SUMMARY

Introduction

The Elko Field Office of the Bureau of Land Management (BLM) is currently preparing three environmental impact statements (EISs) for mining operations within their jurisdiction. These documents are Barrick Goldstrike Mines Inc.'s Betze Project Supplemental EIS, Newmont Gold Company's South Operations Area Project Amendment EIS, and Newmont Gold Company's Leeville Project EIS. During the preparation of these three EISs, the BLM determined the potential exists for cumulative environmental impacts associated with the ground water pumping and water management operations of these mines. To facilitate preparation of these EISs, the BLM directed the three third-party EIS contractors to cooperatively prepare this cumulative impact analysis (CIA) report to address potential cumulative dewatering and discharge impacts for all three mine projects.

This document analyzes the cumulative impacts associated with the dewatering and water management activities at the Goldstrike Mine (including the Betze-Post Pit and the Meikle Mine); the South Operations Area Project Amendment (SOAPA), which is an expansion of the Gold Quarry Mine; and the proposed Leeville Mine. In addition, the BLM considered the potential effects of other past, present, and reasonably foreseeable future actions that may potentially affect ground water and surface water resources within the area of potential effect, including the Humboldt River.

The objective of this report, as a stand-alone document, is to identify the potential cumulative impacts to environmental resources associated with the Goldstrike, Gold Quarry, and Leeville mines in the case of ground water drawdown, and the Goldstrike, Gold Quarry, Leeville, and Lone Tree mines in the case of dewatering discharge to the Humboldt River. This report identifies and describes the potential cumulative impacts associated with all of these projects and does not identify the incremental direct or indirect impacts associated with one or more individual projects. The discussions of the cumulative impacts associated with mine dewatering and dewatering discharge in the three individual EISs will reference and summarize the impacts discussed in this document. In addition, each individual EIS will identify the incremental direct and indirect dewatering and discharge impacts of that individual project; each EIS also will discuss the other types of cumulative environmental impacts (i.e., non-dewatering-related impacts) associated with the Proposed Action and project alternatives analyzed in that EIS.

This document addresses the environmental impacts to resources potentially affected by water management operations. Resources addressed in this analysis include geology, ground and surface water resources, riparian areas and wetlands, terrestrial wildlife, aquatic habitat and fisheries, special status species, livestock grazing, socioeconomics, and Native American religious concerns.

Impacts Summary

This section and Table S-1 summarize the potential cumulative environmental impacts associated with the dewatering and water management operations analyzed in this document.

Geology

The primary issue identified for this assessment of cumulative geologic impacts is the potential for development of sinkholes or other karst-type collapse features that could result from mine-induced drawdown and water management activities. Three sinkholes have been documented to date in the area since dewatering operations were initiated at the Goldstrike and Gold Quarry mines: 1) a sinkhole approximately 3.5 miles northwest of the center of the Betze-Post Pit, 2) a sinkhole approximately 2.8 miles west of the center of the Betze-Post Pit located near spring 6, and 3) a sinkhole along Maggie Creek in an area referred to as the Maggie Creek Narrows.

Available information on the geology in the region and prediction of mine-induced ground water drawdown were used to identify areas potentially susceptible to future sinkhole development; these areas include 1) areas underlain by carbonate rock located between the Betze-Post Pit and Gold Quarry Pit, 2) an area northwest of the Betze-Post Pit, and 3) an area along Maggie Creek located north of the Gold Quarry Pit. The areas that could be susceptible to sinkhole development are generally undeveloped areas. Critical mine-related facilities such as waste rock storage facilities, heap leach pads, and mill and tailings facilities are not located within these areas. Features included within these areas include a 1-mile segment of Boulder Creek, a 1-mile segment of Sheep Creek, a 2.5-mile segment of Maggie Creek, several springs and intermittent streams, a corral, and several dirt roads.

Water Resources and Geochemistry

Impacts from Mine Dewatering and Localized Water Management Activities

As of the end of 1998, 1,527 feet of drawdown had occurred to date in the vicinity of the Goldstrike Mine, and 658 feet of drawdown had occurred in the vicinity of the Gold Quarry Mine as a result of mine dewatering. In the vicinity of the proposed Leeville Mine, 360 feet of drawdown had occurred from existing dewatering operations at other mines. Ground water cones of depression have formed around the Goldstrike and Gold Quarry mines; both cones of depression exhibit a northwest-southeast elongation and apparently merge together beneath the Tuscarora Mountains southeast of the Carlin Mine.

