3.3 Soils and Reclamation

3.3.1 Affected Environment

Baseline soils data were collected by both detailed mapping and sampling, which focused on the proposed areas of disturbance, and by more extensive reconnaissance-level surveys completed for the northern part of Lander County by the National Cooperative Soil Survey (JBR 1999b; U.S. Soil Conservation Service 1992). Information from both sources was assembled for the complete project area in the soils report prepared by JBR (1999b). Information used to characterize the soils of the cumulative effects area was taken from the survey of northern Lander County.

3.3.1.1 Project Area Soil Characteristics

Soil variability within the project area results from residual and transported parent materials subsequently influenced by topography, climate, vegetation, and weathering rates. ***Figure 3.3-1*** depicts the soil map units delineated from the surveys of the project area. ***Tables 3.3-1*** and ***3.3-2*** present selected soil characteristics that affect the suitability of the dominant soils for use as growth media for reclamation.

Tables 3.3-3 and ***3.3-4*** identify depths of potentially salvageable growth medium, as well as limitations to reclamation use pertaining to each soil unit. ***Figure 3.3-2*** identifies erosion hazards and depicts the occurrence and depths of suitable growth media that is potentially salvageable from these soils.

Soils in the project area were evaluated for reclamation suitability on the basis of field observations and site-specific sampling and laboratory analyses. Threshold values for assessing the suitability of material for plant growth medium were based on the following physical and chemical parameters. The limitation is described in parentheses following the criterion.

- Sodium adsorption ratio greater than 12 (excess sodium)
- Electrical conductivity greater than 8 micromhos per square centimeter (mhos/cm^2) (excess salt)
- Boron contents greater than 5 parts per million
- pH greater than 8.5 (high pH), less than 6.0 (low pH)
- Soil texture: clay, silty clay, sandy clay (too clayey); or sand, fine sand, very fine sand (too sandy)
- Coarse fragments (rock fragments greater than 2mm in size) greater than 50 percent by weight, depending on size (small stones, large stones)
- Depth to rock or hardpan less than 20 inches (depth to rock, cemented pan)
- Erosion hazard for water or wind: severe (erosion hazard)

Soils at higher elevations in the northern and central mountainous portion of the project area (map units 1, 2, 3, 9, 10, 1532, 2652, and 3432) are developing in residuum or colluvium from chert, shale, or mixed volcanic rocks. Slopes range from 15 to 75 percent. Typically these soils are well drained and have low available water capacities. Rock outcrops and very gravelly to extremely cobbly surfaces commonly occur within these map units.

Soil textures range from gravelly loam to extremely gravelly clay loam. The content of coarse fragments in these soils typically ranges from 35 percent to over 65 percent. Electrical conductivity values are typically less than 1 millimho/cm^2 throughout these mountain and hillslope soils, and sodium adsorption ratios are typically less than 12. Growth medium salvage potential is constrained by several factors as shown in ***Tables 3.3-1*** through ***3.3-4***.

Map units 4, 5, 6, 8, 413, 605 and 1042 occur on fan piedmonts and piedmont slopes in relative proximity to the base of the mountains. The soils are forming in alluvium from mixed rock sources on slopes ranging from 2 to 8 percent. They are typically deep and well drained to somewhat excessively drained, and the soil materials vary widely in their ability to hold water available for plant growth. Units 5 and 413 have a cemented hardpan at depths of 20 to 40 inches, which restricts plant growth.

Soil textures are highly variable in these units, ranging from clay loams to extremely gravelly, sandy loams, and loamy sands. Coarse fragment contents typically range from 25 to 65 percent, though some soil contain fewer coarse fragments.

Table 3.3-1
Soil Characteristics - Detailed Survey Mapping Units

Map Unit Symbol	Map Unit Name	Reaction (pH)	Permeability	Available Water Capacity (inches)	Depth to Bedrock or Hardpan (inches)	Water Erosion Hazard	Wind Erosion Hazard	Per-cent Slope
1	Bregar - Rubbleland association	7.0 - 8.5	Moderately slow	0 - 1.3	10 - 20	Slight	Slight	30 - 50
2	Roca gravelly silt loam	7.0 - 8.5	Moderately slow	2.9 - 3.6	20 - 40	Moderate	Slight	20 - 50
3	Roca - Rubbleland association	7.0 - 8.5	Moderately slow	0 - 3.6	20 - 40	Slight	Slight	20 - 50
4	Rednik very gravelly sandy clay loam	8.6 - 9.2	Moderately slow	2.6 - 4.1	60 +	Slight	Slight	5 - 8
5	Misad very gravelly sandy clay	8.2 - 9.6	Moderately rapid	2.9 - 4.1	60 +	Slight	Slight	0 – 3
6	Golconda gravelly very fine sandy loam	8.5 - 9.6	Slow	4.2 - 5.1	20 - 40	Slight	Slight	0 - 3
7	Ocala variant silty clay loam	8.8 - 9.6	Very slow	11.4 - 12.6	60 +	Slight	Slight	0 -3
8	Rednik - Creemon association	8.2 - 9.2	Moderately slow to moderate	2.6 - 11.6	60 +	Slight	Slight	5 -8
9	Stingdorn extremely cobbly loam	8.0 - 9.4	Moderately slow	1.5 - 1.9	8 - 20	Moderate	Slight	10 -35
10	Bregar - Roca association	7.0 - 8.5	Moderately slow	1.0 - 3.6	10 – 40	Moderate	Slight	30 - 50

Source: JBR 1999b.

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Explanation

ORDER 3 SOIL MAP UNITS

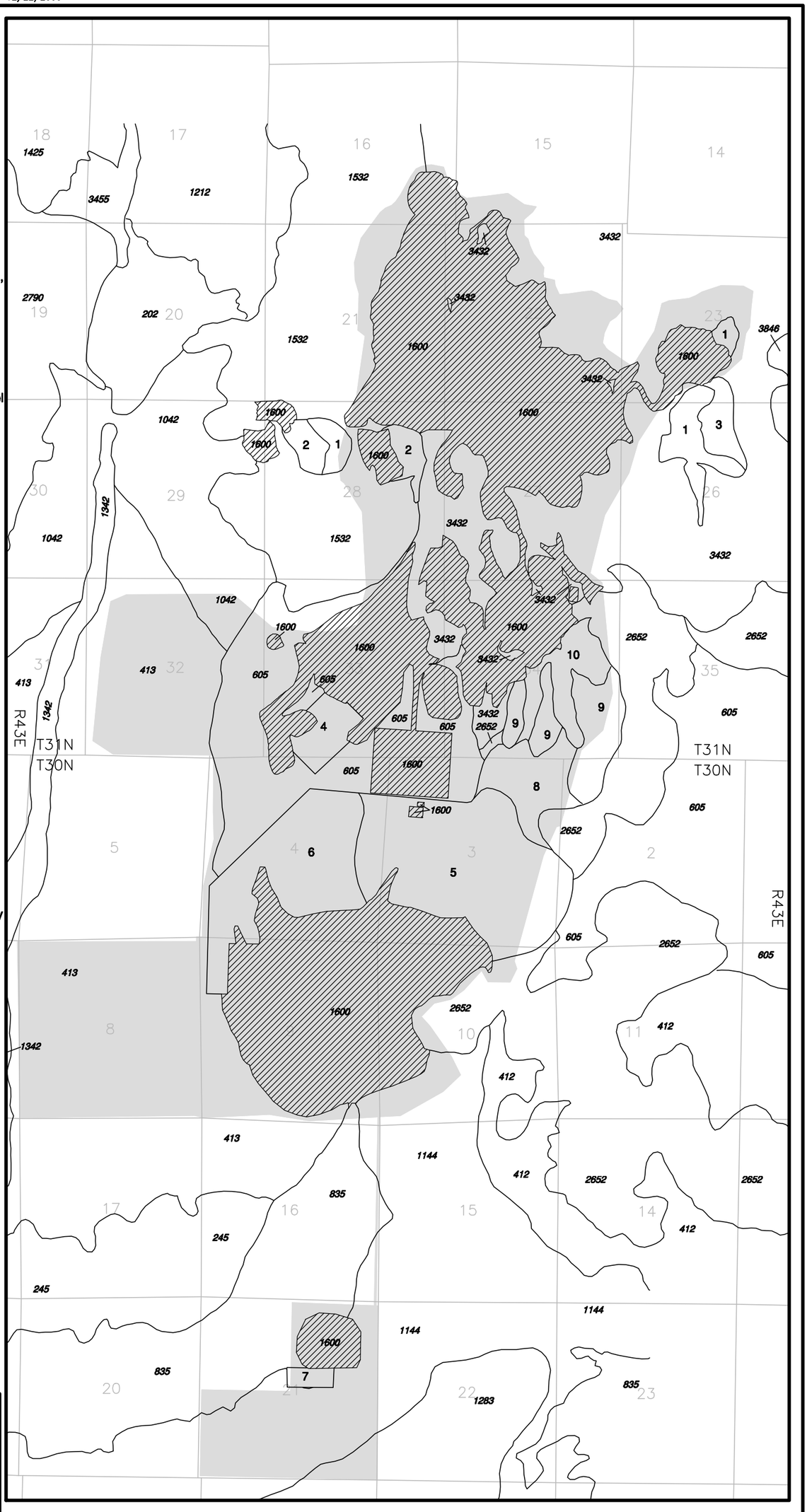
MAP NO.	MAP UNIT
202	Bioya-Chiara-Cortez association
245	Bubus-Needle Peak-Yipor association
412	Golconda-Dun Glen association
413	Golconda-Blownout land complex
605	Misad-Creemon-Rednik association
835	Reese-Ocala association
1042	Tenabo very gravelly loam, 2 to 8 percent slopes
1144	Wendane-Batan-Broyles association
1162	Whirlo silt loam, 0 to 2 percent slopes
1212	Wiskan-Roca-Bregar association
1283	Ricert-Kingingham-Oxcorel association
1292	Kingingham-Golconda-Whirlo association
1342	Doowak, cobbly-Doowak-Veta association
1425	Sumine-Loncan association
1532	Cleavage-Rubbleland-Bregar association
1600	Dumps and Pits, mine
2652	Malpais-Stingdorn association
2790	Old Camp-Minat-Osoll association
3432	Bregar-Roca-Quarz association
3455	Reluctan-Roca-Colbar association
3846	Jung-Wiskan association

ORDER 2 SOIL MAP UNITS

MAP NO.	MAP UNIT
1	Bregar - Rubbleland association
2	Roca very gravelly clay
3	Roca - Rubbleland association
4	Rednik very gravelly sandy clay loam
5	Misad very gravelly sandy loam
6	Golconda gravelly very fine sandy loam
7	Ocala variant silty clay loam
8	Rednik - Creemon association
9	Stingdorn extremely cobbly loam
10	Bregar - Roca association

Project Facility Boundary

Existing Disturbance Phoenix Project



Source: JBR 1999b

Phoenix Project

Figure 3.3-1
Soils Map

Table 3.3-2
Soil Characteristics - Reconnaissance Survey Mapping Units

Map Unit Symbol	Map Unit Name (allow 15 to 20% inclusions)	Reaction (pH)	Permeability	Available Water Capacity (inches)	Depth to Bedrock or Hardpan (inches)	Water Erosion Hazard	Wind Erosion Hazard	Per-cent Slope
413	Golconda-Blownout land complex	8.2	Slow	4.2 - 5.1	20 - 40	Slight	Slight	2 - 25
605	Misad-Creemon-Rednik association	8.2 - 8.6	Moderately slow to moderately rapid	2.6 - 11.6	>60	Slight	Slight	0 - 8
835	Reese-Ocala association	9.0 - 9.2	Slow	9.2 - 17.6	>60	Slight	Slight	0 - 2
1042	Tenabo very gravelly loam, 2 to 8 percent slopes	8.2	Moderately slow	3.2 - 3.6	>60	Slight	Slight	2 - 8
1144	Wendane-Batan-Broyles association	8.6 - 9.6	Moderately slow to moderately rapid	11.4 - 12.6	>60	Slight – moderate	Slight	0 - 2
1283	Ricert-Kingingham-Oxcorel association	8.2 - 8.4	Moderately slow to very slow	3.6 - 7.0	20 - >60	Slight	Slight	2 - 4
1532	Cleavage-Rubbleland-Bregar association	6.5 - 7.0	Moderately slow	0.9 - 1.8	5 - 20	Slight – moderate	Slight	15 - 50
1600	Dumps and Pits, mine	-	-	-	-	-	-	-
2652	Malpai-Stingdorn association	8.2	Moderately rapid to moderately slow	1.5 - 5.4	8 - 60	Moderate	Slight	4 - 50
3432	Bregar-Roca-Quarz association	7.2 - 7.4	Moderately slow to very slow	1.0 - 3.6	5 - 40	Moderate	Slight	15 - 75

Source: JBR 1999b.

Table 3.3-3
Salvageable Soil Characteristics - Detailed Survey Mapping Units

Mapping Unit	Soil Component	Percent of Unit	Potential Salvage Depth (inches)	Suitability Limitations Within Potential Salvage Depth	Limits to Deeper Salvage on Overall Unit
1	Bregar	65[1]	8	Slope, small stones	Slope, depth to rock
	Rubbleland	20	0	---	
	Haplargids	10	6	Small stones	
	Roca	5	28	Small stones	
2	Roca	85[1]	28	Slope, small stones, clayey	Slope, depth to rock
	Reina	5[1]	12	Small stones	
	Hoot	5[1]	12	Small stones	
	Haplargids	5[1]	6	Small stones	
3	Roca	65[1]	28	Slope, small stones, clayey	Slope, depth to rock
	Rubbleland	25	0	---	
	Bregar	10[1]	8	Slope, small stones	
4	Rednik	90	15	Small stones	Excess salts, small stones, too sandy
	Haplargids	10	6	Small stones	
5	Misad	85	15	Small stones, excess salts	Excess sodium, small stones, Excess salts, cemented pan
	Rednik	10	6	Small stones	
	Golconda	5	8	Excess sodium, small stones	
6	Golconda	90	8	Excess salt and sodium, small stones	Excess salt and sodium, cemented pan
	Misad	10	15	Small stones, excess salt and sodium	
7	Ocala variant	95	0	---	Excess sodium, clayey
	Playas	5	0	---	
8	Rednik	60	6	Small stones	Excess salts, excess sodium, cemented pan
	Creemon	30	15	Small stones	
	Misad	5	15	Small stones, excess sodium	
	Stingdorn	5	6	Small stones	
9	Stingdorn	85	6	Small stones	Cemented pan, small stones
	Bregar	5	8	Slope, small stones	
	Rednik	5	6	Small stones	
	rock outcrop	5	0	---	
10	Bregar	45[1]	8	Slope, small stones	Slope, small stones, depth to rock
	Roca	40[1]	28	Slope, small stones, clayey	
	Scree	10	0	---	
	rock outcrop	5	0	---	

[1]Only 1/3 to 1/2 of the mapping unit area may be salvageable due to heavy equipment operating limitations on steep slopes.

Table 3.3-4
Salvageable Soil Characteristics - Reconnaissance-level Mapping Units

Mapping Unit	Soil Component	Percent of Unit	Potential Salvage Depth (inches)[1]	Suitability Limitations Within Potential Salvage Depth	Limits to Deeper Salvage on Overall Unit
413	Golconda	60	8	Small stones	Excess salt, excess sodium, cemented pan
	Blownout land	25	0	---	
	Inclusions	15	6	---	
605	Misad	35	15	Small stones, excess salt	Excess salt, small stones, excess sodium
	Creemon	30	15	Excess salt	
	Rednik	20	6	Small stones	
	Inclusions	15	6	---	
835	Reese	45	0	---	Excess sodium, excess salt
	Ocala	40	0	---	
	Inclusions	15	0	---	
1042	Tenabo	85	6	Small stones	Cemented pan, excess sodium, small stones
	Inclusions	15	6	Small stones	
1144	Wendane	30	0	---	Excess salt, excess sodium
	Batan	30	0	---	
	Broyles	25	0	---	
	Inclusions	15	0	---	
1283	Ricert	45	6	Erodibility	Excess sodium, small stones, cemented pan, too clayey
	Kingingham	20	6	Small stones	
	Oxcorel	20	8	Erodibility	
	Inclusions	15	0	---	
1532	Cleavage	45	0	---	Small stones, rock outcrop
	Rubble land	25	0	---	
	Bregar	15	8	Small stones, depth to rock	
	Inclusions	15	0	---	
1600	Mine Pits and Dumps	100	0	---	Slope, depth to rock, small stones
2652	Malpais	50	0	---	Small stones, depth to rock, slope, cemented pan
	Stingdorn	40	0	---	
	Inclusions	10	0	---	
3432	Bregar	35	0	---	Slope, small stones, depth to rock, too clayey
	Roca	30	0	---	
	Quarz	20	0	---	
	Inclusions	15	0	---	

[1]Inclusions were given a nominal 6-inch salvage depth potential if they appeared to be salvageable based on brief descriptions in the U.S. Soil Conservation Service soil survey. Further information to refine this is not available.

Six general soil survey map units comprise the cumulative effects area. These map units were based on the survey completed for a portion of Lander County (U.S. Soil Conservation Service 1992). The map units correspond to four major landforms identified within the cumulative effects area. These landforms include mountains, foothills, fans, and floodplains.

The soils overlying the mountains in the northwest portion of the cumulative effects area are typified by the Punchbowl, Sumine, Roca, and Cleavage soils series. These soils occur on the shoulders and sideslopes of mountains at slopes ranging from 15 to 75 percent. Parent materials consist primarily of residuum with some colluvium and andesite, rhyolite, quartz, sandstone, chert, shale, and mixed volcanic sources. These soils are typically less than 30 inches deep to hard bedrock and are neutral to moderately alkaline, non-saline, and non-sodic. Surface textures typically range from very gravelly to very cobbly loams and sandy loams. Subsurface textures range from gravelly to very cobbly loams, clay loams, and clays.

The Wiskan, Bregar, Linrose, and Quarz soil series dominate the mountains in the northeastern portion of the cumulative effects area. These soils are forming in residuum and colluvium of a variety of parent materials including mixed volcanics, shales, and sandstones. Slopes typically range from 15 to 75 percent. These soils are dominantly less than 28 inches to unweathered bedrock and are mildly alkaline, non-saline, and non-sodic. Textures are highly variable. Surface textures range from gravelly silt loams to very cobbly loams. Subsurface textures range from very gravelly loams to very gravelly clay loams to extremely gravelly loams in the typical profiles.

Revegetation limitations include high rock fragment contents, droughty soil conditions, and susceptibility to erosion. Water erosion hazards range from moderate to severe, while wind erosion hazards are slight for all dominant soil series.

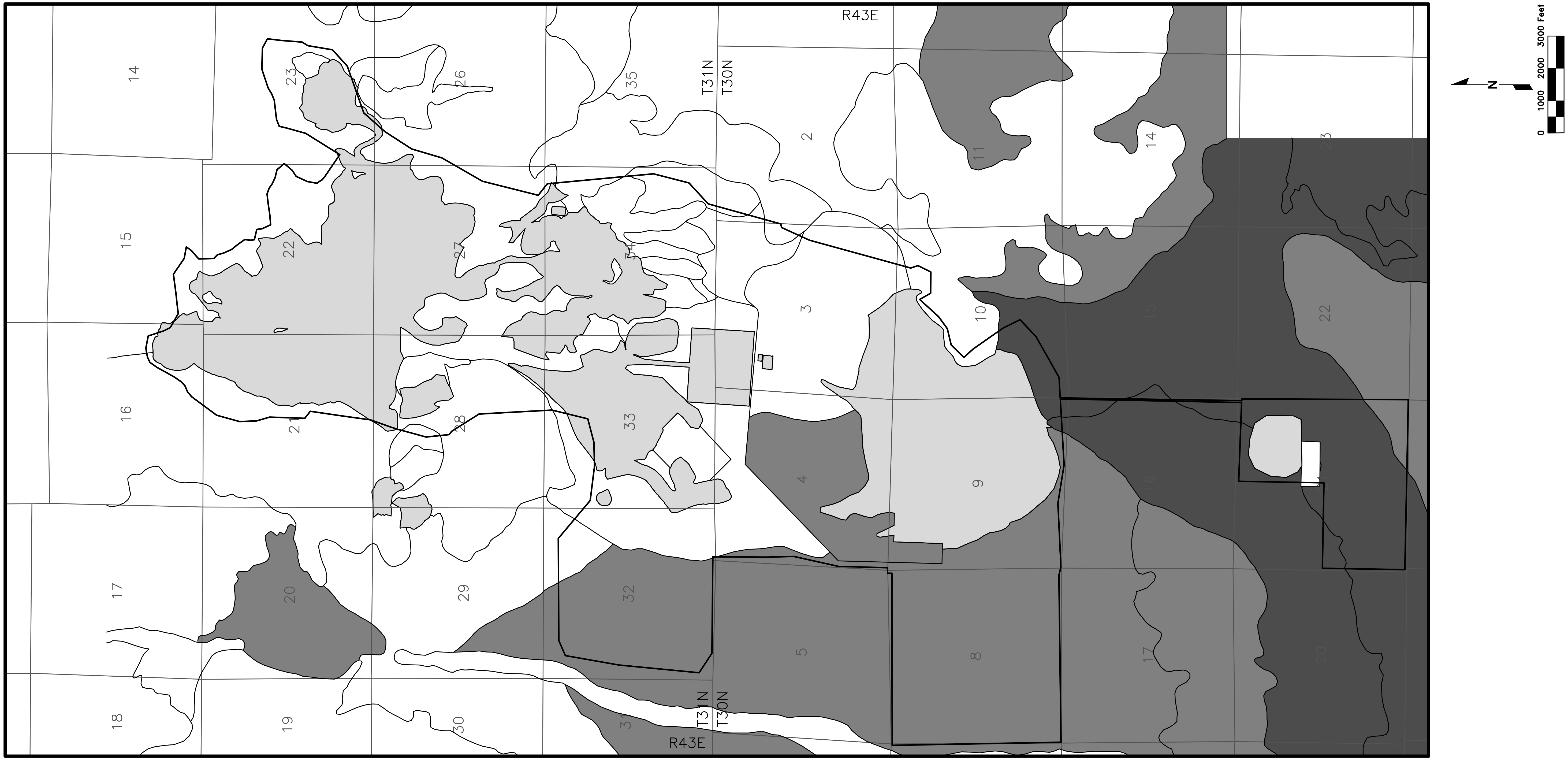
Foothills within the cumulative effects area are dominated by the Havingdon, Malpais, Old Camp, and Stingdorn soil series. Slopes typically range from 15 to 50 percent. Parent materials consist chiefly of residuum and colluvium. Shallow soil depths less than about 20 inches to a hard pan or hard bedrock are most common, though deeper soils also occur in more weatherable parent materials. These soils are neutral to moderately alkaline, non-saline, and non-sodic. Soils having deeper horizons high in sodium may occur at lower elevations bordering alluvial fans. The Havingdon, Old Camp, and Malpais series are characterized by gravelly to very gravelly loams, clay loams, and fine sandy loams in the surface horizons. Very gravelly loams and clay loams are typical of the subsurface horizons. Very cobbly loams over very cobbly clay loams typify the Stingdorn series.

