3.9 Riparian and Wetland Areas

The study area for direct, indirect, and cumulative impacts for riparian and wetland areas is based on the projected maximum extent of the 10-foot groundwater drawdown contour (**Figure 3.9-1**), which has a radius of 7.9 miles from the center of the core project area and encompasses 127,275 acres. It is defined as the area of maximum extent of the 10-foot groundwater drawdown contour, as simulated by the groundwater model (Brown and Caldwell 2010a), and as described in Section 3.5, Groundwater Resources and Geochemistry. The maximum extent of the 10-foot groundwater drawdown contour encompasses the riparian and wetland areas that are potentially impacted by the Proposed Action. The proposed project would result in approximately 117 acres of surface disturbance in addition to the approximately 105 acres of existing authorized disturbance for a total disturbance of approximately 222 acres.

3.9.1 Affected Environment

Riparian habitat includes areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant species relative to nearby uplands while wetlands are characterized as areas of low-lying land that are submerged or periodically inundated with water (Lincoln et al. 1990).

As described in Section 3.6, Surface Water Resources and Watersheds, the United States Army Corps of Engineers (USACE) formally determined that Little Antelope Creek and tributary features in the project area are jurisdictional waters of the U.S. (USACE 2004). That determination was valid through April 2009, and no modifications to that jurisdictional status have been made. According to earlier field surveys in the project area, 2.43 acres of waters of the U.S. and 1.01 acres of wetlands occur along Little Antelope Creek, (JBR Environmental Consultants, Inc. [JBR] 2003a). An additional 0.87 acre of hydrophytic vegetation occurred along Little Antelope Creek at the time of the 2003 survey. It is assumed that the USACE maintains jurisdiction over the previously delineated and confirmed waters of the U.S. and wetlands.

Riparian and wetland areas in the region are characterized as Great Basin foothill and lower montane riparian woodland and shrubland, North American arid west emergent marsh, and open water habitats (U.S. Department of Agriculture-Natural Resources Conservation Service 2010; U.S. Geological Survey 2004). **Figure 3.9-1** illustrates riparian and wetland areas that occur in the study area (i.e., maximum extent of the 10-foot groundwater drawdown contour). Riparian and wetland areas within the study area were delineated based on field surveys, review of National Wetland Inventory maps, and review of May 2006 aerial photography (AECOM 2010a; Bureau of Land Management [BLM] 2011b; JBR 2007, 2003a). **Table 3.9-1** provides a general summary of riparian and wetland areas that occur in the study area and cumulative effects study area (CESA).

Table 3.9-1 Riparian and Wetland Areas that Occur in the Study Area/CESA

Riparian or Wetland Areas	Study Area	
	Number	**Acres**
Riparian Areas	19	560
Wetland Areas	205	408
Total	**224**	**968**

Sources: AECOM 2010a; BLM 2011b; JBR 2007, 2003a.