Infiltration of excess mine water from the dewatering operations has resulted in an increase in water levels, or mounding, in the upper Boulder Valley and lower Maggie Creek areas. As of the end of 1998, water levels in the Boulder Valley region had risen up to approximately 70 feet in the rhyolite in the Sheep Creek Range and 50 feet in the alluvium in upper Boulder Valley. Seepage from Maggie Creek Reservoir and through infiltration along portions of lower Maggie Creek has resulted in an increase in water levels up to 45 feet.

Near the Goldstrike Mine, several springs located both within and outside of the current 10-foot drawdown area have dried up or shown a reduction in flow, and some of these effects may be related to mine dewatering. The flow and vegetation in Brush Creek, a tributary to Rodeo Creek, have changed substantially since 1993, indicating that this drainage has been impacted by mine dewatering. No other stream impacts have been identified on the western side of the Tuscarora Mountains. In addition, no effects on monitored spring flows have been identified in the vicinity of the Gold Quarry Mine.

Numerical models were used to predict ground water drawdown over time resulting from the cumulative mine dewatering. There are approximately 537 springs and seeps identified within the predicted cumulative 10-foot drawdown area. Hydrogeologic conditions, spring and seep surveys, elevations, and geochemistry for representative springs indicate that 182 of these springs and seeps are located in areas where perennial surface waters could potentially be impacted by drawdown.

Flows in some stream reaches could be reduced as a result of the mine-induced drawdown from the Goldstrike, Leeville, and Gold Quarry mine operations. Drawdown could impact flows in lower Maggie Creek, lower Marys Creek and adjacent areas, lower Susie Creek, Rock Creek, and Boulder Creek; the actual magnitude and extent of impacts to perennial streams is uncertain.

Ground water modeling results indicate that water levels in 115 ground water rights (with current *permit*, *certificate*, or *vested* status) could be lowered by at least 10 feet during the mine life or in the postmining period as a result of Barrick and/or Newmont ground water pumping. The point of diversion locations listed for 34 applications for ground water rights also are located within the cumulative 10-foot drawdown contour. In addition, there are five known wells (without water rights status) located within the identified cumulative drawdown area. Lowering the water levels in these wells would potentially reduce yield, increase pumping cost, or if the water level were lowered below the pump setting or below the bottom of the wells, the well would become unusable.

A potential reduction in the baseflow of perennial springs and streams could affect surface water rights within the drawdown area. There are 45 surface water rights located within the potential drawdown area. Thirty-two of these water rights are used either for irrigation or stock watering, and 13 are used for domestic, mining and milling, municipal, or other uses. The actual potential for impacts to individual water rights would depend on the site-specific hydrologic conditions that control surface water discharge.

Impacts to the Humboldt River

Surface discharge of excess mine dewatering water was initiated in 1992 and increased between 1992 and 1998. On an individual basis, the Lone Tree Mine began discharging treated water to the Humboldt River in 1992; the Gold Quarry Mine began discharging to Maggie Creek near Carlin, Nevada, in 1994; and the Goldstrike Mine discharged water to the Humboldt River from September 1997 to February 1999. In addition, the proposed Leeville Mine is anticipated to discharge to the river through the existing Goldstrike Mine water conveyance system beginning in the year 2000. All of these individual mine discharges would combine to produce the highest cumulative discharges to the river during the years 1999 through 2006. Substantially smaller cumulative discharges are planned to continue from 2007 through 2011. The mines

would not necessarily discharge to the river during the entire time they would be dewatering or conducting operations.

Comparison of monthly flows recorded at USGS gaging stations on the Humboldt River during the premine discharge period (1946 to 1990) with flows to date during the postmine discharge period (1991 to 1998) indicate that for all months except January 1997 at Battle Mountain, the range of flows recorded during the discharge period (1991 to 1998) are within the range of flows recorded historically (1946 to 1990).

Modeling of projected future discharges indicates that compared to the average premine conditions, the largest percentage increase in flow would occur in the lower flow months (late summer and fall months), and relatively little changes in flow are anticipated during the peak flow months (spring to early summer). Simulation of changes to flow during a low-flow year indicate that there is a large relative change to the average monthly flows for the low-flow late summer and fall months at both the Battle Mountain and Comus gages under the maximum discharge scenario.