Revegetation limitations for these soils include an arid climate and droughty soil conditions along with high profile rock fragment contents. The water erosion hazard for these soils is slight to severe. The wind erosion hazard is rated as slight for the dominant soils of the foothills.

Soils overlying fan landforms typically occur on fan piedmonts, skirts, and slopes as well as associated alluvial flats at slopes less than 8 percent. These soils are all 60 or more inches deep, although indurate hardpans may occur within this depth increment. Parent materials consist primarily of alluvium and mixed rock sources overlain or influenced by loess. Revegetation limitations include excess salt and sodium, arid climate, and rooting depth. The hazards for both wind and water are rated as slight for all dominant soil series.

Fan landforms in the western portion of the cumulative effects area are dominated by the Kingingham, Whirlo, Golconda, and Wendane soil series. Surface soil horizons are typically moderately alkaline, non-saline, and non-sodic, though soils on associated alluvial flats have higher alkalinity and salinty values. Subsurface soil materials are typically strongly alkaline, moderately to strongly saline, and slightly to moderately sodic. Surface soils textures range from gravelly sandy loams to silt loams. Subsoil textures range from sandy loams and very gravelly sandy loams to clay loams and gravelly clays.

Fan landforms in the eastern part of the cumulative effects area are overlain primarily by the Broyles, Oxcorel, Kingingham, and Misad soil series. Surface soils are moderately to strongly saline, non-saline, and non-sodic and exhibit sandy loam to gravelly loam textures. Subsoils are strongly to very strongly alkaline, slightly to strongly saline, and non- to strongly sodic. Subsoil textures are highly variable ranging from stratified loams to clays to gravelly clays.



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Explanation

- Slight Water Erosion/ Slight Wind Erosion
- Moderate Water Erosion/ Slight Wind Erosion
- Slight Water Erosion/ Moderate Wind Erosion
- Slight Water Erosion/ Severe Wind Erosion
- Project Facility Boundary

Phoenix Project

Figure 3.3-2

Soil Erosion Potential of Soil Map Units

Floodplains associated with the Reese River and an unnamed tributary to Willow Creek in the southern portion of the project area are overlain by the Ocala and Reese soil series. Parent material consists of alluvium from volcanic rocks, which is influenced by volcanic ash away from active riparian channels. These soils are typically deep, strongly alkaline, and moderately to strongly saline and sodic and occur on level to nearly level landforms. Both soils are typified by silt loam surface textures and silt loam to silty clay loam subsurface textures.

The main limitations to revegetation of floodplain soils is high pH, salinity, and sodicity. The Reese soil is subject to occasional flooding. The hazards for wind and water are rated as slight for both of these soils.

3.3.1.2 Alternative Growth Media Characteristics

Extensive mining operations have taken place within the Phoenix Project area over several decades resulting in a large disturbance acreage for which reclamation would be required. Soils were not required to be salvaged when the majority of these disturbances took place. Therefore, alternative materials would be used as growth media or capping material, in lieu of, or in addition to, salvaged soil to provide the necessary depth of cover on selected disturbances (see Section 2.4.18).

The characteristics of these alternative growth media are presented below, based on the report prepared by Exponent (2000a), and in greater detail in Sections 3.1 and 3.2, Geology and Minerals, and Water Resources and Geochemistry, respectively.

Considerable field sampling and laboratory analyses of the physical and chemical nature of these alternative materials have been conducted by Exponent (2000a). In addition, considerable revegetation has been accomplished by BMG on similar materials in the Reona and Copper Basin areas near the proposed project. This experience indicates that the materials that have been deemed suitable for capping of proposed waste rock facilities would be suitable for supporting plant growth. In some materials, there may be excessive concentrations of chemical constituents that could affect forage quality. The occurrence and suitability of these materials is further discussed in Section 3.2, Water Resources and Geochemistry. Potential impacts on revegetation from these materials are discussed in the environmental consequences sections for Soils and Reclamation, and Vegetation (Sections 3.3.2 and 3.4.2, respectively).

3.3.2 Environmental Consequences

Project issues associated with soil resources and reclamation include 1) loss of soil productivity or productive postmining land uses, 2) physical and chemical stability of the reclaimed landscape and project components, 3) promotion of undesirable plant species, and 4) effects on public safety from features of the disturbed landscape. Impacts to soil resources would be significant if the Proposed Action or No Action alternative would result in any of the following:

- Accelerated erosion in excess of soil loss tolerances on waste rock and heap leach facilities or other sloping surfaces
- Compromised public safety through mass instabilities on slopes or fills, or inadequate draindown and closure procedures
- Significant decrease in the amount of overall site productivity from premining to postmining land uses
- Lack of concurrent reclamation that promotes unnecessary resource degradation during the active mining and processing period or fosters delays in determining appropriate postmining reclamation approaches
- Establishment of undesirable plant species that would comprise the establishment and growth of desirable plant species identified for postmining land uses or would adversely affect existing plant communities

3.3.2.1 Proposed Action

Implementation of the Proposed Action would result in the disturbance and the loss of native soil profiles and related productivity on approximately 4,295 acres of previously undisturbed land.

Existing disturbance within the Proposed Action area currently encompasses 2,783 acres. Most of the soils are coarse-textured and rocky, and several are affected by saline and/or alkaline conditions (see Section 3.3.1). Implementation of the project's Reclamation Plan would mitigate the loss of native soils and create productive postmining land uses, primarily grazing and wildlife habitat. The Reclamation Plan is summarized in Chapter 2 (Section 2.4.21) and is

available for review at the BLM Battle Mountain Field Office. Given the success of the proposed reclamation practices, which have been implemented at the Copper Basin site located approximately 7 miles north of the proposed project, and the commitment to pursue additional evaluations during the project timeframe, the loss of native soil characteristics on project-area lands is not anticipated to result in a significant impact.

Site-specific and reconnaissance soil survey data (JBR 1999b; U.S. Soil Conservation Service 1992) are described in Section 3.3.1. Based on the collected data, approximately 3.6 million cubic yards of native soil materials would be suitable for salvage from the Proposed Action areas of disturbance for re-use in the reclamation program. In addition to the criteria described in Section 3.3.1, this estimate was derived using the following general growth media suitability criteria (***Table 3.3-5***), which have been applied elsewhere in the region (Zielinski 1999; Blank 2000).

These criteria are general guidelines that are principally based on regional growth media characteristics and plant adaptations, as opposed to divergent criteria from different climatic, ecologic, and geologic settings. The expertise and judgement of local resource specialists, including the evaluation of any nearby reclamation, is required on a site-by-site basis to finalize the actual salvage program for a particular project.

By further factoring in recovery limitations on steep, rocky slopes and material volume losses from handling, an estimated 2.7 million cubic yards of native soil materials would be suitable and recoverable for use in the reclamation program. This would yield a nominal 4.5-inch replacement depth on the additional acreage that would be disturbed under the Proposed Action, but would not provide sufficient material for reclaiming the existing disturbance. Native soil materials would be salvaged and used in the reclamation program when their characteristics are suitable for adapted plant growth, and they could be safely recovered (Brown and Caldwell 2000h). However, in order to implement the proposed Reclamation Plan and achieve acceptable postmining closure and reclamation, additional growth media materials must be used.

Other suitable capping material has been identified and characterized on the site (Exponent 2000a; Brown and Caldwell 2000d). Further characterization of the suitability of these materials for reclamation use, particularly regarding their erodibility, has been examined by Golder Associates Inc. (2000b). Approximately 50 to 60 million tons of capping material would be required to restore growth media on the proposed components and for placement of protective caps on the waste rock facilities (see Sections 2.4.18, Growth Media Management, and 2.4.21, Reclamation). As described in the project's Waste Rock Management Plan (Brown and Caldwell 2000d), approximately 38.5 million tons of this material would be required to cap the proposed waste rock facilities. Approximately 200 million tons of capping material has been identified on the site (Brown and Caldwell 2000d). These materials have been characterized as having a net neutralization potential equal to or greater than zero, and as not requiring neutralizing amendments to be useful for facility capping (Brown and Caldwell 2000d).

The successful use of capping material in the reclamation program would be dependent on its ability to support the establishment and long-term productivity of desirable revegetated plant species. Extensive physical and chemical characterization of these materials has been conducted (Exponent 2000a), and the logistical aspects of availability during operations has been examined (Brown and Caldwell 2000a). The physical and chemical characterization of these materials included evaluations of particle size, soil moisture content, and chemical stability.

The active surface zone within the protective cap would be the depth to which water movement would be influenced by evapotranspiration, which can vary from a few feet to tens of feet in depth (Exponent 2000a). Meteoric water (from rain and snow) that infiltrates the soil surface either moves downward by gravity or upward by surface evaporation and plant transpiration. Water not removed by evaporation or transpiration would move through the active surface zone and percolate into underlying waste rock materials (Exponent 2000a), potentially generating acid rock drainage (see Section 3.2, Water Resources and Geochemistry). Thus, the suitability of growth media also would be important to both postmining land use objectives and to the mechanics of site closure and water resources protection.

Particle size evaluations were conducted by Exponent (2000a) using sieve and hydrometer analyses. The results of the evaluations are presented in ***Table 3.3-6***.

Table 3.3-5
General Growth Media Suitability Criteria

Media/Site Characteristic	Suitable Range	Unsuitable Range	Limitation
K factor[1] x Slope (%)	< 8	> 8	Water erosion hazard
Water soluble boron (ppm)	< 5	> 5	Toxicity to some plants
Coarse fragments (%)	< 50	> 50	Coarse fragments, stoniness
PH	6.0 - 8.5	< 6.0, > 8.5	Acidity, alkalinity
Sodium adsorption ratio	< 12	> 12	Excess alkalinity
Electrical conductivity (millimhos/cm^2)	< 8	> 8	Excess salinity
Texture	Other than unsuitable	Fine sandy loam, silt loam, clay, silty clay, sandy clay, sands	Erodibility
Slope steepness	Equipment/method dependent	--	Recoverability
Color	--	Avoid atypical, strongly, mineralized colors	General chemical suitability for plant growth
Workability	--	Material should not "set up" after wetting	Infiltration, seeding suitability

Source: Zielinski 1999; Blank 2000.
[1]K factor = A number less than 1.0 that varies with specific soil characteristics, such as organic matter content, texture, structure, and permeability. It reflects the inherent nature of a soil material to erode by water. Higher values generally indicate higher susceptibility to water erosion.

Table 3.3-6
Project Area Particle Size Distributions

Material Type	Number of Samples	Cobbles (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
Waste rock	12	3	64	25	5	3
Hardpan/haul road	2	0	35	36	22	7
Reclaimed area	4	4	54	30	7	5
Native soil	4	5	53	18	14	10
Pit bench	2	0	67	24	7	2

Similar results to the waste rock values presented above, but with slightly higher silt and clay contents, were identified at Copper Basin and Copper Canyon by Golder Associates Inc. (2000b). It should be noted that these particle size distributions are based on a total weight basis, whereas most agriculturally-oriented distributions are based on a combination of weight percentages (totaling 100 percent for particles less than or equal to 2 millimeters diameter) and volume (additional percentage of larger particles). Nonetheless, since native soils were included and evaluated by consistent methods in the analysis, comparisons between materials can be made. The results indicate that the materials are generally similar, with substantial totals (approximately 85 to 90 percent) of cobble, gravel, and sand.

The native soil materials are somewhat finer, having less gravel and sand and greater silt and clay contents. These materials in general would provide greater nutrient and plant-available moisture supply to a revegetated cover than the coarser materials, but also would be somewhat more erodible on slopes. Data presented for reclaimed areas indicates that handling and traffic during recontouring and revegetation apparently decrease the overall particle sizes and provide additional proportions of silt and clay on surfaces derived from other growth media (Exponent 2000a; Golder Associates Inc. 2000b).

Soil moisture testing indicates that recontoured growth media from waste rock, alluvium, or other suitable sources would have soil moisture contents of approximately 15 to 20 percent at

representative field capacity tension (Exponent 2000a). Field testing on shallower rootzone materials from reclaimed sites indicated that gravimetric moisture contents generally were between 4.5 and 6.5 percent on the non-vegetated site during both the spring and the fall samplings. Vegetated sites had moisture contents generally between 2 to 6 percent in the spring and 2 to 4 percent in the fall. These soil moisture characteristics are typical of sands and sandy loam textures (Buckman and Brady 1969). On a general basis, somewhat more plant-available soil moisture capacity would be expected of the finer sandy loam to silt loam textures occurring in native soil materials on the site. However, the differences in plant-available soil moisture between the finer particle size fractions of the materials may be less important when the coarse fragment contents common to both the native soils and the supplemental growth media are considered. Substantial revegetation has been accomplished by BMG on similar materials at the Reona and Copper Basin sites nearby. The proposed use of suitable growth media would allow establishment and persistence of a revegetated plant community during years of average or greater precipitation. In successive drought years, all vegetation would suffer from lack of moisture availability on both revegetated and undisturbed sites in the area, but perennial herbaceous species would be impacted the most. The reclaimed sites may experience slightly greater drought stress, but the mixes of seeded species would encourage a varied community in response to these climatic conditions (i.e., woody plants would be favored).

Similar growth media materials and reclamation practices, as outlined in the project's Reclamation Plan, have been used at the Copper Basin site, approximately 7 miles north of the proposed project. The restored growth media at that site has been a reasonable replacement of the rocky, hillslope soils that naturally occur in the area, as demonstrated by the diverse and substantial revegetated cover that is currently present. Based on the results of the physical and chemical characterizations conducted on the proposed growth media for the Phoenix Project and the successful use of similar materials at Copper Basin, the capping material, in addition to salvaged topsoil as available, would support the establishment and long-term productivity of desirable, revegetated plant species at the site. As a result, it is anticipated that postmining productivity would be similar to premining levels. In addition, the availability of suitable growth media under the Proposed Action for placement of a 5-foot cap on the waste rock facilities may improve reclamation success over that which would be achieved under the No Action alternative (see Section 3.3.2.2).

The commitment to implement a weed control and monitoring plan, as discussed in Section 3.4, Vegetation, and the anticipated successful revegetation of the site utilizing the proposed growth media material would minimize the potential for undesirable plant species to become established at the site. As a result, the establishment and growth of desirable plant species identified for postmining land uses would not be compromised. In addition, existing plant communities at the site would not be adversely affected by the invasion of undesirable plant species as a result of the implementation of the project's weed control program.

Surficial erosional stability has been investigated for the proposed reclaimed topography, particularly the waste rock facilities, by Golder Associates Inc. (2000b). Field sampling and characterization was performed to identify erodibility characteristics for the proposed growth media and the occurrence of erosional features on existing reclaimed areas at Copper Basin. Using local meteorological inputs, the Revised Universal Soil Loss Equation was applied to the proposed reclaimed topography and materials to investigate potential rates of sheet and rill erosion following reclamation. Resulting predicted soil losses on the facilities were low, with an area-weighted average loss of 0.64 tons per acre per year during the early stages of revegetation. After revegetated plant communities have become established, estimated erosion losses dropped to approximately 0.2 tons per acre per year on an area-weighted average basis. Over the long-term, losses were anticipated to average approximately 0.5 tons per acre per year. The variation over time is caused by gradual material weathering and by changes in vegetation and micro-topography. No rilling or gullying was observed on existing reclaimed areas at Copper Basin, which has employed similar materials and configuration to those of the proposed project. Natural slopes in the project area generally range from 20 to 50 percent (5 horizontal:1 vertical to 2 horizontal:1 vertical), with steeper slopes being common. Recontoured slope breaks and drainage features, Best Management Practices to control runoff and sedimentation, concurrent reclamation, and postreclamation monitoring are part of the Proposed Action under the project's Reclamation

Plan (Brown and Caldwell 2000h) and Storm Water Pollution Prevention Plan (Brown and Caldwell 2000g). As a result of the committed measures in these plans, no acceleration of the existing natural erosion rates or impacts from surface erosion on the reclaimed features are anticipated under the Proposed Action. Therefore, potential erosion of reclaimed facilities would not be anticipated to exceed soil loss tolerances.

According to the Plan of Operations and Reclamation Plan, the steepness of proposed reclaimed slopes would range from 2 horizontal:1 vertical to 3 horizontal:1 vertical for waste rock facilities, and would be approximately 2.5 horizontal:1 vertical for the proposed tailings embankments. The flatter slopes (3 horizontal:1 vertical) and somewhat steeper slopes (up to 2.5 horizontal:1 vertical) are generally recognized as desirable or feasible slopes for successful revegetation of disturbed lands in Nevada and elsewhere. However, 2 horizontal:1 vertical slopes, particularly when they consist of coarse-textured materials in arid environments, are generally recognized to pose difficulties for revegetation due to droughty conditions, restricted equipment access for seeding, and effects on seedling establishment. The proposed range of reclaimed slopes thus creates the potential for impacts to successful revegetation and the re-establishment of grazing and wildlife postmining land uses.

Review of the proposed postmining topography indicates that the extent of waste rock facility slopes steeper than 2.5 horizontal:1 vertical is limited to isolated areas in the northern part of the project area (see Section 2.4.21.5). Additional constructed slopes during the operations phase may be steeper as well, but would be recontoured to flatter grades during reclamation activities. Reclaimed slopes address a number of objectives, one of them being to recreate past topography and/or to blend visually with the surrounding environment. Steep, rocky debris slopes occur in the project locale and elsewhere throughout the Basin and Range Province. Furthermore, allowing small areas of steeper topography may enhance reclamation success if larger, flatter surrounding areas can be created as a result. Therefore, eliminating all slopes steeper than 2.5 horizontal:1 vertical may not be feasible or desirable. However, since the potential exists for steep slopes to create impacts to successful revegetation and restoration of productive land uses, additional mitigation is recommended.

Prior to the initiation of reclamation on the heap leach facility, event pond, and tailings facility, draindown and closure procedures would be implemented as discussed in Section 2.4.21, Reclamation. These procedures would aid in the stabilization of these facilities. In addition, geotechnical stability analyses have been performed to ensure the mass stability of recontoured heap leach facilities, waste rock facilities, and tailings embankments as discussed in Section 3.1, Geology and Minerals. Based on the committed procedures and the conducted studies, these reclaimed facilities are not anticipated to compromise public safety following mine closure.

As discussed in Section 2.4.21, Reclamation, concurrent reclamation would be conducted at the waste rock facilities and growth media storage facilities, as site conditions and the mine plan allow. In addition, the downslope face of the tailings embankments, diversion channel and road berms, and any construction-related disturbances that would not be redisturbed during operations would be reclaimed during the active mining phase. The commitment to conduct concurrent reclamation would prevent unnecessary resource degradation during the active mining and processing period. Specific to soils, this would mean a reduction in potential wind and water erosion on the growth media stockpiles, tailings embankments, portions of the waste rock facilities, and miscellaneous ancillary facilities described above. In addition, concurrent reclamation and the commitment to conduct an ongoing assessment of the revegetation practices would prevent delays in determining appropriate postmining reclamation approaches.

Ecological Risk

Whole-rock and meteoric water mobility testing for chemical constituents have been conducted and reviewed for potential growth media sources in the proposed project area (Exponent 2000a). Whole rock analyses are not typically used for agricultural (i.e., reclamation) suitability evaluations, and the sources of comparative soils data are likely to be unrepresentative.

The Meteoric Water Mobility Procedure (MWMP) analyses, which are based on water-soluble constituent concentrations, indicate that elevated levels of arsenic, cadmium, copper, fluoride, nickel, and selenium could occur in oxide waste rock effluent in comparison to State of Nevada

surface water standards for irrigation or livestock watering uses, as shown in ***Table 3.3-7***.

The backfilled and capped waste rock facilities are not predicted to have standing water and should therefore be considered terrestrial environments for the purpose of an assessment of ecological risk. Since the MWMP evaluates water-soluble components, it is not truly representative of a potential exposure source in this particular situation. Nevertheless, the results of the comparison to State of Nevada surface water standards for irrigation and livestock watering uses can be used as a tool for selecting chemicals of potential concern for additional evaluation.

To evaluate, on a screening-level basis, the potential risk to terrestrial organisms that may be exposed to materials in the waste rock facility caps, waste rock metals concentrations were compared to published soils criteria and benchmarks. It is likely that the Phoenix Project waste rock facility caps would be similar to metals concentrations in waste rock. The Waste Rock Management Plan (Brown and Caldwell 2000d) specifies that capping material to be used for reclamation of project facilities would be selected using a criterion of net neutralization potential greater than zero. Exponent (2000a) identified 13 representative whole rock samples (**Table 3.3-8**) that met this criterion from the total of 82 whole rock samples of waste rock.

In ***Table 3.3-8***, the results of the whole rock analyses have been compared to the metals values presented in the "Risk Management Criteria for Metals at BLM Mining Sites" (BLM 1996c, 1999b). The whole rock concentrations presented in ***Table 3.3-8*** represent conservative estimates of the concentrations in the projected capping material since they are 95 percent confidence limits rather than means. In addition, for these constituents below the analytical detection limit, the actual detection limit was used in the calculations (rather than one-half the detection limit). These BLM criteria have been developed to assess the potential risk to selected species that may forage in areas where elevated concentrations of metals may occur (i.e., at mining sites or other naturally occurring non-mined, mineralized areas).

Based on this comparison of capping material metals concentrations to the BLM risk management criteria, the concentrations of metals that could be present in the facility caps would present little risk to most terrestrial mammals that are likely to occur in the area. However, the capping material metals concentrations do meet or exceed the BLM criteria for the American robin. This is primarily because the robin, like some other species, feeds on soil invertebrates (e.g., earthworms) that live directly in the soil and thus present a food-chain exposure route. In addition, the capping material copper concentration is greater than the criteria for bighorn sheep, mule deer, and domestic sheep. However, in all of these cases, the capping material copper concentration was less than twice the risk management criteria, indicating a low risk to these species.

To further examine the potential for adverse effects to organisms, an additional evaluation was completed by comparing the capping material concentrations to other published criteria. Five additional sets of criteria were evaluated, one for wildlife, three for soil invertebrate organisms, and one for plants.