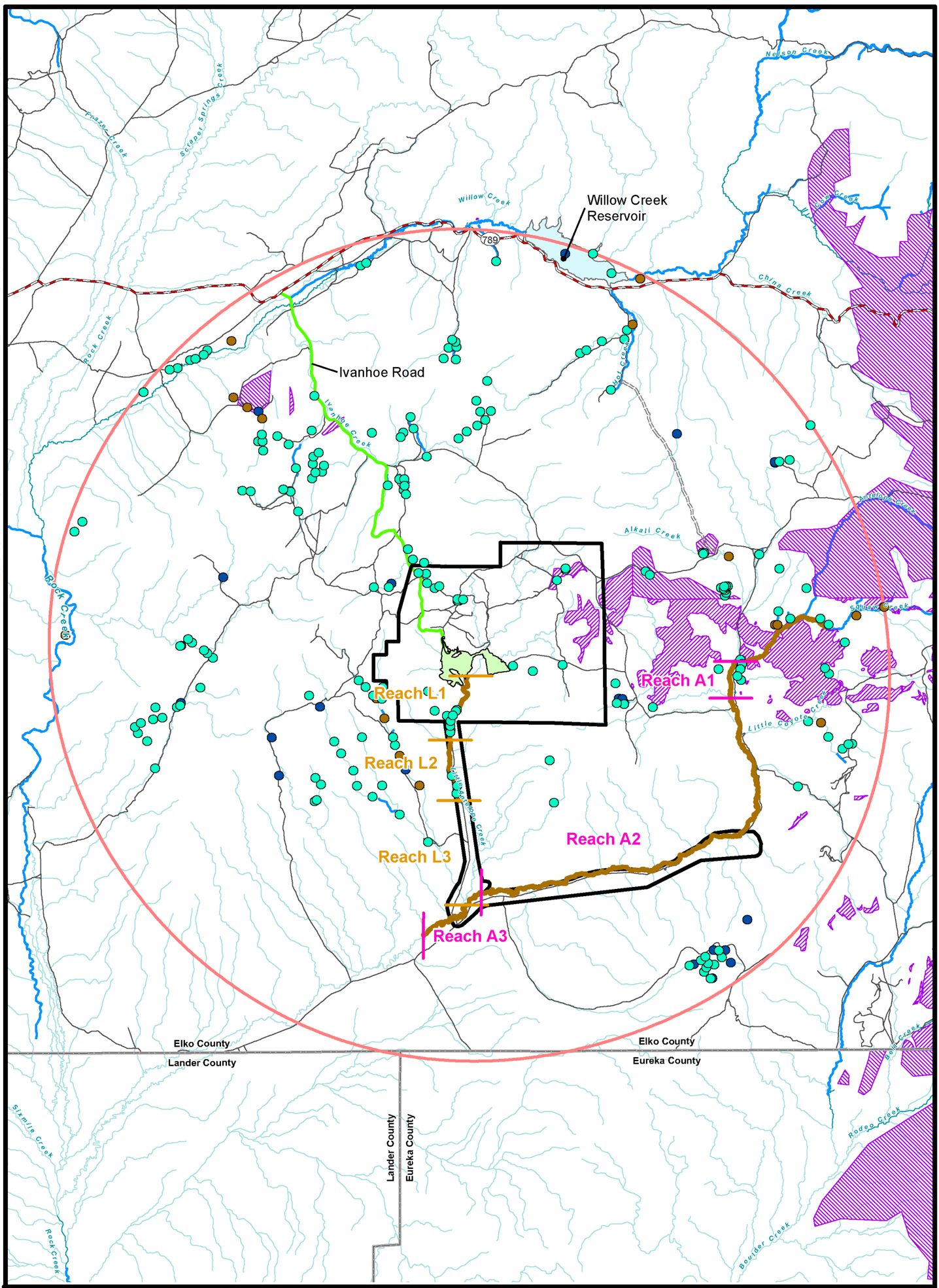
Riparian areas within the study area are associated with Antelope Creek, Little Antelope Creek, Squaw Creek, Willow Creek, and other creeks as tributaries to Rock Creek (**Figure 3.9-1**). Wetlands occur along Little Antelope, Antelope, Willow, and Squaw creeks. Flow occurrence within these creeks primarily is ephemeral (temporary) or intermittent and varies by reach. The source of hydrology supporting the wetlands and riparian areas appears to be derived from snowmelt runoff and groundwater discharge (JBR 2003a). Detailed information regarding streams, seeps, and springs is provided in Section 3.6, Surface Water Resources and Watersheds.

Several field surveys have been completed to identify riparian and wetland areas. In 2003, a delineation of jurisdictional waters (i.e., defined creek channels and wetlands) was completed within the former Hollister Development Block Project area. This survey covered approximately 50 percent of the northern portion of the project area including Little Antelope Creek (JBR 2003a). This survey identified nine wetlands along Little Antelope Creek totaling approximately 1.0 acre and another 0.8 acre of potential wetlands located outside of the survey area based on aerial photograph interpretation (**Figure 3.9-1**). Subsequent to the 2003 field survey, the riparian and wetland vegetation established along Little Antelope Creek was affected by a high flow event that occurred in the winter of 2005-2006. A review of 2006 aerial photography indicated that hydrophytic vegetation occurs along 1.7 miles of Little Antelope Creek in the drainage reaches downstream of the Hollister Site. The majority of this hydrophytic vegetation includes herbaceous species, but some sandbar willow also occurs in these areas. Scattered patches of hydrophytic vegetation also occur farther downstream (JBR 2008).

In 2007, a baseline field survey was conducted in the Rapid Infiltration Basin (RIB) expansion area (i.e., existing East RIB and pipeline) to identify jurisdictional waters (JBR 2007). One wetland, totaling less than 0.1 acre, was observed along the pipeline route to the RIB in the lower portion of Little Antelope Creek. This wetland was not one of the nine wetlands that were previously identified during the 2003 field survey. In 2008, a baseline reconnaissance survey was completed along the proposed electric power transmission line (transmission line) alignments (i.e., proposed 120-kilovolt [kV] and 24.9-kV transmission lines) to identify vegetation (including riparian and wetland areas), potential habitat for special status species, and noxious weed populations.

Dominant riparian and/or wetland species that were observed during these field surveys included sandbar willow (*Salix exigua*), yellow willow (*Salix eriocephala*), curly dock (*Rumex crispus*), Baltic rush (*Juncus balticus*), annual rabbit's-foot grass (*Polypogon monspeliensis*), and meadow barley (*Hordeum brachyantherum*).

