2 year)	Pit Lake (Time 10 year)	Pit Lake (Time 25 year)	Pit Lake (Time 100 year)	Pit Lake (Time 200 year)
pH	7.9700	7.9900	8.0300	8.2000	8.3100
pE	4.0000	4.0000	4.0000	4.0000	4.0000
Alkalinity, as $CaCO_3$	112.0000	117.0000	129.0000	197.0000	265.0000
Chloride	22.0000	23.0000	25.0000	38.0000	58.0000
Fluoride	8.0000	8.5000	9.4000	9.4000	9.9000
Nitrate, as N	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Sulfate, as SO_4^{2-}	71.0000	74.0000	82.0000	124.0000	188.0000
Aluminum	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Antimony	0.0020	0.0020	0.0030	0.0040	0.0060
Arsenic	0.0900	0.0900	0.1000	0.1500	0.2300
Barium	0.0080	0.0080	0.0080	0.0140	0.0220
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron	0.2500	0.2600	0.2800	0.4300	0.6600
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	0.0006
Calcium	20.3000	21.1000	23.0000	30.6000	31.9000
Chromium	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060
Cobalt	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Copper	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Iron	<0.0600	<0.0600	<0.0600	<0.0600	<0.0600
Lead	<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Lithium	<0.0040	0.0040	0.0060	0.0120	0.0210
Magnesium	1.0000	1.0000	1.1000	1.7000	2.8000
Manganese	0.0080	0.0080	0.0080	0.0130	0.0220
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	0.0003
Molybdenum	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Phosphorus	<0.0500	<0.0500	<0.0500	<0.0500	<0.0500
Potassium	3.0000	3.2000	3.5000	5.3000	8.1000
Selenium	<0.0010	<0.0010	0.0010	0.0020	0.0020
Silver	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	72.0000	76.0000	84.0000	127.0000	191.0000
Strontium	0.0030	0.0030	0.0040	0.0070	0.0130
Thallium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	0.0200	0.0200	0.0200	0.0300	0.0400
TDS	265.0000	278.0000	306.0000	455.0000	650.0000

[1] Analyte concentration result is below typical analytical detection limits. Value shown is the detection limit.

Note: All concentrations are in mg/L except for pE and pH (pH in standard units).

TDS calculated as the sum of all dissolved constituents (alkalinity was converted to HCO_3- then multiplied by 0.4917 to account for volatilization of CO_2).

4.3.5 Cumulative Impacts

The CESA for Water Quality and Quantity (Surface and Ground) and Water Use is shown in **Figure 4.3-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; these locations are shown in **Figure 2.9-1**.

Cumulative impacts for water quantity would be associated with the combined pumping at the Round Mountain and Gold Hill pits for dewatering and the continued irrigation pumping in Northern Big Smoky Valley. No additional mining projects or groundwater withdrawal projects are planned for the CESA. Cumulative impacts for water quality would be associated with the pit lakes in the Round Mountain and Gold Hill pits; seepage from the waste rock, leach pads, or tailings; and disposal of dewatering water in the Gold Hill RIB system.

The proposed Round Mountain Area expansion consists of the expansion of the Round Mountain Pit and increased dewatering required for the deeper expanded pit. For the proposed Round Mountain Area expansion, cumulative impacts for water quantity have been discussed under the Proposed Action, Maximum Groundwater Impacts. For water quality, the cumulative impacts would be the pit lake water quality of the expanded Round Mountain Pit. For the Round Mountain Area, the cumulative impacts would be 10 to 20 feet of drawdown in the Quaternary alluvium of the southern half of Northern Big Smoky Valley due to mine dewatering at the expanded Round Mountain Pit and irrigation pumping in the valley. The 10-foot groundwater drawdown isopleth would extend about 1 mile east of the proposed project area in the bedrock aquifers of the Toquima Range. Groundwater would flow from about the center of the southern part of Northern Big Smoky Valley to the expanded pit and would flow in the bedrock aquifers toward the pit over a radius of about 5,000 feet from the center of the pit. Pit lake water would be dominated by sodium bicarbonate and would exceed one or more Nevada water quality standards for fluoride, arsenic, TDS, and alkalinity (wildlife propagation only). Seepage from reclaimed waste rock dumps, heap leach pads, or the tailings impoundment facility is considered unlikely.

Cumulative impacts associated with the development of the Gold Hill Area would be those discussed in Maximum Groundwater Impacts. For water quality, the cumulative impacts would be associated with the post-mining pit lake, discussed in Predicted Pit Lake Water Quality, and disposal of dewatering water in the RIB system. Cumulative groundwater quantity impacts would be limited to the area around the Gold Hill Pit and would consist of approximately 20 feet of drawdown in Johnson springs 1 and 2, and 5 to 10 feet of drawdown near Ink House Spring. Groundwater in the bedrock volcanic aquifer would flow toward the pit over a radius of about 2,000 feet from the pit center. Water quality in the post-mining pit lake would exceed one or more Nevada water quality standards for alkalinity (wildlife propagation only), sulfate, antimony, arsenic, boron, fluoride, manganese, and TDS. The water would be dominated by sodium bicarbonate and would be elevated in sulfate. Seepage from the reclaimed waste rock dumps or heap leach pad is considered unlikely. Water discharged to the Gold Hill RIB system is expected to be similar in water quality to the alluvial groundwater beneath and near the proposed Gold Hill RIB system, and is thus not expected to degrade the water quality of the alluvial aquifer.

There are no reasonably foreseeable future actions that would affect groundwater in the CESA, which comprises the southern half of Northern Big Smoky Valley and the northern one-third of Tonopah Flat. Irrigation would be expected to continue after cessation of mining. No new mines are planned at this time for the CESA. No major groundwater withdrawal projects are presently planned for the area.

4.3.6 Monitoring and Mitigation Measures

Environmental protection measures would be implemented by RMGC as described in Section 2.5, RMGC's Environmental Protection Measures. No additional monitoring and mitigation measures are recommended for water quality and quantity (surface and ground) and water use.

4.3.7 Residual Impacts

Residual impacts would be those associated with the long-term drawdown in groundwater levels caused by evaporation from the pit lakes in the proposed expanded Round Mountain Pit and the proposed Gold Hill Pit, along with the water quality in the pit lakes that would remain indefinitely.

4.3.7.1 Round Mountain Area

Figure 4.3-16 illustrates the expected extent of the long-term residual drawdown due to evaporation from the expected pit lake. The 10-foot groundwater drawdown isopleth in the Quaternary alluvial aquifer would extend just beyond the western portion of the proposed project area. The 20-foot groundwater drawdown isopleth in the bedrock aquifers would extend approximately 1 mile east of the proposed project area and the 10-foot isopleth would extend approximately 2 miles east of the proposed project area. No major springs would be affected.

The base case scenario predicted water quality is provided in **Table 4.3-8**. The water quality at year 200 following cessation of mining would gradually increase in TDS and most constituents due to evaporation from the pit lake over time. Constituents such as TDS, arsenic, fluoride, and possibly alkalinity would continue to exceed one or more Nevada water quality standards. The water would increase in sodium bicarbonate over time after year 200 and eventually become quite alkaline in nature, with high values of sodium. The pit lake water would not be suitable for human consumption, irrigation, or use as stock water.

4.3.7.2 Gold Hill Area

Figure 4.3-16 illustrates the expected long-term drawdown adjacent to the Gold Hill Pit expected as a result of evaporation from the pit lake. The long-term drawdown in the vicinity of Johnson springs 1 and 2 would be approximately 10 to 20 feet. Drawdown in the Quaternary alluvial aquifer west of the pit would not extend beyond the proposed project area. The pit lake may become a flow-through pit lake with groundwater in the Tertiary volcanic bedrock aquifer flowing into the pit from the east, through the pit, and out of the pit to the west, with the groundwater remaining in the volcanic bedrock (**Figure 4.3-23**). The monitoring and revised groundwater modeling discussed in Section 4.3.6, Monitoring and Mitigation Measures, would assist the BLM in reevaluating the expected nature of the post-mining pit lake near the end of mining. The final long-term residual impacts of the Gold Hill Pit lake would be determined at that time.

Table 4.3-13 presents the base case scenario expected water quality for the expected pit lake. The alkalinity of the pit lake water would exceed Nevada wildlife propagation standards by year 200 and continue to increase due to evaporation from the pit lake over time. Chloride levels would reach 359 mg/L by year 200 and continue to increase with time. Sulfate, antimony, arsenic, fluoride, boron, manganese, and TDS would exceed 1 or more Nevada water quality standards by year 200 and continue to increase beyond that time due to evaporation from the pit lake. The pit lake water would not be suitable for human consumption, irrigation, or stock water use.

4.4 Cultural Resources

Primary issues pertaining to NRHP-eligible sites located within the proposed project area include: ground-disturbing activities associated with construction and operation of the proposed project; illegal collecting of artifacts and inadvertent damage to NRHP-eligible sites due to the increased numbers of people in the proposed project area during construction activities; and effects to unknown NRHP-eligible sites that may be discovered during project construction.

The NHPA requires that Federal agencies take into account the effect of a proposed undertaking on historic properties. The National PA and the Nevada Protocol govern the roles and responsibilities of the BLM, the ACHP, and the Nevada SHPO for review and comment on the undertaking and effects on historic properties. Historic property, as defined by the regulations implementing Section 106, means isoplethany prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP maintained by the NPS.isopleth Potential impacts to historic properties are assessed using the isoplethcriteria of adverse effectisopleth (36 CFR 800.5[a][1]), as defined in the implementing regulations for the NHPA. isoplethAn adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.isopleth The analysis of effects using these criteria is limited to those resources that are listed in the NRHP or have been recommended as eligible. There are five broad categories of effect: 1) physical destruction or alteration of a property or relocation from its historic location; 2) isolation or restriction of access; 3) change in the character of the property's use, or of physical features within the property's setting, or the introduction of visible, audible, or atmospheric elements out of character with the significant historic features of the property; 4) neglect leading to deterioration or vandalism; and 5) transfer, sale, or lease from Federal to non-Federal control without adequate and legally enforceable restrictions or conditions to ensure preservation of the historic significance of the property.

Under NEPA, effects to NRHP-eligible properties can be direct or indirect. Potential direct effects can include physical damage resulting from surface-disturbing activities, including access to construction areas by large machinery; development of mine facilities (e.g., open pits, waste rock dumps, heap leach pads, and tailings impoundment facilities); improvement of existing access roads; blasting vibrations; demolition activities; use of staging areas for storage of equipment and supplies; and future maintenance activities. These physical impacts can occur to both known sites and subsurface sites that could be discovered and disturbed during surface disturbing activities. Indirect effects to historic properties often are not quantifiable and can occur both within and outside of the APE. Potential indirect effects can include changes in erosion patterns due to construction, soil compaction, or vegetation removal; fugitive dust; off-road vehicle traffic associated with construction or maintenance activities; and increased vandalism, including illegal artifact collection, due to increased access. Other potential indirect effects can include the introduction of visual or auditory elements out of character with a property that disrupts the property's setting. These effects can result from introducing modern structures and associated auditory emissions into an otherwise rural or natural setting.

4.4.1 Proposed Action

Based on the results of the Class III inventories conducted in the study area, the BLM has determined that seven NRHP-eligible sites would be directly affected by the Proposed Action. The seven NRHP-eligible sites include four prehistoric lithic scatters, one historic mill complex, the Toquima Shaft, and Gold Hill Mine and Mill.

Between May 11 and 27, 2004, WCRM conducted treatment of the Gold Hill Mine and Mill and Toquima Shaft (Peterson et al. 2005). Treatment was conducted at these sites in order to mitigate any adverse effects to these resources as a result of the previously proposed Gold Hill Project and to preserve their historical values. The treatment consisted of five main tasks: 1) extensive photo-documentation of the sites and features, as well as the lands around and between them; 2) GPS mapping of the sites and features, as well as disturbances and anomalies; 3) copying and digitizing old maps to serve as layers/overlays along with the existing conditions to provide a data source for landscape analysis; 4) examination of the mine operator and previous operator's records; and 5) limited data recovery of selected features. Although these mitigation measures previously were conducted at the Gold Hill Mine and Mill and Toquima Shaft, both sites need to be re-evaluated to determine if the previous mitigation is adequate relative to the Proposed Action.

A treatment plan to mitigate effects to all of the NRHP-eligible sites would be developed by the BLM in consultation with the SHPO. Mitigation may include, but would not be limited to, one or more of the following measures: 1) avoidance through changes in the proposed project design; 2) data recovery, which may include the systematic professional excavation of the site; or 3) recordation through the Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) or other agreed upon historic recordation process. The treatment plan, developed in consultation with the SHPO, would satisfy Section 106 requirements regarding adverse effects to the NRHP-eligible sites.

The potential for the discovery of unanticipated cultural resources during construction activities exists within proposed disturbance areas and could result in adverse effects. Unanticipated discoveries would result in displacement or loss (either complete or partial) of the cultural resource involved. Displacement of cultural resources adversely affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric settlement and subsistence patterns.

If unanticipated cultural resources are discovered on BLM-administered land during construction of the mine facilities, construction would be halted in the area of the discovery, and the BLM Authorized Officer would be contacted to evaluate the find. If the site is evaluated as eligible for the NRHP, effects would be mitigated through a data recovery program or appropriate mitigation measures developed by the BLM in consultation with the Nevada SHPO (Section 2.5, RMGC's Environmental Protection Measures).

If construction or other project personnel discover what they believe to be human remains, funerary objects, or items of cultural patrimony on Federal land, construction would cease within the vicinity of the discovery and the BLM Authorized Officer would be notified of the find. Native American human remains, funerary objects, or items of cultural patrimony would be handled in accordance with NAGPRA. Non-Native American human remains would be handled in accordance with Nevada law. Construction would not resume in the area of the discovery until the BLM Authorized Officer has issued a notice to proceed.

If human remains and associated funerary objects are discovered on private land during construction activities, construction would cease within 300 feet of the discovery and the county coroner or sheriff would be notified of the find. Treatment of any discovered human remains and associated funerary objects found on private land would be handled in accordance with the provisions of applicable Nevada law.

Increases in both surface activities and the number of workers during construction could increase the potential for indirect effects to archaeological sites. Indirect effects are difficult to quantify and control; however, they can include the loss of surface artifacts due to illegal collection and inadvertent destruction. To minimize indirect effects to cultural resources from increased numbers of people in the area,

project-related personnel would be trained on site avoidance and protection measures, including information on the statutes protecting cultural resources (Section 2.5, RMGC's Environmental Protection Measures).

4.4.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on known NRHP-eligible sites and any previously unknown NRHP-eligible sites that may be discovered during project construction would be the same as described for the Proposed Action.

4.4.3 County Road Overpass Alternative

No effects of the County Road Overpass Alternative on known NRHP-eligible sites are anticipated. Potential effects to any previously unknown NRHP-eligible sites that may be discovered during project construction would be the same as described for the Proposed Action.

4.4.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and impacts to cultural resources would not occur. Under this alternative, the existing Round Mountain Mine would continue under existing authorizations.

4.4.5 Cumulative Impacts

The CESA for cultural resources is shown in **Figure 4.4-1.** Past, present, and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

As directed by law, cultural resources inventories are conducted for any actions involving Federal lands, and adverse effects to historic properties are avoided or mitigated as appropriate. Avoidance through project redesign is the preferred method of mitigation; however, when avoidance is not feasible, data recovery or other forms of mitigation are implemented prior to ground-disturbing activities. Data recovery or other appropriate mitigation would be conducted at the NRHP-eligible sites located within the proposed project APE. The treatment plan, developed in consultation with the SHPO, would satisfy Section 106 requirements regarding adverse effects to the NRHP-eligible sites.

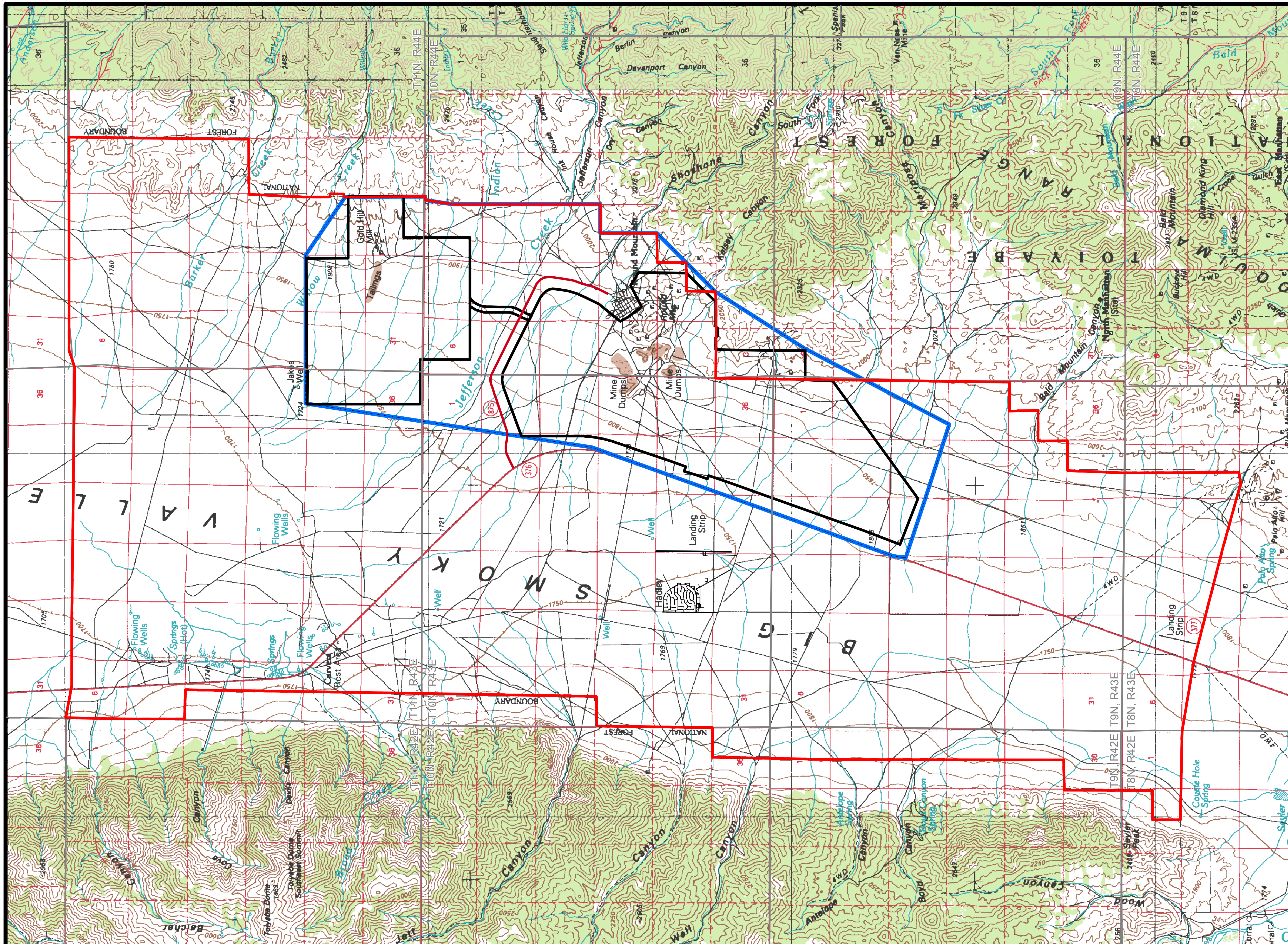
Indirect effects, such as illegal collecting of artifacts, are likely to have occurred and most likely would continue to occur in the CESA through increased access, development, and increased human presence, as a result of past, present, and RFFAs.

4.4.6 Monitoring and Mitigation Measures

All known NRHP-eligible properties identified within the APE would be mitigated in accordance with the NHPA and NEPA. Any cultural properties that may be discovered during construction activities would be reported to the BLM in accordance with RMGC's environmental protection measures as described in Section 2.5.3, Cultural Resources. Therefore, no additional mitigation or monitoring is recommended.

4.4.7 Residual Impacts

No residual effects are anticipated, as all known NRHP-eligible sites would be mitigated in accordance with the NHPA and NEPA. As described above, any cultural properties that may be discovered during construction activities would be reported to the BLM in accordance with RMGC's environmental protection measures as described in Section 2.5.3, Cultural Resources.



Legend

- Proposed Project Boundary
- CESA Boundary for Historic Sites and Features and Native American Traditional Values
- CESA Boundary for Native American (Prehistoric) Sites and Features

N

0 1 2 Miles

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

Round Mountain Expansion Project

Figure 4.4-1

Cumulative Effects Study Area for Cultural Resorces and Native American Traditional Values

05/25/2009

4.5 Native American Traditional Values

Issues of concern identified by Native Americans were associated with ground-disturbing activities that may cause inadvertent damage to significant sites during construction and mining operations, and an increased potential for illegal artifact collection.

4.5.1 Proposed Action

Direct effects to Native American traditional values could occur as a result of the Proposed Action. Areas of concern were identified by Native Americans through communication efforts between the BLM, tribal representatives, and lineal descendents. Of concern to tribal representatives and individuals were the effects of vibrations associated with haulage trucks and other types of equipment operating on the proposed haul road. The results of a vibration study conducted in June 2007 indicate that vibrations estimated for the new haul road are below the limits that could impact nearby cultural resources (Rosenhaim and Lasich 2007). Therefore, no vibration effects to cultural resources are anticipated as a result of the Proposed Action.

Indirect effects to areas of concern to the tribes could occur during construction and operation activities. These types of effects include illegal collecting of artifacts and inadvertent damage to areas of tribal concern due to increased numbers of people in the proposed project area. Native American coordination regarding potential effects to these areas and the development of appropriate mitigation measures is ongoing between the BLM Tonopah Field Office and Timbisha, Duckwater, Yomba, and Ely tribal representatives, and interested tribal individuals. No surface disturbance would occur within or immediately adjacent to the boundary of an area of tribal concern prior to completion of all consultation required by law and, as appropriate, implementation of mitigation measures developed to address effects to that resource.

4.5.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on areas of concern to the tribes would be the same as described for the Proposed Action.

4.5.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on areas of concern to the tribes would be the same as described for the Proposed Action.

4.5.4 No Action Alternative

Under the No Action Alternative, the proposed facilities would not be constructed and associated impacts to Native American Traditional Values would not occur. Under this alternative, the existing Round Mountain Mine would continue under existing authorizations.

4.5.5 Cumulative Impacts

The CESA for Native American Traditional Values is shown in **Figure 4.4-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Any mining or other ground-disturbing activities within the CESA could affect places of tribal importance in those areas. As directed by law, cultural resources inventories and government-to-government consultation would be conducted for any projects involving public lands, and adverse effects would be avoided or mitigated as appropriate. All activities associated with the proposed project would be in accordance with the NHPA and NEPA. Potential effects to tribal areas of concern and any previously unknown tribal resources that may be discovered during construction activities would be mitigated in accordance with the NHPA, NAGPRA, and NEPA. Therefore, the proposed project is not expected to contribute to cumulative effects to Native American traditional values.

4.5.6 Monitoring and Mitigation Measures

Any known areas of concern to the tribes identified in the proposed project area would be mitigated in accordance with the NHPA and NEPA. Any previously unknown tribal resources that may be discovered during construction activities would be mitigated in accordance with the NHPA and NAGPRA. Tribal representatives and/or lineal descendants, along with BLM cultural specialists, may periodically monitor identified cultural sites (pre-identified or inadvertent discovery of any new site). This monitoring could continue throughout the life of the proposed project.

4.5.7 Residual Impacts

No residual impacts to areas of concern to the tribes are anticipated as a result of the Proposed Action because any areas of concern would be protected in accordance with the NHPA, NEPA, and NAGPRA.

4.6 Hazardous Materials and Solid Waste

Primary issues related to hazardous materials and solid waste include the potential for an accident during transport of hazardous materials and potential impacts of accidental hazardous materials spills or releases.

4.6.1 Proposed Action

4.6.1.1 Project-related Hazardous Materials

The proposed project would require the transport, handling, storage, use, and disposal of materials classified as hazardous under various regulatory frameworks. All hazardous materials would be shipped to and from the proposed project area in accordance with applicable USDOT hazardous materials regulations. All shipping containers and vehicles would be USDOT-approved for the specific materials. The proposed rates of use and storage volumes of these substances are listed in **Table 2.4-7**. A brief description of the storage, use, and transportation of hazardous materials during operations under the proposed project is presented in Sections 2.4.3.8 and 2.4.4.9, Ancillary and Support Facilities.

Important issues related to the presence of hazardous materials at the proposed facilities include the accidental release of hazardous materials during transport to the study area or a release related to use or storage at the proposed project area. The criterion for evaluating hazardous materials impacts is the risk of a potential spill, and associated impacts to sensitive receptors along transportation routes or exposure pathways.

If some of the chemicals identified for use during the life of the proposed project were to enter the environment in an uncontrolled manner, there could be associated direct or indirect adverse effects. The environmental effects of a release would depend on the substance, quantity, timing, and location of the release. The spill event potentially could range from a minor oil spill in the proposed project area where cleanup equipment would be readily available, to a large spill during transport involving a release of sodium cyanide solution. Some of the chemicals could have immediate, but short-term destructive effects on aquatic resources and water quality if spills were to enter waterways such as the Reese River. Spills of hazardous materials could seep into the ground and contaminate the local groundwater. Depending on the proximity of such spills to populated areas or the use of degraded water for human consumption, such accidental spills could affect human health.

Transportation

Trucks would be used to transport hazardous materials to the proposed project area. Based on the quantity, number of deliveries, and potential hazard, the materials of greatest concern would be sodium cyanide solution, sodium hydroxide solution, and diesel fuel. These chemicals most likely would be supplied from Elko or Winnemucca, Nevada. The most likely transportation route would be on I-80 from Elko or Winnemucca to SR 305 (Battle Mountain), and then south on SR 305 to U.S. Highway 50, then south on SR 376 to the proposed project area. As a result, this analysis of transportation hazards is confined to trucking along the route south of I-80. The Reese River would be the major surface water body along this transportation route. The distance along the route from I-80 to Round Mountain is 154 miles. Transportation mileage on I-80 is not included, where project-related trucks would be a very small percentage of the total truck volume.

Another likely transportation route is from Las Vegas, Nevada, to Tonopah via SR 95, then to SR 376 from U.S. Highway 6, then along SR 376 to the proposed project area for a total of about 266 miles. The major water body near this route is the Amargosa River (**Figure 4.6-1**). The transportation hazard analysis was completed using the northerly route since, as in the case of I-80, the mine-related traffic on SR 95 would be a small percentage of the overall traffic along that major state route.

Based on the annual consumption rates shown in **Tables 2.4-7** and **2.4-9**, an approximate load delivery frequency for the materials can be determined. This analysis would consider the time period (2009 to 2016) when maximum consumption of hazardous materials would occur, when Round Mountain and Gold Hill areas are operating simultaneously. **Table 4.6-1** displays the annual consumption rates for both mines of the materials of concern.

Table 4.6-1
Potential Number of Mine-related Transportation Accidents Involving a Release

Material	Annual Usage[1]	Shipment Quantity	Number of Shipments[2]	Distance (miles)	Accident Rate per Million Miles[3]	Calculated Number of Accidents (distance) x (accident rate/ 1.0 million miles)	Probability of Release per Accident[4]	Calculated Number of Potential Releases
Sodium Cyanide	3,633,400 gallons	3,100 gallons	9,736	1,499,344	0.5	0.75	0.36	0.27
Sodium Hydroxide	525,000 gallons	2,900 gallons	1,460	224,840	0.23	0.05	0.30	0.02
Diesel Fuel	15,834,000 gallons	10,000 gallons	12,667	1,950,748	0.13	0.25	0.28	0.07

[1] Projected combined usage and shipment at Round Mountain and Gold Hill operations (2009 to 2016).

[2] Time period is 2009 to 2016.

[3] Includes release and non-release accidents.

[4] Releases during accidents; does not include loading and unloading incidents (Battelle 2001).

In order to evaluate the potential impact of the transportation of hazardous materials to the proposed project area, the risk of a transportation accident resulting in a release of hazardous materials was estimated. Accident rates were derived from national statistics for truck accidents that involve hazardous materials as published by the Federal Motor Carrier Safety Administration (Battelle 2001). Estimated accident rates vary for different categories of hazardous materials and are based on 1996 data and include accidents involving releases and non-releases of hazardous cargo. The accident rate involving the category of toxics such as sodium cyanide is 0.50 per million miles traveled. The accident rate for corrosive materials such as sodium hydroxide is 0.23 per million miles traveled. The accident rate involving flammable materials (including diesel fuel) is 0.13 per million miles traveled. Using these rates, the potential number of transportation related incidents for these three materials occurring over the life of the proposed project is shown in **Table 4.6-1**. The potential number of releases shown in the table indicates that there would be a low

probability of an accident involving the release of hazardous materials during the peak operational period of the proposed project.

Hazardous substances would be transported by commercial carriers or vendors in accordance with Federal requirements (CFR 49 parts 300-399). Carriers would be licensed and inspected as required by NDOT and USDOT. Tanker trucks would be inspected and would have a Certificate of Compliance issued by the Nevada Motor Vehicle Division. These permits, licenses, and certificates are the responsibility of the carrier. Federal regulations require that all shipments of hazardous materials be properly identified and placarded. Shipping papers must be accessible and must include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

In the event of a release during transport to the proposed project area, the transportation company would be responsible for response and cleanup. Each transportation company is required to have an emergency response plan to address spills and accidental releases of hazardous materials. Local and regional law enforcement and fire protection agencies also may be involved initially to secure the site and protect public safety. Federal regulations (33 CFR part 153, 40 CFR part 110, and 49 CFR part 130) requires that the carrier notify local emergency response personnel, the National Response Center (for discharge of reportable quantities of hazardous substances), and the USDOT in the event of an accident involving hazardous materials.

Storage and Use

RMGC's Spill Response Plan (SRP) describes the required level of containment and safety measures associated with storage, handling, and spill clean-up of oil (includes but is not limited to petroleum, fuels, sludge, used oil, and mineral oil). Operations conducted in accordance with this plan would ensure that impacts from spills would be minimized and the spilled materials contained and removed. RMGC would have the necessary spill containment and cleanup equipment available in the proposed project area, and personnel would be able to quickly respond.

Particular provisions of a SRP include the following:

- Appropriate containment and diversionary structures including berms, containment ponds, retaining walls, and collection systems.

- A commitment of manpower and equipment to expeditiously control oil that is released in "harmful quantities."

- A complete discussion of all regulations and procedures that apply to facility drainage, bulk storage tanks, facility transfer operations, pumping and in-plant processes, facility tank truck loading/unloading operations, inspections and records, security, and personnel training requirements.

In the event of a major or minor spill of non-oil hazardous materials occurring within or from facilities located in the proposed project area, RMGC's SRP establishes procedures for preventing, controlling, and reporting environmental releases. The SRP would have the following information concerning the facility and emergency response procedures:

- A hazard evaluation;
- Response planning levels;
- Facility response training drills/exercises;
- Description of discharge protection systems;
- The identity and telephone number of the designated qualified individual having authority to implement removal activities;
- The identity of individuals to be contacted;
- A description of information to be passed to response personnel;
- A description of response equipment and location;
- A description of response personnel capabilities and duties;
- Evacuation plans as appropriate;
- A description of immediate containment measures; and
- A diagram of the facility.

The existing and proposed processing facilities that would be used as part of the proposed project were designed to minimize the potential for an upset that could result in a major spill. These facilities are described in Section 2.3, No Action Alternative, and Section 2.4, Proposed Action. The SRP would continue to be implemented for the proposed project to provide the structures, procedures, and training to minimize the impacts of a potential spill of a hazardous material.

Hazardous substances would be handled in accordance with applicable MSHA or OSHA regulations (Titles 30 and 29 of the CFR). The hazardous materials to be used for the proposed project would be handled as recommended on the manufacturer's Material Safety Data Sheets (MSDS). Based on the facility's design features and the operational practices in place, the probability of a major release occurring in the proposed project area during the life of the proposed project is considered to be low.

Potential Effects of a Release. The environmental effects of a release would depend on the material released, quantity released, and location of the release. The accident/release statistics presented in **Table 4.6-1** assume an accident involving a hazardous material transporter, but do not address volume or location. Potential releases could include a small amount of diesel fuel spilled during transfer operations in the proposed project area or the loss of several thousand gallons of sodium hydroxide, diesel fuel, or sodium cyanide into a riparian drainage. In general, the materials of greatest concern would be sodium cyanide, sodium hydroxide, and diesel fuel.

A large-scale release of fuel, corrosives, or cyanide would have implications for public health and safety. The location of the release would again be the primary factor in determining its importance. A release in a

populated area could have effects ranging from simple inconvenience during cleanup to potential loss of life if an explosion and fire were involved. However, the probability of a release anywhere along a transportation route is very small, the probability of a release within a populated area is smaller, and the probability of a release involving an injury or fatality is smaller still. USDOT statistics show that for the State of Nevada between 1993 and 2007, 0.01 injuries or deaths occurred for each hazardous materials highway incident (USDOT 2008). It is not anticipated that a release involving severe effects to human health or safety would occur during the life of the proposed project. None of the process chemicals or fuels to be used in large quantities are carcinogenic. As a result, no increases in cancer risk as a result of a release or mining activity are expected.

The release of a hazardous material or waste into a sensitive area (e.g., stream, wetland, or populated area) is judged to be very unlikely. Again, depending on the material released, the amount released, and the location of the release, an accident resulting in a release could affect soils, water, biological resources, and people.

Response to a Release. All spills, including transportation and loading/unloading spills occurring in the proposed project area, would be cleaned up as soon as possible. If a spill exceeds Federal reportable quantities, it would be reported to the Nevada Division of Emergency Management, NDEP-BMRR, National Response Center, BLM, and Nye County Emergency Response Coordinator.

In the event of a release en-route to the proposed project area, the transportation company would be responsible for response and cleanup. Law enforcement and fire protection agencies also may be involved to initially secure the site and protect public safety.

Hazardous materials transporters are required to maintain an emergency response plan, which details the appropriate response, treatment, and cleanup for a material spilled onto land or into water. For example, a release of nitric acid could require neutralizing the spill with lime, flushing the area with water, or removing contaminated soil. Specific procedures would be developed for fuels, acids, and other hazardous materials. Any cleanup would be followed by appropriate restoration of the disturbed area, which could include replacing removed soil, seeding the area to prevent erosion, and the return of the land to its previous use.

4.6.1.2 Project-related Hazardous and Solid Waste

The procedures for storage, containment, transportation, and handling of hazardous waste and solid waste would be in accordance with applicable rules governing the generation, accumulation, transportation, and disposal of such materials.

Non-hazardous solid waste would be disposed in the proposed or existing waivered Class III landfills. Petroleum-contaminated soils would be managed at existing bioremediation facilities or in accordance with an NDEP-approved petroleum contaminated soil plan.

4.6.2 Gold Hill Processing Alternative

The processing of all Gold Hill ore at Gold Hill would result in a decrease in haulage of ore and less fuel consumption. Implementation of the Gold Hill Processing Alternative would result in reductions of fuel consumption. For the life of the project, these savings would be approximately 2,950,000 gallons of reduced fuel consumption (about 2.05 percent). Given the low probability of a transportation-related spill, lower fuel consumption would further reduce the probability of a spill event. Management and storage of hazardous

material would be the same as described for the Proposed Action. The SRP and training would provide the training and facility infrastructure to minimize the potential effects of a hazardous materials spill. Under this alternative, non-hazardous solid waste would continue to be disposed in the currently permitted waivered Class III landfills and proposed Gold Hill landfill.

4.6.3 County Road Overpass Alternative

The effects of the County Road Overpass Alternative on hazardous materials and solid wastes resources would be the same as described for the Proposed Action.

4.6.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the potential for release of hazardous materials as a result of the proposed project would not occur. The transportation, storage, use, and disposal of hazardous materials at the existing Round Mountain Mine would continue to operate under existing authorizations. However, the amounts of hazardous materials would be less than what is identified for the Proposed Action. As a result, the likelihood of a hazardous material release during transportation would be less than the Proposed Action. In addition, the existing facilities have a SRP in place that would provide the training and facility infrastructure to minimize the potential effects of a hazardous materials spill. Under the No Action Alternative, non-hazardous solid waste would continue to be disposed in the currently permitted waivered Class III landfills.