Drawdown from the mine dewatering operations could reduce baseflow in the Humboldt River. The flow reductions would gradually increase to a temporary maximum of approximately 2 to 3 percent of the average annual volume by the years 2016 to 2019. These reductions in flow would represent a larger percentage of the flow during the low-flow months. Flows are predicted to gradually return to the historic average annual volumes in the postmining period. Newmont has committed to augmenting low flows in the river (if necessary) using senior water rights that the company owns or controls.

The increased Humboldt River flows would generally not create additional flooding along the river upstream of Rye Patch Reservoir. The cumulative mine discharges would contribute to the stored volume in Rye Patch Reservoir and may present difficulties during high-flow years in preserving emergency storage and minimizing flooding and structural damages downstream. Effects related to stream erosion, sedimentation, and channel geometry from the cumulative discharges are likely to be small. Long-term impacts on surface water rights within the Humboldt River Basin are not anticipated.

Mine discharges to the Humboldt River have generally been within their permit limitations. One “significant non-compliance violation” was documented under the current NPDES permits; discharges from the Lone Tree Mine were in non-compliance for arsenic in early 1995, but treatment and dewatering systems were adjusted to correct the NPDES permit exceedence. Provided that all of the mine discharges remain within their permit limitations, cumulative impacts to water quality in the river are not anticipated. On an average annual basis, the mine discharges represent a loading increase in TDS, arsenic, boron, copper, fluoride, and zinc compared with Humboldt River premine conditions. The cumulative loads from the mine discharges would likely increase TDS, arsenic, boron, and fluoride loads to the Humboldt Sink over the mine discharge period. Depending on concentrations in the Humboldt Sink, parameter solubilities, and other physical and biological factors, these increased loads to the sink potentially could result in increased concentrations in the sink wetlands.

Riparian Vegetation

Approximately 600 acres of riparian vegetation occur within drainage areas where perennial waters could be impacted by ground water drawdown. Approximately 18 additional acres of wetland vegetation associated with isolated springs and seeps occur within areas where perennial waters could be impacted. Therefore, the amount of riparian and wetland vegetation in these areas could be reduced.

During the mine dewatering discharge period, effects from increased water levels during baseflow periods would include an elevated water table in low-lying areas located adjacent to the Humboldt River and an increase in the frequency of flooding of streams and meanders and oxbows. Riparian/wetland plants would become established in areas where the water table is elevated to the depths needed for riparian/wetland plant establishment. Increases in the extent of riparian vegetation could be most noticeable along segments of the river with gradual banks and low-lying areas located adjacent to the river and in Herrin Slough. Additional effects may include the deepening of the river channel and loss of streamside riparian vegetation resulting in increased erosion and destabilization of stream banks. During the period of discharges, the areal extent of wetland vegetation within the Humboldt Sink may increase as a result of higher water levels during wet years.

After the cessation of mine dewatering discharges, impacts to riparian/wetland vegetation from anticipated flow reductions within the Humboldt River could include an unquantifiable, long-term reduction in the extent of riparian vegetation along the river. It is assumed that riparian vegetation would begin to re-establish to premining levels upon the eventual recovery of the river's baseflows.

Terrestrial Wildlife

The ground water drawdown from the mines' dewatering activities could result in a long-term reduction in the amount and extent of available surface water and associated riparian, wetland, and mesic habitats within portions of the cumulative assessment area for a number of terrestrial wildlife species. Approximately 618 acres of riparian/wetland habitat are located in areas associated with isolated springs and seeps and perennial drainages that could be affected by the cumulative ground water drawdown. No estimates for possible effects to mesic habitats were developed.

Reduction in surface or subsurface flows could result in effects ranging from reduced plant vigor to the total loss of riparian vegetation cover, depending on a number of hydrological and geological factors. Potential reduction or loss of available water or possible long-term effects to the riparian community could result in a loss of breeding, foraging, and cover habitats; increased animal displacement and loss; reduction in prey availability; reduction in the overall biological diversity; possible genetic isolation; a reduction in the regional carrying capacity for terrestrial wildlife; and possible population declines, depending on the level of effects and the relative species' sensitivity. Incremental habitat loss would affect a variety of big game, upland game birds, waterfowl, shorebirds, raptors, songbirds, nongame mammals, area reptiles, and amphibians. The recovery of ground water and surface water sources would be gradual.

