3.2 Water Resources and Geochemistry

The hydrologic study area and CESA for direct and indirect impacts to water resources and geochemistry is shown on **Figure 3.2-1**. This hydrologic study area encompasses approximately 470 square miles of terrain, ranging from mountains and hillslopes to alluvial fans and playas.

3.2.1 Affected Environment

3.2.1.1 Hydrologic Setting

The existing Phoenix Mine is located within the Buffalo Valley and Lower Reese River Valley hydrographic areas as shown on **Figure 3.2-1**. Elevations in the CESA range from approximately 4,500 feet amsl along the Humboldt River near the Town of Battle Mountain, Nevada, to approximately 8,550 feet amsl at North Peak. Elevations in the study area (which is located in the Buffalo Valley Hydrographic Area) range from approximately 4,700 to 5,300 feet amsl. Major drainage features in the vicinity of the Phoenix Mine are shown in **Figure 3.2-2**. Major surface channel networks include a portion of the Humboldt River to the northeast, part of the Reese River drainage in the south and east, and the Buffalo Valley drainage in the west.

The overall hydrologic setting of the study area previously has been described in the Phoenix Project Final EIS (BLM 2002a). In summary, the region is arid to semi-arid. Average annual precipitation varies widely but generally increases with elevation. Precipitation and resulting runoff vary widely between years and locations in the Basin and Range Province. Periodic droughts occurred in the 1950s, mid-1970s, the 1980s, and early 1990s, and to some degree from 1999 through 2002. Generally, the years after 2002 have been wetter than average in the region with the exceptions of 2007 and 2008.

Total annual precipitation has averaged approximately 8.0 inches near the Town of Battle Mountain for the period 1950 through 2009 (Western Regional Climate Center [WRCC] 2010) (**Table 3.2-1**). Precipitation amounts at the proposed facilities in the study area may differ from those reported. ET, which approximates the losses that may occur from evaporation and plant transpiration, is estimated at approximately 47 inches per year in the study area (Sheverell 1996). Pan evaporation at the mine site is estimated to average 62.5 inches per year (Geomega 2010). When an adjustment coefficient of 0.7 to 0.8 is applied, as is the standard practice, these values are comparable. These values vary locally and between seasons and years. Almost all precipitation is consumed by ET or eventually recharges groundwater.

Table 3.2-1 Average Monthly Precipitation from 1950 through 2006 (inches) at the Town of Battle Mountain

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Battle Mountain 4 SE	0.77	0.65	0.68	0.91	1.06	0.85	0.27	0.31	0.50	0.58	0.67	0.78	8.02

Sources: WRCC 2010.

3.2.1.2 Surface Water

Streamflows and the occurrence of springs and seeps are highly influenced by the occurrence of rainfall and snowmelt, as well as by the nature of underlying sediments, bedrock characteristics, and other geologic features such as faults. In general, the durations of streamflows are longer within the mountain block north of the proposed project area. As streams flow onto the alluvial fan, transmission losses occur by seepage into the fan sediments.

The existing Phoenix Mine is located on a system of coalescing alluvial fans. The proposed project area is located downgradient from where Willow Creek runs off of the mountain front. In these settings, runoff is dissipated across the land surface in a system of fan distributary channels, most of which are small with only ephemeral flow.

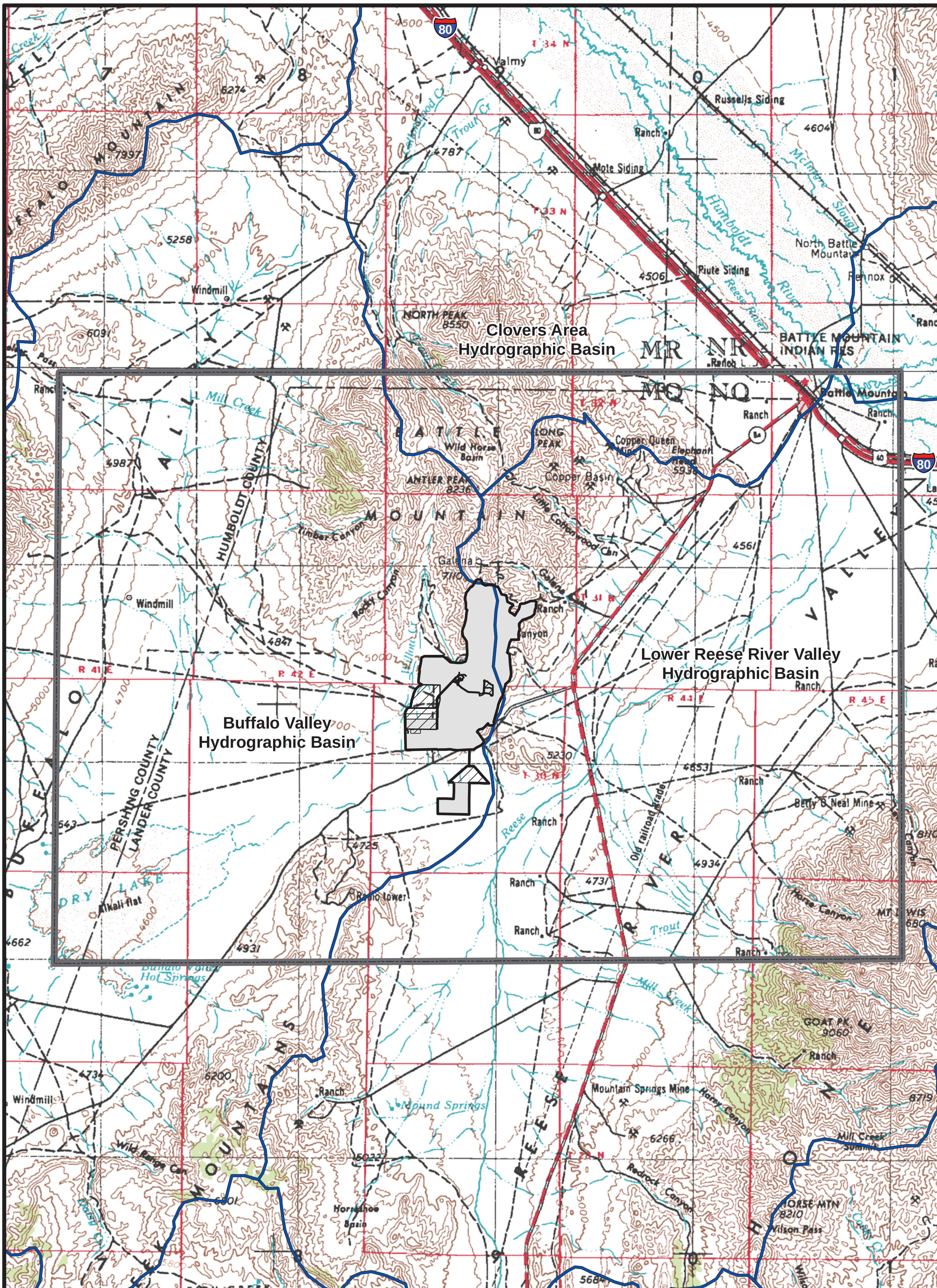
The locations of perennial stream reaches and springs in the vicinity of the Phoenix Mine are shown in **Figure 3.2-2**. No springs or seeps have been identified in or near the proposed project area. The nearest spring is located in the headwaters of Philadelphia Canyon approximately 2 miles northeast of the existing Reona Heap Leach Pad (**Figure 3.2-2**). This spring and others are all outside of the proposed project area.

Willow Creek is the major stream channel and surface water feature that occurs immediately west of the Phoenix Mine (**Figure 3.2-2**). Copper Canyon is an ephemeral stream channel that occurs within the existing POO boundary, but north of the project area (**Figure 3.2-2**). Where the proposed SX-EW facility and Reona facilities would be located downstream from the mouth of Copper Canyon, surface water features have been extensively modified by historical and current operations. Both of these drainages, their surface water characteristics, and associated sampling locations were described in the previous Phoenix Project Final EIS (BLM 2002a). No flow data have been recorded for Copper Canyon, and the stream has been determined to be non-jurisdictional by the USACE (BLM 2002a). The stream is ephemeral, and flows dissipate into the downgradient fan sediments.

During earlier inventories for the Phoenix Project Final EIS (BLM 2002a), the upper portions of the Willow Creek drainage were determined to be perennial. This area occurs approximately 2 miles north of the proposed Phoenix Copper HLF, and 1 to 1.5 miles north of the proposed Section 5 OUA. Two small earthen dams with reservoirs (herein referred to as the upper and lower Willow Creek reservoirs) are located along Willow Creek and provide water for supply and recreation. An additional smaller stock pond, as well as a former impoundment site, occur a short distance downstream of the two reservoirs. Stream flow in Willow Creek consists of seasonal runoff and groundwater inflow in the form of perennial spring discharge adjacent to and within the stream channel. A major source of perennial flow in upper Willow Creek is groundwater discharge from two perennial springs located approximately 2 miles upstream of the upper reservoir. Streamflows gradually decrease downstream, and eventually cease on the alluvial fan as a result of evaporation and infiltration.

Recent field investigations have been performed along Willow Creek, Galena Creek (and its upper tributaries), and Philadelphia Canyon to define current conditions and verify agency jurisdiction (JBR 2007a). Based on these investigations, the USACE determined that none of these streams are jurisdictional waters of the U.S. (USACE 2007).

During these inventories, Willow Creek was observed to be generally 4 to 5 feet wide as it crosses the upper portion of the fan adjacent to the western edge of the proposed Section 5 OUA. As it trends down the fan, Willow Creek splits into eastern and western branches northwest of the proposed Phoenix Copper Heap Leach Pad (JBR 2007a). The western branch was not flowing at the time of the investigation (March 2007). Surface flow was observed in the eastern branch, which occupied a defined channel approximately 3 feet wide. The eastern branch passes within 1,000 feet of the western edge of the proposed Phoenix Copper Heap Leach Pad and eventually splits into several smaller distributaries in Section 20, approximately 1 mile south of the proposed pad. At the time of the investigation (March 2007), the flows were observed to dissipate into the fan sediments in that vicinity (JBR 2007a). It is likely that flows are not sustained in lower Willow Creek later than the spring season.