4.6.5 Cumulative Impacts

The CESA for hazardous materials and solid waste is shown in **Figure 4.6-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

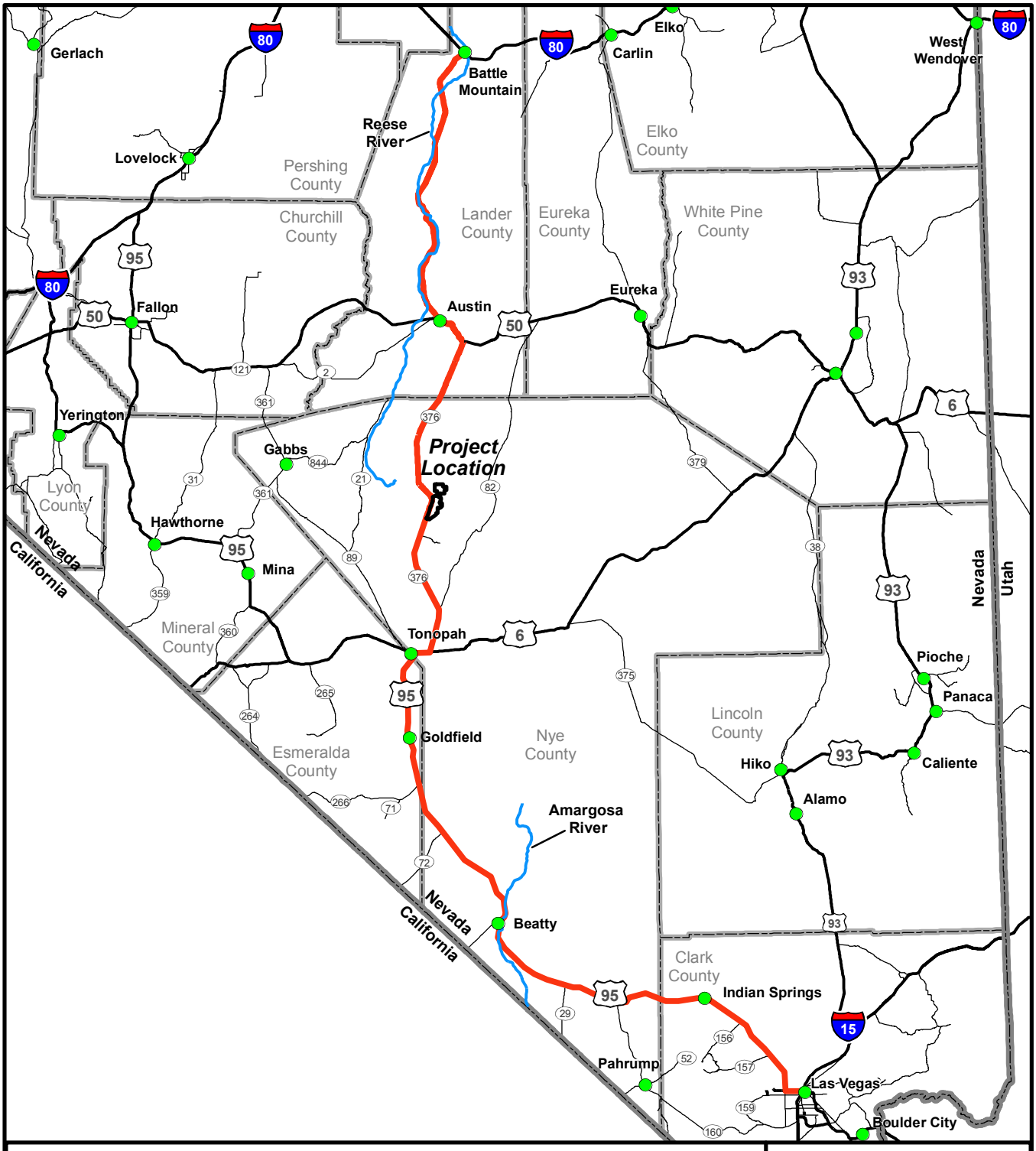
The Proposed Action would increase the amount of hazardous materials transported, stored, and consumed on site by 25 to 50 percent. However, even with an increase of hazardous materials being transported to the proposed project area under the Proposed Action, there still would be a low probability of a potential release. Given the low probability of a hazardous materials release and based on proper implementation of the SRP, potential for cumulative impacts resulting from a release of hazardous material under the Proposed Action would be low.

The SRP for the existing Round Mountain Mine and implementation of such plans for the proposed project also would minimize the potential impacts of a spill or release of hazardous materials.

No other RFFAs have been identified in the Big Smoky Valley area. Ongoing mineral exploration in the area mainly would result in the consumption of fuels and lubricants and would represent only a fraction of the consumption and use of an operating mine.

4.6.6 Monitoring and Mitigation Measures

Based on compliance with current statutes and regulations that govern the transportation, storage, use, and disposal of hazardous materials and the disposal of solid wastes, no additional monitoring or mitigation measures are recommended for hazardous material and solid wastes.



Legend

- Proposed Project Boundary
- CESA Route for Hazardous Materials and Solid Wastes
- City or Town

N

0 10 20 30 40 Miles

Round Mountain Expansion Project

Figure 4.6-1

Cumulative Effects Study Route for Hazardous Materials and Solid Wastes

05/05/2009

4.6.7 Residual Effects

Residual effects resulting from the use of hazardous materials under the Proposed Action would depend on the substance, quantity, timing, location, and response involved in the event of an accidental spill or release. Operation in accordance with the facility's SRP, and prompt cleanup of potential spills and releases, would minimize the potential of residual effects due to an accidental spill or release of hazardous materials. Reagents such as sodium cyanide can be acutely toxic, but do not persist in the environment for long periods of time. Modern regulations that govern the transportation, storage, use, and disposal of hazardous materials have greatly reduced the potential for residual effects due to hazardous materials.

Proper disposal of non-hazardous solid waste in the waivered Class III landfills according to standards would minimize residual effects with regard to such materials.

4.7 Air Quality

Primary issues related to air quality include potential impacts associated with project-generated air emissions.

4.7.1 Proposed Action

The proposed project would include the expansion of the Round Mountain project boundary by approximately 3,122 acres to a total of 10,385 acres. The Gold Hill project boundary area (including the Transportation/Utility Corridor) would consist of approximately 4,994 acres. The total proposed project boundary would be approximately 15,379 acres, and the total surface disturbance would be approximately 4,698 acres. The proposed project would include several activities that would cause fugitive emissions. These activities include expansion of the existing Round Mountain Pit and the excavation of the proposed Gold Hill Pit, expansion of the existing North Waste Rock Dump and construction of two new waste rock dumps, expansion of stockpile areas, construction of the Transportation/Utility Corridor between the Round Mountain and Gold Hill areas, construction of internal haul and secondary roads, and other construction activities.

Regulatory Framework and Associated Impacts. Ambient air quality and the emission of air pollutants are regulated under both Federal and State of Nevada laws and regulations.

Federal Clean Air Act. The Federal CAA, and the subsequent Federal Clean Air Act Amendments of 1990 (CAAA), require the USEPA to identify National AAQS (NAAQS) to protect public health and welfare. The CAA and the CAAA established NAAQS for seven pollutants, known as “criteria” pollutants. The ambient standards set for these pollutants satisfy “criteria” specified in the CAA.

The USEPA has developed classifications for distinct geographic regions. An area is classified as in “attainment” if the area has “attained” compliance with the NAAQS for that pollutant. It is classified as “non-attainment” if the levels of ambient air pollution exceed the NAAQS for that pollutant. If the monitored pollutants have fallen from non-attainment levels to attainment levels, it is classified as “maintenance.”

The CAA directs the USEPA to delegate primary responsibility for air pollution control to state governments, which comply with certain minimum requirements. State governments, in turn, often delegate this responsibility to local or regional governmental organizations. The SIP was originally the mechanism by which a state set emission limits and allocated pollution control responsibility to meet the NAAQS. The function of a SIP broadened after passage of the CAAA and now includes the implementation of specific technology-based emission standards, permitting of sources, collection of fees, coordination of air quality planning, and prevention of significant deterioration of air quality within regional planning areas and statewide. Section 176 of the CAA, as amended, requires that Federal agencies must not engage in, approve, or support in any way any action that does not conform to a SIP for the purpose of attaining AAQS.

Nevada State Air Quality Program. The BAPC is the agency in the State of Nevada that has been delegated the responsibility for implementing a SIP (excluding Washoe and Clark counties, which have their own SIP). Included in the SIP are the State of Nevada air quality permit programs (NAC 445B.001 through 445B.3497, inclusive). The Nevada AAQS also are part of the SIP. Areas for which sufficient ambient monitoring data are not available are designated as “unclassified” for those particular pollutants.

In addition to the designations relative to attainment of conformance with the NAAQS, the CAA requires the USEPA to place selected areas within the U.S. into one of three classes, which are designed to limit the deterioration of air quality when it is "better than" the NAAQS. Class I is the most restrictive air quality category. It was created by Congress to prevent further deterioration of air quality in National Parks and Wilderness of a given size, which were in existence prior to 1977, or those additional areas that have since been designated Class I under Federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I boundaries were designated Class II areas, which allow a relatively greater deterioration of air quality, although still below NAAQS. No Class III areas have been designated.

Federal PSD regulations limit the maximum allowable increase in ambient particulate matter in a Class I area resulting from a major or minor stationary source to 5 $\mu g/m^3$ (annual geometric mean) and 10 $\mu g/m^3$ (24-hour average). Increases in other criteria pollutants are similarly limited. Specific types of facilities (listed facilities) that emit, or have the potential to emit, 100 tons per year (tpy) or more of total particulate matter, PM_{10}, or other criteria air pollutants, or any facility that emits, or has the potential to emit, 250 tpy or more of total particulate matter, PM_{10}, or other criteria air pollutants, are considered major stationary sources. Major stationary sources are required to notify federal land managers of Class I areas within 100 km (62 miles) of the major stationary source. There are no Class I areas within 100 km of the study area. The nearest Class I planning area to the study area, the Jarbidge Wilderness, is located approximately 190 km (118 miles) northeast of the study area. Neither the air pollutant emission sources at the Round Mountain Mine, nor the Proposed Action emission sources, are major stationary sources subject to PSD regulatory requirements.

4.7.1.1 Sources of Air Pollutants

Air quality in the study area would be affected by both construction and operation of mining facilities. Construction activities associated with mine development would cause an increase in fugitive and gaseous emissions in the local area. Dust generated from these open sources is termed "fugitive" because it is not discharged to the atmosphere in a confined flow stream (e.g., stack, chimney, or vent). Increases in local fugitive dust levels would result in temporary localized air quality impacts.

In addition to fugitive dust, the proposed expansion would cause fugitive hydrogen cyanide (HCN) emissions from new leach facilities, including leach pads, process ponds, tailings disposal, reagent storage, and a carbon adsorption facility. HCN emissions from these new activities and all existing activities have been quantified and are below 10 tpy.

In the Round Mountain Area, proposed operations would expand to include underground mining, which is classified as a trivial activity. Associated with the underground mining is a new cemented rockfill batch plant and a new shotcrete batch plant. The rockfill batch plant would consist of a cement/shotcrete/fly ash silo, an aggregate bin, a sand bin, a weigh hopper, and a central mixer. The silo would be pneumatically loaded and controlled with a vent filter and would discharge through a sealed transfer to a screw conveyor. The aggregate and sand bins would discharge through enclosures to screw conveyors with enclosures for conveyor transfers. The weigh hopper and central mixer would load through enclosures. The shotcrete batch plant would consist of a cement/shotcrete/fly ash silo, which would be pneumatically loaded and controlled with a vent filter and would discharge through a sealed transfer to a screw conveyor, and a shotcrete mixer truck with enclosed loading.

Also associated with the proposed expansion in the Round Mountain Area are two new lime silos, which would be pneumatically loaded and controlled with vent filters and would discharge through sealed transfers to screw conveyors. The Round Mountain Area expansion also would include duplicating the existing milling

facilities to increase the milling throughput capacity. The milling operations are wet processes and are not a source of air emissions. The proposed new processing facilities in the Gold Hill Area would consist of a heap leach facility, a Merrill-Crowe plant, a retort, and a refinery. A majority of the ore from the proposed Gold Hill Pit would be processed at the new Gold Hill facilities; however, depending on the metallurgical characteristics, some ore may be hauled to the Round Mountain Area for processing.

In the Gold Hill Area, uncrushed ore would be hauled to the new heap leach pad for conventional cyanide leaching. To maintain a proper pH of the pad, lime would be added to the ore prior to leaching and milk-of-lime may be added to the leach pad. The new leach facilities would include two new lime silos, which would be pneumatically loaded and controlled with vent filters and would discharge through sealed transfers to screw conveyors.

The Merrill-Crowe precipitation process is a potential source of fugitive emissions of HCN only and, therefore, does not require permitting in specific terms. Filter cake formed by the precipitate would be retorted to remove mercury. The mercury retort would be controlled with a condenser and carbon filter to control mercury emissions. The retort product would be refined in the induction furnace. The furnace stack would be controlled by a baghouse and/or wet scrubber and subsequent carbon filter to reduce particulate and mercury emissions. In addition, mercury inhibitor reagents may be added to limit the dissolution of mercury.

The facility-wide potential to emit shown in **Table 4.7-1** is a summary of all stationary source emissions including the insignificant activity emissions.

Table 4.7-1
Facility-wide Potential to Emit

Pollutant	Amount (tpy)
Total Particulate Matter	139.86
Particulates as PM_{10}	71.12
Sulfur Dioxide	11.27
Carbon Monoxide	21.89
Oxides of Nitrogen	87.77
Volatile Organic Compounds	7.07
Lead	N/A
Hazardous Air Pollutants (HAPs)	<25 in aggregate <10 per single HAP

Source: Air Sciences Inc. 2008b.

No individual HAP (including mercury) would be emitted in a quantity greater than the major source limit of 10 tpy. Also, the combined HAP emissions would be less than the major source limit of 25 tpy. Therefore, the proposed project would not constitute a major HAP source.

In general, all surface-disturbing activities in the proposed project area would be conducted using best practical methods to prevent particulate matter from becoming airborne. Best practical methods include, but are not limited to, paving, chemical stabilization, watering, phased construction, and re-vegetation.

Table 4.7-2 provides the total mercury emissions for Round Mountain reported to the BAPC for the years 2007 (NDEP 2007b) and 2008 (NDEP 2008c). Stack testing used USEPA Method 29. Reductions in 2008 emissions from the carbon kiln and furnace reflect the installation of mercury emission controls in early 2008. Each unit was equipped with a dynamic wet scrubber followed by a deep bed sulfur-impregnated carbon filter. The minimum control efficiency expected for these filters is 90 percent. As a result, emissions for 2008 are significantly lower than 2007 and also are provided in **Table 4.7-2**.

Table 4.7-2
Round Mountain Total Current Mercury Emissions

Source Description	Total Mercury (lb/yr)
2007 Emissions (USEPA Method 29)	
Carbon kiln	47.60
Furnace	13.90
Deminimis equipment	3.06
2007 Facility Total	**64.56**
2008 Emissions	
Carbon kiln	3.96
Furnace	1.29
Deminimis equipment	3.06
2008 Facility Total	**8.31**

Source: RMGC 2008b.

Control of mercury air emissions would be provided by the installation of controls that would be negotiated with NDEP as part of the permitting process pursuant to the NMCP. Controls installed would meet the NVMACT standard. Mercury inhibitor reagents may be added to leach solutions to encourage precipitation of mercury in the Gold Hill Area.

Appropriate air quality permits would be obtained from the NDEP/BAPC for the proposed facilities and land disturbance. Based on BAPC regulations, the project air quality operating permit must be authorized by NDEP/BAPC prior to project commissioning. Should USEPA issue MACT standards addressing mercury emissions from gold mining procedures, depending on the scope of any future MACT, the proposed facility may potentially be subject to MACT standards.

Energy Requirements and Greenhouse Gases

The estimated fuel and electrical power consumption for the Proposed Action are provided in **Table 4.7-3**. In accordance with Nevada law, 15 percent of the electrical power consumed by Round Mountain would continue to come from renewable energy sources, increasing from 11 percent in 2009 to 15 percent in 2013 and thereafter (Nevada State Legislature 2008).

Table 4.7-3
Fuel and Power Consumption – Proposed Action

Year	Annual Fuel Consumption[1] (gallons)	Annual Power Consumption[1] (megawatt-hour)	Annual GHG Emission (tons)[2]
2010	13,430,016	162,669	227,336
2014	14,415,225	221,525	273,284
2018	13,011,531	218,331	258,136
2022	3,853,892	87,638	90,787

[1] Source: RMGC 2008b

[2] GHGs are reported in accordance with the Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard, which does not include NO_x and O_3 (March 2004).

Recent scientific evidence suggests there is a direct correlation between global warming and emissions of GHG. The USEPA has identified CO_2, methane, N_2O, and fluorinated gases (hydrochlorofluocarbons, chlorofluorocarbons, and halons) as the principal GHGs that enter the atmosphere due to human activities (USEPA 2009). Although many of these gases occur naturally in the atmosphere, man-made sources substantially have increased the emissions of GHGs over the past several decades. Of the man-made GHGs, the greatest contribution currently comes from CO_2 emissions.

GHG emissions associated with the proposed project primarily would be associated with the consumption of energy for mining and ore processing over the 13-year mine life. Operations that would contribute to GHG emissions would include:

- Fuel consumption (vehicles and machinery); and
- Electricity consumption (machinery, milling, heap leach water circulation, dewatering).

The current national annual emissions of GHGs is approximately 8 billion tons (USEPA 2008). Under the Proposed Action during the expected peak production Year 2014, the proposed project would emit approximately 275,000 tpy of GHGs, or approximately 0.0034 percent of the national annual emissions.

While global and national inventories are established, regional and state-specific inventories are in varying levels of development. Quantification techniques are in development. For example, there is a good understanding of climate change emissions related to fuel usage; however, measuring and understanding the effects of albedo is less comprehensive. Analytical tools necessary to quantify climatic impacts are presently unavailable. As a consequence, impact assessment of specific effects of anthropogenic activities cannot be determined.

4.7.1.2 Air Pollution Control Measures

Committed air quality practices would include dust control for mine unit operations as described by the BAPC-required Dust Control Plan. In general, the Dust Control Plan would provide for water application to haul roads and other disturbed areas; chemical dust suppressant application (such as magnesium chloride)

where appropriate; and other dust control measures as per accepted and reasonable industry practice. Also, disturbed areas would be seeded with an interim seed mix to minimize fugitive dust emissions from un-vegetated surfaces where appropriate.

Fugitive emissions in the process area would be controlled at the crusher and conveyor drop points by using water sprays where necessary. Other process areas requiring dust or emission controls include the laboratory and refinery. Appropriate emission control equipment would be installed and operated in accordance with the construction and operating air permits.

RMGC would be required to comply with all applicable controls on capital diesel particulate matter (DPM). Where required, pollution control devices installed by equipment manufacturers would control combustion emissions. Thermal processing units with the potential to emit mercury at levels above de minimis levels would be permitted by NDEP. Emissions from these units would be subject to the NVMACT evaluation process as required by the NMCP. Pollution control equipment would be installed, operated and maintained in good working order to minimize emissions.

Mining activities would control fugitive dust in accordance with the Fugitive Dust Plan submitted on April 10, 2003. RMGC proposes to revise its Class II Operating Permit (AP1041-0444.01) to expand existing operations in the Round Mountain Area and to develop mining and leaching operations in the Gold Hill Area.

4.7.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on air quality resources would be the similar to those described for the Proposed Action, except that GHG emissions would be reduced by approximately 30,500 tons (about 2.05 percent), as a result of lower fuel consumption and fugitive emissions from fewer trips by haul trucks.

4.7.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on air quality resources would be the same as described for the Proposed Action.

4.7.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the associated impacts would not occur. The existing Round Mountain Mine would continue to operate under current authorizations. **Table 4.7-4** provides the annual fuel consumption, power consumption, and GHG emissions for the No Action Alternative.

4.7.5 Cumulative Impacts

The CESA for air resources is shown in **Figure 4.7-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Because no local impacts from mercury would occur as a result of the Proposed Action, there would be no associated cumulative impacts. However, a brief descriptive discussion of mercury issues may be informative for the reader.

Table 4.7-4
Fuel and Power Consumption – No Action Alternative

Year	Annual Fuel Consumption[1] (gallons)	Annual Power Consumption[1] (megawatt-hour)	Annual GHG Emission (tons)[2]
2010	13,430,016	162,699	227,336
2014	13,228,461	162,618	225,415
2018	12,173,332	159,062	213,309
2022	636,911	97,660	66,853

[1] Source: RMGC 2008.

[2] GHGs are reported in accordance with the Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard, which does not include NO_x and O_3 (March 2004).

Mercury is generally present in the atmosphere in one of three chemical forms: gaseous elemental mercury, reactive mercury, and particulate mercury. Typical atmospheric mercury concentrations in northern latitudes normally range between 0.0000015 and 0.000005 milligrams per cubic meter (mg/m^3), and typical atmospheric concentrations do not pose a breathing hazard. The OSHA has set exposure limits of 0.05 mg/m^3 for elemental mercury vapor for 8-hour shifts and 40-hour weeks or about 10,000 to 30,000 times the typical atmospheric concentrations.

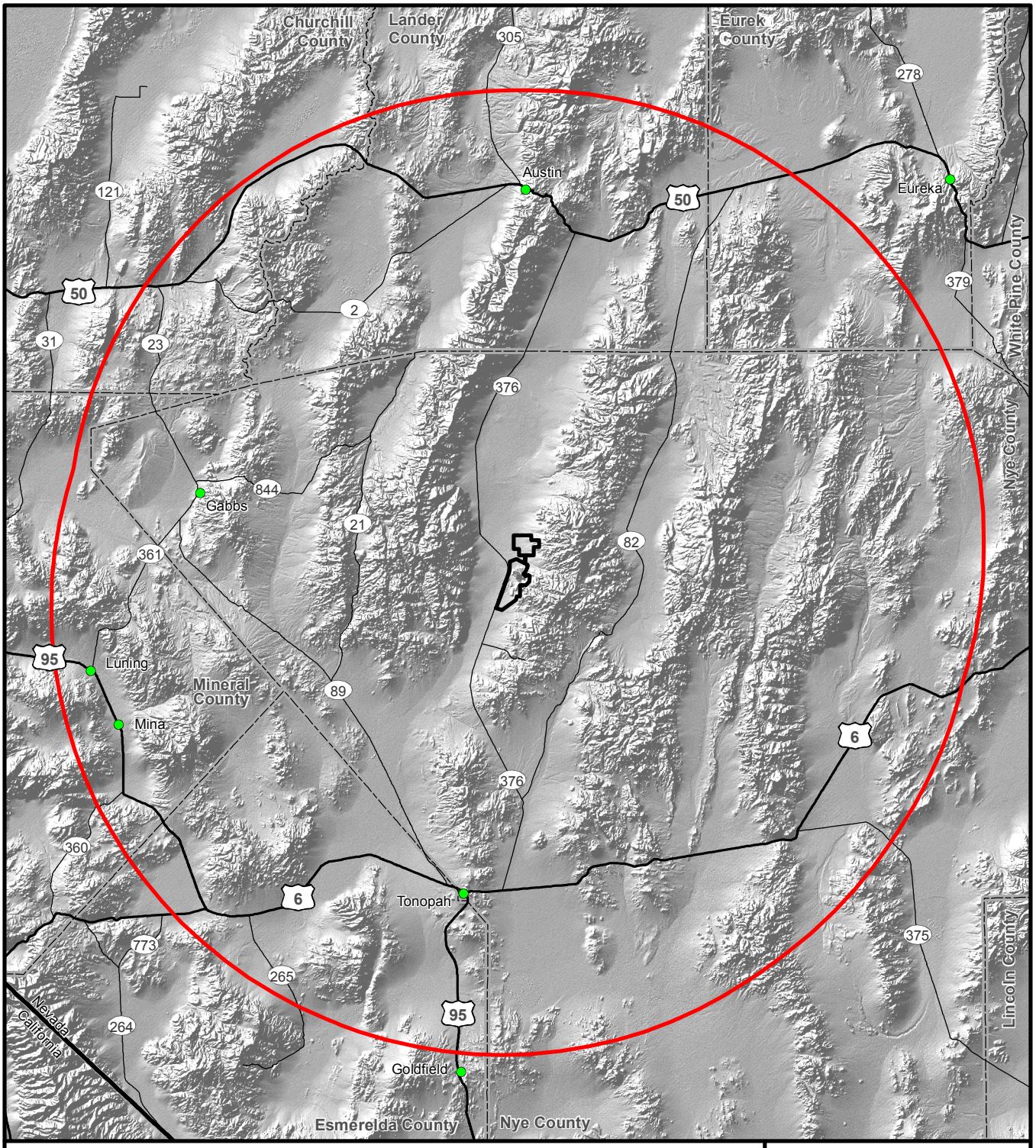
Most of the mercury being emitted from mine sites is gaseous elemental mercury. In terms of toxicity, gaseous elemental mercury vapors (with exposure by inhalation) and methyl mercury (with exposure by ingestion) are two of the most harmful species. Elemental, reactive, and particulate forms of mercury are emitted from mines in Nevada. But concentrations of all forms of mercury in the free atmosphere in the vicinity of the mine do not approach levels that would be considered hazardous to human health. Exposure through inhalation is extremely rare and typically associated with industrial exposure of employees that work directly with mercury.

Methyl mercury is not emitted from any mine source. However, once mercury is released into the atmosphere, it can travel long distances. Mercury in the air eventually settles into water or onto land where it can be washed into water. Once deposited in a water body, certain microorganisms can change it into methyl mercury, a highly toxic form that builds up in fish, shellfish, and animals that eat fish. Fish and shellfish are the main sources of methyl mercury exposure to humans.

In Nevada, the largest source of atmospheric mercury is caused from processing gold through precious metal mines operations. The main anthropogenic sources in the Northern Nevada Region are other gold mines and a coal-fired power plant.

4.7.5.1 Nevada State-wide Mercury Impacts

Figure 4.7-2 provides the mercury deposition contributions from the mercury emissions from the "other gold mines" category as a percentage of the total deposition (including global background) to each watershed in Nevada. The AggreGATOR does not provide a category for Round Mountain specifically as it does for other mines (e.g., Cortez, Goldstrike, etc.). Thus, the deposition can only be viewed for the combined emissions from Round Mountain and the other nine mines in the "other gold mines" category. The best representation



Legend

Es Id C

- Proposed Project Boundary
- CESA Boundary for Air Quality
- City or Town

N

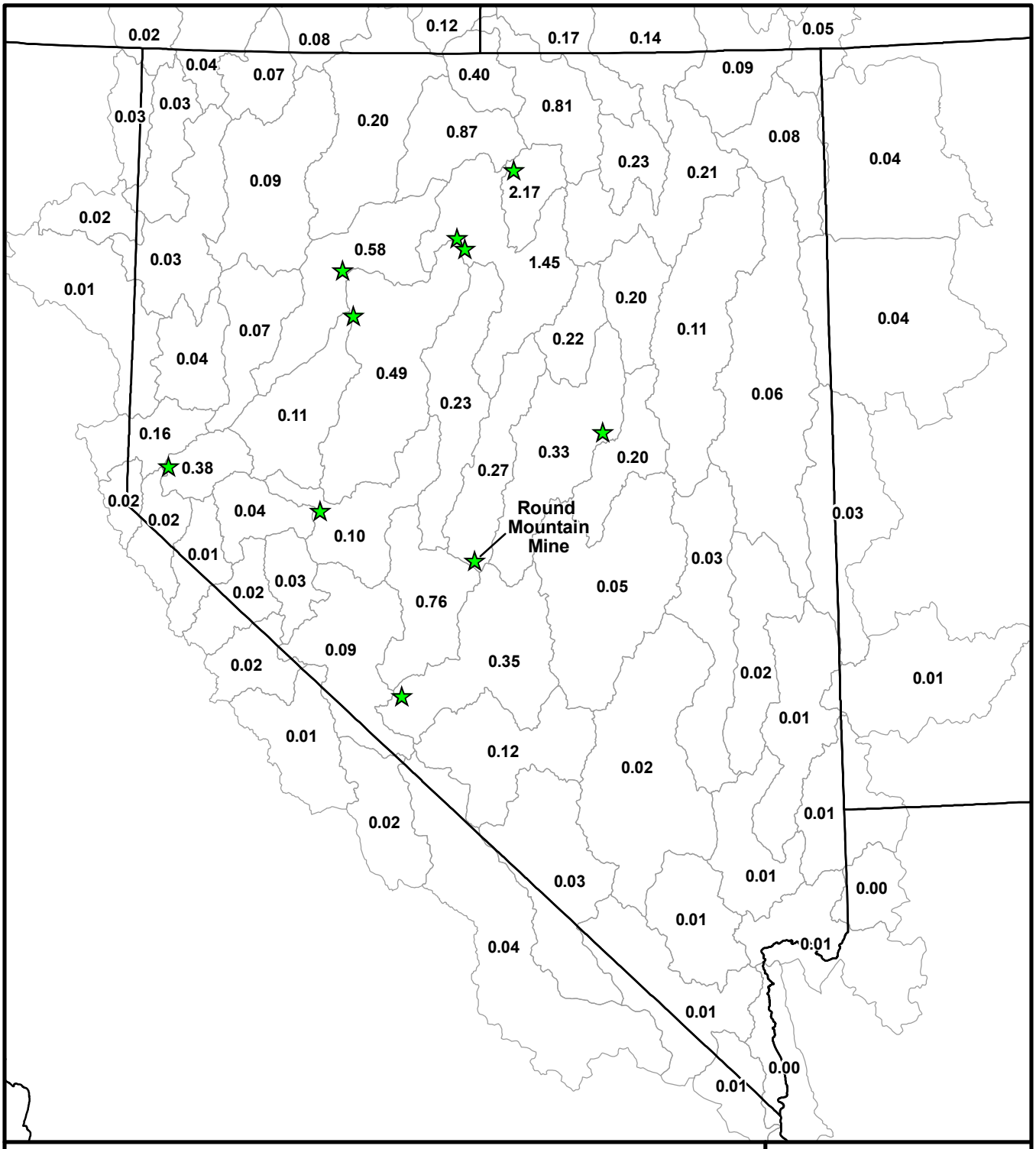
0 5 10 20 Miles

Round Mountain Expansion Project

Figure 4.7-

Cumulative Effects Study Area for Air Quality

04/11/2009


0.02
0.08
0.12
0.17
0.14
0.05
0.04
0.07
0.40
0.09
0.03
0.03
0.20
0.81
0.87
0.08
0.04
0.09
2.17
0.23
0.21
0.02
0.03
0.58
1.45
0.01
0.20
0.04
0.07
0.22
0.11
0.04
0.49
0.06
0.23
0.11
0.16
0.33
0.20
0.38
0.27
0.02
0.04
0.03
0.02
0.10
Round
Mountain
Mine
0.01
0.03
0.05
0.02
0.03
0.76
0.09
0.35
0.02
0.01
0.02
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0.12
0.02
0.01
0.02
0.03
0.01
0.00
0.01
0.04
0.01
0.01
0.00
0.01
Legend
Hydrologic Unit Boundary
Other Gold Mines
N
0
25
50
100
Miles
Note: Mercury deposition number represents percent of total contribution.
Source: Air Sciences 2008b.
Round Mountain Expansion Project
Figure 4.7-2
Mercury Deposition Contributions from Other Gold Mines

05/11/2009

of Round Mountain's mercury deposition is within the watershed where Round Mountain resides. As shown by **Figure 4.7-2**, this deposition is 0.27 percent of the total deposition.

Figure 4.7-3 provides the mercury deposition contributions from the mercury emissions from all Nevada gold mines to each watershed in Nevada. As shown by **Figures 4.7-2** and **4.7-3**, the deposition contribution from the gold mines is localized. For example, the mercury deposition in the watersheds that fall on the Nevada border from the "other gold mines" category is less than 1 percent of the total deposition (**Figure 4.7-2**).

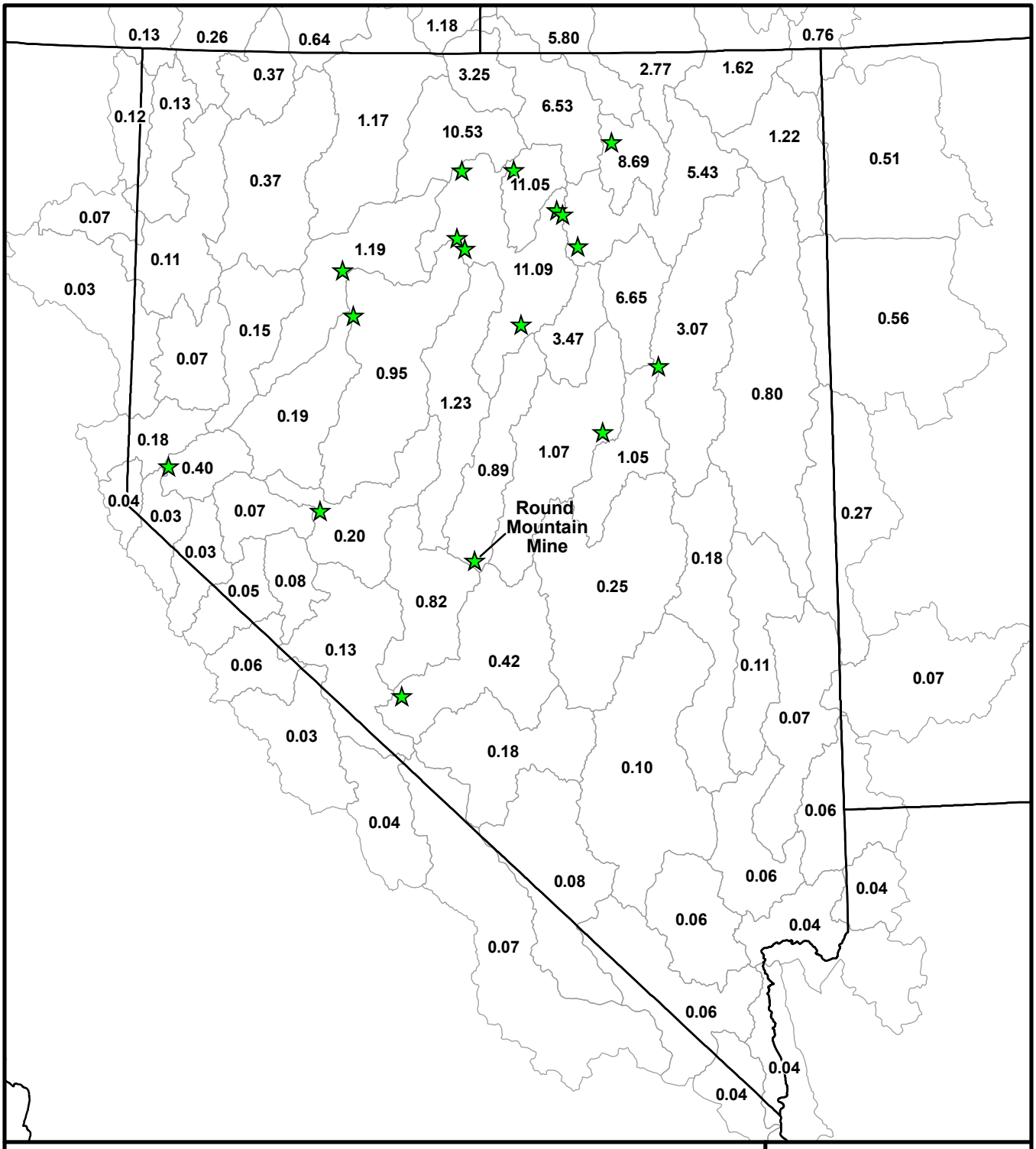
Figure 4.7-4 provides the mercury deposition contributions from the global background to each watershed in Nevada. The global background accounts for 66 to 97 percent of the total deposition in each watershed.

4.7.6 Monitoring and Mitigation Measures

Since the Proposed Action and alternatives would comply with air quality standards, specification of monitoring or mitigation measures is not necessary.

4.7.7 Residual Effects

No residual impacts to air quality from the proposed project would occur since reclamation and revegetation would stabilize exposed soil and control fugitive dust emissions. As vegetation becomes established, particulate levels should return to what is typical for an arid desert environment. Once the disturbance ceases and wind erodible surfaces are reclaimed, air quality would revert to its original state.



Legend

Hydrologic Unit Boundary

All Gold Mines

N

0 25 50 100 Miles

Note: Mercury deposition number represents percent of total contribution.

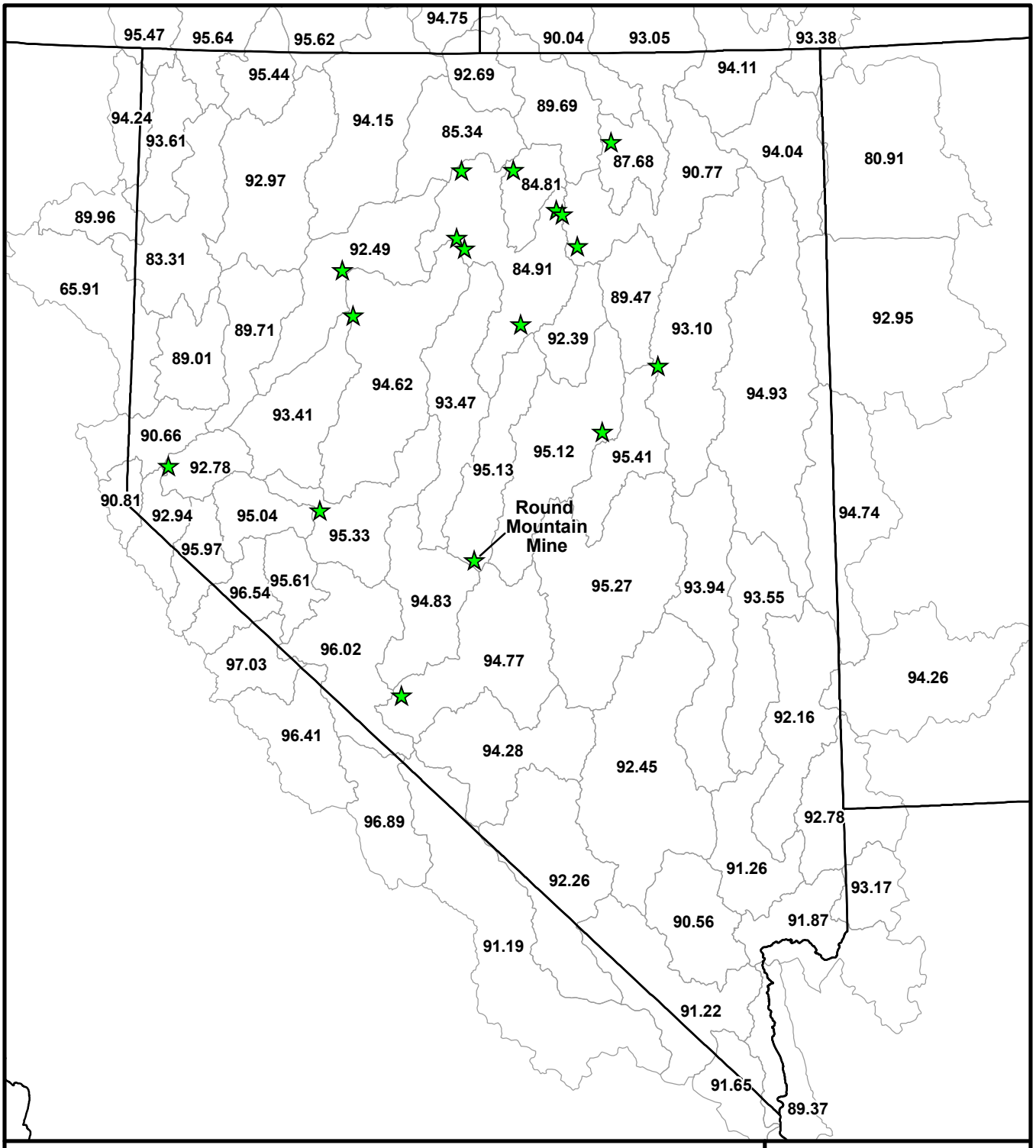
Source: Air Sciences 2008b.

Round Mountain Expansion Project

Figure 4.7-3

Mercury Deposition Contributions from All Nevada Gold Mines

05/11/2009



Legend

Hydrologic Unit Boundary

Global Background

N

0 25 50 100 Miles

Note: Mercury deposition number represents percent of total contribution.