Sample et al. (1996) provides an extensive list of toxicological benchmarks for wildlife that often are used in risk assessments. These benchmarks are based primarily on laboratory toxicity studies in which standard test organisms are exposed to inorganic and organic chemicals via water or food. Sample et al. (1996) converts consumption benchmarks (mg/kg/day) to food and water concentration (mg/kg and mg/L, respectively) benchmarks. For this comparison, it was assumed that target organisms would receive only food from the study area (facility caps). The No Observed Adverse Effects Level (NOAEL)-based food consumption benchmarks from Sample et al. (1996) were converted to soil concentrations by dividing the benchmarks by the soil-plant uptake factors (for arsenic, cadmium, copper, lead, mercury, and zinc) presented in the BLM risk management criteria document (1996) or the soil-to-plant bioconcentration factors (for nickel and selenium) presented in U.S. EPA (1999). The results are presented in ***Table 3.3-9***.

In this evaluation, the capping material arsenic concentration exceeds the white-footed mouse and whitetail deer benchmarks by a small amount, and the capping material arsenic concentration is over three times the benchmark for the cottontail rabbit. The zinc concentration is several times higher than the benchmark for the robin. These comparisons suggest that the risk to these species is moderate based on the BLM risk management criteria (BLM 1999b). Once again, this is probably related to the potential exposure route via food items in the soil.

Table 3.3-7
Oxide Meteoric Water Mobility Analyses versus Nevada State Irrigation and Livestock Surface Water Standards

Constituent	Irrigation Standard (mg/l)	Percent Exceeding Irrigation Standard	Range of Reported Values Exceeding Irrigation Standards (mg/l)	Livestock Watering Standard (mg/l)	Percent Exceeding Livestock Watering Standard	Range of Reported Values Exceeding Livestock Watering Standards (mg/l)
Arsenic	0.10	18	0.107 - 1.79	0.20	6	1.35 - 1.79
Cadmium	0.01	6	0.0191 - 1.25	0.05	3	1.25
Copper	0.20	6	1.2 - 15.1	0.50	6	1.2 - 15.1
Fluoride	1.00	9	1.0 - 2.3	2.00	6	2.0 - 2.3
Nickel	0.20	6	0.45 - 1.04	--	--	--
Selenium	0.02	9	0.046 - 0.079	0.05	3	0.079

Table 3.3-8
Comparison of Capping Material Metals Concentrations with BLM Wildlife and Livestock Risk Management Criteria (mg/kg)

Capping Material Whole Rock Analysis	Arsenic	Cadmium[1]	Copper[2]	Lead[2]	Mercury[3]	Zinc
	148	3	130	90	1	190
Species						
Deer Mouse	230	7	640	142	2	419
Cottontail	438	6	358	172	15	373
Bighorn Sheep	387	9	64	152	6	369
Mule Deer	200	3	102	106	9	222
Elk	328	3	131	127	11	275
Cattle	419	15	413	244	45	1082
Sheep	352	12	86	203	38	545
Robin	4	0.3	7	6	1	43

Source: BLM 1999b.
[1]Nine of 13 samples were less than the detection limit.
[2]Two of 13 samples were less than the detection limit.
[3]All of the samples were less than the detection limit.

Table 3.3.9
Comparison of Capping Material Metals Concentrations with NOAEL-Based Soil-Concentration Benchmarks (mg/kg)[1]

Capping Material Whole Rock Analysis	Arsenic	Cadmium	Copper	Lead	Mercury	Nickel	Selenium	Zinc
	148	3	130	90	1	23	3	190
Species								
White-Footed Mouse	147	89	24,575	11,487	84	16,153	162	9,846
Cottontail	42	26	7,075	3,308	24	4,651	47	2,835
Whitetail Deer	104	63	17,325	8,098	59	11,387	114	6,941
American Robin	717	8	486	104	2	2,002	26	57

[1]Soil-concentration benchmarks were derived from food-consumption benchmarks reported in Sample et al. 1996.
[2]Mercury values are based upon inorganic mercury.

Potential risk to soil organisms was evaluated by comparing the waste rock metals concentrations to available soil screening benchmarks from two sources: Will and Suter (1995) and U.S. EPA (Draft 2000). Those results are presented in ***Table 3.3-10***. Also included in this table are the plant soil screening levels for arsenic, cadmium, and zinc.

In this evaluation, the capping material concentrations of arsenic, copper, and zinc exceed one or more of the benchmarks. The mercury concentration exceeds the earthworm benchmark, but since the mercury concentration is based entirely on nondetectable values, this is not considered an indication of risk. Both the copper and arsenic concentrations exceed all of the screening-level benchmarks for plants and invertebrates.

There is a degree of uncertainty that is incorporated into the development and application of any of these criteria. Therefore, exceedence of a criterion or benchmark does not necessarily constitute a risk to the target, or other, organisms. All of the criteria and benchmarks used here are intentionally conservative in order to provide confidence that contaminants do not present an unacceptable risk. For example, in calculating both the BLM wildlife and livestock criteria and the wildlife benchmarks it was assumed that 100 percent of the animals' food would be coming from the area in question, in this case, the waste rock caps. In reality, animals (except, perhaps the mouse) range over a larger area, and much of their food is likely to be obtained from areas where the soil metals concentrations are substantially lower.

Based on these preliminary screening evaluations, it appears that there could be a risk to soil invertebrates and subsequently to those organisms that consume those invertebrates (e.g., the robin). The metal that consistently exceeded the risk criteria was arsenic and, to a lesser degree, copper and zinc. Once again, however, the conservative assumptions are likely to result in a substantial over-estimation of risk. Although all soils will harbor at least some invertebrate organisms, arid western soils tend to contain less than organically-rich soils from areas of higher rainfall. The range of the robin extends throughout the United States, including southwestern states. However, the robin, and similar birds that feed on insects and other invertebrates, are likely to be found in more hospitable habitats where food is more abundant.

In addition to animals, there may be a risk to plants. The whole rock arsenic concentration was over four times the soil screening level-benchmark. An indication that the arsenic concentration in the capping material may cause adverse effects to plant growth is also suggested in other studies (Sheppard 1992). It is possible, therefore, that some sensitive plants may have difficulty becoming established on the capping material.

In conclusion, based on these evaluations and given the conservative nature of the available soil screening criteria, the risk to wildlife and livestock utilizing forage growing on the reclaimed soils, and even soil invertebrates, is low to moderate. The concentration of some metals, especially arsenic, in the waste rock used as capping material may be high enough to adversely affect plant growth, thus limiting vegetation cover and available forage.

3.3.2.2 No Action Alternative

The reclamation and erosion control programs for the No Action alternative are generally similar to those of the Proposed Action, being largely a result of existing approved state and federal permits and associated monitoring programs. Under the No Action alternative, the operation would continue to operate under the existing, approved plans and permits. With respect to soils and reclamation, this would include the Storm Water Pollution Prevention Plan for the Battle Mountain Gold Complex (Brown and Caldwell 1997b) and Reclamation Plan for the Battle Mountain Gold Complex (BMG and WESTEC 1993) and closure assessments and plans. These approved programs address site stabilization, recontouring and revegetation, storm water and drainage management, public safety, control of erosion and sedimentation, avoidance of unnecessary and undue environmental degradation, and restoration of productive postmining land uses in accordance with applicable regulations and permit requirements.

The potential impacts related to soils and reclamation considerations would be similar in type to those described for the Proposed Action, but would vary in degree and extent. Approximately 45 acres of additional disturbance (permitted Midas Pit) beyond the existing condition would occur under the No Action alternative (***Table 2-1***). Site recontouring, drainage, and erosion control would be similar to that described for the Proposed Action. Growth media restoration

Table 3.3-10
Comparison of Capping Material Metals Concentrations with Screening-level Benchmarks for Soil Invertebrates and Plants (mg/kg dry weight)

Constituent	Capping Material Whole Rock Analysis	U.S. EPA (2000)		Will and Suter (1995)	
		Soil Invertebrates	Plants	Earthworms	Soil Microorganisms
Arsenic	148	NA	37	60	100
Cadmium	3	110	29	20	20
Copper	130	61	NA	50	100
Nickel	23	NA	NA	200	90
Selenium	3	NA	NA	70	100
Lead	90	NA	NA	500	900
Mercury	1	NA	NA	0.1	30
Zinc	190	120	190	200	100

NA = Screening-level benchmarks are not available.

would utilize available salvaged materials in existing stockpiles in addition to benign or oxide waste rock materials. An approximately 1-foot cover of these materials would be used for waste rock facilities, which would then be revegetated; however, there is some question of availability of sufficient suitable growth media to achieve a 1-foot cover based on the Reclamation Plan for the Battle Mountain Gold Complex (BMG and WESTEC 1993). As stated in that report, ongoing investigations to further characterize the site would be used to develop component-specific final closure and reclamation plans.

Accelerated erosion and sedimentation are not likely to generate impacts under the No Action alternative for reasons similar to those described previously for the Proposed Action. Revegetation efforts and storm water and drainage controls approved in existing permits would mitigate potential impacts from erosional runoff and loss of soil productivity. The potential for plant uptake and bioaccumulation of dissolved metals under the No Action alternative is considered similar to the Proposed Action (see Section 3.3.2.1).

3.3.3 Cumulative Impacts

Under the Proposed Action, the cumulative effects area for soils includes the Copper Canyon grazing allotment area (***Figure 3.3-2***). The proposed project would disturb approximately 4,295 additional acres, adding to the considerable mining disturbance that has already occurred in the area in association with past mining operations. From a soils and reclamation standpoint, however, this additional disturbance is not anticipated to create additional adverse impacts. Over time, growth media salvage and re-use, recontouring, erosion and drainage controls, and revegetation practices are anticipated to restore similar or improved postmining land use conditions on the disturbed areas in comparison to existing conditions. It is possible that elevated levels of some metals in the Phoenix Project capping material may inhibit the growth of sensitive plants. However, more tolerant plants should contribute to successful revegetation in the cumulative effects area.

3.3.4 Monitoring and Mitigation

S-1: Fencing. BMG would leave the project perimeter fencing intact to facilitate proper pasture management within the allotment and thereby protect the integrity of the waste rock caps. This fencing is recommended to control the potential loss of perennial vegetation on reclaimed areas, particularly on waste rock facilities and pit backfills, where the amount and type of vegetation is integral to managing the potential for acid rock drainage. Such mitigation would consist of long-term fencing and maintenance in coordination with the BLM, such that grazing and pasture rotation scheduling could be managed to avoid adverse grazing impacts on the reclaimed areas. Additional internal fencing may be used to subdivide the reclaimed areas to provide productive postmining land uses while maintaining the quality and water balance function of reclaimed surfaces. If found to be appropriate, fencing maintenance ***would*** gradually be decreased as desirable plant community succession occurs on the revegetated areas, and they can be incorporated into the overall BLM range management program for the grazing allotment.

Long-term perimeter fence physical maintenance would be the responsibility of the permittee and/or private landowner. Fiscal responsibility for fence maintenance ***would*** be addressed by project bonding. Long-term management oversight of the pasture defined by the perimeter fence as well as fence maintenance oversight would be the responsibility of the BLM on public lands and the landowner on private lands.

S-2: Grazing Management Plan. In association with S-1, BMG would ***coordinate with the grazing permittee(s), BLM, and NDOW to*** develop a grazing/land management plan over the short-term (prior to final revegetation bond release). This plan would address development of any desired subpastures, private land versus public land issues, waste rock cap integrity, and fire breaks among other issues for the area internal to the perimeter fence. The potential need for fire breaks relates to the need to attempt protection, over the long-term, of revegetated areas from conversion to annual grasslands as a result of wildfire. The grazing management plan would account for both livestock and wildlife grazing at proper intensities, livestock watering sources and salting program, responsibility for physical fence maintenance, fiscal responsibility for fence maintenance, and responsibility for overall management and/or incorporation into the BLM's future allotment management plans.

S-3: Steep Slopes. The number and extent of waste rock and backfill slopes steeper than 2.5 horizontal:1 vertical would be limited in the postmining topography wherever possible given land ownership and other constraints. In the northern part of the proposed project area (north of the center of Section 34, Township 31 North, Range 43 East), waste rock and backfill slopes steeper than 2.5 horizontal:1 vertical would be allowed but their extent would be minimized. The occurrence of these slopes steeper than 2.5 horizontal:1 vertical in the postmining topography would be limited to those areas where:

- A small transition area is needed to maintain visual appearance consistent with adjacent topography of similar steepness.

- The presence of small, isolated steeper slopes allows the creation of larger flat surrounding areas so that overall revegetation and land use objectives are more likely to be successful.

S-4. Waste Rock Capping Material. The Waste Rock Management Plan (Brown and Caldwell 2000d) specifies that potentially acid generating material in waste rock facilities would be capped with 5 feet of waste rock material having a net neutralization potential of greater than zero. Available data suggest that some of the material that could be used as capping material contains metals concentrations that could adversely affect plant growth or could pose a risk to some terrestrial organisms. To further evaluate and mitigate these potential impacts, the following measures would be implemented:

1) BMG would conduct a geochemical characterization of waste rock to characterize trace metals, sulfide sulfur concentrations, and net neutralization potential of the capping material.

2) BMG would evaluate the potential short-term, and long-term effects to plant species to be used for reclamation ***in the pilot test plot studies conducted during concurrent reclamation (see Section 2.1.21.4).*** This ***would*** include an evaluation of metals concentrations in cap materials and vegetation; effects to plant species at analogous reclaimed sites (e.g., Copper Basin, Copper Canyon, or other Nevada mining sites with similar metals concentrations); evaluation of the sensitivity of the reclamation species to the anticipated metals concentrations; and monitoring of plant growth (as stated in mitigation measure V-1, Section 3.4.4).

3) BMG would conduct a site-specific ecological risk assessment during the revegetation test plot studies (see Section 2.4.21.4) to determine the potential risk to species that occupy the project area (i.e., wildlife and livestock).

Ecological risk assessment is "a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors" (USEPA 1992). In this case, the stressors under consideration are the metals that may be mobilized as a result of the mining operations and are present in the cap material. The screening-level risk assessment concluded that some metals may be present in high enough concentrations to cause adverse effects to some animals and also to some plants, which could adversely affect revegetation efforts. Since risk assessment is an iterative process, these preliminary data

suggest the need for a more targeted, site-specific risk assessment.

A site-specific risk assessment would determine whether: 1) a stressor has the ability to cause adverse effects and 2) ecological units (e.g., communities, populations, organisms) are in contact with the stressor for sufficient time and at a sufficient level to cause harm. If either of these two factors does not occur, then there is no risk.

The site-specific ecological risk assessment would be conducted in three broad phases: 1) problem formulation, 2) analysis, and 3) risk characterization.

- ***Problem Formulation: Preliminary characterization of exposure and effects; evaluation of the available scientific data; definition of objectives; and identification of data needs.***

- ***Analysis: Characterization of exposure and ecological effects. Includes determination of spatial and temporal distribution of stressors and co-occurrence with the ecological unit, and identification and quantification of adverse effects. Effects are typically defined as toxicity.***

- ***Risk Characterization: Uses the results of the exposure and effects characterization to determine the likelihood of adverse effects.***

For the Phoenix Project, site-specific data would be collected during the revegetation test plot studies, including rock/soil and tissue metals concentrations, for use in the site-specific risk assessment. In addition to the collection of data on chemical concentrations, the site-specific risk assessment would consider appropriate organisms to be selected as target receptors (during the Problem Formulation phase) that would most likely be exposed to chemicals of concern. The selection of target receptor organisms may consider not only which organisms are abundant in the study area, but also endangered/threatened species and species of economic importance, i.e., livestock. Given this potential pathway, risk to humans may also require assessment.

If ecological risk is indicated during the evaluation of the test plot data, then the data would be evaluated to determine the source of risk and what mitigation measures are necessary to eliminate it or reduce it to acceptable levels.

4) If the above evaluations determine that there is a risk to either plant or wildlife species, BMG would modify the Waste Rock Management Plan to include specific measures (such as selective handling of waste rock to exclude cap materials with elevated metal concentrations, modification of the reclamation seed mix to exclude sensitive plant species, and/or recapping areas with elevated metals concentrations) to minimize these risks.

All evaluations performed as part of ***items*** 1, 2, or 3 listed above, and ***the associated mitigation identified in item 4 above***, would be submitted to the BLM for approval.

3.3.5 Residual Adverse Effects

No residual adverse effects to soil resources are anticipated with implementation of recommended monitoring and mitigation measures.

3.4 Vegetation

3.4.1 Affected Environment

3.4.1.1 Plant Communities/Associations

Eight upland plant communities/associations were identified in the original study area (***Figure 3.4-1***), including 1) Black Sagebrush-Mountain Sagebrush/Grassland, 2) Mountain Sagebrush/ Grassland, 3) Shadscale – Budsage/Grassland, 4) Big Sagebrush-Rubber Rabbitbrush/Grassland, 5) Mixed Brush, 6) Low Sagebrush/Grassland, 7) Black Greasewood/Shadscale, and 8) Disturbed Areas (WESTEC 1995a,d,f; SRK 1999c). All of these communities are typical of Great Basin communities of northern Nevada. The moist bottomland communities typically delineated as wetlands or riparian areas are described in Section 3.4.1.2, Jurisdictional Delineations. A brief description of these eight upland communities and their floristic and habitat-related attributes is included in the subsections below. Additional information and data specific to these plant communities are provided in the various vegetation studies that have been completed for the proposed project (WESTEC 1995a,f, 1996; SRK 1999c).

The locations of these eight plant communities are shown in ***Figure 3.4-1***, while the acreages and other relevant vegetation data associated with these communities are presented in ***Table 3.4-1***. ***Table B-1*** in Appendix B presents a summary of cover, composition, production, and carrying capacity by plant community, as well as the weighted average of these parameters for the project area as a whole.

Black Sagebrush - Mountain Sagebrush/ Grassland

This plant community is the third most extensive in the project area occupying 2,302 acres (or 21.9 percent of the area) and is typically found at the upper elevations between 5,000 and 7,500 feet amsl (***Table 3.4-1***). It is largely located in the northern half of the project area and is found on all slopes, aspects, and topographic positions. As indicated in ***Figure 3.4-1***, the Black Sagebrush - Mountain Sagebrush/Grassland type often intergrades with the Mountain Sagebrush/ Grassland community.

The community is dominated by reasonably dense stands of black sagebrush (*Artemisia nova*) and mountain big sagebrush (*Artemisia tridentata* ssp *vaseyana*). Other shrubs in the overstory include rubber rabbitbrush (*Chrysothamnus nauseosus*), green rabbitbrush (*Chrysothamnus viscidiflorus*), Great Basin buckwheat (*Eriogonum microthecum*), matted buckwheat (*Eriogonum caespitosum*), and sulfur buckwheat (*Eriogonum umbellatum*). The sparse understory exhibits a few grass species, including bluebunch wheatgrass (*Pseudoroegneria spicata*), bottlebrush squirreltail (*Elymus elymoides*), cheatgrass (*Bromus tectorum*), Sandberg's bluegrass (*Poa sandbergii*), Thurber's needlegrass (*Stipa thurberiana*), and a variety of forbs (WESTEC 1995a). Shrubs vastly dominate the vegetation ground cover of this community. Rock cover is relatively high, and bare ground exposure is moderately high.

Mountain Sagebrush/Grassland

This plant community is fourth in areal extent within the project area occupying 965 acres (or 9.2 percent of the area) and is typically found at the upper elevations between 5,000 and 6,500 feet amsl (***Table 3.4-1***). It is entirely located in the northern half of the project area primarily on north- and west-facing aspects and along most slopes. As indicated in ***Figure 3.4-1***, the Mountain Sagebrush/Grassland type often intergrades with the Black Sagebrush - Mountain Sagebrush/ Grassland community.

This community is dominated by dense stands of mountain big sagebrush. Other shrubs in the overstory include rubber rabbitbrush, green rabbitbrush, and sulfur buckwheat. The sparse understory exhibits few grass species (bottlebrush squirreltail and cheatgrass) and few forbs (WESTEC 1995a). Shrubs nearly dominate the vegetation ground cover in the community while litter cover is high. Rock cover is moderately low, and bare ground exposure is reasonably low.

Shadscale - Budsage/Grassland

This plant community is the most extensive in the project area occupying 3,980 acres (or 37.9 percent of the area) and is typically found at the middle elevations between 4,500 and 5,700 feet amsl (***Table 3.4-1***). It is largely located in the central portion of the project area along more gentle slopes and southerly aspects. As indicated in ***Figure 3.4-1***, the Shadscale - Budsage/ Grassland type is a transitional community separating the upper sagebrush communities from the bottomland greasewood type.

Table 3.4-1
Plant Community Data

Plant Community	Elevational Range (feet amsl)	Vegetation Study Area		Percent Composition		
		Acreage	Percent	Grasses	Forbs	Shrubs
Black Sagebrush -Mountain Sagebrush/ Grassland	5,000-7,500	2,302	21.9	4.2	5.6	90.2
Mountain Sagebrush/ Grassland	5,000-6,500	965	9.2	0.0	0.6	99.4
Shadscale Budsage/Grassland	4,500-5,700	3,980	37.9	0.0	6.2	93.8
Big Sagebrush - Rubber Rabbitbrush/ Grassland	4,500-6,500	0	0.0	0.0	0.0	100.0
Mixed Brush	5,000-6,500	35	0.3	0.0	0.0	100.0
Low Sagebrush/Grassland	>6,500	4	0.04	0.0	19.1	80.9
Black Greasewood/ Shadscale	<4,700	424	4.0	0.0	0.0	100.0
Disturbed Area	4,500-6,500	2,783	26.5	6.7	49.7	43.5
Total	NA	10,493	100.00	NA	NA	NA

NA – Not Applicable.

The Shadscale - Budsage/Grassland community is dominated by moderately dense stands of shadscale (*Atriplex confertifolia*) and budsage (*Artemisia spinescens*). The sparse understory exhibits few grass species, including bottlebrush squirreltail, cheatgrass, Sandberg's bluegrass, pine bluegrass (*Poa scabrella*), and a few forbs, especially desert globemallow (*Sphaeralcea grossulariafolia*), clasping peppergrass (*Lepidium perfoliatum*), shy gilia (*Gilia inconspicua*), annual stickseed (*Lappula redowski*), and evening primrose (*Oenothera caespitosa*) (WESTEC (1995a and 1996). Shrubs vastly dominate the vegetation ground cover of the community while litter cover is average. Rock cover is moderate, and bare ground exposure is the highest of the natural communities.