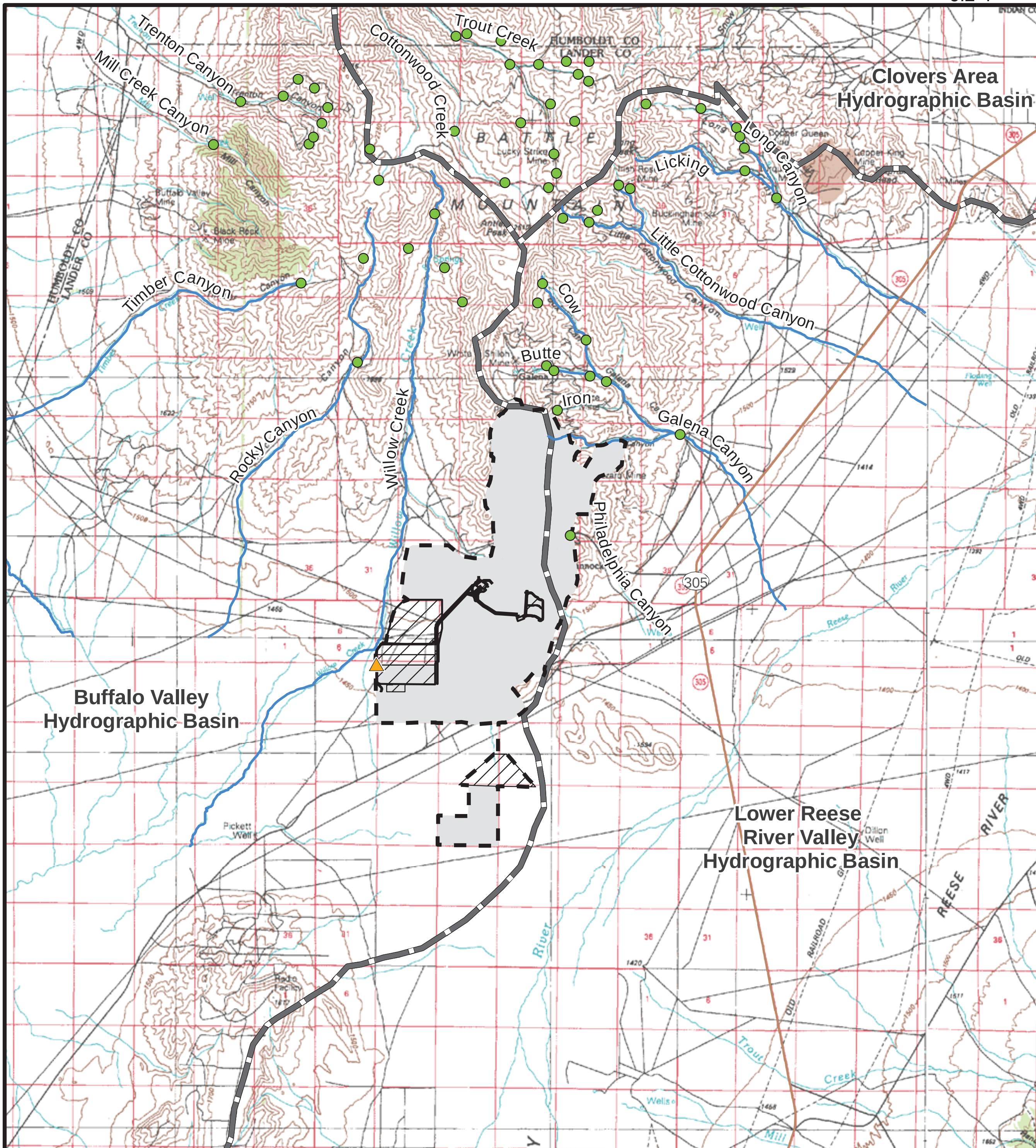


Phoenix Copper Leach Project

Figure 3.2-1

Water Resources and Geochemistry CESA

06/29/2011



Legend

- Proposed POO Boundary
- Proposed Action
- Proposed Action Linear Feature
- Permitted Disturbance
- Proposed Production Well
- Hydrographic Basin Boundary
- Drainage
- Perennial Spring

N

0 1 2 Miles

Source: Itasca 2010.

Phoenix Copper Leach Project

Figure 3.2-2

Regional Drainage Features

06/15/2011

Water rights in the area are depicted on **Figure 3.2-3**. Water rights on Willow Creek include beneficial uses for irrigation, mining, and milling. All currently permitted water rights applications, and all certificated or vested water rights are held by Newmont (JBR 2007a). Additional beneficial uses at Willow Creek Reservoir, which is categorized as a Class B water by the State of Nevada, include municipal or domestic supply with treatment, contact and non-contact recreation, irrigation, livestock watering, aquatic life and propagation of wildlife, and industrial uses (NAC 445A.125.4).

3.2.1.3 Groundwater

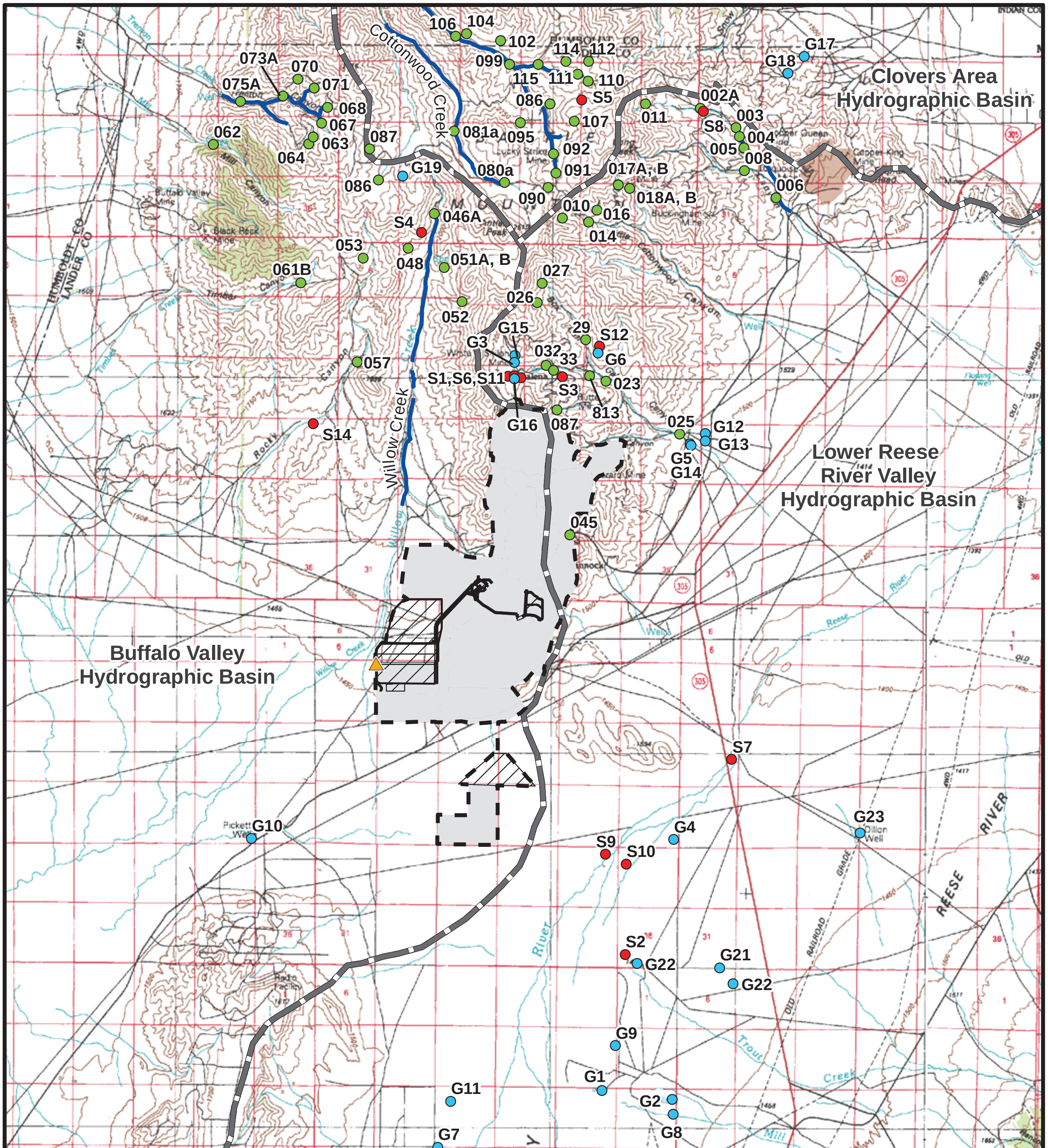
A detailed description of the hydrogeologic conditions in the proposed project area was provided in the Phoenix Project Final EIS (BLM 2002a). The following paragraphs provide an overview summary of the relevant hydrogeologic conditions presented in that document.

Recharge, storage, and movement of groundwater is dependent in part on the geologic conditions and the topography of a site. The geologic formations and lithologic units can be grouped into 11 hydrostratigraphic units in the proposed project area (Baker Consultants, Inc. 1997). The correlation between the geologic formations and the hydrostratigraphic units is provided in **Table 3.2-2**. These 11 hydrostratigraphic units can be grouped into two principal categories: 1) a regional bedrock assemblage composed of Paleozoic bedrock and Tertiary intrusives; and 2) valley fill deposits composed of Tertiary volcanic rock, volcaniclastic valley fill, and alluvial basin fill.

Table 3.2-2 Correlation of Hydrostratigraphic Units with Geologic Formations and Units

Hydrostratigraphic Unit		Geologic Formation or Unit	
Symbol	**Name**	**Symbol**	**Name**
Valley Fill Deposits			
QA	Quaternary Alluvium	Qa	Quaternary Alluvium
TB	Basalt	Tb	Tertiary Basalt Flows
TA	Tertiary Alluvium	Ta	Tertiary Valley Fill Alluvium Unit
TT	Tuffaceous Material	Ta	Tertiary Valley Fill Tuff and Pyroclastic Unit
		Tc	Caetano Tuff
Regional Bedrock Assemblage			
TI	Igneous/Intrusives	Kgd	Cretaceous Granodiorite
		Tgd	Tertiary Granodiorite
PP	Pumpernickel Group	PMh	Havallah Formation
		PPp	Pumpernickel Formation
PEM	Edna Mountain Unit	Pem	Edna Mountain Formation
PAP	Antler Peak Unit	PPap	Antler Peak Formation
PB	Battle Mountain Unit	Pb	Battle Formation
CH	Harmony Unit	Ch	Harmony Formation
DSC	Scott Canyon Unit	Ov	Valmy Formation
		Dsc	Scott Canyon Formation

Source: Baker Consultants, Inc. 1997; BLM 2002a.



Legend

- Proposed POO Boundary
- Proposed Action
- Proposed Action Linear Feature
- Permitted Disturbance
- Proposed Production Well
- Hydrographic Basin Boundary
- Perennial Stream Reach
- Perennial Spring
- Groundwater Rights on File at State Engineer's Office
- Surface Water Rights on File at State Engineer's Office

N

0 1 Miles

Source: Itasca 2010.