Source: Air Sciences 2008b.

Round Mountain Expansion Project

Figure 4.7-4

Mercury Deposition Contributions from Global Background

05/11/2009

4.8 Paleontological Resources

Primary issues related to paleontological resources are potential damage and loss of scientifically important fossils from mining and construction of associated roads and facilities.

4.8.1 Proposed Action

No direct or indirect impacts to paleontological resources would occur as a result of ground-disturbing activities associated with the Proposed Action. As discussed in Section 3.8, Paleontological Resources, the rocks present in the proposed project area would be assigned to PFYC Class I and it is very unlikely fossils would occur within the proposed project area.

4.8.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on paleontological resources would be the same as described for the Proposed Action.

4.8.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on paleontological resources would be the same as described for the Proposed Action.

4.8.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed. Impacts to paleontological resources would not occur with the development of previously permitted areas.

4.8.5 Cumulative Impacts

No cumulative impacts to paleontological resources would occur since impacts to these resources would not occur with the development of the proposed project.

4.8.6 Monitoring and Mitigation Measures

No additional monitoring or mitigation measures are recommended for paleontological resources.

4.8.7 Residual Effects

There would be no residual effects to paleontological resources as a result of the proposed project.

4.9 Social and Economic Values

Primary issues related to social and economic values include: population; income; employment; public finance; schools; housing; and other public services, (e.g., water and sewer, waste management, fire protection, and medical services).

The following work force numbers were used to conduct the socioeconomic impact analysis:

- No Action Alternative
  - The current Round Mountain work force of approximately 730 workers would vary somewhat over the remaining mine life to adapt to increasing pit depth and other changes in operating conditions (**Table 4.9-1**).
  - The existing open pit mining operations would continue at current levels through approximately 2012; rehandle of mill stockpiles to provide mill feed would continue through approximately 2015 when the mill would shut down.
  - Ongoing ore processing, decommissioning, and reclamation would continue to approximately 2015 with a gradually declining work force (**Table 4.9-1**).
  - Active reclamation would continue through approximately 2020 with a small work force of 20 individuals.
  - Closure, fluid management, and monitoring activities would continue at a lower level for several more years.
- Proposed Action
  - The proposed work force would vary somewhat over the mine life to adapt to changes in operating conditions.
  - Construction phase – simultaneous development: Beginning with the issuance of the ROD, approximately 300 contract workers would be needed for construction activities during the approximately 12- to 24-month construction period with 200 assigned to the Round Mountain Area and 100 assigned to the Gold Hill Area (**Table 4.9-2**).
  - Construction phase – sequential development: Approximately 200 contract workers would be needed for construction activities in the Round Mountain Area during the approximately 12-month construction period; approximately 100 contract workers would be needed for construction activities in the Gold Hill Area during the approximately 12-month construction period near the end of the Round Mountain Mine production in approximately 2014 as mine production begins to ramp down (**Table 4.9-3**).

Table 4.9-1
Employment Estimates
No Action Alternative

Work Force for Existing Operations	2009	2010	2011	2012	2013[2]	2014[2]	2015[2]	2016	2017	2018	2019	2020	2021	2022	2023
Open Pit[1]	730	710	710	690	320	80	80	20	20	20	20	20	0	0	0
Total	**730**	**710**	**710**	**690**	**320**	**80**	**80**	**20**	**20**	**20**	**20**	**20**	**0**	**0**	**0**

[1] Includes 30 full-time, contract equipment maintenance/repair employees.

[2] In-pit mining stops by 2012. Years 2012 to 2015 include rehandle of mill ore stockpiles to feed the mill.

Table 4.9-2
Employment Estimates
Round Mountain – Gold Hill Simultaneous Development Scenario

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Work Force															
Open Pit[1]	730	730	730	730	730	730	590	600	320	80	40	40	40	0	0
Subtotal	**730**	**730**	**730**	**730**	**730**	**730**	**590**	**600**	**320**	**80**	**40**	**40**	**40**	**0**	**0**
Proposed Work Force															
Construction - Round Mountain[2]	0	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction - Gold Hill[2]	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0
Open Pit - Gold Hill	0	0	100	100	100	100	100	50	20	0	0	0	0	0	0
Underground	110	110	110	110	110	110	110	110	0	0	0	0	0	0	0
Subtotal	**110**	**410**	**210**	**210**	**210**	**210**	**210**	**160**	**20**	**0**	**0**	**0**	**0**	**0**	**0**
Total Work Force															
Construction	0	300	0	0	0	0	0	0	0	0	0	0	0	0	0
Open Pit	730	730	830	830	830	830	690	650	340	80	40	40	40	0	0
Underground	110	110	110	110	110	110	110	110	0	0	0	0	0	0	0
Total	**840**	**1,140**	**940**	**940**	**940**	**940**	**800**	**760**	**340**	**80**	**40**	**40**	**40**	**0**	**0**

[1] Includes 30 full-time, contract equipment maintenance/repair employees.

[2] Construction work force would be contract employees.

Table 4.9-3
Employment Estimates
Round Mountain – Gold Hill Sequential Development Scenario

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Work Force															
Open Pit[1]	730	730	730	730	730	730	590	600	320	80	40	40	20	20	20
Subtotal	**730**	**730**	**730**	**730**	**730**	**730**	**590**	**600**	**320**	**80**	**40**	**40**	**20**	**20**	**20**
Proposed Work Force															
Construction - Round Mountain[2]	0	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction - Gold Hill[2]	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0
Open Pit - Gold Hill[3]	0	0	0	0	0	0	100	100	100	100	100	50	20	20	20
Underground	110	110	110	110	110	110	110	110	0	0	0	0	0	0	0
Subtotal	**110**	**310**	**110**	**110**	**110**	**210**	**210**	**210**	**100**	**100**	**100**	**50**	**20**	**20**	**20**
Total Work Force															
Construction	0	200	0	0	0	100	0	0	0	0	0	0	0	0	0
Open Pit	730	730	730	730	730	730	690	700	420	180	140	90	40	40	40
Underground	110	110	110	110	110	110	110	110	0	0	0	0	0	0	0
Total	**840**	**1,040**	**840**	**840**	**840**	**940**	**800**	**810**	**420**	**180**	**140**	**90**	**40**	**40**	**40**

[1] Includes 30 full-time, contract equipment maintenance/repair employees.

[2] Construction work force would be contract employees.

[3] Gold Hill operations work force would be transferred from Round Mountain operations.

- Operations phase – simultaneous development: 100 additional employees would be needed for surface mining activities in the Gold Hill Area and 110 employees would be needed for underground activities in the Round Mountain Area in addition to the current Round Mountain work force of 730.

- Operations phase – sequential development: 110 additional employees would be needed for underground activities in the Round Mountain Area, no additional employees would be needed for the Gold Hill Area as workers from the Round Mountain Area would be transferred to the Gold Hill Area during the ramp down of Round Mountain operations.

Construction Phase Assumptions

- Thirty percent of the construction work force would be local; 70 percent of the construction work force would come from other parts of Nevada or out of state.

- The new construction work force would seek temporary (i.e., rental or RV site) housing primarily in Big Smoky Valley and, as necessary, in other areas of Nye County, particularly the Tonopah area.

- The indirect construction employment (i.e., secondary or induced employment) is calculated using a construction employment multiplier of 1.2 (Dobra 1989).

- Based on previous EISs prepared for similar gold mining projects in northern Nevada, it is assumed that 70 percent of the indirect labor force would be second persons in a direct labor household or current residents of the study area.

- Based on previous EISs prepared for similar gold mining projects in northern Nevada, the construction work force composition is estimated to be 90 percent single (including married without family present) and 10 percent married with families. The population estimates are based on 1 person per single household and an average of 2.9 persons per married household (based on average family size in Nye County).

Operations Phase Assumptions

The operations phase assumptions were developed primarily from previous EISs prepared for similar gold mining projects in northern Nevada and on residence locations of current RMGC employees:

- Approximately 91.5 percent of RMGC employees live in Nye County (81.6 percent in Round Mountain/Carvers, 8.4 percent in Tonopah, 0.8 percent in Manhattan, 0.7 percent elsewhere in the county); 7.3 percent live elsewhere in Nevada, primarily in Lander County, and 1.2 percent claim primary residences outside Nevada.

The following operations phase assumptions were used to conduct the socioeconomic impact analysis:

- The new operations work force is assumed to be 60 percent local and 40 percent non-local.

- The percentage distribution of residence locations for new employees would be approximately the same as for existing RMGC employees.

- The indirect operations employment (secondary or induced employment) is calculated using an operations employment multiplier of 1.74 (Dobra 1989).

- It is assumed that 70 percent of the indirect labor force would be second persons in a direct labor household or current residents of the study area.

- The new operations work force composition is estimated to be 75 percent married with families and 25 percent single. The population estimates are based on 1 person per single household and an average of 2.9 persons per married household, including an average of 0.77 school-age children.

4.9.1 Proposed Action

Simultaneous Development Scenario

Development of the proposed project is anticipated to begin in 2010 and take approximately 12 to 24 months, although some hiring, particularly for underground work may begin very late in 2009. During that time, a construction work force of approximately 300 contract workers would be employed: 200 at Round Mountain for relocation of crushers and construction of the mill, leach pads, tailings impoundment facilities, and infrastructure; and 100 at Gold Hill for construction of processing facilities and infrastructure (**Tables 4.9-2** and **4.9-4**). An additional 110 direct employees would be hired for development and implementation of underground operations. Existing employees would continue working at the Round Mountain operations through the construction phase, which would be completed by the end of 2011 or earlier. At completion of construction, the 300 contract construction workers would be replaced by approximately 100 permanent operations employees for the Gold Hill Operations (depending on skill sets of the workers, some of the "construction" workers may transition to operations). As noted in **Table 4.9-2**, the existing total employment level of approximately 730 workers would grow to a maximum of 1,140 during construction, would range between 760 and 940 through completion of surface mining in 2016, when it would begin a gradual decline to approximately 340 for continued processing of ore and reclamation activities through 2017. Total employment would decline to approximately 40 to 80 workers from 2018 through 2021 as closure and final reclamation activities are completed. It is expected that the proposed project would terminate at the end of 2021.

Sequential Development Scenario

This scenario would include development of the Round Mountain Expansion, initially, followed by later development of the Gold Hill portion of the proposed project. Under this sequential development scenario, a construction work force of approximately 200 would be contracted for approximately 12 to 24 months, beginning in 2010, to relocate the crushers and construct leach pads, mill, tailings impoundment facilities, and associated infrastructure at Round Mountain. At the same time, or perhaps slightly sooner, approximately 110 employees would be hired for underground mining operations. Subsequently, in about 2014, approximately 100 construction workers would be contracted to construct Gold Hill processing facilities and infrastructure. No additional surface mine operations employees would be hired under the sequential development scenario. Since Gold Hill would not begin operations until Round Mountain operations were scaling down, operations workers would be shifted from Round Mountain to the Gold Hill operation. Under this scenario, the maximum employment would be 1,040 during the construction period at Round Mountain, followed by 6 years ranging from 800 to 940 during operations at Round Mountain.

Construction at Gold Hill would temporarily raise the total to 940, but it would decrease to 800 the following year and would gradually decline to 140 in 2019 when mining would be completed at Gold Hill. Total employment would range from 40 to 90 workers for closure and final reclamation activities from 2020 through 2023 (**Table 4.9-3**).

4.9.1.1 Population

Simultaneous Development Scenario

Anticipated population increases resulting from construction and operation of the Simultaneous Development Scenario are presented in **Tables 4.9-4** and **4.9-5**, respectively. The projections include both direct and indirect employment increases together with their family members.

Table 4.9-4
New Construction-related Employment, Households, and Population Projects for the Proposed Action – Simultaneous Development Scenario

New Construction-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
90.0	210.0	300.0	42.0	18.0	60.0	132.0	228.0	360.0

New Construction-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	210.0	18.0	NA
Single	189.0	5.4	194.4
Married - 1 Worker	18.9	6.3	25.2
Married - 2 Workers	1.1	3.2	4.2
New Households	**209.0**	**14.9**	**223.8**

New Construction-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-Age	Other	Total
Single Households	194.4	194.4	0.0	0.0	194.4
Married Households	29.4	58.8	19.8	6.6	85.3
Total	**223.8**	**253.2**	**19.8**	**6.6**	**279.7**[7]

[1] Construction work force was assumed to be 30 percent local, 70 percent non-local.

[2] Construction-generated indirect employment was calculated using an employment multiplier of 1.2 (Dobra 1989); the indirect work force was assumed to be 70 percent local and 30 percent non-local.

[3] The direct construction work force was assumed to be 90 percent single, or married without spouse or family present; 10 percent of the married households were assumed to be 2-worker families.

[4] The indirect work force was assumed to be 30 percent single, or married without spouse or family present; half of the married households were assumed to be 2-worker families.

[5] Population estimates were based on 1 person per single household and 2.9 persons per married household.

[6] Seventy-five percent of children were assumed to be of school age.

[7] Minor inconsistencies in numbers are the result of rounding errors.

Table 4.9-5
New Operations-related Employment, Households, and Population Projections for the Proposed Action – Simultaneous Development Scenario

New Operations-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
126.0	84.0	210.0	108.8	46.6	155.4	234.8	130.6	365.4

New Operations-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	84.0	46.6	NA
Single	21.0	18.6	39.6
Married - 1 Worker	56.7	14.0	70.7
Married - 2 Worker	3.2	7.0	10.1
New Households	**80.9**	**39.6**	**120.5**

New Operations-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-Age	Other	Total
Single Households	39.6	39.6	0.0	0.0	39.6
Married Households	80.8	161.6	54.5	18.2	234.3
Total	**120.4**	**201.2**	**54.5**	**18.2**	**273.9**[7]

[1] Operations work force was assumed to be 60 percent local, 40 percent non-local.

[2] Operations-generated indirect employment was calculated using an employment multiplier of 1.74 (Dobra 1989); the indirect work force was assumed to be 70 percent local and 30 percent non-local.

[3] The direct operations work force was assumed to be 25 percent single, or married without spouse or family present; 10 percent of the married households were assumed to be 2-worker families.

[4] The indirect work force was assumed to be 40 percent single, or married without spouse or family present; half of the married households were assumed to be 2-worker families.

[5] Population estimates were based on 1 person per single household and 2.9 persons per married household.

[6] Seventy-five percent of children were assumed to be of school age.

[7] Minor inconsistencies in numbers are the result of rounding errors.

In-migrating construction workers and their families would include approximately 280 persons (**Table 4.9-4**). This increase represents a 10 percent increase over the 2007 population estimated at approximately 2,738 for the Round Mountain-Carvers-Big Smoky Valley communities in the study area most likely to be affected by project-related population. If Tonopah's population is added to the base, the construction-related population would represent a 5 percent increase over the 2007 population. Typical construction involves fluctuating work forces as special crews may only be employed for certain components of a project lasting

only several weeks. Consequently this population would tend to be quite transient, represented by different people at different times.

Adding in the population increase attributable to underground mining operations, which would occur concurrently, produces a total in-migrating population during the construction period of approximately 423 persons (**Tables 4.9-4** and **4.9-7**). This number would equal approximately a 15 percent increase over the 2007 local population and an 8 percent increase over the combined local and Tonopah population.

Following completion of construction activities, the project-related population effect would decrease from 423 to 274, corresponding to a drop in new employment to 210 workers, all of which would be mine employees rather than contractors (**Table 4.9-5**). Total employment would drop from 1,140 to 940 workers. Operations workers would tend to be more stable and more likely to have families with them. This population would represent a 10 percent increase over the 2007 local population and a 5 percent increase over local and Tonopah populations combined. With rapid population increases of this magnitude, there could be adverse effects in localized areas. In particular, if the in-migrating population distribution mimics the existing worker residence distribution, the Round Mountain-Carvers-Big Smoky Valley area could experience project related growth of 13 percent during the construction period, dropping to 9 percent over the 2007 population after construction is completed.

Sequential Development Scenario

Population increases at the Round Mountain Area resulting from construction and operation of the Sequential Development Scenario are presented in **Tables 4.9-6** and **4.9-7**, respectively. Under this scenario, approximately 200 contract construction workers would be needed, which would bring a total of approximately 186 new people to the area. In addition, 110 underground mine employees would be added, bringing 144 people for a total population increase of 330 during the year of construction. This would represent a 13 percent increase over the Round Mountain-Carvers-Big Smoky Valley 2007 population, or a 6 percent increase over the combined local and Tonopah population.

At the end of construction in the Round Mountain Area, the 186 people associated with the construction workers would be expected to depart, leaving a population increment of 144 over the 2007 population level. This would represent increases of 6 percent over the local population, or 3 percent over the combined local and Tonopah population.

When surface mining in the Round Mountain Area nears completion in approximately 2014, a construction crew of 100 workers would be contracted for approximately 12 months to initiate the Gold Hill portion of the proposed project. This activity would bring a temporary population increase of 93 people in addition to the 144 already in the area associated with the underground operations for a total project related increment of 237 people (**Tables 4.9-7** and **4.9-8**). Assuming the earlier population increase would be assimilated by the time of the Gold Hill construction activity, 93 people would represent a 3 percent increase over the local population level (2007 plus the Round Mountain operations-related population), or 2 percent over the combined local and Tonopah population.

At the end of construction in the Gold Hill Area, the 100 construction workers, with an associated population of 93, would be expected to depart, but they would be replaced by 100 operations workers. The population associated with 100 operations workers is estimated at 131 people; however, these workers would be existing employees in the Round Mountain Area, which would be ramping down production at approximately the same time. Consequently, although the 131 people would be associated with the proposed project, the

total population in the study area would be only slightly above the 2007 level and would begin to decline in following years (**Tables 4.9-7** and **4.9-9**).

Table 4.9-6
New Round Mountain Construction-related Employment, Households, and Population Projections for the Proposed Action – Sequential Development Scenario

New Construction-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
60.0	140.0	200.0	28.0	12.0	40.0	88.0	152.0	240.0

New Construction-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	140.0	12.0	NA
Single	126.0	3.6	129.6
Married - 1 Worker	12.6	4.2	16.8
Married - 2 Workers	0.7	2.1	2.8
New Households	**139.3**	**9.9**	**149.2**

New Construction-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-Age	Other	Total
Single Households	129.6	129.6	0.0	0.0	129.6
Married Households	19.6	39.2	13.2	4.4	56.8
Total	**149.2**	**168.8**	**13.2**	**4.4**	**186.4**[7]

[1] Construction work force was assumed to be 30 percent local, 70 percent non-local.

[2] Construction-generated indirect employment was calculated using an employment multiplier of 1.2 (Dobra 1989); the indirect work force was assumed to be 70 percent local and 30 percent non-local.

[3] The direct construction work force was assumed to be 90 percent single, or married without spouse or family present; 10 percent of the married households were assumed to be 2-worker families.

[4] The indirect work force was assumed to be 30 percent single, or married without spouse or family present; half of the married households were assumed to be 2-worker families.

[5] Population estimates were based on 1 person per single household and 2.9 persons per married household.

[6] Seventy-five percent of children were assumed to be of school age.

[7] Minor inconsistencies in numbers are the result of rounding errors.

Table 4.9-7
New Underground Operations-related Employment, Households, and Population Projections for the Proposed Action – Sequential Development Scenario

New Operations-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
66.0	44.0	110.0	57.0	24.4	81.4	123.0	68.4	191.4

New Operations-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	44.0	24.4	NA
Single	11.0	9.8	20.8
Married - 1 Worker	29.7	7.3	37.0
Married - 2 Worker	1.7	3.7	5.3
New Households	**42.4**	**20.7**	**63.1**

New Operations-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-Age	Other	Total
Single Households	20.8	20.8	0.0	0.0	20.8
Married Households	42.3	84.6	28.6	9.5	122.7
Total	**63.1**	**105.4**	**28.6**	**9.5**	**143.5**[7]

[1] Operations work force was assumed to be 60 percent local, 40 percent non-local.

[2] Operations-generated indirect employment was calculated using an employment multiplier of 1.74 (Dobra 1989); the indirect work force was assumed to be 70 percent local and 30 percent non-local.

[3] The direct operations work force was assumed to be 25 percent single, or married without spouse or family present; 10 percent of the married households were assumed to be 2-worker families.

[4] The indirect work force was assumed to be 40 percent single, or married without spouse or family present; half of the married households were assumed to be 2-worker families.

[5] Population estimates were based on 1 person per single household and 2.9 persons per married household.

[6] Seventy-five percent of children were assumed to be of school age.

[7] Minor inconsistencies in numbers are the result of rounding errors.

Table 4.9-8
New Gold Hill Construction-related Employment, Households, and Population Projections for the Proposed Action – Sequential Development Scenario

New Construction-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
30.0	70.0	100.0	14.0	6.0	20.0	44.0	76.0	120.0

New Construction-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	70.0	6.0	NA
Single	63.0	1.8	64.8
Married - 1 Worker	6.3	2.1	8.4
Married - 2 Workers	0.4	1.1	1.4
New Households	**69.7**	**5.0**	**74.6**

New Construction-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-Age	Other	Total
Single Households	64.8	64.8	0.0	0.0	64.8
Married Households	9.8	19.6	6.6	2.2	28.4
Total	**74.6**	**84.4**	**6.6**	**2.2**	**93.2**[7]

[1] Construction work force was assumed to be 30 percent local, 70 percent non-local.

[2] Construction-generated indirect employment was calculated using an employment multiplier of 1.2 (Dobra 1989); the indirect work force was assumed to be 70 percent local and 30 percent non-local.

[3] The direct construction work force was assumed to be 90 percent single, or married without spouse or family present; 10 percent of the married households were assumed to be 2-worker families.

[4] The indirect work force was assumed to be 30 percent single, or married without spouse or family present; half of the married households were assumed to be 2-worker families.

[5] Population estimates were based on 1 person per single household and 2.9 persons per married household.

[6] Seventy-five percent of children were assumed to be of school age.

[7] Minor inconsistencies in numbers are the result of rounding errors.

Table 4.9-9
Gold Hill Operations-related Employment, Households, and Population Projections
Proposed Action – Sequential Development Scenario

Operations-related Employment								
Direct[1]			Indirect[2]			Total		
Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
60.0	40.0	100.0	51.8	22.2	74.0	111.8	62.2	174.0

Operations-related Households			
	Direct[3]	Indirect[4]	Total New Households
New Non-local Workers	40.0	22.2	NA
Single	10.0	8.9	18.9
Married – 1 Worker	27.0	6.7	33.7
Married – 2 Workers	1.5	3.3	4.8
New Households	**38.5**	**18.9**	**57.4**

Operations-related Population					
		Population[5]			
			Children[6]		
	Households	Adults	School-age	Other	Total
Single Households	18.9	18.9	0.0	0.0	18.9
Married Households	38.5	77.0	26.0	8.7	111.7
Total	**57.4**	**95.9**	**26.0**	**8.7**	**130.6**[7]

[1] Operations work force was assumed to be 60 percent local, 40 percent non-local.

[2] Operations-generated indirect employment was calculated using an employment multiplier of 1.74 (Dobra 1989); the indirect work force was assumed to be 70 percent local and 30 percent non-local.

[3] The direct operations work force was assumed to be 25 percent single, or married without spouse or family present; 10 percent of the married households were assumed to be 2-worker families.

[4] The indirect work force was assumed to be 40 percent single, or married without spouse or family present; half of the married households were assumed to be 2-worker families.

[5] Population estimates were based on 1 person per single household and 2.9 persons per married household.

[6] Seventy-five percent of children were assumed to be of school age.

[7] Minor inconsistencies in numbers are the result of rounding errors.

4.9.1.2 Income and Employment

Simultaneous Development Scenario

The direct work force increase during the construction period would be approximately 300 contract construction workers, plus 110 underground operations employees for a total of 410 workers. Indirect employment generated by the activity is projected at 141 additional jobs, raising the temporary impact

to 551. Local labor is expected to meet 30 percent of the direct project construction jobs, 60 percent of the direct underground jobs, and 70 percent of the indirect jobs, resulting in a demand for 296 workers from outside the local area.

The direct employment effect during the construction period would represent a 3.3 percent increase over total employment in Nye County (4th quarter 2007), and 2.1 percent of the county's total labor force. The total employment effect would be 4.4 percent of existing total employment and 2.8 percent of the county labor force.

Direct payroll to new workers during the construction period, not including the value of benefits, is projected to be approximately $27 million on an annual basis. A substantial portion of this amount would be spent locally for items such as food, clothing, fuel, and rent, which would stimulate the local economy.

After completion of construction, direct employment (over and above levels for existing operations) would be approximately 210 workers, raising total operations employment to approximately 940 workers. Indirect employment generated by operations activity is projected at 155 additional jobs, raising the total project operations-related employment to 365 workers (**Table 4.9-5**). Approximately 60 percent of new surface and underground related workers are expected to come from the local labor force; 70 percent of the indirect jobs are also projected to be filled by local workers. The resulting demand for non-local workers is projected at approximately 131.

The total new employment of 365 operations-related employees would represent a 2.9 percent increase over total employment in Nye County, and 1.9 percent of the county labor force. Hypothetically, if the necessary skills were available in the unemployed portion of the county work force, the unemployment rate could be reduced from the July 2008 rate of 9.3 percent to 7.4 percent.

The estimated annual payroll for the proposed operation, not including benefits, would be approximately $14 million. Each $1.00 in local earnings would indirectly generate $0.37 in earnings to other workers in the local economy (U.S. Bureau of Economic Analysis [BEA] 1992; Dobra 1988). Consequently, the annual indirect impact on earnings would be approximately $5.2 million, yielding a combined impact of $19.2 million. This would be an increase in income earnings over current levels and would constitute an economic benefit accruing from the proposed project to the local economy.

Sequential Development Scenario

The first component of the Sequential Development Scenario would be expansion of the Round Mountain Mine. The direct work force increase during construction in the Round Mountain Area under the Sequential Development Scenario would be approximately 200 contract construction workers, plus 110 underground operations employees for a total of 310 workers (**Tables 4.9-3**, **4.9-6**, and **4.9-7**). Indirect employment generated by the activity is projected at 121 additional jobs, raising the temporary increase to 431 workers. Local labor is expected to meet 30 percent of the direct project construction jobs, 60 percent of the direct underground jobs, and 70 percent of the indirect jobs, leaving a demand for 220 workers from outside the local area.

The direct employment effect during the construction period would represent a 2.5 percent increase over total employment in Nye County (4th quarter 2007), and 1.6 percent of the county's total labor force. The

total employment effect would be 3.4 percent of existing total employment and 2.2 percent of the county labor force.

Direct payroll to new workers during the construction period, not including the value of benefits, is projected to be approximately $21 million on an annual basis. A substantial portion of this would be spent locally for items such as food, clothing, fuel, and rent, stimulating the local economy.

After completion of construction, direct employment (over and above levels for existing operations) would include the underground work force of approximately 110 workers, raising total operations employment to approximately 840 workers. Indirect employment generated by operations activity is projected at 81 additional jobs, raising the total new operations-related employment from the Sequential Development Scenario to 191 workers (**Tables 4.9-3** and **4.9-7**). As previously noted, approximately 60 percent of new underground workers and 70 percent of the indirect jobs are expected to come from the local labor force. The resulting demand for non-local workers is projected to be approximately 68. The total 191 operations-related new employment would represent a 1.5 percent increase of total employment and 1.0 percent of the labor force in Nye County.

The estimated annual payroll for the proposed operation in the Round Mountain Area, not including benefits, would be approximately $7.3 million. Each $1.00 in local earnings would indirectly generate $0.37 in earnings to other workers in the local economy (BEA 1992; Dobra 1988). Consequently, the annual indirect impact on earnings would be approximately $2.7 million, yielding a combined impact of $10 million. This would be an increase in income earnings over current levels and would constitute an economic benefit accruing from the proposed project to the local economy.

The second part of the Sequential Development Scenario would be the development of the Gold Hill Area, which would not occur until surface mining at the Round Mountain Pit was nearing completion. The direct work force increase during construction in the Gold Hill Area would be approximately 100 contract construction workers (**Table 4.9-8**). Indirect employment generated by the activity is projected at 20 additional jobs, raising the temporary impact to 120 jobs. Local labor is expected to meet 30 percent of the direct project construction jobs and 70 percent of the indirect jobs, resulting in a residual demand for 76 workers from outside the local area.

The direct employment effect during the construction period would represent a 0.8 percent increase over total employment in Nye County (4th quarter 2007), and 0.5 percent of the county's total labor force. The total employment effect would be 1.0 percent of existing total employment and 0.6 percent of the county labor force.

Direct payroll to new workers during the construction period, including the value of benefits, is projected to be approximately $6.6 million on an annual basis. A substantial portion of this would be spent locally for items such as food, clothing, fuel, and rent, stimulating the local economy.

After completion of construction, the total project work force would revert to approximately 800 employees who had been working at the Round Mountain Mine. Up to 100 of these workers would be transferred to the Gold Hill Area to conduct surface mining and processing activities. Project-related payroll and indirect earnings would revert to the levels previously described for the Round Mountain portion of the Sequential Development Scenario.

4.9.1.3 Public Finance

Construction

During the construction phase, the principal revenue change for Nye County would result from an increase in sales and use tax revenues. According to RMGC, it is estimated that capital expenditures for the proposed project would be approximately $168.2 million and there would be approximately $48.0 million worth of additional equipment purchased. Under the Simultaneous Development Scenario, essentially all of these expenditures would occur in the approximate 1-year construction period. This would generate nearly $14.6 million in sales and use tax revenue for affected state funds and for Nye County.

Under the Sequential Development Scenario, capital expenditures of $134.8 million and equipment purchases of $44.9 million would take place during the construction year at Round Mountain, generating approximately $12.1 million in sales and use tax revenue at that time. Approximately 4 years later, during construction at Gold Hill, there would be additional capital expenditures of $33.5 million and equipment purchases of $3.1 million, generating sales and use tax revenues of approximately $2.5 million.

Operations

Under the Simultaneous Development Scenario, RMGC estimates the proposed Round Mountain Expansion Project would make local purchases of taxable materials ranging from an average of approximately $216 million per year in peak years (2012 to 2017) to an average of approximately $61 million per year in waning years of the project. At the Nye County sales tax rates of 6.75 percent, the proposed project would pay approximately $14.6 million per year in peak year sales and use taxes and $4.1 million per year in sales and use taxes in declining years.

RMGC estimates total purchases of taxable materials would be about the same under the Sequential Development Scenario as under the Simultaneous Development Scenario, but the amounts would vary somewhat during continuation and expansion of the Round Mountain Pit and would be lower during operation of the Gold Hill Pit. It is estimated that the annual sales tax generated would be approximately $13.4 million per year from 2012 through 2015, would rise to approximately $14.9 million per year for 2016 and 2017, would then decline to approximately $4.3 million per year through 2019, and finally, would decline to approximately $2.9 million per year through the end of the project.

RMGC would continue to pay net proceeds taxes on mine production and property taxes on the assessed value of the mining property. Both would be expected to increase under the proposed project because production would increase and the anticipated $216 million in capital expenditures would be expected to increase the assessed value of the property. Assuming the entire amount of capital expenditures would accrue to assessed valuation, it would increase Nye County's total assessed valuation (exclusive of net proceeds of mines) by approximately 18 percent. The effect on county revenues would depend on the tax rates applied during the life of the mine. **Table 4.9-10** illustrates the net proceeds and property taxes paid by RMGC for 5 recent years.

Table 4.9-10
RMGC Net Proceeds, Sales, Use, and Property Tax Payments
(2003-2007)

Year	Net Proceeds Tax	Sales & Use Tax	Property Tax
2003	$5,787,000	$3,214,000	$2,302,000
2004	$5,924,000	$3,478,000	$2,286,000
2005	$5,835,000	$3,896,000	$2,231,000
2006	$7,586,000	$3,917,000	$2,245,000
2007	$7,400,000	$4,648,000	$2,450,000

Source: RMGC 2008.

4.9.1.4 Public Education

Simultaneous Development Scenario

The proposed project would increase the school age population in the study area by an estimated 48 students during the construction period (**Tables 4.9-4** and **4.9-7**) and 55 students during project operations (**Table 4.9-5**) under the Simultaneous Development Scenario. Assuming the new population would locate in approximately the same locations proportionally as current employees, this would increase enrollment in Round Mountain schools by 10.8 percent during construction and 12.3 percent during operations. Tonopah schools would see increases of 0.9 percent during construction and 1.0 percent during operations.

Sequential Development Scenario

Under the Sequential Development Scenario, there would be approximately 42 new students during the construction phase in the Round Mountain Area (**Tables 4.9-6** and **4.9-7**), an estimated 35 of whom would attend Round Mountain schools, increasing enrollment at Round Mountain schools by 9.5 percent. Project operations under this scenario would generate 28 new school-aged youth, increasing Round Mountain school enrollments by 6.3 percent.

Subsequent construction in the Gold Hill Area would increase the number of project-related students by approximately 6 individuals, which would increase Round Mountain school enrollments by approximately 1.3 percent. Project-related enrollment increases in Tonopah schools would be less than 1 percent under all time periods of the Sequential Development Scenario.

4.9.1.5 Housing

Simultaneous Development Scenario

Under this scenario, demand for housing is estimated at 287 units during the construction period, 209 of which would be for contract construction workers – presumably short term, mostly transient housing – and 78 of which would be for underground mine workers and new indirect worker households – presumably more permanent. Although data are not available to accurately determine the current availability of housing in the study area, it would be expected that this level of demand would stretch the capacity of the local housing market during the approximately 12- to 24-month-long construction period. There would

undoubtedly be some doubling up in housing units, but construction workers, in particular, may be forced to locate in Tonopah or other outlying communities and endure long daily commutes. It is anticipated that there are sufficient motel rooms in Tonopah to accommodate the increased demand for short-term construction worker housing. With excess demand for housing, there may also be problems with unauthorized long-term camping on public lands in the vicinity, although there are some available RV spaces in Carvers and Hadley.

Upon completion of construction, the demand for short-term housing would largely disappear, but the need for more permanent housing would increase to an estimated 121 units. This level of demand would likely exceed the number of units available in the Round Mountain-Carvers-Big Smoky Valley area and would continue to strain the local housing market.

Sequential Development Scenario

Under this scenario, demand for housing during the construction period is estimated at 213 units, of which 139 would be for contract construction workers and 74 would be for underground mine workers and new indirect worker households. It would be expected that this demand, though lower than for the Simultaneous Development Scenario, would nevertheless strain the capacity of the local housing market during the construction period. Similar issues with long commutes and unauthorized camping would be expected.

Upon completion of construction, the demand for short-term housing would disappear, and the need for permanent housing would decline to an estimated 63 units. The majority, if not all, of this demand would likely be accommodated by available units and vacant lots in the Round Mountain-Carvers-Big Smoky Valley area.

During the construction phase in the Gold Hill Area, there would be a need for approximately 74 mostly short-term housing units. This need would likely strain the local housing market, although not as severely as the Simultaneous Development Scenario.

4.9.1.6 Other Public Services

Generally, existing utilities and emergency response services should be able to accommodate the population growth the proposed project would bring to the Big Smoky Valley and Nye County. It is expected that the proposed project would have only minor effects on public services and facilities in the study area.

4.9.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on social and economic values would be similar as described for the Proposed Action except there would be a reduction in fuel consumption, which would reduce annual expenditures. Employment numbers would not differ appreciably from the Proposed Action.

4.9.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on social and economic values would be similar as described for the Proposed Action except there would be a minor increase in construction cost associated with construction of the overpass, but it would not appreciably affect the impacts of the proposed project.

4.9.4 No Action Alternative

4.9.4.1 Population

Under the No Action Alternative, full scale mining at the Round Mountain Mine would continue through approximately 2012. Subsequent to the end of mining, heap leaching, rehandling of ore stockpiles, and milling of the stockpiled ore would continue through approximately 2015, concurrent with reclamation and decommissioning activities. Active reclamation would continue through approximately 2020 with a small workforce of 20 individuals (**Table 4.9-1**).

The specific effect on study area population is uncertain. With an average family size of 2.9 people in Nye County, where over 91 percent of the Round Mountain Mine workers live, as many as 1,800 county residents (4 percent of the county population) are currently directly supported by the mine. An additional increment of the population is indirectly supported by the mine as well. The effects of mine closure on Big Smoky Valley communities would be dramatic. Approximately 560 mine employees live in Round Mountain/Carvers and Manhattan. Including family members, closure of the mine could displace as many as 90 percent of the residents of the Big Smoky Valley because there are very few, if any, employment alternatives within commuting distance of the valley.

It is assumed that layoffs would begin as mining declined beginning in late 2012 or 2013 and that additional layoffs would occur as stockpile processing decreased over subsequent years, with nearly all employees gone at the time of closure. The estimated rate at which layoffs would occur is illustrated in **Table 4.9-1**. Some mines elsewhere in Nevada are currently expanding, although no major mines are within daily commuting distance of Round Mountain. The availability of alternative employment in the industry from 6 to 10 years in the future is difficult to predict. Ultimately, it is expected that nearly all current workers and their families would have to leave the area to find employment.

It is assumed that the workers at the Round Mountain Mine approximately reflect the ethnic and racial pattern of the study area. As such, it is unlikely that any population change related to early termination of production at the mine would alter the demography of the study area.

4.9.4.2 Income, Economy, and Employment

As previously noted, closure of the Round Mountain Mine under the No Action Alternative would require reduction of the work force beginning about 2013. There are currently approximately 730 workers employed at the mine, representing 60 percent of the “natural resources and mining” workers and 5.8 percent of all employed workers in Nye County (**Table 3.9-2**). **Table 4.9-1** illustrates approximately how rapidly layoffs of the existing work force would occur after 2012; all but a few would be terminated between 2012 and 2015. If large numbers of workers were terminated simultaneously, the unemployment rate for Nye County would be increased substantially.

Any loss of jobs would reduce the dollars flowing into the local and state economy. The Round Mountain Mine provided an estimated $46.7 million in wages and salaries in 2007, plus benefits. The mine also purchased supplies, services, and commodities worth an estimated $68.9 million in the state. Under the No Action Alternative, the combined $115.6 million flowing into the Nevada economy annually for labor and materials would decline, beginning after 2012 with the ramping down of mining activities.

