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CRIPPLE CREEK & VICTOR

Permit M-1980-244

Cresson Project Amendment 14

Appendix 5

Baseline Soils and Biological Resources Studies

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Baseline Technical Report

For Soils and Biological Resources, Cresson Project Mine Life Extension 2 Project Area,

Cripple Creek & Victor Gold Mining Company
Teller County, Colorado

November 2011

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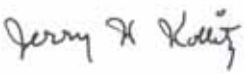

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Baseline Technical Report

Report for Soils and Biological Resources, MLE2 Project Area

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EXECTUTIVE SUMMARY

ARCADIS U.S., Inc. performed soil and biological resources assessments of the Cripple Creek & Victor Gold Mining Company (CC&V) Cresson Project as part of the requirements to extend mining operations under the proposed Mine Life Extension 2 Project (MLE2). Field investigations were conducted the week of July 17, 2011 to supplement a desktop review of previous investigations. Soil investigation efforts produced a revised Cresson Project soil map, evaluation of soil resources, and assessment of salvageable secondary growth media. Biological investigation efforts produced revised MLE2 vegetation and wildlife resources maps and evaluation of the vegetation and wildlife resources within the Cresson Project, including special status species. Impacts to soil and biological resources were also evaluated and recommendations for resource use and impact mitigation are provided.

1. INTRODUCTION

Cripple Creek & Victor Gold Mining Company (CC&V) is proposing to extend its mining operations at the Cresson Project in the Cripple Creek Mining District (District) in Teller County, Colorado (**Figure 1-1**). The proposed project, referred to as the Mine Life Extension 2 Project (MLE2), would occur on approximately 420 acres surrounding the existing operations. All lands within the project area are owned or controlled by CC&V. The proposed project requires that CC&V submit a modification to the existing state mining permit to the Colorado Division of Reclamation, Mining, and Safety (DRMS).

As part of the permit modification, CC&V must fulfill requirements specified in the "Hard Rock/Metal Mining Rules and Regulations of the Colorado Mined Land Reclamation Board (CMLRB)" as well as requirements per Teller County land use regulations. To meet these requirements, ARCADIS, on behalf of CC&V, collected baseline resource information on soils and biological resources (vegetation, wildlife, and special status species). This report summarizes the baseline information collected for these resources.

1.1 Project Area Description

CC&V's Cresson Project is located between the towns of Cripple Creek and Victor in Teller County, Colorado. It is a low-grade, open-pit gold mining operation where the ore is treated using a valley-type, heap-leach process with activated carbon used to recover the gold (CC&V 2011). The proposed project area is located within lands

owned by CC&V surrounding the Cresson mine. The legal description of the project area is:

- Township 15 South, Range 69 West, Sections 16 to 21 and 29
- Township 15 South, Range 70 West, Sections 24, 25, and 36

The project area ranges in elevation from approximately 9,000 feet (2,743 meters) to 10,500 feet (3,200 meters) above mean sea level (amsl). Vegetation communities are relatively diverse consisting of communities such as grasslands, woodlands, and wet meadows. Geology in the District consists of an Oligocene-aged (approximately 30 million years ago) diatreme-volcanic, intrusive complex surrounded by Precambrian rocks. The eastern portion of the District is characterized by a flat-lying sequence of volcanoclastic sediments and phonolite flow units. The central portion of the District is dominated by complex flow dome structures with cross-cutting intrusive dikes and sills. The western side of the District contains extensive areas of diatremal volcanoclastic breccias with scattered intrusive and flow dome features (Vardiman et al. 2006).

1.2 Survey Methods

1.2.1 Phase I – Compile Existing Data

ARCADIS performed a detailed compilation of existing resource information available for the MLE2 project area (hereafter referred to as the 'survey area'). The survey area is part of the larger Cresson Project area that encompasses most of the District (**Figure 1-1**). Based on the information required by the CMLRB and Teller County for the permit amendment, information on the following resources was compiled:

- Soil resources, including plant growth medium;
- Vegetation resources;
- Wildlife resources; and
- Special status species (Threatened, Endangered, Sensitive and Candidate Species [TECS] and Colorado sensitive wildlife and plant species).

1.2.1.1 Soil Resources

Previous soil surveys were conducted within the Cresson Project area by Nerco Minerals Company in 1984 and by Newport Minerals in 1985. These surveys were conducted in the northern portion of the District. Preliminary soil mapping was

conducted by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (Soil Conservation Service prior to 1994) in 1993 and 1995. At that time, three dominant soil units were identified within the Cresson Project area:

- Grenadier-like-Unnamed very gravelly loam complex (HL);
- Quander-Varden complex (PF); and
- Rogert very gravelly sandy loam.

In 1996, CC&V conducted a modified Order II soil survey to map a portion of the Cresson Project area to the series level in support of the Amendment No. 7 project (JBR 1997). Approximately 60 soil pits were used to determine soil characteristics in the field including the soil depth, types of horizons, parent material, structure, texture, color, pores, stoniness, roots, and other special characteristics. The mapped soils were identified to the soil series level where possible, using named soil associations identified by the NRCS.

NRCS updated the soils mapping for parts of Teller and Park Counties, including the survey area. Information on NRCS soil units in the survey area is available via the Web Soil Survey website (SSS 2011), which was developed by the NRCS to provide access to the most current soil data. A review of the most current soil spatial (Version 4, May 19, 2008) and tabular data (Version 4, March 7, 2008), indicated discrepancies between previous JBR Environmental Consultants (JBR), Greystone Environmental Consultants (Greystone), and ARCADIS soil mapping and current NRCS mapping.

1.2.1.2 Vegetation Resources

Existing baseline information on vegetation resources in the survey area was collected, compiled, and reviewed for completeness and accuracy. The existing baseline information was primarily based on past field surveys and vegetation mapping efforts completed by JBR in 1997 in support of Amendment No. 7, by Greystone in 1999 in support of Amendment No.8, and by ARCADIS in 2007 in support of Amendment No. 9.

1.2.1.3 Wildlife Resources

ARCADIS compiled baseline information on wildlife resources by reviewing data from CC&V's files (CC&V 1992, 1993, 1998); wildlife inventories performed by Colorado Division of Wildlife (CDOW) in 1997; and wildlife inventories performed by JBR in

1996, Greystone in 1999, and ARCADIS in 2007. In addition, existing information from past U.S. Fish and Wildlife Service (USFWS) consultation, publically available published/unpublished literature, maps, population data, and any other applicable information were qualitatively evaluated, integrated, and used to develop the baseline description of the survey area's existing wildlife.

1.2.1.4 Special Status Species

Several literature reviews and field surveys for special status species have been conducted for the mine in the past. However, because species lists are frequently updated, ARCADIS reviewed recent publically available literature to determine which currently listed special status species have potential to occur in the survey area.

ARCADIS first conducted a literature search for federally listed TECS. TECS are identified by the USFWS under the provisions of the Endangered Species Act of 1973, as amended. The website for the USFWS was queried for a list of TECS that have potential to occur in the District/Teller County (USFWS 2010). CDOW maintains a state list of threatened and endangered wildlife species and also lists some wildlife species with declining populations as 'species of special concern.' The website for CDOW was queried to determine state-listed threatened, endangered, and species of concern that have potential to occur in the survey area. In addition, the Colorado Natural Heritage Program (CNHP) maintains a list of rare plant species for the state, which includes rare plant species as listed by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) (CNHP 2011). The potential for any special status species to occur in the survey area was based on habitat suitability in the survey area.

1.2.2 Phase II – Collect Baseline Data

Once all existing baseline information was compiled, ARCADIS conducted field surveys and inventories from July 19 to 21, 2011 to verify and update the existing information in the survey area, as appropriate. Field surveys and inventories included:

- Soil profile investigations and soil mapping,
- Vegetation mapping (map and characterize vegetation community types in the survey area),
- Raptor nest survey,

- Habitat assessment for special status species (confirm presence or absence of suitable habitat),
- Inventory of wildlife species, and
- Inventory of plant species.

Once field work was completed, ARCADIS summarized relevant information for each resource (soils, vegetation, wildlife, and special status species) and identified any additional information or modifications to the existing baseline description for the survey area. This information is summarized in the results below.

2. SOIL AND GROWTH MEDIUM RESOURCES

In order to be consistent with published data, this report presents a revised soils map based primarily on the 2008 NRCS data available through the Web Soil Survey. NRCS data has been supplemented by data collected during the reconnaissance soil survey conducted by Greystone from August 16 to 20 and September 22 to 24, 1999; a follow-up survey by ARCADIS on June 21 and 22, 2007; and a third survey by ARCADIS from July 19 to 21, 2011. Field investigations by ARCADIS in 2011 focused on the MLE2 project areas/survey area. Data collected within the Cresson Project area are considered to represent a more detailed level of analysis than NRCS data, and map unit boundaries have been adjusted accordingly. In addition, aerial photography of the District taken in 2010 was utilized to more accurately define soil map unit boundaries. An explanation of revisions made to soil units presented in the 2007 Baseline Technical Report for Amendment No. 9 (ARCADIS 2007) is incorporated into the descriptions of soil map units in **Section 2.1**. A revised soil map of Cresson Project area soils is presented in **Figure 2-1**. Characteristics of the soil types in the area are summarized below and in **Table 2-1**. Soil map unit OR (Disturbed land, mine areas, overburden storage areas, mine complex) is not included in **Table 2-1** due to its variability. Unit OR varies for all characteristics depending on the age, amount, and type of disturbance and original character of the soil. **Table 2-2** identifies the soil map units within the survey area.

Soil surveys of disturbance areas proposed under MLE2 were conducted concurrently with vegetation mapping, which allowed for close correlation of mapped soil units with vegetative cover. In addition, soil units were differentiated based on geology, aspect, and slope steepness. Exposed soil profiles in road cuts, walls of surface mines and exploration sites, and other excavations were examined. Soil pits were excavated where exposed soils did not exist. In order to confirm accurate mapping by NRCS, soil exposures and pits were selected for examination based on slope, aspect, parent material, and vegetation present that matched published descriptions of the soil unit mapped by NRCS at that specific location. The range in thickness of the salvageable upper horizons of each soil unit profile occurring within the MLE2 project areas are shown on **Figure 2-1**.

2.1 Soil Resources

2.1.1 BW. Bushpark-Seitz association, 15 to 20 percent slopes

Within the Cresson Project area, these soils are found on south-facing mountainsides within the open conifer-dominated woodland vegetation community

type. However, this soil unit is not found within the survey area. Soils in this association are formed from colluvium or slope alluvium formed from volcanic breccias and are very to extremely gravelly loam and well drained. Seitz series soils are deeper than Bushpark series soils and have a thin upper horizon composed of decomposed organic material. The small area mapped as BW by NRCS was previously mapped solely as Seitz series soils (ARCADIS 2007).

2.1.2 CQ. Adderton-Rosane taxadjunct complex, 0 to 6 percent slopes

These soils are hydric or partially-hydric soils that occur on grassy stream terraces, toe slopes, and floodplains in the Cresson Project area. Approximately 10 acres of these soils are present within the survey area in Section 17 (2 percent of the total survey area). Adderton series soils are deep, loamy, and well drained, whereas the Rosan series soils are shallower loams and are poorly drained. Within the survey area, Rosan series soils were observed to contain buried organic horizons with abundant wood fragments. Both soil unit components are derived from alluvium. Rosan series soils replace the Cryaquolls included in the previous CQ soil map unit (ARCADIS 2007).

2.1.3 EB. Quander-Bushpark very gravelly loams, 5 to 40 percent slopes

These soils are found on mountainsides and face terraces in association with the natural and disturbed grassland vegetation community types. Both components are derived from colluvium and residuum composed of breccias and tuff, are very to extremely gravelly loams and clay loams, and are well drained. Both series are characterized by thick subsoil composed of angular cobble-sized rock fragments, often with little soil between fragments. Inter-fragment soil is more abundant where soils formed from colluvium than as residual soils. Bushpark series soils are shallower and found on steeper slopes. This extensive soil unit comprises approximately 43 percent of the survey area (183 acres). Quander series soils replace the Ess series soils included in the previous EB soil map unit (ARCADIS 2007). Quander series soils were previously included in the Quander-Varden complex soil unit (PF), which has been discontinued for consistency with NRCS mapping. In addition, significant areas in the northern portion of the project area categorized as Rogert series soils in 2007 are now mapped as the EB soil unit.

2.1.4 OR. Disturbed land, mine areas, overburden storage areas, mine complex

Areas that were historically mined or otherwise altered by human activities are classified as disturbed soils. Surface disturbance was identified from 2010 aerial photography and field observations. Differences in vegetation were also used in

mapping these units, as some vegetation has developed on disturbed areas through succession from surrounding vegetated areas. Portions of this map unit may have native soil remaining, but the unit is dominated by disturbed soil to the point where salvage of secondary growth medium is unfeasible from this unit. This map unit replaces unit DS used in the 2007 Baseline Report (ARCADIS 2007) in order to be consistent with NRCS mapping. Although this is the most extensive soil unit in the Cresson Project area, only 6 percent (26 acres) of the survey area is classified as disturbed soil.

2.1.5 Re. Rogert very gravelly sandy loam, cool, 10 to 40 percent slopes

Within the Cresson Project area, these soils are found on mountainsides with the natural and disturbed grassland vegetation community types. Texturally, these soils are identical to those of soil unit Rg described below, but have cooler subsurface temperatures. Mapped distribution of this soil unit is unchanged from the 2007 Baseline Report (ARCADIS 2007). This soil unit does not occur within the survey area.

2.1.6 Rg. Rogert very gravelly sandy loam, 15 to 40 percent slopes

These soils are found on mountainsides with the conifer-dominated woodland vegetation and natural grassland community types, typically on west- or south-facing slopes. Rogert series soils have formed from residuum derived from gneiss, granite, monzonite, or granodiorite. These soils are generally shallow and well drained. Approximately 2 percent (8 acres) of the survey area is comprised of this soil unit.

2.1.7 RgR. Rogert-Rock outcrop complex, 20 to 60 percent slopes

This soil unit consists of areas where cliffs and rock outcrops occur comingled with Rogert series soils on steep mountainsides. Cliffs and rock outcrops may compose 30 percent of the unit. Approximately 16 percent (69 acres) of the survey area is comprised of this soil unit.

2.1.8 Rl. Herbman gravelly sandy loam, 5 to 55 percent slopes

These soils are found on mountainsides in association with the natural grassland vegetation community type in the survey area in Section 17. Herbman series soils formed from residuum weathered from granite bedrock (also known as grus). These soils are shallow and well-drained. Approximately 25 acres of these soils are present in the survey area (6 percent of the total survey area).

2.1.9 Sl. Ivywild-Catamount complex, 30 to 70 percent slopes

Within the Cresson Project area, these soils are found on north-facing mountainsides in association with the dense conifer-dominated woodland vegetation type, and some areas of transitional aspens. Both unit components have formed from colluvium and residuum derived from granite. Both soils are somewhat excessively drained, shallow, and consist of gravelly sandy loam or loamy coarse sand. This soil unit is not present within the survey area.

2.1.10 Sz. Seitz very gravelly loam, 20 to 50 percent slopes

Seitz series soils are found on mountainsides with the dense conifer-dominated woodland vegetation type and in some areas of transitional aspen forests. Typically, these soils consist of very gravelly loams and clay loams to a depth of approximately 24 inches, which overlie a subsoil composed of very angular cobbles. A thin surface layer composed of decomposing conifer needles (duff) is often present within the survey area. Approximately 24 percent of the survey area (103 acres) is comprised of this soil unit. Portions of the northern Cresson Project area previously mapped as Seitz series soils have been disturbed by timbering and land-clearing operations.

2.2 Growth Medium Resources

As part of the ongoing mining operations at the Cresson Project, CC&V salvages soil that is suitable for assisting with revegetation. Soil recovered for use during reclamation is termed growth medium. The soils information presented in **Table 2-3** is generally representative of growth medium within the District. However, the depth figures for these soil map units are not representative of the depths that can be salvaged. The volume of growth medium that can be salvaged from areas proposed for disturbance is based primarily on the depth of the upper soil horizons, but also is influenced by slope, surface rock, areal extent, and vegetative cover. Regardless of these factors, depths of less than 6 inches are typically considered to be unsalvageable due to the large size of the equipment used to recover soil for reclamation purposes. Growth medium depths vary greatly depending on their position on the terrain, with the shallowest soil on the upper slopes and deepest at the toe of the slope. The presence of rock outcrops in some areas renders salvage operations unmanageable. By removing large roots and stumps and pushing slash, unavoidable mixing of the soil horizons occurs. Many soils within the project area are very to extremely cobbly at shallow depths, which may limit their usefulness as growth medium during reclamation. Field tests of soil pH did not indicate any additional limitations to use of project area soils as secondary growth medium.

Given the factors above and the data from field surveys, an average growth medium salvage depth was determined for each mapped soil unit (**Table 2-3**). Suitability ratings are based on soil interpretation records provided by the NRCS and the suitability guidelines in **Table 2-4**.

Four suitability ratings (Good, Fair, Poor, and Unsuitable) were used to determine the salvage depths of each mapping unit. Limiting factors were noted for each component of a soil series or phase. Coarse fragment content is primarily responsible for the suitability ratings in **Table 2-3**. Soils with more than 35 percent coarse fragments are rated unsuitable for use as growth medium.

Estimates of salvageable soil growth medium were calculated based on suitability ratings, average growth medium depths, and soil distributions presented in **Tables 2-2, 2-3,** and **2-4**. Soil components with average growth medium depths of less than 6 inches were not included in the total amount of salvageable material due to complications associated with salvaging shallow soils with heavy equipment. Good quality soil growth medium is limited to the extents of soil map unit CQ. Soil map units EB, RI, and Sz contain fair quality soil growth medium. Approximately 1.13 million cubic feet (26 acre-feet) of good and approximately 8.97 million cubic feet (206 acre-feet) of fair quality soil growth medium would be potentially salvageable. These estimates suggest that all areas within the MLE2 project area could be potentially reclaimed with approximately 6 inches of secondary growth medium.

3. VEGETATION RESOURCES

A qualified ARCADIS biologist mapped and characterized vegetation types within the survey area from July 19 to 21, 2011. The survey area has been, and continues to be, disturbed by historic and ongoing mine-related activities (e.g., underground development rock piles, prospecting excavations, surface mines, overburden storage areas, roads). However, despite these disturbances, several distinct vegetation communities persist within the survey area. Field verification and modification of baseline vegetation information resulted in the identification of nine vegetation community types within the survey area (**Table 3-1**). Descriptions of these vegetation communities are described below. **Appendix A** includes the common name and scientific nomenclature for each plant species identified within the survey area. Taxonomic names conform to Weber and Wittman (1996). Vegetation community types within the survey are also mapped on **Figure 3-1**. On **Figure 3-1**, each separate section of the survey area is labeled with a unique number (Areas 1-6); these numbers are referenced in the vegetation community descriptions below.