Big Sagebrush - Rubber Rabbitbrush/ Grassland

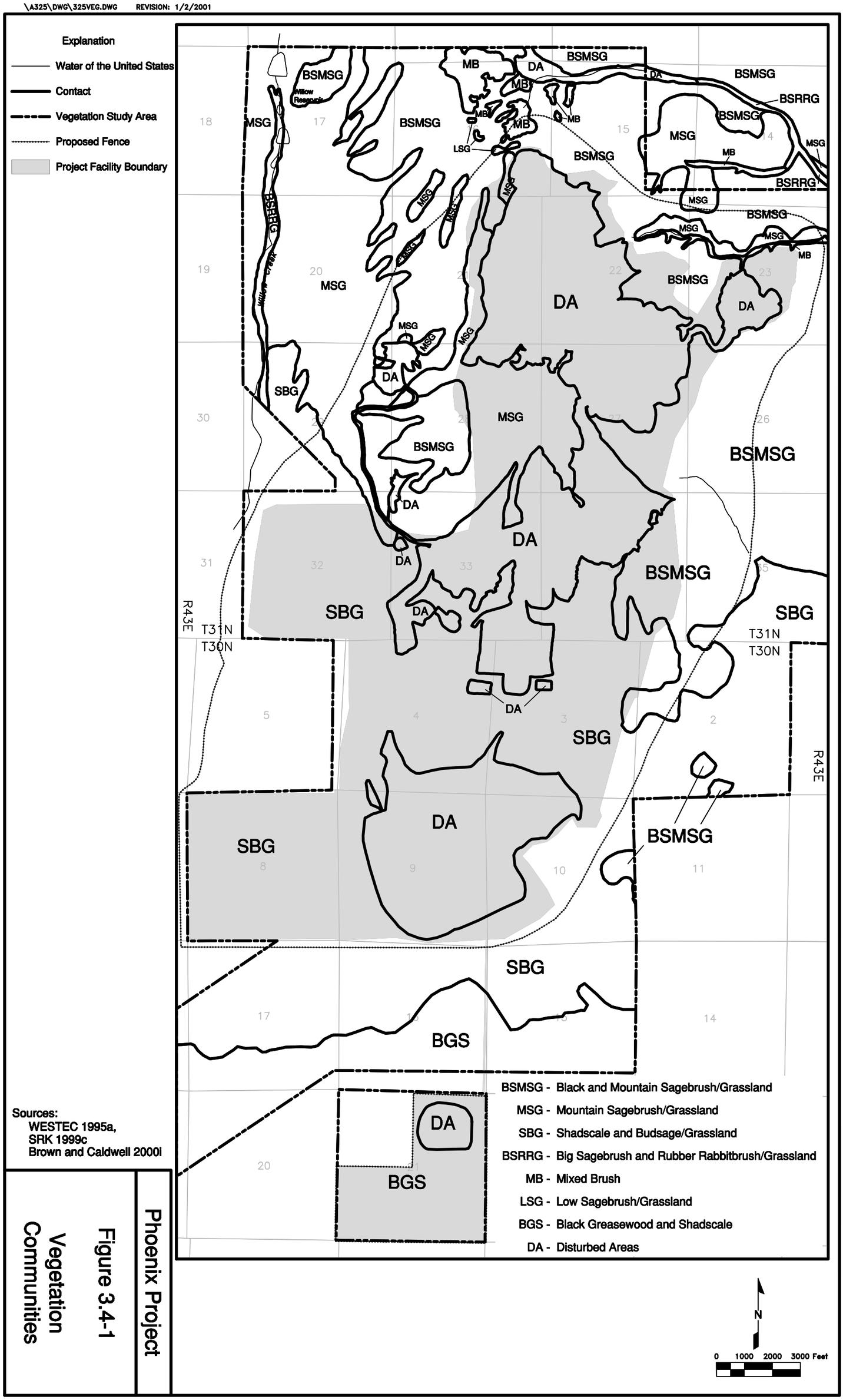
This plant community occurs immediately outside of the perimeter fence (project boundary); therefore, it will not be directly disturbed or influenced under the Proposed Action. This community is found at middle to upper elevations between 4,500 and 6,500 feet amsl (***Table 3.4-1***). It is located in only two drainage bottoms (both intermittent) in the project area (Willow Creek and Galena Canyon); therefore, as indicated in ***Figure 3.4-1***, it is typically adjacent to the upper Mountain Sagebrush communities. The Big Sagebrush - Rubber Rabbitbrush/Grassland type occurs in these valley bottoms because of the deep loamy soils and the more mesic conditions afforded by these topographic positions.

The Big Sagebrush - Rubber Rabbitbrush/Grassland community is dominated by dense stands of Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and rubber rabbitbrush. Other shrubs in the overstory include black greasewood (*Sarcobatus vermiculatus*) and green rabbitbrush. The sparse understory is composed mainly of weedy grasses and forbs, including cheatgrass, povertyweed (*Iva axillaris*), clasping peppergrass, tansy mustard (*Descurania pinnata*), and desert alyssum (*Alyssum desertorum*) (WESTEC 1995a and 1996). An occasional Great Basin wildrye (*Elymus cinereus*) plant can be observed, but this native species has substantially declined from expected levels probably because of past grazing pressure. Shrubs dominate the vegetation ground cover of the community, and litter cover is the highest. Rock cover is minimal, and bare ground exposure is moderately high.

Mixed Brush

This plant community is the third least extensive in the project area occupying 35 acres (or 0.3 percent of the area) and is found at two principal locations ranging in elevation from 5,000 to 6,500 feet amsl (***Table 3.4-1***). These locations are Iron Canyon in the northeast corner of the project area and the headwaters of Duck Creek in the north-central portion of the project area. The Mixed Brush community generally occurs on north-facing aspects in association with the Black Sagebrush - Mountain Sagebrush/Grassland community.

The Mixed Brush community is dominated by dense stands of Basin big sagebrush, desert peach (*Prunus andersonii*), and bitterbrush (*Purshia tridentata*). Other shrubs in the overstory



Sources:
WESTEC 1995a,
SRK 1999c
Brown and Caldwell 2000i

Phoenix Project

Figure 3.4-1
Vegetation Communities

include rubber rabbitbrush. The sparse understory is composed mainly of cheatgrass, Sandberg's bluegrass, tansy mustard, and annual stickseed (WESTEC 1995a). Shrubs dominate the vegetation ground cover of the community, and litter is relatively high. Rock cover is minimal, and bare ground exposure is moderate.

Low Sagebrush/Grassland

This plant community is the least extensive within the project area occupying only 4 acres (or 0.04 percent of the area) and occurs above 6,500 feet amsl (***Table 3.4-1***). It occupies three small pockets located in the north-central portion of the project area on northeast-facing slopes in association with the Black Sagebrush - Mountain Sagebrush/ Grassland community (***Figure 3.4-1***).

The Low Sagebrush/Grassland community is dominated by stands of low sagebrush (*Artemisia arbuscula*). Other shrubs in the overstory include rubber rabbitbrush, matted buckwheat, and sulfur buckwheat. The understory is composed mainly of Sandberg's bluegrass, bottlebrush squirreltail, rayless daisy (*Stenotus acaulis*), desert parsley (*Cymopterus ibapensis*), bitteroot (*Lewisia rediviva*), Hood's phlox (*Phlox hoodii*), and long-leaf phlox (*Phlox longifolia*) (WESTEC 1995a). Shrubs dominate the vegetation ground cover of the community, and litter is nearly absent. Rock cover is very substantial, and bare ground exposure is low.

Black Greasewood/Shadscale

This plant community is fifth in areal extent in the project area occupying 424 acres (or 4.0 percent of the area) and is typically found at elevations below 4,700 feet amsl (***Table 3.4-1***). It is located entirely in the southernmost portion of the project area along the gentle south-facing slopes and flat playa bottoms. As indicated in ***Figure 3.4-1***, the Black Greasewood/Shadscale type adjoins the Shadscale - Budsage/Grassland community along a broad ecotone.

The Black Greasewood/Shadscale community is dominated almost equally by moderate stands of black greasewood, shadscale, and Torrey seablite (*Suaeda moquinii)*. Other shrubs in the overstory include Wyoming big sagebrush (*Artemisia tridentata* ssp *wyomingensis*), budsage, and spiny horsebrush (*Tetradymia canescens*). The sparse understory exhibits few herbaceous species, including cheatgrass, bottlebrush squirreltail, tansy mustard, and shy gilia (WESTEC 1995a and 1996). Shrubs dominate the vegetation ground cover of the community while litter cover is moderately high. Rock cover is non-existent, and bare ground exposure is quite high.

Disturbed Areas

This last designation is composed of all previously disturbed areas of which only a small portion have revegetated, either naturally or by reclamation; substantially revegetated portions are estimated to comprise approximately 10 percent of the area due to the area's current status as an active mine. Historic wildfires have contributed to the acreage designated as disturbed (WESTEC 1995a and 1996). Overall, this designation is second in areal extent occupying 2,783 acres (or 26.5 percent of the project area) and is found at elevations between 4,500 and 6,500 feet amsl (***Table 3.4-1***).

The sampled portion of the disturbed area involved seeded areas that are dominated by both native and introduced, early successional species. The overstory is dominated by rubber rabbitbrush. The only other shrub detected in the overstory was black sagebrush. The understory, however, exhibits a substantial number of species with shy gilia and knotweed (*Polygonum aviculare*) dominating. Other herbaceous species detected in the understory include crested wheatgrass (*Agropyron cristatum*), cheatgrass, bottlebrush squirreltail, tansy mustard, Lilliput lupine (*Lupinus unicialis*), white-stem blazing star (*Mentzelia albicaulis*), Pursh's milkvetch (*Astragalus purshii*), Snake River cryptantha (*Cryptantha spiculifera*), false phlox (*Phlox gracilis*), and Douglas pincushion (*Chaenactis douglasii*) (WESTEC 1995a and 1996). Shrubs and forbs share vegetation ground cover dominance while litter exhibits a modest ground cover. Rock cover is moderate, and bare ground exposure is the highest of all eight communities.

3.4.1.2 Jurisdictional Delineations (Wetlands/Waters of the United States)

A survey by Gibson & Skordal Wetland Consultants (1996) resulted in the delineation of jurisdictional wetlands and waters of the United States within and near the project area. Such jurisdictional delineations were performed in accordance with Section 404 of the Clean Water Act as administered by the U.S. Army Corps of Engineers. In this region of Nevada, these areas are typically found in association with larger springs and seeps or the moist bottoms of valleys and canyons. Administratively, these habitats can

be considered as a ninth plant community (wetlands/riparian areas).

On January 9, 2001, the U.S. Supreme Court issued a decision in Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, No. 99-1178 (Jan. 9, 2001). That decision invalidated part of the regulatory definition of "waters of the United States" as used by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency, and relied upon in the 1996 survey by Gibson & Skordal (1996) [citing 33 C.F.R § 328.3(a)(3)]. In light of the Court's decision, it is likely that some of the jurisdictional wetlands and waters of the United States identified in the 1996 survey would no longer be jurisdictional.

Jurisdictional wetlands and waters of the United States were detected in three watersheds: 1) Willow Creek, 2) Philadelphia Canyon, and 3) Galena Canyon (***Figure 3.4-1***). A previous survey by Gibson & Skordal Wetland Consultants (1993) examined the Copper Canyon watershed, which was determined to be an isolated watershed from the Reese River and Buffalo Valley drainages. The delineations have been accepted under the Clean Water Act by the U.S. Army Corps of Engineers ***(U.S. Army Corps of Engineers 2000).***

Willow Creek occurs along the far western border of the project area for a distance of approximately 2.5 miles (Gibson & Skordal Wetland Consultants 1996), and the jurisdictional channel averages 8 feet in width. Flows within the channel appeared to be perennial, resulting from several seeps and springs located above the project area high in the watershed. Several seeps and springs and a perimeter zone around a reservoir along Willow Creek (in Section 17) were noted to support wetlands. Dominant hydrophytic species in these wetland areas include Baltic rush (*Juncus balticus*), tufted hairgrass (*Deschampsia caespitosa*), fowl bluegrass (*Poa palustris*), and rabbitsfoot grass (*Polypogon monspeliensis*) (Gibson & Skordal Wetland Consultants 1996). Along the banks of the creek, yellow willow (*Salix lutea*) and coyote willow (*Salix exigua*) often were evident.

Philadelphia Canyon occurs in the southeastern portion of the project area and supports a narrow band of jurisdictional wetlands (approximately 10 feet wide) for a distance of approximately 800 feet (Gibson & Skordal Wetland Consultants 1996). These wetlands are sustained by seeps within or immediately adjacent to the channel and are dominated by cattail (*Typha angustifolia*) and rabbitsfoot grass. Below these wetlands, the jurisdictional channel extends for an additional 1,400 feet and averages 3 feet in width.

Galena Canyon and its subdrainages occur within the northeastern portion of the project area and beyond. Only a very small segment of the mainstem of Galena Canyon occurs within the project area in the northeastern-most corner. However, three of Galena Canyon's subdrainages in the project area contain jurisdictional wetlands and/or waters of the United States: Iron Canyon, Butte Canyon, and Duck Canyon. The portion of the mainstem of Galena Canyon in the project area averages 8 feet in width and extends for approximately 2,300 feet. Iron Canyon contains a narrow band of wetlands (5 to 10 feet wide that occur intermittently for approximately 2,000 feet) along the upper east fork of the drainage. Extensive, historic modifications have altered the drainage. Where wetlands exist, they are dominated by rabbitsfoot grass, Baltic rush, and Great Basin wildrye. With regard to Butte Canyon, only a short segment of channel occurs within the project area. This channel segment contains no wetlands, averages 4 feet in width, and extends for approximately 500 feet before leaving the project area. Finally, Duck Canyon, which exists in the northern-most portion of the project area, contains no areas of wetlands, but does contain a narrow jurisdictional channel. Gibson & Skordal Wetland Consultants (1996) did not provide a width for this channel; therefore, a width of 4 feet was assumed based on proximity and similarity to Butte Canyon. Based on jurisdictional mapping, the portion of the channel within the project area appears to be approximately 6,000 feet long.

From a habitat perspective, the scattered riparian areas along these jurisdictional delineations (usually in association with springs and seeps) support yellow and coyote willow as the dominant species. In somewhat drier locations, chokecherry (*Prunus virginiana*), Wood's rose (*Rosa woodsii*), and western serviceberry (*Amelanchier alnifolia*) tend to dominate drainage bottoms. On occasion, individual or small pockets of Fremont cottonwood (*Populus fremontii*) also are present. Where wetland conditions are supported by seeps and/or springs, an understory of hydrophytic vegetation is usually present. Dominant species in these areas include rabbitsfoot grass, yellow monkey flower (*Mimulus guttatus*), Baltic rush, spikerush (*Eleocharis* sp.), tufted hairgrass, fowl bluegrass, and sedges (*Carex* spp.). Where flowing water is

present for extended periods, aquatic species, such as watercress (*Rorippa* sp.) and American speedwell (*Veronica americana*), are common (Gibson & Skordal Wetland Consultants 1996).

3.4.1.3 Special Status Plant Species

Federal databases and those of the Nevada Natural Heritage Program indicate that no federally threatened or endangered plants potentially occur on or near the project area (WESTEC 1995d; SRK 1999a). Similarly, no plants proposed for listing, currently designated as candidates for listing, or BLM sensitive species potentially occur in or near the project area. In addition, no potentially suitable habitat exists for these species in the project area. Two former C2 candidate plants were identified as potentially occurring within the project area by the U.S. Fish and Wildlife Service. These species, which at present are no longer classified as candidates, are Eastwood's milkweed (*Aesclepias eastwoodiana*) and wind-loving buckwheat (*Eriogonum anemophilum*).

Because these species were still on the candidate list when work on this EIS began, surveys were implemented in late May 1995 and mid-November 1998. The results of those surveys were negative for both species. However, a population of approximately 100 individuals of a former C3 candidate, doublet (*Dimersia howellii*), was identified on a hilltop in the north-central portion of the ***survey*** area. Because this plant has been found to be more abundant and widespread than previously believed, it is no longer considered a candidate for listing by the U.S. Fish and Wildlife Service; this species does not fall under any other federal or state agency management program that would require special consideration under the National Environmental Policy Act. ***Furthermore, the population would not be affected by the proposed project as it is located approximately 0.25 mile outside the project perimeter fence.***

Additional detail regarding the timing and location of sensitive plant surveys, findings, and other related information is presented in the WESTEC (1995d) and SRK (1999a) vegetation reports.

Another category of special status plant species includes those that have an ethnobotanical relevance to Native American cultures that historically occurred in the vicinity of the proposed project. Based on the review of a list of plants exhibiting such relevance (Desert Research Institute 1979), at least 57 species from the area were used by Native Americans (***Table 3.4-2***). Uses included food or food supplements (16 species), fiber (1 species), gum (2 species), soap (1 species), medicinal (42 species), dye (4 species), tea (2 species), and ceremonial ("magic") (1 species).

3.4.1.4 Noxious Weeds and Invasive Species

A noxious weed survey was conducted within and adjacent to the project area (total of 9,000 acres) during late June and July 1999 as part of BMG's noxious weed inventory and risk assessment (Environmental Management Associates 1999c). A total of 6 noxious weed species were observed and mapped from 30 locations within this area. Observed species included 1) salt cedar (*Tamarix* spp.), 2) Scotch thistle (*Onopordum acanthium*), 3) Canada thistle (*Cirsium arvense*), 4) musk thistle (*Carduus nutans*), 5) hoary cress (*Cardaria draba*), and 6) Russian knapweed (*Centaurea repens*). An additional 13 species were noted that are not listed noxious weeds, but are often considered undesirable by rangeland managers (e.g., cheatgrass). These species were identified by Environmental Management Associates (1999c).

Salt cedar was noted at 21 of the 30 mapped locations and accounted for approximately 3 acres (excluding a sizable population located on the tailings facility). Typically, these were isolated plants or small groups of plants including those that had historically been planted as ornamentals at three former home sites. Musk thistle and Russian knapweed only were found at single locations of less than 0.01 acre each. Canada thistle was found at three sites, and was widely scattered at two others, for a total of 1 acre of occupied area. Hoary cress was observed at four locations and accounted for approximately 11 acres of occupied area. Scotch thistle was observed scattered along the access and haul road in Philadelphia Canyon for a total of 0.5 acre.

According to Environmental Management Associates (1999c), these six noxious weeds are "Class B" weeds as indicated by the Management Emphasis Priorities ranking system. Salt cedar, hoary cress, and Russian knapweed were classified as high risk, whereas the other three were given a risk assignment of moderate. This rating process is consistent with the BLM Manual 9015 – Integrated Weed Management (1992). The presence of Class B weeds requires that management measures for control be developed and implemented along with a monitoring system.

Table 3.4-2
Ethnobotanical Use by Native American Cultures of Plants Observed within the Project Area

Scientific Name	Common Name	Included In BMG's Seed Mixes	Native American Use of Plants
Achnatherum hymenoides	indian ricegrass	X	seeds eaten
Amelanchier alnifolia	Serviceberry		fruit eaten
Amsickia tessellata	Fiddleneck		seeds eaten
Arenaria spp.	Sandwort		medicinal
Artemisia spp.	Sagebrush		medicinal
Artemisia arbuscula	low sagebrush		medicinal
Artemisia spinescens	bud sagebrush		medicinal
Artemisia tridentata	Basin sagebrush	X	medicinal, dye
Asclepias spp.	Milkweed		fiber
Asclepias fascicularis	Mexican milkweed		medicinal
Aster scopulorum	dwarf aster		medicinal
Astragalus spp.	milk vetch		seeds as seasoning
Atriplex confertifolia	Shadscale	X	seeds eaten
Balsamorhiza sagittata	Arrowleaf balsamroot	X	seeds and leaves eaten, medicinal, ceremonial
Calochortus spp.	Mariposa lily		bulbs eaten
Castilleja spp.	indian paintbrush		magical
Caulanthus crassicaulis	Thickstem wild cabbage		medicinal
Chaenactis douglasii	Douglas chaenactis		medicinal
Chaenactis stevioides	brides bouquet		medicinal
Chrysothamnus nauseosus	rubber rabbitbrush	X	medicinal, dye
Chrysothamnus viscidiflorus	low rabbitbrush	X	chewing gum, medicinal
Claytonia (Montia) perfoliata	miner's lettuce		eaten, medicinal
Crepis acuminata	Tapertip hawksbeard		medicinal
Crepis modocensis	Modoc hawksbeard		medicinal
Elymus elymoides	Squirreltail	X	seeds eaten
Ephedra nevedensis	Mormon tea		tea, medicinal
Erigeron aphanactis	brass buttons		medicinal
Eriogonum microthecum	wild buckwheat		medicinal
Eriogonum ovalifolium	Butterballs		medicinal
Eriogonum umbellatum	Sulphur flower		medicinal
Gutierrezia sarothrae	Snakeweed		medicinal, dye
Iva axillaris	Povertyweed		medicinal
Juniperus osteosperma	Utah juniper		medicinal
Krascheninnikovia lanata	Winterfat	X	medicinal, tea, soap
Leptodactylon pungens	prickly phlox		medicinal
Lewisia rediviva	Bitterroot		eaten, medicinal
Lupinus spp.	Lupine	X	medicinal
Mentzelia albicaulis	whitestem blazing star		seeds eaten, medicinal
Mentzelia laevicaulis	blazing star		seeds eaten
Oenothera caespitosa	alkali lily		medicinal
Penstemon deustus	scabland penstemon		medicinal
Phlox longifolia	longleaf phlox		medicinal

Table 3.4-2 (Continued)

Scientific Name	Common Name	In BMG's Seed Mixes	Native American Use of Plants
Phoenicaulis cheiranthoides	dagger-pod		medicinal
Poa scabrella	pine bluegrass		seeds eaten
Potentilla spp.	Cinquefoil		medicinal, dye
Prunus andersonii	desert peach		medicinal
Purshia tridentata	antelope bitterbrush		medicinal, magic
Ranunculus aquatilis	hairleaf water buttercup		eaten
Ribes cereum	wax currant		berries eaten, ceremonial
Rosa woodsii	Woods rose		medicinal
Salix exigua	coyote willow		medicinal
Sarcobatus vermiculatus	Greasewood		medicinal
Senecio spp.	Groundsel		chewing gum
Stanleya pinnata	yellow prince's plume		eaten, medicinal
Tetradymia canescens	gray horsebrush		medicinal
Tetradymia glabrata	cedar brush		combs
Zigadenus venenosus	death camas		medicinal

Source: McGonagle 1979.