In addition to the direct employment and income provided by the Round Mountain Mine, the economic activity results in indirect and induced employment and income in the local economy. Employees of the mine spend their income in the local area for goods and services, which provides opportunities for other businesses selling clothing, groceries, and fuel to hire workers and for service providers like the school district to hire teachers. It has been estimated that each direct employee in the hard rock mining industry generates demand for an additional 0.74 indirect and induced employees in the Nye County economy (Dobra 1989). Also, each $1.00 of direct labor income ("labor income" includes the sum of employee compensation and proprietor income) from the hard rock mining sector generates an additional $0.37 of indirect and induced labor income (Dobra 1989). Based on these multipliers, the loss of 730 jobs from the Round Mountain Mine would result in the loss of an additional 540 jobs in the rest of the Nye County and Nevada economy.

As previously noted, the timing of the job losses has been estimated, but is not precisely known. It is assumed that the losses would begin in late 2012 or 2013 and continue over perhaps the following 3 years. The actual effects on the study area economy would depend on both the timing of layoffs and the type and availability, if any, of other employment that may be available in the area when the layoffs occur. Very few laid off workers would be expected to find replacement employment in the immediate area, and it is even less certain whether they would find jobs at wage levels they currently have.

4.9.4.3 Housing

Effects on the local housing market from the No Action Alternative would be expected to be commensurate with the employment and population decline, which would be dramatic in the Big Smoky Valley, where most mine employees live. The overall effect on the remainder of the county housing market would be much more moderate, but still notable.

4.9.4.4 Community Facilities and Services

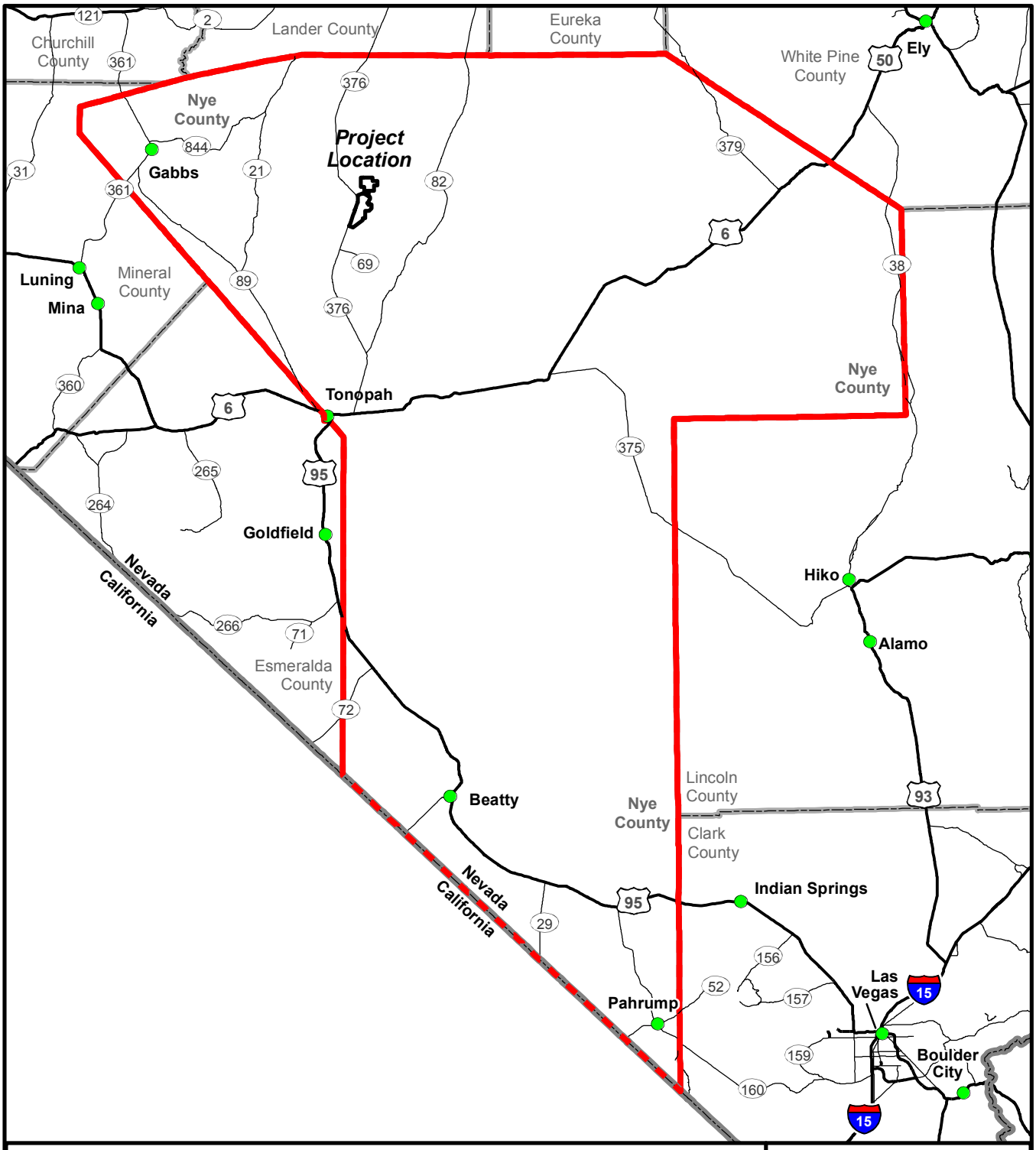
The No Action Alternative would be expected to adversely affect public facilities and services in the Round Mountain/Big Smoky Valley area. Hadley would likely be dramatically reduced in size, which could adversely affect the resources of the service district and its ability to provide services. In addition, the demand for services also would decline dramatically. The greatest effect could be on the school district; a dramatic loss of school-aged children would result in enrollment declines and, perhaps, raise a question about the continued viability of maintaining school facilities in the area.

4.9.4.5 Public Finance

In addition to wages, salaries, and purchases, the Round Mountain Mine annually pays taxes and fees to local and state agencies. The mine paid an average of $12.6 million per year in 3 major tax categories from 2003 through 2007 (**Table 4.9-10**). These tax payments would decline over time to a small fraction of current levels with the ramping down of mining activities after 2012.

4.9.5 Cumulative Impacts

The CESA for social and economic resource is shown in **Figure 4.9-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.



Legend

- Proposed Project Boundary
- CESA Boundary for Social and Economic Values
- City or Town

N

0 10 20 30 Miles

Round Mountain Expansion Project

Figure 4.9-1

Cumulative Effects Study Area for Social and Economic Values

04/11/2009

The social and economic effects of past and present activities are largely included in the affected environment data addressed in Section 3.9, Social and Economic Values. Consequently, any potential cumulative effects are addressed in the discussion of environmental consequences above. Anticipated schedules for increases or decreases in employment for RFFAs in the CESA are not known, but are not believed to be substantial. Therefore, it is expected that the effects identified for the proposed project and alternatives would constitute most, if not all, of the cumulative social and economic effects. Simultaneous opening of other projects in the study area would increase pressure on housing in the CESA. At the present time, however, there are no known plans for such openings.

There is potential for modest, cumulative aggravating effects of the No Action Alternative in the event other activities in the CESA were to decline at nearly the same time as the existing RMGC operation. However, the scale of the existing Round Mountain Mine work force is sufficiently larger than other economic activities in the CESA that it is expected that the effects identified for the No Action Alternative would make up the bulk of any related cumulative effects.

4.9.6 Monitoring and Mitigation Measures

Issue: The availability of housing is likely to be problematic for implementation of the Proposed Action under either the Simultaneous Development Scenario or the Sequential Development Scenario.

Mitigation Measure SE-1: If a substantial increase in new operations-related employment occurs, a plan will be developed for providing the needed housing for construction and operations workers or for providing bussing of workers from the Tonopah area.

Effectiveness: Sufficient housing would be provided for the expanded workforce.

Issue: A shortage of worker housing may result in unauthorized ad hoc camping on public lands.

Mitigation Measure SE-2: RMGC will include information regarding unauthorized camping on public lands in their new hire training program.

Effectiveness: Education of new employees would minimize adverse effects from unauthorized camping on public lands.

4.9.7 Residual Impacts

No residual effects to social and economic values are anticipated from the proposed project or alternatives.

4.10 Recreation

Primary issues related to recreation include: the potential for the project alternatives to displace dispersed recreational use from areas for which there are no reasonable substitutes as a result of decreases in game population; reduced quality of the aesthetic experience; and loss of access.

4.10.1 Proposed Action

The proposed project area for the Round Mountain and Gold Hill areas and the Transportation/Utility Corridor, would encompass a total of approximately 15,379 acres, of which approximately 13,744 acres (89 percent) are BLM-administered public land, 516 acres (3 percent) are Toiyabe National Forest lands, and 1,119 acres (7 percent) are RMGC-owned private lands. The total area would encompass the existing project boundary area of 7,263 acres (**Table 2.3-3**) plus an additional 8,116 acres, including 8,057 acres of BLM-administered public lands. Total new proposed surface disturbance would include approximately 4,698 acres, of which approximately 4,581 acres (98 percent) would occur on public land. The new surface disturbance would be in addition to the 5,928 acres of previously approved disturbance, which would be an increase of approximately 80 percent (**Table 2.4-3**).

Public access for recreational purposes would be prohibited within the proposed project area and Transportation/Utility Corridor and would be physically restricted by perimeter fencing for the life of the project. However, most of this potentially restricted area receives very little recreational use at the present time because of minimal recreational opportunities or resources. Also, there is extensive public land in the immediately surrounding area that would accommodate migration of dispersed recreation activity from the proposed access restricted area.

Upon completion of mining, ore processing, closure, and reclamation, most of the area within the boundary and much of the disturbance area on public lands would again be available for dispersed recreation use. However, recreational opportunities and resources would likely remain minimal.

The Proposed Action would deter access to Jefferson and Shoshone Canyons to some degree due to construction and use of the Transportation/Utility Corridor between the Round Mountain and Gold Hill areas. However, public road access would be maintained on CR 875 throughout the project life, since the road provides the only access to Round Mountain, which is still occupied by several families. CR 875 also provides access from Big Smoky Valley to the Alta Toquima Wilderness, which would remain available via very rough two-track “roads.” However, other access to designated trails in the wilderness is available from several miles north of the proposed project area via Forest Road 008 or from Monitor Valley to the east.

A modest increase in regional population may occur as a result of the Proposed Action (Section 4.9, Social and Economic Values). The new residents would increase the demand for recreation resources and opportunities in the region, but the increase would be very small in the context of the existing population base. Ample public land is available in the region to accommodate dispersed recreation needs of the increased population. Minor effects to parks and other developed recreation facilities may occur in the communities where the increase in population would reside, primarily Round Mountain, Hadley, Carvers, and, to a small extent, Tonopah.

Effects on recreation resources that would occur as a result of the Proposed Action would be minor since there is an ample supply of alternative land for dispersed recreation activities in the vicinity of the proposed project, and no unique recreation resources would be impacted.

4.10.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on recreation resources would be the same as described for the Proposed Action, except that access to Jefferson and Shoshone canyons would be slightly less constricted due to a reduction of haul truck traffic across CR 875.

4.10.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on recreation resources would be the same as described for the Proposed Action, except that access to Jefferson and Shoshone canyons would be physically separated from haul road traffic by the county road overpass and there would be no traffic conflict to the canyons and National Forest lands.

4.10.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed. Impacts to recreation resources would result in a continuation of existing recreation conditions in the proposed project area for the duration of authorized mining activities.

4.10.5 Cumulative Impacts

The CESA for recreation is shown in **Figure 4.10-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present actions and RFFAs in the CESA have resulted, or would result, in approximately 12,656 acres of surface disturbance, of which approximately 7,302 acres is related to mining activities, approximately 3,449 acres is related to utilities/community actions (e.g., transmission lines, highways, secondary roads), approximately 940 acres is related to Federal land withdrawals, approximately 42 acres is related to geothermal exploration and development, and approximately 923 acres is related to other developments (gravel pit, landfill, and agriculture). The proposed project incrementally would increase disturbance to recreation by an additional 4,698 acres (less than 1 percent of the CESA) resulting in a total cumulative disturbance of approximately 17,354 acres (approximately 1 percent of the CESA).

Although the cumulative surface disturbance would be considerably greater than the direct disturbance from the proposed project, the vast acreage of public lands in the CESA would be more than sufficient to accommodate dispersed recreation activities displaced by past and present actions and RFFAs in the CESA. The cumulative unreclaimed surface disturbance (i.e., Gold Hill and Round Mountain pits) within the proposed project area, would represent a small fraction of the total land area available for dispersed recreation in the CESA, and would have a negligible effect on recreation resources and opportunities.

Past and present actions and RFFAs identified in Section 2.9, Past, Present, and Reasonably Forseeable Future Actions would not directly affect parks, concentrated recreational use areas, designated wilderness or Wilderness Study Areas (WSAs), or other protected areas in the CESA.

It is not known at this time whether the RFFAs identified in Section 2.9, Past, Present, and Reasonably Foreseeable Future Actions would result in a substantial increase in local population such that demand would exceed the current supply of developed recreation facilities. If the cumulative demand for developed

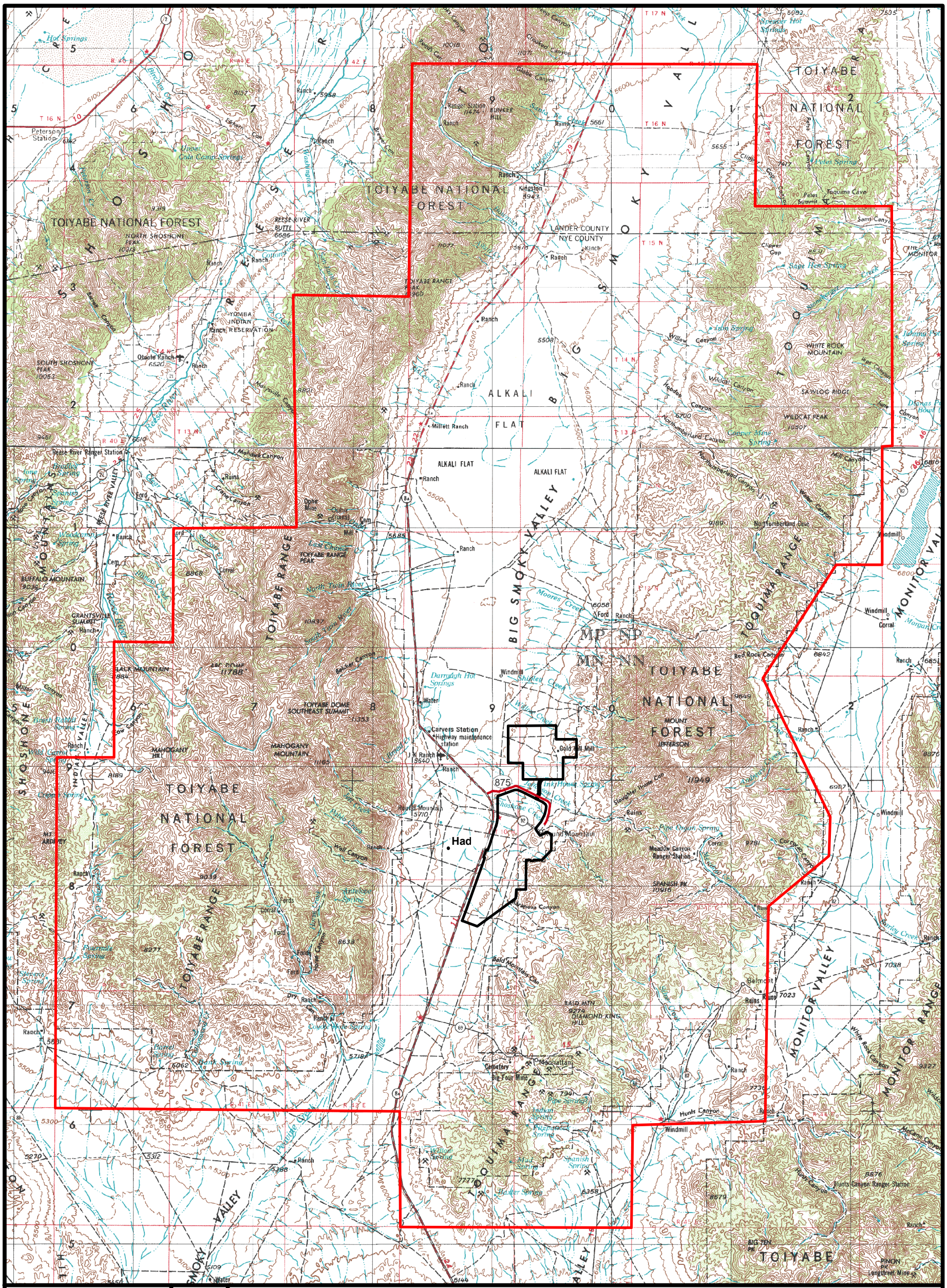
recreational opportunities were to exceed the available supply, additional facilities would need to be developed.

4.10.6 Monitoring and Mitigation Measures

Based on the conclusions of the impact analysis, no monitoring or mitigation measures would be required for recreation.

4.10.7 Residual Impacts

There would be a permanent loss of approximately 351 acres of wildlife habitat and multiple use lands available for recreation associated with the expansion of the Round Mountain Pit and development of the Gold Hill Pit, which would not be reclaimed.



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

Round Mountain Expansion Project

Figure 4.10-1

Cumulative Effects Study Area for Recreation and Wilderness

04/11/2009

4.11 Wilderness

Primary issues related to wilderness include whether the permitted action would be in compliance with the Wilderness Act of 1964 and the BLM Interim Wilderness Management Policy. In this regard, it will be important to determine whether and to what degree the quality of opportunities for wilderness experiences in designated wilderness would be degraded.

4.11.1 Proposed Action

Direct effects to the Arc Dome Wilderness or Alta Toquima Wilderness would not occur from the proposed project. Indirect noise effects on the Alta Toquima Wilderness would occur that could degrade the sense of solitude for wilderness users (Section 4.20, Noise). This effect would be most pronounced in the western reaches of the wilderness, which are infrequently used by the public because of difficult access. During periods of low background noise, the effect may extend to the Mount Jefferson Trail at lesser intensity; it would not affect the eastern slope of Mount Jefferson or the eastern half of the wilderness because the mountain ridge would be a barrier to sound transmission. During windy periods, when background noise is higher, noise from the proposed project would be effectively masked by the background noise.

Haul truck and mine traffic on the Transportation/Utility Corridor may discourage access to the western side of the Alta Toquima Wilderness, but access on the county road to Round Mountain would remain open throughout the life of the proposed project so the effect would be very low. Overall, the effects of the proposed project on wilderness resources in the study area would be low.

4.11.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on recreation resources would be largely the same as described for the Proposed Action. Noise effects from ore processing would be somewhat higher, but noise emitted by traffic using the Transportation/Utility Corridor would be substantially reduced. However, there would be minimal difference in the overall effect. With less mine traffic using the Transportation/Utility Corridor, the minor deterrence to wilderness access would be reduced slightly.

4.11.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on recreation resources would be mostly the same as described for the Proposed Action. Noise levels from the Transportation/Utility Corridor would be increased slightly due to haul trucks having to ascend a grade over the overpass. However, the Transportation/Utility Corridor would not be a major contributor to noise in the wilderness area with or without the overpass. Access to the western side of the Alta Toquima Wilderness would not be impeded by the Transportation/Utility Corridor.

4.11.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and related impacts to wilderness would not occur. The existing Round Mountain Mine would continue under existing authorization. Under this alternative, reclamation activities would be completed by approximately 2020, after which most of the existing and authorized disturbed area would be returned to open lands.

4.11.5 Cumulative Impacts

The CESA for wilderness is shown in **Figure 4.10-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present projects and RFFAs in the CESA would have no direct effect on the Arc Dome Wilderness or Alta Toquima Wilderness. In the event mining is reactivated in the Jefferson Canyon District, there would be a possibility of cumulative noise effects on the southwestern corner of the Alta Toquima Wilderness. The likelihood of such an occurrence is unknown at this time, but is not considered to have a high probability in the near future.

4.11.6 Monitoring and Mitigation Measures

Based on the conclusions of the impact analysis, no monitoring or mitigation measures would be required for wilderness resources.

4.11.7 Residual Adverse Impacts

At the completion of the Proposed Action, noise effects and access deterrence would cease. Therefore, no residual effects on wilderness resources would occur.

4.12 Visual Resources

Primary issues related to visual resources include whether the proposed project would cause varying levels of contrasts of introduced land forms, vegetation, and structures to the characteristic landscape.

Visual impacts of the proposed project were analyzed using the procedures outlined in the BLM Handbook H-8431-1, Visual Contrast Rating (BLM 2007b). Visual impacts were determined by comparing visual contrast ratings for the proposed project facilities with the allowable VRM objectives for the management class areas that would be affected (Section 3.12, Visual Resources). As noted previously, the management standards and allowable contrasts for the visual rehabilitation area are those of the management Class IV objective.

4.12.1 Proposed Action

Photographs were taken and visual analysis was completed for 9 KOPs (**Figure 3.12-1**): 1) KOP 1 is located approximately 4 miles north of Carvers on SR 376, representing travelers approaching the study area from the north; 2) KOP 2 is located approximately 4 miles south of the Hadley on SR 376, representing travelers approaching from the south; 3) KOP 3 is located at the intersection of the south entrance to Carvers; 4) KOP 4 is located at the intersection of the south entrance to Hadley; 5) KOP 5 is located on the bleachers of the school athletic field in Hadley representing residents and visitors in the community; 6) KOP 6 is located at the entrance of Pablo Canyon approximately 5 miles west of the study area, representing travelers approaching from the mouth of the canyon; 7) KOP 7 is located at the entrance of Jett Canyon approximately 5 miles west of the study area, representing travelers approaching from the mouth of the canyon; 8) KOP 8 is located at the entrance of the Broad Creek Canyon approximately 6 miles west of the study area, representing travelers approaching from the mouth of the canyon; and 9) KOP 9 is located near the entrance of Jefferson Canyon approximately 3 miles east of the study area, representing travelers approaching from the mouth of the canyon. Visual contrast ratings were prepared for KOPs 1 and 2 (**Appendix E**).

Development and expansion of the Round Mountain Area would minimally heighten visual contrast between existing, previously permitted, mine-related facilities and the natural landscape character, and would not substantially increase the visual impact from the currently permitted levels. As noted in Section 3.12, Visual Resources, the existing mine features exhibit strong color contrast, particularly under bright, clear light conditions. In addition, there are moderate to strong line and landform contrasts generated to a large extent by the flat tops and ultimate geometric shapes of the waste rock dumps, tailings impoundment facility, and leach pads. Finally, there is a moderate texture contrast between the bare surfaces of the mine features and the vegetation textures and patterns in the natural landscape.

Development of the proposed project to the south of existing development in the Round Mountain Area would cause moderate to strong visual contrast between mine-related facilities and the natural landscape character. Development of the proposed Gold Hill Area would cause moderate to strong visual contrast between mine-related facilities and the natural landscape character.

Among the various facilities associated with the Proposed Action, the proposed tailings impoundment facility would result in the greatest visual contrast. While the new mill, crusher, and ore stockpile would be sizable and potentially visually prominent in a different context, they are quite small in the context of the existing Round Mountain Mine. In addition, the proposed facilities would be located in the interior of the study area and visually shielded by existing leach pads and waste rock dumps, which would render them virtually

indistinguishable from existing mine facilities and features. However, expansion of the tailings impoundment facility would occur along the perimeter of the site in the foreground of the viewshed as seen from the KOPs. The proposed tailings impoundment facility expansion would have visual characteristics similar to existing waste rock dumps and leach pads, notably a geometric form and raw rock visual surfaces. Consequently, the tailings impoundment facility would have similar, but expanded, visual effects to those already occurring because of the existing project. Visual effects would include strong color contrast, moderate to strong line and landform contrast, and moderate texture contrast. Therefore, the key consideration is the degree of expansion of the visual impacts.

The existing project facilities extend approximately 3.5 miles north to south and over 3 miles east to west. The existing study area has an irregular western footprint limit along the SR 376, which is the public highway along the western edge of the mine. The center one-third of the study area is set back approximately 1,200 feet from SR 376, the northern one-third is set back more than 0.5 mile, and the southern one-third is set back more than 1 mile from SR 376 to the first major feature (i.e., Dedicated Leach Pad). The proposed facilities would be constructed approximately 1,000 feet east of SR 376 and extend south from the existing tailings impoundment facility, which would double the ultimate “wall” along SR 376 from its presently approved 8,000 to 16,000 feet (more than 3 miles). Although the height would be less for the proposed tailings impoundment facility than for the authorized waste rock dumps, the “wall” effect would occur with the expansion of the tailings impoundment facility.

The visual effect would be greatest on views from KOP 2 because the extension would be in the immediate foreground as motorists approach from the south (**Appendix E**). The relatively low profile of the proposed tailings impoundment facility would help subordinate it to the higher backdrop of waste rock dumps backed by the even higher Toquima Range. The east-west extent of the project would not change noticeably for views from KOP 1. Views from KOP 1 would be moderately to strongly affected by the proposed project (**Appendix E**); the Gold Hill development would increase the overall north-south extent from this perspective 2 miles to the north. Views from KOPs 3 through 7 would include the greatest north-south expansion of the project. The proposed expansion of the tailings impoundment facility would extend the south side of the disturbance area by almost 1 mile, or approximately 25 percent. **Appendix E** illustrates views from KOPs 1 and 2 after reclamation.

Prior to final reclamation and mitigation, the proposed project would not meet the Visual Resource Management Class IV management objectives, particularly the stipulations relative to “minimizing disturbance” and “repeating basic elements” (i.e., form, line, color, and texture). However, the objectives also indicate “major modification” would occur and that “visual dominance” can be accommodated in Class IV areas.

4.12.2 Gold Hill Processing Alternative

Effect of the Gold Hill Processing Alternative on visual resources would be the same as described for the Proposed Action.

4.12.3 County Road Overpass Alternative

The visual effect would be minimal from KOPs 1 and 8 and moderate from KOP 3. Effects would result from changes in form and color in the characteristic landscape. Visual effects would be indistinguishable from the remaining KOPs.

4.12.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and related potential impacts to visual resources would not occur. The existing Round Mountain mining operations would result in the continuation of the existing visual environment during project operations, eventually culminating in reclamation and revegetation of the project facilities.

4.12.5 Cumulative Impacts

The CESA for visual resources is shown in **Figure 4.12-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present activities associated with the Round Mountain Mine are described in the environmental consequences analysis. Relevant past and present actions and RFFAs are those located within the viewshed of the proposed project. Visual effects would vary with location and size of the disturbance. The visual contrast associated with the construction and operation of past and present actions and RFFAs, in addition to the Proposed Action, would include: strong color contrast, stronger line and form contrast, and moderate textural contrast.

4.12.6 Monitoring and Mitigation Measures

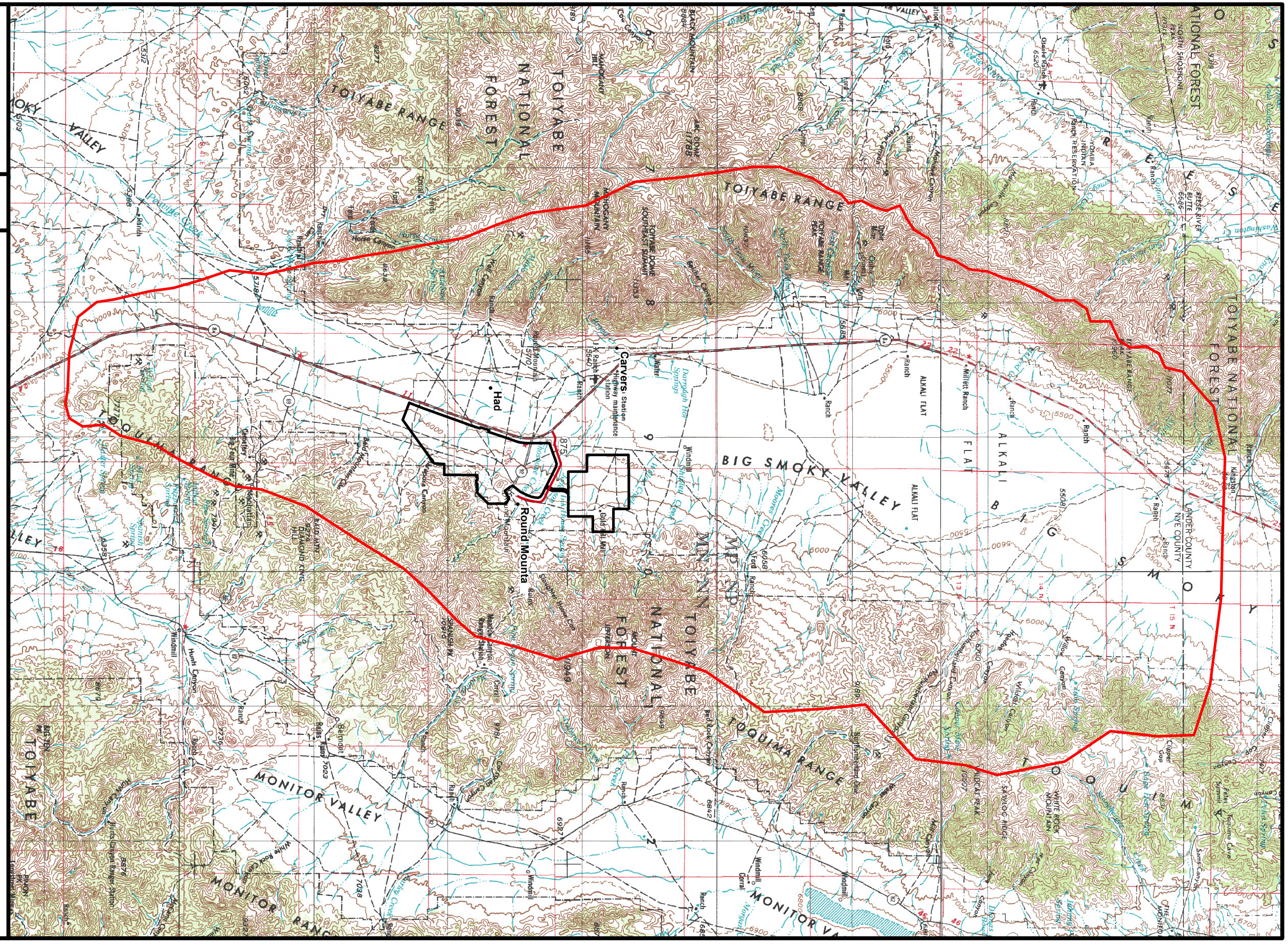
Issue: Expansion of the tailings impoundment facility would result in a strong visual contrast with the surrounding landscape.

Mitigation Measure VR-1: To reduce the visual contrast of the proposed tailings impoundment, RMGC would vary slope angles and avoid long linear features and overly simple geometric forms, to the extent that the engineering design permits. During final reclamation, relief on the top of the south and west perimeter of the impoundment would be varied with horizontally and vertically irregular massing to repeat the basic elements of the natural landscape and surrounding foothills. These modifications would be implemented such that they would not affect the geotechnical stability of the tailings impoundment.

Effectiveness: Implementation of this measure would minimize visual contrasts to a moderate level.

4.12.7 Residual Effects

Revegetating the visible faces of the tailings impoundment facility would notably reduce color contrast over the long term; regrading would reduce the form contrast. With the implementation of reclamation and mitigation measures, the Class IV Visual Resource Management objectives would be achieved. Therefore, residual effects to visual resources would be minimized.


Round Mountain
Expansion Project
Legend
Proposed Project Boundary
CESA Boundary for Visual Resources
Figure 4.12-1
Cumulative Effects Study
Area for Visual Resources
Note: Topographic elevations provided in feet. USGS 1929 Vertical Datum.
0
2.5
5
Miles
N
04/30/2009

4.13 Soils and Watershed

Primary issues related to soils and watershed include: potential erosion impacts; availability of suitable soils and growth media for revegetation; potential for successfully restoring post-mining land uses; protection of public safety after mine reclamation and closure; and stabilization of site drainage.

During development of mining projects in Nevada, suitable soil resources and/or growth media substitutions are salvaged as land disturbance proceeds. These materials typically are directly redistributed or stockpiled and protected for later use in seedbed reconstruction during agency-approved reclamation programs. In the past, RMGC has had considerable success in growth media management and reclamation. Investigations indicate that sufficient suitable growth media exist for the Proposed Action and action alternatives. Additional descriptions of RMGC's environmental protection measures, growth media handling, and reclamation materials and practices are presented in Chapter 2.0, Alternatives Including the Proposed Action. RMGC's environmental protection measures for soils and watershed are presented in Sections 2.5.2, Water Resources; 2.5.7, Soils and Watershed; and 2.5.8, Erosion and Sediment Control. Revegetation practices, which have a bearing on the successful surface stabilization and erosion control, are discussed in Section 2.5.9, Vegetation and Invasive and Non-native Species.

Impacts to soils and watershed would occur during and after mining. Impact assessments were based on understanding the range of physical and chemical soil characteristics, as well as the pre-mining topography and drainage in comparison to short-term and long-term reclaimed configurations.

4.13.1 Proposed Action

4.13.1.1 Soils

Surface Disturbance

The proposed expansion of the Round Mountain Area and development of the Gold Hill Area would result in approximately 4,698 acres of disturbance to soil resources. Soil mapping units in proposed disturbance areas are illustrated in **Figure 3.13-1**. Replacement of growth media for vegetation is proposed for major disturbances associated with the proposed project. Salvaged growth media would be comprised of both surface soils and pit alluvium. The pit alluvium from the Round Mountain Pit is physically and chemically suitable for plant growth, and has been successfully used for reclamation efforts in the Round Mountain Area. In areas of new disturbance, up to 12 inches of growth media would be salvaged as appropriate. The available salvage depth for native soil material is provided in **Table 3.13-1**.

Much of the disturbance from the proposed expansion of the Round Mountain Pit would occur where the Pintwater-Rock Outcrop soils occur. These soils are shallow to hard bedrock and range from moderately sloping to steep slopes. There may be as much as 30 percent rock outcrop where the Pintwater-Rock Outcrop complex occurs. The proposed North Waste Rock Dump expansion would occur where Lathrop-Bluewing association and Quima soils occur. The upper 13 inches of the Lathrop soil is suitable for reclamation growth media. Bluewing soils do not provide suitable growth media. The Quima soils provide ample growth media and should be salvaged prior to disturbance. The proposed tailings impoundment expansion area includes Bluewing and Lathrop soils. The Bluewing series are sandy, droughty and have varying modifiers of very stony to very gravelly horizons. These materials would not be well suited for recovery as growth media. However, the upper 13 inches of the Lathrop soil is suitable for reclamation growth media.

Much of the proposed disturbance in the Gold Hill Area include the Vigus-Koyen association and Lyda soils (NRCS 2007). Vigus soils are moderately deep to a weakly cemented layer. This soil may be salvaged to a depth of 13 inches. Below this depth these soils have elevated salt concentrations. Koyen soils are loamy and the upper 18 inches are suitable for growth media. These soils may be salvaged to a depth of 44 inches where gravel is not excessive. Lyda soils are shallow to an indurated hardpan. The upper 12 inches may be salvaged for growth media. The Old Camp-Rock Outcrop Series occur on the east side of the Gold Hill Area. Old Camp comprises approximately 40 percent of the complex. The Old Camp series is shallow to lithic (hard, durable) bedrock and is found on steep slopes. There may be as much as 30 percent rock outcrop within this complex. If disturbed, this area may be difficult to reclaim due to the steep slopes, shallow soils, and rock outcrop.

The pit alluvium from the Round Mountain Area has been used successfully in reclamation efforts and would continue to be used in reclamation efforts. In the Gold Hill Area, the lower pit alluvium should be avoided for use as growth media due to the unsuitable chemical and textural properties. RMGC collected several samples of alluvium from the Gold Hill Area. In the upper Gold Hill alluvium, one sample demonstrated very highly saline-sodic properties. Another sample, although droughty (coarse-textured), did not have chemically undesirable characteristics. The upper pit alluvium would be recoverable for growth media where the more desirable material can be distinguished in the field and separated from the highly saline-sodic material. As stated in RMGC's Environmental Protection Measures (Section 2.5), additional documentation of the suitability of Gold Hill Pit alluvium for use as growth media would be provided to the BLM for review, prior to its use. In the Gold Hill Area, RMGC would identify the locations of suitable and unsuitable upper alluvium and distinguishing characteristics between the two, in order to salvage suitable growth media in the area. Salvageable surface soils in this area would be used for growth media. If adequate growth media are not available, alluvium may be brought in from the Round Mountain Area to reclaim the site.

RMGC has investigated potential erosion losses from proposed project facilities using a RUSLE analysis (SRK 2001). Initially developed by the USDA and supplemented by research over several decades, the RUSLE has become an accepted tool for investigating erosion losses and comparing the effectiveness of different erosion control practices. Typically, soil loss tolerances for shallow, poorly-developed soils in the Western U.S. range from less than 1 to 2 tons per acre per year. Soil loss calculations for the proposed project indicate that on surfaces that are reclaimed to 2.5H:1.0V slopes, covered with pit-run alluvium and scarified or ripped with minimum 2 to 3 inch furrows, result in a value of 0.4 ton per acre per year. This estimate is well within the general soil loss tolerances. However, if finer grained materials are used for reclamation of these slopes, or if slope lengths are increased, soil losses also would increase considerably.

It should be noted that inputs to any RUSLE analysis involve professional judgment. Since the equation multiplies the inputs for various factors, these inputs may dramatically influence the outcome. For this reason, the RUSLE is best used as a comparative tool to investigate erosion control practices, rather than as a quantitatively accurate means of predicting erosion losses.

Revegetation monitoring and ongoing maintenance and inspection of BMPs during the required reclamation monitoring period would facilitate successful control of accelerated erosion. Such monitoring and any necessary corrective practices would be implemented as described in an approved Reclamation Plan.

Overall site productivity is primarily a vegetation measure. Productivity varies with vegetation community, but more importantly, with land management objectives as they relate to which vegetation types are

desirable or productive. In contrast, soil quality is an inherent soil resource characteristic involving aeration, permeability, texture, salinity and alkalinity, microbial populations, fertility, and other physical and chemical characteristics that are accepted as beneficial to overall plant growth and establishment. Based on this concept, there would be impacts to the existing quality of native soils from project-related disturbance. Growth media excavation, transport and storage, and redistribution would modify existing soil structure, which would affect aeration and permeability. It is likely that some mixing of textural zones would occur, as well as mixing of saline or alkaline materials with relatively salt-free materials. This may result in chemical impacts to soil quality for seedbeds. In addition, microbial populations currently exist in the growth media would likely decrease during stockpiling and storage.