3.1 Aspen-Dominated Woodland

Aspen-dominated woodlands account for approximately 60 acres [14 percent of the total survey area (**Table 3-1**)]. This vegetation community type can be found in Sections 1, 2, 5, and 6. Within the survey area, aspen-dominated woodlands have a somewhat closed canopy of trees, 15 to 65 feet (5 to 20 meters) tall, dominated by quaking aspen (*Populus tremuloides*). Conifers are present in this vegetation community type in the survey area, but never co-dominant. Species include subalpine fir (*Abies bifolia*), Englemann spruce (*Picea engelmannii),* lodgepole pine (*pinus contorta*), Colorado blue spruce (*Picea pungens*), ponderosa pine (*Pinus ponderosa*), and Douglas fir (*Pseudotsuga menziesii*). Of these species, Engelmann spruce and ponderosa pine appear to be the most common coniferous species that occur in aspen-dominated woodlands. Conifer species may contribute up to 15 percent of the tree canopy before the community would be reclassified as a mixed conifer/aspen vegetation community. Shrubs were not common within this vegetation community, but some that were observed included red raspberry (*Rubus idaeus* ssp. *melanolasius*), wild gooseberry (*Ribes montigenum*), serviceberry (*Amelanchier alnifolia*), common juniper (*Juniperus communis*), and wood rose (*Rosa woodsii*). The herbaceous layer is generally lush, contributing to the majority of understory cover (approximately 10 to 50 percent cover). Common grasses include blue wild-rye (*Elymus glaucus*), bearded wheatgrass (*Elymus trachycaulus*), and Arizona fescue (*Festuca arizonica*). The most common forb in the understory of aspen-dominated woodlands in the survey area is golden banner (*Thermopsis montana*). Other

common forbs include yarrow (*Achillea millefolium*), larkspur (*Delphinium* spp.), meadowrue (*Thalictrum fendleri*), fringed sage (*Artemesia frigida*), cinquefoil (*Potentilla ovina*), fireweed (*Chamerion danielsii*), goldenrod (*Solidago multiradiata*), clover (*Trifolium* sp.), and milk vetch (*Astragalus* sp.).

3.2 Open, Conifer-Dominated Woodland

Open, conifer-dominated woodlands account for approximately 54 acres (13 percent of the entire survey area) and occur in Sections 3, 4, and 6. This vegetation community consists of an open tree canopy primarily dominated by lodgepole pine. Other trees, such as juniper (*Juniperus* spp.), ponderosa pine, Douglas fir, bristlecone pine (*Pinus aristata*), and limber pine (*Pinus flexilis*) are occasionally present within this community in the survey area. Bearberry (*Arctostaphylos uva-ursi*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), common juniper, bitterbrush (*Purshia tridentate*), wild gooseberry, and bilberry species (*Vaccinium* spp.) form an open shrub layer in some stands. The herbaceous layer is generally moderate in cover (approximately 20 to 50 percent) and is composed of xeric graminoids, such as Arizona fescue, Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and clover. This vegetation type tends to occur at the higher elevations within the survey area.

3.3 Dense, Conifer-Dominated Woodland

Dense, conifer-dominated woodlands account for approximately 80 acres (19 percent of the entire survey area), occurring in Sections 2 to 6 (most dominant in Sections 4 and 5). Englemann spruce and subalpine fir dominate the canopy, either mixed or alone. Lodgepole pine is common in many occurrences and patches of pure lodgepole pine are not uncommon, as well as patches of mixed conifer/quaking aspen stands. This community is composed of a mixed stand of trees, ranging from saplings (1-10 feet [0.3 to 3 meters] in height) to mature trees (approximately 60 feet [18.3 meters] in height). This community, like all others, appears to be a result of secondary succession. Common xeric species include common juniper, twinflower (*Linnaea borealis*), or holly-grape (*Mahonia repens*). Mesic understory shrubs may include species such as serviceberry (*Amelanchier alnifolia*), raspberry (*Rubus parviflorus*), and willow species (*Salix* spp). The herbaceous layer is sparse to moderately dense (5-40 percent cover). Common herbaceous species include Colorado thistle (*Cirsium scariosum*), fringed sage (*Artemisia frigida*), golden banner, fireweed, clover, wild strawberry (*Fragaria virginiana*), yarrow, *and* cinquefoil.

3.4 Natural Grassland

Natural grasslands account for approximately 164 acres (39 percent of the entire survey area) and occur in Sections 2, 3, 4, and 6. This vegetation community is the most frequent of communities in the survey area. Natural grasslands in the survey area have a species composition and density that has not been substantially changed as a result of disturbance. Cover is relatively high and ranges from 60 to 90 percent. Natural grasslands occur on gentle slopes with a southern exposure. Dominant species include Parry's oatgrass (*Danthonia parryi*), junegrass (*Koelaria macrantha*), Kentucky bluegrass (*Poa pratensis*), mountain muhly (*Muhlenbergia Montana*), squirreltail (*Elymus elymoides*), western wheatgrass (*Pascopyron smithii*), bearded wheatgrass, and Arizona fescue. Grassy slope sedge (*Carex oreocharis*) (once considered a rare species by the Colorado Natural Heritage Program, but not currently) occurs relatively frequently in this vegetation community type on granitic soils. Noxious weeds are generally not present or are sporadic in nature within natural grasslands.

3.5 Disturbed Grassland

Disturbed grasslands account for approximately 10 acres (two percent of the entire survey area), occurring primarily in Section 6, adjacent to an active mine site. These grasslands have been disturbed in historical times (primarily as a result of older mining activities) and continue to be disturbed by ranching practices (cattle grazing) and road construction/adjacent mining operations. Disturbed grasslands occur on gentle slopes with a southern exposure in the survey area. The composition, density, and cover of vegetation (30-60 percent) have been substantially altered. Dominant species include Kentucky bluegrass, western wheatgrass, squirreltail, redtop (*Agrostis stolonifera*), junegrass, green needlegrass, Arizona fescue, and smooth brome (*Bromopsis inermis*). Several noxious weed species are present, including but not limited to Canadian thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), and dalmatian toadflax (*Linaria dalmatica*).

3.6 Riparian Woodland

Riparian woodlands (as mapped) account for only 5 acres (one percent of the entire survey area); however, this community was not observed during the survey. Saturated drainages/wetlands were also not observed due to the late-summer (typically dry) timing of the survey. As such, riparian vegetation that may normally be present during the spring was not observed during this late-summer survey. If missed, but potentially present within the survey area, dominant tree may species

include subalpine fir, Englemann spruce, Douglas fir, Colorado blue spruce, quaking aspen, and Rocky Mountain juniper (*Juniperus scopulorum*). Other trees that may be present include alder (*Alnus incana*), lodgepole pine, cottonwood (*Populus deltoides*), boxelder (*Acer negundo*), and Utah juniper (*Juniperus osteosperma*).

3.7 Wet Meadow

Wet meadows account for approximately 9 acres (two percent of the entire survey area), only occurring in Section 3 of the survey area. Due to the late-summer timing of the survey, 'wet meadows' were dry during the survey. However, moisture for this community appears to come from groundwater, stream discharge, overland flow, overbank flow, and on-site precipitation. A delineation of potential wetlands and other waters of the U.S. for the areas of new disturbance (including wet meadows) in the MLE2 project area was completed in July of 2011.No features characteristic of wetlands or Waters of the U.S. as regulated under Section 404 of the Clean Water Act were found in the project area.

A mosaic of plants was observed in this vegetation community. Dominant species include hydric sedge species (*Carex* spp.), tufted hairgrass (*Deschampsia caespitosa*), spikerush species (*Eleocharis spp.*); and rush species (*Juncus spp.*). Common forb species include wild iris (*iris missouriensis*), cinquefoil, and clover species.

3.8 Disturbed Areas

Disturbed areas are a result of past and ongoing mining and ranching practices. Disturbed areas account for approximately 40 acres (10 percent of the entire survey area and one of the more frequent communities in the survey area). Most or all of the soil has been disturbed, and vegetation is dramatically changed or absent in these areas. Where vegetation occurs, it is typically a mix of native and non-native grasses, forbs, and noxious weeds.

3.9 Reclaimed Areas

Reclaimed areas account for 1 acre (less than one percent of the survey area). These areas have been disturbed by mining activity in the past, but have since been reclaimed. The vegetation is typically a mix of native and non-native grasses and forbs and often reflects the composition of the reclamation seed mix that was in use at the time. Tree saplings (primarily Engelmann spruce) and shrubs (primarily cinquefoil) have started to grow within reclaimed areas in the survey area. Cover is

open to dense (50 to 70 percent), depending on the amount of time that has passed since reclamation. Noxious weeds are present where native vegetation has not been completely re-established.

3.10 Noxious Weeds

Noxious weeds are primarily associated with disturbed areas and alongside roads. The most commonly noted species is yellow toadflax (*Linaria vulgaris*), with lesser amounts of Canada thistle, musk thistle (*Carduus nutans*), oxeye daisy (*Chrysanthemum leucanthemum*), bull thistle, cheatgrass (*Anisantha tectorum*), and Dalmatian toadflax. These species do not presently appear to be displacing native vegetation. Several of these species were probably introduced to the area as ornamentals (toadflax and ox-eye daisy), or by livestock (thistles and cheatgrass).

3.11 Potential Impacts to Vegetation Resources

The project footprint should be limited to the proposed project boundary to the greatest extent feasible as to avoid unanticipated impacts to native vegetation. Reclamation performance standards per Rule 3 of the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board (CMLRB) for Hard Rock, Metal, and Designated Mining Operations (CMLRB 2010) should be implemented for post-mining use. Per this rule, CC&V will need to choose how the affected lands will be reclaimed (and how to avoid introduction of noxious weeds to the site), and the results of these decisions will need to be formulated into a Reclamation Plan. Reclamation measures per section 3.1.5 of CMLRB mining rules and regulations (CMLRB 2010) should be implemented.

A delineation of potential wetlands and other waters of the U.S. for the areas of new disturbance included in the MLE2 Project of the Cresson Project by CC&V was completed in July of 2011. Wetlands and other waters are regulated under Section 404 of the Clean Water Act (CWA) and authorization (a Section 404 permit) is required for the placement of dredged and fill material into them. No wetlands or other waters regulated under Section 404 were found in any of the study areas. The lack of these features is due to the relatively small watersheds, well drained soils, steep slopes, and only moderate precipitation of the study areas.

Disturbances to the prevailing hydrologic balance of the affected land and surrounding area and to the quantity or quality of water in surface and groundwater systems should be minimized per measures as described in Section 3.1.6 (Water – General Requirements) of the CMLRB mining ruling and regulations (CMLRB 2010).

4. WILDLIFE RESOURCES

ARCADIS conducted an inventory of wildlife habitats and species within the survey area in conjunction with evaluating vegetation communities from July 29 to 21, 2011. Important observations are shown on **Figure 4-1** and discussed in detail below.

4.1 Big Game

Prior to visiting the survey area, existing baseline information indicated that the Rocky Mountain elk (*Cervus canadensis*) is the most abundant big game species within the survey area. CDOW habitat mapping (2011) indicates that the area provides summer and overall ranges, while crucial winter range is found two to five miles northeast of the survey area. Elk sign (primarily pellet groups) was observed on several occasions throughout the survey area, particularly in aspen dominated woodlands, open conifer dominated woodlands, and dense conifer dominated woodlands.

CDOW habitat mapping (2011) indicates that the survey area provides summer and overall ranges for mule deer (*Odocoileus hemionus*), with some crucial winter range just south of Sections 1 and 6. Mule deer sign in the form of pellets was observed on several occasions, throughout all vegetation communities, in the survey area during the wildlife inventory. A female and two young mule deer were also observed foraging on the understory of an aspen dominated woodland in Section 1. In addition, two young bucks were observed foraging on the understory of a coniferous forest in the northern finger of Section 6. These individuals were foraging in the near vicinity of noisy road-work, which may indicate their adaptability to human disturbance.

Bighorn sheep (*Ovis canadensis*) do not generally occur within the District, but areas of bighorn sheep overall and winter ranges are found several miles to the northeast and southwest (CDOW 2011). No bighorn sheep, sign of bighorn sheep, or habitat suitable for this species was observed in the survey area.

The survey area is part of black bear (*Ursus americanus*) overall range, and is also designated a human/bear conflict area (CDOW 1997). The conflict area is that portion of the overall range where two or more confirmed black bear complaints per season were received which result in CDOW investigation, damage to persons or property, and/or removal of the problem bear(s). Black bear sign in the form of scat was observed on several occasions in aspen-dominated woodlands as well as open/dense conifer dominated woodlands.

4.2 Game Birds

Existing baseline information indicated that the blue grouse (*Dendragapus obscurus*) is the only game bird species expected to occur within the survey area. Sections 2, 3, and 5 of the survey area, with their mix of dense conifer stands and aspen groves provide ideal blue grouse habitat. However, no blue grouse or sign thereof were observed in the survey area.

4.3 Raptor Nests

Raptors observed in the survey area included red-tailed hawks (*Buteo jamaicensis*), prairie falcons (*Falco mexicanus*), and turkey vultures (*Cathartes aura*). These raptors were generally observed soaring or perched; however, no active nests were observed. A juvenile red-tailed hawk flushed from a ponderosa pine tree in an aspen-dominated woodland in the north-central portion of Section 6. This individual sounded off alarm calls, as to indicate its foraging or possibly nesting territory. A qualified ARCADIS biologist searched the area for a nest or signs thereof, but did not find any evidence. The area has been designated as a potential red-tailed hawk nesting territory, but cannot be confirmed due to the lack of a nest observation. A similar event (red-tail hawk flushed and sounded an alarm) occurred in an open, lodgepole pine dominated woodland in the northern portion of Section 3. Both potential red-tailed hawk nesting territories are mapped on **Figure 4-1**. Other raptors that may be found in the area, and potentially nest in the area, but were not observed during 2011 field surveys include the northern goshawk (*Accipiter gentilis*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), and great horned owl (*Bubo virginanus*). One golden eagle was observed flying over grassland habitat outside the town of Victor during the surveys, but not within the survey area.

4.4 Other Wildlife Species

Several small game and nongame species occur in the area and are typical of the high-elevation habitat present, including bird species such as the gray jay (*Perisoreus canadensis*), common raven (*Corvus corax*), black-billed magpie (*Pica pica*), northern flicker (*Colaptes aurates*), downy woodpecker (*Picoides pubescens*), dark-eyed junco (*Junco hyemalis*), mountain chickadee (*Poecile gambeli*), Clark's nutcracker (*Nucifraga columbiana*), yellow-rumped warbler (*Dendroica coronata*), mountain bluebird (*Sialia currucoides*), chipping sparrow (*Spizella passerina*), American robin (*Turdus migratorius*), white-breasted nuthatch (*Sitta carolinensis*),

red-breasted nuthatch (*Sitta canadensis*), mourning dove (*Zenaida macroura*), steller's jay (*Cyanocitta stelleri*), and barn swallow (*Hirundo rustica*); reptile species such as the garter snake (*Thamnophis* spp.); larger mammals such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), mountain lion (*Felis concolor*); and rodents such as the ground squirrel (*Spermophilus* spp.), Botta's pocket gopher (*Thomomys bottae*), meadow vole (*Microtus* spp.), cottontail rabbit (*Sylvilagus* spp.), jackrabbit (*Lepus* spp.), pine squirrel (*Tamiasciurus hudsonicus*), Gunnison's prairie dog (*Cynomys gunnisoni*) and deer mouse (*Peromyscus* spp.).

Shafts and adits associated with historic underground mining in the area represent potential habitat for bat species such as the sensitive Townsend's big-eared bat (*Corynorhinus townsendii*). Suitable foraging habitat for bats exists along Cripple Creek, Arequa Gulch, Squaw Gulch, Wilson Creek, Grassy Creek, and several unnamed drainages on the north end of the District. No underground surveys for bats were conducted during the 2011 site visit.

4.5 Potential Impacts to Wildlife Resources

Proposed project activities will likely result in the loss of foraging and calving habitat for big game (particularly elk and mule deer), strutting habitat for grouse, habitat for small mammals, and potentially nesting habitat for raptors. Per CMLRB's mining rules and regulations (CMLRB 2010), all aspects of the mining and reclamation plan should take into account the safety and protection of wildlife on the mine site, at processing sites, and along all access roads to the proposed project sites with special attention given to critical periods in the life of wildlife (e.g. elk calving, migration routes, grouse strutting periods, raptor nesting periods, etc.). Habitat management and creation should be directed toward encouraging the diversity of both game and non-game species, and should provide protection, rehabilitation, or improvement of wildlife habitat.

While no active raptor nests were found during the 2011 surveys, it is recommended that if any active raptor nests are located prior to development, that the nests be clearly marked in the field so that disturbance can be avoided. It is prohibited to take a raptor, its nest, eggs, or young under the federal Migratory Bird Treaty Act (and under the Bald and Golden Eagle Protection Act in the case of eagles). CDOW has a set of recommended no surface occupancy buffer zones and seasonal human encroachment restrictions for active raptor nest sites (CDOW 2008). The recommended buffer zones range from 1/4 mile to 1/2 mile depending on the species. Red-tailed hawks were observed in the project area and showed signs of

territorial behavior (potentially indicated a nesting territory). CDOW recommends a ⅓ mile non-disturbance buffer around active red-tailed hawk nests with no human encroachment from April to August.

5. SPECIAL STATUS SPECIES

ARCADIS queried USFWS, CDOW, and CNHP websites and developed a list of special status species that have potential to occur in the survey area. Species and status designations are as follows:

Birds

- American peregrine falcon (*Falco peregrinus anatum*): state species of concern
- Bald eagle (*Haliaeetus leucocephalus*): state species of concern
- Burrowing owl (*Athene cunicularia*): state threatened
- Ferruginous Hawk (*Buteo regalis*): state species of concern
- Greater sandhill crane (*Grus Canadensis tabida*): state species of concern
- Least tern (*Sternula antillarum*): federally endangered/state endangered
- Mexican spotted owl (*Strix occidentalis lucida)*: federally threatened/state threatened
- Piping plover (*Charadrius melodus*): federally threatened/state threatened
- Whooping crane (*Grus americana*): federally endangered

Mammals

- Botta's pocket gopher (*Thomomy bottae rubidus*): state species of concern
- Gunnison's prairie dog (*Cynomys gunnisoni*): federal candidate
- Preble's meadow jumping mouse (*Zapus hudsonius preblei*): federally threatened/state threatened
- Townsend's big-eared bat (*Corynorhinus townsendii palllescens*): state species of concern

Fish

- Pallid sturgeon (*Scaphirhynchus albus*): federally endangered

Invertebrates

- Pawnee montane skipper (*Hesperia leonardus montana*): federally threatened

Plants

- Pale moonwort (*Botrychium pallidum*): state rare plant
- Reflected moonwort (*Botrychium echo*): state rare plant
- Rocky Mountain columbine (*Aquilegia saximontana*): state rare plant
- Western prairie fringed orchid (*Platanthera praeclara*): federally threatened

The least tern, piping plover, whooping crane, sandhill crane, and pallid sturgeon are all associated with water bodies, particularly, the South Platte River in Teller County. Activities associated with the survey area do not affect waters of the South Platte River or its tributaries. Waters leaving the area generally feed creeks which drain to the south and ultimately may flow into the Arkansas River. The five species are not likely to be affected by project activities. The discussion of the remaining listed species that follows includes site-specific information, where appropriate.