Although not a formally listed noxious weed, cheatgrass is one of the most problematic undesirable plant species in the West, especially northern Nevada. It is extremely difficult and/or expensive to control through conventional means. It is found almost ubiquitously across the BLM Battle Mountain District at levels ranging from 1 to 15 percent ground cover in association with perennial vegetation. In lower elevational areas where fire has occurred, it can be found with other annual species at ground cover values exceeding 30 percent and sometimes as high as 50 percent. Because of its nearly ubiquitous distribution in the general vicinity of the project, cheatgrass is readily observable within the project area at levels averaging between 2 and 10 percent ground cover. Areas exhibiting reduced perennial vegetation exhibit the higher levels of cheatgrass, whereas in those areas exhibiting a more robust stand of perennials, cheatgrass levels are more subdued. These levels of cheatgrass fluctuate given the amount, timing, and duration of precipitation in any given year.

3.4.2 Environmental Consequences

The primary issues associated with vegetation resources include 1) potential impacts to sensitive species; 2) the ability of the revegetation program to establish perennial vegetation suitable to protect soil surfaces from excessive erosion, provide suitable forage for livestock and wildlife, and preclude persistent populations of noxious weeds; and 3) potential impacts to unique plant communities.

Impacts to vegetation resources would be significant if the Proposed Action or No Action alternative result in one or more of the following:

- Impacts to special status species, including direct or indirect disturbance of federally threatened or endangered plant species or their critical habitat, or disturbance of federal candidate or BLM sensitive species in a manner and a degree that would contribute to their being listed as either federally threatened or endangered
- Removal or loss through dewatering of unique plant communities, such as natural wetlands or riparian habitats
- Establishment of persistent populations of noxious weeds dominating anywhere within the project area
- Failure of reclamation efforts to achieve a stable, perennial vegetation cover that protects disturbed soil surfaces against erosion
- Establishment of plant communities on the reclaimed areas that fail to meet the

reclamation objective of providing suitable forage for livestock and wildlife

- ***Establishment of plants (that would receive significant livestock and/or wildlife use as forage) containing elevated concentrations of metals and/or other trace elements above background levels, resulting in unacceptable risk to those herbivores.***

3.4.2.1 Proposed Action

Plant Communities/Associations

Six of the areas eight plant communities and/or associations were identified in the Proposed Action area, including approximately 2,709 acres of previously disturbed areas (historic and currently permitted disturbances). Approximately 74 acres of disturbance (Sunshine Pit and facilities and the Independence Mine) exist between the Proposed Action footprint and the perimeter fence. None of these eight communities are considered important, unique, or valuable with regard to area resources, as they represent some of the most common vegetation types in northern Nevada. Approximately 40 percent of the disturbance associated with the Proposed Action would occur on previously disturbed areas, and therefore, would result in no new impact to plant communities. Under the Proposed Action, five plant communities (Black Sagebrush-Mountain Sagebrush/Grassland, Mountain Sagebrush/ Grassland, Shadscale - Budsage/Grassland, Mixed Brush, and Black Greasewood/Shadscale) would be directly affected (short-term removal) resulting in a total of 4,364 acres of new disturbance. Two communities (Big Sagebrush – Rubber Rabbitbrush/ Grassland and Low Sagebrush/ Grassland) would remain undisturbed. Disturbance acreages are presented in ***Table 3.4-3***.

As indicated in ***Table 3.4-3***, approximately 40 percent of the impact would occur within the Shadscale-Budsage/Grassland community. A large portion of this disturbance would be associated with the Natomas Waste Rock Facility, Tailings Area #2, and the South Optional Use Area. The distribution of remaining disturbances attributed to the Proposed Action is identified in **Table 3.4-3**.

The proposed reclamation and revegetation program has the potential to mitigate the aforementioned impacts. In this regard, a total of 6,497 acres (or 92 percent of the disturbed area) would eventually be revegetated. Only the 576 acres of pit highwalls would remain unrevegetated due to human safety considerations.

Revegetation activities would be conducted in accordance with the project's Reclamation Plan as outlined in Section 2.4.21.4, Revegetation Guidelines. These procedures also would involve a process of annual monitoring and appropriate modifications of revegetation guidelines in accordance with site-specific findings to maximize the potential for revegetation success. Site-specific success criteria and a program for success evaluation are identified in BMG's Reclamation Plan. Given the documented successes with similar reclamation practices at BMG's adjacent Copper Basin property, it is anticipated that reclamation efforts would be able to achieve a stable, perennial vegetation cover that would 1) protect disturbed soils from erosion, and 2) meet the reclamation objectives of providing suitable forage for livestock and wildlife habitat. As a result, impacts to vegetation would not be considered significant.

There exists a potential in the long-term for unabated wildfire to facilitate conversion of reclaimed areas from domination by perennial species to domination by annuals. Given such an event, there would be an increased potential for significant impacts at several points. First, and foremost, the integrity and/or function of the waste rock caps may be compromised, thereby resulting in an increased potential for acid rock drainage. Second, the potential for a noxious weed infestation would be substantially elevated. Third, soil surfaces would not be as adequately protected from erosion. Fourth, the reclamation objective of providing suitable forage for wildlife and livestock would no longer be applicable. Although preclusion of wildfire cannot be guaranteed, there are management measures that can reduce the potential for conversion of perennial grasses and shrublands to annual grasslands.

In addition to the direct impacts to vegetation resources noted above, an indirect effect of the Proposed Action would result from the construction of additional perimeter fencing to ***discourage*** livestock and human trespass during project operations. In effect, those portions of fenced plant communities that are not disturbed by the Proposed Action would be protected from grazing impacts during the life of the mine. Over this period, slow recovery of these areas would occur.

Table 3.4-3
Acreage Effects by Plant Community

Plant Community	Proposed Action		No Action Alternative	
	Disturbance (acres)	Percent of Total	Disturbance[2] (acres)	Percent of Total
BSMSG	746	10.6	0	0
MSG	448	6.3	0	0
SBG	2,770	39.2	40	1
BSRRG	0	0.0	0	0
MB	2	0.03	0	0
LSG	0	0.0	0	0
BGS	398	5.6	0	0
D	2,709	38.3	2,783	99
Total acres or percent of disturbance	7,073	100	2,823	100

[1]BSMSG = Black Sagebrush-Mountain Sagebrush/Grassland
MSG =Mountain Sagebrush/Grassland
SBG = Shadscale-Budsage/Grassland
BSRRG = Big Sagebrush-Rubber Rabbitbrush/Grassland
MB = Mixed Brush
LSG = Low Sagebrush/Grassland
BGS = Black Greasewood/Shadscale
D = Disturbed Area
[2]Disturbance acreages for the No Action alternative are currently permitted.

As indicated in Section 3.3, Soils and Reclamation, there is a potential for elevated levels of some constituents in the capping material to be used for reclamation. These elevated concentrations could cause adverse effects to plant growth and soil invertebrates.

Jurisdictional Delineations (Wetlands/Waters of the United States)

Wetlands and riparian areas within the project area are important to area biotic resources because of the presence of surface water for extended periods. There are no jurisdictional wetlands within the proposed areas of disturbance; however, examination of the effect of predicted ground water drawdown for the Proposed Action (Section 3.2, Water Resources and Geochemistry) indicates that ten springs and seeps, nine of which exhibit small associated spring-related vegetation, would potentially be affected by the project (***Table 3.4-4***). Furthermore, according to ***Figure 3.2-12***, about 1 mile of lower Willow Creek that has been identified as a gaining reach potentially would be affected by ground water drawdown. Because it is a gaining reach, it exhibits a small strip of associated riparian vegetation along the banks. Cumulative losses would likely total less than 1 acre of this community type. However, if these areas of spring-related vegetation should be lost as a result of dewatering activities, it would result in a significant impact. Impacts to these communities would be mitigated in accordance with water resources mitigation measure***s WR-1, WR-2, and WR-3*** (see Section 3.2.4).

There are no areas designated as waters of the United States within the proposed area of direct disturbance. Ground water drawdown would have little or no effect on most designated waters of the United States or any associated riparian vegetation within the project area, as they are classified as “losing” reaches. (Losing reaches are supplied by runoff and surface flows in response to meteoric events.) “Gaining” reaches (those that receive some flow from ground water sources), such as the portion of Willow Creek discussed above, could be affected by ground water drawdown. These potential impacts could comprise a narrowing or shortening of the jurisdictional reaches.

Special Status Plant Species

No adverse effects to federally threatened or endangered plant species, species proposed for listing, federal candidate species, or BLM sensitive species would occur as a result of the implementation of the Proposed Action, based on

Table 3.4-4
Potential Spring-related Wetland Areas that May be Affected by Dewatering (Proposed Action) (Based on Table 3.2-14)

EIS Reference No.	JBR (1996d and 1996g) Reference No.	Location	Wetland Status
23	31-43-14-142	Galena Canyon	Small Area of Spring-related Vegetation
25	31-43-24-21	Galena Canyon	Pool and Small Area of Spring-related Vegetation
26	31-43-3-34	Cow Canyon	Small Area of Spring-related Vegetation
27	31-43-3-323	Cow Canyon	Small Area of Spring-related Vegetation Below Seep
29	31-43-11-31	Duck Creek Canyon	Small Area of Spring-related Vegetation
32	31-43-15-12	Duck Creek Canyon	Small Area of Spring-related Vegetation
33	31-43-15-122	Duck Creek Canyon	Small Area of Spring-related Vegetation
37	31-43-15-43	Butte Canyon	No Areas of Spring-related Vegetation
45	31-43-27-44	Philadelphia Canyon	Small Area of Spring-related Vegetation
52	31-43-4-33	East of Willow Creek	Small Area of Spring-related Vegetation

the lack of occurrence of designated critical habitat within the project area.

Direct impacts to some of the 57 identified plant species having an ethnobotanical relevance to Native Americans would occur as a result of project implementation; however, quantification of this impact is not possible. As indicated in ***Table 2-8***, the proposed revegetation seed mixes would include nine species with ethnobotanical relevance; therefore, some revegetation of these plant species may occur following implementation of the Reclamation Plan.

Noxious Weeds and Invasive Species

Six species of designated noxious weeds have been identified within and adjacent to the project area, three of which are classified as high risk species. As a result, there exists potential for a problematic infestation. However, given the procedures outlined in the project's Reclamation Plan and the documented success with similar procedures in Copper Basin, the probability for a problematic infestation would be substantially reduced. Further reduction of the potential for a problematic infestation would occur with the implementation of the project's noxious weed monitoring and control program (Environmental Management Associates 1999c). However, for full effectiveness, such a plan would have to be coordinated and integrated with adjacent landowners and the BLM. According to Environmental Management Associates (1999c), all six identified noxious weeds could be controlled through application of herbicides given careful adherence to species-specific regimens. Based on the committed reclamation and noxious weed programs, the potential for the establishment of persistent and dominant populations of noxious weeds on reclaimed disturbance areas would not be considered significant. However, the undesirable species cheatgrass cannot be readily controlled. It is highly probable that cheatgrass would invade reclaimed areas and establish levels up to, but typically not exceeding, those levels observable in undisturbed areas throughout the BLM Battle Mountain District. It has been commonly observed that in areas of reclamation where perennial plant dominance is strong, cheatgrass levels are typically reduced. However, if such an area is subjected to wildfire or overgrazed for a period of years and the dominant

perennial vegetation is eliminated, a cheatgrass infestation could be problematic.

3.4.2.2 No Action Alternative

Impacts associated with vegetation disturbance, special status plant species, and noxious weeds would be similar to those discussed for the Proposed Action with the following exception. As indicated in ***Table 3.4-3***, 2,783 acres (99 percent) of the 2,823 acres permitted for disturbance under the No Action alternative have previously been disturbed by mining, as authorized under the Reona Project and other approvals. The remaining 40 acres (1 percent) is associated with the final permitted size of the Midas Pit. If mining were to be reinitiated under the No Action alternative, a direct impact (removal) to 40 acres of Shadscale and Budsage/Grassland would occur.

3.4.3 Cumulative Impacts

The cumulative effects area for vegetation extends from the Phoenix Project north to Interstate 80, east to State Highway 305, west to the Buffalo Valley Road that runs north/south (the main road closest to the Battle Mountain range), and south to include the clay borrow area. Besides the Battle Mountain Complex, two other past, present, or reasonably foreseeable future projects occur within the vegetation cumulative effects area, including the Trenton Canyon Mine and the Marigold Mine. Because no adverse impacts to sensitive plant species have been identified for the Phoenix Project, cumulative impacts would not increase over the levels already documented for the Trenton Canyon and Marigold projects. Cumulative effects to waters of the United States and/or riparian areas would be limited to 2.02 acres for the Trenton Canyon Project, 1.3 acres for the Marigold Project, and less than 0.1 acre of potential impact due to ground water drawdown for the Phoenix Project. Impacts to wetlands are not anticipated for all three projects, and cumulative effects to spring-related vegetation would be limited to approximately 0.1 acre at the Phoenix Project.

The potential for noxious weed and cheatgrass infestations grows proportionately with disturbed acreage. However, based on BMG's success with the proposed reclamation techniques at Copper Basin and the committed noxious weed control plan, and the noxious weed control plans for the Trenton Canyon and Marigold projects, no incremental increase in cumulative impacts from noxious weeds or cheatgrass would be anticipated.

Development of the Phoenix Project would incrementally increase cumulative impacts to vegetation resources in the cumulative effects area. The cumulative effects area comprises an area of approximately 140,000 acres dominated by sagebrush and salt desert scrub communities. Past and present disturbance at the Phoenix project totals 2,783 acres composed primarily of Black Sagebrush – Mountain Sagebrush/ Grassland, Mountain Sagebrush/Grassland, and Shadscale - Budsage/Grassland communities. Although the exact acreages of past disturbance to these three communities cannot be determined, it can be estimated based on surrounding distributions. In this regard, these three communities occupied about 35 percent, 20 percent, and 40 percent of the past disturbance area, respectively. The remaining 5 percent was composed of the four minor communities described in Section 3.4.1.

The Trenton Canyon Mine is currently permitted for a total of 2,683 acres of mine disturbance and an additional 955 acres of exploration disturbance or 2.6 percent of the cumulative effects area. The vast majority of this acreage is composed of the Wyoming Big Sagebrush community. The Marigold Mine is currently permitted for 1,349 acres with a proposed expansion of up to an additional 717 acres for a combined total of 1.5 percent of the cumulative effects area. The vast majority of this acreage is composed of Wyoming Big Sagebrush and Salt Desert Shrub communities.

Development of the proposed Phoenix Project would incrementally increase the disturbance area by 4,290 acres, or 3 percent of the cumulative effects area. The breakdown of disturbance acreage by plant community is provided on ***Table 3.4-3***. However, as discussed above the majority of these acreages, including those for the Trenton Canyon and Marigold mines, would be revegetated postmining. Although revegetated communities would be somewhat different than adjacent native types, over the long-term revegetated areas would develop similar community structure and overlapping species composition with the adjacent native communities as a result of natural successional processes (assuming proper postmining management). It is possible that elevated levels of some metals in the Phoenix Project capping material may inhibit growth of sensitive plants. However, more tolerant

plants should contribute to successful revegetation in the cumulative effects area. Cumulative impacts to vegetation are not anticipated to be significant.

3.4.4 Monitoring and Mitigation Measures

BMG has committed to reclamation and revegetation of the project area (see Section 2.4.21). Associated with this commitment is an annual monitoring program designed to ensure successful revegetation efforts at the proposed Phoenix Project (Section 2.4.21.4). Adherence to these commitments should preclude long-term adverse effects to vegetation resources.

Measures to mitigate the potential impacts to spring-related vegetation associated with seeps and springs along lower Willow Creek, which could be affected by ground water drawdown, are provided in Section 3.2.4, Monitoring and Mitigation Measures (Water Resources and Geochemistry).

Mitigation measures designed to facilitate successful reclamation and revegetation are addressed in Section 3.3.4, Monitoring and Mitigation Measures (Soils and Reclamation). As discussed in mitigation measure S-4 (Section 3.3.4), use of an additional criterion in the selection of capping material (sulfides less than 1 percent) should result in lower metals concentrations. It is likely that plants and soil microorganisms/ invertebrates found in the area would be tolerant of elevated metals levels and would not exhibit significant adverse effects.

V-1: Revegetation Monitoring. Because the growth media materials for both the Proposed Action and the No Action alternative may contain chemical constituents that could affect forage quality, revegetation on existing reclaimed sites would be monitored for chemical uptake and accumulation of selected elements. Such monitoring on disturbed areas would be accompanied by similar activities on nearby undisturbed lands to create a basis for comparison with native vegetation resources. Further investigations, particularly involving a review of research and existing data, would be conducted to gain further insight to the potential for plant uptake and accumulation of chemical constituents and their effect on plant success and on wildlife and livestock in comparison to undisturbed areas in the immediate region.

Postmining annual monitoring efforts (see Section 2.4.21.16) would include an evaluation of the plant tissue of revegetation species to ***determine if*** metals are bioaccumulating in revegetated plants.

If monitoring of plant tissue during initial concurrent reclamation and for a period of 5 to 10 years indicates that plant uptake could result in adverse impacts to wildlife or livestock, a plan would be developed by BMG and submitted to BLM and NDOW for approval to minimize potential impacts associated with accumulated metals. Possible mitigation measures to be considered, if necessary, include selective handling of growth media to further exclude certain material that contains elevated metals concentrations, or modification of the reclamation seed mixture to exclude species that are particularly susceptible to metals uptake and accumulation.

3.4.5 Residual Adverse Effects

Following successful revegetation, residual adverse effects to vegetation resources would be limited to those areas (e.g., the pits) that would not be reclaimed and revegetated. Some beneficial effects could result from changes in species composition of the reclaimed communities. Plant community composition changes typical of revegetated areas would be considered beneficial as the early to mid-seral types that result from reclamation typically exhibit greater carrying capacity for herbivores, both domestic and wild. More detailed discussion of this topic is provided in Section 3.6.5 for Range Resources.

3.5 Wildlife and Fisheries Resources

3.5.1 Affected Environment

The project area consists of approximately 7,073 acres (see ***Figure 3.5-1***) of disturbance that would encompass existing and proposed components of BMG's proposed Phoenix Project. Wildlife surveys addressed a much larger study area consisting of 18,400 acres that encompassed the entire project area and additional surrounding acreage. The cumulative effects area extends north from the project area to Interstate 80, east to State Highway 305, west to Buffalo Valley Road that runs north/south (the main road closest to the Battle Mountain Range, and south to the Buffalo Valley Road that runs east/west and includes the clay borrow area.

Information regarding wildlife species and current habitat conditions within the project area and the larger cumulative effects area (Section 3.5.3) was obtained from a review of existing published sources, BLM and NDOW file information, the Nevada Natural Heritage Program database, and site-specific field surveys by WESTEC (1995b,c) and SRK (1999a,b).

Wildlife species and habitats occurring in the project area are typical of the northern Great Basin desert region. Habitats within the project area are dominated primarily by sagebrush, shadscale, greasewood, and grassland communities. In addition, small areas of wetland/riparian communities are supported along some of the drainage bottoms and in areas where seeps or springs have surface expression (see Sections 3.2, Water Resources and Geochemistry; and Section 3.4, Vegetation). Perennial ponds, springs, and stream flow provide a valuable water source to wildlife yearlong, while ephemeral seeps and springs provide water on a seasonal basis.

Perennial aquatic habitat within or near the project area is limited primarily to Willow Creek, Willow Creek reservoirs, and small ponds along Galena Canyon, as well as the pond that has developed in the Fortitude Pit. Willow Creek is the only drainage that supports perennial flow near the project area***. The*** Willow Creek reservoirs ***and Willow Creek itself above and below the reservoirs*** are the only aquatic habitats that support any fisheries near the project area.

3.5.1.1 Mule Deer

The project area is located within NDOW's mule deer Management Area 15, Unit 151, and the BLM's Shoshone-Eureka Resource Management Area. Existing information indicates that a small herd of mule deer is supported in the Battle Mountain range (WESTEC 1995b,c). NDOW mule deer surveys in Management Area 15 since the 1970s have documented no more than 85 individuals except for a winter herd count of 182 in 1986 (WESTEC 1995b,c).

According to the Resource Management Plan (BLM 1983), mule deer move seasonally between the higher elevation summer range and the lower yearlong and winter ranges, usually within the same mountain range. The extreme northern portion of the project area is classified as yearlong habitat, and the remainder of the project area lies within designated winter range except for the southern third that is outside of any occupied mule deer range (***Figure 3.5-1***). The most extensive habitats within or near the project area potentially used by wintering mule deer are represented by the Black Sagebrush - Mountain Sagebrush/ Grassland and Mountain Sagebrush/Grassland plant communities (see Section 3.4).

No summer or fawning habitat has been documented by NDOW within the project area (WESTEC 1995b). During the summer months, mule deer tend to occupy higher elevations habitats than those found within the project area. Summer range is considered limiting for the mule deer population in the Battle Mountain range (Lamp 1998). No migration routes exist within the project area, but some individuals may migrate within the southern end of Rocky Canyon (WESTEC 1995b).

Aerial surveys for mule deer and other species were conducted in December 1994 and the spring of 1995. The December 1994 survey focused primarily on the project area while the spring 1995 surveys covered the entire cumulative effects area. The December 1994 survey located a total of 24 deer (5 separate groups) within or near the project area (WESTEC 1995b) (see ***Figure 3.5-1***). Most groups were observed on steep, rocky slopes below 6,200 feet in elevation, suggesting that they were either residing on or moving to winter range at the time of the survey (WESTEC 1995b).