Due to these probable effects, the initial soil quality of reconstructed seedbeds and root zones would be less than that of the existing soil resources. A permanent irreversible loss of soil productivity would occur on approximately 351 acres in association with development of the proposed pits, which would not be reclaimed.

Over time, these impacts would be reduced by RMGC's commitment to reclaim project facilities and successfully restore productive post-mining land uses. These objectives would be attained through the use of BMPs, RMGC's environmental protection measures, and the use of site-adapted plant species for reseeding. In addition, state and Federal reclamation requirements require revegetation monitoring in comparison with established quantitative standards for the locale. A period of overall reclamation monitoring (and maintenance as necessary) also is required prior to agency approval of reclamation bond release. Based on these requirements, it is likely that short- to long-term (e.g., up to 10 years or more) decreases in soil quality would not limit the attainment of overall post-mining land use objectives. Over time, soil quality on reclaimed and revegetated sites would resemble pre-mining conditions. Substantial long-term effects on proposed post-mining land uses from soil quality impacts are not anticipated.

Water Management Activities

Hydric soils associated with riparian areas may be affected as a result of drawdown effects associated with pit dewatering activities.

4.13.1.2 Watershed

Surface Disturbance

Proposed concurrent reclamation, drainage, and erosion control are discussed in Chapter 2.0, Alternatives Including the Proposed Action. Although not subject to stormwater permitting requirements through NDEP, RMGC would design, construct, and maintain a stormwater management system during project operations. This system of diversions would route runoff and streamflows between and around proposed project components. By operating in conformance with an approved Nevada Water Pollution Control permit, RMGC also would isolate process fluids (e.g., heap leach solution, tailing slurry, and solutions) from surrounding lands and water resources. In combination with concurrent reclamation efforts, compliance with these permit requirements would minimize watershed impacts during operations. Nonetheless, unavoidable adverse impacts would occur in the form of modifications to existing topography and drainage features.

Heap leach pads, waste rock dumps, and tailings embankments would be regraded to an average slope not steeper than 2.5H:1.0V. Free-draining post-mining topography, growth media restoration, and other reclamation practices are proposed for these components.

Post-mining recontouring, road reclamation, building removal, and enhancement of drainage features and access restrictions for the long-term would stabilize the surface of the site. After proposed operations cease, reclamation and closure plans would be implemented in accordance with requirements of these permits. With respect to watershed considerations, the reclamation measures developed by RMGC address recontouring and slope stability, restoration of surface drainage for tailings impoundments facilities, growth media restoration and revegetation, reclamation of road features and ponds, and measures to minimize sediment contributions to surface waters. Heap leach components would be drained, recontoured, and revegetated. Disposition of buildings and support facilities, and other aspects of a bonded and monitored reclamation program, also are addressed in Section 2.6.7, Facility Reclamation.

Examination of the proposed project configuration indicates that the Gold Hill development would obstruct a number of ephemeral drainageways that cross the alluvial fan between Willow Creek to the north and Indian Creek to the south. A proposed stormwater diversion would route some runon to the south, from the southeastern upgradient watershed into an ephemeral tributary that parallels Indian Creek. Along the northeastern side of the Gold Hill Area, the proposed Gold Hill Pit and North Waste Rock Dump would block distributary ephemeral drainages that cross the fan system south of Willow Creek.

Overall, the watershed that contributes to the fan channels in the Gold Hill Area occupies approximately 3 square miles. The drainage area that is currently not anticipated to be routed around the proposed project components is roughly half this size (about 1.5 square miles), and is characterized by steep topography sloping down to the ephemeral channels. Historically, streamflows have transported tailings down the valley from pre-World War II mining and processing in this locale. The materials have spread into the smaller distributing channels lower on the fan system.

A somewhat similar situation would occur at the expanded Round Mountain Pit, where the hillslopes east of the proposed pit wall would prevent diversion runon from Kelsey Canyon. In this location, the higher land surfaces on either side of the channel itself would create an area where runoff would pool against the pit margin. Further planning may result in additional stormwater controls in these areas. In the Gold Hill Area runoff could be directed northward into lower Willow Creek or other existing drainages. During mining, adaptive stormwater management and pit operations would reduce the potential for drainage impacts.

Other ephemeral drainages in the area between Gold Hill and Round Mountain would pass through culverts along the proposed Transportation/Utility Corridor. In the central part of the proposed project area, the expansion of the North Waste Rock Dump would obstruct distributary fan channels below Shoshone Canyon. The proposed stormwater diversion channel would route runoff around the expanded waste rock dump toward Jefferson Creek or other existing drainages. In the southern part of the proposed project area, proposed tailings impoundment dam expansion areas would obstruct ephemeral fan tributaries of Mariposa Canyon. These drainages would be routed to the south by a stormwater diversion channel. At both locations, stabilized culverts of adequate capacity would be installed, inspected, and maintained, if necessary.

Under NAC 445A.397, methods for the control of storm flow runon are part of the engineering design report filed in accordance with requirements for the state WPCP. Stormwater diversions around the process components (e.g., tailings ponds, leach heaps) would be designed, constructed, and maintained during operations. This program differs from the state NPDES permit program, and is specifically oriented to mining and mineral processing operations as administered by the NDEP Bureau of Mining, Regulation Branch. Under this state regulatory program, “all process components must be designed to withstand the runoff from

a 24-hour storm event with a 100-year recurrence interval" (NAC 445A.433). In addition, "the primary fluid management system must be designed to be able to remain fully functional and fully contain all process fluids including all accumulations resulting from a 24-hour storm event with a 25-year recurrence interval. The fluid management system must be designed to be functional for 5 years after the projected operating life of the process component and permanent closure period" (NAC 445A.433).

The permit review and approval processes on the part of NDEP, as well as periodic inspections by RMGC and agency personnel, would ensure adequate construction and performance of erosion controls and site drainage during operations. Given the geomorphic setting of the proposed project area and the adjacent valley, seepage of storm runoff into the alluvial deposits is likely to minimize the potential impacts of stormwater routing. Remaining surface flows would temporarily collect on the valley floor until they evaporate or percolate into the basin deposits. This would be a continuation of the existing processes in this arid locale. No long-term impacts to existing watershed yield or stability are anticipated during the proposed operations.

After mining ceases, flows from Kelsey Canyon would be routed into the Round Mountain Pit, and flows from smaller ephemeral channels would be routed into the Gold Hill Pit. In each case, approximately 3 square miles of watershed area would be permanently diverted into the respective pits. Given the comparatively small size of these watersheds, the limited precipitation in the area, and the existing evaporation and seepage of runoff into valley alluvium, little impact on watershed yield or downgradient flows is anticipated. Protection measures as identified in Section 2.6.7.1, Pit Reclamation and Security, would minimize potential long-term stormwater run-off impacts.

After the cessation of operations, the successful implementation of the Reclamation Plan and recommended additional mitigation measures would substantially mitigate watershed impacts over the long term. No long-term impacts to existing watershed conditions would be anticipated.

Water Management Activities

The groundwater drawdown effect from pit dewatering may result in reduced stream flows and have drying effects on seeps, springs, and ephemeral creeks and the hydric soils associated with these areas. This may dramatically change the microbial and chemical characteristics of the soils and alter vegetative communities. Specific impacts to water features as a result of water management activities are provided in Section 4.3, Water Quality and Quantity (Surface and Ground) and Water Use.

4.13.2 Gold Hill Processing Alternative

The effects of this alternative on soils and watersheds would be the same as described for the Proposed Action.

4.13.3 County Road Overpass Alternative

The effects of this alternative on soils and watersheds would be the same as described for the Proposed Action except there would be approximately 2 additional acres of disturbance associated with the construction of the overpass at the county road intersection. Short-term impacts would occur from wind and water erosion until the fill is revegetated.

Growth media salvage, redistribution, and concurrent reclamation practices would minimize potential impacts to soils and watersheds. Runoff and erosion controls would be incorporated into the overall embankment and road configuration to assist in drainage stability. Watershed impacts would be the same as described for the Proposed Action.

4.13.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and associated impacts to soil and watershed resources would not occur. Under this alternative, the existing Round Mountain Mine would continue to operate under existing authorizations. Under this alternative, sufficient growth media resources have been salvaged during current mining activities, and reclamation progress has been approved under state and Federal guidelines.

4.13.5 Cumulative Impacts

The CESA for soils and watershed is shown in **Figure 4.13.1**. The past and present actions and RFFAs in this area are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Cumulative impacts to soils resources and watershed drainage features from the proposed project would include additional disturbance of soils in the proposed project area, and further modification of drainage patterns. The Proposed Action would necessitate the excavation and storage of additional soil materials as growth media. In most cases, suitable pit alluvium would be substituted for native surface soil. Cumulative effects to runoff and drainage characteristics would be mitigated by implementation of the Reclamation Plan. Surface configurations and drainage controls would manage runoff from the proposed project area, concurrent with operations and over the long-term. As a result, effects to drainages and watershed stability are expected to be minimal.

Past and present actions and RFFAs within the CESA have resulted, or would result, in approximately 10,767 acres of soil disturbance, of which approximately 6,374 acres are related to mining activities and 4,393 acres are related to utilities/community actions (e.g., transmission lines, interstate highways, secondary roads), agriculture, geothermal exploration and development, and other development (e.g., landfill). The proposed project incrementally would increase disturbance to soils by an additional 4,698 acres (approximately 5 percent of the CESA) resulting in a total cumulative disturbance of approximately 15,465 acres (approximately 16 percent of the CESA). It is assumed that portions of past mining-related disturbances in the CESA have been reclaimed, and ongoing reclamation at existing operations would continue to reduce the impacts to soils. Pending completion of successful reclamation, the incremental additional impacts to soils as a result of the proposed project would be temporary in nature for the majority of the project disturbance area (with the exception of the development of the Gold Hill Pit and expansion of the Round Mountain Pit).

4.13.6 Monitoring and Mitigation Measures

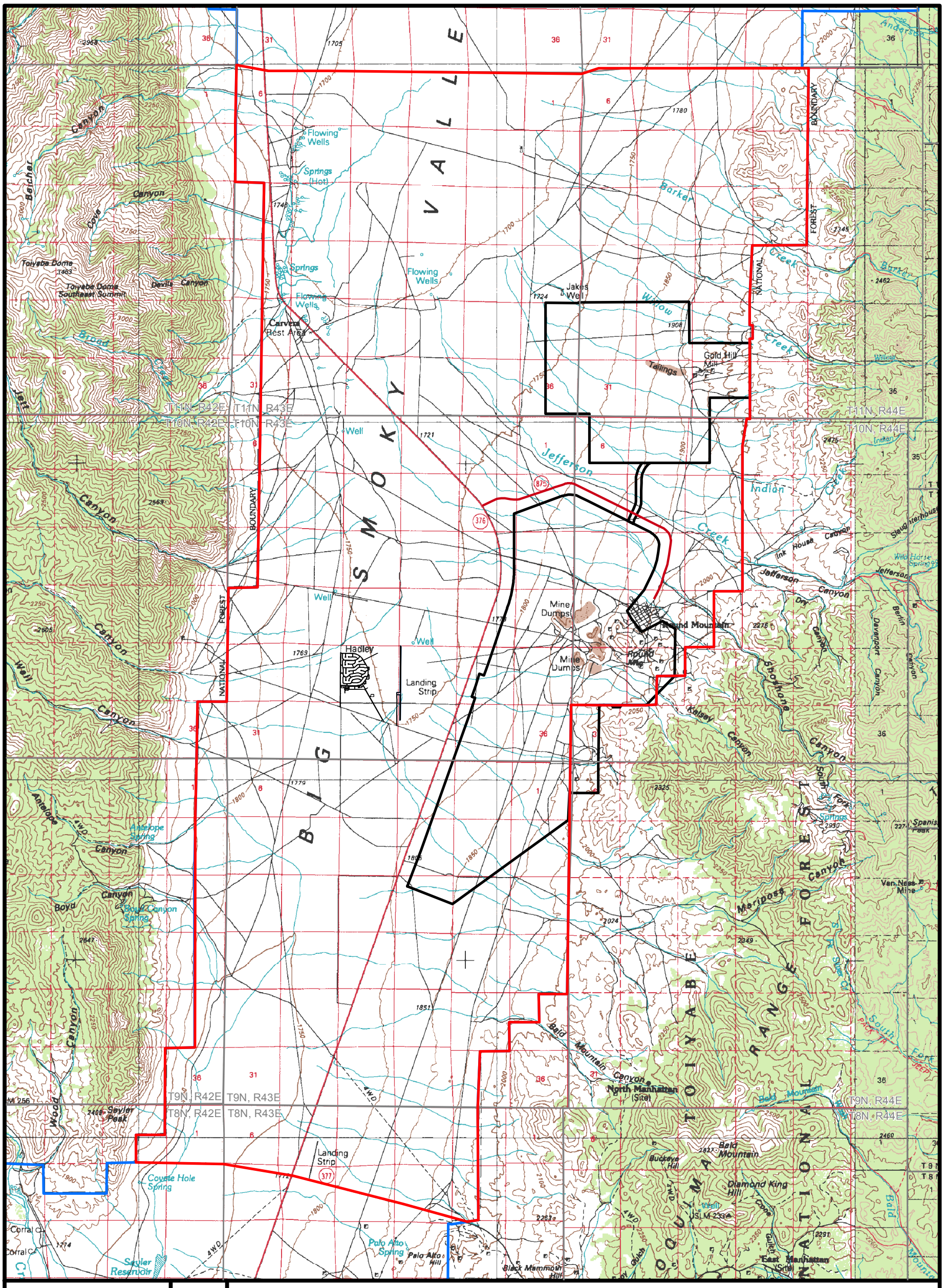
Issue: Runoff could pool along the waste rock dumps in the Gold Hill Area, affecting mass stability of these features. In addition, if such pools form, they could create areas where surface water quality is reduced through long-term contact with waste rock materials. The severity of such impacts would depend on the locations, sizes, and depths of any pools that formed.

Mitigation Measure SW-1: In reclamation planning, RMGC will incorporate stormwater controls (e.g. stormwater ponds, diversions) for the watershed areas of the North Waste Rock Dump and northern portion of the West Waste Rock Dump in the Gold Hill Area. This measure will apply to all action alternatives except the No Action Alternative.

Effectiveness: Mitigation Measure SW-1 would mitigate the potential for seepage to affect the stability of toes of waste rock dumps in the Gold Hill Area. By maintaining free surface drainage, the potential for long-term site stability would increase.

4.13.7 Residual Impacts

Residual impacts to soils and watershed resources would consist of the permanent loss of soil quality and vegetative productivity from about 351 acres associated with the proposed pits.



Round Mountain Expansion Project

Figure 4.13-1

Cumulative Effects Study Area for Soils and Watershed, Vegetation, and Noxious Weeds and Invasive Species

Legend

- Proposed Project Boundary
- CESA Boundary for Soils and Watershed, Vegetation, and Noxious Weeds and Invasive Species

N

0 1 2 Miles

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

05/25/2009

4.14 Vegetation

Primary issues related to vegetation resources include direct and/or indirect impacts to upland vegetation and special status plant species, riparian habitats, forage production rates in rangeland areas, and impacts associated with the introduction and/or spread of noxious weeds and invasive species.

4.14.1 Proposed Action

4.14.1.1 Surface Disturbance

Under the Proposed Action, mine development and operation would disturb approximately 4,698 acres through surface disturbance. From this area, approximately 4,690 acres of vegetation (4,689 acres of shrub-dominated communities and less than 1 acre of barren cover and riparian vegetation) would be disturbed or removed; developed land occupies approximately 8 acres and does not support vegetation (**Table 4.14-1**). Project-related activities would result in the conversion of shrub-dominated vegetation cover types to grass/forb-dominated vegetation cover types in the short term. Over the long term, shrubs would become re-established and increase in abundance within the majority of disturbed areas as a result of reclamation and natural re-colonization.

The loss of shrub-dominated vegetation communities would represent a long-term impact as it would take up to 25 years following reclamation for mature shrub species to re-establish. A permanent loss of approximately 351 acres from the development of the Round Mountain and Gold Hill pits would occur under the Proposed Action. This permanent loss would include approximately 343 acres of shrub-dominated communities and less than 1 acre of barren cover.

Approximately 0.05 acre of riparian vegetation associated with Jefferson Creek would be removed or disturbed as a result of surface disturbance from the Proposed Action. However, mine development and operation would result in the filling and excavation of small intermittent drainages.

Reclamation would be completed on approximately 4,348 acres (approximately 93 percent) of the total proposed surface disturbance area. To minimize mine-related impacts to vegetation, reclamation would be conducted as soon as practical, with concurrent reclamation implemented to the maximum extent possible as discussed in Section 2.5, RMGC's Environmental Protection Measures. Reclamation activities may include, but are not limited to, grading of final slopes; ripping of compacted soil; application of growth media; and broadcasting of seed. Seed mixes, as described in Section 2.6.5, Revegetation, Seeding, and Planting, would be used for revegetation activities. Satisfactory revegetation of mine-related disturbance areas (i.e., assuming the primary goal of soil stabilization through presence of adequate plant cover) is anticipated to occur approximately 10 to 15 years following reclamation. After 25 years, the reclaimed plant communities likely would consist of adequate herbaceous plant cover with sufficient diversity to substantially reduce the potential for soil erosion and provide forage for use by livestock and wildlife.

Table 4.14-1
Acres of Vegetation Disturbed or Removed Under the Proposed Action

Vegetation Types	Open Pits	Waste Rock Dumps	Leach Pads	Tailings Impoundment	Growth Media and Ore Stockpiles	Process Facilities	Infrastructure	Intramine Area	Transportation/ Utility Corridor	Exploration	Total Acres
Salt-desert shrubland	163.6	1,251.4	563.6	855.0	330.1	139.4	493.8	134.0	40.60	7.9	3,979.4
Sagebrush shrubland	179.6	167.3	135.7	30.8	5.9	8.5	79.9	70.6	25.55	6.0	709.9
Pinyon-juniper woodland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Riparian/wetland[1]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.0	0.0
Invasive annual grassland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.1	0.1
Barren	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.8
Total Vegetation Cover Disturbance	**344.0**	**1,418.7**	**699.3**	**885.8**	**336.0**	**147.9**	**573.7**	**204.6**	**66.20**	**14.0**	**4,690.2**
Developed	6.7	0.6	0.8	0.0	0.0	0.0	0.1	0.0	0.00	0.0	8.2
Total Disturbance	**350.7**	**1,419.3**	**700.1**	**885.8**	**336.0**	**147.9**	**573.8**	**204.6**	**66.20**	**14.0**	**4,698.4**

[1] Per SWReGAP data, no riparian/wetland vegetation cover types would be impacted under the Proposed Action; however, aerial photographic interpretation and site reconnaissance indicates that Jefferson Creek would be impacted as a result of construction activities for the Transportation/Utility Corridor.

Source: USGS 2004.

4.14.1.2 Water Management Activities

It is anticipated that mine-related groundwater drawdown would not result in direct impacts to upland vegetation within the 10-foot groundwater drawdown isopleth. Black greasewood and other shrubs roots' do not extend below 20 to 25 feet (Branson, Miller, & McQueen 1976; Comstock & Ehlerigner 1992; Donovan, Richards, & Muller 1996; Foxx & Tierney 1987; Shantz & Piemeisel 1940; Robertson 1983), and most grass roots would not extend below 7 feet (Elmore, Manning, Mustard, & Craine 2006). The water table in the proposed project area for upland areas is greater than 50 feet below the soil surface, and therefore, these upland plants would not be affected by the lowering of the water table.

Potential impacts to riparian vegetation could occur where gaining stream flow is sustained by groundwater sources within the projected mine-related 10-foot groundwater drawdown isopleth. As discussed in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, a measurable decrease in groundwater baseflow of gaining stream reaches is not anticipated where the groundwater drawdown is projected to be 10 feet or less; therefore, impacts to the vegetation associated with these reaches are not anticipated.

As discussed in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, groundwater drawdown within the projected mine-related 10-foot groundwater drawdown isopleth may potentially affect seeps, springs, and ephemeral creeks. Johnson springs 1 and 2 occur within the 10-foot groundwater drawdown isopleth and may experience reduced flows during summer and fall. These springs currently feed into Willow Creek. As a result, reduced flows may result in the partial loss of herbaceous riparian vegetation. In addition, riparian vegetation associated with Ink House and Healy springs that occurs approximately 0.5 mile east of the 10-foot groundwater drawdown isopleth may be impacted from groundwater drawdown. Groundwater flows to springs and seeps should recover in 50 to 100 years following initial drawdown. Adverse impacts to water wells and water rights that are attributable to mine dewatering would be monitored and mitigated through implementation of RMGC's environmental protection measures.

4.14.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on vegetation resources, including riparian habitats, would be the same as described for the Proposed Action.

4.14.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on vegetation resources, including riparian habitats, would be the same as described for the Proposed Action, with the exception that approximately 2 acres of additional sagebrush shrubland vegetation would be disturbed from the construction of the overpass structure.

4.14.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to vegetation resources would not occur. The existing Round Mountain mining operations would continue under existing authorizations, which includes the additional incremental surface disturbance of approximately 225 acres of vegetation (**Tables 2.3-1**).

Ongoing reclamation would minimize existing impacts to vegetation in mine-related surface disturbance areas, with resulting short-term impacts to herbaceous species and long-term impacts to woody species and riparian habitats.

Water management-related impacts to vegetation resources would occur as a result of existing and ongoing mine-related groundwater drawdown. Riparian habitats, including vegetation associated with seeps/springs would be affected by groundwater drawdown. Groundwater flows to springs and seeps should recover in 50 to 100 years following initial drawdown. Upland vegetation would remain unaffected by groundwater drawdown.

4.14.5 Cumulative Impacts

The CESA for vegetation resources is shown in **Figure 4.13.1**. The past and present actions and RFFAs in this area are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present actions and RFFAs within the CESA have resulted, or would result, in approximately 10,767 acres of disturbance to vegetation, of which approximately 6,374 acres are related to mining activities and 4,393 acres are related to utilities/community actions (e.g., transmission lines, interstate highways, secondary roads, landfills), agriculture, geothermal exploration and development, and other development (e.g., landfill). The proposed project incrementally would increase disturbance to vegetation by an additional 4,690 acres (approximately 5 percent of the CESA) resulting in a total cumulative disturbance of approximately 15,457 acres (approximately 16 percent of the CESA). It is assumed that portions of past mining-related disturbances in the CESA have been reclaimed, and ongoing reclamation at existing operations would continue to reduce the impacts to vegetation. Pending completion of successful reclamation, the incremental additional impacts to vegetation as a result of the proposed project would be temporary in nature for the majority of the project disturbance area (with the exception of the development of the Gold Hill Pit and expansion of the Round Mountain Pit), and the loss of mature shrubs would be minimal relative to the total acreage of woody species communities that occur in the cumulative effects study area. The removal of shrubs from these areas would result in a long-term change in vegetative structure since it would take up to 25 years for shrub species, of similar stature to become re-established in these areas.

Cumulative groundwater drawdown associated with water management-related impacts to vegetation resources may continue to affect riparian habitats, including vegetation associated with seeps, springs, and segments of Willow Creek. Since water management-related impacts to upland vegetation would not occur under the Proposed Action, no cumulative impacts to upland vegetation associated with water management activities, are anticipated.

4.14.6 Monitoring and Mitigation Measures

Issue: The long-term loss of riparian vegetation along seeps, springs, and perennial streams as a result of groundwater drawdown impacts.

Mitigation Measure V-1: RMGC will monitor potential changes in the extent of riparian vegetation associated with Willow Creek, and areas downgradient of Ink House and Healy springs, and Jefferson Creek on a 3-year frequency through 2040. RMGC will coordinate with the BLM to enhance existing riparian areas (planting of native riparian species, and removal of noxious weed and invasive species) at off-site locations to compensate for the loss of riparian vegetation. The loss of riparian vegetation would be compensated at a 2:1 ratio. RMGC would be responsible for monitoring these sites on an annual basis for

approximately 3 years after enhancement to ensure that these mitigation measures were effective and provide similar functions as existing riparian areas. RMGC would be responsible for developing an annual riparian vegetation monitoring report, which would be provided to the BLM for review and approval.

Effectiveness: The enhancement of existing riparian areas would ensure that the loss of riparian vegetation would be offset. The submittal of annual monitoring reports to the BLM during the 3-year monitoring period would provide a basis for evaluating the effectiveness of the program.

Additional monitoring and mitigation measures have not been identified since the reclamation activities are included as part of the Proposed Action and substantially would reduce potential impacts to vegetation resources.

4.14.7 Residual Impacts

Residual impacts to vegetation resources as a result of surface disturbance-related activities would include the permanent loss of vegetation from approximately 344 acres from the expansion of the existing Round Mountain Pit and the development of the Gold Hill Pit.

4.15 Noxious Weeds and Invasive Species

Primary issues related to noxious weeds and invasive species include direct and indirect impacts associated with the introduction or spread of noxious weeds and invasive species and the loss or degradation of native vegetation communities, or preferred grazing areas as a result of undesirable species invasion.

4.15.1 Proposed Action

As discussed in Section 3.15, Noxious Weeds and Invasive Species, four invasive, non-native species have been observed within the study area. These species are salt-cedar, Russian olive, Russian knapweed, and hoary cress. Noxious weeds and invasive species readily invade areas that have been subject to surface disturbance, which typically lack, or have minimal vegetative cover. Project-related activities associated with the Proposed Action would remove or disturb approximately 4,698 acres, of which 351 acres are associated with the Round Mountain and Gold Hill pits and would not be reclaimed (**Table 4.14-1**).

Implementation of RMGC's Reclamation Plan (Section 2.6, Reclamation) would reduce the potential for noxious weeds and invasive species to become introduced or spread within the study area. However, minor populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas.

To stabilize the growth media, reduce soil erosion, and minimize the potential for the establishment of noxious weeds and invasive species, growth media stockpiles may be seeded with the seed mix provided in Section 2.6, Reclamation, as needed. In addition, the design and construction of the proposed mine facilities would facilitate concurrent reclamation to the maximum extent practical. Successful reclamation of mine-related disturbance areas would result in the establishment of a permanent vegetative cover, which would minimize the potential establishment of noxious weeds and invasive species in the long term. Although the proposed Round Mountain and Gold Hill pits would not be reclaimed, noxious weeds and invasive species would not likely become established in these areas due to the absence of soil and the formation of pit lakes in the long term. As described in Section 2.5, RMGC's Environmental Protection Measures, seed mixes and mulches used for reclamation would be certified weed-free. If noxious weeds become established in project-related disturbance areas, a weed removal or spraying program would be implemented in accordance with State of Nevada and BLM regulations. As described in Section 2.6.6, Weed Control, weed control practices would be implemented during reclamation phases to limit the growth and spread of noxious weeds and invasive species and facilitate successful revegetation with the approved seed mix. Weed control practices would be implemented in coordination with the BLM Tonopah Field Office to minimize the potential for the introduction and spread of noxious weeds and invasive species within the study area.

4.15.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative resulting from the potential introduction or spread of noxious weeds and invasive species would be the same as the potential described for the Proposed Action.

4.15.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative resulting from the potential introduction or spread of noxious weeds and invasive species would be the same as described for the Proposed Action, except that

there would be an incremental increase in the introduction or spread of noxious weeds and invasive species from approximately 2 acres of additional surface disturbance.

4.15.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and subsequent impacts associated with the introduction or spread of noxious weeds and invasive species would not occur. The potential spread of noxious weeds and invasive species would be managed under existing authorizations. Ongoing reclamation and existing weed control measures would continue to be implemented to prevent the establishment of new populations and to control existing populations within the Round Mountain Mine disturbance areas.

4.15.5 Cumulative Impacts

The CESA for noxious weeds and invasive species is shown in **Figure 4.13.1**. The past and present actions and RFFAs in this area are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present actions and RFFAs within the CESA have resulted, or would result, in approximately 10,767 acres of surface disturbance. The proposed project incrementally would increase surface disturbance by an additional 4,698 acres (approximately 5 percent of the CESA) resulting in a total cumulative disturbance of approximately 15,465 acres (approximately 16 percent of the CESA). It is assumed that the majority of the surface disturbance within the CESA would be reclaimed, which would minimize the establishment of noxious weeds and invasive species. In addition, implementation of the proposed project's Reclamation Plan would help minimize the establishment and spread of noxious weeds and invasive species in the proposed disturbance areas and, therefore, minimize the project's contribution to cumulative effects associated with these species.

Cumulative impacts associated with the introduction or spread of noxious weeds and invasive species as a result of decreased or cessation of flow in seeps, springs, and riparian habitats may be affected by cumulative groundwater drawdown. Implementation of RMGC's Reclamation Plan, in association with the Proposed Action and other authorized actions, would minimize the introduction or spread of noxious weeds and invasive species within the study area and, thereby minimizing the project's contribution to cumulative effects.

4.15.6 Monitoring and Mitigation Measures

No additional monitoring or mitigation measures would be recommended for noxious weeds and invasive species.

4.15.7 Residual Impacts

Implementation of RMGC's Reclamation Plan would minimize impacts associated with the introduction or spread of noxious weeds and invasive species in areas that would be reclaimed.

4.16 Range Management

Primary issues related to range management resources include: potential loss of active AUMs by allotment due to direct disturbance or the potential for reduced forage production following reclamation; potential impacts to existing water sources and range improvements; and potential impacts to seasonal livestock movement within grazing allotments.

4.16.1 Proposed Action

4.16.1.1 Surface Disturbance

Under the Proposed Action, perimeter fences would be erected along the proposed project area and Transportation/Utility Corridor. Perimeter fences would exclude livestock from an additional 6,577 acres of rangeland for the duration of the project. Part of the 8,116 acres (1,539 acres) of the proposed expansion was previously removed from the Smoky Allotment, which would amount to 68.4 AUMs (Deverse 2009). Perimeter fences on the south end of the proposed project area would be phased in as development progresses. This would temporarily reduce the AUMs excluded from grazing until development is complete. **Table 4.16-1** identifies acreage and AUM loss per grazing allotment as a result of implementation of the Proposed Action. Permanent loss of active AUMs was calculated based on application of the average stocking rate of the entire allotment to the areas that would not be reclaimed and available for livestock grazing.

Table 4.16-1
Impacts to Grazing Allotments

Grazing Allotment	Total Acreage	Total Active AUMs[1]	Stocking Rate Ac/AUM	Acreage Temporarily Excluded from Grazing	Acreage Permanently Excluded from Grazing	Temporary Loss of Active AUMs[2]	Permanent Loss of Active AUMs
Smoky	125,247	5,571	22.5	5,917	351	263.2	15.6
San Antone	442,555	13,580	32.5	309	0	9.5	0
Francisco	16,896	1,209	14.0	0	0	0	0
Total	**-**	**-**	**-**	**6,226**	**351**	**272.7**	**15.6**

[1] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.

[2] Projected active AUMs and percent active AUM loss were calculated based on a percentage of the stocking rate within the surface disturbance-related impact area compared to the allotment stocking rate as a whole.

Reclamation would be completed on approximately 4,348 acres (approximately 93 percent) of the total proposed disturbance area (4,698 acres). As discussed in Section 2.6, Reclamation, approximately 351 acres associated with the development of the Round Mountain and Gold Hill pits would not be reclaimed. Satisfactory revegetation of mine-related disturbance areas (i.e., assuming the primary goal of soil stabilization through presence of adequate plant cover) is anticipated to occur approximately 10 to 15 years following reclamation. After 25 years, the reclaimed plant communities would likely consist of adequate herbaceous plant cover with sufficient diversity to provide forage for use by livestock. When the re-establishment of vegetation cover would be considered capable of supporting grazing, perimeter fences would be removed. Livestock grazing could be resumed following successful revegetation, recovering 273 of the 288 AUMs from mine-related activities (**Table 4.16-1**).

A temporary loss of 6,226 acres and 273 AUMs would occur during the 13-year life of the project (**Table 4.16-1**). A permanent loss of approximately 351 acres and 16 AUMs within the Smoky Allotment would occur as a result from the development of the Round Mountain and Gold Hill pits. This reduction could limit the future expansion of the current grazing operation and would be considered during the formal allotment evaluation process. The permanent loss of 16 AUMs would represent less than 1 percent decrease of the active grazing preference associated with the Smoky Allotment. No permanent exclusion areas would be located within the San Antone Allotment. Surface disturbance-related activities are not proposed within the Francisco Allotment. Therefore, no direct impacts to this allotment would occur.

The increased mine development and operational activity may affect the distribution of cattle within the Smoky and San Antone allotments. The effects to livestock distribution also would affect the utilization of forage in upland and riparian areas in the long term. Two box-culvert underpasses would be installed along the Transportation/Utility Corridor to allow the passage of livestock within the Smoky Allotment.

No direct impacts are anticipated for range improvements (e.g., cattle guards, fences) for the Proposed Action.

4.16.1.2 Water Management Activities

Water management-related impacts to range resources, as a result of groundwater drawdown within the projected mine-related 10-foot groundwater drawdown isopleths, could include the reduction of groundwater levels for 2 water-related range improvements (i.e., the Upper Rogers Well and the Francisco Well) within the Smoky and Francisco allotments, respectively (**Table 4.16-2**). It is anticipated that mine-related groundwater drawdown would not result in direct impacts to upland vegetation within the 10-foot groundwater drawdown isopleths.

Table 4.16-2
Water-related Range Improvements Impacted under the Proposed Action

Range Improvement Name[1]	Legal Location				
	Meridian	Township	Range	Section	Subdivision
Smoky Allotment					
Upper Rodgers Well	Mount Diablo	009 N	043 E	005	SESW
Francisco Allotment					
Francisco Well	Mount Diablo	010 N	043 E	021	NWNE

[1] No water-related range improvements would be impacted as a result of water management-related impacts under the Proposed Action for the San Antone Allotment.

4.16.2 Gold Hill Processing Alternative

Impacts to range resources under this alternative would be the same as described for the Proposed Action.

4.16.3 County Road Overpass Alternative

Impacts to range resources under this alternative would be similar to those described for the Proposed Action, with the exception that approximately 2 acres of additional surface disturbance would occur within the Smoky Allotment.

4.16.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to range resources would not occur. The existing mining operation associated with the Round Mountain Mine would continue under existing authorizations. RMGC would reclaim mine-related disturbance areas, with the exception of the existing pit. Reclaimed areas would be available for livestock grazing following successful reclamation.

Impacts to water-related range improvements would include possible reduced flows of Upper Rodgers Well and the Francisco Well, as well as those impacts associated with ongoing permitted mining activities.

4.16.5 Cumulative Impacts

The CESA for range resources is shown in **Figure 4.16-1**. The past and present actions and RFFAs in this are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present actions and RFFAs within the CESA have resulted, or would result, in the loss of approximately 13,264 acres (590 AUMs) from active grazing preference, of which approximately 7,913 acres is related to mining activities, approximately 3,449 acres is related to utilities/community actions (e.g., community development, transmission lines, highways, secondary roads), and approximately 940 acres is related to Federal land withdrawals. The remaining 962 acres of disturbance is related to agriculture, geothermal exploration and development, and other development (e.g., landfill). The proposed project incrementally would reduce active grazing preference by an additional 6,577 acres (288 AUMs - approximately 3 percent of AUMs within the CESA) resulting in a total cumulative disturbance of approximately 19,841 acres (878 AUMs - approximately 11 percent of AUMs within the CESA). Following reclamation under the Proposed Action, it is assumed that 273 AUMs would be restored and available for grazing; the unreclaimed project components would result in the permanent loss of 16 AUMs in the Smoky Allotment.

No direct or indirect impacts to range improvements, excluding water-related range improvements, are anticipated under the Proposed Action. Therefore, no cumulative effects to range improvements are anticipated.

Water management-related impacts to range resources, as a result of groundwater drawdown within the projected mine-related 10-foot groundwater drawdown isopleths, could include the reduction of groundwater levels for 2 water-related range improvements (i.e., the Upper Rogers Well and the Francisco Well) within the Smoky and Francisco allotments, respectively. In addition, flows associated with seeps, springs, and waterbodies (e.g., Willow Creek) potentially could decrease, thereby reducing the amount of available water for livestock consumption within the Smoky allotment. Potential impacts to wells would be mitigated through implementation of RMGC's environmental protection measures.

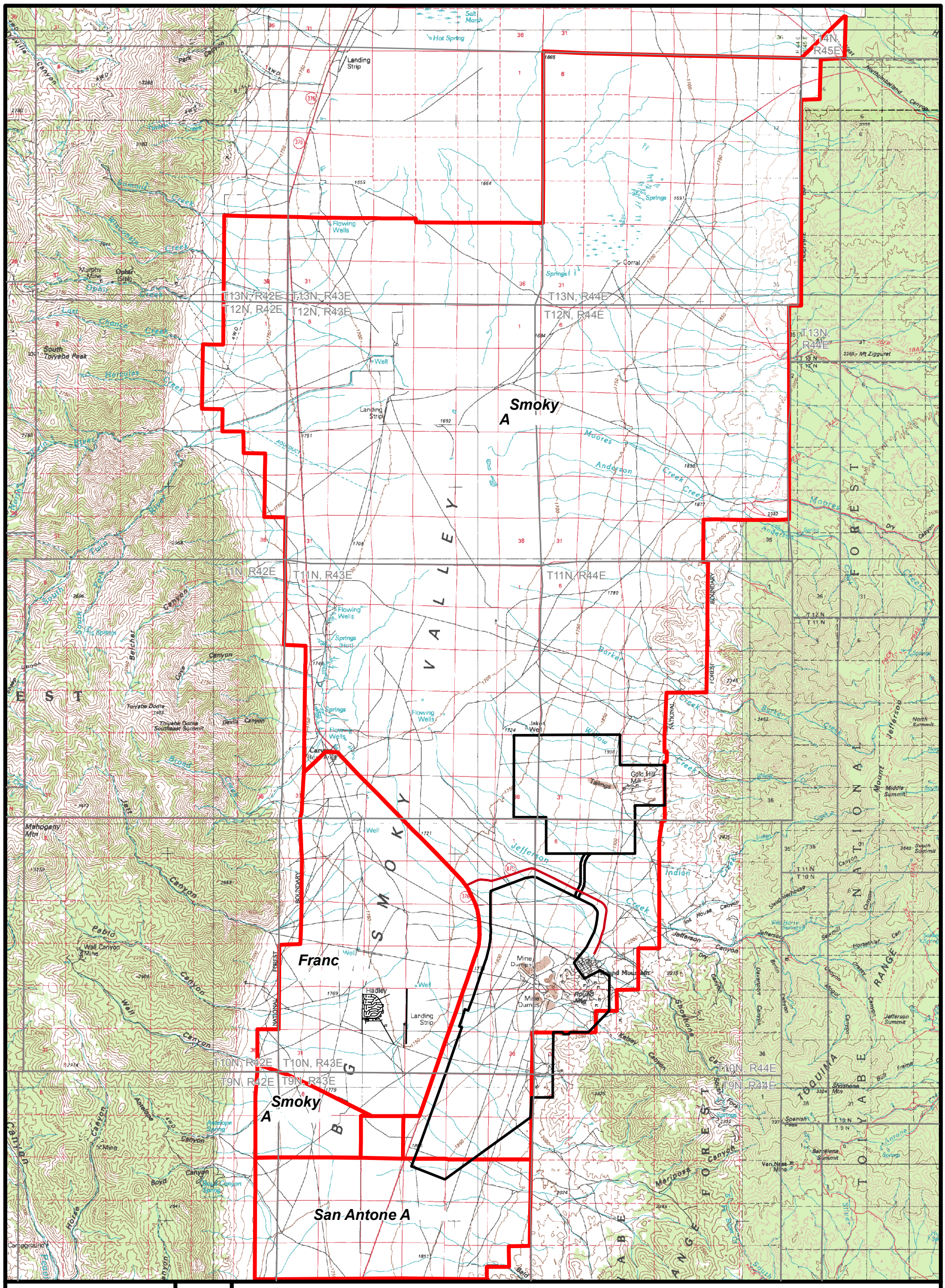
The reduction in available water within the CESA may result in a decrease in available forage from active grazing areas until such time that adequate herbaceous cover with sufficient diversity becomes established for livestock consumption. The loss of riparian vegetation adjacent to seeps, springs, and perennial waterbodies may result in a long-term change in vegetation structure, thus potentially reducing the available forage quantity for livestock grazing within these areas.