5.1 Birds

5.1.1 American Peregrine Falcon

The American peregrine falcon is a state listed species of concern. This species inhabits open spaces usually associated with high cliffs and bluffs overlooking rivers or other large bodies of water (CDOW 2011). No American peregrine falcons were observed in the survey area. In addition, there is no suitable habitat (i.e., cliffs or high bluffs) for this species in the survey area. Individuals of this species may occasionally pass through the area during migration but are not expected to stopover in the area due to the lack of suitable habitat.

5.1.2 Bald Eagle

In June 2007, the Secretary of the Interior announced the removal of the bald eagle from the USFWS threatened and endangered species list. However, bald eagles continue to be protected under the federal Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Food availability is probably the single most important factor affecting bald eagle distribution and abundance. Fish and waterfowl are the primary sources of food. Big game and livestock carrion, as well as larger rodents (e.g. prairie dogs), also can be important dietary components where these resources are available (Ehrlich et al. 1988).

There are no known bald eagle nest sites or winter roosts in the District or the survey area. Food resources present within the survey are most likely insufficient to attract bald eagles, particularly due to the lack of large water bodies in the survey area that would support fish and waterfowl. Individuals of this species may occasionally pass through the area during migration but are not expected to stay in the area due to limited foraging habitat. No bald eagles were observed in the survey area during the 2011 site visit.

5.1.3 Burrowing Owl

The burrowing owl is a state listed threatened species. Burrowing owls occupy grasslands and mountain parks, typically in or near prairie dog colonies where they can use abandoned burrows to modify and use as their own (USFWS 2003). Grasslands and prairie dog colonies were searched intensively during the 2011 site visit; however, no burrowing owls were observed within the survey area. Though there are historic occurrences of this species within Teller County; current distribution maps do not show this species occupying Teller County (USFWS 2003). As such, it is not expected that burrowing owls would occur in the survey area.

5.1.4 Ferruginous Hawk

The ferruginous hawk is considered a species of concern in Colorado. The ferruginous hawk is a bird of open grasslands and shrub steppe vegetation communities (CDOW 2004). Birds nest in flat, rolling, or rugged terrain in open areas, including short-grass prairie, canyons with cliffs or rock outcrops, and areas with isolated trees (CDOW 2004). There is suitable habitat for this species within native grasslands in the survey area. However, no ferruginous hawks or nests were observed during the 2011 site visit. Considering this species typically avoids areas of high human disturbance (CDOW 2004), such as that of mine activity and road work within the vicinity of the survey area, the ferruginous hawk is unlikely to use habitats within the survey area (particularly for nesting).

5.1.5 Mexican Spotted Owl

The Mexican spotted owl is a federally and state listed threatened species. It inhabits two different primary habitats in Colorado: 1) old growth mixed coniferous forests in mountainous areas ay elevations ranging from 5,500 to 9,000 feet and 2) large steep canyons and areas of pinyon-juniper with scattered stands of old growth Douglas-fir in narrow, shady canyons. Canyon bottoms often have riparian vegetation composed of cottonwoods, willow, box elder, and other riparian shrub and tree species. Downed logs and snags are also important habitat components. Day roost sites are found in

cool, shady canyons, often on north-facing slopes (Andrews and Righter 1992) or on ledges or in cavities in canyon walls (Ganey and Balda 1994).

Previous CNHP data (CNHP 1999) show recorded occurrences to the south, east, and north of the survey area. The USFWS has designated three areas of critical habitat in Colorado. The closest critical habitat area is known as SRM-C-1a and encompasses areas to the south, east, and northeast of the survey area (USFWS 2007).

Limited areas of potential foraging habitat for the Mexican spotted owl exist in Sections 2, 4, and 5 of the survey area. However, little to no nesting habitat (old-growth forests, steep canyons) exists in the survey area. Based on the limited size of observed foraging habitat patches and the distance from known critical habitat, Mexican spotted owls are not expected to occur in the survey area.

5.2 Mammals

5.2.1 Botta's Pocket Gopher

The Botta's pocket gopher is a state species of concern. It can be found in a variety of vegetation types, including agricultural lands, grasslands, roadsides, open parklands, pinyon-juniper woodlands, open montane forests, and montane shrublands (NDIS 2011). Habitat, particularly in natural grassland and open conifer dominated woodlands, is present within the survey area. No individual Botta's pocket gophers were observed within the survey area. However, distinctive burrow mounds of pocket gophers (plugged mounds) were observed in natural grasslands in the survey area.

5.2.2 Gunnison's Prairie Dog

The Gunnison's prairie dog is a candidate for federal listing. Gunnison's prairie dogs require deep, well-drained soils for development of burrows. Topography of inhabited areas is generally flat to gently rolling, with slopes generally less than 30 percent. Gunnison's prairie dog colonies can typically be found in relatively open plant communities with short-stature vegetation (Seglund and Schnurr 2010). Natural grasslands within the survey area support Gunnison's prairie dog habitat. An active prairie dog colony, in the upwards of 50 plus burrows, was found directly adjacent to the northeastern edge of Section 2 of the survey area (**Figure 4-1**). No burrows or individuals appeared to extend into the survey area, particularly because a relatively

steep slope leads up into the area (on which prairie dogs are less likely to colonize). This was the only active prairie dog colony found near the survey area.

5.2.3 Preble's Meadow Jumping Mouse

The Preble's meadow jumping mouse is a federally and state listed threatened species. Typical habitat for the Preble's meadow jumping mouse is composed of well-developed plains riparian vegetation with adjacent, relatively undisturbed grassland communities, and a nearby water source. These riparian areas include a relatively dense combination of grasses, forbs, and shrubs. Preble's are known to regularly range outward into adjacent uplands to feed and hibernate. The USFWS has designated 11 areas in Colorado as critical habitat (USFWS 2009). The closest critical habitat unit is Unit 10: Upper South Platte River. The unit consists of four subunits including one subunit which occurs in Teller County, the Trout Creek Subunit (USFWS 2009). This subunit is located approximately 40 miles north of the survey area, and suitable habitat for this species does not exist within the survey area.

5.2.4 Townsend's Big-Eared Bat

The Townsend's big-eared bat is listed as a state species of concern in Colorado. This species can be found in mines, caves, and structures in woodlands and forests to elevations above 9,500 feet. Due to safety concerns, underground mine inspections were not conducted to determine the presence of bats in abandoned mines present within the survey area. However, it is likely that bats, and potentially the Townsend's big-eared bat, occupy abandoned mines in the survey area. This species can be sensitive to disturbance, particularly during hibernation. Therefore, if this species is ever identified in the survey area, care should be taken to not disturb them during the winter months to avoid accidental arousal during hibernation and thus cause energy depletion that is needed to survive through hibernation.

5.3 Invertebrates

5.3.1 Pawnee Montane Skipper

The Pawnee montane skipper is a federally listed threatened species. This butterfly inhabits dry, open ponderosa pine woodlands with a sparse understory at 6,000 feet to 7,500 feet amsl on soils derived from the Pikes Peak granite. Blue grama grass (*Bouteloua gracilis*) (the larval food plant) and prairie gayfeather (*Liatris spicata*) (the primary nectar plant) are two necessary components of the ground cover (USFWS 1998). The only known location is at Deckers, approximately 40 miles north of the

District (Ronish 1999). No potential habitat for the Pawnee montane skipper was observed in the survey area. Small areas of ponderosa pine were observed with near-by blue grama, but no gayfeather was observed and the elevation was likely too high.

5.4 Plants

The western prairie fringed orchid is a federally listed threatened species. The pale moonwort, reflected moonwort, and Rocky Mountain columbine are all listed as state rare plants. None of these special status plant species were observed in the survey area, and past survey data does not suggest the presence of these species in the survey area.

5.5 Impacts to Special Status Species

An active Gunnison's prairie dog colony was found adjacent to Section 2 of the proposed project area (**Figure 4-1**). In addition, potential burrows of the Botta's pocket gopher were found within open grassland habitat in Sections 2 and 3 of the proposed project area. These species are not afforded specific protections under state or federal laws; however, it is recommended that direct impacts to active burrows or colonies be avoided to the greatest extent feasible. Habitat management and creation should provide protection, rehabilitation, or improvement habitat for these species as well as for all special status species with potential to occur in the project area.

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TABLES

Table 2-1 Soils Within the Survey Area

	Adderton-Rosane taxadjunct complex (CQ)		Quander-Bushpark very gravelly loams (EB)		Rogert Soils		Herbman gravelly sandy loam (Rl)	Seitz very gravelly loam (Sz)
	Adderton	Rosan	Quander	Bushpark	Rogert very gravelly sandy loam (Rg)	Rogert with rock outcrops (RgR)		
Percentage of Complex*	65	30	60	30	85	60 (30 percent rock)	90	90
Steepness of Slope (percent)	0-3	0-3	5-40	10-40	15-40	20-60	5 to 55	20-50
Aspect	All	All	All	All	Mostly south and west	Mostly south and west	East and north	Mostly north
Landforms	Floodplain steps	Floodplain steps	Upper side slopes	Side slopes and foot slopes	Mountainsides	Mountainsides	Side slopes	Mountainsides and side slopes
Parent Material	Alluvium	Alluvium	kind=colluvium source=phonolite, latite-phonolite, breccia from phonolite & latite, trachydolerite	kind=residuum source=phonolite, latite-phonolite, breccia from phonolite &latite, trachydolerite	kind=colluvium source= gneiss, granite, monzonite, or granodiorite	kind=colluvium source= gneiss, granite, monzonite, or granodiorite	kind = residuum source = granite	kind=colluvium, slope alluvium source= trachyte, breccias, tuff
Native Plant Community	Natural Grassland/ Wet Meadow	Natural Grassland/ Wet Meadow	Natural Grassland	Natural Grassland	Conifer-dominated Woodland and Natural Grassland	Conifer-dominated Woodland and Natural Grassland	Natural Grassland	Conifer-dominated Woodland
Typical Profile	0 to 42” = loam 42 to 50” = sandy loam 50 to 60” = very gravelly sandy loam	0 to18” = loam 18 to 24” = very gravelly sandy clay loam 24 to 60” = extremely gravelly sand	0 to 9" =brown gravelly loam 9 to 24" = borwn very cobbly silty clay loam 24-60" = reddish brown extremely cobbly silty clay loam	0 to 8” = dark yellowish to grayish brown fine gravelly silt loam 8 to 16” = brown fine gravelly silt loam 16 to 25” = light redish brown very cobbly silt loam 25 to 30+” = light reddish brown extremely cobbly silty loam	0 to 6” = light brown gravelly silt loam 6 to 14” = extremely cobbly silt loam 14+” = gneiss or other bedrock	0 to 13" = extremely gravelly clay loam 13+” = gneiss or other bedrock	0 to 5” = brown gravelly sandy loam 5 to 12” = light brown cobbly sandy loam 12+” granite bedrock	0 to 4” = conifer litter 4 to 16” = light brown very gravelly loam to silt loam 18 to 26” = yellowish to light brown extremely cobbly silt loam 26+” = light brown to light reddish brown extremely cobbly silt loam
Depth Class	Very deep	Moderate	Shallow to rock fragments; very deep to bedrock	Shallow to rock fragments; very deep to bedrock	Very shallow and shallow	Very shallow and shallow	Shallow	Shallow to rock fragrments; very deep to bedrock
Drainage Class	Well	Very poorly	Well	Well	Well	Well	Well	Well
Permeability	Moderately rapid	Moderate	Moderate	Moderate	Rapid	Rapid	Rapid	Slow
Available Water Capacity	Moderate	Moderate	Low to Moderate	Low	Very low	Very low	Low to Moderate	Low
Potential Rooting Depth	60+”	60+”	24”	30”	5-14"	8-13"	12”	24”
Runoff	Medium	Medium	Very rapid	Very rapid	Rapid to very rapid	Very rapid	Rapid	Very rapid
Hazard of Water Erosion (No Plant Cover)	Moderate	Slight to Moderate	Very high	Very high	High to very high	Very high	Very high	Very high

* Remaining percentages of map units consist of contrasting inclusions.

Table 2-2 Soil Types the Survey Area

Soil Map Unit	Total Acres in Survey Area	Percent of Survey Area
CQ. Adderton-Rosane taxadjunct complex, 0 to 6 percent slopes	**9.8**	**2**
EB. Quander-Bushpark very gravelly loams, 5 to 40 percent slopes	**183.2**	**43**
OR. Disturbed land, mine areas, overburden storage areas, mine complex	**26.3**	**6**
Rg. Rogert very gravelly sandy loam, 15 to 40 percent slopes	**7.8**	**2**
RgR. Rogert-Rock outcrop complex, 20 to 60 percent slopes	**69.4**	**16**
Rl. Herbman gravelly sandy loam, 5 to 55 percent slopes	**24.6**	**6**
Sz. Seitz very gravelly loam, 20 to 50 percent slopes	**103.3**	**24**
Total	**424.4**	**100**

Table 2-3 Estimates of Growth Medium Salvage Depth and Suitability Within the Survey Area

Soil Map Unit	Soil Depth From NRCS[1]		Soil Depths From This Study		
	Range of Depth (inches)	Mean Depth (inches)	Range of Depth (inches)	Mean Depth (inches)	Suitability Rating
Adderton	ND	ND	30-42	36	Good
Rosan	ND	ND	24-30	28	Good
Quander	4-15	9.5	4-16	8	Fair
Bushpark	ND	ND	6-9	8	Fair
Rogert very gravelly sandy loam	1-5	3	1-6	3	Poor
Rogert with Rock Outcroppings	1-3	2	1-5	2	Poor
Herbman	ND	ND	8-12	10	Fair
Seitz	1-11	6	1-18	10	Fair

[1] NRCS 1999.

ND = No Data. These soil types were not named at the time of communication with NRCS.

Table 2-4 Soil Material Suitability Criteria for Salvage And Redistribution as Growth Medium

Soil Property	Soil Quality			
	Good	Fair	Poor	Unsuitable
Texture	Sandy loam Loam Silt loam	Sandy clay loam Silty clay loam Clay loam	Sandy clay Loamy sand Silty clay	Clay>60 percent
Coarse Fragment (percent by volume)	0-10	10-20	20-35	>35
Organic Matter (percent)	>1.5	0.5-1.5	<0.5	
Soil pH	6.1-7.8	5.1-6.1 7.9-8.4	4.5-5.0 8.5-9.0	<4.5 >9.1
Salinity (mmho/cm)	<3	3-6	6-9	>9
Available Water Retention Capacity (in/in)	>0.16	0.2-0.6	<0.2 or >6.0	
Permeability	0.6-6.0	0.2-0.6	<0.2 or >6.0	

Notes:
mmho/cm = millimho per centimeter
in/in = inch per inch
Source: NRCS 1999.

Table 3-1 Vegetation Community Type Acreage Summary in the Survey Area

Vegetation Community Type	Total Acres in Survey Area	Percent of Survey Area
Aspen dominated woodland	60.2	14
Dense conifer dominated woodland	80.1	19
Disturbed	40.4	10
Disturbed Grassland	10	2
Natural Grassland	164.2	39
Open conifer dominated woodland	54.4	13
Reclaimed	1.2	0
Riparian Woodland	4.7	1
Wet Meadow	9.2	2
Total	**424.4**	**100**

ARCADIS

FIGURES

Cripple Creek

Victor

T15S R70W T15S R69W

T16S R70W T16S R69W

1

2

3

4

5

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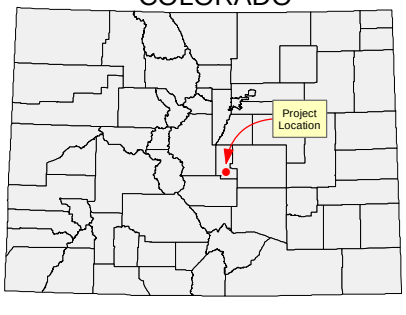
COLORADO



Legend

Project Area

MLE2 Project/Survey Areas

N

W E

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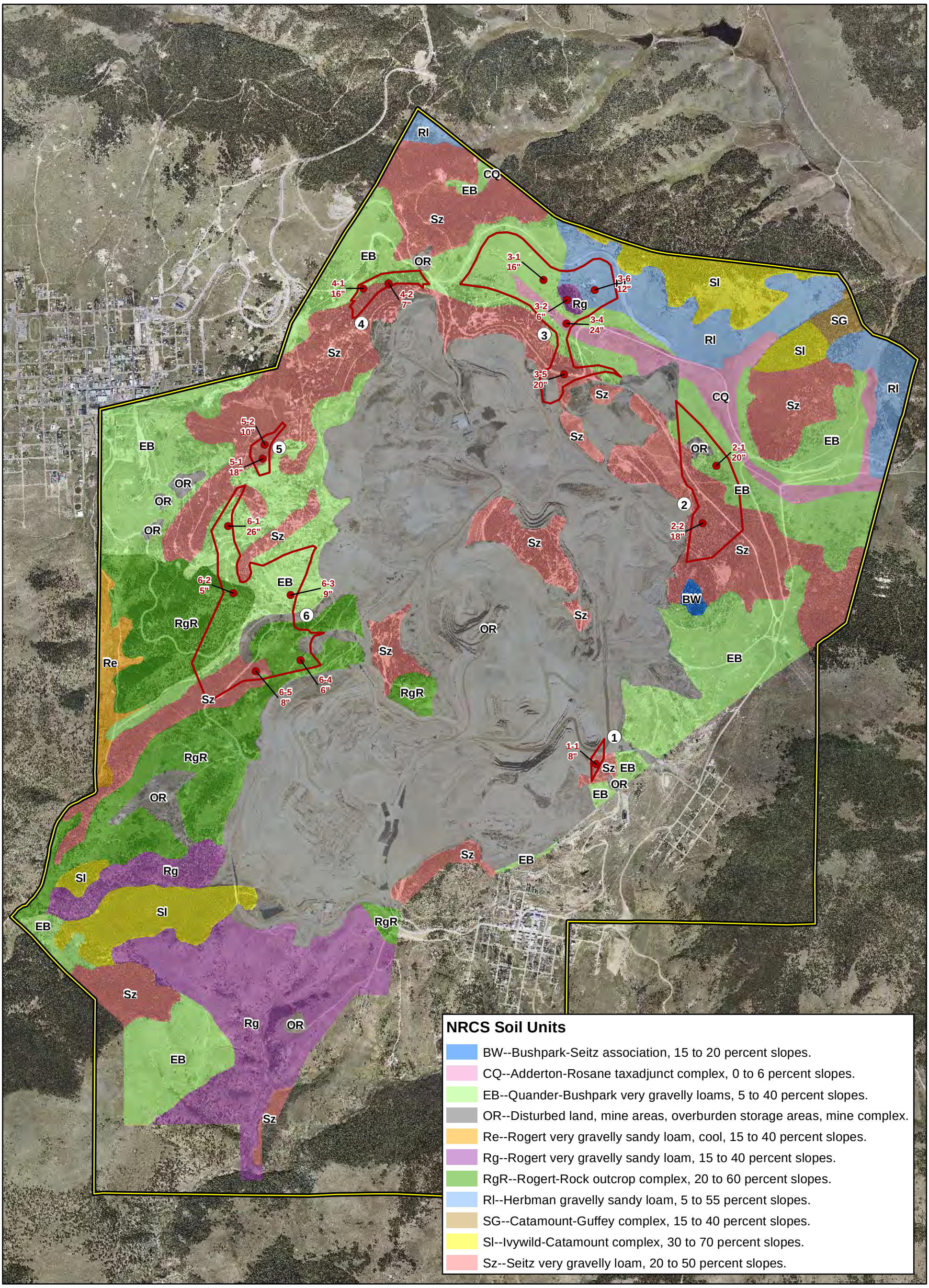
0 2,000 4,000 Feet

CC&V

ANGLOGOLD ASHANTI
ANGLOGOLD ASHANTI (COLORADO) CORP.