The eventual reduction in flows within the three artificially created wetlands in Boulder Valley would result in a transition back into an upland plant community with an associated reduction in use by water birds. Based on current observations, it appears that saturated soils are increasing the leaching of minerals and salts into the soil surface and subsurface layers. The eventual transition to a plant community of more salt-tolerant species would result in changing wildlife composition for this area of Boulder Valley into the long term.

Water discharges into the Humboldt River would result in a net increase in water flows, even with additional water use by existing water rights for irrigation purposes. A net increase in flows within the river system would increase the overall water availability for consumption; support riparian and wetland vegetation along the channel; restore portions of wetland and marshy habitats; and provide additional breeding, foraging, and resting habitats for both resident and migratory wildlife resources. These potential short-term effects would be most apparent during the low-flow period (late summer and fall months). Potential effects from seasonal flooding would include a possible loss of available nesting and foraging habitat for some species; however, this impact would be offset by the creation and enhancement of the backwater and slough areas along the river corridor. Increased annual flows may result in additional open water during the winter season, consequently improving foraging opportunities.

After mine dewatering discharges cease, the eventual possible reduction in Humboldt River baseflow from cumulative ground water drawdown could impact the amount of available water and support of riparian vegetation along the river, similar to the effects anticipated for the potential reduction or loss of perennial water sources within the cumulative assessment area. However, the river ecosystem has evolved in association with highly fluctuating flows, variable water quality, and historical shifts in channel geometry; therefore, the effects on terrestrial wildlife from slightly reduced baseflows are anticipated to be minimal.

Temporary increases in flows into the Humboldt Sink (including the Humboldt Wildlife Management Area) would improve breeding, foraging, and resting opportunities for resident and migratory wildlife. Possible exposure risks of avian and mammalian wildlife species to metals and other constituents associated with premining conditions would be minimal. However, the dynamic nature of the Humboldt Sink's water system, influence of upstream water demands, fluctuations in water levels, bioaccumulation factors for some metals, and a number of environmental variables (e.g., wind deposition of salts) make it difficult to predict future long-term exposure risks to the biota.

Aquatic Resources

Mine dewatering could reduce water levels or flows in some springs and perennial reaches within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek drainages. However, it is important to note that the model-predicted surface water reductions are uncertain. If any perennial stream flows are decreased, the effect on the aquatic resources would be a reduction of the associated aquatic habitats. These habitats would support periphyton and invertebrates and, depending on where they occur, could support Lahontan cutthroat trout and other native fish species. Water level reductions in springs would affect periphyton, macroinvertebrates, and native fish species (if present). Habitat reductions would likely result in decreased numbers in these communities. If stream segments become dry as a result of reduced flows, aquatic habitat and associated biota would be eliminated. Drawdown of the water table would

continue to expand and reach a maximum at approximately 100 to 170 years during the postmining period. Afterward, there would be a gradual recovery of the aquifer and associated surface waters.

The effects of flow increases would affect aquatic communities in the Humboldt River. Discharges to the river would increase the habitat for fish, macroinvertebrates, and periphyton. However, the possible reduction of shallow pools and braided channels could adversely affect the development of young fish. Increased flows also could result in fish composition changes, as introduced species would be able to disperse and utilize wider areas of the river and likely compete with native species. Overall, the effects of increased flows on water quality conditions would be minor; however, it is possible that increased sediment levels may affect aquatic biota in sections of the river near the Barrick outfall and Comus gage.

Threatened, Endangered, Candidate, and Sensitive Species

Potential effects to the special status species identified for the cumulative assessment areas from the mines' dewatering activities would parallel those impacts discussed for terrestrial and aquatic wildlife resources. The extent of available surface water and riparian habitats could be reduced within the cumulative assessment area, encompassing 18 acres of riparian and wetland habitats associated with isolated springs and seeps and 600 acres of habitat along perennial stream reaches encompassing upper and lower Maggie Creek, lower Susie Creek, Marys Creek, Boulder Creek, and lower Rock Creek. The potential incremental reduction in available water and riparian habitats may either directly or indirectly affect the following terrestrial species: the Preble's shrew, six sensitive bat species, bald eagle, golden eagle, northern goshawk, Swainson's hawk, ferruginous hawk, burrowing owl, sage grouse, white-faced ibis, black tern, and Nevada viceroy. No impacts to the osprey, American white pelican, or Lewis buckwheat would be anticipated from the mines' dewatering activities. For the terrestrial species present, the potential reduction in the riparian communities could result in the same impacts discussed for general terrestrial wildlife species, encompassing habitat loss, increased displacement, loss of individuals, reduced prey availability, reduced diversity, possible genetic isolation, and potential population declines, depending on the extent of effects and relative species' sensitivity.