Phoenix Copper Leach Project

Figure 3.2-3

Perennial Streams, Springs, and Water Rights

The general distribution of these units is presented in Figure 3.1-3 in the Phoenix Project Final EIS (BLM 2002a). In the bedrock assemblage, recharge, storage, flow, and discharge of groundwater generally are controlled by porosity, permeability, and structure (i.e., fault and fracture zones) of the geologic material. In the valley fill sediment, the groundwater is stored and transmitted through interconnected pores within the consolidated to unconsolidated sediments.

Bedrock Hydrostratigraphic Units

The bedrock assemblage consists of a structurally complex assemblage of Paleozoic-age sedimentary, metasedimentary, and metavolcanic and Tertiary intrusive rocks. These rocks are exposed in the Battle Mountain Range and underlie the basin fill sediments in the valleys.

The Tertiary deposits can be separated into three principal hydrostratigraphic units, including: 1) local basalt flows; 2) Tertiary tuffaceous material deposited as valley fill; and 3) Tertiary alluvium (which is combined with the Quaternary alluvium). Tertiary basalt flow forms a ridge along the eastern boundary of the existing tailings disposal area (Figure 3.1-4, Phoenix Project Final EIS [BLM 2002a]). This feature extends to the west and south dipping under the tailings area and Quaternary/Tertiary alluvium. The basalt acts as an aquitard, locally restricting groundwater movement between the overlying alluvium and underlying Tertiary alluvium and tuffaceous sediments (Baker Consultants, Inc. 1997).

The Tertiary tuffaceous material consists of an assemblage of various interbedded tuffaceous strata that have been encountered in deep boreholes recently drilled in the Buffalo and Reese river valleys south and east of the existing tailings disposal area. The tuff is often interfingered with gravel and other Tertiary alluvial deposits.

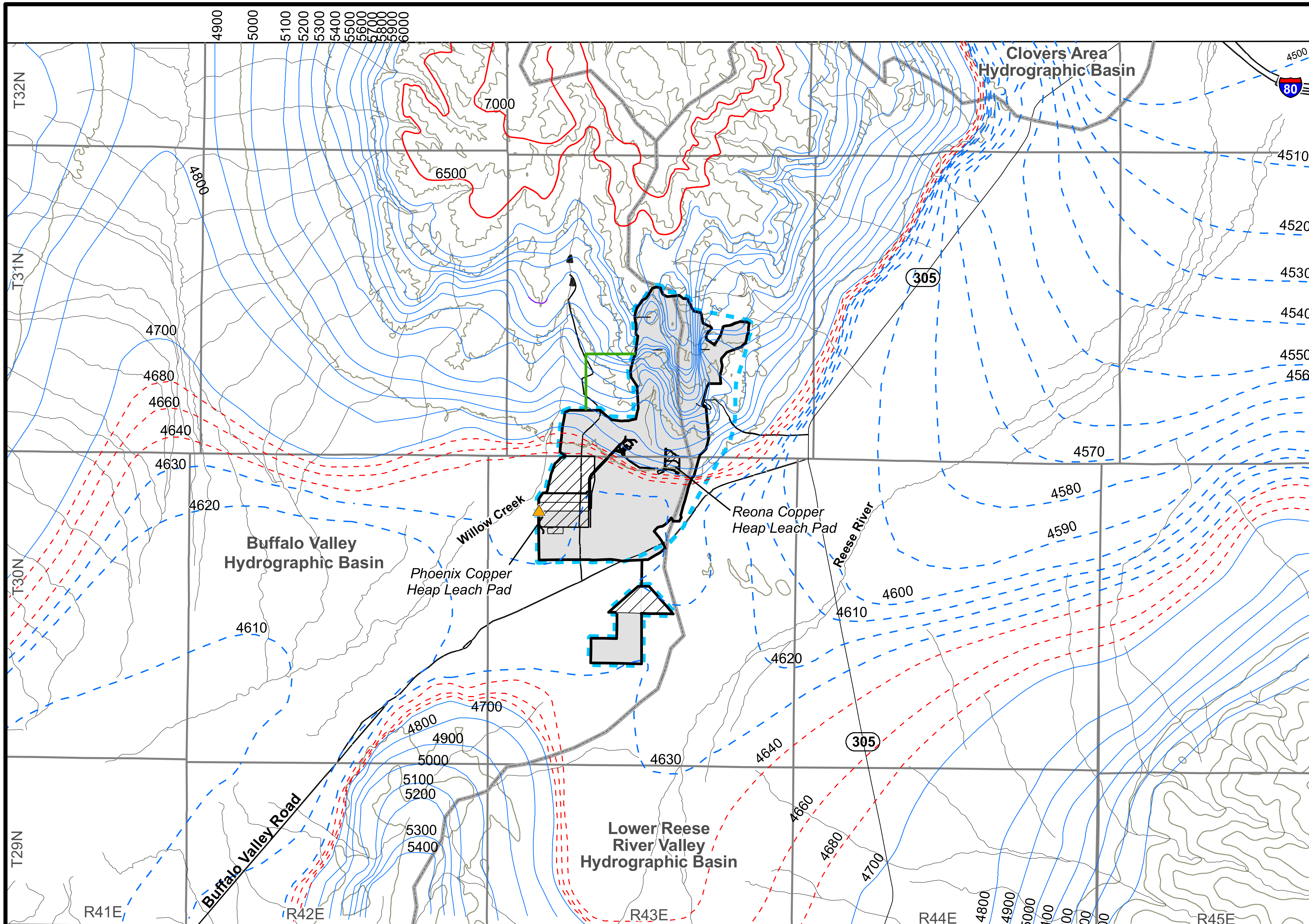
Quaternary/Tertiary Alluvium

The alluvium in the hydrologic study area is derived from the adjacent Battle Mountain Range, Tobin Range, Fish Creek Mountains, and Shoshone Range. The alluvium consists of coarse-grained-sands and gravel with silts and clay deposited by alluvial fans, intermittent streams and associated floods, wind, and lakes (Buffalo Playa). These deposits gradually thicken from a thin veneer at the margin of the valley to several thousand feet in the valley's center. As shown in Figure 3.1-1 in the Phoenix Project Final EIS (BLM 2002a), these sediments cover extensive areas in the Buffalo and Reese river valleys.

Water Levels

The general groundwater elevations in the hydrologic study area are shown in **Figure 3.2-4**. The groundwater elevation contours are based on 49 on-site and off-site wells, piezometers, and perennial springs that were monitored on a quarterly basis during 1996 (Baker Consultants, Inc. 1997). As shown in **Figure 3.2-4**, the groundwater surface tends to mimic the topography, with steep gradients in the mountain ranges and gentler gradients in the basins. The water level contours also indicate that for the upper aquifers, the ridge located between the Virgin and Plumas faults behaves as a groundwater divide with groundwater flowing away from the ridge crest west-southwest into the Buffalo Valley Hydrographic Basin and east-southeast into the Reese River system. The groundwater elevation contours also steepen in the vicinity of the Virgin and Plumas faults, indicating that these structures are acting as partial barriers to groundwater flow. Hydraulic head losses of hundreds of feet from one side of the faults to the other occur in these areas. In addition, historic dewatering activities and recent pit lake filling in the Fortitude Pit have caused local groundwater to flow toward the pit area.

Groundwater extraction wells have a strong seasonal influence on the groundwater system in the area directly beneath and to the south of the existing tailings disposal area. These wells typically are continuously pumped during the spring, summer, and autumn months, which causes flow to move from the tailings area to the southwest toward the wells. The groundwater system in this area also is influenced by a basalt unit that acts as an aquitard, restricting groundwater movement between the overlying alluvium and underlying tuffaceous sediments (Baker Consultants, Inc. 1997).



LEGEND

- Proposed POO Boundary
- Proposed Action
- Proposed Fenceline
- Reona POO Fenceline
- Proposed Production Well
- Permitted Disturbance
- Ground Water Contour Elevation Contour Interval = 500 Feet
- Ground Water Contour Elevation Contour Interval = 100 Feet
- Ground Water Contour Elevation Contour Interval = 20 Feet
- Ground Water Contour Elevation Contour Interval = 10 Feet
- Hydrographic Basin Boundary
- Drainage

Source: Baker Consultants, Inc. 1997.

0 1 2 Miles

Phoenix Copper Leach Project

Figure 3.2-4

Regional Groundwater Elevation Map

3.2.1.4 Water Quality

Waters of the State of Nevada are defined in the Nevada Revised Statutes (NRS) Chapter 445, Section 445.191 and include, but are not limited to: 1) all streams, lakes, ponds, impounding reservoirs, marshes, water courses, waterways, wells, springs, irrigation systems, and drainage systems; and 2) all bodies of accumulations of water, surface and underground, natural or artificial. Water quality standards for state waters have been established by the State of Nevada under NAC 445A.117 through 445A.128. Standards for toxic materials applicable to designated beneficial uses of surface water are described in NAC 445A.144 and summarized in **Table 3.2-3**.

Table 3.2-3 Nevada Water Quality Standards

Constituent (mg/L)[1]	Groundwater		Surface Water			
	Nevada Drinking Water Standards		Municipal or Domestic Supply	Nevada Agriculture		Aquatic Life
	Primary MCL	Secondary MCL		Irrigation	Livestock Watering	
Physical Properties						
Dissolved Oxygen	--	--	Aerobic	--	Aerobic	5.0
Color (color units)	--	15[3]	75	--	--	--
TDS (at 180°C)	--	500[4]; 1,000[3]	500[4]; 1,000[3]	--	3,000	--
Turbidity (NTU)*	--	--	--	--	--	--
Inorganic Nonmetals						
Ammonia (unionized) (Total NH_3 as N)	--	--	0.5	--	--	--
Chloride	--	250[4]; 400[3]	250[4]; 400[3]	--	1,500	--
Cyanide (as CN)	0.2	--	0.2	--	--	--
Fluoride	4.0	2.0[4]	--	1.0	2.0	0.0052[5]
Nitrate (as N)	10	--	10	--	100	--
Nitrite (as N)	1.0	--	1.0	--	10	--
pH (standard units)	--	6.5-8.5[3]	5.0-9.0	4.5-9.0	6.5-9.0	6.5-9.0
Sulfate	--	250[4], 500[3]	250[4]; 500[3]	--	--	--
Metals[6]/Elements						
Aluminum	--	0.05[3]-0.2[4]	---	--	--	--
Antimony	0.006	--	0.006	--	--	--

Table 3.2-3 Nevada Water Quality Standards

Constituent (mg/L)[1]	Groundwater		Surface Water			
	Nevada Drinking Water Standards		Municipal or Domestic Supply	Nevada Agriculture		Aquatic Life
	Primary MCL	Secondary MCL		Irrigation	Livestock Watering	
Arsenic (total)	0.01	--	0.01	0.10	0.20	0.18[5,7]
Barium	2.0	--	2.0	--	--	--
Beryllium	0.004	--	--	0.10	--	--
Boron	--	--	--	0.75	5.0	--
Cadmium	0.005	--	0.005	0.01	0.05	0.0006[5,8]
Chromium (total)	0.1	--	0.1	0.10	1.0	0.015[5,8]
Copper	1.3[9]	1.0[3]	--	0.20	0.50	0.0065[5,8]
Iron	--	0.3[4]; 0.6[3]	--	5.0	--	1.0
Lead	0.015[9]	--	0.05	5.0	0.10	0.0004[5,8]
Magnesium	--	125[4]; 150[3]	--	--	--	--
Manganese	--	0.05[4]; 0.1[3]	--	0.2	--	--
Mercury	0.002	--	0.002	--	0.01	0.00012[5]
Nickel	0.1	--	0.134	0.20	--	0.087[5,8]
Selenium	0.05	--	0.05	0.02	0.05	0.005[5]
Silver	--	0.1[3]	--	--	--	0.0014[5,8]
Thallium	0.002	--	0.013	--	--	--
Zinc	--	5.0[4]	--	2.0	25	0.584[5,8]

[1] Units are milligrams per liter (mg/L) unless otherwise noted.