CRIPPLE CREEK & VICTOR GOLD MINING COMPANY

FIGURE 1-1
MINE LIFE EXTENSION 2
PROJECT LOCATION



NRCS Soil Units

- BW--Bushpark-Seitz association, 15 to 20 percent slopes.
- CQ--Adderton-Rosane taxadjunct complex, 0 to 6 percent slopes.
- EB--Quander-Bushpark very gravelly loams, 5 to 40 percent slopes.
- OR--Disturbed land, mine areas, overburden storage areas, mine complex.
- Re--Rogert very gravelly sandy loam, cool, 15 to 40 percent slopes.
- Rg--Rogert very gravelly sandy loam, 15 to 40 percent slopes.
- RgR--Rogert-Rock outcrop complex, 20 to 60 percent slopes.
- Rl--Herbman gravelly sandy loam, 5 to 55 percent slopes.
- SG--Catamount-Guffey complex, 15 to 40 percent slopes.
- Sl--Ivywild-Catamount complex, 30 to 70 percent slopes.
- Sz--Seitz very gravelly loam, 20 to 50 percent slopes.

Legend

- Project Area
- MLE2 Project/Survey Areas
- Soil Pits and Salvageable Soil Depth

N W E S

0 2,000 4,000 Feet

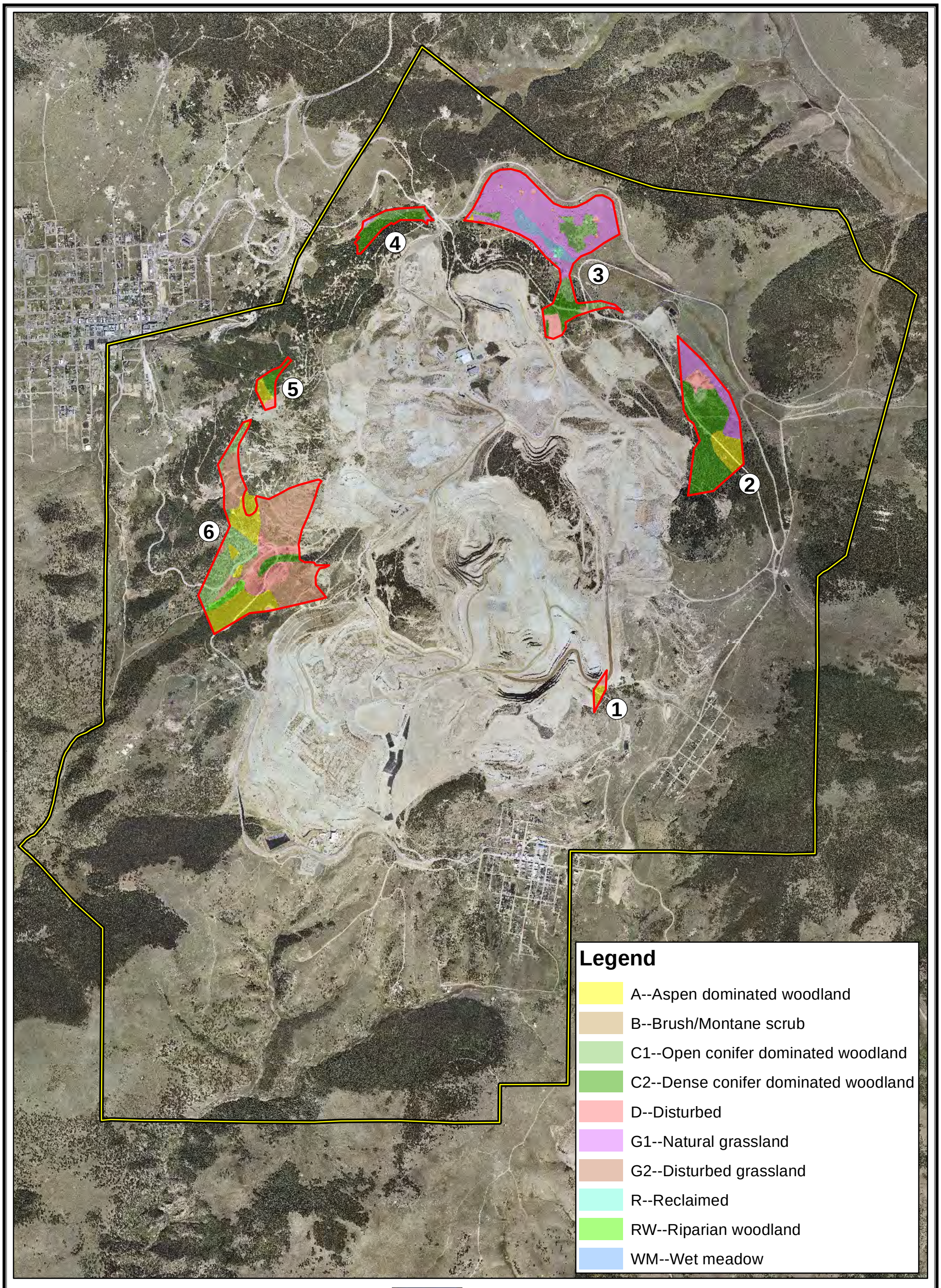
CC&V

AngloGold Ashanti
AngloGold Ashanti (Colorado) Corp.

CRIPPLE CREEK & VICTOR GOLD MINING COMPANY

FIGURE 2-1
MINE LIFE EXTENSION 2
SOILS MAP

ARCADIS



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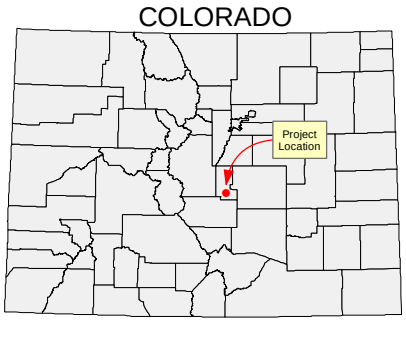


Legend

Project Area

MLE2 Project/Survey Areas

N W E S

Feet

0 2,000 4,000

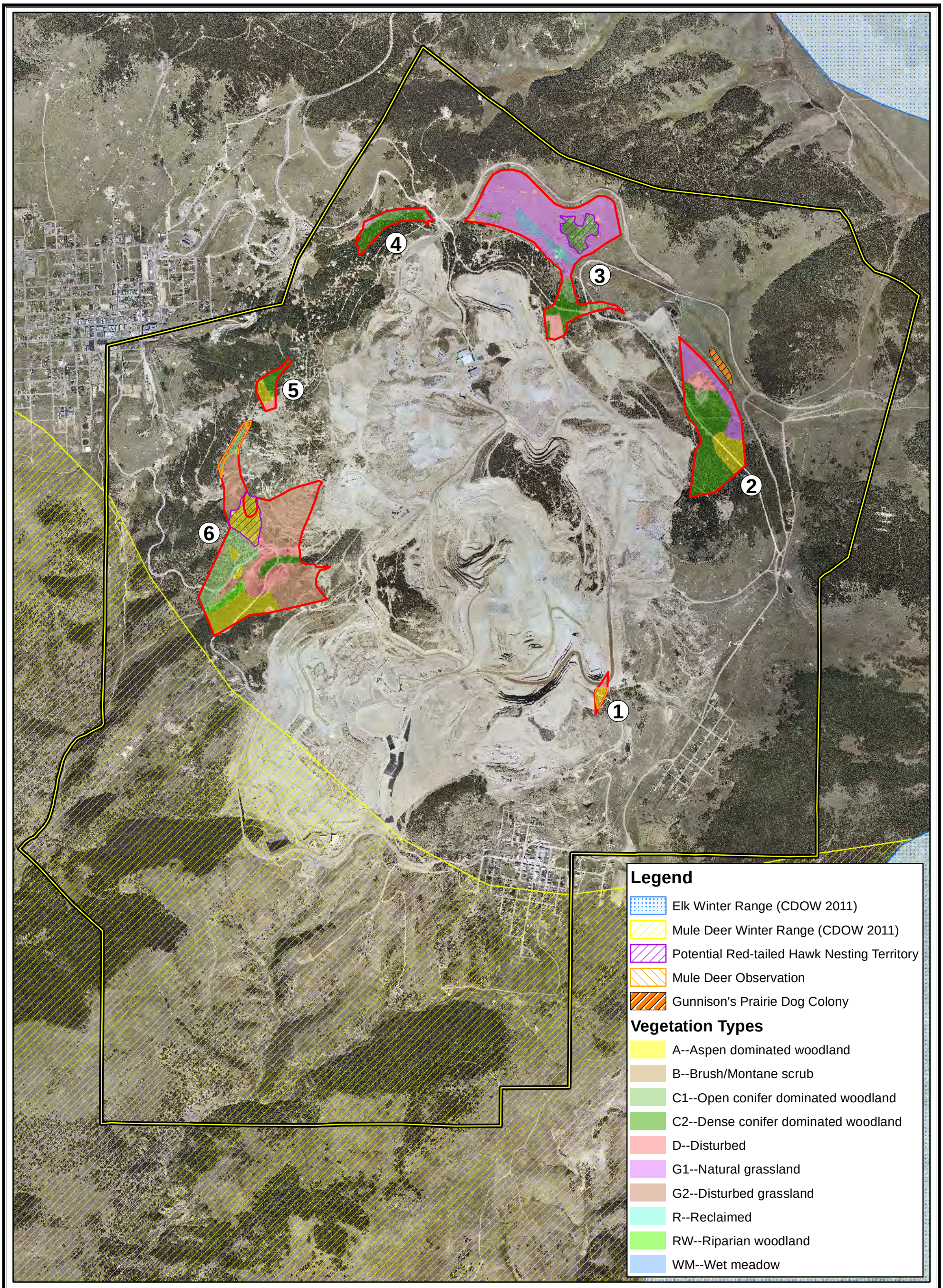
CC&V

ANGLOGOLD ASHANTI
ANGLOGOLD ASHANTI (COLORADO) CORP.

CRIPPLE CREEK & VICTOR GOLD MINING COMPANY

FIGURE 3-1
MINE LIFE EXTENSION 2
VEGETATION COMMUNITY TYPES

ARCADIS



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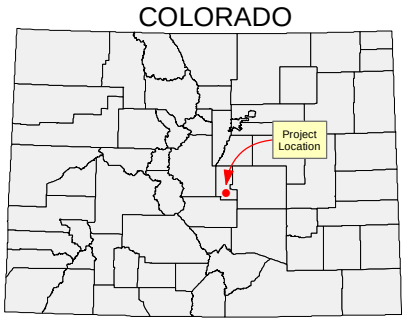

Legend

Project Area

MLE2 Project/Survey Areas

N W E S

0 2,000 4,000 Feet

CC&V

ANGLOGOLD ASHANTI
ANGLOGOLD ASHANTI (COLORADO) CORP.

CRIPPLE CREEK & VICTOR GOLD MINING COMPANY

FIGURE 4-1
MINE LIFE EXTENSION 2
WILDLIFE RESOURCES

ARCADIS

Appendix A

Vegetation Data

Table A-1 Plant Species Observed in Survey Area

Common Name	Scientific Name
TREES	
Subalpine fir	*Abies bifolia*
Rocky Mountain maple	*Acer glabrum*
Alder	*Alnus incana* ssp. *tenuifolia*
Englemann spruce	*Picea engelmannii*
Colorado blue spruce	*Picea pungens*
Bristlecone pine	*Pinus aristata*
Pinyon pine	*Pinus edulis*
Limber pine	*Pinus flexilis*
Ponderosa pine	*Pinus ponderosa*
Quaking aspen	*Populus tremuloides*
Douglas fir	*Pseudotsuga menziesii*
Gambel's oak	*Quercus gambelii*
Rocky Mountain juniper	*Sabina scopulorum*
SHRUBS	
Serviceberry	*Amelanchier alnifolia*
Bearberry	*Arctostaphylos uva-ursi*
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*
Mountain mahogany	*Cercocarpus montanus*
Green rabbitbrush	*Chrysothamnus viscidiflorus*
Hazelnut	*Corylus cornuta*
Oceanspray	*Holodiscus discolor*
Common juniper	*Juniperus communis*
Prickly pear cactus	*Opuntia polyacantha*
Boulder raspberry	*Oreobatus deliciosus*
Shrubby cinquefoil	*Pentaphylloides floribunda*
Gooseberry current	*Ribes cereum*
Wild current	*Ribes inerme*
Wild gooseberry	*Ribes montigenum*
Wood rose	*Rosa woodsii*
Thimbleberry	*Rubacer parviflorum*
Red raspberry	*Rubus idaeus* ssp. *melanolasius*
Red elderberry	*Sambucus microbotrys*
Dwarf bilberry	*Vaccinium cespitosum*
Spanish bayonet	*Yucca glauca*
FORBS	
Yarrow	*Achillea lanulosa*
Blue flax	*Adenolinum lewisii*
False dandelion	*Agoseris glauca*
Wild onion	*Allium cernuum*
Pussytoes	*Antennaria rosea*
Arnica	*Arnica* sp.
Fringed sage	*Artemisia frigida*
Mugwort	*Artemisia ludoviciana*

Table A-1 Plant Species Observed in Survey Area

Common Name	Scientific Name
Leafy aster	*Aster foliaceus*
Milk vetch	*Astragalus* sp.
Blue clematis	*Atragene columbiana*
Kochia	*Bassia sieversiana*
Bistort	*Bistorta bistortoides*
False arabis	*Boechera* sp.
Canada thistle	*Breea arvensis*
Gunnison star-tulip	*Calochortus gunnisonii*
Common harebell	*Campanula rotundifolia*
Whitetop	*Cardaria chalepensis*
Musk thistle	*Carduus nutans*
Indian paintbrush	*Castilleja miniata*
Indian paintbrush	*Castilleja rhexifolia*
Fireweed	*Chamerion danielsii*
Colorado thistle	*Cirsium scariosum*
Bull thistle	*Cirsium vulgare*
Rocky Mountain beeplant	*Cleome serrrulata*
Brittle fern	*Cystopteris fragilis*
Fleabane	*Erigeron* sp.
Wild buckwheat	*Eriogonum umbellatum*
Wild strawberry	*Fragaria virginiana*
Monument plant	*Frasera speciosa*
Bedstraw	*Galium septentrionale*
Wild geranium	*Geranium caespitosum*
Gumweed	*Grindelia squarrosa*
Golden aster	*Heterotheca villosa*
Alum-root	*Huechera parvifolia*
Scarlet gilia	*Ipomopsis aggregata*
Wild iris	*Iris missouriensis*
Ox-eye daisy	*Leucanthemum vulgare*
Nodding ragwort	*Ligularia bigelovii*
Dalmation toadflax	*Linaria genistifolia* ssp. *dalmatica*
Yellow toadflax	*Linaria vulgaris*
Tansy aster	*Machaeranthera canescens*
Moss	mosses
Mushroom	mushrooms
Evening primrose	*Oenothera elata*
Cat's-eye	*Oreocarya thyrsiflora*
Owl clover	*Orthocarpus luteus*
Canada lousewort	*Pedicularis canadensis*
Fern lousewort	*Pedicularis procera*
Red beardtongue	*Penstemon barbatus*
Beardtongue	*Penstemon virgatus*
Bottle gentian	*Pneumonanthe parryi*

Table A-1 Plant Species Observed in Survey Area

Common Name	Scientific Name
Cinquefoil	*Potentilla ovina*
Cinquefoil	*Potentilla pulcherrima*
Tuber starwort	*Pseudostellaria jamesiana*
Black-eyed susan	*Rudbeckia ampla*
Dock	*Rumex* sp.
Figwort	*Scrophularia lanceolata*
Jim Hill mustard	*Sisymbrium altissimum*
Blue-eyed grass	*Sisyrinchium montanum*
Goldenrod	*Solidago multiradiata*
Cut-leaf Tansy	*Tanacetum vulgare*
Dandelion	*Taraxacum officinale*
Meadowrue	*Thalictrum fendleri*
Golden banner	*Thermopsis Montana*
Pennycress	*Thlaspi arvense*
Salsify	*Tragopogon dubius*
Salsify	*Tragopogon pratensis*
Clover	*Trifolium* sp.
Stinging nettle	*Urtica gracilis*
Mullein	*Verbascum thapsus*
GRAMINOIDS	
Indian ricegrass	*Achnatherum hymenoides*
Letterman's needlegrass	*Achnatherum lettermanii*
Bentgrass	*Agrostis scabra*
Redtop	*Agrostis stolonifera*
Cheatgrass	*Anisantha tectorum*
Pine dropseed	*Blepharoneuron tricholepis*
Mountain brome	*Bromopsis canadensis*
Smooth brome	*Bromopsis inermis*
Sedge	*Carex athrostachya*
Sedge	*Carex filifolia*
Elk sedge	*Carex geyeri*
Nebraska sedge	*Carex nebrascensis*
Sedge	*Carex simulata*
Sedge	*Carex utriculata*
Sedge	*Carex vesicaria*
Blue grama	*Chondrosum gracile*
Foxtail barley	*Critesion brachyantherum*
Parry's oatgrass	*Danthonia parryi*
Tifted hairgrass	*Deschampsia caespitosa*
Squirrel tail	*Elymus elymoides*
Blue wild-rye	*Elymus glaucus*
Thickspike wheatgrass	*Elymus lanceolatus*
Bearded wheatgrass	*Elymus trachycaulus* ssp. *subsecundus*
Slender wheatgrass	*Elymus trachycaulus* ssp. *trachycaulus*