Increased flows in the Humboldt River and the Humboldt Sink would result in the same effects to special status terrestrial species as discussed above for terrestrial wildlife resources. It is likely that a net increase in annual flows and expanded riparian community would provide additional nesting, brooding, foraging, and resting habitat for those individuals that occur along the river, including the sensitive wildlife species mentioned above and osprey, if present along the river corridor. The greater availability of open water areas during the winter season would potentially extend available foraging habitat for wintering bald eagles along the river. Long-term reductions in the Humboldt River baseflow and potential effects of exposure to chemical constituents of concern in the Humboldt Sink would result in the same potential impacts to special status species (if present) as discussed for terrestrial wildlife species.

Mine dewatering could adversely affect habitat for the Lahontan cutthroat trout. Surface flows could be reduced in portions of Little Jack, Coyote, Jack, Beaver, and Maggie creeks, which are occupied by Lahontan cutthroat trout. Habitat reductions could result in reduced numbers, if a substantial amount of

habitat is removed. Since only the lower portions of occupied habitat may be affected, sufficient habitat would remain to allow viable populations to persist.

Mine dewatering also could adversely affect habitat for the Columbia spotted frog, California floater, and springsnails. Flow reductions in the Maggie Creek subbasin could decrease habitat used by the Columbia spotted frog and California floater. Water level reductions also may occur in two springs (Upper Antelope Creek and Warm Spring) occupied by springsnails.

Grazing Management

The potential long-term loss of water sources may result in the potential long-term loss of permitted active grazing use or affect livestock distribution and forage utilization within grazing allotments or individual pastures within an allotment. Allotments and water-related range improvements that potentially could be affected by ground water drawdown include:

- **Twenty-five allotment:** six water troughs, one water pipeline, and three improved springs located in the Willow Creek Seeding and Santa Reina pastures;

- **T Lazy S allotment** four stockwater ponds, two water pipelines, three stockwells, and seven improved springs located in the Central Native pasture;

- **Hadley allotment:** five stock wells, two improved springs, one water pipeline, and one trough and pipeline located in the South Hadley No. 2 pasture;

- **Carlin Field allotment:** one improved spring, one stock well, and one water pipeline located in the North Carlin Field and South carlin Field pastures;

- **McKinley allotment:** one stock well and two troughs located in the South pasture; and

- **Marys Mountain allotment:** three improved springs, three water pipelines, and one natural spring located in the allotment.

In addition, perennial creeks located within these allotments potentially could be affected by ground water drawdown, which could affect grazing management operations within these allotments.

Slightly increased water levels within the Humboldt River would likely increase the areal extent of herbaceous wetlands immediately adjacent to the river channel. Forage production and the carrying capacity of these narrow areas along the channel margins would likely increase during the mine dewatering discharge period. Increased flows may increase the availability of water for livestock use. Discharge waters reaching the Humboldt and Carson sinks would not affect grazing management since livestock grazing is not allowed within these areas. After mine dewatering discharges cease, reduced baseflows (as a result of combined drawdown effects) may decrease the extent of herbaceous wetlands. Flow augmentation plans are being developed to mitigate such impacts.

Socioeconomics

Potential reductions in ground water levels could affect water uses such as domestic, industrial, commercial, irrigation, and stock water, resulting in socioeconomic impacts to the water users.

Since the Humboldt River is over-appropriated, the additional excess mine water during dewatering discharge would be a positive effect to water right holders in the basin. Adverse effects from increased flow in the Humboldt River could include limited additional flooding to irrigated fields during periods of high flow. The additional inundated area would likely be limited to the immediate vicinity of the river and generally would involve lower elevation hayfields and meadows. If additional mine discharge water during high-flow periods causes Rye Patch Reservoir to exceed its storage capacity, damage could occur to the conveyance canals and gates and cause flooding of agricultural fields downstream from the reservoir.