4.16.6 Monitoring and Mitigation Measures

No additional monitoring or mitigation measures would be recommended for range resources.

4.16.7 Residual Impacts

Residual impacts for range resources would include the permanent loss and exclusion of livestock grazing on approximately 351 acres associated with areas that would not re reclaimed (i.e., the Round Mountain and Gold Hill pits). This would result in the permanent loss of 16 AUMs within the Smoky Allotment.



Round Mountain Expansion Project

Figure 4.16-1

Cumulative Effects Study Area for Range Management

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

05/25/2009

4.17 Wildlife and Fisheries Resources

Wildlife species and related issues addressed by this analysis were determined through consultation with the BLM, NDOW, and USFWS. The primary issues related to wildlife and fisheries resources include the loss or alteration of native habitats, increased habitat fragmentation, animal displacement, direct loss of wildlife, and impacts associated with water management.

The potential impacts of the proposed project on terrestrial wildlife can be classified as short-term, long-term, and permanent. Short-term impacts arise from habitat removal and disturbance as well as from activities associated with mine operation; these impacts would cease upon mine closure and completion of successful reclamation. Long-term impacts would result from habitat disturbance that would continue post-reclamation (beyond 16 years). Permanent impacts consist of permanent changes to habitats and the wildlife populations that depend on those habitats, irrespective of reclamation success. Direct impacts to wildlife populations could include limited direct mortalities from mine development, habitat loss or alteration, incremental habitat fragmentation, and animal displacement. Indirect impacts could include increased noise, additional human presence, and the potential for increased vehicle-related mortalities. However, the degree of the effects on terrestrial wildlife species and their upland habitats would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of project activity, and physical parameters (e.g., topography, cover, forage, climate).

4.17.1 Proposed Action

4.17.1.1 Terrestrial Wildlife

Surface Disturbance

Impacts to wildlife from mine-related surface disturbance would include the temporary (short-term and long-term) and permanent reduction or loss of habitat. This impact would result from construction and operation of the proposed project. Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals and reptiles, and the displacement of more mobile species into adjacent habitats. Displacement also could result in some local reductions in wildlife populations if adjacent habitats are at carrying capacity. Mine-related surface disturbance also would result in an incremental increase in habitat fragmentation at the mine site until reclamation has been completed and vegetation is re-established. It is anticipated that the potential mine-related habitat fragmentation effects would be highest for wildlife species that typically use the Jefferson Creek corridor.

The proposed project would result in the long-term reduction of approximately 4,346 acres and the permanent loss of 344 acres of wildlife habitat (i.e., salt-desert shrublands, sagebrush shrublands, pinyon-juniper woodlands, invasive annual grassland, barren land, and less than 1 acre of riparian habitat [approximately 0.05 acre]) from the development of the Gold Hill Pit and expansion of the Round Mountain Pit (**Table 4.14-1**). Woody species such as sagebrush would require up to 25 years to reach maturity. The disturbance associated with the proposed project, excluding open pits, would be reclaimed following completion of mining activities.

Game Species. Direct impacts to mule deer would include the incremental long-term reduction of potential forage and the incremental increase of habitat fragmentation from vegetation removal associated with the proposed project. The project would disturb approximately 128 acres of mule deer winter range, consisting primarily of sagebrush shrublands habitat. In addition, approximately 174 acres associated with the Gold Hill

Pit would not be reclaimed. This anticipated loss of habitat would result in a small, incremental reduction in the amount of available habitat and is expected to have negligible effects on the deer population in the study area. Although approximately 729 acres of mule deer winter range occurs in the eastern portion of the proposed project area, no important mule deer movement corridors or seasonal habitats would be directly impacted from project activities. As a result, impacts to deer populations from the proposed project would be low.

Impacts to pronghorn would be similar to those discussed above for mule deer. Direct impacts would include the incremental long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of pronghorn range from the development of the Gold Hill Pit and expansion of the Round Mountain Pit. However, no important pronghorn seasonal ranges would be directly impacted from project activities. As a result, impacts to pronghorn populations from the proposed project would be low.

Impacts to mountain lions would be expected to be minimal, based on the infrequent occurrence of the species within the study area.

Direct impacts to small game species (e.g., chukar, mourning dove, pygmy rabbit, and black-tailed rabbit) would include the incremental long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potential habitat from the development of the Gold Hill Pit and expansion of the Round Mountain Pit. Impacts also would include displacement from the disturbance areas and increased habitat fragmentation, until reclamation has been completed and vegetation is re-established. In most instances, suitable habitat adjacent to disturbance areas would be available for use by these species. However, displacement would increase competition and could result in some local reductions in wildlife populations if adjacent habitats are at carrying capacity. Potential impacts also could include nest and burrow abandonment or loss of eggs or young. However, potential effects to small game from mine development are expected to be low. These temporary losses would reduce productivity for that breeding season. Potential impacts to the pygmy rabbit are discussed in Section 4.18, Special Status Species.

Potential effects to upland game birds from mine development are expected to be low. The lack of known breeding sites (e.g., greater sage-grouse leks) and water sources that would support brooding birds limit the overall habitat quality for greater sage-grouse, mourning dove, and chukar. Potential impacts to the greater sage-grouse are discussed in Section 4.18, Special Status Species.

Nongame Species. A variety of resident and migratory bird species (e.g., raptors and songbirds) have been identified as potentially occurring in the study area. Potential direct impacts to bird species would include the incremental long-term loss of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potentially suitable breeding, roosting, and foraging habitat associated with the Gold Hill Pit and expansion of the Round Mountain Pit. However, this temporary loss is expected to have little effect on local bird populations based on the amount of suitable breeding and foraging habitat in the surrounding area. If construction or development of the proposed facilities was to occur during the breeding season (approximately March 1 through July 31, depending on species), direct impacts to breeding birds could include the possible direct loss of nests or indirect effects (e.g., abandonment) from increased human noise and human presence within close proximity of an active nest site. Loss of an active nest site, incubating adults, eggs, or young would be in violation of the Migratory Bird Treaty Act. In order to minimize impacts to breeding raptors, RMGC has committed to conducting breeding raptor surveys and implementing appropriate mitigation measures, as needed, in the event that project construction should occur during the raptor breeding season. In addition, for the protection of breeding songbirds, RMGC has committed to avoiding habitat removal, to the extent possible, between March 1 and July 31 or, alternately, conducting

breeding bird surveys and implementing appropriate mitigation in coordination with the BLM and NDOW. Additionally, when bats are excluded from the underground mine workings, efforts would be made to exclude owls and other bird species, as well as other wildlife species that may be present in the mine workings. With implementation of these measures, residual impacts to nesting bird species within the study area would be limited primarily to temporary habitat loss. This loss is anticipated to have little effect given the extent of native habitats in the surrounding region.

New and rerouted power line segments (i.e., transmission lines and distribution lines) and the new substation potentially could pose an electrocution hazard for raptor species attempting to perch on the structures. To minimize this potential impact, RMGC has committed to using a raptor-deterring design as discussed in Section 2.5, RMGC's Environmental Protection Measures. New and rerouted power line segments also would incrementally increase collision potential for migrating and foraging bird species. However, collision potential typically is dependent on variables such as the location in relation to high-use habitat areas (e.g., nesting, foraging, and roosting), line orientation to flight patterns and movement corridors, species composition, visibility, and line design (APLIC 1996). To minimize potential collision risk to migrating and foraging bird species, RMGC has committed to using standard measures as discussed in Section 2.5, RMGC's Environmental Protection Measures.

Human Presence and Noise. Indirect impacts to wildlife species would result from human presence and noise. These impacts would continue under the proposed action for the Round Mountain Area and incrementally increase in the Gold Hill Area. The most common wildlife responses to noise and human presence are avoidance or accommodation. Avoidance would result in displacement of wildlife from an area larger than the actual disturbance area. The total extent of habitat lost as a result of wildlife avoidance response is impossible to predict since the degree of this response varies from species to species and can even vary between different individuals of the same species. Also, after initial avoidance of human activity and noise producing areas, certain wildlife species may acclimate to the activity and begin to reoccupy areas formerly avoided. For example, during the initial development phases, it is likely that big game (i.e., pronghorn and deer) would be displaced from a larger area than the actual disturbance sites due to the avoidance response. However, these big game species have demonstrated the ability to acclimate to a variety of mining activities as long as human harassment levels do not increase substantially. It is possible, therefore, that the extent of displacement would approximate the actual disturbance area after the first few years of mine operation. One factor that would add to the reduction of potential effects related to increased human presence and noise in the study area is that the proposed project is an expansion of an existing mine site where human activity associated with processing operations continues to date.

Under the proposed project, a haul road would be constructed within the Transportation/Utility Corridor connecting Gold Hill and Round Mountain. Therefore, truck traffic from Gold Hill to the Round Mountain would increase as some of the ore from Gold Hill would be processed at Round Mountain. Potential impacts associated with the haul road would include an increase in the potential for wildlife/vehicle collisions, resulting in an unquantifiable, but probably minor, reduction in wildlife populations. As presented in Section 2.5, RMGC's Environmental Protection Measures, RMGC has committed to establishing a 35 mph speed limit for haul trucks and 45 mph speed limit for smaller vehicles along the Transportation/Utility Corridor, as well as fencing the boundary of the Transportation/Utility Corridor with a four-strand range fence. In addition, two box-culvert underpasses would be constructed to provide for wildlife passage under the Transportation/Utility Corridor.

Water Management Activities

Wildlife populations within the proposed project area could be affected by exposure to mine related process solutions, which could contain potentially toxic levels of cyanide. Potential sources for wildlife exposure to these solutions would include the proposed Gold Hill Heap Leach Facility, Round Mountain North Dedicated Heap Leach Facility, associated process solution ponds, and the Round Mountain tailings impoundment facility expansion.

To minimize potential wildlife mortalities from exposure to adverse cyanide concentrations in the heap leach processing solution, RMGC would implement the following committed environmental protection measures as discussed in Section 2.5, RMGC's Environmental Protection Measures. An 8-foot-tall chain link fence would be installed around each of the heap leach facilities, and solution ditches and ponds would be covered with netting, pond covers, or floating "bird balls" to minimize wildlife access to process solutions. In addition, new and expanded heap leach facilities and mill and tailings impoundment facilities would be designed and constructed as zero discharge facilities to minimize the potential for release of process solutions outside of the appropriately protected containment areas as discussed in Sections 2.4.3.6 and 2.4.4.5, Ore Processing Operations. To minimize impacts to wildlife from exposure to adverse cyanide concentrations at the tailings impoundment facilities, RMGC has committed to maintaining WAD cyanide concentrations at non-lethal levels through the continued operation of the existing cyanide destruction system. Based on RMGC's environmental protection measures, potential impacts to wildlife resources from cyanide ingestion would be low.

As discussed in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, dewatering activities would result in groundwater drawdown potentially impacting 2 springs (Johnson springs 1 and 2) and associated riparian habitat that occurs within the 10-foot groundwater drawdown isopleth (**Figure 4.3-14**). No wetlands would be impacted by the 10-foot groundwater drawdown. In addition, riparian vegetation associated with Ink House and Healy springs that occurs approximately 0.5 mile east of the 10-foot groundwater drawdown isopleth may be impacted from groundwater drawdown.

Naturally occurring seeps, springs, and perennial and ephemeral creeks provide important wildlife habitat in the study area and CESA. The cumulative effects area consists of spring, seeps, and drainages within the Big Smoky Valley. As discussed in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, Shoshone Canyon and Kelsey Canyon flow into the Round Mountain Area and both Willow Creek and Indian Creek flow into the Gold Hill Area.

Riparian habitat and its associated plant communities contribute to greater wildlife species diversity, compared to the adjacent upland areas. Since surface water and the associated riparian habitat are limiting factors for wildlife within the study area, the loss riparian habitat could result in: 1) a reduction of available water for consumption; 2) a reduction in riparian vegetation for breeding, foraging, and cover; 3) reduction in the regional carrying capacity; 4) displacement and loss of animals; 5) a reduction in the overall biological diversity; 6) a potential long-term impact to the population numbers of some species; and 7) reduction in prey availability. The degree of impacts to wildlife resources would depend on a number of variables, such as the existing habitat values and level of use, species' sensitivity (i.e., level of dependency on riparian areas), and the extent of the anticipated water and riparian habitat reductions.

Species likely affected by reductions in available water sources and riparian habitats would include big game, upland game birds and mammals, nongame birds (e.g., raptors and passerines), mammals (e.g., bats), reptiles, amphibians, and fish. The related long-term impacts to wildlife would continue until

mine dewatering is completed, groundwater elevations have recovered to approximate pre-mining levels, and riparian vegetation has become re-established. The extent of these indirect effects from the mine's dewatering activities would depend on the species' use and relative sensitivity, as discussed for each group below.

Game Species. Big game (i.e., mule deer, pronghorn, and desert bighorn sheep) require water year-round, to satisfy physiological requirements. The reduction or loss of existing water sources and riparian areas could impact big game use and movements. As discussed above, relatively low big game populations currently occupy the study area. However, a reduction in available surface water for big game within the mine's drawdown area could result in a long-term direct adverse impact to big game until the completion of the project and the water table recovers to approximate pre-mining water elevation levels, and surface water and associated riparian habitat availability approximates pre-mining conditions. It is assumed that some individuals would be displaced due to the reduction of surface water and riparian vegetation and may move into adjacent areas that are already at their carrying capacity. As discussed in Section 4.14, Vegetation, direct impacts would result in the long-term loss of less than 1 acre (0.05 acre) of riparian habitat. Potential indirect impacts may result in an incremental reduction of riparian habitat from groundwater drawdown. However, impacts to regional big game populations from the reduction of surface water and riparian vegetation are expected to be low.

A reduction in the riparian community would affect the amount of nesting, brooding, and foraging habitat for upland game birds (e.g., chukar and mourning dove), and denning and foraging habitat for small game mammals (e.g., pygmy rabbit and black-tailed jackrabbit), and furbearers (e.g., kit and gray fox, coyote, bobcat, and other small mustelids). A decline in surface water availability would impact the extent of available surface water and riparian vegetation along portions of the seeps, springs, and streams. Since riparian communities are limited within the study area, it cannot be assumed that displaced individuals would successfully relocate into adequate breeding or foraging habitat in adjacent areas, as it is assumed that these habitats already would be at carrying capacity. Potential direct and indirect impacts from the reduction of surface water and riparian vegetation would be the same as discussed above for big game.

Nongame Species. As discussed above for general wildlife, a variety of nongame species (e.g., birds and mammals) may breed, forage, or roost within or near the study area. Potential long-term impacts to these species could include loss of nesting, brooding, roosting, foraging, and cover habitats along riparian areas, and at the seep and springs identified in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use that occur within the 10-foot groundwater drawdown isopleth (**Figure 4.3-14**). These losses would result from an incremental reduction in available habitat for both resident and migratory bird and mammal species. In addition, the regional carrying capacity would be reduced by the incremental loss of available riparian breeding and foraging habitat. As discussed in Section 4.14, Vegetation, direct impacts would result in the long-term loss of less than 1 acre (0.05 acre) of riparian habitat. Potential indirect impacts may result in an incremental reduction of riparian habitat from groundwater drawdown. However, impacts to nongame wildlife populations from the reduction of surface water and riparian vegetation are expected to be low.

Potential impacts to amphibian and reptile species that are associated with the available water sources and riparian areas and, therefore, may be affected by mine-related groundwater drawdown activities would parallel those discussed for other terrestrial wildlife species. The loss or reduction in surface water availability and associated riparian vegetation would result in an incremental reduction of suitable breeding, foraging, and cover habitats for these species until the completion of the project and the water table

recovers to approximate pre-mining water elevation levels, and riparian vegetation has become re-established.

As discussed in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, at Round Mountain, disposal of excess water from dewatering activities through the existing RIBs is not anticipated to affect groundwater quality or the water quality of associated seeps, springs, or gaining reaches of streams. For Gold Hill, disposal of excess water from dewatering activities through the RIBs may impact groundwater quality as the water quality at Gold Hill is slightly worse than the groundwater. However, impacts to wildlife species are still expected to be low based on water quality analyses in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use.

Pit Lake. Based on guidance in BLM IM NV-2004-031, Ecological Risk Assessment Guidelines for Open Pit Mine Lakes in Nevada (BLM 2004a), "ERAs should normally be used for additional analysis when the predicted pit water chemistry identifies a potential problem with the future pit lake." To address potential future issues related to pit lake water chemistry, the BLM is directed to consider predicted (modeled) pit water chemical constituents and possible exposures to terrestrial and aquatic feeding wildlife that are likely to develop at the pit lake.

The Proposed Action includes the development of the Gold Hill Pit and the expansion of the existing Round Mountain Pit. Per BLM guidelines (BLM 2004a), ecological assessments are thus warranted to assess potential risks resulting from pit expansion if predicted (modeled) water chemistry data are at levels that represent a potential concern for ecological receptors. As a result, a screening level ecological risk assessment (SLERA) was conducted (Parametrix 2009). The SLERA analysis methodology, assumptions, and results are summarized below.

Methodology and Assumptions. The Ecological Risk Assessment (ERA) was conducted in three primary steps:

- Step 1 – SLERA Problem Formulation, Exposure Assessment and Toxicity (effects) Assessment. Includes site characterization, development of conceptual site model, and exposure and toxicity assessments.

- Step 2 – SLERA Initial Screening Risk Characterization. Provides a conservative risk estimate based on conservative assumptions but includes site-specific measurement receptors (wildlife).

- Step 3 – SLERA Secondary Screening (chemicals of potential concern [COPC] refinement) Exposure Assumptions and Risk Characterization. Provides a conservative risk estimate but with relaxed exposure assumptions to allow for further site-specific significance.

Step 1 defined the environmental setting of the study area and the types of species that are likely to occur and are typical of the arid and semi-arid environments of central Nevada. The post-mining pit lakes could provide a water resource that may attract mammal and bird species. Pit lake habitats typically include open-water areas and near-shore littoral zones. Pit lake morphology, at least in the initial stages, generally is conducive to narrow littoral zones with little available benthic habitat. Due to pit wall benching and rehabilitation measures taken at the time of pit closure, coupled with the predicted depth of the pit takes and anticipated oligotrophic characteristics (low primary productivity), the development of a significant aquatic community and associated littoral habitat is assumed to be limited. As such, aquatic and benthic

invertebrate communities were not specifically evaluated. However, dietary uptake of emergent insects from the pit lakes was assumed for assessment of potential risk to higher trophic order receptors. Habitats that are assumed to be present under future conditions include open-water, riparian (after lake stabilization) and upland (pit walls) habitats. These areas, especially open water in an otherwise arid region, could be attractive to terrestrial- and aquatic-feeding wildlife species looking for forage, water resources, and nesting/resting locations.

Predicted concentrations of COPC were modeled for each of the future pit lakes assuming 3 specific time periods: 2 years post-closure; 25 years post-closure; and 200 years post-closure (WMC 2008). Consideration of each time period provides COPC concentrations that are meant to address changing water quality as the rate of pit lake filling increases in the near term (2 and 25 years post-closure) and eventually, at the 200-year post-closure period, reaches or approaches equilibrium. As organic constituents are not anticipated to be an issue at the pit mines, the modeled COPC were limited to inorganics only. For the purposes of the SLERA, all modeled chemicals were conservatively assumed to represent COPC, as surface water screening benchmarks are not available to assess exposure to wildlife receptors. Nutrients (e.g., potassium and calcium) were screened against wildlife nutritional requirements; no concentrations were higher than the daily nutritional levels for birds or mammals. A listing of COPC to be evaluated in the SLERA is provided in **Table 4.17-1** below.

Table 4.17-1
Chemicals of Potential Concern

Antimony	Lithium
Arsenic	Manganese
Barium	Mercury
Beryllium	Nickel
Boron	Selenium
Cadmium	Strontium
Fluoride	Zinc
Lead	

Source: Parametrix 2009.

As part of the evaluation, a conceptual site model was developed, providing a visual representation of the pathways through which species likely would be exposed to chemicals of potential concern. Receptor species were selected for the analysis based on their representativeness of functional groups (guilds), potential for exposure via direct and indirect pathways, and regulatory or stakeholder concerns. Selected receptor species included mallard duck, cliff swallow, little brown bat, spotted sandpiper, and mule deer. Fish were not included as a receptor organism, nor was fish consumption included as a possible exposure pathway to the receptor species. Exclusion of fish in the SLERA was based on the fact that no plans currently exist to stock the pit lake with fish. **Table 4.17-2** provides a summary of the exposure pathways evaluated in the SLERA.

Table 4.17-2
Exposed Pathways in the SLERA

	2 Years Post-closure		25 and 200 Years Post-closure	
Representative Receptor	**Biota Ingestion**	**Water Uptake**	**Biota Ingestion**	**Water Uptake**
Aquatic-Feeding Receptors[1]				
Spotted Sandpiper	X	X	X	X
Mallard Duck[2]	X	X	--	X
Cliff Swallow	X	X	X	X
Brown Bat	X	X	X	X
Terrestrial-Feeding Receptors				
Mule Deer	--	X	--	X

[1] The cliff swallow and brown bat, that may obtain food resources from both aquatic and terrestrial environments, are assumed to obtaining 100 percent of their diet from aquatic (emergent) insects.

[2] For the 2-year post-closure scenario, the pit lakes are expected to be eutrophic due to presence of nitrogen compound residuals from blasting during pit excavation. The mallard was assumed to have an adequate food supply (plants) during that period. At the later time periods, the pit lakes are expected to become oligotrophic.

- - indicates that pathway is not significant and was not evaluated in the SLERA.

X indicates that pathway is significant and was evaluated in the SLERA.

Two exposure scenarios were considered for each time period. The SLERA is an evaluation based on conservative assumptions and is intended to eliminate COPCs with no potential to cause risk. To this end, the initial SLERA screening (Step 2) is based on conservative assumptions with limited site-specific significance and serves as an indicator of potential risk. A more-detailed refinement of COPCs evaluation (USEPA 2001, 1997) in Step 3 allows for the identification and characterization of risk using site-specific assumptions, and ultimately serves to define the scope for additional ERA tiers (BLRA) or serves as the basis for risk-based decisions.

Analysis. The potential exposure to pit lake COPC was based on individual species exposure pathways. Possible routes of exposure used in the analysis included pit lake water and food sources. Critical input variables, such as body weight, dietary composition of representative wildlife receptors, and water and food ingestion rates, were taken directly from the literature or calculated using standardized equations available from risk assessment documents. Water to invertebrate and water to plant bioconcentration factors (BCFs) were compiled from the literature, principally from studies conducted at pit lakes. These BCFs were included in the calculation of Wildlife Dietary Exposure.

Toxicity Reference Values (TRVs) represent concentrations below which adverse effects are not expected to occur. The TRVs used in this ERA were selected from studies chosen as best representing the receptors being evaluated. For the selection process, toxicity data were compiled and included all known available chronic and subchronic bird and mammal studies; with a few exceptions acute data were excluded, as application of such data in the estimation of risk introduces significant uncertainty in the resulting risk results. For wildlife receptors, two TRVs were developed for each COPC, as available, based upon (study) ingested dose and appropriate toxicological effect endpoint(s) (e.g., reproduction and growth):

- A No Observed Adverse Effects Level (NOAEL) TRV, assumed protective of individuals of a given representative species

- A Lowest Observed Adverse Effects Level (LOAEL) TRV assumed protective of populations of a given representative species.

All TRVs were derived from recognized literature sources including (e.g., USEPA 2005; Sample et al. 1996). The literature data were adjusted, as appropriate, by the application of uncertainty factors to a chronic (study duration) and toxicological endpoint (e.g., NOAEL). The NOAEL and LOAEL TRVs for the pit lake ERA provide a range of potential risks, which approximate the full distribution of exposure and effect.

Once appropriate uncertainty factors were applied to NOAELs and LOAELs, and TRVs derived, the exposure and toxicity assessments were integrated for the purposes of the risk characterization. In the risk characterization, risk was quantified by calculating the ratio of the COPC dose received by a given wildlife receptor and the corresponding TRV. For the SLERA (Step 1 and Step 2), hazard quotients $(HQ)_{NOAELs}$ were calculated by dividing the calculated dose for each receptor species by the TRV_{NOAEL}. The TRV_{LOAEL}, derived for consideration in Step 2, were applied and discussed qualitatively in the risk characterization.

Results. Considering all temporal scenarios, Step 2 residual risk (i.e., HQ>1) based on TRV_{NOAELs} and conservative exposure assumptions was noted for the sandpiper, swallow, and bat exposed to antimony and manganese in the proposed Gold Hill Pit and the bat exposed to arsenic in the existing Round Mountain Pit. No other receptors, COPCs, or pit lake locations (i.e., Round Mountain Pit) had Step 2 SLERA risk in exceedance of unity (i.e., HQ=1). These receptors were carried forward for Step 3 SLERA analysis which incorporated relaxed exposure assumptions (i.e., considered seasonal use by receptors). **Table 4.17-3** presents the calculated Step 3 HQs, which define site chemicals of concern (COC), for each wildlife receptor species. A summary of risk results and conclusions for receptors with residual risk exposed to the proposed Gold Hill Pit and the existing Round Mountain Pit are summarized below.

Table 4.17-3
Calculated HQs for Receptor Species

	Sandpiper			Swallow			Bat		
COC	2-year	25-year	200-year	2-year	25-year	200-year	2-year	25-year	200-year
Proposed Gold Hill Pit									
Antimony	--	0.6	2.3	0.4	0.5	2.2	0.6	0.9	3.7
Manganese	--	0.1	0.5	0.1	0.1	0.5	1.0	1.3	5.1
Round Mountain Existing Pit									
Arsenic	--	--	--	--	--	--	--	--	1.1

-- = no Step 2 SLERA unacceptable risk (HQ>1) estimated for the given time period.

Source: Parametrix 2009.

For antimony, the HQ_{NOAELs} were less than 1.0 (HQ<1) for all receptors in the 2- and 25-year post-closure scenarios; note that no Step 2 SLERA risk was noted for the sandpiper for the 2-year post-closure scenario and thus a Step 3 risk estimate was not computed. All 3 receptors had HQ_{NOAELs} marginally exceeding unity at the estimated pit lake equilibrium (200-year) period and ranged from HQ=2.2 (swallow) to HQ=3.7 (bat). However, when considering the full range of effects of the chronic NOAEL (and LOAEL) toxicity data on which the antimony mammalian TRV is based, which ranges over one order of magnitude above the TRV

NOAEL applied in Step 3, unacceptable risk is not expected for these receptors. The ERA for wildlife receptors concludes that no unacceptable risk exists to receptors exposed to antimony.

For manganese, the HQ_{NOAELs} were less than 1.0 (HQ<1) for the swallow and the sandpiper for all post-closure scenarios. The bat had HQ_{NOAELs} marginally exceeding unity at the 25-year post-closure period (HQ=1.3) and at the estimated pit lake equilibrium (200-year) period (HQ=5.1). The HQ_{NOAELs} was acceptable at the 2-year post-closure (HQ=1). However, when considering the full range of effects of the chronic NOAEL (and LOAEL) toxicity data on which the manganese mammalian TRV is based, which ranges over one order of magnitude above the TRV NOAEL applied in Step 3, unacceptable risk is not expected for these receptors. The ecological risk assessment for wildlife receptors concludes that no unacceptable risk exists to receptors exposed to manganese.

For arsenic in the Round Mountain Pit, the HQ_{NOAEL} exceeded unity for the bat only at the estimated pit lake equilibrium (200-year) period (HQ=1.1). No other exceedence was noted for arsenic. However, when considering the full range of effects of the chronic NOAEL (and LOAEL) toxicity data on which the manganese mammalian TRV is based, which ranges over one order of magnitude above the TRV NOAEL applied in Step 3, unacceptable risk is not expected for the bat. The ecological risk assessment for wildlife receptors concludes that no unacceptable risk exists to receptors exposed to arsenic.

The HQ based on the NOAEL represents a conservative upper-bound risk estimate that approximates risk to individuals of a given receptor guild. Adverse effects to individuals do not necessarily imply adverse effects at the population or community level. In general, the goal of ERA is to protect communities and populations (except in the case of threatened and endangered species), and not each individual in that population. A common endpoint, which unfortunately is very difficult to operationally define, is a population level EC-20 (i.e., the concentration or dose that results in an adverse effect to 20 percent of the population). However, almost all TRVs for dose-based evaluations are based on individual-level adverse effects (i.e., NOAELs). Risk estimates based on individual risk (as represented by Step 2 and Step 3 SLERA risk estimates) overestimate risk to the appropriate population level. In addition, other conservative factors considered in the SLERA, including overestimates of exposure duration (receptors were assumed to obtain food and water resources 100 percent of the time while seasonally present), and the assumption of 10 percent bioavailability of COC in ingested water and food, indicate that the potential for effects from COC exposure in the post-closure pit lakes would be unlikely.

In conclusion, based on the calculated HQ_{NOAELs} for the mammal and bird species evaluated and the conservative assumptions used in the SLERA, it is unlikely that adverse effects would occur as a result of wildlife exposure to the COC in the existing or proposed post-mining pit lakes.

Hazardous Materials Spill. The probability of a transportation-related spill of process chemicals along the proposed haul road is discussed in Section 3.6, Hazardous Materials and Solid Waste.

The potential for wildlife exposure to toxic chemicals as a result of a transportation-related spill would be greatest if an accident were to occur near aquatic/riparian habitats. Spills in dryland habitat would pose only minimal risk to most wildlife species since these spills would be adjacent to highways and could be rapidly contained and cleaned up.

In general, the materials of greatest concern would be sodium cyanide, sodium hydroxide, and diesel fuel. The effects of a sodium cyanide release would be highly variable and would depend on the quantity released, the location of the release (e.g., dry upland area, riparian area, or flowing stream area), the

species exposed, and the chemical conditions at the release location. The most likely effect of a potential release of sodium cyanide would be the poisoning of terrestrial or aquatic species. Wildlife species that drink contaminated water could suffer severe effects or death depending on the concentration of cyanide and the volume of the water consumed. Sodium cyanide solution decomposes rapidly when in contact with the atmosphere into poisonous and flammable hydrogen cyanide gas. Wildlife species that breathe this gas could suffer severe effects or death depending on the concentration of cyanide gas and the duration of exposure. Environmental effects of a cyanide spill or leak would be limited in extent and time of contamination, due to the rapid degradation of cyanide into benign elements when exposed to direct sunlight or oxygen.

Sodium hydroxide spilled onto the ground or into a water body has the potential to cause short-term damage to localized terrestrial and aquatic habitats. A sodium hydroxide release into a stream or other water body has the potential to raise the pH of the water and temporarily reduce populations of aquatic invertebrates, amphibians, and fish.

A diesel spill has the potential to contaminate soil, surface water, and groundwater in addition to harming aquatic life and vegetation. Although unlikely, such a spill also could ignite from the accident and cause a range fire. Since cleanup actions would take place immediately, diesel contamination has a low potential to result in long-term impacts to soil, surface water, and possibly groundwater.

The risk of wildlife exposure associated with accidental spills into aquatic habitats would be highly unlikely for several reasons. The probability of an accident and the resulting release of process chemicals would be low as discussed in Section 4.6, Hazardous Materials and Solid Waste, and areas of aquatic habitat adjacent to the proposed transportation route are limited. Hazardous chemicals would be transported via USDOT certified containers and transporters, and transportation of sodium cyanide and other chemical reagents would be in accordance with all applicable rules and regulations. In the event of a spill, a carrier would be required to implement appropriate emergency response measures as stipulated by state and Federal regulations. In addition, as discussed in Section 2.3.7.9, Spill Prevention and Emergency Response, RMGC would implement the existing Spill Response Plan that establishes procedures for responding to accidental spills or releases of hazardous materials to minimize environmental risks.

4.17.1.2 Fisheries

Surface Disturbance

Perennial stream and spring/pond habitat near the study area is limited to the higher elevations of the Toquima Range. Since no project-related surface disturbance would occur within these areas, impacts to aquatic habitat or fish species (if present) in these areas are not anticipated. Currently, there are no fish species or aquatic habitat present in Jefferson or Willow creeks in the study area. Project-related surface disturbance would occur in multiple intermittent channel segments, including Jefferson Creek; however, these areas do not support aquatic habitat on a consistent basis.

Water Management Activities

As discussed in Section 3.3, Water Quality and Quantity (Surface and Ground) and Water Use, mine-related groundwater drawdown would not affect flows or water levels in any drainages in the vicinity of the study area. The four springs/seeps and associated drainages impacted by groundwater drawdown do not support fisheries and, therefore, impacts are not anticipated.

4.17.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on wildlife and fisheries resources would be the similar to the Proposed Action except that a reduction in mine traffic along the Transportation/Utility Corridor would reduce the potential for wildlife/vehicle collisions. In addition, the probability of a release associated with transport of fuels and the potential for associated impacts to wildlife species would be less then the Proposed Action.

4.17.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on wildlife and fisheries would be the same as described for the Proposed Action, with the exception that approximately 2 additional acres of sagebrush shrubland habitat would be disturbed.

4.17.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to wildlife and fisheries resources would not occur. The existing Round Mountain mining operations would continue under existing authorizations, which includes the additional incremental disturbance of approximately 225 acres of wildlife habitat (**Tables 2.3-1**).

4.17.5 Cumulative Impacts

The CESA for wildlife resources is shown in **Figure 4.17-1**. The past and present actions and RFFAs in this area are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

The cumulative impact analysis focused on the regional wildlife resources and how they may be susceptible to the cumulative actions identified for this project. The analysis assumed that: 1) human use of the CESA would increase with the implementation of the proposed project, 2) wildlife habitats are currently at their respective carrying capacities in and adjacent to the proposed mine expansion area, and 3) the overall region has been previously affected by the historic and current mining activities.

4.17.5.1 Terrestrial Wildlife

Cumulative impacts to wildlife resources primarily would be directly related to habitat loss, habitat fragmentation, and animal displacement. Many of the local wildlife populations (e.g., mule deer, pronghorn) that occur in the CESA would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.

Past and present actions and RFFAs within the CESA have resulted, or would result, in approximately 11,751 acres of disturbance to wildlife habitat, of which approximately 6,409 acres is related to mining activities, 3,449 acres is related to utilities/community actions (e.g., transmission lines, highways, secondary roads), approximately 940 acres is related to Federal land withdrawals, approximately 33 acres is related to geothermal exploration and development, and approximately 923 acres is related to other developments (gravel pit, landfill, and agriculture). The proposed project incrementally would increase disturbance to wildlife habitat by an additional 4,690 acres (approximately 2 percent of the CESA) resulting in a total

cumulative disturbance of approximately 16,441 acres (approximately 6 percent of the CESA). It is assumed that portions of past mining-related disturbances in the CESA have been reclaimed, and ongoing reclamation at existing operations would continue to reduce the impacts to wildlife. Pending completion of successful reclamation, the incremental additional impacts to wildlife as a result of the Proposed Project would be temporary in nature for the majority of the project disturbance area (with the exception of the development of the Gold Hill Pit and expansion of the Round Mountain Pit).

Cumulative effects to mule deer include an incremental long-term reduction of approximately 130 acres of winter range until reclamation has been completed and vegetation has been reestablished. An additional 174 acres of habitat would not be reclaimed and would represent a permanent reduction of mule deer winter range in the CESA. As a result, the total cumulative disturbance to mule deer winter range within the CESA would be approximately 304 acres. Cumulative effects to pronghorn would be the same as described above for general wildlife.

The reclaimed areas, and areas associated with habitat conversion, would be capable of supporting wildlife use; however, species composition and densities would change.

Indirect impacts associated with human presence and noise would incrementally increase in the CESA during the life of the proposed project. The contribution of the proposed project to these impacts would be short-term and temporary and would cease following completion of operations and final reclamation.

Groundwater drawdown associated with existing and proposed dewatering operations could result in a long term reduction in the amount and extent of available surface water (e.g., seeps, springs, streams) and associated riparian habitats for wildlife within the cumulative 10-foot groundwater drawdown isopleth. Potential loss or reduction of available water or possible long-term effects to riparian communities could result in the loss of breeding, foraging, and cover habitats; reduction in available water for consumption; increased animal displacement and loss; reduction in the overall biological diversity; and a reduction in the area's carrying capacity for terrestrial wildlife (i.e., the region located within the cumulative drawdown area would support a lower diversity and reduced number of riparian-dependent wildlife species). Animals that use perennial water sources would be displaced as the available water and riparian vegetation declines. Assuming that these limited communities currently are at their respective carrying capacities, individuals that are displaced into adjacent communities may be lost from the population, concentrating the remaining animals within smaller habitat areas.