Table A-1 Plant Species Observed in Survey Area

Common Name	Scientific Name
Arizona fescue	*Festuca arizonica*
Idaho fescue	*Festuca idahoensis*
Baltic rush	*Juncus balticus*
Junegrass	*Koelaria macrantha*
Mountain muhly	*Muhlenbergia montana*
Green needlegrass	*Nassella viridula*
Western wheatgrass	*Pascopyrum smithii*
Kentucky bluegrass	*Poa pratensis*
Bluegrass	*Poa secunda*
Bluebunch wheatgrass	*Pseudoroegnaria spicata*
Intermediate wheatgrass	*Thinopyrum intermedium*
Spike trisetum	*Trisetum spicatum*

Taxonomic names conform to Weber and Wittman (1996)

Table A-2 Plant Species by Vegetation Types in the Survey Area

Typical Plant Species	Abundant	Common	Occasional
Aspen-dominated Woodland			
Trees	*Populus tremuloides*		*Pseudotsuga menziesii*
	Picea engelmannii		*Pinus ponderosa*
			Abies bifolia
			Pinus aristata
Shrubs		*Juniperus communis*	*Ribes cereum*
			Rosa woodsii
			Pentaphylloides floribunda
			Vaccinium caespitosum
Forbs	*Thermopsis montana*	*Solidago multiradiata*	*mosses*
		Campanula rotundifolia	*Aster foliaceus*
		Achillea lanulosa	*Castilleja miniata*
		mushrooms	*Geranium caespitosum*
		Fragaria virginiana	*Pedicularis procera*
			Chamerion danielsii
Graminoids		*Koelaria macrantha*	*Elymus trachycaulus* ssp. *subsecundus*
		Bromus canadensis	*Muhlenbergia montana*
		Poa pratensis	*Festuca arizonica*
			Danthonia parryi
			Pascopyrum smithii
			Agrostis stolonifera
Open, Conifer-dominated Woodland			
Trees	*Pinus aristata*	*Pseudotsuga menziesii*	*Picea engelmannii*
	Pinus contorta	*Populus tremuloides*	
	Pinus ponderosa		
Shrubs	*Ribes cereum*	*Pentaphylloides floribunda*	*Rubacer parviflorum*
		Holodiscus dumosus	*Juniperus communis*
			Rosa woodsii
			Cercocarpus montanus
Forbs		*Geranium caespitosum*	*Campanula rotundifolia*
		Artemisia frigida	*Achillea lanulosa*
		Thermopsis montana	*Grindelia squarrosa*
			Allium cernuum
Graminoids		*Muhlenbergia montana*	*Nasella viridula*
		Koelaria macrantha	*Danthonia parryi*
			Festuca arizonica
			Pascopyrum smithii
			Blepharoneuron tricholepis
			Achnatherum lettermanii
			Elymus elymoides
			Chondrosum gracile
Dense, Conifer-dominated Woodland			
Trees	*Picea engelmannii*	*Pinus aristata*	*Abies bifolia*
	Populus tremuloides	*Pseudotsuga menziesii*	*Pinus flexilis*

Table A-2 Plant Species by Vegetation Types in the Survey Area

Typical Plant Species	Abundant	Common	Occasional
	Pinus contorta		*Pinus ponderosa*
Shrubs	*Juniperus communis*		*Vaccinium caespitosum*
			Ribes montigenum
			Rosa woodsii
			Arctostaphylos uva-ursi
			Pentaphylloides floribunda
Forbs	*mosses*	*Solidago multiradiata*	*Chamerion danielsii*
	mushrooms	*Pedicularis procera*	*Castilleja miniata*
	Frageria virginiana	*Aster foliaceus*	*Achillea lanulosa*
		Thermopsis montana	
Graminoids		*Bromus canadensis*	*Elymus trachycaulus* ssp. *subsecundus*
		Koelaria macrantha	*Festuca arizonica*
			Muhlenbergia montana
Disturbed Areas			
Trees		*Populus tremuloides*	*Picea engelmannii*
			Pinus ponderosa
			Pseudotsuga menziesii
			Pinus aristata
Shrubs			*Juniperus communis*
			Ribes cereum
Forbs	*Artemisia frigida*	*Thermopsis montana*	*Cirsium scariosum*
	Achillea lanulosa	*Penstemon virgatus*	*Thlaspi arvensis*
		Heterotheca villosa	*Rumex* sp.
		Linaria vulgaris	*Geranium caespitosum*
			Machaeranthera canescens
			Adenolinum lewisii
			Aster foliaceus
			Rudbeckia ampla
			Solidago multiradiata
			Oenothera elata
			Carduus nutans
Graminoids		*Poa pratensis*	*Danthonia parryi*
		Pascopyrum smithii	*Agrostis stolonifera*
		Nasella viridula	*Elymus elymoides*
		Bromus inermis	*Muhlenbergia montana*
		Koelaria macrantha	*Anisantha tectorum*
			Juncus balticus
			Festuca arizonica
Natural Grassland			
Trees		*Pinus aristata*	*Picea engelmannii*
		Populus tremuloides	*Pinus ponderosa*
			Pseudotsuga menziesii
Shrubs		*Pentaphylloides floribunda*	*Rubacer parvifloum*

Table A-2 Plant Species by Vegetation Types in the Survey Area

Typical Plant Species	Abundant	Common	Occasional
Forbs	*Campanula rotundifolia*	*Artemisia frigida*	*Aster foliaceus*
		Achillea lanulosa	*Potentilla pulcherrima*
		Thermopsis montana	*Heterotheca villosa*
		Solidago multiradiata	*Trifolium* sp.
		Geranium caespitosum	
Graminoids	*Danthonia parryi*	*Mulenbergia montana*	*Bromus canadensis*
	Koelaria macrantha	*Elymus elymoides*	*Agrostis stolonifera*
	Poa pratensis	*Pascopyrum smithii*	*Nasella viridula*
		Carex oreocharis	*Blepharoneuron tricholepis*
		Elymus trachycaulus ssp. subsecundus	*Achnatherum lettermanii*
		Festuca arizonica	
Disturbed Grassland			
Trees		*Pinus aristata*	*Populus tremuloides*
			Pinus ponderosa
Shrubs		*Ribes cereum*	*Rubacer parviflorum*
		Pentaphylloides floribunda	*Holodiscus dumosus*
Forbs	*Artemisia frigida*	*Heterotheca villosa*	*Cirsium scariosum*
	Achillea lanulosa	*Geranium caespitosum*	*Penstemon virgatus*
	Thermopsis montana	*Linaria vulguris*	*Trifolium* sp.
			Machaeranthera canescens
			Aster foliceus
			Breea arvensis
			Adenolinum lewisii
			Oenothera elata
			Rudbeckia ampla
			Rumex sp.
			Campanula rotundifolia
			Taraxacum officinale
			Carduus nutans
			Solidago multiradiata
			Linaria genistifolia
Graminoids	*Poa pratensis*	*Elymus elymoides*	*Muhlenberia montana*
	Pascopyrum smithii	*Agrostis stolonifera*	*Anisantha tectorum*
		Koelaria macrantha	*Danthonia parryi*
		Nasella viridula	*Elymus trachycaulus* ssp. *subsecendus*
		Festuca arizonica	*Thinopyrum intermedium*
		Bromus inermis	*Achnatherum lettermanii*
			Juncus balticus

Table A-2 Plant Species by Vegetation Types in the Survey Area

Typical Plant Species	Abundant	Common	Occasional
Riparian Woodland – Not observed in survey area, but if it did occur, plants may include:			
Trees	*Picea pungens*	*Sabina scopulorum*	
	Populus tremuloides	*Acer glabrum*	
	Pinus ponderosa	*Pinus aristata*	
	Alnus incana		
	Pseudotsuga menziesii		
	Picea engelmannii		
Shrubs		*Holodiscus dumosus*	
		Ribes inerme	
		Ribes montigenum	
		Ribes cereum	
		Rubacer parviflorum	
Forbs	*Linaria vulgaris*	*Achillea lanulosa*	
		Cystopteris fragilis	
		Bassia sieversiana	
		Thalictrum fendleri	
		Carduus nutans	
		Artemisia frigida	
		Penstemon virgatus	
		Cleome serrulata	
		Tanacetum vulgare	
Graminoids	*Elymus lanceolatus*	*Achnatherum lettermanii*	
	Poa pratensis	*Agrostis stolonifera*	
	Muhlenbergia montana	*Bromus canadensis*	
	Nasella viridula	*Elymus trachycaulus* ssp. *subsecundus*	
		Chondrosum gracile	
		Elymus trachycaulus ssp. *subsecundus*	
Wet Meadow			
Trees			*Populus tremuloides*
			Acer glabrum
			Picea pungens
			Picea engelmannii
			Pinus aristata
			Pinus ponderosa
Shrubs		*Pentaphylloides floribunda*	*Ribes cereum*
			Ribes inerme
			Rubus idaeus ssp. *melanolasius*
Forbs		*Achillea lanulosa*	*Thermopsis montana*
		Potentilla pulcherrima	*Iris missouriensis*
		Linaria vulgaris	*Bassia sieversiana*
		Artemisia frigida	*Bistorta bistortoides*
		Solidago multiradiata	*Thalictrum fendleri*
		Cirsium scariosum	*Urtica gracilis*

Table A-2 Plant Species by Vegetation Types in the Survey Area

Typical Plant Species	Abundant	Common	Occasional
Graminoids		*Ligularia bigelovii*	*Scrophularia lanceolata*
		Aster foliaceus	*Rumex* sp.
		Campanula rotundifolia	*Thlaspi arvensis*
			Carduus nutans
			Pneumonanthe parryi
			Cystopteris fragilis
			Machaeranthera canescens
			Tanacetum vulgare
			Rudbeckia ampla
			Cleome serrulata
			Penstemon virgatus

Taxonomic names conform to Weber and Wittman (1996)

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Cripple Creek & Victor Gold Mining Company
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Cripple Creek & Victor Gold Mining Company

FINAL

Baseline Technical Report For Soils and Biological Resources, Cresson Project M-1980-0244 Amendment No. 11 Teller County, Colorado

October 2015

ARCADIS

John DuWaldt
Wildlife Biologist

Jason Adams, PG
Soils Specialist

Rachel Cruz
Project Manager

Baseline Technical Report

Soils and Biological Resources,
Amedment No. 11 Project Area

Prepared for:
Cripple Creek & Victor Mining Corporation

Prepared by:
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Tel 720.344.3500
Fax 720.344.3535

Our Ref.:
CO002031.0001

Date:
October 2015

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Table of Contents

Tables

Figures

Appendices

EXECTUTIVE SUMMARY

ARCADIS U.S., Inc. (ARCADIS) performed soil and biological resources assessments of the Cripple Creek & Victor Cresson Project as part of the requirements to modify mining operations under the proposed Amendment 11 to the Office of Mine Land Reclamation Board (OMLB) Permit No. M-1980-0244 (Amendment 11). Field investigations of two survey areas were conducted on August 8 and 9, 2015. Soil investigation efforts produced a revised Cresson Project soil map, evaluation of soil resources, and assessment of salvageable secondary growth media within the two survey areas (together referred to as the "Amendment 11 Project area"). Biological investigation efforts produced revised Amendment 11 Project area vegetation and wildlife resources maps and evaluation of the vegetation and wildlife resources within the Cresson Project, including special status species. Potential impacts to soil and biological resources were also evaluated and recommendations for resource use and impact mitigation are provided.

1. INTRODUCTION

Cripple Creek & Victor Mining Company (CC&V) of Newmont Mining Corporation is proposing to extend mining operations at the CC&V Cresson Project in the Cripple Creek Mining District (District) in Teller County, Colorado (**Figure 1**). The proposed project, referred to as Amendment No. 11 Project, would occur on approximately 186 acres north and west of existing operations. Lands within the Amendment 11 Project area are owned or controlled by CC&V. The proposed project requires that CC&V submit a modification to the existing state mining permit to the Colorado Division of Reclamation, Mining, and Safety (DRMS).

As part of the permit modification, CC&V must fulfill requirements specified in the "Hard Rock/Metal Mining Rules and Regulations of the Colorado Mined Land Reclamation Board (CMLRB)" as well as requirements per Teller County land use regulations. To meet these requirements, ARCADIS, on behalf of CC&V, collected baseline resource information on soils and biological resources (vegetation, wildlife, and special status species). This report summarizes the baseline information collected for these resources.

1.1 Project Area Description

The Cresson Project is located between the towns of Cripple Creek and Victor in Teller County, Colorado. It is a low-grade, surface gold mining operation where the ore is treated using a valley-type, heap-leach process with activated carbon used to recover

the gold. The proposed Amendment 11 Project area is located within lands owned or controlled by CC&V surrounding the Cresson Mine. The legal descriptions of the Amendment 11 Project survey areas are:

- Survey Area 1: Township 15 South, Range 69 West, Section 18 and Township 15 South, Range 70 West, Section 13
- Survey Area 2: Township 15 South, Range 69 West, Section 16

Collectively these two survey areas are referred to as the "Amendment 11 Project area" for the purposes of this report. The Amendment 11 Project area ranges in elevation from approximately 9,560 feet (2,914 meters) to 10,250 feet (3,139 meters) above mean sea level (amsl). Vegetation communities are relatively diverse consisting of communities such as grasslands, woodlands, and wet meadows. Geology in the District consists of an Oligocene-aged (approximately 30 million years ago) diatreme-volcanic, intrusive complex surrounded by Precambrian rocks. The eastern portion of the District is characterized by a flat-lying sequence of volcanoclastic sediments and phonolite flow units. The central portion of the District is dominated by complex flow dome structures with cross-cutting intrusive dikes and sills. The western side of the District contains extensive areas of diatremal volcanoclastic breccias with scattered intrusive and flow dome features (Vardiman et al. 2006).

1.2 Survey Methods

1.2.1 Phase I – Compile Existing Data

ARCADIS performed a detailed compilation of existing resource information available for the Amendment 11 Project area. The Amendment 11 Project area is part of the larger Cresson Project area that encompasses most of the District and consists of two smaller survey areas (**Figure 1**). Based on the information required by the CMLRB and Teller County for the permit amendment, information on the following resources was compiled:

- Soil resources, including plant growth medium;
- Vegetation resources;
- Wildlife resources; and
- Special status species (Threatened, Endangered, Sensitive and Candidate Species [TECS] and Colorado sensitive wildlife and plant species).

1.2.1.1 Soil Resources

Previous soil surveys were conducted within the Cresson Project area by Nerco Minerals Company in 1984 and by Newport Minerals in 1985. These surveys were conducted in the northern portion of the District. Preliminary soil mapping was conducted by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (Soil Conservation Service prior to 1994) in 1993 and 1995. At that time, three dominant soil units were identified within the Cresson Project area:

- Grenadier-like-Unnamed very gravelly loam complex (HL);
- Quander-Varden complex (PF); and
- Rogert very gravelly sandy loam.

In 1996, CC&V conducted a modified Order II soil survey to map a portion of the Cresson Project area to the series level in support of the Amendment No. 7 project (JBR 1997). Approximately 60 soil pits were used to determine soil characteristics in the field including the soil depth, types of horizons, parent material, structure, texture, color, pores, stoniness, roots, and other special characteristics. The mapped soils were identified to the soil series level where possible, using named soil associations identified by the NRCS.

ARCADIS/Greystone conducted modified Order II soil surveys in support of the Amendment No. 9, and Mine Life Extension (Amendment No. 10) projects (ARCADIS 2007, 2011). Prior to the 2011 survey, NRCS updated soils mapping for parts of Teller and Park counties, including the survey area. At that time, information on NRCS soil units in the survey area was available via the Web Soil Survey website (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm), which was developed by the NRCS to provide access to the most current soil data. A review of the updated soil spatial (Version 4, May 19, 2008) and tabular data (Version 4, March 7, 2008), indicated discrepancies between previous JBR Environmental Consultants (JBR) soil mapping, Greystone and ARCADIS soil mapping, and NRCS mapping current as of 2011.

Similarly, prior to the 2015 surveys, NRCS again updated soil data within the District (Spatial Data Version 6, December 23, 2013; Tabular Data Version 7, September 22, 2014). Prior to conducting field surveys, ARCADIS downloaded the 2013 data from Web Soil Survey and reviewed the data to identify discrepancies between the 2011 ARCADIS soil survey and the 2013 NRCS data. Within the revised tabular data,

NRCS now also provides interpretation of various soil suitabilities and limitations, including for use as a source of reclamation material. These interpretations are incorporated into the discussion of growth media in Section 2.2. NRCS has also modified soil map unit indicators from alphabetic (e.g., CQ, SZ, etc.) to numeric (e.g., 3, 16, etc).

1.2.1.2 Vegetation Resources

Existing baseline information on vegetation resources in the Amendment 11 Project area was collected, compiled, and reviewed for completeness and accuracy. The existing baseline information was primarily based on past field surveys and vegetation mapping efforts completed by JBR in 1997 in support of Amendment No. 7, by Greystone in 1999 in support of Amendment No. 8, by ARCADIS in 2007 in support of Amendment No. 9, and by ARCADIS in 2011 in support of Amendment No. 10.

1.2.1.3 Wildlife Resources

ARCADIS compiled baseline information on wildlife resources by reviewing data from CC&V's files (CC&V 1992, 1993, and 1998); wildlife inventories performed by Colorado Division of Wildlife (CDOW) in 1997 as well as 2015 game species occurrence data from Colorado Parks and Wildlife (CPW) databases and websites; and wildlife inventories performed by ARCADIS in 2011. In addition, existing information from past U.S. Fish and Wildlife Service (USFWS) consultation, publicly available published/unpublished literature, maps, population data, and any other applicable information were qualitatively evaluated, integrated, and used to develop the baseline description of the project area's existing wildlife.

1.2.1.4 Special Status Species

Several literature reviews and field surveys for special status species have been conducted for the Cresson Project in the past. However, because species lists are frequently updated, ARCADIS reviewed recent publicly available literature to determine which currently listed special status species have potential to occur in the Amendment 11 Project area.