Based on average river gains and losses, average cumulative dewatering discharges, and general irrigation withdrawals and return-flow assumptions, approximately 18,000 acre-feet per year of mine dewatering water may reach the Humboldt Sink. This could affect agricultural drainage conditions upstream of the Humboldt Sink if the additional flow is excessive. Increased water in the Humboldt River may limit the ability to repair irrigation diversion structures during the low-flow periods. These effects would have a duration approximately equal to the projected life of the combined mine discharges.

The maximum predicted decrease in Humboldt River flow (approximately 2 to 3 percent of the average annual flow) from ground water drawdown could extend from approximately 2016 to 2019. The ability for some agricultural operations to irrigate late season hay or to water livestock may be limited by these decreases in flow. Specific irrigators with more junior water rights may be affected; however, Newmont has committed to augmenting low flows in the river (if necessary) using senior water rights the company owns or controls.

Native American Religious Concerns

The assessment of Native American concerns was based on two types of information. Initially, emphasis was placed on the review of existing literature; sources reviewed included ethnographic reports and monographs that address the region and manuscripts and material on file with the BLM. In addition, the various bands of the Te-Moak Tribe of Western Shoshone, the Duck Valley Tribal Council, the Shoshone-Bannock Tribe, the Western Shoshone Defense Project, and the Western Shoshone Historic Preservation Society were contacted by the BLM.

Ground water modeling results indicate that perennial surface waters within the hydrologic study area potentially could be impacted by mine-induced ground water drawdown. Information derived from Native American sources indicates Native Americans are concerned that ground water drawdown would have an effect on resources of specific concern to Native Americans. Water is central to all living and spiritual things. The Western Shoshone feel that predicted impacts to stream flows, springs, and seeps would have a particularly adverse effect. Impacts could occur to riparian communities and animals that depend on those communities. The Western Shoshone are very concerned with impacts that could occur to water, plants,

and animals. Of even greater concern to the Western Shoshone are the disruptions that could occur to life and spirit forces found in or associated with these waters, plants, and animals. Impacts potentially could occur to two areas identified by the BLM as traditional cultural properties (Tosawihi Chert Quarry along Willow Creek and the Rock Creek Area). The Western Shoshone believe impacts to those areas would affect their ability to maintain cultural traditions.

Flow changes in the Humboldt River also could affect special concerns (plants, animals, and water) for Native Americans. Increased flows would increase riparian vegetation and wildlife during the mine discharge period. After ground water pumping ceases, flow reductions could reduce riparian vegetation and wildlife (see the summaries for these resources).

In summary, the Western Shoshone believe that ground water drawdown would have an adverse impact on both the physical and spiritual worlds. The potential impacts of the magnitude predicted could substantially alter the intricate web of power relationships that exist in nature and between the Western Shoshone and Mother Earth.

Table S-1
Cumulative Impact Summary of Dewatering Operations

Resource	Mine Dewatering and Localized Water Management Activities	Humboldt River/Tributaries Used for Discharge Conveyance
Geology	• Dewatering activities have apparently resulted in the development of three sinkholes to date: two west and northwest of the Betze-Post Pit, and one along Maggie Creek north of the Gold Quarry Pit. • Existing and future drawdown could result in additional sinkhole development in several identified areas; the areas are predominantly undeveloped, but include localized segments of creeks, several springs, a corral, and unpaved roads.	• No impacts are anticipated.
Water Resources and Geochemistry	• Several seeps and springs and flow in Brush Creek have been reduced; these effects may be related to mine dewatering. • Perennial seeps and springs could be impacted by future mine-induced drawdown. There are 182 springs and seeps located in areas where perennial surface waters potentially could be impacted. • Flows in some stream reaches, including Rock Creek, Boulder Creek, Maggie Creek, Marys Creek, and Susie Creek, could be reduced as a result of mine-induced drawdown. • The results of the modeling indicate that water levels in 115 ground water rights could be lowered by at least 10 feet from mine-induced drawdown. • There are 45 surface water rights within the 10-foot drawdown area; reductions in baseflow could affect some of these surface water rights.	• Surface discharge of mine dewatering water would increase flows in the river with the largest flow increase occurring in the low-flow months (late summer and fall), and relatively little change occurring during peak-flow months (spring to early summer). • Drawdown could result in reduced baseflow in the Humboldt River with predicted reductions on the order of approximately 2 to 3 percent of the average annual volume by the years 2016 to 2019. Reductions would represent a larger percentage of flow during the low-flow season. These impacts should be offset by Newmont's existing mitigation plan. • Discharge of mine dewatering water would increase the flow depths and areal extent of the river in low-flow months. • Mine dewatering discharges could produce higher risk from flooding, including potential damages to reservoir infrastructures or flooding to low-lying irrigated lands downstream of Rye Patch Reservoir.