[2] MCL = Maximum contaminant level. Federal primary standards that existed as of July 1, 2009 are incorporated by reference in NAC 445A.4525.

[3] Nevada secondary MCLs.

[4] Federal secondary MCLs.

[5] 96-hour average.

[6] The standards for metals are expressed as total recoverable unless otherwise noted.

[7] Standard for arsenic (III).

[8] Standard is dependent on site-specific hardness; displayed value is based on a hardness of 60 mg/L as calcium carbonate ($CaCO_3$). (See NAC 445A.144 for equations.)

[9] Value is action level for treatment technique for lead and copper.

* NTU = nephelometric turbidity units.

Sources: 40 CFR 141.51; 40 CFR 143.3; NAC 445A.119, 445A.144, 445A.453, and 445A.455.

Standards for protecting groundwater used as a drinking water source have been adopted by the Nevada Bureau of Health Protection Services. Specifically, NAC 445A.453 establishes primary standards in the form of maximum contaminant levels, and NAC 445A.455 establishes secondary standards also as maximum contaminant levels. Primary maximum contaminant levels are established to protect human health from potentially toxic substances in drinking water, while secondary maximum contaminant levels are established to protect aesthetic qualities of drinking water, such as taste, odor, and appearance. Nevada's regulations governing mining facilities provide that, unless otherwise exempt, groundwater quality cannot be degraded beyond established maximum contaminant levels (NAC 445A.424). Nevada primary and secondary maximum contaminant levels are listed in **Table 3.2-3** Baseline surface water and groundwater quality for the existing Phoenix Mine is summarized in the Phoenix Project Final EIS (BLM 2002a). The existing mining operation includes a network of surface water monitoring sites, and groundwater monitoring wells and piezometers (**Figure 3.2-5**). The monitoring sites are located within and peripheral to the Phoenix Mine intended to establish baseline conditions and identify potential impacts to water resources in the project area (Brown and Caldwell 2000). Monitoring at these locations is conducted in accordance with the WPCP (NEV 0087061 and the Water Resources Monitoring Plan) (Brown and Caldwell 2000a). The results of the monitoring are summarized in annual reports submitted to the NDEP and the BLM (Newmont 2008d, 2007b, 2006).

Collection systems are in place to collect and convey low quality storm water runoff and seepage from the North Fortitude WRF, and Philadelphia Canyon, Box Canyon, Iron Canyon, and Butte Canyon. Storm water runoff from historic copper HLFs and WRFs in these areas is characterized as low pH with elevated concentrations of metals. Leachate from facilities in these areas is managed in accordance with existing WPCP and supplemental corrective action plans. The leachate from these areas is conveyed to event ponds where it is either evaporated or reused in the mineral processing facilities. The BLM has issued ROWs for the discharge management systems located downgradient from waste rock facilities located Iron Canyon and Butte Canyon (BLM ROW #N-63060).

The Fortitude Pit is currently the only open pit on the mine site that contains water. The Fortitude Pit Lake initially formed after mine dewatering stopped in 1993 at a pit bottom elevation of 5,765 feet. Fortitude Pit Lake water was used for dust suppression and exploration/development drilling through 1999. From the end of 1999 until 2004, the pit lake has filled at an approximated rate of 27 feet per year. From the beginning of 2004 until the end of 2007, the rate has slowed to approximately 15 feet per year. At the end of 2007, the Fortitude Pit Lake was approximately 161 feet deep with a surface area of 15.2 acres (Newmont 2008d).

In 2008, a water pipeline system was constructed to convey water from the pit lake to a storage reservoir so that the water could be used as make-up water to the Phoenix Mill. Treated Fortitude Pit water also is used for dust suppression. Since the fourth quarter of 2010, the Fortitude Pit Lake had a reported depth of 35 feet and surface area of approximately 2.5 acres. Monitoring data for the Fortitude Pit Lake for 2010 is provided in Newmont's WPCP 2010 fourth quarter report (Newmont 2011c). Trona (a naturally occurring sodium carbonate mineral) has been added to the lake periodically since 2008 for pH control. During 2010, approximately 34 tons of trona was placed into the Fortitude Pit. The 2010 monitoring results indicate that the pH of the lake ranged from 7.2 – 7.6 pH. The 2010 water quality samples indicate that the water met all Nevada primary drinking water standards but exceeds secondary standards for iron, manganese, sulfate and TDS (Newmont 2011c,d).

Groundwater in the vicinity of the Gold Tailings Facility has elevated concentrations of TDS, chloride, sodium, and sulfate. These elevated concentrations are associated with a solute plume originating from the existing Gold Tailings Facility. The source of the plume is an unlined copper and gold tailings disposal area that was used intermittently from 1966 to 1993. The plume currently is being managed by groundwater extraction in accordance with the State of Nevada WPCP. The groundwater extraction wells have a strong seasonal influence on the groundwater system in the area directly beneath and to the south of the tailings disposal area. These wells typically are continuously pumped during the spring, summer, and autumn months, and intermittently pumped in the winter as necessary to control downgradient migration of the plume.

3.2.2 Environmental Consequences

The primary issues related to water resources include: 1) reduction in surface water or groundwater quantity for current users and water-dependent resources from water supply withdrawals or drainage modifications; 2) impacts to groundwater or surface water quality from the construction, operation, and closure of mineral processing facilities (including HLFs) and waste rock facilities; and 3) impacts from flooding or erosion and sedimentation associated with construction, operations, or reclamation activities.

Environmental impacts to surface water resources would be significant if the Proposed Action or alternatives to the Proposed Action result in any of the following:

- Measurable reduction in the baseflow of perennial streams or in perennial spring flows;
- Degradation of the quality of surface water based on applicable state or federal regulations for designated or appropriate beneficial uses, including but not limited to, municipal or domestic water supply, irrigation, livestock watering, or support of wildlife or aquatic life;
- Alteration of drainage patterns or channel geometry resulting in accelerated erosion and sedimentation;
- Measurable reduction of seasonal surface flows caused by withdrawal of contributing watershed area or by channel blockages; or
- Damage to project facilities and on and off site resources during operation or post-reclamation as a result of inadequate drainage control features.

Environmental impacts to groundwater resources would be significant if the Proposed Action or alternatives to the Proposed Action result in the following:

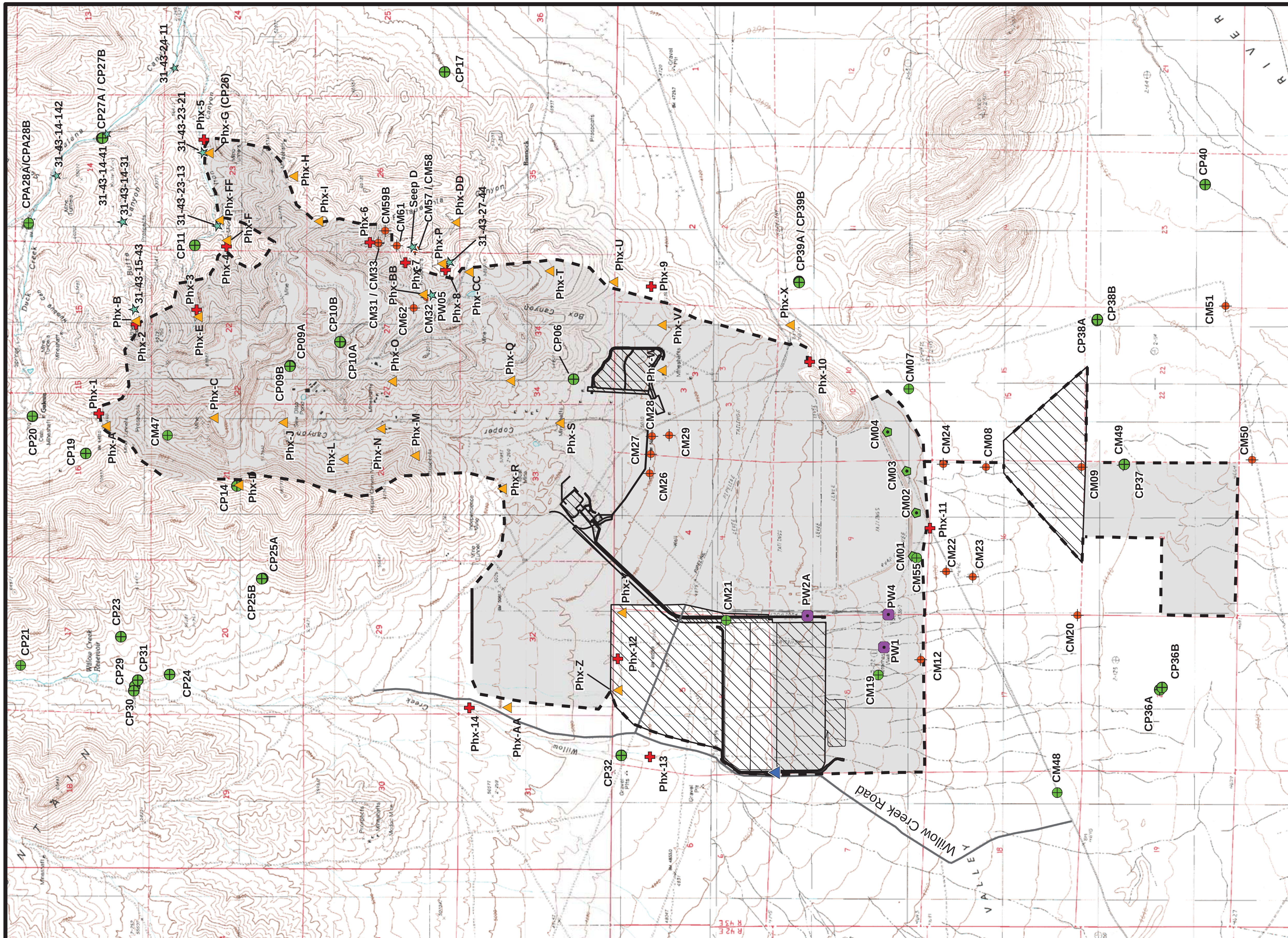
- Reduction of static groundwater levels that could adversely affect water supply, agricultural, or industrial wells caused by project development; or
- Degradation of groundwater quality downgradient from the project facilities such that one or more water quality constituents would exceed Nevada or federal primary or Nevada secondary enforceable maximum contaminant levels established to protect human health from potentially toxic or undesirable substances in drinking water; or where the quality of the groundwater already exceeds the maximum contaminant levels for drinking water, the quality would be lowered such that it would render those waters unsuitable for other existing or potential beneficial use.