In July 2011, BLM staff completed a field review to identify riparian areas along Little Antelope and Antelope creeks (BLM 2011b). Riparian vegetation was observed along Reaches L1 and L2 of Little Antelope Creek, and Reaches A1 through A3 of Antelope Creek (**Figure 3.9-1**). Dominant species observed along Reach L1 of Little Antelope Creek included coyote willow, Baltic rush, and a variety of riparian grass and forb species. Reach L2 of Little Antelope Creek supported dense stands of coyote willow. Reach A1 of Antelope Creek consisted of a series of springs that supported riparian species. Dominant species observed along Reach A2 of Antelope Creek included coyote willow, American bulrush (*Scirpus americanus*), and Nebraska sedge (*Carex nebrascensis*). Reach A3 of Antelope Creek supported a well developed riparian corridor primarily consisting of coyote willow and other riparian species. In addition to these stream reaches, a riparian area was identified along 2 miles of Antelope Creek upstream of Reach A1 to the confluence with Squaw Creek, which was based on the perennial nature of this segment of Antelope Creek, as described in Section 3.6, Surface Water Resources and Watersheds, and review of 2006 aerial photography. Based on field observations made during the July field survey and review of 2006 aerial photography, riparian areas along these reaches of Little Antelope and Antelope creeks had an average width of approximately 15 feet.



Legend

- Project Area Boundary
- Mining Disturbance
- State Highway
- Rural Road
- Vehicular Trail (4WD)
- Ivanhoe Road
- Maximum Extent of the 10-foot Groundwater Drawdown Contour and Cumulative Effects Study Area

Wetland/Riparian Features (AECOM 2010a; BLM 2011b, 2004a; JBR 2010, 2007, 2003a).

- Open Water
- Riparian Area
- Wetland
- Riparian Area (15 feet wide based on Google Earth 2006 aerial imagery)

Vinini Formation

- 1:24k Geologic Maps (NBMG)
- 1:250k Geologic Maps (USGS)

Stream Features

- Perennial Stream Reach
- Intermittent Stream

N

0 1 2 Miles

Hollister Underground Mine Project EIS

Figure 3.9-1

Riparian and Wetland Areas in the Study Area/Cumulative Effects Study Area

3/26/2012

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Based on information provided in various reports and the review of 2006 aerial photography, approximately 19 riparian areas (560 acres) and 205 wetland areas (408 acres) occur within the study area (**Table 3.9-1**). The majority of the riparian areas are associated with Antelope and Little Antelope creeks. The majority of wetland areas are associated with springs (**Figure 3.9-1**).

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action

Surface Disturbance

Construction of the proposed project would not remove or disturb riparian or wetland areas. The proposed project facilities would be constructed in upland areas, of which a portion of these areas previously have been disturbed by mining activities. The proposed 24.9-kV transmission line would be constructed in upland areas east and west of Little Antelope Creek. The proposed 24.9-kV transmission line would cross Little Antelope Creek at two locations and Antelope Creek at one location in the southern portion of the alignment. Based on the proposed alignment, riparian or wetland areas that are known to occur along Little Antelope and Antelope creeks would not be disturbed with the placement of the transmission line poles in upland areas or disturbance by construction equipment within the transmission line road. The proposed alignment for the 120-kV transmission line would cross Antelope Creek at one location and would cross several intermittent tributaries to Antelope Creek. Riparian areas along Antelope Creek would not be affected by construction activities because transmission line poles would be placed in upland areas, thereby avoiding impacts to riparian vegetation. Construction of the Rodeo Creek Substation would occur in an upland area approximately 0.1 mile north of Antelope Creek, thereby avoiding impacts to riparian areas associated with the creek.

Development of exploration sites and access roads would avoid disturbance to riparian or wetland areas in the exploration portion of the project area. Surface exploration activities, including drill site and road construction, could result in sediment and dust transport to nearby riparian and wetland resources.

Maintenance activities on Ivanhoe and Little Antelope Creek roads would not result in widening the existing roads; however, grading activities would result in loosening the road surface soils making them susceptible to erosion and transport to nearby drainages.

Indirect impacts to riparian and wetland areas as a result of soil erosion and sedimentation from mine facility construction, surface exploration, and road maintenance activities would be minimized with the implementation of erosion control measures, as described in Section 2.4.9, Applicant-committed Environmental Protection Measures.

Development of exploration sites and access roads would avoid disturbance to riparian or wetland areas in the exploration portion of the project area, thereby avoiding impacts to these features.

Water Management Activities

Continuous discharge of water into Little Antelope Creek temporarily (for the 20-year mine life) would enhance existing riparian areas in Reaches L1 (1.5 miles in length) and L2 (1.3 miles in length) and create a riparian area along Reach L3 (2.5 miles in length) downstream of the discharge point (**Figure 3.9-2**). Riparian areas along Reach A3 in Antelope Creek may be enhanced, and riparian vegetation could extend below Reach A3 as a result of continuous discharge of water to this stream reach. There is a low potential for riparian vegetation to become established along a segment of Little Antelope Creek extending from the proposed National Pollutant Discharge Elimination System discharge point to Reach L1 due to rocky substrate within the creek bed. After water discharge has ended, riparian vegetation established along Reach L3 and below Reach A3 may take 3 to 5 years to transition back to upland vegetation.