Table S-1
Cumulative Impact Summary of Dewatering Operations (Continued)

Resource	Mine Dewatering and Localized Water Management Activities	Humboldt River/Tributaries Used for Discharge Conveyance
		• Discharge of excess mine dewatering water would likely increase TDS, arsenic, boron, and fluoride loads to the Humboldt Sink.
Riparian Vegetation	• An estimated 600 acres of riparian and wetland vegetation occur in drainages where perennial waters could be impacted by ground water drawdown. • An estimated 18 acres of wetland vegetation associated with isolated springs and seeps occur in areas where perennial waters could be impacted by ground water drawdown.	• Increased water levels during low-flow periods could restore and/or enhance wetland, riparian, and marsh habitats along the Humboldt River and in Herrin Slough. • Potential unquantifiable, long-term reductions in riparian vegetation could occur along the Humboldt River associated with ground water drawdown following the cessation of dewatering discharge. • Increased erosion and destabilization of streambanks could occur due to potential deepening of the river channel and loss of streamside vegetation.
Terrestrial Wildlife	• Potential decreased streamflows could reduce riparian, wetland, and mesic habitats within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek drainages. • An estimated 618 acres of riparian and wetland habitat occur in areas that could be affected by cumulative ground water drawdown along perennial stream reaches and isolated springs and seeps. • Habitat reductions could result in increased animal displacement, reduction in prey availability, reduction in biological diversity, reduction in the regional carrying capacity for terrestrial wildlife, possible genetic isolation, and possible population declines.	• A net increase in flows in the Humboldt River and into the Humboldt Sink would increase water availability and riparian habitat, providing additional breeding, foraging, and resting habitats for both resident and migratory wildlife species. • Increased open water during the winter season may improve foraging opportunities for some species. • Potential seasonal flooding could result in some loss of nesting and foraging habitat; however, this potential impact would be offset by the creation and enhancement of additional backwater areas along the river corridor.

Table S-1
Cumulative Impact Summary of Dewatering Operations (Continued)

Resource	Mine Dewatering and Localized Water Management Activities	Humboldt River/Tributaries Used for Discharge Conveyance
	• Incremental habitat loss would affect a variety of big game, upland game birds, waterfowl, shorebirds, raptors, songbirds, nongame mammals, area reptiles, and amphibians. • Long-term reductions in flows within artificially created wetlands and increased leaching of minerals and salts into the soil and subsurface layers would result in changing wildlife composition in Boulder Valley.	• After ground water pumping ceases, reduced flows could affect riparian habitats and wildlife species in the long term; however, the dynamic nature of the Humboldt River's water regime and augmented water during low-flow periods should minimize these effects. • Minor impacts may occur to resident or migratory wildlife in the Humboldt Sink from accumulated metals, although there is a high degree of uncertainty due to numerous environmental variables.
Aquatic Resources	• Potential decreased streamflows could reduce aquatic habitat within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek drainages. • Habitat reductions could result in decreased numbers of fish (native species and LCT), macroinvertebrates, and aquatic vegetation. • Decreased water levels in springs within the drainages listed above could affect habitat and population levels of native fish, macroinvertebrates, and aquatic vegetation.	• Increased amount of habitat for aquatic biota, which could increase numbers. • Potential reduction of shallow pools and braided channels, which could reduce rearing of young fish. • Potential changes in fish composition could occur as a result of dispersal of introduced species. • There could be minor changes in sediment levels in the river. Increased sediment levels could occur in segments near the Barrick outfall and Comus gage. • After ground water pumping ceases, reduced amount of habitat and possible reductions in macroinvertebrate numbers. No population changes expected for fish species.
TECS Terrestrial Species	• Potential decreased streamflows and associated reductions in riparian, wetland, and mesic habitats could result in the impacts discussed for general terrestrial wildlife species, including possible habitat loss, increased displacement, loss of individuals, reduced prey availability, reduced	• Increased flows would result in the same effects as discussed for terrestrial wildlife resources for the same sensitive wildlife species affected by mine dewatering and osprey, if present along the river corridor.