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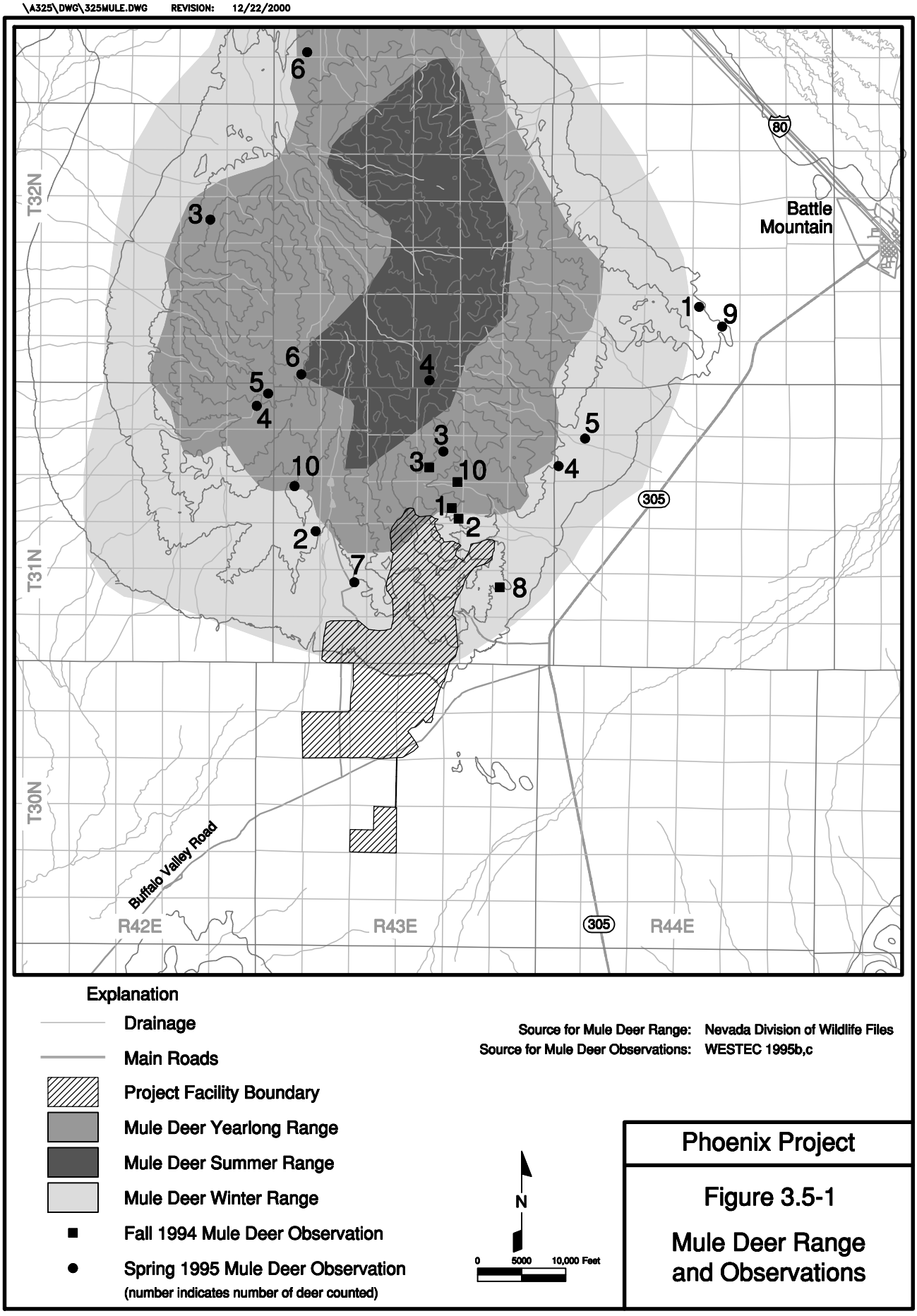

Explanation

- Drainage
- Main Roads
- Project Facility Boundary
- Mule Deer Yearlong Range
- Mule Deer Summer Range
- Mule Deer Winter Range
- ■ Fall 1994 Mule Deer Observation
- ● Spring 1995 Mule Deer Observation (number indicates number of deer counted)

Source for Mule Deer Range: Nevada Division of Wildlife Files
Source for Mule Deer Observations: WESTEC 1995b,c

N

0 5000 10,000 Feet

Phoenix Project

Figure 3.5-1

Mule Deer Range and Observations

Late March/early April, mid-April, and late April aerial surveys counted a total of 14 groups of mule deer ranging in size from 1 to 10 individuals within the cumulative effects area (WESTEC 1995c). The highest total mule deer count of 38 animals was obtained during the late March/early April survey period, while a low count of 8 was recorded for the late April surveys. A total of 23 mule deer were recorded by the mid-April survey. Only one group of seven deer were observed within the project area while the majority of the remaining observations were at the higher elevations of Battle Mountain (***Figure 3.5-1***).

NDOW big game trend surveys completed for mule deer in Management Area 15 (Units 151-155) from 1995 through 1999/2000 (NDOW 1995-2000) demonstrate considerable variability in fall post-hunting counts due to variable observation conditions. Spring total deer counts have been more consistent. In general, the mule deer population in Management Area 15 appears to have increased over the last 3 years, likely due to milder winters and favorable spring weather conditions. Calculated fawn/doe and buck/doe/fawn ratios also indicate a trend of increasing numbers of fawns and bucks in the population.

3.5.1.2 Upland Game Birds

Field surveys documented the presence of mourning dove, chukar, gray partridge, and sage grouse within the project area and cumulative effects area. NDOW has introduced California (valley) quail in the Battle Mountain range, but their presence was not documented in the project area. The sage grouse is listed as a special status species by the BLM and is discussed in Section 3.5.1.7. Mourning doves are summer residents and occur in the project area and cumulative effects area from spring through fall. Spring 1995 avian field surveys recorded mourning dove in Shadscale-Budsage/Grassland, Big Sagebrush-Rubber Rabbitbrush/Grassland, and Riparian vegetation communities (WESTEC 1995c). Mourning dove typically prefer habitats in close association with sources of surface water.

Chukar, gray partridge, and California quail are introduced game birds and all but California quail were observed at scattered locations throughout the project area and cumulative effects area during the December 1994 and Spring 1995 aerial surveys. Chukar was the most frequently observed game bird during the December 1994 survey (WESTEC 1995b), while gray partridge was more commonly sighted during the spring 1995 surveys (WESTEC 1995c). Gray partridge were noted primarily in association with drainages in the cumulative effects area. This species typically prefers grasslands and cultivated grainfields, but also inhabits brushy canyons and stream bottoms (Terres 1980). Chukar prefer arid sagebrush/grasslands in areas of rocky or rugged terrain. NDOW surveys have documented California quail in Galena Canyon and on the west side of the Battle Mountain range in the Cottonwood Creek and Trout Creek drainages (Lamp 2000). They prefer dense shrubby areas and riparian habitats within the cumulative effects area.

Springs in the cumulative effects area provide an important water source for upland game bird species. Chukar require drinking water, except when succulent vegetation is available (Ehrlich et al. 1988), and will make daily trips to watering sites during the hottest parts of the summer (Terres 1980). Two guzzlers (constructed wildlife water sources) were built within the project area in 1997 by BMG, and chukar have been documented in the Copper Basin area since the guzzlers were completed (Lamp 1998).

3.5.1.3 Raptors

Several species of raptors are known to nest in the region and are potential breeders in the cumulative effects area. Some of these species are yearlong residents, while others only occur as seasonal migrants. Based on information provided in Herron et al. (1985), potential yearlong residents and breeders in the cumulative effects area include golden eagle, prairie falcon, American kestrel, red-tailed hawk, Cooper's hawk, sharp-shinned hawk, northern harrier, short-eared owl, long-eared owl, barn owl, and great horned owl. Summer migrants that could hunt over or breed in the cumulative effects area from spring through fall include turkey vulture, ferruginous hawk, Swainson's hawk, and burrowing owl. The only winter migrant likely to be found in the cumulative effects area is the rough-legged hawk. The Reese River Valley, located to the east of the cumulative effects area, is a known raptor migration corridor within the state (Herron et al. 1985), and other migratory raptor species may occasionally occur over the project area.

Aerial and ground surveys performed by WESTEC (1995b,c), and NDOW and BLM file data provide documentation of the presence of 11 species of raptors within the cumulative effects area. They were turkey vulture, golden eagle, northern harrier,

sharp-shinned hawk, Cooper's hawk, red-tailed hawk, ferruginous hawk, prairie falcon, American kestrel, long-eared owl, burrowing owl, and great horned owl. Confirmed nest sites were located for seven of these species. BLM and NDOW file data contain historic records of nesting by red-tailed hawk (1992), American kestrel (1983-1984), great-horned owl (1981-1984), and short-eared owl (1980). All of these nest sites, except for great horned owl, were located in the northeast portion of the wildlife study area within Galena Canyon near or upstream of the Willow Ranch (***Figure-3.5-2***). The great horned owl nest site was in an abandoned mine shaft (Iron Canyon Mine) in Iron Canyon (***Figure 3.5-2***). Surveys performed by WESTEC (1995c) documented continued nesting by red-tailed hawk in Galena Canyon as well as long-eared owl and possibly Coopers hawk. Nesting also was confirmed for prairie falcon and golden eagle within the cumulative effects area but outside of the wildlife study area (***Figure 3.5-2***). A nesting attempt by a pair of golden eagles on the highwall of the Glory Hole was documented in February and early March of 1999. However, the birds were not seen in the area after March 3, 1999, and the nest site was apparently abandoned (Willow 1999).

3.5.1.4 Neotropical and Other Migratory Bird Species

The primary issue with respect to these species and development of the Phoenix Project is the potential for mortalities related to exposure to contaminated water sources associated with mine operation and loss of breeding habitat for migratory songbirds. Migratory and neotropical birds are protected by the Migratory Bird Treaty Act administered by the U.S. Fish and Wildlife Service.

The project area is located within the Pacific Flyway for waterfowl. Although habitat for waterfowl and other waterbirds is limited within the project area and the cumulative effects area, the Humboldt River to the north of the cumulative effects area serves as an important migratory pathway for waterfowl and shorebirds. Migratory species, such as killdeer, spotted sandpiper, mallard, cinnamon teal, gadwall, and American wigeon may occasionally use the Willow Creek reservoirs as resting, foraging, or nesting habitat. These and similar species also may land infrequently on other small ponds in the project area to rest during migration.

A variety of songbirds also inhabit the cumulative effects area and project area with most migrating to and from the area in spring and fall and occurring only as summer residents. A number of these are neotropical migrants that summer and breed in North America and winter in Central and South America. Bird species recorded in the project area by WESTEC (1995c) were representative of open-country, semi-arid habitats of the Great Basin. Representative migratory species were Say's phoebe, gray flycatcher, violet-green swallow, blue-gray gnatcatcher, sage thrasher, orange-crowned warbler, yellow-rumped warbler, brown-headed cowbird, green-tailed towhee, vesper sparrow, Brewer's sparrow, and lark sparrow.

3.5.1.5 Fish

Fisheries resources near the project area are limited to Willow Creek and the Willow Creek reservoirs. NDOW surveys in 1984 documented rainbow, brown, and brook trout in Willow Creek. No Lahonton cutthroat trout (*Oncorhynchus clarki henshawi),* a federally listed threatened species, were found in the drainage.

3.5.1.6 Special Status Species

According to the U.S. Fish and Wildlife Service (letter dated December 6, 2001) no proposed, threatened, or endangered species are likely to occur within the project area. The only federal candidate species potentially occurring in the project area is the Columbia spotted frog.

A number of BLM special status species also could be present. Special status species are not afforded formal protection under the Endangered Species Act. However, it is BLM policy to treat special status species as if they are candidate species under the Endangered Species Act. The BLM cannot authorize any action that might contribute to the listing of special status species as threatened or endangered.

Candidate and special status species possibly occurring near the project area and cumulative effects area are listed in ***Table 3.5-1***. The potential for these species to occur within the cumulative effects area and project area is discussed in the following sections.

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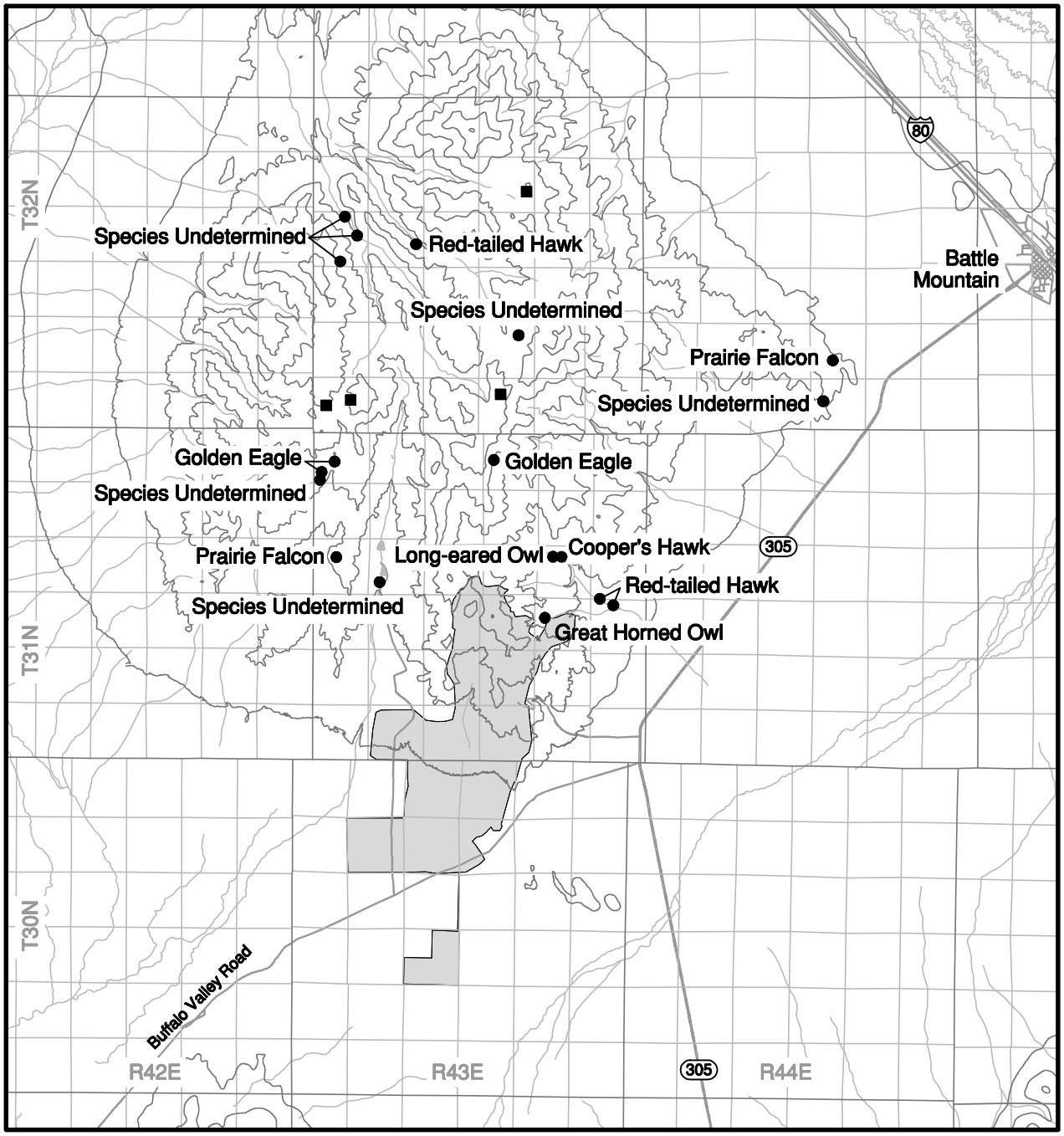

Explanation

- Drainage
- Road
- Sage Grouse Strutting Ground (Lek) Location
- Raptor Nest Location
- Project Facility Boundary

N

0 5000 10,000 Feet

Source: WESTEC 1995b

Phoenix Project

Figure 3.5-2

Raptor Nest and Sage Grouse Lek Locations

Table 3.5-1
Federal Candidate and BLM Special Status Species Potentially Occurring Within the Project Area and Cumulative Effects Area

Common Name	Scientific Name	Status	Occurrence Potential
Amphibians			
Columbia spotted frog	*Rana luteiventris*	C	Possible
Mammals			
Spotted bat	*Euderma maculatum*	S	Possible
Townsend's big-eared bat	*Corynorhinus townsendii*	S	Present
Western small-footed myotis	*Myotis ciliolabrum*	S	Present
Long-eared myotis	*Myotis evotis*	S	Possible
Fringed myotis	*Myotis thysanodes*	S	Possible
Long-legged myotis	*Myotis volans*	S	Present
Yuma myotis	*Myotis yumanensis*	S	Present
Birds			
Ferruginous hawk	*Buteo regalis*	S	Possible
Swainson's hawk	*Buteo swainsoni*	S	Possible
Burrowing owl	*Athene cunicularia*	S	Present
Sage grouse	*Centrocercus urophasianus*	S	Present
Invertebrates			
Springsnails	*Pyrgulopsis spp.*	S	Present
Nevada viceroy	*Limenitus archippus lahontani*	S	Unlikely

C = Candidate. Taxa for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
S = Special Status Species listed by the BLM.

Columbia Spotted Frog. Populations of the Columbia spotted frog in Nevada and the Great Basin are considered to be relict populations occurring in small patches of suitable habitat remaining since the last ice age (U.S. Forest Service 1994). A highly aquatic species, the Columbia spotted frog is usually found near cool, permanent water: streams, rivers, pools, springs, and small lakes. It prefers marshy edges adjacent to slow-moving water (Stebbins 1985). Habitats occupied by Columbia spotted frogs in Nevada have been described by Ports (1994) as: 1) riparian systems with shallow, fast flowing waters and small to medium sized overflow pools; 2) extensive beaver ponds with permanent, intermittent, and ephemeral overflow pools; 3) permanent springs; and 4) stockponds. They prefer marshy edges of ponds or lakes, algae-covered overflow pools of streams, or wet areas with emergent vegetation (U.S. Forest Service 1994).

All ponds and creeks in and near the project area, including the Fortitude Pit lake, tailings ponds, pump stations and wells, Willow Creek and associated reservoirs, Duck Creek, and ponds in Galena Canyon, were surveyed for Columbia spotted frog. No evidence of Columbia spotted frog populations was indicated, but numerous Great Basin spadefoot toad tadpoles were found in the three ponds below Willow Ranch in lower Galena Canyon (WESTEC 1995c).

Special Status Bats. Historic mine shafts and adits, as well as abandoned buildings within the project area represent potentially suitable roost, hibernation, and/or maternity sites for a number of bat species whose ranges overlap the cumulative effects area. Surveys for bats in more than 60 old mine workings were conducted in July and August 1994 and again in March and May 1995 (WESTEC 1995c). A total of 23 of these mine workings contained bats or guano (bat feces).

Townsend's big-eared bat is known to occur throughout western North America and ranges from southern British Columbia to southern Mexico. Throughout much of its range, this bat is common in mesic habitats, characterized by coniferous and deciduous forests (Kunz and Martin 1982). However, surveys in Nevada also indicate the presence of this species and maternity colonies in the more xeric portions of the state (Kuenzi and Morrison 1994). This bat is generally solitary and can be found in mines, caves, and man-made structures to elevations of 9,500 feet. It

does not make major migrations and appears to be relatively sedentary, not traveling far from summer foraging grounds to winter hibernation sites (Barbour and Davis 1969). Its distribution seems to be determined by suitable roost and hibernation sites (Colorado Division of Wildlife 1984). Maternity roosts are almost always caves, although buildings and bridges are known to be used (Kunz and Marten 1982). This species' presence was documented by field surveys in the project area.

The spotted bat occupies habitat ranging from low desert to montane coniferous forests (Watkins 1977). Little is known about the biology of this species, but studies suggest that it may prefer crevices in rocky, cliff habitat for roost sites (Leonard and Fenton 1983; Easterla 1973), especially where rocky cliffs occur near riparian areas (Findley et al. 1975). The potential for the spotted bat to occur in or near the project area is unknown. The presence of this species was not documented by field surveys, but areas of rock outcrop within the project area, especially along Willow Creek and in Galena Canyon, may represent suitable habitat for this species.

The western small-footed myotis inhabits rocky and canyonland areas and is widespread throughout the western United States (Barbour and Davis 1969). Day and maternity roosts of western small-footed myotis have been found in crevices in cliffs, boulders, and on talus slopes. Summer roosts are highly variable and include buildings, mines, under the bark on trees, and crevices in cliffs and boulders. This species prefers small protected dry crevices. Night and hibernation roosts are located in small caves and abandoned mine adits (Zeveloff 1988). Buildings also are used as temporary night roosts between flights. Western small-footed myotis hunt insects over the edge of rocky bluffs. Areas of rock outcrop, as well as mine adits and buildings, in the project area could provide suitable roost and/or maternity sites for this species, and its presence was documented by field surveys in the project area.

The fringed myotis inhabits desert scrub and forests of oak and piñon-juniper in the Southwest. It typically is found at elevations from 4,000 to 7,000 feet (Barbour and Davis 1969). Fringed myotis use mines, caves, rock crevices, and buildings for day roosts. Temporary night roosts have been found in mines, and large maternity colonies have been located in caves and buildings. Little is known about the migration habits of the fringed myotis, but individuals have been documented hibernating in caves. Preferred habitat is generally lacking within the project area and cumulative effects area, and the presence of this species is unlikely.

Long-eared myotis is found throughout most of the western United States and has been found at elevations from sea level to 8,500 feet (Manning and Jones 1989). Optimal habitat consists of stream or riparian areas near forest edges. Long-eared myotis day roosts are found in buildings and under the bark of trees, but caves and abandoned mines also are used as temporary roosts between foraging flights at night (Barbour and Davis 1969). Preferred habitat generally is lacking within the project area and cumulative effects area, and the presence of this species is unlikely.

Long-legged myotis prefer higher elevation coniferous forests but have been recorded in piñon-juniper and montane shrub situations (Zeveloff 1988). Day roosts include buildings and under loose tree bark, as well as crevices in rock cliffs and fissures in the ground. Caves and abandoned mines are used for temporary roosting between foraging flights at night (Barbour and Davis 1969). The species is known to hibernate singly in caves and abandoned mines (Zeveloff 1988). Small nursery colonies have been found in buildings, under the bark of trees, and in fissures in the ground (Barbour and Davis 1969). This species' presence in the project area was documented by field surveys.

Yuma myotis occurs throughout most of the western United States during the summer months. Little is known about its winter range or the migration and hibernation habits of this species. During the summer months, Yuma myotis is restricted to lower elevations and is closely associated with water. It exhibits a dependency for man-made structures, especially for maternity sites (Barbour and Davis 1969). Day roosts within caves/mines and buildings or under bridges are preferred by this species. Females aggregate in large nursery colonies at these roost sites to bear and raise their young. Potential habitat exists for this species in the project area, and its presence was documented by field surveys.

Bat surveys in the old mine workings within or near the project area were conducted in July and August 1994 and in March and May 1995 (WESTEC 1995b,c). Additional surveys were conducted throughout the Battle Mountain range in June and September 1999 and January 2000.

These surveys included adits near the Phoenix Project area but did not address bat habitat within the project area (Brown 2000). Survey findings documented the presence of Townsend's big-eared bat, western small-footed myotis, long-legged myotis, Yuma myotis, pallid bat, and other possible myotis species (WESTEC 1995c). All are listed as special status species by the BLM except for the pallid bat. As indicated previously, 23 of the mine workings contained bats or guano (bat feces). The locations of old mine workings discussed in this section are presented in ***Figure 3.5-3***.