Species likely impacted by the potential cumulative reductions of seeps, springs, streams, and riparian habitats would include big game, upland game birds, raptors, songbirds, nongame mammals, and area amphibians and reptiles. The extent of these indirect effects from water level change would depend on the species' use and relative species' sensitivity.

4.17.5.2 Fisheries

Pit dewatering for the proposed project would not reduce flows or water levels in any surface waters in the vicinity of the study area that may have potential fish habitat. No other additional flow or water level reductions would be expected to occur in other perennial streams in the Big Smoky Valley.

4.17.6 Monitoring and Mitigation Measures

Mitigation that would minimize impacts to riparian habitat from the proposed project is described in Section 4.14.6, Monitoring and Mitigation Measures.

4.17.7 Residual Effects

4.17.7.1 Wildlife

Residual impacts to wildlife resources as a result of surface disturbance-related activities would include the permanent reduction of approximately 344 acres of habitat associated with the Round Mountain and Gold Hill pits. Other residual impacts would include the incremental habitat loss and displacement of wildlife species. Increased human presence would continue to affect the overall distribution of wildlife. Residual effects also would result from the possible long-term or permanent loss of surface water (springs and seeps) and associated riparian habitat due to mine dewatering.

4.17.7.2 Fisheries

No residual impacts to fisheries resources would occur as a result of surface disturbance-related activities or dewatering activities at the Round Mountain and Gold Hill pits. The springs impacted by the 10-foot groundwater drawdown isopleth do not support fisheries resources, therefore, residual impacts are not anticipated to occur.

Carvers
Round Mounta
Had
ALKALI FLAT
TOIYABE NATIONAL FOREST
BIG SMOKY VALLEY
TOIYABE RANGE
MONITOR VALLEY
NYE COUNTY

Figure 4.17-1

Cumulative Effects Study Area for Wildlife and Fisheries

Round Mountain Expansion Project

Legend

- Proposed Project Boundary
- CESA Boundary for Wildlife and Fisheries
- Mule Deer Winter Range

N

0 2.5 5 Miles

Note: The pronghorn range occurs throughout the entire CESA boundary for Wildlife and Fisheries.
Topographic elevations provided in feet, USGS 1929 Vertical Datum.

04/30/2009

4.18 Special Status Species

Primary issues related to special status wildlife species would include the loss or alteration of native habitats, increased habitat fragmentation, animal displacement, direct loss of animals and plants, and impacts associated with water management. Potential impacts for 36 special status species identified as potentially occurring within the proposed project area are discussed below.

4.18.1 Proposed Action

4.18.1.1 Surface Disturbance

Terrestrial Wildlife

Impacts to special status species from mine-related surface disturbance would include the short-term, long-term, and permanent reduction of habitat. Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals and reptiles, and the displacement of more mobile species into adjacent habitats. Displacement also could result in some local reductions in wildlife populations if adjacent habitats are at carrying capacity. Mine-related surface disturbance also would result in an incremental increase in habitat fragmentation at the mine site until reclamation has been completed and vegetation is re-established.

As discussed above in Section 4.17, Wildlife and Fisheries Resources, the proposed project would result in the long-term reduction of approximately 4,346 acres and the permanent loss of approximately 344 acres of habitat (i.e., salt-desert shrublands, sagebrush shrublands, pinyon-juniper woodlands, invasive annual grassland, and barren land) due to the development of the Gold Hill Pit and expansion of the Round Mountain Pit (**Table 4.14-1**). Woody species such as sagebrush would require up to 25 years to reach maturity. The majority of disturbance associated with the proposed Round Mountain Gold Expansion project, with the exception of the pits, would be reclaimed following completion of mining activities.

Mammals

Bats

Of the 14 bat species that could occur in the study area, 11 species (i.e., pallid bat, big brown bat, hoary bat, little brown bat, western pipistrelle, Townsend's big-eared bat, California myotis, small-footed myotis, long-eared myotis, possibly cave myotis, and Brazilian free-tailed bat) were documented by NDOW during acoustic surveys or by Wildlife Resource Consultants (2004) during surveys within the Gold Hill Area. Potentially suitable habitat for the remaining three species (fringed myotis, long-legged myotis, and spotted bat) exists within the study area. Implementation of the proposed project would result in direct and indirect impacts to local bat species and their habitat. Direct impacts would include the long-term reduction of foraging habitat, including approximately 3,816 acres of salt-desert shrublands and 530 acres of sagebrush shrublands habitat. Impacts also would result in the permanent reduction of approximately 164 acres of salt-desert shrublands and 180 acres of sagebrush shrublands habitat from the development of the Gold Hill Pit and the expansion of the Round Mountain Pit. Impacts to bat habitat would result from the loss of 15 mine workings (**Figure 3.18-2**) within the Gold Hill Area and 12 mine workings within the Round Mountain Expansion Area (**Figure 3.18-1**). Based on occurrence surveys in the Gold Hill Area, bats were detected at 11 of the mine workings (**Table 3.18-3**). It is anticipated that an additional 4 mine workings in the Gold Hill Area and 2 mine workings in the Round Mountain Expansion Area would become unsuitable as

potential bat habitat as a result of project-related activities. Based on implementation of RMGC's environmental protection measures, potential impacts to these bat species as a result of the proposed project would be considered low.

The proposed excavation of the Gold Hill Pit and expansion of the Round Mountain Pit would consume historic mine workings and their associated underground mine workings. The historic mine workings are significant habitat features for several Nevada State protected and BLM sensitive bat species, although the numbers of bats and the types of usage there are not fully understood. Direct impacts to bats will be avoided or minimized by excluding bats from these mine workings prior to the start of mining activities. While exclusion efforts will afford effective and reasonable means of escape, the availability of new suitable roosts for displaced bats and potential mortality as a result of excluding bats from suitable roosts are unknown. What is known is that bats have species-specific needs concerning roost site characteristics. For this reason, special status bat species may demonstrate a great deal of fidelity to roost locations. Bats are expected to initially return to the historic Gold Hill and Round Mountain workings, but when discouraged by repeated unsuccessful attempts at entry, displaced bats will eventually seek habitation elsewhere. One way to favor bats in habituating to alternative roost sites is ensuring the availability of other suitable nearby sites. Consequently, protection of known or suitable bat habitat at an offsite location was determined to be the most practicable mitigation to compensate for the loss of bat habitat in the Gold Hill and Round Mountain Expansion areas.

The historic Jefferson Canyon Mining District, situated 3 miles southeast of the proposed project area on National Forest System (NFS) lands in Nye County, contains underground workings bearing suitable habitat features which are also the closest public lands to the Project boundary. Based on the results of acoustic (Fox 2007) and subterranean (Sherwin 2008) bat surveys, abandoned mines in Jefferson Canyon meet all thermal conditions and roost uses (e.g., hibernation, migration, maternity, night roosting, bachelor) that likely exist at the Gold Hill and Round Mountain Expansion areas.

As discussed in Section 2.5, RMGC's Environmental Protection Measures, five bat gates would be installed at suitable mine workings on public lands in Jefferson Canyon to compensate for the loss of roosting habitat in the Gold Hill Area. The construction of five bat gates would protect critically important habitat identified at the Jefferson Canyon mine openings. Placement of bat gates would ensure that the replacement habitat is protected over the long-term while also enhancing public safety at abandoned mine features on the public lands. Additional bat mitigation would be formulated for loss of bat habitat associated with pit expansion in the Round Mountain Area.

Pygmy Rabbit

Implementation of the proposed project would result in the long-term reduction of approximately 530 acres and the permanent reduction of approximately 180 acres of potentially suitable sagebrush habitat (big sagebrush-dominated habitats) associated with development of the Gold Hill Pit and expansion of the Round Mountain Pit. This impact would be considered low to moderate, considering the small amount of potentially suitable habitat located within the study area. However, project construction may result in the direct mortalities of individual rabbits, if present. Indirect impacts associated with mine-related noise and human presence would continue under the proposed project in the Round Mountain Area. Development of the Gold Hill Area would result in an incremental increase in mine-related noise and human presence. The loss of individual pygmy rabbits (a game species in Nevada) would not result in population-level effects.

Desert Bighorn Sheep

This species was not observed within the study area during biological surveys. However, suitable habitat occurs within the study area. Potential direct impacts to this species as a result of mine-related activities could include the incremental long-term reduction of potential forage and the incremental increase of habitat fragmentation from vegetation removal associated with mine construction and development activities. The project would result in the long-term disturbance of approximately 216 acres of desert bighorn sheep range, consisting primarily of sagebrush shrublands habitat and the permanent loss of approximately 236 acres associated with the Gold Hill Pit and expansion of the Round Mountain Pit. This anticipated loss of habitat would result in a small, incremental reduction in the amount of available habitat and is expected to have little impact on the existing desert bighorn sheep population that occurs in the project vicinity. Although approximately 1,160 acres of desert bighorn sheep range occurs in the eastern portion of the proposed project area, no important desert bighorn sheep movement corridors or seasonal habitats would be directly impacted from project activities. Therefore, impacts to desert bighorn sheep populations are expected to be low.

Birds

Based on implementation of RMGC's environmental protection measures, no adverse effects to sensitive raptor species have been identified in association with construction of the proposed power line, and the potential for impacts to sensitive bird species related to exposure to process solutions would be considered low. Other potential species-specific impacts are discussed below.

Golden Eagle

No golden eagle nest sites occur within the proposed project area. However, potential nesting habitat (e.g., exposed rocky outcrops) occurs within the study area. Potential direct impacts to breeding eagles as a result of mine-related activities could include abandonment of a breeding territory or nest site or the potential loss of eggs or young, which would reduce productivity for that breeding season, if present. However, based on RMGC's environmental protection measures, including nesting raptor surveys and implementation of mitigation measures, as applicable, impacts to breeding birds would be minimized. Direct impacts also would include the long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potential foraging habitat associated with development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts associated with mine-related noise and human presence would continue under the proposed project in the Round Mountain Area. Development of the Gold Hill Area would result in an incremental increase in mine-related noise and human presence. Based on implementation of the RMGC's environmental protection measures, the lack of existing nest sites within the project boundary, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Short-eared Owl

This species was documented in the proposed project area during the 2001 and 2006 biological surveys. Direct impacts to breeding birds would be the same as discussed above for golden eagles. However, based on RMGC's environmental protection measures, including nesting raptor surveys and implementation of mitigation measures, as applicable, impacts to breeding short-eared owls would be minimized. Direct impacts also would result from the long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potential foraging habitat in association with the development of the

Gold Hill Pit and expansion of the Round Mountain Pit. These impacts would be considered negligible based on the overall availability of suitable habitat in the vicinity of the study area. Indirect impacts would be the same as discussed above for golden eagle. Based on implementation of the RMGC's environmental protection measures and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Burrowing Owl

Although no burrowing owl nest sites have been documented within the proposed project area, salt-desert shrubland and sagebrush shrubland vegetation that would be disturbed as a result of the proposed project would be suitable habitat for foraging birds within the study area. If present, direct impacts to breeding birds would be the same as discussed above for golden eagles. However, based on the RMGC's environmental protection measures, including nesting raptor surveys and implementation of mitigation measures, as applicable, impacts to breeding burrowing owls would be minimized. Direct impacts to this species would include the long-term reduction of approximately 4,346 acres and the permanent reduction of 344 acres of breeding and foraging habitat associated with the development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts would be the same as discussed above for golden eagle. Based on implementation of RMGC's environmental protection measures and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Ferruginous Hawk

No suitable ferruginous hawk nesting habitat occurs in the proposed project area. However, it is possible that this species could occur in the study area. Based on the RMGC's environmental protection measures, including nesting raptor surveys and implementation of mitigation measures, as applicable, impacts to breeding birds would be minimized. Direct impacts would include the long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potential foraging habitat associated with development of the Gold Hill Pit and expansion of the Round Mountain Pit. However, this impact would be considered negligible based on the overall availability of suitable foraging habitat in the vicinity of the study area. Indirect impacts would be the same as discussed above for golden eagle. Based on implementation of the RMGC's environmental protection measures, the lack of existing nest sites within the proposed project area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Greater Sage-grouse

No greater sage-grouse lek sites have been identified within the proposed project area. As discussed in Section 3.18, Special Status Species, the nearest lek site occurs approximately 7 miles north of the proposed project area. As a result, no impacts to breeding greater sage-grouse would be anticipated from project activities. Although the greater sage-grouse could nest in upland habitats within the study area, it is anticipated that nesting and brooding activity would be low, due to the distance of the proposed project area from the lek known site. Potential direct impacts would include the incremental long-term reduction of 1,408 acres of occupied winter, spring, and brood-rearing habitat. In addition, approximately 222 acres of occupied winter, spring, and brood-rearing habitat associated with the development of the Gold Hill Pit would be permanently lost. This impact would be considered negligible based on the RMGC's environmental protection measures and the overall availability of suitable habitat in the study area.

Prairie Falcon

No prairie falcon nest sites have been documented within the study area. However, potential nesting habitat (exposed rocky outcrops) occurs within the proposed project area. Direct impacts to migrating and foraging falcons would include the long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potential foraging habitat associated with development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts would be the same as discussed above for golden eagle. Based on the implementation of the RMGC's environmental protection measures, the lack of existing nest sites within the proposed project area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Peregrine Falcon

No impacts to breeding birds as a result of proposed mine-related activities would be anticipated based on the lack of potentially suitable breeding habitat (e.g. tall cliffs) in the proposed project area. Direct impacts to this species would result from the long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of potential foraging habitat in association with the development of the Gold Hill Pit and expansion of the Round Mountain Pit. These impacts would be considered negligible based on the overall availability of suitable foraging habitat in the vicinity of the study area. Indirect impacts would be the same as discussed above for golden eagle.

Pinyon Jay

Based on the presence of marginal habitat (i.e., sagebrush shrublands) within the study area, direct impacts to breeding pairs as a result of proposed mine-related activities could include abandonment of a breeding territory or nest site or the potential loss of eggs or young, which would reduce productivity for that breeding season. To minimize these impacts, RMGC has committed to avoiding habitat removal, to the extent possible, between March 1 and July 31 or, alternately, conducting breeding bird surveys and implementing appropriate mitigation in coordination with the BLM and NDOW as discussed in Section 2.5, RMGC's environmental protection measures. Direct impacts to this species would result from the long-term reduction of approximately 530 acres and the permanent reduction of approximately 180 acres of potential foraging habitat in association with the development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts would be the same as discussed above for golden eagle. Based on the implementation of the RMGC's environmental protection measures, the overall availability of suitable habitat in the vicinity of the study area, and the existing level of activity at the mine site, potential impacts to this species as a result of the proposed project would be considered low.

Loggerhead Shrike

Based on the presence of potentially suitable breeding habitat, direct impacts to breeding pairs as a result of proposed mine-related activities and the applicable environmental protection measures to minimize these impacts would parallel those described above for the pinyon jay. Direct impacts to this species would include the long-term reduction of approximately 4,346 acres and the permanent reduction of approximately 344 acres of breeding and foraging habitat in association with the development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts would be the same as discussed above for golden eagle. These impacts would be considered negligible based on implementation of the RMGC's environmental protection measures, the overall availability of suitable habitat in the vicinity of the study area, and the existing level of activity at the mine site.

Sage Thrasher

Based on the presence of potentially suitable breeding habitat, direct impacts to breeding pairs as a result of proposed mine-related activities and the applicable environmental protection measures to minimize these impacts would parallel those described above for the pinyon jay. Direct impacts to this species would include the long-term reduction of approximately 530 acres and the permanent reduction of approximately 180 acres of breeding and foraging habitat in association with the development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts would be the same as discussed above for golden eagle. These impacts would be considered negligible based on implementation of the RMGC's environmental protection measures, the overall availability of suitable habitat in the vicinity of the study area, and the existing level of activity at the mine site.

Brewer's Sparrow

This species was documented within the proposed project area during biological surveys. Based on the presence of potentially suitable breeding habitat, direct impacts to breeding pairs as a result of proposed mine-related activities and the applicable environmental protection measures to minimize these impacts would parallel those described above for the pinyon jay. Direct impacts to this species would include the long-term reduction of approximately 530 acres and the permanent reduction of approximately 180 acres of breeding and foraging habitat in association with the development of the Gold Hill Pit and expansion of the Round Mountain Pit. Indirect impacts would be the same as discussed above for golden eagle. These impacts would be considered negligible based on implementation of the RMGC's environmental protection measures, the overall availability of suitable habitat in the vicinity of the study area, and the existing level of activity at the mine site.

Amphibians

Columbia Spotted Frog

No Columbia spotted frogs have been identified within the proposed project area. No impacts to this species as a result of proposed mine-related activities would be anticipated based on the lack of potentially suitable habitat (e.g., permanent water sources) in the proposed project area.

Invertebrates

Big Smoky Wood Nymph

This species has not been identified within the proposed project area. No impacts to this species as a result of proposed mine-related activities would be anticipated based on the lack of potentially suitable habitat (e.g., grassy alkaline flats) in the proposed project area.

Fish

Perennial stream and spring/pond habitat near the study area is limited to the higher elevations of the Toquima Range. Since no project-related surface disturbance would occur within these areas, impacts to aquatic habitat or special status fish species (if present) in these areas are not anticipated. Project-related

surface disturbance would occur in numerous intermittent channel segments that bisect the study area; however, these areas do not support aquatic habitat on a consistent basis.

Potential impacts for the three special status fish species identified as potentially occurring in the proposed project area are discussed below. No impacts to federally listed, or proposed, or Federal candidate species would occur as a result of the proposed project based on the lack of presence in the proposed project area.

Big Smoky Valley Tui Chub

This species has not been identified within the proposed project area. No impacts to this species as a result of proposed mine-related activities would be anticipated based on the lack of potentially suitable habitat (e.g., permanent water sources) in the proposed project area.

Lahontan Cutthroat Trout

This species has not been identified within the proposed project area. No impacts to this species as a result of proposed mine-related activities would be anticipated based on the lack of potentially suitable habitat (e.g., permanent water sources) in the proposed project area.

Big Smoky Valley Speckled Dace

This species has not been identified within the proposed project area. No impacts to this species as a result of proposed mine-related activities would be anticipated based on the lack of potentially suitable habitat (e.g., permanent water sources) in the proposed project area.

Plants

Potential impacts to special status plant species from surface disturbance-related activities may include the loss of individuals as a result of crushing or uprooting from construction vehicles and equipment. Because surface disturbance areas would be localized and within a small geographic area, population-level impacts on special status plant species are not anticipated. Nonetheless, construction activities could affect local populations of special status plant species within the surface disturbance areas.

Based on habitat requirements and known distribution, three special status plant species and state-protected cacti species were identified as potentially occurring within the proposed project area (**Table 3.18-1**), and are as follows.

Eastwood's Milkweed

As discussed in Section 3.18, Special Status Species, habitat evaluations and species-specific surveys were conducted in 2006 throughout the proposed project area for the Eastwood's milkweed (Reynolds and Fox 2006). No Eastwood's milkweed individuals were identified. Therefore, no impacts to Eastwood's milkweed are anticipated as a result of mine-related activities.

Sanicle Biscuitroot and Nevada Dune Penstemon

Based on habitat requirements and known distribution, suitable habitat for the sanicle biscuitroot or Nevada dune penstemon may occur in portions of the proposed project area. However, no sanicle biscuitroot or

Nevada dune penstemon were found during the 2006 surveys. Therefore, impacts to sanicle biscuitroot and Nevada dune penstemon would not occur as a result of mine-related activities.

Cacti, Evergreen Trees, and Members of the *Yucca* and *Agave* Genera

In 2003 and 2006, presence/absence surveys were conducted within the Round Mountain and Gold Hill areas for state-protected cacti, evergreen, and members of the *Yucca* and *Agave* genera (Reynolds and Fox 2006, 2003). Numerous cacti species were encountered within these areas; however, NRS states that only the commercial harvest, possession, or transportation of such species would be regulated. Since these activities would not be allowed within proposed disturbance areas, direct impacts to these species would not be anticipated. However, if these actions would occur, landowner permission (i.e., BLM) must be obtained prior to activity commencement (BLM 2007f).

4.18.1.2 Water Management Activities

Wildlife

Water management-related impacts to special status wildlife species as a result of the Proposed Action would be the same as described in Section 4.17, Wildlife and Fisheries Resources. No additional impacts to special status wildlife species are expected.

Fish

Water management-related impacts to special status fish species as a result of the Proposed Action would be the same as described in Section 4.17, Wildlife and Fisheries Resources. No additional impacts to special status fish species are expected.

Plants

Special status plant species would not be affected by mine-related groundwater drawdown, since suitable habitat for the species includes upland areas that rely on precipitation to provide adequate soil moisture.

4.18.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on special status species resources would be the same as described for the Proposed Action.

4.18.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on special status species would be the same as described for the Proposed Action, with the exception that approximately 2 acres of additional sagebrush shrubland habitat would be disturbed.

4.18.4 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and the related potential impacts to special status species resources would not occur. The existing surface disturbance-related activities associated with Round Mountain mining operations would continue under existing authorizations

and would include the additional incremental disturbance of approximately 225 acres of potential special status species habitat (**Tables 2.3-1**).

4.18.5 Cumulative Impacts

The CESA for special status species is shown in **Figures 4.17.1**, **4.18-1**, and **4.18-2**. The past and present actions and RFFAs in this area are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

4.18.5.1 Wildlife

Cumulative effects to special status species would parallel those described for general wildlife. Past and present actions and RFFAs have resulted, or would result, in approximately 11,751 acres of disturbance to special status species habitat. The proposed project incrementally would increase disturbance to special status species habitat by an additional 4,690 acres (approximately 2 percent of the CESA) resulting in a total cumulative disturbance of approximately 16,441 acres (approximately 6 percent of the CESA). Pending completion of successful reclamation, the incremental additional impacts to special status species as a result of the proposed project would be temporary in nature for the majority of the project disturbance area (with the exception of the development of the Gold Hill Pit and expansion of the Round Mountain Pit, and the exclusion of mine workings within the proposed project area to bats).

Past and present actions and RFFAs have resulted, or would result, in approximately 455 acres of occupied winter, spring, and brood rearing habitat. The proposed project would incrementally increase disturbance to greater sage-grouse occupied winter, spring, and brood rearing habitat by approximately 1,408 acres (approximately 5 percent of this habitat type in the CESA), until reclamation has been completed and vegetation has been reestablished. In addition, approximately 222 acres of greater sage-grouse occupied winter, spring, and brood rearing habitat associated with the development of the Gold Hill Pit would represent a permanent reduction of this habitat type in the CESA. As a result, the total cumulative disturbance to greater sage-grouse occupied winter, spring, and brood rearing habitat within the CESA would be 2,085 acres (approximately 7 percent of this habitat type in the CESA).

Past and present actions and RFFAs have resulted, or would result, in approximately 218 acres of disturbance to desert bighorn sheep range. The proposed project would incrementally increase disturbance to desert bighorn sheep range by approximately 452 acres (approximately 3 percent of this habitat type in the CESA) until reclamation has been completed and vegetation has been reestablished. Of this disturbance, approximately 236 acres of habitat associated with the development of the Gold Hill Pit and expansion of the Round Mountain Pit would not be reclaimed and would represent a permanent reduction of bighorn sheep range within the CESA. As a result, the total cumulative disturbance to bighorn sheep range within the CESA would be approximately 670 acres (approximately 4 percent of this habitat type in the CESA).

Special status species most susceptible to these cumulative impacts would be resident bats. Historical mine workings within the Gold Hill and Round Mountain Expansion areas will be impacted by the proposed project. Many of these mine workings will be either consumed by the proposed project or severely altered. RMGC's environmental protection measures that would minimize potential impacts on resident bats is described in Section 2.5, RMGC's Environmental Protection Measures.

Indirect impacts associated with human presence and noise would incrementally increase in the CESA during the life of the proposed project. The contribution of the proposed project to these impacts would be short-term and temporary and would cease following completion of operations and final reclamation.

Groundwater drawdown associated with existing and proposed dewatering operations could result in a long term reduction in the amount and extent of available surface water (e.g., seeps, springs, streams) and associated riparian habitats for area special status species within the cumulative 10-foot groundwater drawdown isopleths. Potential loss or reduction of available water or possible long-term effects to riparian communities could result in the loss of breeding, foraging, and cover habitats; reduction in available water for consumption; increased animal displacement and loss; reduction in the overall biological diversity; and a reduction in the area's carrying capacity for special status species (i.e., the region located within the cumulative drawdown area would support a lower diversity and reduced number of riparian-dependent species). Special status species that use perennial water sources would be displaced as the available water and riparian vegetation declines. Assuming that these limited communities currently are at their respective carrying capacities, individuals that are displaced into adjacent communities may be lost from the population, concentrating the remaining animals within smaller habitat areas.

Special status species likely impacted by the potential cumulative reductions of seeps, springs, streams, and riparian habitats would include species such as desert bighorn sheep and greater sage-grouse. The extent of these indirect effects from water level change would depend on the species' use and relative species' sensitivity.

4.18.5.2 Fish

The incremental habitat loss within the cumulative impacts area would be parallel to that described for general fisheries in Section 4.17.5, Cumulative Impacts. No perennial streams or springs that contain special status fish species would be impacted by the 10-foot groundwater drawdown.

4.18.5.3 Plants

Based on 2006 field survey results (Reynolds and Fox 2006), implementation of the proposed project would not contribute to cumulative impacts for the Eastwood's milkweed, sanicle biscuitrout and Nevada dune penstemon.

Since mine-related activities would not contribute to direct impacts to cacti, evergreen trees, and members of the yucca and agave genera, no cumulative impacts to these species would occur.

4.18.6 Monitoring and Mitigation Measures

4.18.6.1 Wildlife

No additional monitoring or mitigation measures are recommended for special status wildlife species.

4.18.6.2 Fish

No additional monitoring and mitigation measures are recommended for special status fish species.

4.18.6.3 Plants

No additional monitoring and mitigation measures are recommended for special status plant species.

4.18.7 Residual Effects

4.18.7.1 Wildlife

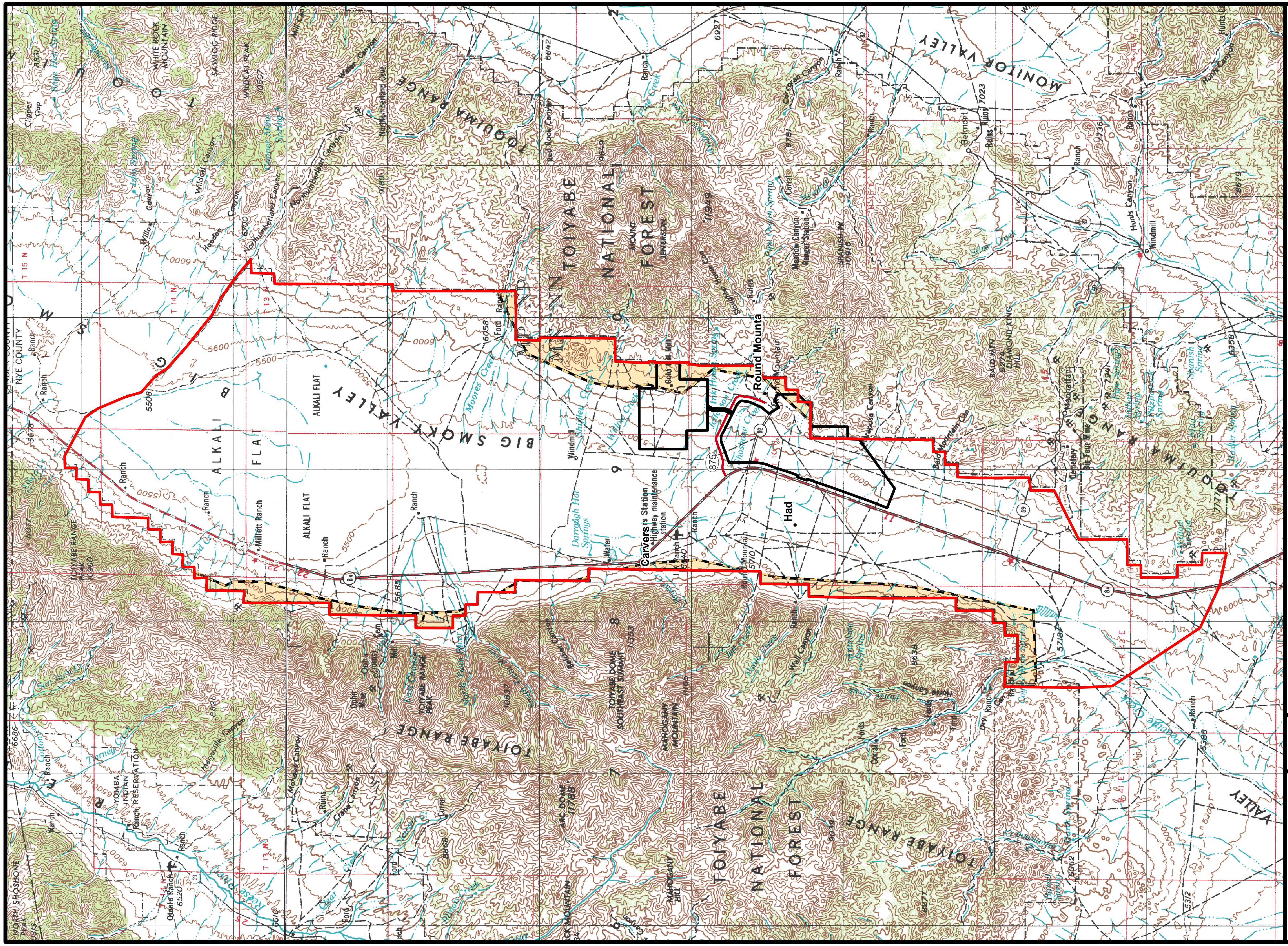
Residual impacts would be the same as described for wildlife in Section 4.17, Wildlife and Fisheries Resources.

4.18.7.2 Fisheries

Residual impacts would be the same as described for fisheries in Section 4.17, Wildlife and Fisheries Resources.

4.18.7.3 Plants

Residual impacts would be the same as described for vegetation in Section 4.14, Vegetation Resources.



Legend

Proposed Project Boundary

CESA Boundary for Desert Bighorn Sheep

Desert Bighorn Sheep Range

N

0 2.5 5 Miles

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

Round Mountain Expansion Project

Figure 4.18-1

Cumulative Effects Study Area for Desert Bighorn Sheep

04/30/2009

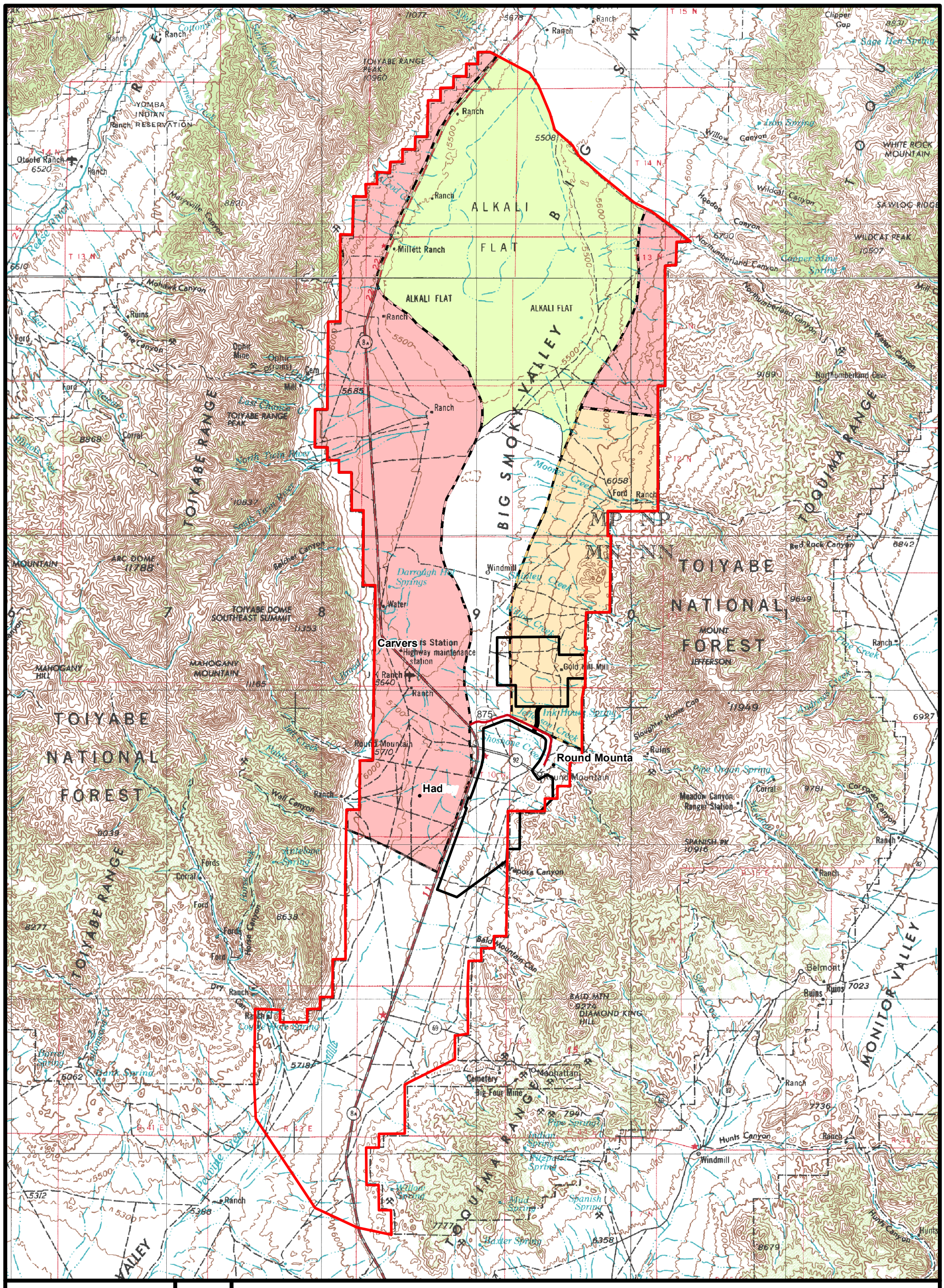


Figure 4.18-2

Cumulative Effects Study Area for Greater Sage-Grouse

Round Mountain Expansion Project

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

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4.19 Access and Land Use

The Proposed Action or alternatives could affect land use both directly and indirectly. Direct impacts may include the termination or modification of existing land uses or ROWs in the proposed project area. Indirect impacts may result in altered land use patterns on areas adjacent to or near the proposed project area. Indirect impacts also would occur if the Proposed Action or alternatives stimulated or encouraged the development of land uses not presently anticipated, or conversely, precluded other planned or proposed uses.

4.19.1 Proposed Action

4.19.1.1 Land Use

The proposed project area encompasses a total of approximately 15,379 acres, of which 13,744 acres (89 percent) are BLM-administered public land, 516 acres (3 percent) are Toiyabe National Forest lands, and 1,119 acres (7 percent) are RMGC-owned private lands. The total area would encompass the existing project boundary area of 7,263 acres (**Table 2.3-3**) plus an additional 8,116 acres associated with the proposed mine expansion. As currently planned, total new surface disturbance would be approximately 4,698 acres, of which approximately 4,581 acres (98 percent) would be on public land. The new disturbance would be in addition to the previously approved disturbance of 5,928 acres, which would be an increase of approximately 80 percent (**Table 2.4-3**).

The Proposed Action is consistent with BLM plans and policies that designate land use within the proposed project area as open for mineral exploration and development, as described in the Tonopah RMP (BLM 1997). Although Nye County does not have jurisdiction to regulate land use on Federal lands, the proposed project would be consistent with the county's preference for "multiple use" management and retention of existing mining areas as expressed in the 1985 Policy for Public Lands (Nye County 1985). The proposed project expansion would not occur on National Forest land. Therefore, the Proposed Action would comply with adopted plans and policies of potentially affected governmental entities.

The proposed project area currently experiences minimal public use, moderate levels of livestock grazing, and a modest amount of dispersed recreation use, which primarily consists of crossing the area to access the western canyons of the Toquima Range on the Toiyabe National Forest. The largest numbers of public users are most likely people coming and going to Round Mountain.

New project-related fenced area (8,116 acres) would reduce the amount of land available for livestock grazing and dispersed recreation, although the loss would be very small relative to the overall area, particularly considering the limited current use levels. The specifics of the loss of access to public lands are addressed in Sections 4.10, 4.11, and 4.16 addressing Recreation, Wilderness, and Range Resources, respectively. The 8,116 acres of fenced area would constitute about 6.5 percent of the 125,247-acre Smoky Grazing Allotment where most of the proposed project area would occur. A small fraction of the area would take place in the 442,555-acre San Antone Allotment (see Sections 3.16 and 4.16 for additional information on Range Management). None of the proposed new fenced area or surface disturbance would occur on currently irrigated cropland. Therefore, a loss of hay production would not occur as a result of the Proposed Action.

The proposed project would require realignment of a 230-kV power line (ROW N-25341) and a 24.9-kV power line (ROW N-60961) that currently run north and south through the proposed North Dedicated Pad.

This would require modification to the ROW permit authorizations (**Table 3.19-1** and **Figure 3.19-2**). The realignment would be required for the ROW to avoid the proposed North Dedicated Pad. The Proposed Action also may require adjustments to power line ROWs near the south end of the proposed new disturbance area where the 230-kV power line and a smaller ROW (Nev-63690) cross tailings impoundment facility cells C and D, respectively. The ROW changes would not adversely affect land use or power availability in the area.

Post-reclamation land use of most of the disturbance area would be returned to open space, grazing, dispersed recreation, and wildlife habitat. These uses would be consistent with local and BLM land use plans and guidelines. The mine pits would remain unreclaimed, for the most part, and would be permanently changed from current uses.

4.19.1.2 Access

Three categories of traffic would be generated by the proposed project: worker commuting traffic, general company and contractor traffic, and material deliveries. Worker commuting, including both direct employees and contractors, and miscellaneous general traffic, would be predominantly light traffic using automobiles and pickup trucks. Material deliveries would employ mainly heavy trucks and tractor-trailer rigs.