Other potential impacts to wetlands and riparian areas are discussed in Section 3.4, Vegetation. Potential impacts resulting from the transportation, storage, and use of hazardous substances are addressed in Section 3.16, Hazardous Materials and Solid Wastes.

3.2.2.1 Proposed Action

<u>Groundwater Pumping</u>

A new groundwater production well would be constructed in the northwest corner of Section 8 to supply water for the copper heap leach process included in the Proposed Action. The new production well would be developed in the alluvial aquifer with a planned maximum flow rate of 1,000 gpm and a nominal flow of 600 gpm. Assuming an approximate 24-year active mine life of the proposed project, the total



Legend

- Proposed POO Boundary
- Proposed Production Well
- Proposed Action
- Proposed Action Linear Feature
- Permitted Disturbance
- Spring and Surface Water Monitoring Location
- Piezometer Monitoring Location
- Monitoring Wells (CM Series)
- Monitoring Wells (Phoenix Series)
- Chloride Plume Pumpback Wells
- Production Wells
- Surface Water Collection System

Humboldt, Elko, Pershing, Lander, Eureka, White Pine, Washoe, Lyon, Churchill, Mineral, Nye, Lincoln, Esmeralda, Clark

N

0 0.5 1 Miles

Source: NDEP 2010; Newmont 2010a.

Phoenix Copper Leach Project

Figure 3.2-5

Water Resources Monitoring Locations

05/26/2011

estimated groundwater that would be used for the proposed project would be approximately 23,000 acre-feet. Historically, groundwater pumping has occurred in the alluvial aquifer in existing permitted wells that are used for water supply and as part of a chloride-plume mitigation system. Between January 2005 and December 2009, the average monthly pumping rate from the existing production wells in the alluvial system has ranged from 24 to 4,389 gpm. These existing permitted groundwater production wells are anticipated to continue to be pumped in the future until the end of the mine life.

Potential impacts to groundwater levels and surface water resources resulting from the proposed groundwater pumping were evaluated using a calibrated groundwater flow model developed for the site. The model was designed to simulate groundwater flow in the alluvial aquifer system. The groundwater modeling was conducted by Itasca using a three-dimensional finite-element computer code (MINEDW). Details regarding the model setup and implementation including steady-state and transient calibration are provided in the model documentation report (Itasca 2010).

The calibrated groundwater model was used to simulate two different pumping scenarios:

Scenario 1 – Historical and future pumping of existing permitted wells with the additional pumping from the proposed new production well; and

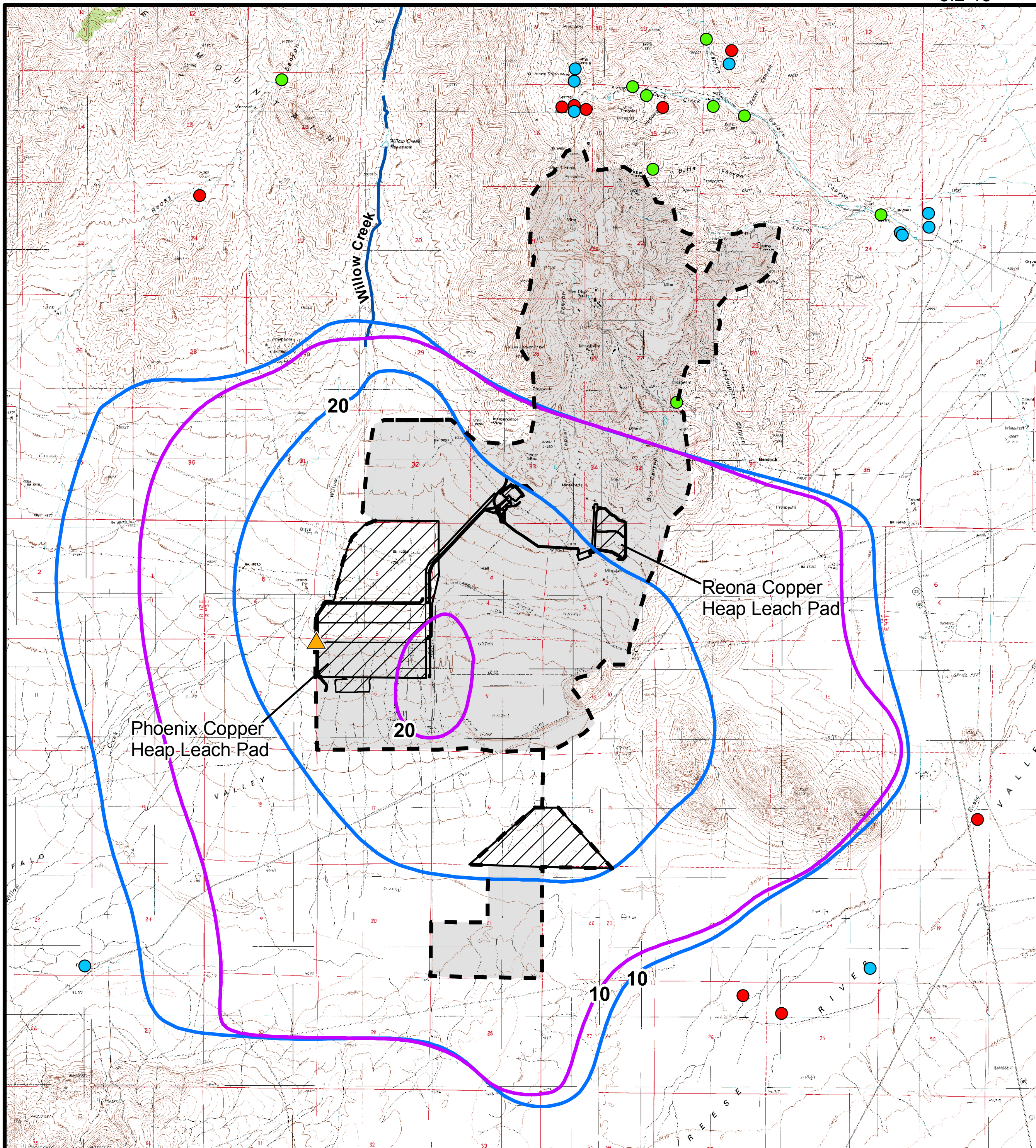
Scenario 2 – Historical and assumed future pumping of existing permitted wells (without the proposed new production well).

The predicted drawdown at the end of mining resulting from the two pumping scenarios is presented in **Figure 3.2-6**. The difference between the two model scenarios represents the incremental increase in drawdown attributable to the proposed production well. The results indicate that groundwater withdrawal from the proposed well is expected to result in a slight increase in drawdown compared with the currently permitted groundwater pumping activities. The simulated drawdown area does not encompass any known perennial surface water resources or surface water rights.

The closest perennial stream reach to the groundwater development site is along Willow Creek located approximately 2 miles upstream (and north) of the site. The groundwater flow model was used to simulate flows in Willow Creek. The model results suggest that the pumping included in Scenarios 1 and 2 would have a negligible effect (less than 0.01 cubic feet per second) on stream flows in Willow Creek compared to the assumed baseline conditions (Itasca 2010). Therefore, pumping of the proposed production well is not expected to affect perennial flows in Willow Creek.

<u>Process Facilities</u>

Proposed facilities included in the Proposed Action would be designed, constructed, operated, and monitored in accordance with NDEP and BLM permit requirements and associated plans and procedures. Examples of NDEP requirements include process component design factors, such as the synthetic linings under the heap leach pads, the synthetic linings and storage capacities of process pond systems, and other aspects of process fluid containment. Temporary and permanent diversion channels designed to convey the 100-year, 24-hour storm event would be constructed around the proposed Reona and Phoenix copper HLFs to capture and divert sheet flow generated from upgradient source areas around the facilities. (Additional discussion of these diversion structures is provided under the Other Flooding, Erosion Sedimentation, and Runoff Related Impacts.)



Legend

- Proposed POO Boundary
- Proposed Action
- Proposed Action Linear Feature
- Permitted Disturbance
- Proposed Production Well
- Scenario 1 - Drawdown Contour with Copper Leach Water Supply Well
- Scenario 2 - Drawdown Contour without Copper Leach Water Supply Well
- Perennial Stream Reach
- Perennial Spring
- Groundwater Rights on File at State Engineer's Office
- Surface Water Rights on File at State Engineer's Office

N

0 0.6 Miles

Source: Itasca 2010.

Phoenix Copper Leach Project

Figure 3.2-6

Model Simulated Drawdown at End of Mining

05/26/2011

The proposed process facilities would be constructed and operated as zero-discharge facilities, as defined through the WPCP review and approval process by the NDEP.

The water resources monitoring plan describes the ongoing program for ascertaining water quality within the currently authorized POO boundary (Battle Mountain Gold Company [BMG] 2000). In the plan, monitoring locations Phx-9 and Phx-10 track surface water conditions in the Reona vicinity, and monitoring locations Phx-11, Phx-12, and Phx-13 monitor conditions in the vicinity of the proposed Phoenix Copper HLF. It is likely that selected surface water monitoring locations may be added or modified as a result of the Proposed Action. Additional monitoring associated with the proposed POO amendment would be specified in revisions to WPCP NEV87061. Quarterly monitoring reports would continue to be submitted to appropriate agencies.

The following discussion evaluates the potential impacts to water resources associated with construction, operation, and closure of the proposed copper HLFs; proposed facilities that could be constructed in the Section 5 OUA; other impacts associated with flooding, erosion, and sedimentation; and runoff from the proposed facilities.

Copper Heap Leach Facilities

The geology in the vicinity of the proposed copper HLFs and SX-EW Facility located in the southern portion of the existing mine site is shown in **Figure 3.1-2**. The proposed facilities are situated in areas underlain by alluvial sediments consisting of unconsolidated gravel, sand, silt, and clay. The thickness of the alluvium is inferred to range from approximately 100 to 300 feet in the vicinity of the proposed copper HLFs (SWC 2007).