The Butte Mine supported a maternity colony of at least 200 females and juveniles of Townsend's big-eared bat and was determined to serve as a hibernation site for this species as well. One western small-footed myotis also was found hibernating in these workings. The Post Mine was determined to serve as a hibernation site for Townsend's big-eared bat and also may be used as an alternate roost for the maternity colony in the Butte Mine. The Reona adit complex is an open pit that intersects historic workings at several levels making it difficult to survey. This adit complex has been documented to support the greatest number and diversity of bats located thus far by bat surveys in the Battle Mountain range (Brown 2000). The Superior Portal in these workings contained a maternity roost of pallid bats (less than 100), and the east side of the Reona hill contained a pallid bat roost site. In addition, a colony of medium-sized myotis (believed to be long-legged myotis) roosts in the Reona workings. The complexity of these workings could provide temperatures suitable for hibernation as well as maternity use. Townsend's big-eared bats, pallid bats, and unidentified myotis species were observed exiting the adit entrances at the Fortitude Mine, while Townsend's big-eared bats and unidentified myotis species were seen exiting the single shaft that provides access to the Nevada Mine underground workings.

The 300-foot adit of the Bannock Mine was carpeted along most of its length with myotis guano and probably supports a maternity colony or serves as a fall swarming area. A small number of Townsend's big-eared bats were located in these workings in winter and early March. One western small-footed myotis also was noted during the winter survey. Several Townsend's big-eared bats also were found in the Iron Canyon workings in August. A small number of hibernating Townsend's big-eared bats were detected in the same workings in March, and the configuration of the workings indicated suitable temperatures could be maintained for possible hibernation sites.

Bald Eagle. ***The bald eagle, a federally listed threatened species, may be an occasional winter visitor over the project and cumulative effects areas. Bald eagles are known to winter along the Humboldt River and feed on fish when segments of flowing water are available. During short periods of extreme cold, when the river is completely frozen, bald eagles will forage for jackrabbits in the uplands or feed on winter-killed deer. Since the Willow Creek reservoirs contain stocked trout and support adjacent large trees suitable for perching, potential bald eagle winter foraging habitat is present within the project area. In addition, Willow Creek is only about 15 miles south of the Humboldt River, a relatively short distance for an eagle to travel during a foraging flight. However, there are no records of bald eagles using the reservoirs or stream reaches of Willow Creek, or any other waters within the project area (WESTEC 1995b,c,d; SRK 1999a).***

Ferruginous Hawk. The ferruginous hawk inhabits grasslands, shrublands, and steppe-deserts of the western United States. Foraging habitat consists of non-forested, non-mountainous areas, such as desert shrub and grassland communities. Nesting habitat consists of low shrub or grassland communities with isolated trees, bluffs, buttes, rock outcrops, and open country with some rolling topographic relief (Jasikoff 1982). In Nevada, the nesting distribution of ferruginous hawks is restricted primarily to the east-central portions of the state to the east of the project area, although isolated nesting pairs have been found throughout the state in suitable habitat (Herron et al. 1985). Areas with scattered junipers found at the interface between piñon-juniper and desert shrub habitats and overlooking broad, open valleys represent preferred nesting habitat in Nevada (Herron et al. 1985). No ferruginous hawk observations were recorded by field surveys, and suitable nesting habitat is generally lacking within the project area.

Swainson's Hawk. Swainson's hawk breeds in open country throughout most of the West. Swainson's hawk is known to nest in trees, shrubs, and occasionally on low cliffs, cutbanks, and on the ground (Terres 1980). In Great Basin desert areas of Nevada, this hawk appears to prefer to nest in deciduous trees in agricultural valleys (Herron et al. 1985). Known nesting areas near the project area exist primarily along the Humboldt River drainage. No Swainson's hawks were observed by field surveys in the project area, and suitable nesting habitat is generally lacking except in Galena Canyon and along Willow Creek.

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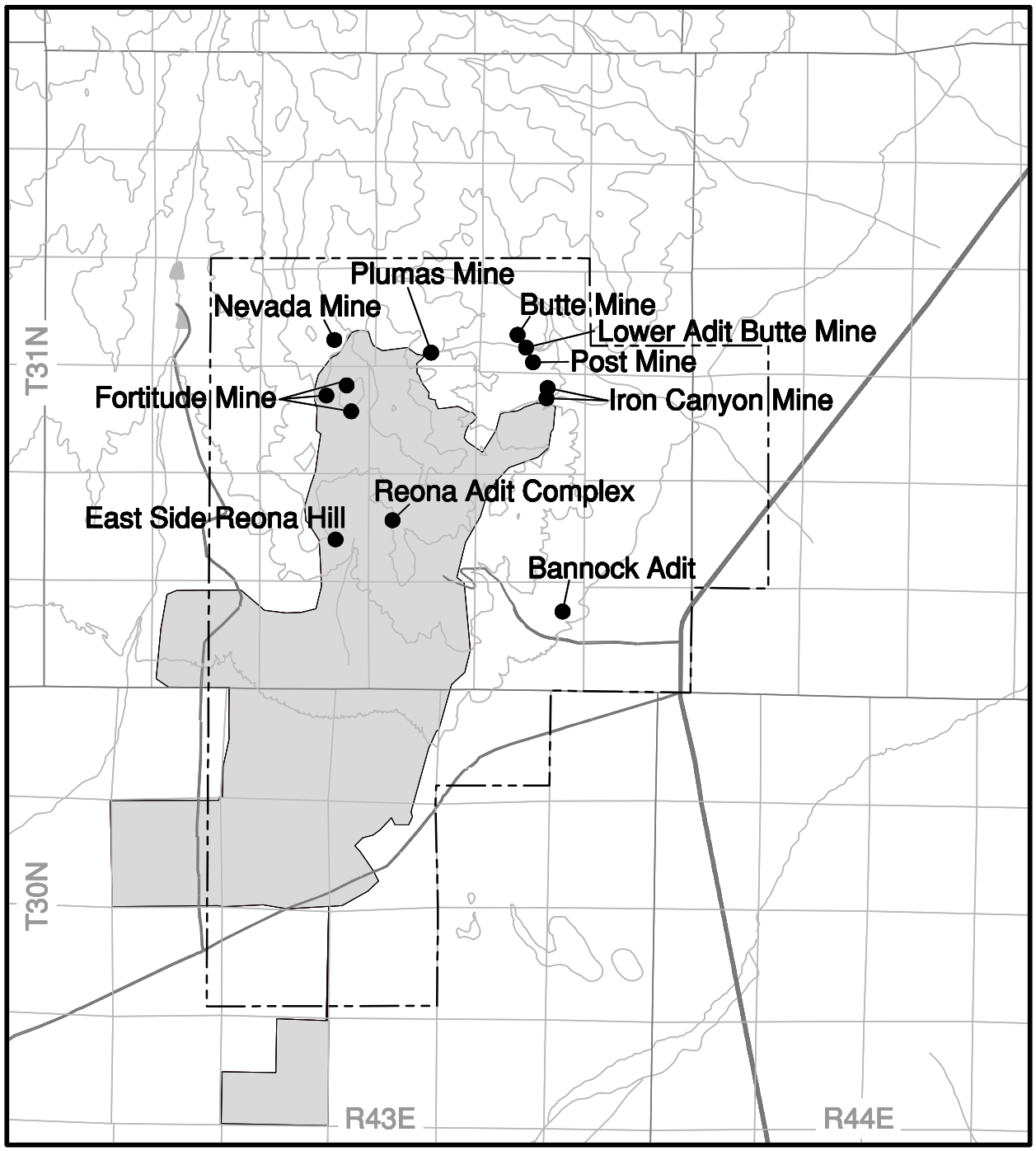

Explanation

- Drainage
- Road
- Project Facility Boundary
- Bat Study Area Boundary
- Bat Habitat Location

0 5000 10,000 Feet

N

Source: WESTEC 1995b,c

Phoenix Project

Figure 3.5-3

Bat Roost, Maternity, and/or Hibernation Sites

Burrowing Owl. The burrowing owl breeds throughout the western United States in open grassland areas. In northern Nevada it occurs as a summer breeder and migrates south during the winter (Herron et al. 1985). Breeding by burrowing owls is strongly dependent on the presence of burrows constructed by prairie dogs, ground squirrels, or badgers. Prime burrowing owl habitat must be open, have short vegetation, and contain an abundance of burrows (Marks and Ball 1983). Conversion of grasslands and pasturelands to croplands and the destruction of rodent colonies are considered the main factors in the decline of burrowing owl populations (Zarn 1974).

Observations of burrowing owls were recorded in the southeast portion of the project area along the Buffalo Valley Road, but searches of existing burrows in the area did not locate any evidence of nesting activity (WESTEC 1995c). Burrowing owls have been found up to 0.6 mile away from a nest burrow (Haug and Oliphant 1990; WESTEC 1995c), and it is possible the birds observed were nesting somewhere in the area.

Sage Grouse. Sage grouse inhabit the cumulative effects area but generally prefer higher elevation habitats than those located within the project area. Sagebrush is a key component of sage grouse habitat on a yearlong basis. Sagebrush provides forage and nesting, security, and thermal cover for sage grouse. Moist areas that provide succulent herbaceous vegetation during the summer months are used extensively as brood rearing habitat. Open, often elevated areas within sagebrush habitats usually serve as breeding areas (strutting grounds or lek sites).

Early spring 1995 aerial surveys documented the locations of three sage grouse strutting grounds to the north of the project area but within the cumulative effects area (WESTEC 1995b) (see ***Figure 3.5-2***). Two of the strutting grounds were leks that were previously located during NDOW mule deer spring surveys (WESTEC 1995b). The third and northern-most lek site was a previously undocumented strutting ground location. All other observations of sage grouse were recorded north of the project area.

Habitats within or near the project area potentially used by sage grouse are represented by the Black Sagebrush - Mountain Sagebrush/Grassland, Mountain Sagebrush/Grassland plant communities (see Section 3.4) as well as spring sites and drainage bottoms. Springs and streams in the cumulative effects area provide an important water source for upland game bird species, including sage grouse. Sage grouse use wet meadow and riparian habitats supported by streams, seeps, and springs as brood rearing habitat.

Springsnails. Springsnails (*Pyrgulopsis* spp.) are small aquatic snails with a conical shell. Endemic populations of springsnails associated with freshwater seeps and springs can be threatened by changes in water quantity and quality. All seeps and springs within a 5-mile radius of the project area were surveyed for springsnails (JBR 1996d). Eighty spring locales were inventoried, and springsnails were collected at ***only*** four locations. Two were within the main channel of Willow Creek (JBR Ref. Nos. 31-43-32-43 and 31-43-8-33), another was a spring adjacent to Duck Creek (JBR Ref. No. 31-43-15-122), and the fourth was an isolated spring in Cow Canyon (JBR Ref. No. 31-43-3-34).

Nevada Viceroy. Populations of Nevada viceroy have been located primarily along the Humboldt River and its lower tributaries (WESTEC 1995c). This species is restricted to areas containing willows, which serve as host plants for its larvae. The closest known population of Nevada viceroy is located north of Battle Mountain (WESTEC 1995c). Stands of willows in Galena Canyon and along Willow Creek were searched for the Nevada viceroy, but none were located (WESTEC 1995c).

3.5.2 Environmental Consequences

This section addresses potential direct and indirect impacts associated with the Proposed Action and the No Action alternative. These impacts are discussed below for all wildlife with particular emphasis on potential impacts to wildlife species of concern. Wildlife species and related issues addressed by this analysis were determined through consultation with the BLM, NDOW, and the U.S. Fish and Wildlife Service. The primary issues related to wildlife and fisheries resources are 1) potential impacts to BLM special status species, especially resident bat and springsnail species, that would contribute to their being listed as federally threatened or endangered; 2) disruption of mule deer seasonal movement corridors and cumulative loss of habitat; 3) potential loss of raptor nest sites; 4) potential impacts to important sage grouse ranges; 5) loss or changes in existing wildlife water sources; 6) potential effects of contaminated water sources; 7) dewatering or water quality changes in Willow Creek; and 8) loss of springs and associated springsnail habitat.

Impacts to terrestrial wildlife would be significant if the Proposed Action or the No Action alternative result in any of the following:

- Impacts to federal candidate or BLM special status wildlife species or their habitat in a manner and to a degree that would contribute to a species being listed as either federally threatened or endangered.
- Impacts to special status species or habitat known to occur in the project area.
- Impact to Battle Mountain mule deer herd if seasonal movement corridors are disrupted between winter range and higher elevation summer range.
- Impacts to wildlife species if habitat fragmentation and animal displacement prevent viable reproduction of resident, migratory, or transient populations, or if migration routes and/or schedules are disrupted.
- Impacts to nesting raptors from the loss of an active nest site caused by mine construction or operation during the breeding season (March through July).
- Impacts to naturally occurring seeps, springs, and creeks in and near the project area from either direct disturbance or indirect effects from mine dewatering activities that reduce the availability ***or quality*** of water.
- Impacts to sage grouse breeding, nesting, or brood-rearing habitat or winter thermal cover, including impacts related to increased predator perch availability.
- Impacts to either resident or migratory wildlife if the project results in either acute or chronic toxicity that may become evident through increased animal mortalities or reduced growth or fitness.

Impacts to aquatic resources would be significant if the Proposed Action or No Action alternative result in the following:

- Impacts to important habitat for Willow Creek trout species because of dewatering or water quality changes resulting in direct toxicity or habitat degradation.
- Impacts of dewatering or diversion/ alteration of ground water or surface water resulting in a loss or decrease of perennial water systems.

3.5.2.1 Proposed Action

The potential impacts of the proposed operation on terrestrial wildlife can be classified as short-term and long-term. Short-term impacts arise from habitat removal and disturbance as well as from activities associated with the mine operation. These impacts cease upon mine closure and completion of successful reclamation. Long-term impacts consist of permanent changes to habitats (and the wildlife populations dependent on those habitats) irrespective of reclamation success. The major impact categories that would potentially affect wildlife populations are direct habitat loss or alteration, increased human presence and noise, and potential changes in surface water quantity and quality.

Direct *or Indirect* Habitat Loss or Alteration. The greatest impact to all wildlife would be the temporary or permanent loss or alteration of habitat. Temporary loss or alteration of habitats would be caused by construction and operation of mine facilities for the life of the mine. Habitat loss or alteration would result in direct losses of smaller, less mobile species of wildlife, such as small mammals and reptiles, and displacement of more mobile species to adjacent undisturbed habitats until reclamation is completed. Displacement also could result in some local reductions in wildlife populations if adjacent undisturbed habitats are at carrying capacity.

Long-term or permanent loss or alteration of habitat would result if reclamation efforts cannot return disturbed areas to conditions similar to those that were present prior to mining. Where reclaimed and unreclaimed habitats support less productive and less diverse plant communities than those present prior to mining, the long-term impacts would be adverse with regard to re-establishment of wildlife populations to premining levels. Based on BMG's Reclamation Plan and the available soils resource, most of the mine disturbance areas eventually would be returned to mid-successional grassland communities (see Section 3.4, Vegetation). With reapplication of grazing pressure, once reclamation is complete, shrubs would also become reestablished over time through initial plantings and natural invasion.

Nearly 50 percent (2,709 acres) of the Proposed Action disturbance would occur in existing

disturbed areas. There would be an additional total disturbance of 4,364 acres of previously undisturbed Shadscale-Budsage/Grassland, Black Sagebrush-Mountain Sagebrush/Grassland, Black Greasewood/Shadscale, Mountain Sagebrush/ Grassland, and Mixed Brush habitats in descending order of acreage (see ***Table 3.4-3*** in Section 3.4, Vegetation). Based on the project's Reclamation Plan for the Proposed Action, a long-term loss or alteration of 576 acres of habitat would occur in association with the pit highwalls, which would not be reclaimed. The pit highwalls would remain as open excavations with benched rock walls having a low potential for vegetation re-establishment. Under the Proposed Action, one existing (Minnie) and four new or expanded (Midas, Phoenix, Reona, and Iron Canyon) pits would be sufficiently backfilled to preclude the formation of any standing water or lakes within the pits.

As described in Section 3.3.2, a screening-level analysis was conducted to determine the potential risk to plants and wildlife of chemical constituents in the capping material used for the reclamation and revegetation of project facilities. The risk to wildlife or livestock utilizing forage on the reclaimed facilities was determined to be low to moderate.

Mule Deer. Minor amounts of new disturbance would occur within mule deer yearlong and winter range with most occurring within the Shadscale and Budsage/Grassland plant community. Losses to more important mule deer habitats, including Black Sagebrush - Mountain Sagebrush/ Grassland, Mountain Sagebrush/Grassland, and Mixed Brush plant communities, would be considerably less (see ***Table 3.4-3***). There would be no disturbance to mule deer summer range, which is considered most limiting for mule deer populations in the Battle Mountains. The majority of new disturbance would occur at the edge of mule deer winter range or outside of identified mule deer ranges. Therefore, direct impacts to mule deer populations would be minimal, and there would be no disruption of movement corridors between winter and summer range. Backfilling of pits and revegetation efforts would eventually reclaim the majority of the project area to habitats suitable for use as mule deer year-long or winter range.

Project development has the potential to indirectly affect mule deer by modifying springs and seeps that serve as potential winter range water sources in Philadelphia Canyon and in Galena Canyon and its tributaries. The loss of springs or seeps as a result of direct removal or drawdown associated with mine dewatering would result in a significant project impact.

Effects resulting from the loss of springs within the project area could be mitigated by the establishment of replacement or additional artificial water sources such as wildlife guzzlers within drainages where springs are affected; see Section 3.5.4, Monitoring and Mitigation Measures.

Raptors. As indicated in Section 3.5.1.4, a variety of birds of prey occur and nest in the region. Several species are potential breeders in the area. Nest sites within the project area were documented in Galena Canyon for Cooper's hawk, red-tailed hawk, American kestrel, and short-eared owl. Nesting by great horned owl occurred in an abandoned mine shaft (Iron Canyon Mine) in Iron Canyon (see ***Figure 3.5.2***). Nest sites for golden eagle and prairie falcon also were located within the cumulative effects area but outside of the project area. All nest sites except the great horned owl nest are located more than 0.5 mile away from, and out of direct line-of-sight of, proposed project development sites. Therefore, any adverse effects on these nest sites would be unlikely. The great horned owl nest site is approximately 0.1 mile from the proposed waste rock facility at the Iron Canyon Pit but also is out of direct line-of-sight. Great horned owls are relatively adaptable to human activity, and project activities are not likely to render this nest site unsuitable for use by great horned owls.

Other Upland Game Birds. Aside from sage grouse, the cumulative effects area also supports populations of mourning dove, chukar, and gray partridge. These species are widespread and relatively common in Nevada. They were observed at scattered locations throughout the cumulative effects area. Project development would not directly affect any areas of identified important habitat for these species. However, project development has the potential to indirectly affect these upland game birds by modifying seeps and springs in Philadelphia Canyon and in Galena Canyon and its tributaries. Based on significance criteria developed for the Phoenix Project, loss of springs in these tributaries, either through direct removal or the effects of ground water drawdown associated with mine dewatering, would result in a significant project impact.

Effects resulting from the loss of springs within the project area could be mitigated by the

establishment of replacement or additional artificial water sources such as wildlife guzzlers within drainages where springs are affected; see Section 3.5.4, Monitoring and Mitigation Measures.

Neotropical and Other Migratory Bird Species. There would be no direct impacts to breeding habitat for migratory waterbirds, but there would be a reduction in shrubland habitats, primarily in Shadscale - Budsage/Grassland, Sagebrush/Grassland, and Black Greasewood/ Shadscale plant communities (see ***Table 3.4-3***), which would result in a loss of potential breeding habitat for migratory songbird species such as sage thrasher, green-tailed towhee, vesper sparrow, Brewer's sparrow, and lark sparrow.

Potential impacts to breeding migratory songbirds from the proposed mine expansion would include possible direct loss of nests (e.g., crushing) or indirect effects (e.g., abandonment) from increased noise and human presence within close proximity to an active nest site. Wildlife mitigation (see Section 3.5.4) would require conducting breeding bird surveys within suitable native habitats prior to ground disturbance, if construction were to occur between April 15 and August 1. If active nests were located, determination of appropriate mitigation measures would be completed in consultation with the BLM to minimize effects on nesting birds. Mitigation measures could include avoidance, buffer zones, construction constraints, etc., and would be determined on a case-by-case basis. An alternative to requiring nesting surveys would be clearing vegetation outside of the breeding season to avoid impacting nesting birds. Residual impacts to nesting birds within the project area would be limited to incremental habitat loss associated with mine expansion. This loss, however, would not be significant given the extent of native habitats in the surrounding region, the lack of unique habitats or documented rare bird species in the project area, and existing disturbance sites within the project area (i.e., reduced carrying capacity of the native habitats immediately adjacent to disturbed sites).

Drawdown analyses (see Section 3.2, Water Resources and Geochemistry) indicate that the drawdown area would extend into the lower perennial reach of Willow Creek below the Willow Creek reservoirs by the end of mining (model year 25), resulting in a probable flow reduction in this reach of the creek. A reduction in flow could result in a loss or degradation of riparian habitat along this segment of the creek. Reductions in riparian habitat could result in a decrease in the amount of feeding and nesting habitat along the creek for migratory waterbirds.

Fish. Drawdown analyses (see Section 3.2, Water Resources and Geochemistry) indicate that the drawdown area would extend into the lower perennial reach of Willow Creek below the Willow Creek reservoirs by the end of mining (model year 25), resulting in a probable flow reduction in this reach of the creek. A reduction in flow possibly could reduce the length of perennial stream reach in this area, thereby reducing the extent of suitable habitat for resident trout species. Based on significance criteria developed for the Phoenix Project, a loss or decrease of perennial water systems would result in a significant impact.

BLM Special Status Species. As indicated in Section 3.5.1.7, a number of special status species, including bat species, burrowing owl, sage grouse, and springsnail have been found within the project area or cumulative effects area. ***In addition, the bald eagle may be a rare winter visitor.***

Based on current project development maps, waste rock disposal, backfilling, and recontouring would result in the loss of the Fortitude Mine adits and the Reona adit complex. Surveys documented a pallid bat maternity roost and a long-legged myotis roosting colony within the Reona adit complex. These adits also were judged to be potentially suitable as hibernation sites. In addition, Townsend's big-eared bats, pallid bats, and an unidentified myotis species were observed exiting the adit entrances at the Fortitude Mine. If any of these adits serve as important hibernation or maternity sites for Townsend's big-eared bat or other special status myotis species, loss of these adits could result in a reduction of local populations of these species, resulting in a significant wildlife impact. Mitigation would be required to reduce potential impacts to these species (see Section 3.5.4, Monitoring and Mitigation Measures).