Commuter traffic would depend on the employment scenario selected. Under the simultaneous development scenario, assuming the maximum of approximately 300 construction workers and 110 new underground operations workers, up to 273 light vehicle trips could be generated during the shift change, half inbound and half outbound. For analysis purposes, shift changes are assumed to occur concurrently with morning and afternoon peak traffic flow hours. General light traffic during the same peak periods is assumed to be approximately 20 additional trips per hour. Heavy traffic generated by the Proposed Action would include two loads of fuel and one load of reagent per day for a total of six heavy vehicle trips. For analysis purposes, it is assumed that no more than two of those trips would typically occur during a peak traffic hour. The total increase in vehicle trips would be equivalent to 297 passenger cars in the peak hour.

Highway traffic effects of the Proposed Action were analyzed using techniques promulgated in the Highway Capacity Manual (HCM) (Transportation Research Board [TRB] 2000). The standard measure of traffic flow from the HCM is LOS for a given segment of roadway. LOS is a method of qualitatively measuring the operational conditions of traffic flows on roadways, and the perception of those conditions by motorists and passengers (TRB 2000). LOS are rated “A” through “F”; “A” generally represents free flowing traffic conditions with few restrictions and “F” represents a “forced or breakdown” flow with queues forming and traffic volumes exceeding theoretical capacity of the roadway (TRB 2000). Generally, level “E” represents traffic volumes at the capacity of the roadway.

Under the simultaneous development scenario for the proposed project, peak hour traffic would drop to LOS “B,” very slightly below LOS “A,” on SR 376 north of the entrance to the Round Mountain Mine. LOS “B” represents a stable flow condition. The individual driver retains considerable freedom to select his/her desired speed, but the freedom to maneuver within the traffic stream is slightly less than under LOS “A” conditions (TRB 2000). The increase in traffic would be noticeable because of the very low existing traffic volumes on the highway, but the traffic “bulge” would be of short duration, lasting only about 1 year, and would have little effect on the ability of other motorists to navigate safely and comfortably. Traffic flows would return to LOS “A” conditions after completion of construction.

Under the sequential development scenario, the maximum number of new workers would be 310 in approximately 2011, which would generate an estimated 207 light vehicle trips during the shift change. Adding the 20 general light traffic trips and 2 heavy vehicle trips would result in the equivalent of a total of 229 passenger cars in the peak hour. With this level of traffic, SR 376 north of the mine entrance would continue to operate at LOS "A" during the peak hour. LOS "A" indicates traffic operates in a free flowing condition allowing individual motorists considerable freedom to maneuver and to select their desired speed; LOS "A" provides ample opportunities for passing and entering or exiting the traffic flow safely (TRB 2000). As noted for the simultaneous development scenario, the increase in traffic under this scenario would be noticeable, but would be of short duration and would have little effect on the ability of other motorists to navigate safely and comfortably.

Transportation safety concerns related to highway traffic generated by the Proposed Action would be minimal. Lines of sight at intersections are unobstructed and sight distances are ample. Development of the proposed project would have no effect on the physical characteristics of the major intersections or the geometrics of SR 376. The increase in traffic would be modest, remaining well within the capacity of the roadway. The mix of heavy vehicles in the traffic stream would not change substantively. As such, any increase in the risk of traffic accidents would be minor and proportional to the overall increase in traffic.

The proposed construction of the Transportation/Utility Corridor between the Round Mountain and Gold Hill areas would result in a point of conflict between surface traffic on CR 875 and haul road traffic primarily made up of large haul trucks. Although traffic levels on CR 875 remain very low and standard traffic controls (e.g., signage) would be in place at the intersection, there would be an increase in risk of accidents at the intersection and a minor increase in travel times on CR 875 compared with existing conditions.

Based on the preceding analysis, development of the proposed project would not adversely affect highway traffic in the project vicinity. Roadway safety conditions would be slightly degraded; the degree would depend partially on the level of traffic through the CR 875/Transportation/Utility Corridor intersection.

An additional access consideration related to the proposed project would be the constraint to National Forest access resulting from construction of the Transportation/Utility Corridor between the Round Mountain and Gold Hill areas. Access to Jefferson and Shoshone canyons would remain open with only minor delays, but some recreationists who are not familiar with a Transportation/Utility Corridor may find it intimidating.

Based on the analysis, the effects of the proposed project on land use and access in the project vicinity would be considered minor.

4.19.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on access and land use would be similar to those described for the Proposed Action. The principal difference would be that access to Round Mountain and Jefferson and Shoshone canyons would be slightly less constrained due to less traffic using the Transportation/Utility Corridor than would be required under the Proposed Action. The average daily haul traffic reduction would range from approximately 2 trips per day (i.e., 1 load) in 2010 to a high of 14 trips per day (7 loads) in 2015. There also would be a very minor reduction in heavy truck traffic on SR 376 because of reduced demand for fuel and other consumables. All other effects would be the same as described for the Proposed Action.

4.19.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on access and land use would be similar to those described for the Proposed Action. The notable difference would be that public traffic accessing Round Mountain and Jefferson and Shoshone canyons would be physically separated from traffic using the Transportation/Utility Corridor with the construction of an overpass, which would prevent traffic conflicts or delays and constrain access. In addition, construction of an overpass structure would result in a very small increase in new disturbance (approximately 2 acres), which would have minimal effects in the context of the area. All other effects would be the same as described for the Proposed Action.

4.19.4 No Action Alternative

The No Action Alternative would result in a continuation of existing access and land use conditions in the proposed project area for the duration of authorized mining activities. It would result in completion of reclamation activities by approximately 2021, after which most of the existing and authorized disturbed area would be returned to open lands, available for wildlife habitat and dispersed recreation uses. The area released for public use after completion of reclamation activities would be a minor incremental increase in available land. Traffic demand would decline after closure as a result of the loss of jobs and the resultant emigration of much of the Round Mountain/Hadley population to other locations for employment.

4.19.5 Cumulative Impacts

The CESA for access and land use is shown in **Figure 4.19-1**. Past and present actions and RFFAs are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past and present actions in the CESA have a total approved surface disturbance of approximately 10,532 acres, 180 acres of which have been reclaimed. RFFAs would disturb approximately 40.4 additional acres for a total of approximately 10,392 acres of disturbance. Approval of the Proposed Action would add an increment of 4,698 acres to the disturbance for a total of 15,230 acres, a 45 percent increase over the total of past, present, and reasonably foreseeable disturbance. Although the cumulative surface disturbance would be greater than the proposed new disturbance from the proposed project, it still would be a small increment of the vast acreage of public lands in the area, and would have minimal effect on land uses displaced by past, present, and reasonably foreseeable projects in the CESA. The cumulative unreclaimed disturbance area that would remain after completion of the interrelated actions, including the pit areas of the Proposed Action, would be a small percentage of the total land area in the CESA, and would have a negligible effect on land uses.

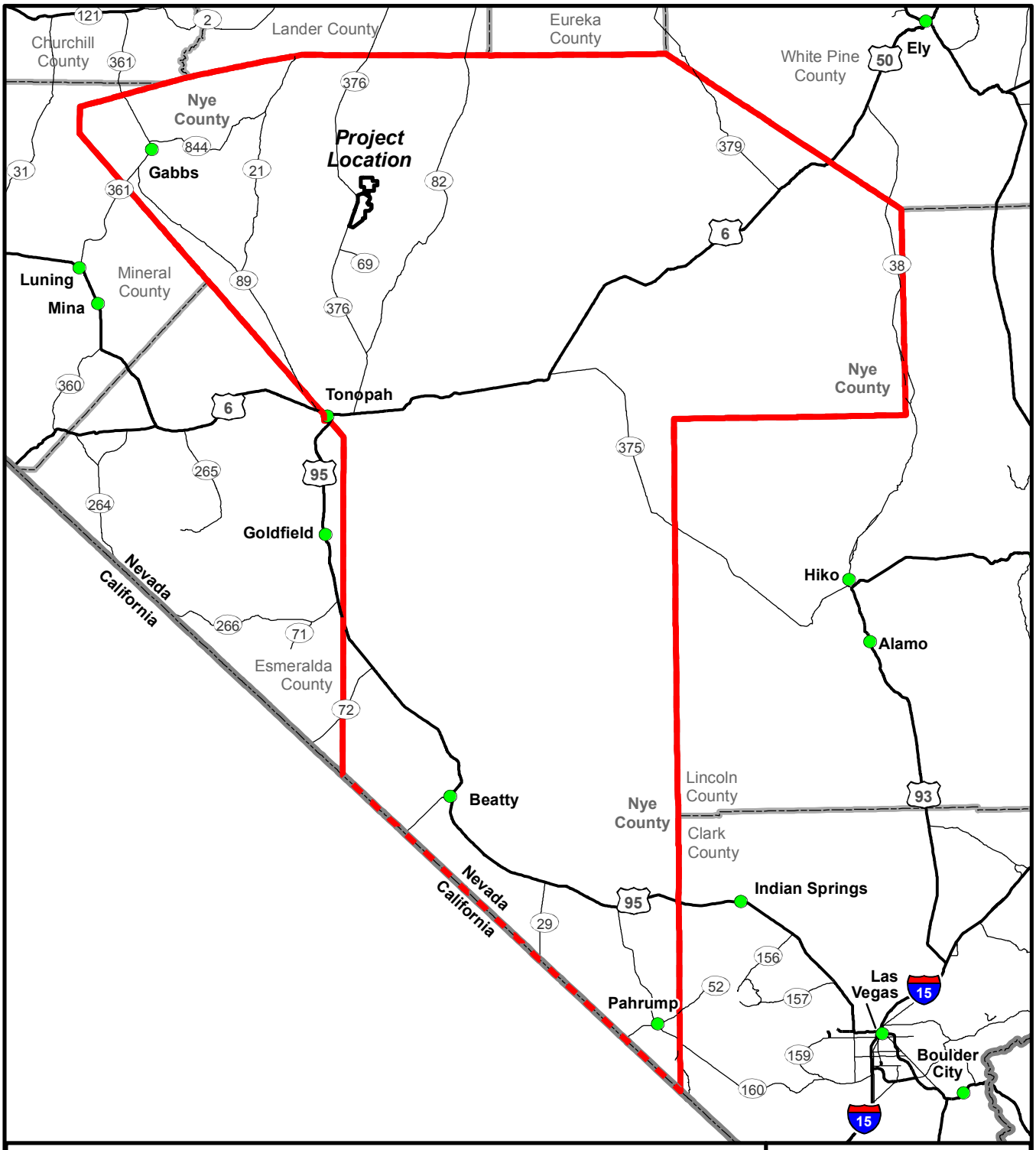
There would be few, if any, cumulative effects on access or traffic conditions from the proposed project and other interrelated past, present and reasonably foreseeable future activities because they are all relatively small traffic generators and most of their access points are widely distributed throughout the CESA.

4.19.6 Monitoring and Mitigation Measures

No additional monitoring or mitigation measures would be recommended for access and land use.

4.19.7 Residual Impacts

There would be a permanent loss of approximately 351 acres of multiple use lands associated with the expansion of the Round Mountain Pit and development of the Gold Hill Pit, which would not be reclaimed. There would be very minor increases in traffic delays and accident risk.



Legend

- Proposed Project Boundary
- CESA Boundary for Social and Economic Values
- City or Town

N

0 10 20 30 Miles

Round Mountain Expansion Project

Figure 4.9-1

Cumulative Effects Study Area for Social and Economic Values

04/11/2009

4.20 Noise

Project-related noise would be a concern if noise levels were sufficiently high to adversely affect the use and enjoyment of noise sensitive properties, such as schools, churches, or residences, in the project vicinity.

Noise impacts are commonly evaluated using two general criteria: the extent to which a project would exceed Federal, state, or local noise regulations; and the estimated degree of disturbance to people. There are no specific Federal, state, or local noise regulations that would govern at the proposed project area. Neither the State of Nevada nor Nye County has noise regulations governing mining operations.

Without legislative guidance, the degree of disturbance becomes the key factor in evaluating noise effects. In this case, evaluating disturbance suggests a focus on the 3 communities near the study area (i.e., Round Mountain, Carvers, and Hadley) and on the 3 individual residences within 2.7 miles of the Gold Hill Area. The concept of human disturbance is known to vary with a number of interrelated factors, including not only changes in noise levels, but the presence of other, non-project related noise sources in the vicinity; peoples' attitudes toward the project; the number of people exposed; and the type of human activity affected (e.g., sleep or quiet conversation as compared to physical work or active recreation).

4.20.1 Proposed Action

Major sources of noise from mining and processing operations of the proposed project would include rock drilling, blasting, loading of rock and ore, truck hauling, ore crushing, and crushed ore handling and distribution. Project construction also would include road building associated with the proposed Transportation/Utility Corridor. An equipment roster with noise emissions estimates is provided in **Table 4.20-1**. Noise emissions estimates were developed from published USEPA data (USEPA 1971), from previous Nevada mining EISs (BLM 2002, 1996), and from file data for comparable mining projects in Nevada and other western states.

The proposed project would extend over an area of 15,379 acres, or slightly more than 24 square miles. However, project-related noise would emanate primarily from several major focal points of activity within that area. The main noise generating activity centers in the Round Mountain Area would include the expanded Round Mountain Pit, the expanded North Waste Rock Dump, a new North Dedicated Leach Pad, and two new Tailings Impoundment Cells. Noise generating activity centers in the Gold Hill Area would include the proposed Gold Hill Pit, West Waste Rock Dump, North Waste Rock Dump, Heap Leach Pad, and Transportation/Utility Corridor connecting the Gold Hill Area to the Round Mountain Area.

For purposes of the analysis, assumptions were made regarding the roster of equipment that would be operating at each activity center and noise levels were calculated for each of 6 potential noise sensitive receptors: the Carvers community, Round Mountain, Hadley, a ranch approximately 1.0 mile west of the Gold Hill Area, a ranch approximately 2.7 miles north-northwest of the Gold Hill Area, and a rural residence approximately 1.5 miles northeast of the Gold Hill Area (Section 3.20.1). In addition, project-related noise levels were calculated for the nearest point in the Alta Toquima Wilderness and for the Mount Jefferson Trail, which is one of the more highly used areas in the WSA. Equipment duty cycles were estimated for each type of equipment. The analysis was conservative, as noise attenuation between the sources and the sensitive receptors was calculated only for the spreading of the sound waves over the distance to the residences. As a consequence of this approach, the calculated noise levels are believed to be higher than actual, project related noise levels would ever be expected to be. Under actual conditions, noise emissions would be lower as a result of atmospheric absorption and ground absorption; and would decrease over time

from barrier attenuation as the pit depths increased and the waste rock dumps and heap leach pads expand.

Table 4.20-1
Surface Mining Equipment Roster and Associated Noise Emissions

Type of Equipment	Units		Estimated dBA[1]
	Existing	Proposed	
Caterpillar 785 150-ton haul truck	12	-	90
Caterpillar 789 190-ton haul truck	14	-	90
Caterpillar 793 240-ton haul truck	12	6	90
P&H 2300 XPA 28 cubic yard. electric shovel	3	-	90
Caterpillar 5230 hydraulic shovel	1	-	85
Komatsu WA 1200 26 cubic yard. loader	1	1	90
Caterpillar 992 G loader	2	2	87
Caterpillar 992 C loader	2	-	87
Caterpillar 992 D loader	1	-	87
Ingersoll-Rand DM-50 ELP blasthole drill	2	2	86
Ingersoll-Rand DM-50-E rotary blasthole drill	2	-	86
Ingersoll-Rand DML rotary blasthole drill	1	-	86
Caterpillar D10 dozer	3	2	85
Caterpillar D11 R dozer	2	1	87
Caterpillar 16 G grader	3	-	85
Caterpillar 16 H grader	1	1	85
Caterpillar 245 excavator	1	-	85
Caterpillar 690 D rubber tire dozer	1	-	85
Caterpillar 834 B rubber tire dozer	2	-	87
Caterpillar 854 G rubber tire dozer	2	1	87
Caterpillar 631 E scraper	1	-	87
Caterpillar 777 B water truck	1	-	83
Caterpillar 631 E water truck	1	-	83
Caterpillar 785 B water truck	2	1	83
Caterpillar 777 B lowboy	1	-	85
Air track drill	1	-	86

[1] Sound pressure levels (SPL) measured at a reference distance of 50 feet (see Glossary).

Source: RMGC 2008b.

Based on the equipment distribution scenarios developed for the project activity centers, and the assumptions previously described, projected noise levels at 4 of the 6 sensitive receptors, including both project-related noise and background noise, would be below 50 dBA. The estimated levels would range from 44.3 dBA at the north-northwest ranch to 48.1 dBA at the northeast rural residence. The projected level

at the ranch just west of the Gold Hill Area would be slightly higher at 50.4 dBA. The highest level calculated would be 61.0 dBA at Round Mountain. The projected levels would be loud enough to be heard at the rural locations during periods of low background noise, for example at night when there is very little wind. At times of low noise, the incremental increase over background levels may be sufficient to be an annoyance to some individuals. Background noise, even during quiet periods, is somewhat higher at Carvers and Hadley. Consequently, the likelihood of annoyance at those communities is lower. During windy periods, it is likely that background noise would mask project-related noise unless the wind was blowing from mine activity toward a receptor.

Background noise levels at Round Mountain are notably higher than at other parts of the study area due to its close proximity to existing mining operations. Reports indicate that some residents of the community find existing noise levels obtrusive (Fannin 2007). The higher projected noise level would occur during the early stages of the Round Mountain Pit expansion, when drilling and excavation equipment would be operating at or near the surface. As the pit work continues, the equipment would be working progressively lower into the pit, which would result in a barrier effect from the pit wall that would gradually reduce the noise levels in the community. It is likely, however, that noise levels would remain at or above current levels during pit operations in close proximity to the Round Mountain community.

Project-related noise levels at the nearest point (i.e., the southwest boundary) in the Alta Toquima Wilderness was calculated at 47.9 dBA, which would be noticeable during periods of low background noise, as it would for other rural locations. Terrain in the area is rugged and convoluted such that project-related noise may be reduced by terrain barriers in some places, especially in canyons and low areas. Noise at the Mount Jefferson Trail, approximately 3 miles farther from the project boundary, was calculated at 42.9 dBA, or 5 dBA lower. This level would be perceived as almost half as loud as at the wilderness boundary. It would still be readily noticeable during periods of low background noise, but less so when there is wind. Terrain and dense tree cover would reduce the perceived noise level in some locations along the trail. Wilderness users expect an experience with little human generated noise, so the anticipated noise levels may be an annoyance to some individuals in the wilderness.

Blasting noise is not included in the noise level estimates noted above, mainly because mine blasting is typically an extremely brief event occurring an average of once per day at each pit. Although blasts are sometimes perceived by the layman to be one large explosion, mining blasts are actually a series of smaller, single-hole explosions. Each hole is sequentially delayed and detonated independently of the other holes. Less noise and ground vibrations are generated because several small blasts (delays) are detonated in sequence rather than as one large instantaneous blast. Blasting can be further controlled by varying the amount of explosive, the type of delay, the delay sequence, and the type of explosives. Blasting would take place only during daylight hours and would be conducted under strict MSHA safety procedures.

Information on noise emissions from blasting is inconsistent. Noise analyses for development proposals at other Nevada mining facilities (BLM 2004b, 2000) have assumed blasting noise levels of approximately 115 to 125 dBA at 900 feet from the blast source, lasting for up to 15 seconds. In contrast, measurements taken for the Cortez Hills EIS at the Pipeline/South Pipeline Pit Complex in 2003 recorded maximum (L_{max}) noise levels of 69.8 dBA at approximately 10,000 feet from the source, lasting for less than 5 seconds, which would be equivalent to approximately 91 dBA at 900 feet, a substantially lower level (BLM 2007g). In addition, measurements and field observations taken in April 2007 for this EIS could not differentiate blast noise from ambient noise during a blast at the Round Mountain Pit. Measurement/observer distance during this observation was approximately 4,000 feet, the blast was fairly deep in the pit, and the blast employed

modern electronic detonators, which are reportedly much quieter than older style primacord detonators (Fenne 2007).

Based on the field measurements and subjective observations from the same time, this analysis assumes the lower levels are more representative of the actual blasting noise than the assumed levels used for prior EISs. To be conservative, the blasting noise emission level used in the analysis was 91 dBA at a 900-foot reference distance. If the level observed during field measurements for this EIS proves to be more representative of actual conditions in the proposed project area, the blasting noise levels would be approximately 13 dBA lower at each noise sensitive area than the levels reported below for the analysis.

Using the 91 dBA figure, the calculated L_{max} noise levels from blasting at either the Round Mountain Pit expansion areas or the proposed Gold Hill Pit would be below 67 dBA at 5 of the 6 sensitive receptor locations. Noise at Round Mountain from blasting at the proposed Round Mountain Pit expansion was calculated at 82.5 dBA. The highest level at the other 5 sensitive receptors would be just under 67 dBA at the northeast residence from blasting at the Gold Hill Pit. Levels at other receptors would range from a low of 56.9 dBA at the northwest ranch to slightly over 64.6 dBA at the west ranch.

Blasting noise was calculated at 60.4 dBA and 65.8 dBA at the wilderness boundary and 57.4 dBA and 59.9 dBA at Mount Jefferson Trail from the Round Mountain Pit and the proposed Gold Hill Pit, respectively. Brief blasting noise at these levels would be noticeable in the wilderness and may be an annoyance to some people.

The blasting calculations were based on blasting at the surface with no excess attenuation. As with other pit-related noise emissions, the noise from blasting would be increasingly reflected upward by the pit walls as the pit depth increased, which would reduce the noise levels outside the pits.

With modern blasting techniques, blast noise would be experienced by people at the sensitive receptors as a brief, somewhat muted clap and roll of thunder preceded by a warning whistle or siren. Public acceptance is generally improved by scheduling blasting at the same time every day to further reduce the “startle factor.”

There is an additional consideration regarding the noise calculations for Carvers and the west ranch. Because of their locations, they would experience project-related noise from both the Round Mountain expansion and the new Gold Hill Area. The analyses assumed both portions of the proposed project would occur simultaneously. If, instead, they were to take place serially, noise levels at Carvers and the west ranch would be somewhat lower.

4.20.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on recreation resources would be largely the same as described above for the Proposed Action. The principal difference would be that noise from the Transportation/Utility Corridor would be somewhat less due to less heavy traffic on the haul road than would occur under the Proposed Action. This would mainly affect noise levels at Carvers and at the west ranch. Slightly higher noise levels may occur at the northeast residence because of greater activity at the proposed process facilities on the eastern side of the Gold Hill Pit. All other effects would be the same as described for the Proposed Action.

4.20.3 County Road Overpass Alternative

The County Road Overpass Alternative would increase noise levels somewhat at Carvers and the west ranch. Haul trucks climbing the grade of the overpass would emit higher noise levels than trucks on a nearly flat grade and the noise would last somewhat longer for each truck because the climb would reduce their speed. All other effects would be the same as described for the Proposed Action.

4.20.4 No Action Alternative

The No Action Alternative would result in a continuation of existing noise conditions in the study area for the duration of authorized mining activities. It would result in completion of mining by approximately 2012 and completion of reclamation activities by approximately 2022, after which the area would revert to relatively quiet wildlife habitat, agriculture, and dispersed recreation uses common throughout most of the rest of the Big Smoky Valley. Most of the noise generated by human activity associated with the community of Hadley would also cease as most of the employment that supports Hadley residents is provided by the mine.

4.20.5 Cumulative Impacts

The CESA for noise is shown in **Figure 4.20-1**. The past and present actions and RFFAs in this area are identified in **Table 2.9-1**; their locations are shown in **Figure 2.9-1**.

Past actions would have no effect on noise in the study area because noise emissions terminate at the completion of a project or activity. Any potential cumulative noise effects from present actions is included in the measured background levels for the proposed project provided in **Appendix C**, although no such noise effects were observed at the time of the field monitoring. Noise from RFFAs would not be expected to cause cumulative effects with noise from the Proposed Action because noise tends to be localized to the area within 2 to 5 miles of an activity and there are no RFFAs close enough to the proposed project, and with sufficiently strong noise emissions, to create cumulative noise effects at the identified noise sensitive receptors.

4.20.6 Monitoring and Mitigation Measures

Based on the conclusions of the impact analysis, no noise monitoring measures would be required. Higher noise levels at the Round Mountain townsite indicate efforts to minimize noise at the community would be warranted.

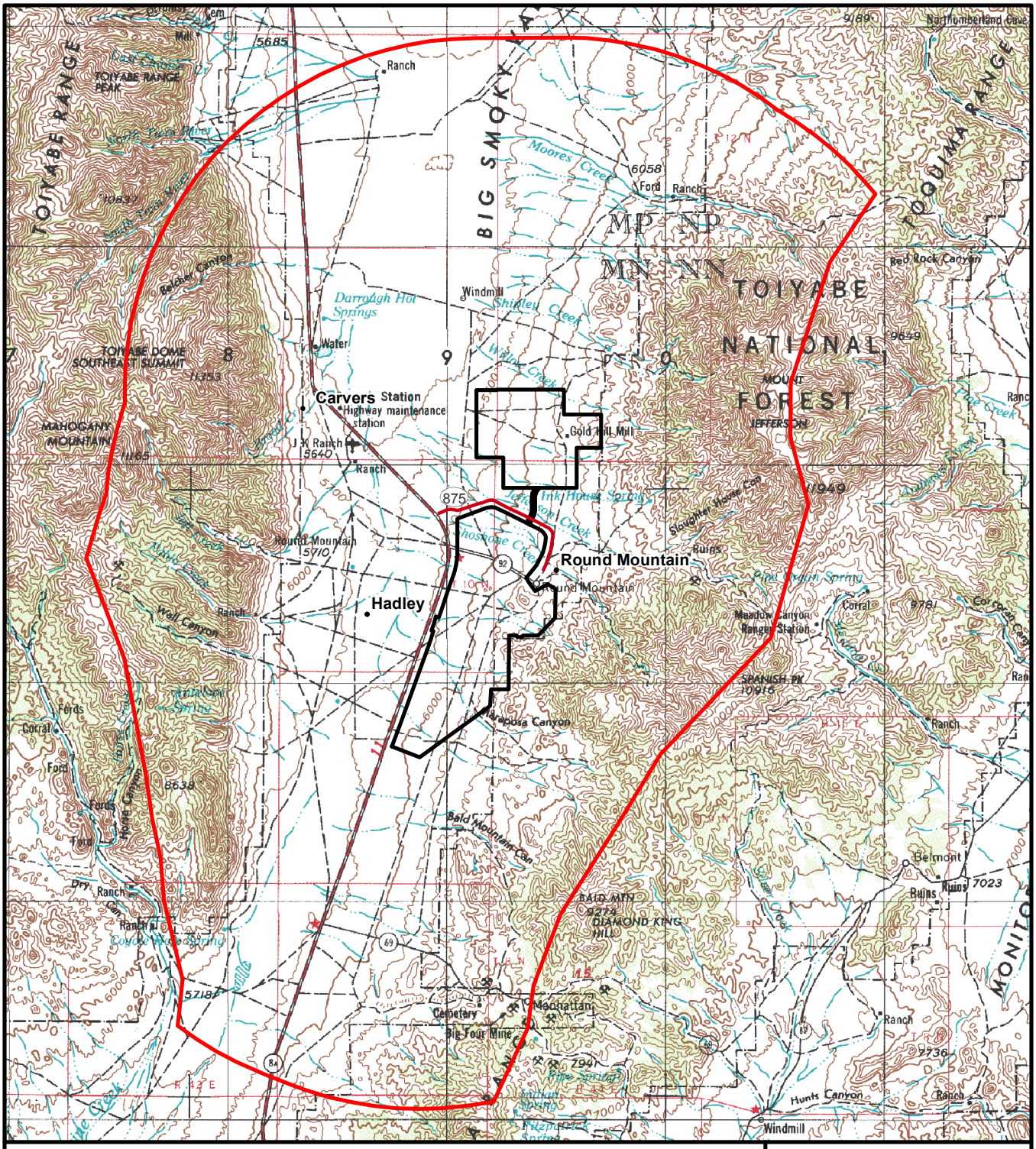
Issue: Increased noise levels at the Round Mountain townsite from proposed activities in the Round Mountain Area.

Mitigation Measure N-1: If residents complain about excessive noise from mining operations during the pit expansion into the area south of the Round Mountain townsite, RMGC, in consultation with the BLM, will mitigate noise impacts to the Round Mountain townsite. Potential mitigation measures include reduction of mining activities during hours of darkness, mining the pit expansion from the south to the north, to the degree possible, and constructing a substantial berm between the townsite and mining operations. BLM will select mitigation measures for implementation after consultation with RMGC and affected residents.

Effectiveness: Implementation of this measure will minimize noise impacts to the Round Mountain townsite.

4.20.7 Residual Impacts

Upon completion of the reclamation activities associated with previously approved projects and the proposed project, noise emissions would cease and there would be no residual noise effects.



Round Mountain Expansion Project

Figure 4.20-1

Cumulative Effects Study Area for Noise

04/30/2009

4.21 Environmental Justice

Primary issues related to Environmental Justice are guided by EO 12898 that initiated consideration of Environmental Justice in Federal actions. The basic question is whether any potential adverse effects of the Proposed Action or alternatives would fall disproportionately on minority or low income members of the affected community.

4.21.1 Proposed Action

USEPA's Guidance for Incorporating Environmental Justice Concerns in USEPA's NEPA Compliance Analyses (USEPA 1998) suggests a screening process to identify environmental justice concerns. The two-step process is as follows:

1) Does the potentially affected community include minority and/or low-income populations?

2) Are the environmental impacts likely to fall disproportionately on minority and/or low-income members of the community and/or a tribal resource?

If the two-step process indicates that there exists a potential for environmental justice effects to occur, the following are considered in the analysis:

- Whether there exists a potential for disproportionate risk of high and adverse human health or environmental effects;

- Whether communities have been sufficiently involved in the decision-making process; and

- Whether communities currently suffer, or have historically suffered, from environmental and health risks and hazards.

In order to assess the potential for environmental justice impacts, the socioeconomic characteristics of the study area counties and communities are first analyzed for the presence of minority and low-income populations. Second, if minority or low-income populations are identified based on the USEPA's Environmental Justice Guidance (USEPA 1998), the project and alternatives are evaluated for potential effects, which may be expected to disproportionately impact any such populations.

The initial analysis indicates that the potential effects of the Proposed Action would not be expected to disproportionately affect any particular population. The racial and ethnic composition of Nye County and the Big Smoky Valley is mixed, but percentages of minorities are below state averages, except for American Indians (Section 3.21, Environmental Justice), which are primarily located on or near the Duckwater Reservation over 75 miles east of the proposed project area. There is no indication of a meaningfully larger percentage of a minority population near the proposed project area. While there are likely households under the poverty threshold near the proposed project area, there also are many mine employees with above average household incomes. Environmental effects that may occur either in close proximity to the proposed project area, or at a greater distance, such as noise, visual, or air impacts, would affect the area's population equally, without regard to race, ethnicity, age, or income level.

4.21.2 Gold Hill Processing Alternative

Effects of the Gold Hill Processing Alternative on Environmental Justice concerns would be the same as described for the Proposed Action.

4.21.3 County Road Overpass Alternative

Effects of the County Road Overpass Alternative on Environmental Justice concerns would be the same as described for the Proposed Action.

4.21.4 No Action Alternative

The No Action Alternative would result in a scaling down of mining from 2012 through approximately 2015 and complete closure of the Round Mountain Mine within a few years after that when all ore processing and reclamation activities have been completed. This would result in staged termination of essentially all 730 employees of the mine, ending the economic benefits currently provided by the mine. While the effects on household incomes would be substantial, they would be expected to affect people of all income levels more or less equivalently.

4.21.5 Cumulative Impacts

Environmental justice effects of past and present actions in the CESA have been incorporated into the affected environment as described in Section 3.21, Environmental Justice. No environmental justice effects would occur as a result of the proposed project. Therefore, cumulative environmental justice effects would not occur.

4.21.6 Monitoring and Mitigation Measures

Based on the conclusions of the impact analysis, no monitoring or mitigation measures are recommended for environmental Justice.

4.21.7 Residual Impacts

There would be no residual environmental justice effects from the proposed project or alternatives.

4.22 Relationship Between Short-term Uses of the Human Environment and the Maintenance and Enhancement of Long-term Productivity

As described in the introduction to Chapter 2.0, short term is defined as the 13-year operational life of the proposed project, and the 5-year reclamation period and long term is defined as the future following reclamation (i.e., beyond 16 years). This section identifies the tradeoffs between the short-term impacts to environmental resources during the operation and reclamation versus the long-term impacts to resource productivity that would extend beyond the end of reclamation.

The short-term use of resources during the construction, operation and reclamation of the mine expansion would result in beneficial impacts in the form of additional local employment and the generation of revenue.

The proposed project would result in various short-term impacts such as the temporary loss of soil and vegetation productivity and the associated loss of herbaceous habitat, possible wildlife avoidance, a reduction in dispersed recreation opportunities, temporary increases in fugitive dust, social and economic impacts to the local infrastructure, and increased noise levels. These impacts are expected to end upon completion of operations and would be minimized through implementation of RMGC's environmental protection measures.

The short-term visual impacts would last a few years beyond mine closure and would gradually be reduced as vegetation becomes established. The scale and extent of the waste rock dumps and tailings impoundment facilities would continue to alter the local landscape and views in the long term.

Impacts to long-term productivity (i.e., following project reclamation) would primarily depend on the effectiveness of the proposed reclamation of the disturbed areas. Successful reclamation would provide for post-mining wildlife and livestock grazing by establishing self-sustaining plant communities. Revegetation is also expected to stabilize disturbed surfaces and control erosion.

There would be long-term loss in soil and vegetation productivity and associated terrestrial wildlife habitat, a reduction in livestock grazing areas, and public lands used for dispersed recreation that would not be reclaimed. In addition, a potential long-term loss of riparian vegetation associated with seeps, springs, and ephemeral creek associated with mine dewatering pending recovery of the groundwater tables.

4.23 Irreversible and Irretrievable Commitment of Resources

The Proposed Action could result in the irreversible commitment of resources (e.g., the loss of future options for resource development or management, especially of nonrenewable resources such as minerals or cultural resources) or the irretrievable commitment of resources (e.g., the lost production or use of renewable natural resources during the life of the operations). Irreversible and irretrievable impacts of the proposed action are summarized for each resource in **Table 4.23-1**.

Table 4.23-1
Irreversible and Irretrievable Commitment of Resources by the Proposed Action

Resource	Irreversible Impacts	Irretrievable Impacts	Explanation
Geology and Minerals	Yes	Yes	Approximately 998 Mt and 48 Mt of processed ore would be mined during operations at the Round Mountain and Gold Hill areas, respectively. This would result in the irreversible and irretrievable commitment of this resource.
Water Quality and Quantity (Surface and Ground) and Water Use	Yes	Yes	Groundwater levels affected by proposed mine dewatering and infiltration operations are predicted to partially recover in the long term. The total estimated volume of additional groundwater extracted during pit dewatering is 27.9 billion gallons over the mine life would be permanently removed from the groundwater system and consumed for operational use. This permanent extraction of groundwater is considered an irretrievable commitment of resources. In addition, approximately 954 and 91 gpm of water would be lost to evaporation in the Round Mountain and Gold Hill pit lakes, respectively.
Cultural Resources	No	No	No disturbance to known cultural sites is anticipated.
Native American Traditional Values	No	No	Areas of traditional value to Native Americans in the project vicinity would not be disturbed.
Hazardous Materials and Solid Waste	No	No	No irreversible or irretrievable commitment of resources or impact is anticipated. However, if a spill were to affect a sensitive resource, an irretrievable impact could occur pending the recovery of the resource.
Air Quality	No	No	Project emissions would not exceed Federal or state AAQS. Air quality would return to existing conditions after completion of the project.
Paleontological Resources	No	No	No disturbance to scientifically significant paleontological resources is anticipated.

Table 4.23-1 (Continued)

Resource	Irreversible Impacts	Irretrievable Impacts	Explanation
Social and Economic Values	No	Yes	There would be increased local productivity including jobs for construction and operations workers during the life of the project. State and local government revenues also would benefit. Resources committed to development of the proposed project would not be retrievable.
Recreation	Yes	Yes	There would be an irretrievable loss of public land available for dispersed recreational opportunities during operations and reclamation; an irreversible loss would occur on approximately 351 acres of public land associated with unreclaimed lands.
Wilderness	No	No	Access to wilderness areas would be maintained.
Visual Resources	Yes	No	Impacts to visual resources would be reduced through successful reclamation procedures and implementation of the environmental protection measures, but permanent changes would result.
Soils and Watershed	Yes	Yes	Suitable growth media would be salvaged from the mine disturbance areas for use in reclamation. There would be a loss of soil productivity during operations on approximately 4,698 acres, resulting in an irretrievable commitment of this resource. There would be an irreversible commitment of the resource on approximately 351 acres associated with the Round Mountain and Gold Hill pits, which would not be reclaimed.
Vegetation	Yes	Yes	There would be an irretrievable commitment of vegetation resources on approximately 4,690 acres during operations; vegetation subsequently would be re-established on 4,348 acres. Approximately 344 acres of vegetation would be irreversibly lost as a result of development of the Round Mountain and Gold Hill pits.
Noxious Weeds and Invasive Species	No	No	Disturbance areas within the proposed project area would be monitored to identify any noxious weed and invasive species. If populations are observed within the proposed project area during operations, they would be removed. Successful reclamation of disturbance areas also would minimize the potential for establishment of noxious weed and invasive species within the proposed project area.

Table 4.23-1 (Continued)

Resource	Irreversible Impacts	Irretrievable Impacts	Explanation
Range Management	Yes	Yes	Forage from approximately 351 acres of BLM-administered land would be permanently lost and excluded by the proposed action. A permanent loss of 16 AUMs would occur within the Smoky Allotment.
Wildlife and Fisheries Resources	Yes	Yes	Approximately 4,346 acres of habitat would be irretrievably lost until vegetation has re-established following reclamation. Approximately 344 acres of the total habitat disturbance would be irreversibly lost to game and avian species as a result of development of the Round Mountain and Gold Hill pits.
Special Status Species	No	No	Irreversible impacts to special status species would not occur as a result of the proposed action providing field surveys are conducted in suitable habitat areas and appropriate mitigation measures implemented prior to ground disturbance.
Access and Land Use	Yes	Yes	There would be no irreversible or irretrievable impacts to access; public access patterns would be maintained. Approximately 351 acres would be permanently disturbed and unreclaimed and would no longer be available for pre-project land use.
Noise	No	No	Noise is not considered irreversible, because it would cease following the completion of mine operations.
Environmental Justice	No	No	The proposed project would not disproportionately affect minority or low-income populations.