Table S-1
Cumulative Impact Summary of Dewatering Operations (Continued)

Resource	Mine Dewatering and Localized Water Management Activities	Humboldt River/Tributaries Used for Discharge Conveyance
	diversity, genetic isolation, and population declines. • Potential reductions in available water and riparian habitats could directly or indirectly affect the Preble's shrew, six sensitive bat species, bald eagle, golden eagle, northern goshawk, Swainson's hawk, ferruginous hawk, burrowing owl, sage grouse, white-faced ibis, black tern, and Nevada viceroy. • An estimated 618 acres of riparian and wetland habitat could be affected by cumulative ground water drawdown, resulting in a reduction or loss of potential nesting and brooding habitat for sage grouse.	• Increased open water during the winter season may improve foraging opportunities for wintering bald eagles along the river. • Minimal impacts could occur to resident or migratory wildlife in the Humboldt Sink from accumulated metals, although a high degree of uncertainty exists due to numerous environmental variables.
TECS Aquatic Species	• Potential decreased streamflows in portions of Little Jack, Coyote, Jack, Beaver, and Maggie creeks could affect occupied habitat for the Lahontan cutthroat trout (LCT). • Habitat reductions could result in reduced LCT numbers, if flow reductions are substantial and persist longer than several months. • Flow reductions in the Maggie Creek subbasin could decrease habitat and numbers of the Columbia spotted frog. • Flow reductions in the Maggie Creek subbasin and the lower portion of Rock Creek could decrease habitat and numbers of the California floater. • Water level reductions in two springs (i.e., Upper Antelope Creek and Warm Springs could affect springsnail numbers and their habitat.	• No impacts on TECS aquatic species during mine discharge period and after groundwater pumping ceases.

Table S-1
Cumulative Impact Summary of Dewatering Operations (Continued)

Resource	Mine Dewatering and Localized Water Management Activities	Humboldt River/Tributaries Used for Discharge Conveyance
Grazing Management	• Ground water drawdown could affect various water sources used by livestock (i.e. improved springs, stock wells, springs, seeps, perennial stream reaches, and water troughs and pipelines). • Ground water drawdown impacts include reduced flow and/or complete cessation of flows in springs and other water sources. • Reduction in the number and distribution of water sources could affect livestock distribution, forage utilization, and grazing management operations.	• Potential increase of forage production, carrying capacity and available water with increased areal extent of herbaceous wetlands within the Humboldt River floodplain.
Socioeconomics	• Potential reductions in ground water levels could affect water uses such as domestic, industrial, commercial, irrigation, and stock water. • If stock water availability were reduced, potential grazing use and livestock numbers could be reduced. • Potential reductions in stream flows could affect surface water rights used for irrigation and livestock watering. • If sinkholes occur in the area, potential damage to private property and/or natural resources could occur.	• Additional excess water resulting from mine discharges could increase water availability to water users. • Any additional flooding is expected to be limited and not affect agricultural fields. • If additional mine discharge water contributes to reaching the capacity of Rye Patch Reservoir, damage could occur to conveyance canals and gates and result in flood damage to agricultural fields downstream of the reservoir. • Storage of excess water below the capacity level in Rye Patch Reservoir could provide additional water to downstream irrigators. • Increased water in the Humboldt River upstream of Rye Patch Reservoir could provide additional habitat for wildlife. • Increased water in the river could limit the ability to repair irrigation diversion structures during low flow periods.

Table S-1
Cumulative Impact Summary of Dewatering Operations (Continued)

Resource	Mine Dewatering and Localized Water Management Activities	Humboldt River/Tributaries Used for Discharge Conveyance
Native American Religious Concerns	• Ground water drawdown could reduce surface flows and affect resources of special concern to Native Americans such as plants (riparian vegetation), animals, and water. The types of impacts predicted for these resources are identified under the respective headings in this table. • The Western Shoshone are concerned that impacts to plants, animals, and water could disrupt their life and spirit forces. • Potential flow reductions could affect two areas considered to be traditional cultural properties for the Western Shoshone Tribe (Tosawihi Chert quarry along Willow Creek and the Rock Creek Area).	• Flow changes in the Humboldt River could affect plant, animal, and water resources, which represent special concern for Native Americans. Increased flows could increase riparian vegetation and wildlife. Refer to the summaries for these resources for predicted impacts. • After ground water pumping ceases, flow reductions could result in reductions in plant, animal, and water resources. Refer to the summaries for these resources for predicted impacts.