ARCADIS first conducted a literature search for federally listed TECS. TECS are identified by the USFWS under the provisions of the Endangered Species Act of 1973, as amended. The website for the USFWS was queried for a list of TECS that have potential to occur in the District/Teller County (USFWS 2015). CPW maintains a state list of threatened and endangered wildlife species and also lists some wildlife species with declining populations as 'species of special concern.' The CPW website was

queried to determine state-listed threatened, endangered, and species of concern that have potential to occur in the Amendment 11 Project area (CPW 2015). In addition, the Colorado Natural Heritage Program (CNHP) maintains a list of rare plant species for the state, which includes rare plant species as listed by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) (CNHP 2014). From these initial lists, ARCADIS narrowed the list of potential special status species that could occur in the Amendment 11 Project area based on each species' habitat requirements. Species with no suitable habitat in the Amendment 11 Project area were eliminated from further consideration.

1.2.2 Phase II – Collect Baseline Data

Once existing baseline information was compiled, ARCADIS conducted field surveys and inventories on August 8 and 9, 2015 to verify and update the existing information in the Amendment 11 Project Area, as appropriate. Field surveys and inventories included:

- Soil profile investigations and soil mapping,
- Vegetation mapping (map and characterize vegetation community types in the Amendment 11 Project area),
- Raptor nest survey,
- Habitat assessment for special status species (confirm presence or absence of suitable habitat),
- Inventory of wildlife species, and
- Inventory of plant species.

Once field work was completed, ARCADIS summarized relevant information for each resource (soils, vegetation, wildlife, and special status species) and identified any additional information or modifications to the existing baseline description for the Amendment 11 Project area. This information is summarized in the results below.

2. SOIL AND GROWTH MEDIUM RESOURCES

In order to be consistent with published data, this report presents a revised soils map based primarily on current NRCS data available through the Web Soil Survey. NRCS data have been supplemented by data collected during the reconnaissance soil survey conducted by Greystone from August 16 to 20 and September 22 to 24, 1999; a survey by ARCADIS on June 21 and 22, 2007; a survey by ARCADIS from July 19 to 21, 2011; and the July 8 and 9, 2015 survey described herein. Field investigations by ARCADIS in 2015 focused on two survey areas within the Amendment 11 Project area. Data collected within the survey areas are considered to represent a more detailed level of analysis than NRCS data, and map unit boundaries have been adjusted accordingly. In addition, aerial photography of the District taken in September 2014 was utilized to more accurately define soil map unit boundaries. Since the 2011 ARCADIS survey and report, NRCS has revised the soil map units mapped within the Cresson Project. These revisions are described on a map unit basis below.

A revised soil map of Amendment 11 Project area soils is presented as **Figure 2**. Characteristics of the soil types in the area are summarized below and in **Table 2-1**. **Table 2-2** identifies characteristics of the soil map units within the Amendment 11 Project area. Soil map unit 76 (Disturbed land, mine areas, overburden storage areas, mine complex) is not included in **Table 2-2** due to the lack of suitable soils for reclamation. Unit 76 varies for all characteristics depending on the age, amount, and type of disturbance and original character of the soil.

Soil surveys of the project area were conducted concurrently with vegetation mapping, which allowed for close correlation of mapped soil units with vegetative cover. In addition, soil units were differentiated based on geology, aspect, and slope steepness. Exposed soil profiles in road cuts, walls of exploration pits, and other excavations were examined where feasible and safe. Soil pits were excavated where exposed soils did not exist. In order to confirm accurate mapping by NRCS, soil exposures and pits were selected for examination based on slope, aspect, parent material, and vegetation present that matched published descriptions of the soil unit mapped by NRCS at that specific location.

2.1 Soil Resources

This section summarizes the soil resources observed within the 2015 project area as well as the larger Cresson Project area as determined through review of NRCS soil mapping and previous baseline studies. The names of soil units within the Cresson Project area have changed repeatedly over recent years. This report uses current

NRCS terminology and explains the general correlation between current and previous soil unit names. Soil map units 3, 14, 19, 21, and 59 were not observed within the project area but are described for reference as they are present within the greater Cresson Project area.

2.1.1 3. Adderton-Platdon association, 0 to 6 percent slopes

These soils are hydric or partially-hydric alluvial soils found on grassy stream terraces, toe slopes and floodplains in the Cresson Project area. Adderton series soils are deep, loamy, and well drained, whereas the Platdon series soils are shallower, poorly drained, and have coarser texture. This unit was been variably mapped as map unit CQ (Adderton-Rosane taxadjunct complex, 0 to 6 percent slopes) and Hydric Soils in previous surveys. Platdon series soils replace the Rosane and Cryaquoll soils previously included in the CQ map unit. This map unit was not observed during the 2015 survey.

2.1.2 14. Bushpark-Seitz association, 15 to 50 percent slopes

These soils are found on a single south-facing mountainside in the eastern portion of the Cresson Project area and are associated with the conifer-dominated woodland vegetation community type. Soils in this association are formed from colluvium or slope alluvium formed from volcanic breccias and are very to extremely gravelly loam and well drained. Seitz series soils are deeper than Bushpark series soils and have a thin upper horizon composed of decomposed organic material. The small area mapped as this unit by NRCS was previously mapped solely as Seitz series soils (ARCADIS 2007). This map unit was not observed during the 2015 survey.

2.1.3 17. Catamount-Guffey complex, 15 to 40 percent slopes

These soils are found on mountainsides in the northeastern portion of the Cresson Project area and are associated with conifer-dominated and mixed conifer-aspen woodlands. Soils in this complex are formed in colluvium or slope alluvium derived from granite, gneiss, or schist. Catamount soils are shallow gravelly sandy loams whereas Guffey soils are moderately deep gravelly sandy loams with an accumulation of clay at depth (Bt horizon). The distribution of this unit is similar to previous NRCS mapping within the area; however, survey observations indicate that the unit extends further to the north than mapped by NRCS. This is the dominant soil map unit within Survey Area 2. Approximately 35.4 acres of this soil map unit (mostly Catamount series) are present within the Amendment 11 Project area, all within Survey Area 2.

2.1.4 19. Cathedral very gravelly sandy loam, 15 to 40 percent slopes

These soils are found on south-facing mountainsides in the southern portion of the Cresson Project area. These are shallow to very shallow stony or gravelly sandy loam that have formed in slope alluvium and colluvium from granite, monzonite, schist, or gneiss. This map unit replaces areas previously mapped by NRCS as Rogert very gravelly sandy loam, 15 to 40 percent slopes. This map unit was not observed during the 2015 survey.

2.1.5 21. Cathedral-Rock outcrop complex, 20 to 60 percent slopes

This soil unit consists of areas where cliffs and rock outcrops occur comingled with Cathedral series soils on steep mountainsides. Cliffs and rock outcrops may compose 30 percent of the unit. This map unit replaces areas previously mapped by NRCS as Rogert-Rock Outcrop complex, 20 to 60 percent slopes. Some areas previously mapped as this unit have been disturbed by mining operations. This map unit was not observed during the 2015 survey.

2.1.6 59. Ivywild-Catamount complex, 30 to 70 percent slopes

Within the Cresson Project area, these soils are found on north-facing mountainsides in association with the dense conifer-dominated woodland vegetation type, and some areas of transitional aspens. Both components have formed from colluvium and residuum derived from granite. Both soils are somewhat excessively drained, shallow, and consist of gravelly sandy loam or loamy coarse sand. Catamount soils are shallower and contain more gravel at depth. Distribution of this map unit is generally consistent with previous NRCS mapping but has been re-mapped as units 19 and 88 in some areas. This map unit was not observed during the 2015 survey.

2.1.7 76. Disturbed land, mine areas, overburden storage areas, mine complex

Areas that were historically mined or otherwise altered by human activities are classified as disturbed soils. Surface disturbance was identified from September 2014 aerial photography and field observations. Differences in vegetation were also used in mapping these units, as some vegetation (particularly aspen-dominated woodland) has developed on disturbed areas through succession from surrounding vegetated areas. Portions of this map unit may have incipient soils formed on mine tailings or native soil remaining, but the unit is dominated by disturbed soil to the point where salvage of secondary growth medium is unfeasible from this unit. This map unit replaces unit DS used in the 2007 Baseline Report (ARCADIS 2007) and unit OR in the 2011 Baseline Report (ARCADIS 2011) in order to be consistent with NRCS mapping. Areas of

disturbed land occur as minor components of all map units observed in the project area. This map unit is associated with recent and historical mining activity in the Amendment 11 Project area, including right-of-way construction in Survey Area 2. Approximately 42.6 acres of this unit are present in the Amendment 11 Project area (39.4 acres in Survey Area 1; 3.2 acres in Survey Area 2).

2.1.8 82. Quander-Bushpark very gravelly loams, 5 to 40 percent slopes

These soils are found on mountainsides and face terraces. Both components are derived from colluvium and residuum composed of breccias and tuff, are very to extremely gravelly loams and clay loams, and are well drained. Both series are characterized by subsoil composed of angular cobble-sized rock fragments. Bushpark series soils are shallower, found on steeper slopes, and are most commonly associated with aspen-dominated plant community types. Bushpark soils observed in the Amendment 11 Project area are slightly deeper than the NRCS typical soil profile. Quander soils are most commonly associated with natural or disturbed grasslands.

This is the dominant soil map unit within Survey Area 1. The unit comprises approximately 89.7 acres of Survey Area 1, with Quander soils representing 40 percent (35.7 acres) and Bushpark 60 percent (54.0 acres). Areas of soil unit 82 in the southern part of Survey Area 1 are currently mapped by NRCS as unit 97 (Seitz very gravelly loam, 20 to 50 percent slopes), but are reclassified as Bushpark series soils due to the lack of an O horizon and lack of an albic B horizon, among other characteristics. This map unit was not observed in Survey Area 2.

Previous soil surveys of the Cresson Project variably mapped Quander series soils as the Ess series soils of the former EB soil map unit or as part of the Quander-Varden complex soil unit (PF). The EB and PF soil map units are both herein discontinued for consistency with NRCS mapping. In addition, some areas in the northern portion of the Cresson Project area previously mapped by as Rogert series soils in 2004 and 2007 are now mapped as soil unit 82. Similarly, in revised NRCS data the Quander-Bushpark map unit includes areas previously mapped as Rogert, Ivywild, and Catamount series soils by NRCS in 2011.

2.1.9 88. Rofork very gravelly sandy loam, 5 to 55 percent slopes

This map unit is generally found on south-facing mountain slopes in association with the natural grassland vegetation community type within the Cresson Project area. Rofork series soils are very gravelly sandy loam or loamy coarse sand that have formed in slope alluvium and residuum derived from granitic rocks, schist, and gneiss.

Approximately 2.5 acres of this soil map unit are present within the Amendment 11 Project area, all within Survey Area 2. This map unit largely replaces areas mapped by NRCS in 2011 as Herbman gravelly sandy loam, 5 to 55 percent slopes.

2.1.10 97. Seitz very gravelly loam, 20 to 50 percent slopes

Seitz series soils are found on mountainsides with the dense conifer-dominated woodland vegetation type and in some areas of transitional aspen forests. These soils consist of very gravelly loams and clay loams to a depth of approximately 24 inches, which overlie a subsoil composed of very angular cobbles. A thin surface layer composed of decomposing conifer needles and other vegetation is often present within the Amendment 11 Project area. Approximately 15.1 acres of this soil map unit are present within the Amendment 11 Project area, all within Survey Area 1. The distribution of this soil unit is generally consistent with previous NRCS mapping but has been partially re-mapped as unit 82 in portions of the Cresson Project area, including part of Survey Area 1.

2.2 Growth Medium Resources

Soils that are suitable for assisting with revegetation are salvaged as part of the ongoing mining operations at the Cresson Project. Soil recovered for use during reclamation is termed growth medium. The volume of growth medium that can be salvaged from areas proposed for disturbance is primarily limited by the amount of coarse rock fragments. Large coarse fragments (stones and larger) limit operators' ability to strip and stockpile soil, and all coarse fragments contribute to the inability of the soil to hold water for vegetation). In addition, depths of less than 6 inches are typically considered to be unsalvageable due to the large size of the equipment used to recover soil for reclamation purposes. The depth of potentially salvageable soil varies greatly depending on terrain position, with the shallowest soils typically occurring on upper slopes and deepest soils at the toe of slopes. Although not observed extensively within the project area, the presence of small rock outcrops may also render salvage operations unmanageable.

Given the factors described above and data from field surveys, an average growth medium salvage depth was determined for each component of mapped soil units (**Table 2-3**). Suitability ratings are based on guidance provided by NRCS and USDA as summarized in **Table 2-4**. NRCS interpretations of suitability and limiting factors are also provided for comparison; however, these interpretations do not reflect site-specific observations or the suitability guidance previously provided for the Cresson Project (NRCS 1999). NRCS interpretations are made for soil map units and soil profiles as a

whole and do not account for the fact that more suitable soils are often found near the top of soil profiles.

Four suitability ratings (Good, Fair, Poor, and Unsuitable) were used to determine the salvage depths of each mapping unit. Coarse fragment content is primarily responsible for the suitability ratings in **Table 2-3**. Growth medium suitability generally decreases with depth as coarse fragment content increases. Soils with more than 50 percent cobble or larger fragments are rated unsuitable for use as growth medium. Low organic content may also somewhat limit the suitability of some soils (e.g., Quander and Bushpark series). Field tests of soil pH did not indicate any additional limitations to use of project area soils as secondary growth medium. Good quality soil growth medium may be salvaged from the Catamount and Platadon series soils. The Platdon, Quander, Bushpark, and Seitz series soils contain salvageable amounts of fair quality soil growth medium. During salvage and clearing/grubbing operations, removing large roots and stumps and pushing slash often mixes soil horizons; therefore, the ratings provided in **Table 2-3** are intended to inform salvage and reclamation and do not represent strict salvage guidelines. Soils rated as poor are considered acceptable for reclamation purposes but may require treatment (e.g., screening out large rock fragments or adding additional organic material) to facilitate successful reclamation.

Estimated volumes of salvageable soil growth medium were calculated using suitability ratings, average growth medium depths, and soil distributions presented in **Tables 2-2, 2-3,** and **2-4**. Soil components with average growth medium depths of less than 6 inches were not included in the total amount of salvageable material due to complications associated with salvaging shallow soils with heavy equipment. Previously disturbed soils (map unit 76) were also not included in calculations. Previously disturbed soils were observed to support vegetation in the Squaw Gulch and Chicago Portal areas but do not contain sufficient soil to represent a source of secondary growth medium.

Based on mapped distributions of soil components and interpretations of depth and suitability, approximately 627,000 cubic yards of suitable growth media is present within the Amendment 11 Project area. Soils rated as good comprise approximately 6 percent of the total (37,000 cubic yards), fair soils comprise 25 percent (157,000 cubic yards), and poor soils comprise approximately 69 percent (434,000 cubic yards). These estimates suggest that all areas within the Amendment 11 Project area could be potentially reclaimed with approximately 24 inches of secondary growth medium.

Within Survey Area 1, approximately 457,000 cubic yards of suitable growth media are available for salvage. Of this, approximately 39 percent (178,000 cubic yards) are soils rated as fair and 61 percent (279,000 cubic yards) are rated as poor.

Within Survey Area 2, approximately 62,000 cubic yards of suitable growth media are available for salvage. Of this, approximately 59 percent (37,000 cubic yards) are soils rated as good, less than 1 percent (500 cubic yards) are soils rated as fair, and 40 percent (25,000 acres) are soils rated as poor.

3. VEGETATION RESOURCES

A qualified ARCADIS biologist mapped and characterized vegetation types within the Amendment 11 Project area from August 8 to 9, 2015. The survey areas constituting the Amendment 11 Project area have been, and continue to be, disturbed by historic and ongoing mine-related activities (e.g., underground development, rock piles, prospecting excavations, surface mines, overburden storage areas, structures, and roads). A mosaic of several distinct vegetation communities persists within the survey areas. Field verification and modification of baseline vegetation information resulted in the identification of eight vegetation community types within the Amendment 11 Project area. **Table 3-1** summarizes the distribution of vegetation communities within survey areas. Each of these vegetation communities is described below. **Appendix A** includes the common name and scientific nomenclature for each plant species identified within the Amendment 11 Project area. Taxonomic names conform to Weber and Wittman (1996). Plant communities within the Amendment 11 Project area are also mapped on **Figure 3**.

3.1 Aspen-Dominated Woodland

Aspen-dominated woodland accounts for approximately 63.1 acres (34 percent) of the Amendment 11 Project area (**Table 3-1**). This plant community can be found in Survey Area 1. Within Survey Area 1, interior portions of aspen-dominated woodland stands have a closed 15- to 65-foot (5- to 20-meter) tall canopy dominated by quaking aspen (*Populus tremuloides*). Margins of woodland stands and adjacent areas recently colonized by aspen have shorter and sparser trees. Several conifer species are subdominant components of these woodland stands including subalpine fir (*Abies lasiocarpa*), Englemann spruce (*Picea engelmannii),* limber pine (*Pinus flexilis*), lodgepole pine (*Pinus contorta*), Colorado blue spruce (*Picea pungens*), ponderosa pine (*Pinus ponderosa*), and Douglas fir (*Pseudotsuga menziesii*). Of these species, Engelmann spruce and limber pine appear to be the most common coniferous species occurring in aspen-dominated woodlands within the Amendment 11 Project area. The presence of the conifer species suggests that the long-term trajectory of aspen-dominated woodlands is toward mixed conifer stands. Conifer species may contribute up to 15 percent of the tree canopy before the community would be reclassified as a mixed conifer/aspen plant community. Shrubs are not common within this vegetation community. The herbaceous layer is generally lush, constituting the majority of understory cover (approximately 50% and greater cover). Common grasses include blue wild-rye (*Elymus glaucus*), slender wheatgrass (*Elymus trachycaulus*), fringed brome (*Bromus ciliatus*), and Arizona fescue (*Festuca arizonica*). The most common forb in the understory of aspen-dominated woodlands

in the Amendment 11 Project area is golden banner (*Thermopsis montana*). Other forbs include yarrow (*Achillea millefolium*), meadow-rue (*Thalictrum fendleri*), cinquefoil (*Potentilla ovina*), fireweed (*Chamerion danielsii*), clover (*Trifolium* sp.), and milk vetch (*Astragalus* sp.).

3.2 Dense, Conifer-Dominated Woodland

Dense, conifer-dominated woodland accounts for 36.5 acres (20 percent) of the Amendment 11 Project area and occurs primarily in Survey Area 2. This is a mixed stand of lodgepole pine and aspen with subcomponents of Englemann spruce and limber pine situated on a rocky northeast-facing slope. The toe slope area contains a stand of Englemann and Colorado blue spruce. This is primarily a younger, secondary succession forest heavily stocked with small to medium size class trees and fewer mature height (69-foot [18.3-meter]) trees. The understory is dominated by common juniper, forbs, and shrubs including golden banner, daisy (*Erigeron* sp.), bearberry, and dwarf bilberry. Shrubby cinquefoil (*Dasiphora [Pentaphyloides] floribunda*) is also present on the lower slope of Survey Area 2. Other forbs include milkvetch, yarrow, pussytoes (*Antenniaria rosea*), columbine (*Aquilegea* sp.), geranium (*Geranium caespitosum*), and harebell (*Campanula rotundifolia*).