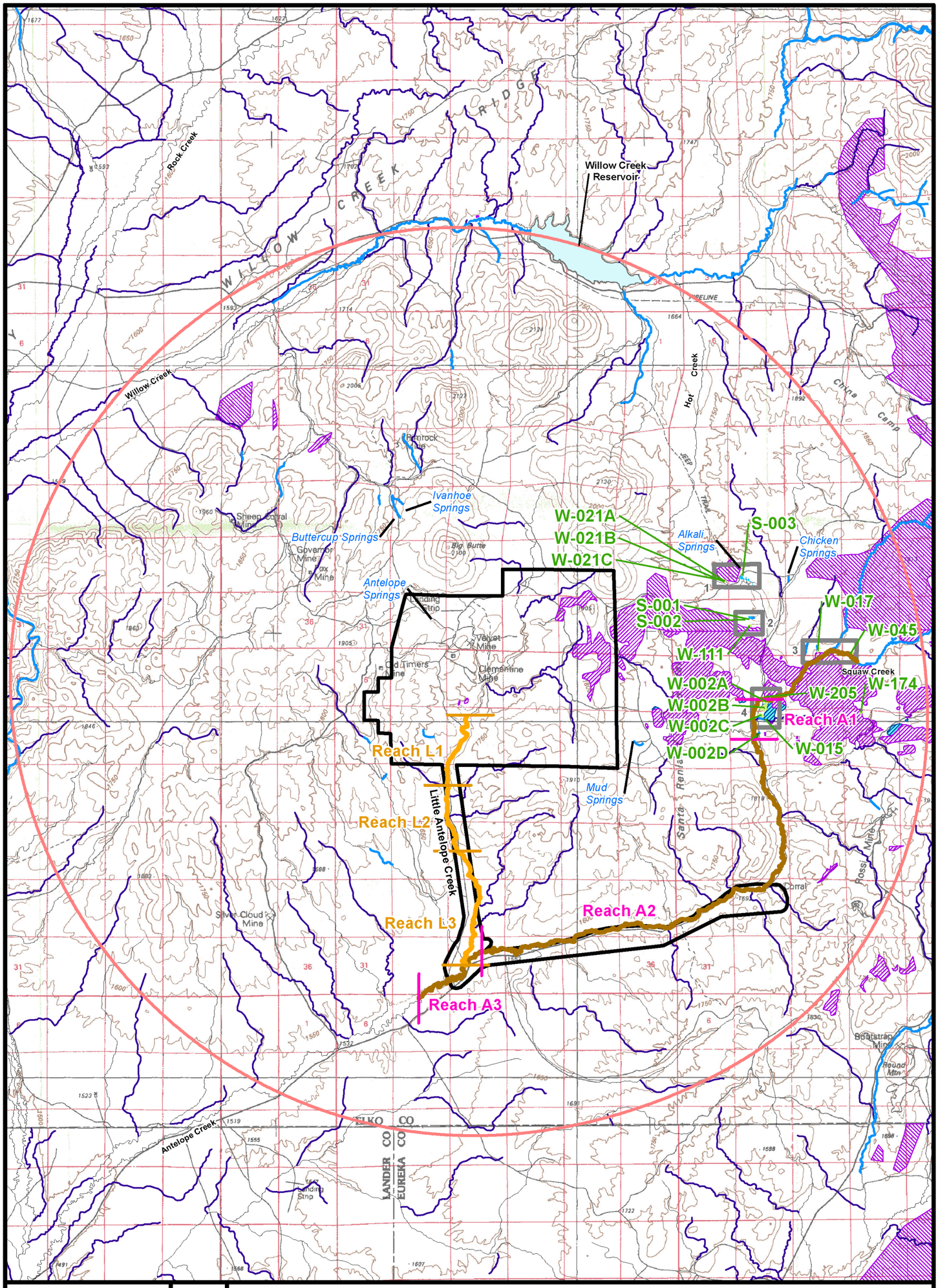
As discussed in Section 3.6, Surface Water Resources and Watersheds, groundwater drawdown within the predicted mine-related maximum extent of the 10-foot groundwater drawdown contour potentially may affect some seeps and springs. **Figures 3.9-2** and **3.9-3** illustrates springs and spring complexes that may be affected by groundwater drawdown. Reduced flows may result in the partial loss of herbaceous riparian and wetland vegetation; cessation of flows would result in the long-term loss of woody and herbaceous riparian and wetland vegetation. **Figure 3.9-2** illustrates riparian and wetland areas potentially affected by groundwater drawdown or water discharge. As provided in **Table 3.9-2**, approximately 12 acres of wetland vegetation that occurs within the maximum extent of the 10-foot groundwater drawdown contour may be impacted from groundwater drawdown. **Table 3.9-2** lists the wetland areas and associated springs that have potential to be affected by groundwater drawdown, and estimated acreages of wetlands that may be affected by groundwater drawdown.