Observations of burrowing owls were recorded in the southeast portion of the project area along the Buffalo Valley Road, but no burrowing owl nests were located in the project area. Construction of the Phoenix tailings facility and the tailings pipeline as well as the excavation of the clay and gravel borrow pits would be the principal project components to affect potential burrowing owl habitat (approximately 2,770 acres of new disturbance in Shadscale-Budsage/Grassland habitat). Since no burrowing owl nests were found in these areas, project development may affect

individual burrowing owls by a reduction in available habitat but is unlikely to result in a reduction in population viability of burrowing owls in the project area. Nest surveys implemented prior to construction would ensure that no nesting activity would be affected.

Sage grouse inhabit the region but generally prefer higher elevation habitats than those located within the project area. All observations of sage grouse and locations of sage grouse leks were located more than 2 miles north of the project area at the higher elevations. New disturbance would affect primarily the Shadscale and Budsage/ Grassland plant community that does not represent an important habitat for sage grouse. Losses to more important sage grouse habitats, including Black Sagebrush - Mountain Sagebrush/ Grassland, Mountain Sagebrush/Grassland, and Mixed Brush plant communities, would be considerably less (see ***Table 3.4-3***). There would be no direct impacts to moist spring or riparian habitats. Therefore, project development is unlikely to have a significant effect on populations of sage grouse.

Project development does have the potential to indirectly affect sage grouse by modifying seeps and springs in the area and by reducing the extent of flow in lower Willow Creek (see ***Table 3.2-14*** and ***Figure 3.2-12***). Any loss of water sources and adjacent mesic plant communities could reduce the extent of important watering and brood rearing sites for sage grouse. Monitoring and mitigation measures WR-1 and WR-2 (see Section 3.2.4) and W-8 (see Section 3.5.4) would be required to mitigate potential impacts to sage grouse from loss of important water sources.

According to ***Table 3.2-14***, two of the springs documented to contain populations of springsnails would be affected by mine dewatering. These springs are in Cow Canyon (JBR Ref. No. 31-43-3-34) and in Duck Creek (JBR Ref. No. 31-43-15-122). Loss of these springs and a subsequent loss of the springsnail populations would result in a significant project impact.

As indicated in ***Figures 3.2-12*** through ***3.2-15, potential drawdown impacts could affect the lower perennial reach of Willow Creek, but the impacts are not projected to affect the reach of stream that includes the two reservoirs. Consequently, there should be no change to the fish populations, fish habitat, or bald eagle roost sites (trees) and foraging habitat in or adjacent to the reservoirs. The lower reaches of Willow Creek potentially affected by drawdown do not support suitable perch trees or potential foraging habitat for bald eagles. Therefore, there would be no adverse effect on potential bald eagle winter use of Willow Creek.***

Human Presence and Noise. The most common wildlife responses to noise and human presence are avoidance or accommodation. Avoidance would result in displacement of animals 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 severity 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 reinvade areas formerly avoided. For example, during initial development phases, it is likely that mule deer would be displaced from a larger area than the actual disturbance sites due to avoidance response. However, mule deer have demonstrated the ability to acclimate to a variety of mining activities in the West as long as human harassment levels do not increase substantially. It is possible, therefore, that the extent of mule deer displacement would approximate the actual disturbance area after the first few years of mine operation. Overall, patterns of wildlife avoidance of the project area would be expected to be relatively similar to those occurring with current project operations since most new project development areas would be within the sphere of existing project noise and disturbance zones.

In addition to avoidance response, increased human presence intensifies the potential for wildlife/human interactions ranging from harassment of wildlife to poaching and legal harvest. Increased human presence and related increases in traffic levels on project access roads also increases the potential for wildlife/vehicle collisions. The greatest increases in traffic levels on access roads to the project area would occur during the peak of construction. Once construction is completed, traffic levels would decrease correspondingly to the loss of construction workers. Reduced traffic levels could be accomplished if BMG provides buses or van pools for employee travel to and from the project site.

The potential for wildlife/vehicle collisions is typically highest in the early morning and evening hours and where roads traverse ranges or areas

where big game concentrate. In the cumulative effects area, the risk of vehicle/mule deer collisions is expected to be low since no concentration areas have been identified along the access routes. In addition the posting of appropriate speed limits along the access roads reduces the risk of deer/vehicle collisions.

NDOW requires mine operators to provide regular monitoring reports of incidences of wildlife mortality. If monitoring indicates a higher than expected incidence of deer/vehicle collisions along the access road, additional mitigation would be required to alleviate the problem. NDOW mortality records for the Copper Canyon ***and Reona mines*** confirm that wildlife/vehicle collisions are relatively low in the area. Only ***three*** wildlife mortalit***ies*** (non-cyanide related) was recorded for the period from 1990 through ***2000 (Lamp 2001).***

Contaminated Water Sources. Wildlife populations in the project area and the cumulative effects area could be affected by the creation of mine-contaminated water sources. Wildlife exposure to contaminated surface water could occur at tailings facility areas, on the heap leach pad if cyanide solutions are allowed to pool on the surface, and at the process solution ponds at the heap leach beneficiation facility. The mill facility would be designed to be a zero-discharge, closed-loop system with no risk of wildlife exposure to process solutions.

Solutions present on the leach pad and in the process ponds would contain potentially toxic levels of weak acid dissociable (WAD) cyanide. The process ponds would be encircled by 8-foot fencing and covered with netting or other type of exclusion methods to exclude all wildlife. BMG has indicated that the tailings pond and heap leach facility also would be fenced to exclude wildlife. It is assumed that fencing would be a combination of chain link and wire mesh to exclude terrestrial wildlife as required by the NDOW's Industrial Artificial Pond Permit. As described in Section 2.4.23, BMG would periodically sample, analyze, and manage open surface solution waters for wildlife protection.

The WAD cyanide levels in the tailings pond waters would be reduced to near or below 40 ppm through use of the INCO (or comparable) process. WAD cyanide below this level by itself is not likely to pose a toxicity hazard to wildlife. However, tailings pond water also could have a low pH and contain potentially toxic levels of metals. The effects of low levels of cyanide in combination with other metals are uncertain, and as a result, no safe level of cyanide in conjunction with other metals has been established (Eisler 1990). Mitigation measure WR-8 in Section 3.2.4 (Water Resources and Geochemistry) is recommended to address the potential for tailings impacts to wildlife.

In addition, if leachate solutions are allowed to pool on top of the leach pad, small mammals, birds, and bats not excluded by fencing could be exposed to toxic solutions and suffer mortalities. NDOW mortality records for other mine operations in the region indicate that there is the potential for cyanide losses of a variety of species, especially birds. BMG's records for the Copper Canyon Mine indicate a low incidence of cyanide related mortalities, but past bird mortality problems have been documented on the Reona heap leach facility ***and at the Reona event pond. Mortalities at the heap leach facility were associated with surface pooling of leachate solutions on the surface while event pond mortalities were due primarily to songbirds passing through the netting cover (Lamp 2001). BMG has since modified operations of the Reona heap leach facility to eliminate leachate pooling and wildlife mortalities. BMG also added plastic balls to cover the event pond surface in 1999. Since that time only one songbird mortality (a bird caught in the netting) has been recorded at the Reona event pond (Lamp 2001).*** Industrial Artificial Pond Permits issued by the NDOW mandate no wildlife mortalities and require that all mine waters containing chemicals lethal to wildlife be fenced and covered to preclude access by all wildlife species. If wildlife mortalities are documented at the tailings or heap leach facilities, additional exclusion methods or process modifications would be required by the NDOW ***(see mitigation measure W-10 in Section 3.5.4).***

Accidental transportation spills of process chemicals also could pose a potential risk of exposure of wildlife to toxic chemicals. The potential for accidental spills to affect a variety of wildlife species would be greatest with accidents near aquatic habitats such as the Humboldt River. Spills in dryland habitat would pose only a minimal risk to most wildlife species since these spills would be adjacent to highways and could be rapidly contained and cleaned up.

Even though the risk for wildlife exposure would be higher with accidental spills into aquatic habitats, the risk of this type of

accident would also be negligible for several reasons. The probability of an accident and the release of process chemicals would be very low (see Section 3.15.2), and areas of aquatic habitat adjacent to highways are extremely limited in this region of Nevada. Hazardous chemicals would be transported via U.S. Department of Transportation certified containers and transporters, and transportation of sodium cyanide and other chemical reagents would comply with the U.S. Department of Transportation, Occupational Safety and Health Administration (OSHA), and Mine Safety and Health Administration (MSHA) 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. Finally, as summarized in Section 3.15, Hazardous Materials, BMG has developed an Emergency Response Plan (Terracon 2000) that establishes procedures for responding to accidental spills or releases of hazardous materials to minimize environmental risks.

3.5.2.2 No Action Alternative

Under the No Action alternative, facilities and operations that are currently authorized by the BLM and/or the State of Nevada would continue. Potential impacts would be the same as described for the Proposed Action with the following exceptions. The currently approved Reclamation Plan would be implemented for the existing disturbance areas that total 2,778 acres, and, if developed, the additional 45 acres of disturbance currently permitted for expanding the Midas Pit. Aside from a much smaller total disturbance footprint, the main difference between this alternative and the Proposed Action is that a smaller percentage of pit area would be backfilled and reclaimed, and the existing pit lake would remain in the Fortitude Pit. Small ponds also may form in the Minnie and Bonanza pits. Because there would be substantially less backfill of pits with this alternative, existing mine adits associated with the Reona adit complex, the Fortitude Mine, Iron Canyon Mine, and Nevada Mine would not be backfilled and would continue to support existing levels of bat use.

The water sampled from the Fortitude Pit lake in 1999 had a neutral pH and met all Nevada primary drinking water quality criteria. The water exceeded secondary standards for iron, aluminum, manganese, and sulfate (see Section 3.2, Water Resources and Geochemistry). Seep and runoff water entering the pit lake were sampled and found to have low pH (3.0 to 3.2) and metals concentrations in excess of water quality standards, but this water was neutralized upon entering the pit lake. Metals and other constituents have been observed to form solid precipitates as the water is neutralized. These precipitates settle to the bottom of the lake, but could potentially be redissolved or made available to aquatic organisms under seasonal lake turnover (mixing) conditions. Over a longer period the concentrations of constituents in the Fortitude Pit lake could increase due to evaporative concentration. It is uncertain whether increased concentrations of constituents would eventually reach levels that could have deleterious effects on wildlife drinking from or using the Fortitude Pit lake for resting, foraging, or drinking.

Although it is not currently expected, shallow pit lakes may also collect in the bottom of the Minnie Pit and in the P-1 and P-2 depressions in the Bonanza Pit. If water does pond in these two pits, it is likely to be acidic and contain elevated levels of several metals (see Section 3.2.2.2, Pit Lake Water Quality). These waters could pose a toxicity hazard to wildlife.

3.5.3 Cumulative Impacts

Cumulative effects to wildlife and wildlife habitat in the cumulative effects area have resulted from past fires, mineral exploration and mining activities, grazing, and drought. These factors have reduced habitat quality and effectiveness through habitat conversion and loss of wildlife security through increased human presence.

Besides the Battle Mountain Complex, two other past, present, or reasonably foreseeable future projects, the Trenton Canyon Mine and the Marigold Mine, occur within the wildlife and fisheries resources cumulative effects area. Continued livestock grazing is the only other reasonably foreseeable activity that would affect the wildlife and fisheries cumulative effects area.

The wildlife and fisheries cumulative effects area encompasses an area of approximately 140,000 acres. The Trenton Canyon Mine is currently permitted for a total of 2,683 acres of mine disturbance and an additional 955 acres of exploration disturbance or 2.6 percent of the cumulative effects area. The Marigold Mine is currently permitted for 1,349 acres with a proposed expansion of up to an additional 717

acres for a combined total of 1.4 percent of the cumulative effects area. The existing disturbance in the proposed Phoenix Project area is 2,709 acres, or approximately 2 percent of the cumulative effects area. Under the Proposed Action, disturbance at the site would incrementally increase by an additional 4,364 acres for a combined total of 7,073 acres, or ***5*** percent of the cumulative effects area. However, as discussed above, the majority of these acreages, including those for the Trenton Canyon and Marigold mines, would be revegetated postmining. Although revegetated communities would initially be somewhat different than neighboring native types, over the long-term, revegetated areas would evolve into communities similar to adjacent undisturbed land as a result of natural successional processes (assuming successful revegetation and proper postmining management).

As indicated, potential significant impacts to special status species or other species of concern could be associated with the potential loss of seeps and springs in Philadelphia Canyon and Galena Canyon and their tributaries with the Proposed Action. The Proposed Action could also result in dewatering and reduction of trout habitat in lower Willow Creek. Based on information provided in the Trenton Canyon Project EIS (BLM 1998) and Marigold Mine Expansion Project EIS (BLM 2000a), neither of these projects are anticipated to have dewatering effects on perennial seeps and springs or other water sources. Eventual backfilling of the Fortitude Mine adits and the Reona adit complex with the Proposed Action would result in the loss of bat hibernaculum and maternity sites. No impacts to occupied bat adits has or would occur with the Trenton Canyon Project, but two adits utilized by bats were impacted by the Marigold Mine. Both were used as maternity sites by pallid bats, and one served as fall mating habitat for pallid and Townsend's big-eared bats. This adit was also suspected as being a hibernation site for Townsend's big-eared bats (Brown 2000).

The NDOW has identified approximately 61,519 acres of mule deer range within the cumulative effects area. According to the Trenton Canyon Mine EIS, approximately 3,262 acres of past mining disturbance has occurred within identified mule deer range. Currently permitted and proposed activities for the Trenton Canyon Mine would affect an additional 1,245 acres of mule deer range (primarily sagebrush habitats in winter and yearlong range). Marigold Mine disturbances are located outside of mule deer range. The Proposed Action for the Phoenix Project would impact additional acreage of approximately 1,196 acres of Black Sagebrush - Mountain Sagebrush/ Grassland, Mountain Sagebrush/Grassland, and Mixed Brush plant communities in mule deer winter and yearlong range. The cumulative reduction in winter and yearlong mule deer range would be approximately 5,703 acres or 9.3 percent of total mule deer range. These habitat losses would be short-term since the majority of these disturbances would be eventually reclaimed to productive shrub communities (assuming successful reclamation). In addition to habitat loss effects on mule deer, increases in road densities resulting from mineral exploration and mine development in the Battle Mountain range has resulted in cumulative reductions in secure habitat areas for mule deer during the hunting seasons.

Cumulative impacts to sage grouse can be estimated based on losses in suitable sagebrush habitats. Historic and currently permitted activities for the Trenton Canyon Mine have resulted in the loss of approximately 2,990 acres of sagebrush habitats (primarily Wyoming big sagebrush). Although historical data are lacking for documentation of historic plant community disturbances within the Phoenix Project area, based on elevation, slope, and aspect it is estimated that approximately 2,200 acres of the existing 2,709 acres of disturbance was in Black Sagebrush - Mountain Sagebrush/ Grassland and Mountain Sagebrush/Grassland plant communities, approximately 1,196 acres new acres of disturbance in Black Sagebrush - Mountain Sagebrush/ Grassland, Mountain Sagebrush/Grassland, and Mixed Brush would be associated with the Proposed Action. The Marigold Mine is located outside of suitable sagebrush habitats for sage grouse. Therefore, the total cumulative loss of sage grouse sagebrush habitats associated with the Proposed Action would be approximately 6,386 acres. These losses would be relatively long-term since, even with successful reclamation, redevelopment of mature sagebrush communities would take many years.

3.5.4 Monitoring and Mitigation Measures

Measures to mitigate the potential reduction in spring and stream flows are identified in Section 3.2.4 for Water Resources and Geochemistry. A measure to address potential bioaccumulation of chemical constituents in the capping material is

identified in Section 3.4.3. Based on the potential impacts to wildlife identified in Section 3.5.2, monitoring and mitigation measures to reduce impacts to wildlife, beyond those required by an NDOW Industrial Artificial Pond Permit, are recommended below.

W-1: Burrowing Owl Survey. Prior to development of the clay and gravel borrow sites or expansion of the tailings facility and tailings pipeline, these disturbance areas would be resurveyed to ensure the non-occurrence of any burrowing owl nest sites. ***If surveys identify active burrowing owl nest sites, ground disturbance would be conducted outside of the nesting season, if possible. If construction occurs within the nesting season, appropriate mitigation would be developed and implemented in coordination with the BLM, such as establishing buffer zones around active nest sites.***

W-2: Big Game Collisions. Employees would be required to report any big game-vehicle collisions on the mine site and access road to BMG. If problems along the access road are identified, BMG would consult with the NDOW to identify and develop appropriate risk-reduction measures.

W-3: Firearms Control. BMG would prohibit employees from hunting or carrying firearms within the project area fenceline.

W-4: Wildlife Harassment. BMG would post informational bulletins to discourage employees from inadvertent or purposeful harassment of wildlife. BMG also would post state and federal regulations regarding legally protected species that could occur within the project area.

W-5: Off-road Traffic. BMG would prohibit unauthorized off-road vehicle traffic within the project area controlled by BMG.

W-6: Bat Mitigation. Prior to any new ground disturbance activities, adits and shafts that could provide suitable bat roost sites within 0.25 mile of proposed activities would be resurveyed (preferably a warm season survey) for evidence of bat occupation. Shafts that cannot be safely accessed would be surveyed by conducting exit counts. Shafts or adits containing evidence of significant use by bat colonies would be marked in the field and on topographic maps and designated for mitigation prior to disturbance by mine development. Prior to disturbance of any identified important bat occupation sites, adits or shafts would be blocked to prevent bat entry during a period of nonoccupation.

Excluding bats from parts of the Reona adit complex may not be possible because of adit size and number as well as dangerous access. Therefore, a stepwise collapse of the complex would be evaluated in coordination with BLM and NDOW that would permit bats an opportunity to abandon this complex without being trapped. Ideally, collapse and closure of adits would be completed from late August through early October so that bats are not impacted during hibernation or maternity periods.

Suitable alternate adit or shaft roost sites located outside of potential disturbance areas would be protected from human intrusion by the construction of bat gates across the openings or other suitable measures. Bat gates are designed to prevent human access but allow bat passage. Selection of alternate roost sites and design of the gated closure would be coordinated with appropriate NDOW and BLM biologists, and gated closures would be inspected at regular intervals during the life of mining to ensure their effectiveness and continued bat use.

Based on information provided by Brown (2000), the following provides a list of nearby mines and comments on their potential as bat mitigation sites.

- Galena adit - a hibernaculum for Townsend's big-eared bats with an opening suitable for gating.
- Post Mine - a maternity site and hibernaculum for Townsend's big-eared bats. The two adits would require some work to make suitable for gating.
- Butte Mine - a maternity site and hibernaculum for Townsend's big-eared bats. Smaller, lower adit could be gated. Upper, larger opening not suitable for gating but could be perimeter fenced (chain link) to reduce risk of human intrusion.
- Humbug Mine - maternity site and September use by Townsend's big-eared bats. Configuration and airflow also indicate its potential use as a hibernation site. Opening not suitable for gating but could be perimeter fenced (chain link) to reduce risk of human intrusion.

- Nevada shaft - documented Townsend's big-eared bat and Myotis use. Opening could be secured with a cupola type closure.

- Iron Canyon adits - summer and hibernation use by Townsend's big-eared bats. Adits with more stable rock openings are suitable for gating.

- Bannock complex - longest adit supported *Myotis* and Townsend's big-eared bat hibernation. Also suspected of being a fall swarming site for Myotis. This adit is suitable for gated closure after silt deposits are removed.

W-7: Power Line Raptor Safety. BMG would ensure all project power poles and power lines are constructed in configurations that preclude collisions and inadvertent electrocution of raptors using the power poles for perch sites. In addition, power poles would be fitted with anti-perching devices to minimize potential raptor and raven predation/harassment of sage grouse. ***The design and placement of anti-perching devices on power poles would be coordinated with the BLM and NDOW.***

W-8: Wildlife Water Sources. As described in mitigation measures WR-1, WR-2, and WR-3 in Section 3.2.4, BMG would monitor seep, spring, and stream water quality and flow rates within the mine's potential drawdown area. If reductions in water quality or loss of flow are documented***, mitigation measures would be applied as described in mitigation measure WR-3 (Section 3.2.4). Additional mitigation measures such as the establishment of wildlife guzzlers would be implemented if determined to be appropriate by the NDOW and BLM biologists. Appropriate mitigation measures to address any reduction in trout habitat also would be developed in consultation with the NDOW.*** Design and placement of mitigation guzzlers would be coordinated with NDOW and BLM.

Mitigation measures to minimize impacts to trout populations in lower Willow Creek would involve monitoring and reporting of flow changes, as described for Water Resources (mitigation measures WR-1 and WR-3).

Springsnail specimens would be collected at identified population locations in Duck Creek (JBR Ref. No. 31-43-15-122) and Cow Canyon (JBR Ref. No. 31-43-3-34) and identified to species by a springsnail expert to determine if these populations represent unique species ***prior to dewatering***. If these springsnail populations are determined to be unique species, then additional mitigation measures may be needed including seep and spring mitigation measures, in addition to those described in WR-1 and WR-2, to preserve these springsnail populations.

W-9: Ground-clearing. Ground-clearing activity would not occur during the migratory bird nesting season between April 15 and August 1 unless under the direction of a qualified biologist to locate migratory songbird nest sites. If ground clearing occurred during the nesting season, mitigation for identified occupied nest sites would be determined on a case-by-case basis in consultation with the BLM. ***Mitigation measures could include avoidance, buffer zones, or construction constraints.***

W-10: Contaminated Water Sources. Monitoring and mitigation described under WR-8 (Section 3.2.4) would ensure that migratory bird species and other wildlife are not exposed to potentially toxic water sources in the tailings impoundment. For process ponds and other water sources that may contain potentially toxic water sources for wildlife, wildlife exclusionary measures including, but not limited to, fencing, netting, and plastic balls would be installed as necessary.

3.5.5 Residual Adverse Effects

Residual adverse effects as a result of implementation of the Proposed Action would include the permanent loss of habitat associated with the pit highwalls (576 acres), which would not be reclaimed following the completion of mining. Because of the surface configuration of the pit highwalls and lack of soils resource at each open pit following closure, habitation conditions similar to those present prior to disturbance would be impossible to reestablish. However, some of the remaining pit highwalls could provide additional nesting habitat for cliff nesting raptor species. The closure of existing underground mine workings that currently provide maternity, roost, and hibernation sites for bat species also would be a residual adverse effect. In addition, residual adverse effects would result from the loss of seeps and springs, or a reduction in seep or spring flows, due to mine dewatering activities.