The water table was not encountered within the depth of geotechnical exploration borings (i.e., 102 feet, Phoenix Copper HLF; 110 feet, Reona Copper HLF) drilled at the proposed leach pad sites (SWC 2007). Based on nearby monitoring wells, the depth to groundwater is estimated to range from 160 to 200 feet beneath the proposed copper HLFs (Halepaska and Associates 2007).

The general groundwater elevation within the vicinity of the Phoenix Mine is illustrated in **Figure 3.2-4**. The groundwater elevation contours indicate that the general direction of groundwater flow beneath the proposed Phoenix Copper HLF is towards the south in the western and central portion of the facility, and towards the southeast under the southeastern portion of the facility. The groundwater elevations and gradient along the southeastern portion of the Phoenix Copper HLF influenced by drawdown resulting from seasonal groundwater pumping associated with the existing Phoenix tailings facility chloride plume remediation system. The groundwater gradient beneath the proposed Reona Copper HLF is towards the south.

As described in the Phoenix Project Final EIS (BLM 2002a), numerical model simulations of mine-induced drawdown resulting from the previously proposed and authorized dewatering operations predicted that the groundwater elevations in the vicinity of the mine would be reduced by the end of the anticipated mine life. This drawdown is predicted to range from several 10s of feet at the location of the proposed Phoenix Copper HLF to over 100 feet beneath the proposed Reona Copper HLF.

<u>Geochemical Characterization</u>. Geochemical characterization tests were performed on eight bulk rock samples of copper leach ore. The tests were conducted to evaluate the geochemistry of the process leach solutions, and leachate generated from the spent ore using various methods for rinsing and neutralization. The tests included column leach tests, Modified Acid/Base Static Acid Rock Drainage Potential Tests, and Meteoric Water Mobility Procedure Tests. The testing methodology and results are presented in the material testing report prepared by McClelland Laboratories, Inc. (McClelland 2008a,b).

The results of the column leach test indicate that the process leach solutions would be acidic (average pH 1.8) and contain high metals, sulfate, and TDS concentrations (McClelland 2008a,b). The rate of infiltration of meteoric water into the HLF facilities during the closure and post-closure period will depend on the final HLF cover design. Active fresh water rinsing is not proposed as part of closure. Depending on the final cap design, meteoric water may control the long-term flow rates from the HLF during closure (Geomega 2010). The infiltration of meteoric water after the cessation of acid leaching could change the concentration of the effluent water quality of the leachate from the HLF's during closure and post-closure. For example, laboratory testing conducted by applying the equivalent of three pore volumes of fresh water over each sample column of spent ore indicate that this fresh water addition would slightly increase the pH to an average of 2.6 and decrease the concentrations of metals, sulfate, and TDS in the leachate (**Table 3.2-4**).

ABA often is used as a screening tool for discriminating rocks with the potential to generate acid by reacting with air and water from rocks that have the potential to consume acid. ABA is based on determinations of the acid-generating potential, which is a function of the amount of sulfide minerals in a rock, and the acid-neutralizating potential, which is a function of the amount of carbonate minerals in a rock. The acid-neutralizating potential and acid-generating potential are determined in static tests and are expressed in terms of tons of $CaCO_3$ per kiloton of rock. The difference between the acid-neutralizing potential and the acid-generating potential is called the net neutralization potential.

The BLM's State of Nevada Acid Rock Drainage Testing Requirements (IM No. NV-8009-032 and IM No. NV-2010-014) (BLM 1996) states that rocks with a ratio of acid-neutralizating potential to acid-generating potential greater than 3 probably will not generate acid through exposure to air and water. For rocks with a ratio less than 3, additional testing may be conducted to obtain a better measure of the potential for the rocks to generate acid. The criterion used by the State of Nevada for designating waste rock as acid-generating is a ratio of acid-neutralizing potential to acid-generating potential of less than 1.2. Modified Acid/Base Static Acid Rock Drainage potential tests were conducted on the leached (spent ore) that also had been rinsed with three volumes of fresh water. The results of the Modified Acid/Base Static Acid Rock Drainage Potential tests indicate that the leached ore could produce some acid in the natural weathering and oxidizing environment because the net neutralization values were small positive and negative values (ranging from less than 2.49 to -2.36); and ratio of acid-neutralizating potential to acid-generating potential ranged from 1.05 to 0.42 (**Table 3.2-5**).

Meteoric Water Mobility Procedure testing is designed to simulate solutes washing off the surfaces of rocks when they are exposed to rain or snow melt. The test are conducted by rinsing the sample columns with 5 liters of water with a pH from 5.6 to 6.0 over 24 hours. The water passing through the rocks in the column is then collected and analyzed for chemical composition. Meteoric Water Mobility Procedure tests were conducted on the leached (spent ore) that had been rinsed with three volumes of fresh water. The results of the test (**Table 3.2-4**) indicate that the Meteoric Water Mobility Procedure test leachate generated from the spent ore contained acidity (average pH 3.5), aluminum, arsenic, beryllium, cadmium, copper, iron, manganese, nickel, pH, sulfate, TDS, and zinc concentrations that exceed the Nevada primary and secondary drinking water MCLs.

<u>Construction and Operation Impact</u>. As described above, the geochemical testing results indicate that the leachate from the proposed HLFs (during the copper leaching process) would be strongly acidic and have high concentrations of metals. The design of the HLFs is described in Section 2.3.3, Copper Heap Leach Facilities. Under the Proposed Action, the facility would be designed in accordance with standard geotechnical design practices; would include a composite liner and leak detection system; and would be designed, constructed, operated in accordance with NDEP requirements for a zero discharge facility. Therefore, significant impacts to surface water and groundwater quality from these facilities are not anticipated during construction and operation.

Table 3.2-4 Summary of Column Leach and Meteroic Water Mobility for Leached Phoenix Copper Heap Bulk Ore Samples[1]

Constituent (mg/L)[1]	Nevada Drinking Water Standards[2]	Average Effluent Water Quality Generated During Copper Leaching of Bulk Ore Samples[3]	Average Effluent Water Quality from Leached Ore After Rinsing with Three Pore Volumes of Fresh Water[4]	Average Water Quality from Meteoric Water Mobility Tests of Leached Ore[4]
Aluminum	0.05[5] – 0.2[6]	4,800	465	31
Antimony	0.006	0.01	<0.0025[7]	<0.0025[7]
Arsenic (total)	0.01	111	2.34	0.20
Barium	2	0.38	0.09	0.03
Beryllium	0.004	0.7	0.07	0.008
Cadmium	0.005	31	3.0	0.47
Chloride	250[5], 400[6]	102	23	5.0
Chromium (total)	0.1	11.2	1.1	0.04
Copper	1.3[4], 1.0[6]	624	77	48
Fluoride	2.0[5], 4.0[6]	141	23	1.8
Iron	0.3[5], 0.6[6]	5,000	179	6
Lead	0.015[4]	0.58	0.11	<0.020[7]
Magnesium	125[5], 150[6]	3,300	371	50
Manganese	0.05[5], 0.1[6]	640	42	4.9
Mercury	0.002	0.0010	0.00230	0.0012
Nickel	0.1	83	7.6	1.3
Nitrate (as N)	10	6.7	1.27	<1.0
pH (standard units)	6.5 – 8.5[6]	1.80	2.62	3.5
Selenium	0.05	0.52	0.03	0.009
Silver	0.1[6]	0.22	<O.050[7]	0.014
Sulfate	250[5], 500[6]	107,000	10,300	1,400
Thallium	0.002	0.030	0.009	0.002
TDS	500[5], 1.000[6]	71,000	8,700	1,600
Zinc	5.0[6]	890	69	10

1 Units are milligrams per liter (mg/L) unless otherwise noted.

2 Nevada primary MCLs unless otherwise noted.

3 Averages calculated based on the volume percentage of ore by rock type (Geomega 2010).

4 Averages calculated from analytical results for 8 samples provided in McClelland 2008a.

5 Federal secondary MCLs.

6 Nevada secondary MCLs

7 All Values below detection limits.

Sources: Geomega 2010 (compiled from analytical data provided in McClelland 2008a,b).

Table 3.2-5 Summary of Acid-base Accounting Tests for Column Leached and Rinsed Phoenix Copper Heap Bulk Ore Samples

Sample	Paste pH	Acid-Generating Potential (AGP)[1,2]	Acid-Neutralization Potential (ANP)	Net Neutralization Potential (NNP)	Ratio (ANP:AGP)
Harmony Oxide (AC-1)	4.61	2.19	2.3	0.11	1.05
Pumpernickel PL (AC-7)	4.28	0.31	<0.3	-0.31	<0.75
TAG Oxide (AC-20)	5.01	0.63	<0.3	-0.63	<0.53
TAG PL (AC-26)	4.31	<0.31	<0.3	0.00	N/A
Harmony PL (AC-34)	4.02	0.31	<0.3	-0.31	<0.86
Pumpernickel Oxide – 2nd (AC-42)	4.69	4.06	1.7	-2.36	0.42
Virgin Fault (AC-48)	3.59	0.31	<0.3	-0.31	<0.65
Pumpernickel Oxide – 1st (AC-61)	4.58	<0.31	2.8	<2.49	N/A

1 AGP based on pyritic $S^{=}$ content ($S^{=}$% x 31.25).

2 AGP, ANP, and NNP in units of tons CaCO3 equivalents per 1,000 tons of solids.

Source: McClelland 2008a,b.

<u>Closure and Post-Closure Impacts</u>. The geochemical testing results suggest that the spent copper ore has the potential to develop leachate from the infiltration of precipitation that likely would be acidic and contain concentrations of aluminum, arsenic, beryllium, cadmium, copper, iron, manganese, nickel, sulfate, TDS, and zinc that exceed the Nevada primary and secondary drinking water MCLs. A Final Plan for Permanent Closure of the copper heap leach pads, detailing draindown, solutions management, and any necessary management requirements for any long-term effluent discharge and closure, would be developed 2 years prior to project closure in accordance with NDEP requirements (NAC 445A.446 and 445A.447) and Nevada BLM's Reclamation/Closure Policy for Hardrock Mining Activities (IM-2004-065). In accordance with NAC 445A, permanent closure plans for process facilities are required to provide for chemical and physical stabilization of the project area such that facilities do not present the potential to degrade waters of the State.

Two closure options for the proposed copper HLFs are described in Section 2.4.3.1 and included in the Proposed Action. Under Closure Option 1, the heap leach pads would be covered with either a 5-foot engineered ET alluvial cap; Closure Option 2 would consist of an engineered synthetic liner with an ET alluvial cap. At the early stages of closure, the draindown would be managed by active evaporation at the top of the copper heap leach pads using evaporators. Once draindown flow rate is reduced to relatively low flow rates, the draindown would be managed by passive evaporation in a series of specially designed E-ponds (see Section 2.4.3.2 for detailed description).