Table 3.9-2 Wetland Areas Potentially Affected by Groundwater Drawdown

Wetland Number	Associated Spring Identification Number or Name	Spring Complex	Potential to be Affected by Groundwater Drawdown[1]	Size of Wetland (acres)
W-205	1295CF	4	High	0.07
S-001	565	2	High	0.88
S-003	Alkali Springs	1	High	2.52
W-017	570, 1295D2	3	High	0.24
W-021A		1	High	0.08
W-021B		1	High	0.03
W-021C	1295C4	1	High	0.13
W-045	Sada 11	3	High	0.80
W-111	566, 1295D6	2	High	0.39
W-174		--	High	0.20
Subtotal				**5.34**
W-015	1295CA	4	Low	0.31
S-002	1295D5, 566	4	Low	0.03
W-002A	571, 1295CE	4	Low	0.94
W-002B	572, 573, 574, 1295CD, 1295CC, Sada 2, Sada 3, Sada 4, Sada 5, Sada 6, Sada 7, Sada 8	4	Low	2.71
W-002C	575, Sada 8, Sada 9, 1295CB	4	Low	0.70
W-002D		--	Low	1.95
Subtotal				**6.64**
Total Acres				**11.98**

[1] High or low potential to be affected by groundwater drawdown was determined according to **Table 3.6-7** information.

Sources: AECOM 2010a; BLM 2000b; JBR 2010; Sada 2007.



Legend

- Project Area Boundary
- Maximum Extent of the 10-foot Groundwater Drawdown Contour
- Spring Complex Areas
- Stream (Intermittent or Ephemeral)
- Perennial Stream Reach

Wetland and Spring

- Wetlands Potentially Affected by Groundwater Drawdown (AECOM 2010a; BLM 2011b; JBR 2010).
- Riparian Areas Potentially Affected by Groundwater Drawdown (BLM 2011b).
- Riparian Areas Created or Enhanced by NPDES Discharge (BLM 2011b).

Vinini Formation

- 1:24k Geologic Maps (NBMG)
- 1:250k Geologic Maps (USGS)

Strathearn Formation

- 1:24k Geologic Maps (NBMG)

N

0 1 2 Miles

Sources: AECOM 2010a; BLM 2011b; JBR 2010; NBMG 2003; USGS 2005.

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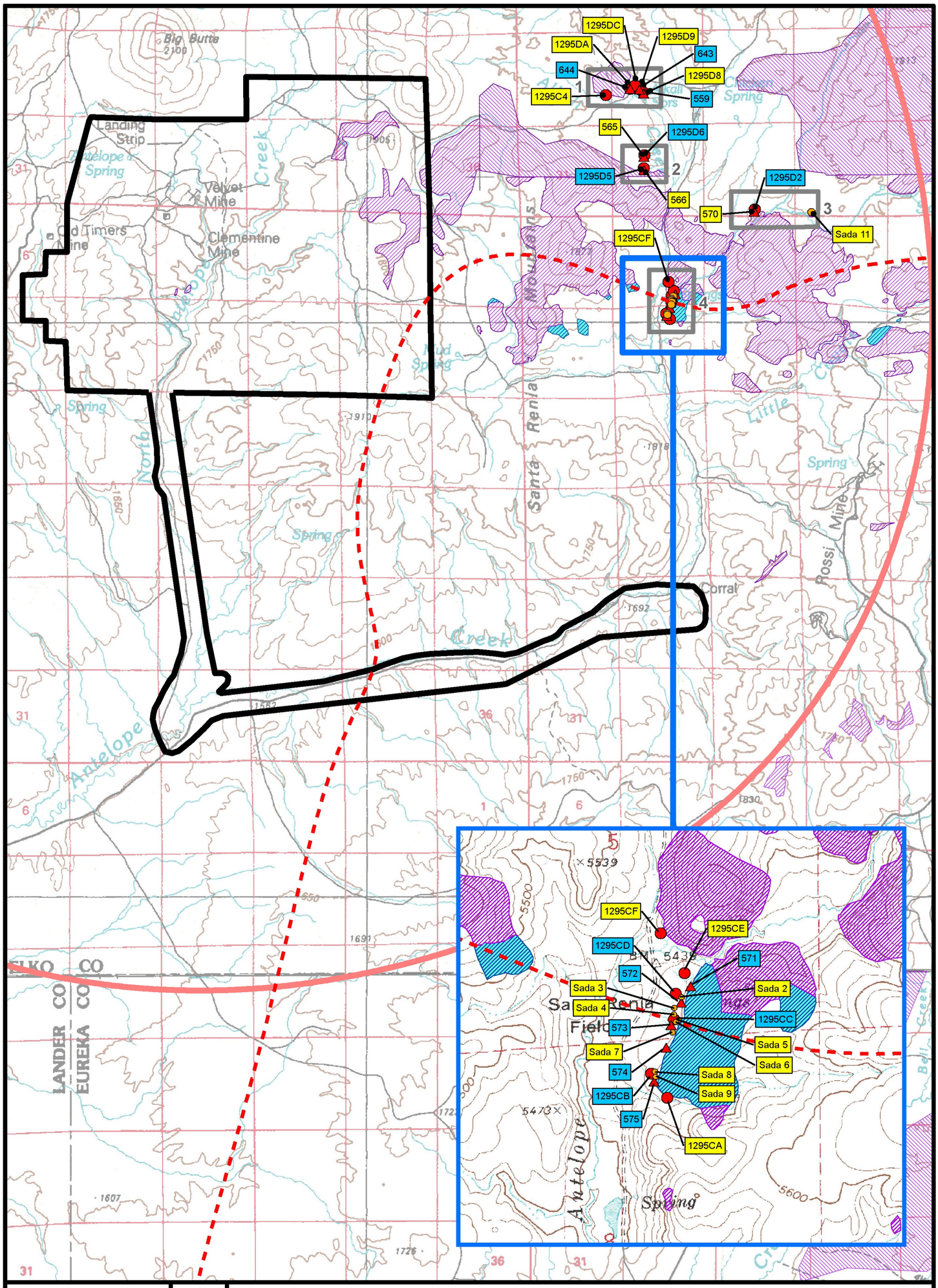
Figure 3.9-2