3.3 Mixed Conifer/Aspen-Dominated Forest

Survey Area 1 contains a 15.1-acre stand of mixed conifer/aspen-dominated forest (8 percent of the Amendment 11 Project area). Although the stand is dominated by large mature aspen trees, Englemann spruce and, to a lesser extent, limber pine is replacing the aspen and will probably overtake the aspen in coming decades. Understory/groundcover is relatively sparse and includes golden banner, violet (*Viola* sp.), wild strawberry, mountain muhly (*Muhlenbergia montana*) and fringed brome.

3.4 Natural Grassland

Natural grasslands account for approximately 10.7 acres (6 percent) of the Amendment 11 Project area and occur in Survey Areas 1 and 2. Natural grasslands in the Amendment 11 Project area have a species composition and density that has not substantially changed as a result of disturbance. Cover is relatively high and ranges from 60 to 90 percent. Natural grasslands occur on gentle to moderate slopes with variable exposures. Dominant species include Parry's oatgrass (*Danthonia parryi*), junegrass (*Koelaria macrantha*), Kentucky bluegrass (*Poa pratensis*), mountain muhly, squirreltail (*Elymus elymoides*), western wheatgrass (*Pascopyron smithii*), bearded wheatgrass, and Arizona fescue. Grassy slope sedge (*Carex oreocharis*) (once

considered a rare species by the Colorado Natural Heritage Program, but not currently) occurs in this plant community on granitic soils. Noxious weeds are generally not present or are sporadic in nature within natural grasslands.

3.5 Disturbed Grassland

Disturbed grasslands account for approximately 10.0 acres (5 percent) of the Amendment 11 Project area and occur in Survey Area 1, adjacent to the active mine site. These grasslands have been disturbed in historical times (primarily as a result of older mining activities and road or utility construction) and continue to be disturbed by ranching practices (cattle grazing) and road construction/adjacent mining operations. This vegetation community is primarily distinguished from the "Disturbed Area" vegetation community type (see Section 3.9) by having a higher overall plant cover, dominated by grass species. Disturbed grasslands occur on gentle slopes with a southern exposure in the Amendment 11 Project area. The composition, density, and cover of vegetation (30-60 percent) have been substantially altered. Dominant species include Kentucky bluegrass, western wheatgrass, squirreltail, redtop (*Agrostis stolonifera*), junegrass, green needlegrass, Arizona fescue, and smooth brome (*Bromus inermis*). Several noxious weed species are present, including but not limited to Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), and dalmatian toadflax (*Linaria dalmatica*).

3.6 Riparian Woodland

Riparian woodlands were not observed during the survey of the Amendment 11 Project area. A drainage channel trending northeast to southwest through Survey Area 1 has a mosaic of vegetation cover types including aspen forest, bare ground as a remnant of historical mining activity, and savanna-like conifer meadow. None of these classify as true riparian woodland, likely due to the intermittent nature of streamflow.

3.7 Wet Meadow

Wet meadows account for 0.3 acres (0.1 percent) of the Amendment 11 Project area, only occurring in the lower, northern portion of Survey Area 2. Moisture for this community appears to come from groundwater, stream discharge, overland flow, and on-site precipitation. A delineation of potential wetlands was not conducted, however wet meadow acreage in Survey Area 2 may be a jurisdictional wetland under Section 404 of the Clean Water Act (CWA). The Survey Area 2 wet meadow contains a variety of hydrophytic plant species, including sedges (*Carex* spp.), tufted hairgrass

(*Deschampsia caespitosa*), shrubby cinquefoil, a spikerush species (*Eleocharis spp.*), Baltic rush (*Juncus balticus.*), marsh marigold (Caltha leptosepala), wild iris (*Iris missouriensis*), buttercups (*Ranunculus* spp.), American bistort (*Bistorta bistoroides*), and Sphagnum moss (*Sphagnum* spp.). The area had been disturbed by grazing (likely Rocky Mountain elk, *Cervus canadensis*) and the water table was at the ground surface in a portion of the wet meadow with surface runoff originating from one or more springs.

3.8 Disturbed Areas

Disturbed areas are a result of past and ongoing mining and ranching practices. Disturbed areas account for approximately 50.0 acres (27 percent) of the Amendment 11 Project area (46.8 acres in Survey Area 1; 3.2 acres in Survey Area 2). Most or all of the soil has been disturbed, and vegetation is dramatically changed, diffuse, or absent in these areas. Where vegetation occurs, it is typically a mix of native and non-native grasses, forbs, and noxious weeds. This is an ecologically-distinct vegetation community type and is mapped separately from "Disturbed Grasslands" (see Section 3.6 and **Table 3-1**).

3.9 Noxious Weeds

Noxious weeds are primarily associated with disturbed areas and roadsides. The most commonly noted species were yellow toadflax (*Linaria vulgaris*), with lesser amounts of Canada thistle, musk thistle (*Carduus nutans*), oxeye daisy (*Chrysanthemum leucanthemum*), bull thistle, cheatgrass (*Bromus tectorum*), and Dalmatian toadflax. These species do not presently appear to be displacing native vegetation.

3.10 Potential Impacts to Vegetation Resources

Reclamation performance standards per Rule 3 of the Mineral Rules and Regulations of the CMLRB for Hard Rock, Metal, and Designated Mining Operations (CMLRB 2010) will be implemented for post-mining use. CC&V's site-wide reclamation plan sets restoration goals based on past and expected post-mining land uses.

A delineation of potential wetlands and other waters of the U.S. for the areas of new disturbance included in the Amendment 11 Project area was not performed during August 2015 fieldwork. Wetlands and other waters of the U.S. are regulated under Section 404 of the CWA and authorization (a Section 404 permit) is required for the placement of dredged and fill material into them. One potential wetland was located in

Survey Area 2 and is likely a 1.3-acre jurisdictional wet meadow wetland which extends beyond the Amendment 11 Project area boundary.

4. WILDLIFE RESOURCES

ARCADIS conducted an inventory of wildlife habitats and species within the Amendment 11 Project area in conjunction with evaluating vegetation communities from August 8 to 9, 2015. Important observations are discussed in detail below.

4.1 Big Game

Prior to surveys, existing baseline information indicated that the Rocky Mountain elk is the most abundant big game species within the Amendment 11 Project area. CPW habitat mapping (2015) indicates that the area provides summer and overall ranges, while winter range is found 3,000 feet northeast of Survey Area 2. Elk sign (primarily pellet groups and tree rubs) were observed in several locations throughout the project area, particularly in aspen-dominated woodlands, open conifer-dominated woodlands, and dense conifer-dominated woodlands. A group of approximately 20 elk was observed walking west near the southern boundary of Survey Area 2 on August 8.

CPW habitat mapping (2015) indicates that the Amendment 11 Project area provides summer and overall ranges for mule deer (*Odocoileus hemionus*), with winter range located west and south of the Amendment 11 Project area. Mule deer sign in the form of pellets was observed in several locations throughout all vegetation communities in the Amendment 11 Project area during the wildlife inventory. One mule deer doe was encountered on the edge of an aspen stand in Survey Area 1.

Moose (*Alces alces*) are relatively new inhabitants of Teller County. Moose were reintroduced to north-central Colorado starting in 1978. It is thought that a breeding population did not exist in Colorado in recent times prior to reintroduction (Armstrong, Fitzgerald, and Meaney 2011). The species is now established along the Continental Divide and areas on the west side of the Front Range, including parts of Teller County. At least one individual bull was observed in the vicinity of the Amendment 11 Project area in the summer of 2015 (Chris Hanks, personal communication). Moose require dense vegetation for browsing and thus show preference for early successional stands. Major food plants include willow, spruce, fir, aspen, alder and birch. Home ranges in North Park, Colorado varied up to 135 square miles (Armstrong, Fitzgerald, and Meaney 2011). Evidence suggests that the Amendment 11 Project area currently falls within the home range of one or more moose.

Bighorn sheep (*Ovis canadensis*) do not generally occur within the District, but areas of bighorn sheep overall and winter ranges are found several miles to the northeast and

southwest (CPW 2011). No bighorn sheep, sign of bighorn sheep, or habitat suitable for this species was observed in the Amendment 11 Project area.

The Amendment 11 Project area is part of black bear (*Ursus americanus*) overall range, and is also designated a human/bear conflict area (CPW 1997). Conflict areas are those portions of the overall range where two or more confirmed black bear complaints per season were received which resulted in CPW investigation, damage to persons or property, and/or removal of the problem bear(s). Black bear sign in the form of scat and claw marks on aspen were observed in an aspen-dominated woodland in Survey Area 1, and claw marks and a minimal amount of shredded downed logs where observed intermittently in other aspen stands.

4.2 Game Birds

Existing baseline information indicated that the dusky grouse (*Dendragapus obscurus*) is the only game bird species expected to occur within the Amendment 11 Project area. The mix of dense conifer stands and aspen groves in Survey Areas 1 and 2 provide ideal dusky grouse habitat. However, no dusky grouse or sign were observed in the Amendment 11 Project area.

4.3 Raptor Nests

Raptors observed in the Amendment 11 Project area included red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), American kestrel (*Falco sparverius*), great horned owl (*Bubo virginianus*), and turkey vulture (*Cathartes aura*). These raptors were generally observed soaring or perched; no active nests were observed. An adult red-tailed hawk was observed hunting in Survey Area 1, suggesting that this and adjacent terrain is a potential nesting territory; however, no nest was confirmed. On August 9 a juvenile great horned owl was observed roosting on top of a telephone pole in the Chicago Portal area. This individual flushed uphill into adjacent aspen woodlands and was observed twice more in mature aspen stands south of and adjacent to the Chicago Portal. No tree nest was located; however, historic mine structures in the area may harbor a nest

4.4 Other Wildlife Species

Several small game and nongame species occur in the Cresson Project area and are typical of the high-elevation habitat present, including bird species such as the gray jay (*Perisoreus canadensis*), common raven (*Corvus corax*), black-billed magpie (*Pica pica*), northern flicker (*Colaptes aurates*), downy woodpecker (*Picoides pubescens*),

dark-eyed junco (*Junco hyemalis*), mountain chickadee (*Poecile gambeli*), Clark's nutcracker (*Nucifraga columbiana*), yellow-rumped warbler (*Dendroica coronata*), mountain bluebird (*Sialia currucoides*), chipping sparrow (*Spizella passerina*), American robin (*Turdus migratorius*), white-breasted nuthatch (*Sitta carolinensis*), red-breasted nuthatch (*Sitta canadensis*), mourning dove (*Zenaida macroura*), Steller's jay (*Cyanocitta stelleri*), and barn swallow (*Hirundo rustica*); reptile species such as the garter snake (*Thamnophis* spp.); carnivorous mammals such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and mountain lion (*Felis concolor*); and rodents such as the golden-mantled ground squirrel (*Callospermophilus lateralis*), Botta's pocket gopher (*Thomomys bottae*), meadow vole (*Microtus pennsylvanicus*), mountain cottontail rabbit (*Sylvilagus nuttallii*), pine squirrel (*Tamiasciurus hudsonicus*), Gunnison's prairie dog (*Cynomys gunnisoni*), and deer mouse (*Peromyscus maniculatus*).

Shafts and adits associated with historic underground mining in the Cresson Project area represent potential habitat for bat species such as the sensitive Townsend's big-eared bat (*Corynorhinus townsendii*). Suitable foraging habitat for bats exists along unnamed tributaries to Cripple Creek in the Amendment 11 Project area. No underground surveys for bats were conducted during the 2015 site visit and no bats were observed.

4.5 Potential Impacts to Wildlife Resources

Proposed Amendment 11 Project activities in Survey Area 1 may result in the loss of limited amounts of foraging and calving habitat for big game (particularly elk and mule deer), strutting habitat for grouse, habitat for small mammals, and potential nesting habitat for raptors and other migratory birds. These impacts are limited by the recreational Buffer Contact between CC&V and Teller County which limits the amount of surface disturbances within Survey Area 1 to those disturbances necessary to support underground operations. If surface disturbances occur within Survey Area 2, similar types of impacts would occur; however, disturbances in that area are not planned at this time. Per CMLRB's mining rules and regulations (CMLRB 2010), all aspects of the mining and reclamation plan should take into account the safety and protection of wildlife on the mine site, at processing sites, and along all access roads to the proposed project sites with special attention given to critical periods in the life of wildlife (e.g. elk calving, migration routes, grouse strutting periods, raptor nesting periods, migratory bird breeding periods, etc.). Habitat management and creation should be directed toward encouraging the diversity of both game and non-game species, and should provide protection, rehabilitation, or improvement of wildlife habitat.

While no raptor nests were found during the 2015 surveys, if nests are discovered prior to development, the findings should be reported to CC&V Environmental Resources to ensure appropriate procedures are followed (CC&V 2013). It is prohibited to take a raptor, an active nest, eggs, or young under the federal Migratory Bird Treaty Act (and under the Bald and Golden Eagle Protection Act in the case of eagles). CPW has a set of recommended no surface occupancy buffer zones and seasonal human encroachment restrictions for active raptor nest sites (CPW 2008). The recommended buffer zones range from 1/4 mile to 1/2 mile depending on the species. Red-tailed hawks were observed in the project area and showed signs of territorial behavior (potentially indicated a nesting territory). CPW recommends a 1/3-mile non-disturbance buffer around active red-tailed hawk nests with no human encroachment from April to August. In addition, the presence of a juvenile great horned owl in the Chicago Portal area strongly suggests owl nesting in this area, possibly within one of the area's historic structures due to the paucity of large nest trees.

In addition to raptors, the Migratory Bird Treaty Act protects most other migratory bird species that could potentially occur in the project area. It is unlawful to destroy active nests of bird species listed under the Act. To minimize the potential for inadvertent nest destruction, vegetation clearing should be planned to take place outside of the active nesting season (approximately March 15 to July 15). If vegetation clearing must take place during the nesting season, a nest clearance survey could be conducted prior to construction to identify active nests so that they can be avoided.

5. SPECIAL STATUS SPECIES

ARCADIS queried USFWS, CDOW, and CNHP websites and developed a list of special status species that have potential to occur in the Amendment 11 Project area. Species and status designations are as follows:

Birds

- American peregrine falcon (*Falco peregrinus anatum*): state species of concern
- Bald eagle (*Haliaeetus leucocephalus*): state species of concern
- Burrowing owl (*Athene cunicularia*): state threatened
- Ferruginous Hawk (*Buteo regalis*): state species of concern
- Mexican spotted owl (*Strix occidentalis lucida)*: federally threatened/state threatened

Mammals

- Botta's pocket gopher (*Thomomy bottae rubidus*): state species of concern
- Preble's meadow jumping mouse (*Zapus hudsonius preblei*): federally threatened/state threatened
- Townsend's big-eared bat (*Corynorhinus townsendii palllescens*): state species of concern

Invertebrates

- Pawnee montane skipper (*Hesperia leonardus montana*): federally threatened

Plants

- Pale moonwort (*Botrychium pallidum*): state rare plant
- Reflected moonwort (*Botrychium echo*): state rare plant
- Rocky Mountain columbine (*Aquilegia saximontana*): state rare plant

5.1 Birds

5.1.1 American Peregrine Falcon

The American peregrine falcon is a state species of concern. This species inhabits open spaces usually associated with high cliffs and bluffs overlooking rivers or other large bodies of water (CPW 2011). No American peregrine falcons were observed in the Amendment 11 Project area. In addition, there is no suitable habitat (i.e., cliffs or high bluffs) for this species in the Amendment 11 Project area. Individuals of this species may occasionally pass through the area during migration but are not expected to stop over in the area due to the lack of suitable habitat.

5.1.2 Bald Eagle

In June 2007, the Secretary of the Interior announced the removal of the bald eagle from the federal threatened and endangered species list. However, bald eagles continue to be protected under the federal Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Food availability is probably the single most important factor affecting bald eagle distribution and abundance. Fish and waterfowl are the primary sources of food. Big game and livestock carrion, as well as larger rodents (e.g. prairie dogs), also can be

important dietary components where these resources are available (Ehrlich et al. 1988).

There are no known bald eagle nest sites or winter roosts in the District or the Amendment 11 Project area. The project area lacks large water bodies that would support fish and waterfowl and other food resources in the project area are likely insufficient to attract bald eagles. Individuals of this species may occasionally pass through the area during migration but are not expected to stay in the area due to limited foraging habitat. No bald eagles were observed in the Amendment 11 Project area during the 2015 survey.

5.1.3 Burrowing Owl

The burrowing owl is a state listed threatened species. Burrowing owls occupy grasslands and mountain parks, typically in or near prairie dog colonies where they can use abandoned burrows to modify and use as their own (USFWS 2003). Limited grassland acreage and no prairie dog colonies were located within the Amendment 11 Project area during the 2015 survey. Though there are historic occurrences of this species within Teller County, current distribution maps do not show this species occupying Teller County (USFWS 2003). As such, it is not expected that burrowing owls would occur in the Amendment 11 Project area.

5.1.4 Ferruginous Hawk

The ferruginous hawk is a species of concern in Colorado. The ferruginous hawk is a bird of open grasslands and shrub steppe vegetation communities. These birds nest in flat, rolling, or rugged terrain in open areas, including short-grass prairie, canyons with cliffs or rock outcrops, and areas with isolated trees (Colorado Breeding Bird Atlas 1998). There is little suitable habitat for this species within native grasslands in the Amendment 11 Project area, and no ferruginous hawks or nests were observed during the 2015 survey. Considering this species typically avoids areas of high human disturbance (Colorado Breeding Bird Atlas 1998), such as mine activity and road work, the ferruginous hawk is unlikely to use habitats within the Amendment 11 Project area (particularly for nesting).

5.1.5 Mexican Spotted Owl

The Mexican spotted owl is a federally and state listed threatened species. It inhabits two different primary habitats in Colorado: 1) old growth mixed coniferous forests in mountainous areas at elevations ranging from 5,500 to 9,000 feet amsl and 2) areas of pinyon-juniper with scattered stands of old growth Douglas fir in steep, narrow, shady

canyons. Canyon bottoms often have riparian vegetation composed of cottonwoods (*Populus* spp.), willow (*Salix* spp.), box elder (*Acer negundo*), and other riparian shrub and tree species. Downed logs and snags are also important habitat components. Day roost sites are found in cool, shady canyons, often on north-facing slopes (Andrews and Righter 1992) or on ledges or in cavities in canyon walls (Ganey and Balda 1994).