The E-ponds would include a double-lined system with leak detection to prevent infiltration to groundwater. Monitoring and sampling of the draindown would continue during the closure of the heaps as per the WPCP for the copper HLFs. Newmont would monitor the E-ponds for buildup of excess precipitates and perform periodic maintenance of the E-ponds as necessary to provide for adequate storage capacity to manage the residual draindown fluid during the closure and post-closure period. After ponds storage capacity for precipitate is reached they would be covered with 5 feet of alluvial material and 2 feet of growth media and seeded. Cover material and growth media would be obtained from stockpiles near the ponds. New E-ponds would be constructed as necessary to manage long-term draindown. All E-ponds would be fenced and bird netted to preclude wildlife access to the residual leachate solution.

The HLDE model was used to estimate solution volumes and flow rates that would drain once application of solution to the HLFs ceases for the initial 30 year closure period under Closure options 1 and 2. The methodology and input parameter values assumed for the analysis are described in the Closure Options Evaluation Report (JBR 2011). For the alluvial cap (Closure Option 1) the results of the analysis estimate average flow rates after 30 years of draindown of 10.3 gpm for the proposed Phoenix HLF, and 1.2 gpm from the proposed Reona HLF. These rates are based on an assumed infiltration rate of 2 percent of annual precipitation for the covered reclaimed facilities.

For the synthetic liner and alluvial cap (Closure Option 2), the HLDE model results estimate the average flow rates after 30 years of draindown of 8.7 gpm for the proposed Phoenix HLF, and 0.9 gpm from the proposed Reona HLF (JBR 2011). These results are based on an assumed infiltration rate of 0 percent to reflect the presence of the synthetic liner system that would cover the facility and inhibit infiltration.

The yearly draindown estimates from the HLDE model estimates also indicated that the long term steady state flow rates from the HLFs were not reached within the 30-year draindown simulation period. Geomega reviewed available draindown curves for 19 existing HLFs in Nevada that had potentially reached steady-state flow rates ranging from approximately 0 to 3 percent of annual precipitation with higher rates generally occurring at higher elevation sites. Geomega concluded, after review of the draindown curves for similar existing HLFs, that the long-term infiltration rate is anticipated to be about 2 percent of annual precipitation at the Phoenix and Reona HLFs (Geomega 2010).

AMEC (2011b) used a computer model to estimate the long-term steady state drainage from the Phoenix and Reona HLFs resulting from either a alluvial cap (Closure Option 1) or synthetic liner and alluvial cap (Closure Option 2). The infiltration modeling was conducted using the finite element based program HYDRUS Version 4.14 (Simunek et al. 2009) designed to simulate variably saturated flow (including unsaturated flow) through a porous medium. Details regarding the input parameters including the material properties and boundary conditions are summarized in the AMEC (2011b) report. The estimated average annual rainfall at the Phoenix Copper Leach Project site is approximately 7.3 inches. The anticipated infiltration rate through the cover systems range from 2 percent of the average annual rainfall for the alluvial cap (Closure Option 1) to 0 percent of average annual rainfall for the synthetic liner and alluvial cap (Closure Option 2). To account for uncertainty in the infiltration rate, modeling was conducted for infiltration rates ranging from 0 to 3 percent. Each model scenario was simulated for a period of 500 years.

The model simulated long-term steady state effluents rates from the Phoenix HLF (assuming infiltration rates ranging from 0 to 3 percent) range from 0.4 gpm to 4.3 gpm (**Table 3.2-6**). Using the 2 percent infiltration rate as the best estimate for the alluvial cap (Closure Option 1), the model simulated draindown curve for this scenario indicates that the flow rates reach a steady state flow of 2.9 gpm at approximately 130 years after closure (AMEC 2011b, Figure 4).

Assuming an approximate 0 percent infiltration rate for the synthetic liner and alluvial cap (Closure Option 2), the model results indicate that the Phoenix HLF reaches steady state flow rate of 0.4 gpm after approximately 450 years. The model simulated draindown curve for this scenario indicates that the flow rates would reduce from approximately 4 gpm after 50 years, to 1.8 gpm after 100 years, to less than 1.0 gpm after 180 years. Between 180 years and 450 years the flow rate under this scenario gradually declines to 0.4 gpm at 450 years (AMEC 2011b, Figure 4). The AMEC report concludes that the soil properties and restriction of meteoric recharge would likely result in negligible effluent (or none) after 500 years.

For the Reona HLF, the model simulated long-term steady state effluents rates (assuming infiltration rates ranging from 0 to 3 percent) range from <0.1 gpm to 0.6 gpm (**Table 3.2-6**). Using the 2 percent infiltration rate as the best estimate for the alluvial cap (Closure Option 1), the model simulated draindown curve for this scenario indicates that the flow rates reach a steady state flow of 0.4 gpm at approximately 80 years after closure (AMEC 2011b, Figure 5). Assuming an approximate 0 percent infiltration rate for the synthetic liner and alluvial cap (Closure Option 2), the model simulated long-term steady state flow rate of <0.1 gpm reached at approximately 200 years after closure.

Table 3.2-6 Estimated Long-term Post Closure Steady-State Effluent Rates for the Proposed Phoenix and Reona Copper HLFs

Assumed Meteoric Water Infiltration Rate (as % of Precipitation)	Meteoric Water Infiltration Rate (in/year)	Phoenix HLF Long–term, Steady-State Effluent Rates (gpm)[1]	Reona HLF Long–term, Steady-State Effluent Rates (gpm)[1]	Best Estimate for Specific Closure Option
0	0	0.4	<0.1	Closure Option 2
1	0.07	1.5	0.2	
2	0.15	2.9	0.4	Closure Option 1
3	0.22	4.3	0.6	

[1] Results rounded to the nearest tenth of a gpm.

Source: AMEC 2011b.

In summary, the geochemical testing results suggest that the spent copper ore has the potential to develop leachate from the infiltration of precipitation that would likely be acidic and contain elevated concentrations of heavy metals, sulfate, and TDS. The proposed design of the E-ponds and procedures for E-pond closure and replacement would provide for management of leachate generated from the HLFs in the closure and post-closure period (under either Option 1 or Option 2) and prevent the solution from infiltrating to the groundwater system or impacting surface water resources. Mineral precipitate that forms through evaporation in the E-ponds would be contained within the lined and covered E-ponds. Therefore, construction, operation and closure of the copper HLFs and E-ponds are not expected to impact water resources.

Natomas Waste Rock Facility

There is no proposed change in the design of the previously permitted Natomas WRF; however, development of the proposed project would reduce the volume of material, and reduce the ultimate height of the previously permitted Natomas Waste Rock Facility that was evaluated as part of the Phoenix Project EIS (BLM 2002a). This reduction in volume would occur because waste rock material that would have been placed in the Natomas WRF under the original Phoenix Project would now be placed on the proposed copper HLFs. The reduction in volume would likely reduce the height of the waste rock facility from the original 540 feet that was proposed for the Phoenix Project to an estimated thickness of 280 feet (Newmont 2010c). The actual final height and configuration of the facility at the end of mining may be more or less depending on future economic conditions.

The Phoenix Project EIS (BLM 2002a) estimated the potential effects of infiltration of acidic leachate generated in WRFs on groundwater quality beneath or downgradient from the facilities. A contingent long-term groundwater management plan (Brown and Caldwell 2000b) was developed to mitigate potential impacts to groundwater quality associated with infiltration through the Phoenix Project WRFs. New estimates of the time required for meteoric water to infiltrate through the reconfigured Natomas

WRF were calculated for this impact analysis (Newmont 2010a). The estimates were developed using essentially the same approach and calculation method developed for the Phoenix Project EIS by Exponent (2000). The reduction in the final elevation of the Natomas WRF resulted in a slight reduction in the estimated precipitation amount and net infiltration rate. An additional change included the use of alluvium as cover material for reclamation rather than oxide waste rock material that was assumed in the original analysis. The BLM approved the use of alluvium as part of the approved Phoenix Mine WRMP (Newmont 2008a).

The overall results for the Natomas WRF are similar to the results provided in Exponent (2000) (i.e., that the estimated time required for meteoric water to flow through the facility and reach the water table is >1,000 years). The modeling results indicate that the reduced configuration would have little effect on the time required for meteoric water to infiltrate through the facility and underlying bedrock and reach groundwater. Therefore, the change in the configuration of the Natomas WRF resulting from the Proposed Action is not expected to change the timing of potential impacts to groundwater quality that was previously addressed in the Phoenix EIS (BLM 2002a).

Section 5 Optional Use Area

Per the proposed POO amendment (Newmont 2010a), Newmont proposes designation of the Section 5 OUA for use as a borrow area. The area to be designated as the Section 5 OUA would be located primarily north of the proposed Phoenix Copper HLF (**Figure 2.3-1**).

Surface water resources in these areas are limited to small ephemeral channels crossing the alluvial fan system. The proposed project area is underlain by alluvium sediments. Available information suggests that of the thickness of the alluvial sediments and depth to groundwater is greater than 100 feet throughout the area.

Reclamation of the borrow area would be planned in accordance with a reclamation plan permit application, which would undergo a review and approval process by the NDEP and BLM in accordance with the agency Memorandum of Understanding (MOU) for reclamation and water quality management. Site drainage and storm water pollution prevention would be part of the construction, operation, and reclamation objectives. Therefore, based on the current designs and regulatory requirements, no significant impacts to surface water quantity or quality are currently anticipated for this area.

Other Flooding, Erosion, Sedimentation, and Runoff Related Impacts

No impacts to delineated flood hazard Zone A areas would occur under the Proposed Action. Zone A delineations identify locations where flooding from a 100-year, 24-hour runoff event is expected. Identification of potential flood hazard zones by the Federal Emergency Management Agency (FEMA) indicates that Zone A delineations occur along the Lower Reese River, and on Willow Creek downstream of the southern portion of Section 12, T30N, R42E (FEMA 2008). The latter area is approximately 1.5 miles downstream of the proposed Phoenix copper leach pad. Due to the zero-discharge requirements for managing and monitoring process fluids, Newmont would avoid most potential impacts to surface water quality.

The NDEP reviews and approves applications under General Permit NV300000 for storm water discharges to waters of the U.S. associated with metals mining activities (NDEP 2008a). Although no waters of the U.S. would be affected by the Proposed Action, Newmont typically has enacted procedures and practices to avoid water quality impacts from storm water runoff from project facilities, haul roads, and other project disturbances. Even though storm water runoff typically would not mix with process solutions, it still may contain suspended and dissolved solids eroded from disturbed surfaces. To avoid or minimize the potential for surface water quality impacts from such sources, BMPs such as operator education, erosion controls, storm water diversion and detention, spill responses, observing cleaning and maintenance schedules, and proper trash handling practices have been employed at Phoenix operations. A SWPPP was submitted in November 2007 to the NDEP-Bureau of Mining Regulation and

Reclamation. Along with other pollution-control programs, these continuing practices would help minimize impacts to runoff water quality within the project area and downstream.