Riparian and Wetland Areas that are Potentially Impacted by Groundwater Drawdown or NPDES Discharge

3/23/2012



Legend

- Project Area Boundary
- Spring Complex
- Maximum Extent of the 10-foot Groundwater Drawdown Contour
- Maximum Extent of the Barrick 10-foot Drawdown Contour, Betze Pit SEIS 2007 Model

Seeps/Springs

- Springs (BLM 2006)
- Seeps/Springs (BLM 2000b)
- Springs (Sada 2007)

Vinini Formation

- 1:24k Geologic Maps (NBMG)
- 1:250k Geologic Maps (USGS)

Strathearn Formation

- 1:24k Geologic Maps (NBMG)

Spring Labels

- 570 Spring Location
- 570 Probable Duplicated Spring

N

0 1 2 Miles

Sources: BLM 2006, 2000b; Sada 2007.

Hollister Underground Mine Project EIS

Figure 3.9-3

Springs and Spring Complexes Potentially Affected by Groundwater Drawdown and Barrick 2007 Model Drawdown Contour

3/23/2012

Based on the projected groundwater drawdown within and immediately adjacent to the Vinini Formation, it is anticipated that 10 wetland areas have high potential to be affected by groundwater drawdown in the long term and 6 wetland areas have low potential to be affected by groundwater drawdown in the long term. In addition, as described in Section 3.6, Surface Water Resources and Watersheds, reduced flows from springs contributing to Antelope, Alkali, and Squaw creeks may result in the long-term loss of some riparian vegetation. Groundwater flows to springs and seeps potentially impacted by this project are projected to recover in approximately 50 to 100 years following initial drawdown (Brown and Caldwell 2010a).

3.9.2.2 Mud Springs Road Transmission Line Alternative

Surface Disturbance

The proposed 24.9-kV transmission line (North Option), including the substation, would be constructed in upland areas. The 249.9-kV transmission line route would cross one wetland area (0.08 acre) that would be spanned by the transmission line or avoided by construction equipment, thereby avoiding impacts to this wetland.

The entire alignment of the proposed 24.9-kV transmission line (South Option), including the substation, would be constructed in upland areas. Therefore, impacts to riparian or wetland areas are not anticipated from transmission line or substation construction.

Water Management Activities

Impacts to riparian and wetland areas would be the same as those described for the Proposed Action.

3.9.2.3 Mud Springs Waste Rock Storage Facility Alternative

Surface Disturbance

Impacts to wetland and riparian areas would be the same as described for the Proposed Action. No additional wetlands or riparian areas would be impacted by the construction and use of the Mud Springs Waste Rock Storage Facility.

Water Management Activities

Impacts to riparian and wetland areas would be the same as those described for the Proposed Action.

3.9.2.4 Backfill Alternative

Surface Disturbance

Impacts to riparian and wetland areas from the implementation of this alternative would be the same as described for the Proposed Action.

Water Management Activities

Impacts to riparian and wetland areas would be the same as those described for the Proposed Action.

3.9.2.5 No Action Alternative

Under the No Action Alternative, the proposed project would not be developed, and the related impacts to riparian and wetland areas would not occur. The existing Hollister exploration activities would continue under current permits and authorizations.

3.9.3 Cumulative Impacts

Past and present actions and reasonably foreseeable future actions are summarized in Section 3.2. **Figure 3.9-4** illustrates the CESA for riparian and wetland areas, which is the maximum extent of the

10-foot groundwater drawdown contour associated with the Proposed Action. This figure also illustrates the cumulative groundwater drawdown contour as illustrated in the Betze Pit Expansion Project Supplemental Environmental Impact Statement (BLM 2008b). Cumulative impacts to riparian and wetland areas would result from ongoing surface disturbance by mining, livestock grazing, and other land uses, mine groundwater pumping and the associated groundwater drawdown and groundwater pumping discharges. Groundwater drawdown associated with the Proposed Action may result in the loss of approximately 12 acres of wetland vegetation and some additional riparian vegetation along Antelope Creek from the potential loss or decrease in water flow from seeps and springs. The impacts from the proposed project would add to the existing and future riparian and wetland impacts within the CESA. Most of these cumulative impacts would result from mine development and water management activities, as well as from livestock grazing, roads, and other surface disturbance activities.

Cumulative groundwater drawdown occurs in the CESA from the ongoing Betze Mine operated by Barrick Goldstrike Mines Inc. (**Figures 3.9-3** and **3.9-4**). In combination with direct drawdown impacts that are anticipated to occur as a result of the proposed Hollister groundwater pumping, regional groundwater levels would undergo additive declines. This would create cumulative impacts in the form of reduced flows from springs, seeps, and groundwater contributions to streamflows and would directly affect riparian and wetland areas.

In particular, **Figure 3.9-4** shows a small overlap between the Hollister maximum extent of the 10-foot groundwater drawdown contour and the Betze maximum extent of the 10-foot groundwater drawdown contour, although each drawdown occurs in a separate and unconnected aquifer. The proposed Hollister project's predicted impacts to wetland and riparian areas would add to the number of such features impacted from drawdown generated by Barrick or Newmont and thus would be an overall cumulative impact. Because each wetland and riparian area is fed by springs from a particular aquifer, cumulative impacts on any particular wetland and riparian area are not anticipated. The riparian and wetland areas that would be impacted, and therefore add to the number of such features cumulatively impacted in the region, are depicted in **Figure 3.9-2** and listed in **Table 3.9-2**.

Other potential sources of cumulative impacts to riparian and wetland areas in the CESA would include existing land uses such as mining disturbance, grazing, and road construction and maintenance. Mine development, road construction, and maintenance activities have resulted in direct impacts to riparian and wetland areas by removing or filling these areas. Grazing has been the major land use in the CESA and is expected to continue to be so in the future. Livestock can impact wetland and riparian areas through trampling and shearing of streambanks, compaction of wetland soils, trampling of plants, and overuse of riparian plant species. Riparian and wetland areas that have been overgrazed are susceptible to invasion by noxious weeds and non-native invasive plant species, which can displace riparian and wetland species over time.

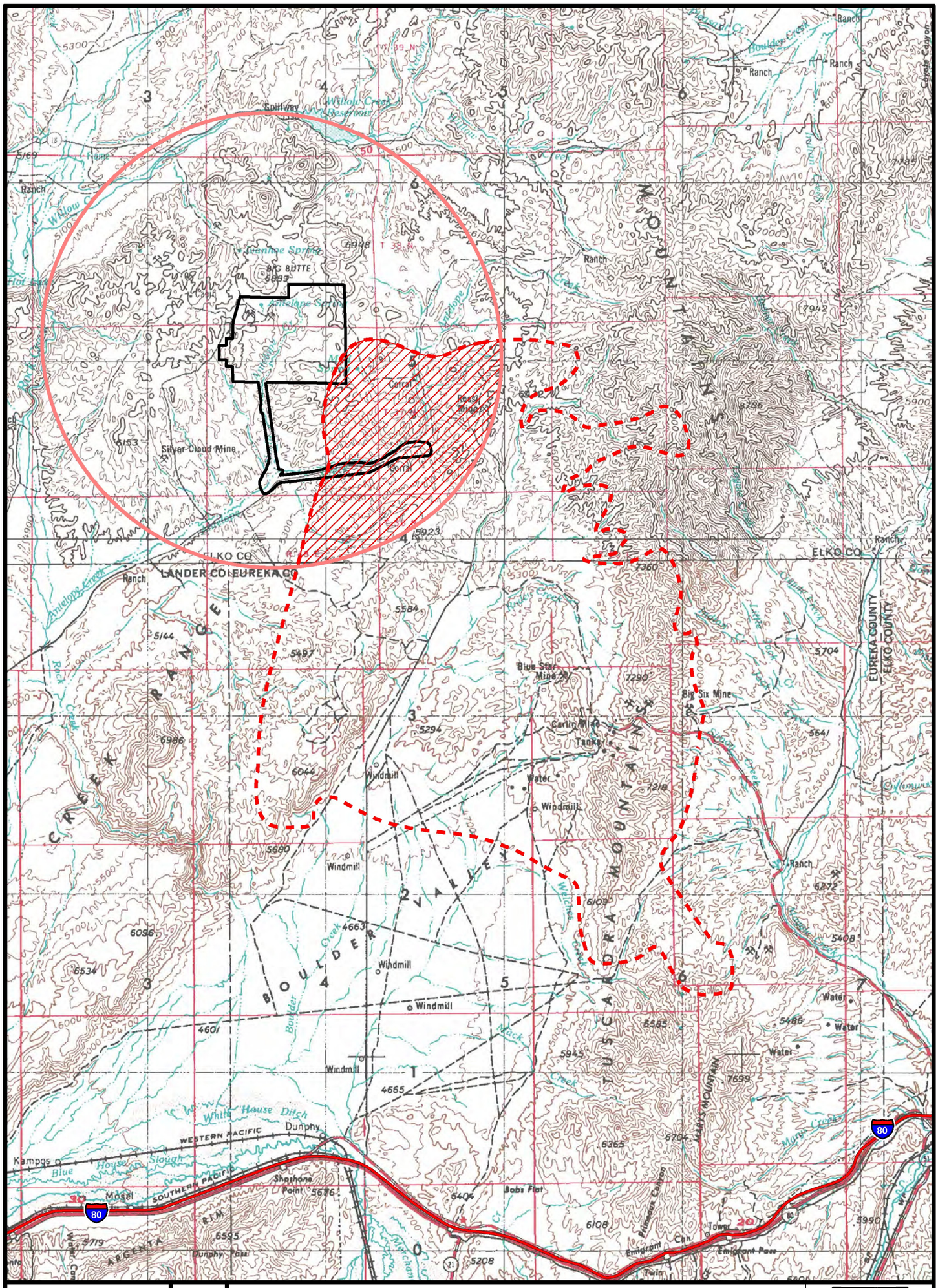
3.9.4 Potential Monitoring and Mitigation Measures