The planned storm water diversions around the proposed Reona and Phoenix Copper HLFs may have relatively sharp bends or steep channel gradients. Estimated peak flows and velocities resulting from a 100-year, 24-hour storm event have been used for designing the diversion channels and riprap lining for the channels. In the unlikely event of a channel failure, storm water at the proposed Phoenix Copper HLF would disperse onto the adjacent alluvial fan, whereas overflow from the Reona diversion channel would report to the existing tailings storage facility. Newmont would undertake diversion repairs immediately. Minimal impacts to surface water quantity or quality would occur in either case.

The Reclamation Plan describes interim and final practices that currently are and would continue to be used to stabilize the site and minimize the exposure of facilities to runoff and accelerated erosion. The reclamation of process ponds, heaps, process buildings, roads, and ancillary facilities are specifically planned and financially bonded. Measures to control runoff, run-on, and erosion and sedimentation from mining and processing facilities are part of ongoing site practices. Additional description of these measures is provided in Section 2.4.3, Facility Reclamation. Drainage management and reconstruction, including road ditches and drainage at channel crossings, is part of ongoing and planned reclamation and stabilization programs that would help decrease surface water impacts within the proposed POO boundary and downstream. Disturbance and reclamation at the proposed Section 15/16 Borrow Area on the lower-elevation valley fill would not affect surface water. The area has subdued drainage with little or no channel network or ponding.

<u>Willow Creek Flooding and Channel Migration</u>. The active floodplain for Willow Creek is located west of the proposed Phoenix Copper HLF (**Figure 3.2-3**). Willow Creek in this area is characterized as a largely incised braided channel that experiences seasonal, ephemeral flow. AMEC (2011b) conducted an evaluation to assess: 1) the potential risk of flooding from the 100-year, 24-hour runoff event occurring in the Willow Creek watershed; and 2) the potential risk of channel migration along Willow Creek to affect the facility. The risk of flooding was evaluated using the USACE's computer Program HEC-RAS 4.1.1 and detailed topographic surveys with transects across Willow Creek and the proposed facility footprint. The results of this study indicate the site would not be subject to flooding during the 100-year, 24-hour event.

An evaluation of the geomorphic conditions observed in the field indicate that the proposed footprint of the facility is located east of the area that is subject to channel migration (AMEC 2011b). The northwest corner of the proposed Phoenix Copper HLF is the portion of the pad that is situated closest to the channel migration area. In this area, the proposed HLF would be situated approximately 8 to 15 feet higher than, and east of a well defined slope that bounds the channel migration area. In addition, field observations indicate that there is no evidence of historic debris flows in the lower Willow Creek drainage. This combined with the observed size of the channel suggest that debris flows are unlikely to pose a threat to the HLF. The results of the evaluation conclude that *"channel avulsion or erosion is not anticipated to occur in magnitudes that would endanger or undercut the Phoenix Copper HLF during operational or closure timeframes."* Therefore, potential impacts due to flooding, erosion, or deposition along Willow Creek are not anticipated.

<u>Spills and Release-related Impacts</u>

With respect to the potential for impacts from spills and releases, the Emergency Response Plan (Newmont 2010a) further describes procedures Newmont would use to respond to such occurrences, if needed. Reagents used for the copper recovery primarily would consist of sulfuric and hydrochloric acids. These would be managed by monitoring from central control rooms. Newmont would extend its current program to the new facilities. Controls would consist of primary and secondary containment, pumps, and backups within the process flow circuit. Additional sumps and portable pumps and pipelines would provide contingency controls. Concrete floors and curbs would provide secondary containment at process buildings associated with the proposed SX-EW plant. The floors would slope to drains connected to sumps. The capacity of secondary containment at the process buildings would be sufficient to contain releases and spills. Cleanup and further containment capacity would be available by using mine equipment, and supplies of absorbent materials and over-pak drums would be staged at selected locations. Based on existing and proposed response programs, minimal impacts to surface water quality are anticipated from spills and releases at the mine site.

A maximum of 50,000 gallons per day (gpd) of sulfuric acid is anticipated to be delivered to the proposed project by truck. Assuming that the acid is purchased from a chemical supplier in the Town of Battle Mountain, it would be transported up the Lower Reese River Valley on SH 305 to the project area. If a spill occurred in transport, the likelihood of significant surface water quality impacts would be low. Each truck would transport approximately 2,500 gallons per load. The overall route is generally 2.5 to 5 miles away from the Reese River, and primarily crosses porous alluvial fan sediments. Most channels that are intercepted by the road are ephemeral. Because of these factors, it is likely that a spill of sulfuric acid in transport would seep into the ground before reaching a waterbody. Subsequent clean-up efforts and attenuation within calcareous soils would further minimize the potential for significant impacts to surface water quality.

Additional reagents would be trucked to the mine site (see **Table 2.3-5**). Major chemicals would include an organic copper solvent extractant (e.g., Cognis LIX-984), a diluent such as SX-12 (a solvent extraction grade of kerosene), and liquid cobalt sulfate heptahydrate for use in the copper EW circuits. Both the extractant and diluent have specific gravities less than 1.0 (likely to float on a water surface), and both are biodegradable. Cobalt sulfate heptahydrate is toxic to aquatic organisms and may cause long-term adverse effects in an aquatic environment. Given the semi-arid setting, transportation safety protocols, Newmont's Emergency Response program, and the general lack of surface waterbodies in the area, there is little risk of significant impacts to surface water quality from these materials.

3.2.2.2 Reona Copper Heap Leach Facility Elimination Alternative

The Reona Copper HLF Elimination Alternative would be similar to the Proposed Action, except that the Reona Copper HLF and associated infrastructure (i.e., solution pipelines) would not be developed. The Reona HLF (Gold) would continue to operate under current permitted authorizations. Makeup water requirements for the Reona Copper HLF would require an estimated peak monthly flow rate ranging from up to 52 gpm (during a dry year) and 36 gpm (during an average year) (Ecological Resource Consultants, Inc. 2007). Under this alternative, no water would be required for the leach process at the Reona Copper HLF since the facility would not be constructed. All other direct and indirect impacts associated with this alternative would be the same as the Proposed Action.

3.2.2.3 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed and associated impacts to water resources would not occur. Under this alternative, the existing Phoenix Project would continue to operate under existing authorizations and approved plans. Potential impacts to water resources previously were discussed and analyzed in the Phoenix Project Final EIS (BLM 2002a). The ongoing operations and reclamation programs, and activities resulting from the WRMP and the water resources monitoring plan, would continue to be conducted. Through these procedures and practices, which involve compliance with the WPCP and other permit authorizations, Newmont would decrease the potential for significant impacts to water resources.

3.2.3 Cumulative Impacts

The CESA for water resources is shown in **Figure 3.2-1**. Past and present actions and RFFAs are identified in **Table 2.8-1**; their locations are shown in **Figure 2.8-1**.

Major past and present mining disturbances within the CESA include the existing Phoenix Mine, Copper Basin Mine, Copper Queen/Copper King Mine, Trenton Canyon Mine, Buffalo Valley Mine, Sunshine Mine, and Independence Mine.

Past and present actions and RFFAs within the CESA have resulted, or would result, in the direct disturbance of approximately 21,688 acres, of which approximately 12,317 acres have been related to mining activities; 490 acres related to exploratory projects; and 8,881 acres related to utilities/community actions (e.g., transmission lines, interstate highways, secondary roads, landfills).

An unquantifiable portion of this disturbance has, or would, result in a permanent alteration of the natural topography. Of the 902 total acres of disturbance that would occur under the Proposed Action, the proposed project would incrementally increase the permanent alteration of topography within the CESA on approximately 852 acres.

The Buffalo Valley Mine was an open-pit, heap leaching operation. Mining and processing ceased in 1990, but gold exploration continues in the area. Exploration disturbance in the locale primarily includes the construction of drill sites, roads, sediment traps, bulk sampling trenches, and staging/office areas. With respect to the other projects listed above, potential direct and cumulative impacts are described in earlier NEPA documents. These primarily include the Trenton Canyon Project Final EIS (BLM 1998a) and the Phoenix Project Final EIS (BLM 2002a).

Development of a new groundwater production well for the proposed project is expected to result in a slight increase in the magnitude and aerial distribution of drawdown in the alluvial aquifer system. Historically, groundwater pumping has occurred in the alluvial aquifer in existing permitted wells that are used for water supply and as part of a chloride-plume mitigation system. These existing permitted groundwater production wells are anticipated to continue to be pumped in the future until the end of the mine life. The cumulative drawdown was evaluated using the calibrated groundwater flow model developed for the proposed project as previously described. The model simulated cumulative drawdown in the alluvial aquifer resulting from the combined pumping from existing permitted wells and the proposed new production well is shown as Scenario 1 on **Figure 3.2-6**. The results indicate that the cumulative groundwater withdrawal in the alluvial aquifer is expected to result in a slight increase in drawdown compared with the currently permitted groundwater pumping activities. The simulated cumulative drawdown area does not encompass any known perennial surface water resources or surface water rights.

Groundwater drawdown impacts from pumping or pit lake evaporation in the currently permitted Phoenix Project would be localized, and would not have a significant impact on the water balance within the hydrographic areas (BLM 2002a). The Proposed Action is not expected to result in any impacts to the quality of surface water or groundwater resources. Therefore, the project is not anticipated to contribute to cumulative water quality impacts in the area.

Based on the minimal direct impacts to surface water flows expected from the Proposed Action, cumulative impacts to streamflow quantities would consist of those described in earlier NEPA assessments (BLM 2002a, 1998a). Surface water withdrawals are not being used as mining or processing supply sources in the area.

Additional sedimentation of stream channels is likely to occur in the immediate vicinity of mining and exploration projects within the CESA (BLM 1998a). This impact would be minimized by the implementation of BMPs during operations, and by reclamation practices after project activities cease. Stream channels below the mountain blocks are generally in a depositional environment naturally. With past and approved disturbance at the Phoenix Mine, Trenton Canyon, and in the Buffalo Valley vicinity, approximately 12,317 acres of mining-related disturbance has been authorized within the water resources CESA. The Proposed Action incrementally would increase the cumulative impacts by 902 acres. With approximately 1.16 million acres total in Buffalo Valley, the Lower Reese River Valley, and the Clovers Area, the total cumulative disturbance represents less than 1 percent of the land area in the three hydrographic areas combined.

3.2.4 Monitoring and Mitigation Measures

No significant impacts to geology and mineral resources were identified; therefore, no additional monitoring and mitigation measures are recommended.

3.2.5 Residual Adverse Effects

No residual adverse effects to water resources are anticipated from the Proposed Action or alternatives.