Because 12 acres of wetland vegetation and some riparian vegetation along Antelope Creek may potentially be impacted by groundwater pumping from the proposed project, additional monitoring and mitigation measures are recommended.

The following mitigation measures would be implemented to minimize impacts to riparian and wetland areas.

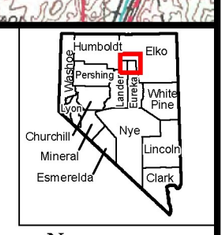
RW-1

Issue: Potential impacts to spring complexes and associated riparian and wetland vegetation within the maximum extent of the 10-foot groundwater drawdown contour.



Legend

- Project Area Boundary
- Maximum Extent of Barrick 10-foot Drawdown Contour, Betze Pit SEIS 2007 Model
- Maximum Extent of the 10-foot Groundwater Drawdown Contour, Hollister 2010 Model (Study Area and CESA)
- Area of Potential Cumulative Impacts from Groundwater Drawdown



N

0 2 4 Miles

Sources: BLM 2008b; Brown and Caldwell 2010a.

Hollister Underground Mine

Figure 3.9-4

Riparian and Wetland Areas Cumulative Effects Study Area

3/7/2012

Monitoring/Mitigation Measure: Rodeo Creek Gold Inc (RCG) would establish a riparian trust fund for the 12 acres of wetland and riparian habitat potentially impacted by the proposed project. The funds would be placed into an interest bearing account to mitigate for the potential loss of wetland/riparian habitat on the Twenty-Five Allotment due to potential groundwater drawdown. The account would be used to improve wetland and riparian habitat on public and/or private lands within the Twenty-Five Allotment. Such restoration projects would be contingent upon agreement with the private land owner(s).

Effectiveness: The establishment and implementation of a riparian trust fund would provide funding for riparian and wetland habitat improvement to offset potential loss of 12 acres of wetland habitat.

RW-2

Issue: Control of livestock use along Little Antelope Creek for the purpose of mitigating potential surface water and groundwater impacts and allowing for increased growth and establishment of riparian and wetland vegetation resulting from discharge into Little Antelope Creek.

Monitoring/Mitigation Measure: RCG would repair and maintain the exclosures (two adjacent to each other) along Little Antelope Creek for the life of the project. RCG would install one cattleguard on the lower end of the existing exclosure on Little Antelope Creek. RCG would maintain the four cattleguards along the Little Antelope Creek Road. Evaluation of the two exclosures may warrant adjustments to the fencing creating one exclosure instead of two, and changes to the fence line to incorporate the springs into the exclosure. This measure would include the signing of a cooperative agreement for materials, labor, and maintenance with the BLM Elko District.

Effectiveness: This measure would enhance and protect riparian vegetation by excluding cattle grazing from this segment of Little Antelope Creek. This measure would help offset the loss of riparian and wetland areas and enhance water quality by filtering potential runoff from the project area.

RW-3

Issue: Potential impacts to riparian and wetland plant communities from project-related groundwater drawdown, which may include increases in noxious weeds and non-native invasive plant species.

Monitoring/Mitigation Measure: If groundwater drawdown results in reduction of riparian and wetland communities within the maximum extent of the 10-foot groundwater drawdown contour, RCG may take commercially reasonable efforts to come to an agreement with the landowner to allow RCG to control noxious weed infestations in such areas. RCG would not be required to provide any consideration to the landowner in exchange for access, other than performing or paying for such weed control.

Effectiveness: Implementation of noxious weed control measures would enhance riparian habitat along Antelope Creek and minimize the potential spread of noxious weeds and non-native invasive plant species to help offset the loss of riparian and wetland areas.

3.9.5 Residual Impacts

The potential long-term loss of approximately 12 acres of wetland habitat and some additional riparian habitat within the study area would be a residual effect. However, the implementation of the mitigation measures would offset anticipated effects to riparian and wetland areas within the study area.