Previous CNHP data (CNHP 1999) show recorded occurrences to the south, east, and north of the Amendment 11 Project area. The USFWS has designated three areas of critical habitat in Colorado. The closest critical habitat area is known as SRM-C-1a and encompasses areas to the south, east, and northeast of the Amendment 11 Project area (USFWS 2007).

Limited areas of potential foraging habitat for the Mexican spotted owl exist in the Amendment 11 Project area. However, no nesting habitat (old-growth forests, steep canyons) exists in the Amendment 11 Project area. Based on the limited size of observed foraging habitat patches and the distance from known critical habitat, Mexican spotted owls are not expected to occur in the Amendment 11 Project area.

5.2 Mammals

5.2.1 Botta's Pocket Gopher

The Botta's pocket gopher is a state species of concern. It can be found in a variety of vegetation types, including agricultural lands, grasslands, roadsides, open parklands, pinyon-juniper woodlands, open montane forests, and montane shrublands (NDIS 2011). Habitat, particularly in natural grassland and open conifer-dominated woodlands, is present within the Amendment 11 Project area. No individual Botta's pocket gophers were observed within the Amendment 11 Project area. However, burrow mounds distinctive of pocket gophers (plugged mounds) were observed in natural grasslands in the Amendment 11 Project area and the species is known to inhabit southern Teller County (Armstrong, et al. 2011).

5.2.2 Preble's Meadow Jumping Mouse

The Preble's meadow jumping mouse is a federally and state listed threatened species. Typical habitat for the Preble's meadow jumping mouse is composed of well-developed plains riparian vegetation with adjacent, relatively undisturbed grassland communities, and a nearby water source. These riparian areas include a relatively dense combination of grasses, forbs, and shrubs. This species is known to regularly range outward from riparian zones into adjacent uplands to feed and hibernate. The

project area lacks suitable riparian habitat for this species. The USFWS has designated 11 areas in Colorado as critical habitat (USFWS 2009). The closest critical habitat unit is Unit 10: Upper South Platte River. The unit consists of four subunits including one subunit (Trout Creek Subunit) which protrudes less than one mile into northern Teller County (USFWS 2009). This subunit is located approximately 40 miles north of the Amendment 11 Project area, and is not hydrologically connected to streams in the Amendment 11 Project area. Based on the lack of habitat in the Amendment 11 Project area and distance from mapped critical habitat, the Preble's meadow jumping mouse is not expected to occur in the Amendment 11 Project area.

5.2.3 Townsend's Big-Eared Bat

The Townsend's big-eared bat is a state species of concern in Colorado. This species can be found roosting in mines, caves, and other man-made structures in woodlands and forests to elevations above 9,500 feet amsl. Due to safety concerns, underground mine inspections were not conducted to determine the presence of bats in abandoned mines present within the Amendment 11 Project area. However, it is likely that bats, and potentially the Townsend's big-eared bat, occupy abandoned mine features in the Cresson Project area.

5.3 Invertebrates

5.3.1 Pawnee Montane Skipper

The Pawnee montane skipper is a federally listed threatened species. This butterfly inhabits dry, open ponderosa pine woodlands with a sparse understory at 6,000 feet to 7,500 feet amsl on soils derived from the Pikes Peak granite within the South Platte River drainage basin. Blue grama grass (*Bouteloua gracilis*) (the larval food plant) and prairie gayfeather (*Liatris spicata*) (the primary nectar plant) are two necessary components of the ground cover (USFWS 1998). The only known location for the Pawnee montane skipper is at Deckers, approximately 40 miles north of the Amendment 11 Project area (Ronish 1999). No potential habitat for the Pawnee montane skipper was observed in the Amendment 11 Project area. Small areas of ponderosa pine were observed with nearby blue grama, but no gayfeather was observed and the elevation was likely too high.

5.4 Plants

The pale moonwort, reflected moonwort, and Rocky Mountain columbine are all listed as state rare plants. Pale moonwort is known from east-central Teller County. Species habitat includes exposed hillsides, cleared areas including old mining sites at

elevations of 9,800 to 10,600 feet amsl (CNHP2014). The reflected moonwort occurs on rocky hillsides, and grassy slopes/meadows at elevations of 9,500 to 11, 000 feet amsl. Rocky Mountain columbine occurs on cliffs and rocky slopes at elevations of 9,000 to 12,300 feet amsl (CNHP 2014). The project area contains habitat patches for these species; however none of these special status plant species were observed in the Amendment 11 Project area during a habitat survey, and past survey data does not suggest the presence of these species in the Amendment 11 Project area.

5.5 Potential Impacts to Special Status Species

Potential burrows of the Botta's pocket gopher were found within open grassland habitat in Survey Area 1. This species is not afforded specific protections under state or federal laws; however, it is recommended that direct impacts to active burrows or colonies be avoided to the greatest extent feasible. Habitat management and creation should provide protection, rehabilitation, or improvement of habitat for this species as well as for all special status species with potential to occur in the Amendment 11 Project area.

The Townsend's big-eared bat can be sensitive to disturbance, particularly during hibernation. Therefore, if this species is ever identified in the Cresson Project area, care should be taken to not disturb it during the winter months to avoid accidental arousal during hibernation. Abandoned mine structures that could harbor roosting bats should be surveyed for the presence of bats prior to closure or removal.

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TABLES

Table 2-1 Soil Types in the Amendment 11 Project Area

Soil Map Unit (Component)	Survey Area 1 (acres)	Survey Area 2 (acres)	Total Acres
17. Catamount-Guffey complex, 15 to 40 percent slopes (Catamount)	--	29.6	29.6
17. Catamount-Guffey complex, 15 to 40 percent slopes (Guffey)	--	5.8	5.8
76. Disturbed land, mine areas, overburden storage areas, mine complex	39.4	3.2	42.6
79. Platdon loam, frequently flooded, 0 to 3 percent slopes	--	0.3	0.3
82. Quander-Bushpark very gravelly loams, 5 to 40 percent slopes (Bushpark)	54.0	--	54.0
82. Quander-Bushpark very gravelly loams, 5 to 40 percent slopes (Quander)	35.7	--	35.7
88. Rofork very gravelly sandy loam, 5 to 55 percent slopes	--	2.5	2.5
97. Seitz very gravelly loam, 20 to 50 percent slopes	15.1	--	15.1
Total	144.3	41.5	185.6

Table 2-2 Amendment 11 Project Area Soil Characteristics

	17 – Catamount-Guffey Complex		79 - Platdon loam, frequently flooded	82 – Quander-Bushpark very gravelly loams		88 – Rofork very gravelly sandy loam	97 – Seitz very gravelly loam
	Catamount	Guffey		Quander	Bushpark		
Percentage of Map Unit*	60	30	90	60	30	90	90
Slope (%)	15-40	15-40	30-70	5-40	10-40	5-55	20-50
Aspect	All	All	All	All	All	Mostly south	Mostly north
Landforms	Mountainflank, mountaintop	Mountainflank, mountaintop	Floodplains	Mountainflank, mountainbase	Mountainflank, mountainbase	Mountainflank, mountaintop	Mountainflank
Parent Material	kind=slope alluvium over residuum source=granite	kind=colluvium over residuum source=granite	Alluvium	kind=colluvium source=phonolite, latite-phonolite, breccia from phonolite & latite, trachydolerite	kind=residuum source=phonolite, latite-phonolite, breccia from phonolite &latite, trachydolerite	kind=slope alluvium, residuum source=granite, gneiss	kind=colluvium, slope alluvium source= trachyte, breccias, tuff
Native Plant Community	Conifer-dominated Woodland	Mixed Conifer-Aspen Woodland	Wet Meadow	Natural Grassland	Natural Grassland, Aspen-dominated Woodland	Natural Grassland	Conifer-dominated Woodland
Typical Texture Profile	0 to 1” = decomposed plant material 1 to 3” = gravelly sandy loam 3 to 9” = very gravelly sandy loam 9 to 13” = extremely gravelly loamy coarse sand	0 to 1” decomposed plant material 1 to 13” = very gravelly coarse sandy loam 13 to 27” = very gravelly clay loam	0 to 18” = loam 18 to 30” = very gravelly sandy clay loam 30 to 60” = extremely gravelly sand	0 to 9" =gravelly loam 9 to 24" = very cobbly silty clay loam 24-60" = extremely cobbly silty clay loam	0 to 8” = fine gravelly silt loam 8 to 16” = fine gravelly silt loam 16 to 25” = very cobbly silt loam 25 to 30+” = extremely cobbly silty loam	0 to 5” = gravelly sandy loam 5 to 9” = extremely gravelly sandy loam 9 to 14” = extremely gravelly coarse sand	0 to 4” = conifer litter 4 to 16” = very gravelly loam to silt loam 18 to 26” = extremely cobbly silt loam 26+” = extremely cobbly silt loam
Depth Class	Very deep	Moderately Deep	Very Deep	Very deep	Shallow	Shallow	Very deep
Drainage Class	Excessively	Well	Poorly to Very Poorly	Well	Well	Well	Well
Organic Matter (%)	5	5	2	1	1	2	3
pH (standard units)	6.0	6.0	7.3	6.7	6.7	6.3	6.7
Salinity (mmhos/cm)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Available Water Capacity (in/in)	0.06	0.06	0.05	0.03	0.03	0.05	0.04
Saturated Hydraulic Conductivity (µm/second)	16	16	216	12	12	24	22
NRCS Erosion Hazard (Off-Road, Off-Trail)	Moderate	Moderate	Severe	Moderate	Moderate	Moderate	Moderate

Notes:
* Remaining percentages of map units consist of contrasting inclusions.
Soil map unit 76 (Pits, mine-Dumps, mine complex) is not included due to lack of appreciable soils for reclamation salvage.
Site-specific data supplemented by NRCS soil survey data as applicable. Representative values (e.g., soil profile weighted average) for each soil unit component are provided.
Abbreviations: mmho/cm = millimho per centimeter; in/in = inch per inch; µm/second = micrometers per second

Table 2-3 Soil Salvage Depths and Suitability Ratings

Soil Map Unit - Component	Salvageable Depth (NRCS[1])	Salvageable Depth (This Study)		Suitability Rating - Observed	Suitability Rating - NRCS	Limiting Factors - Observed	Limiting Factors – NRCS[3]
		Range of Depth (inches)	Mean Depth (inches)				
17 - Catamount	9	NA	NA	Good to 9”	Poor	Coarse fragments; shallow bedrock	Droughty; shallow bedrock; low organic matter; acidity; sand content
17 – Guffey	27	22-26	24	Poor to 24”	Poor	Coarse fragments	Droughty; low organic matter; shallow bedrock; acidity
79 – Platdon	60	NA	NA	Good to 18” Fair to 30” Poor to 60”	Fair	Coarse fragments	Droughty; low organic matter
82 – Quander	60	>22 - >24	>23	Fair to 7” Poor to 60”	Poor	Coarse fragments; low organic matter	Cobble content; droughty; stone content; low organic matter
82 – Bushpark	16	9-21	16	Fair to 16”	Poor	Coarse fragments, low organic matter; shallow bedrock	Droughty; shallow bedrock
88 – Rofork	14	NA	NA	Poor to 14”	Poor	Shallow bedrock	Droughty; shallow bedrock; sand content; acidity
97 – Seitz	28	10-26	17	Fair to 14” Poor to 26”	Poor	Coarse fragments	Droughty; low organic matter; acidity; clay content

1 Based on review of NRCS 2014 data.
NA = no applicable field observations.
Source: NRCS Web Soil Survey, September 1, 2015.

Table 2-4 Soil Material Suitability Criteria for Salvage And Redistribution as Growth Medium

Soil Property	Soil Quality			
	Good	Fair	Poor	Unsuitable
Texture	Sandy loam Loam Silt loam	Sandy clay loam Silty clay loam Clay loam	Sandy clay Loamy sand Silty clay	Clay >60%
Coarse Fragment (gravel and larger) (% by volume)	0-25	25-50	>50	>50
Organic Matter (%)	>1.5	0.5-1.5	<0.5	--
Soil pH	6.1-7.8	5.1-6.1 7.9-8.4	4.5-5.0 8.5-9.0	<4.5 >9.1
Salinity (mmho/cm)	<3	3-6	6-9	>9
Available Water Retention Capacity (in/in)	>0.16	0.2-0.6	<0.2 or >6.0	--
Saturated Hydraulic Conductivity (µm/second)	10-100	1-10	<1 or >100	--

Notes:
Source: Modified from NRCS 1999
Abbreviations: mmho/cm = millimho per centimeter; in/in = inch per inch; µm/second = micrometers per second
Permeability classes have been replaced by Saturated Hydraulic Conductivity in current NRCS soil surveys. Correlative rating classes provided in NRCS Soil Survey Technical Note 6.
Soils considered to be unsuitable for reclamation if cobble content is greater than 50%.
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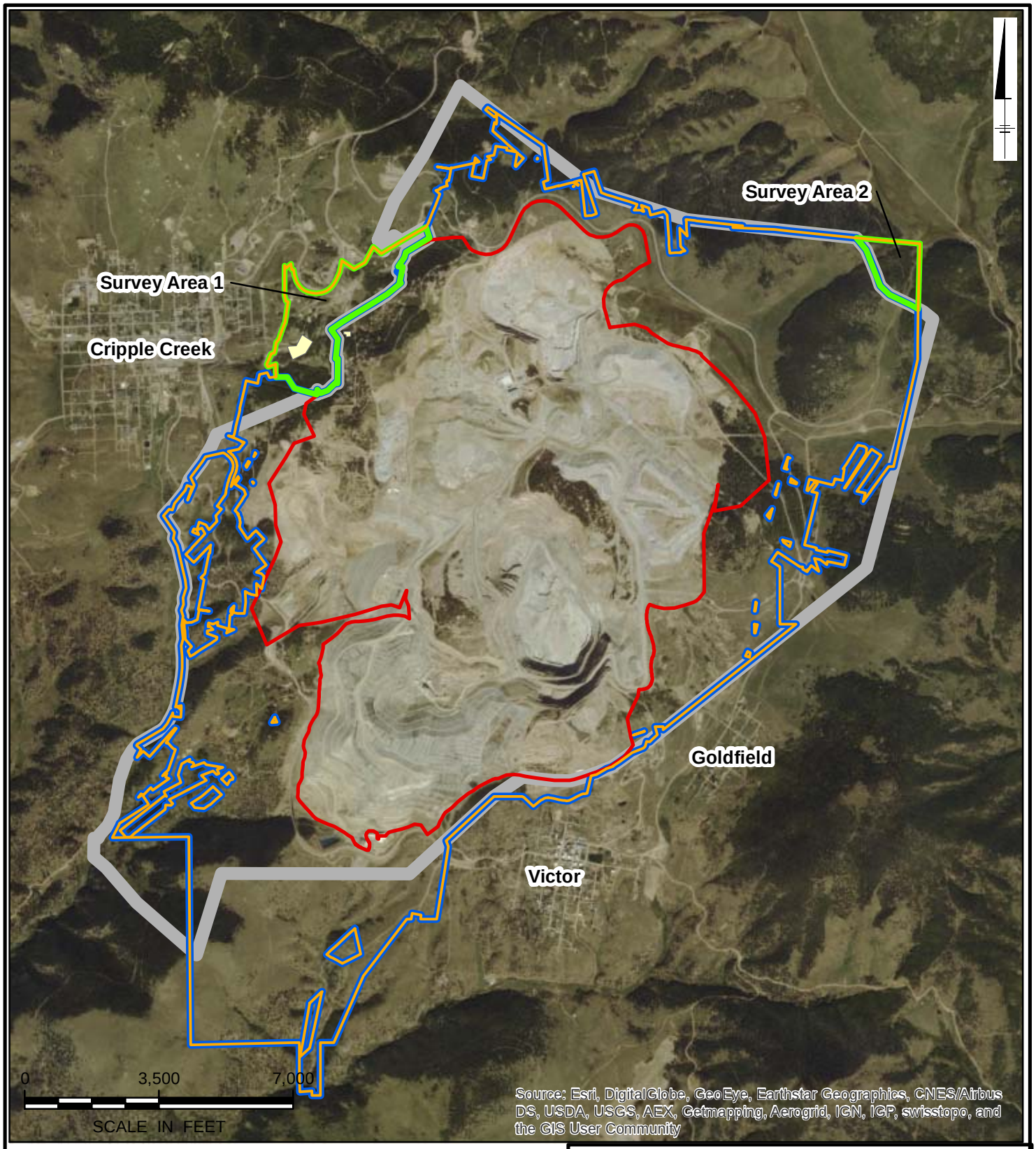
Table 3-1 Vegetation Community Type Acreage Summary in the Amendment 11 Project Area

Vegetation Community Type	Survey Area 1 (acres)	Survey Area 2 (acres)	Total Acres	Percent of Amendment 11 Project Area
Aspen-dominated woodland	63.1	--	63.1	34
Dense conifer-dominated woodland	--	36.5	36.5	20
Disturbed areas	46.8	3.2	50.0	27
Disturbed grassland	10.0	--	10.0	5
Mixed conifer/aspen-dominated woodland	15.1	--	15.1	8
Natural grassland	9.2	1.5	10.7	6
Wet meadow	--	0.3	0.3	<1
Riparian woodland	--	--	0	0
Total			**185.6**	**100**

ARCADIS

FIGURES



Legend

- Proposed Affected Land Boundary
- Amendment No. 11 Project Area
- Chicago Tunnel Permit Boundary
- Current Affected Land Boundary
- Amendment 10 Boundary
- Cripple Creek Mining Overlay District

M-1980-0244 AMENDMENT NO. 11 PROJECT
CRIPPLE CREEK MINING DISTRICT
TELLER COUNTY, COLORADO

PROJECT OVERVIEW MAP

ARCADIS

FIGURE
1

CITY:(DEN-TECH) DIV/GROUP:(ENV/GIS) DB: WEBB LD: PIC: PM: TM:
PROJECT: PATH: Z:\GISPROJECTS_ENV\Cresson\MXD\Figure1_projectOverview_letter.mxd

Survey Area 1

Survey Area 2

0 325 650
SCALE IN FEET

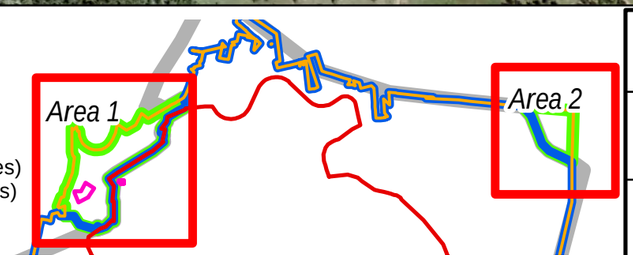
0 250 500
SCALE IN FEET

Legend

- Proposed Affected Land Boundary
- Chicago Tunnel Permit Boundary
- Current Affected Land Boundary
- Amendment 10 Boundary
- Amendment No. 11 Project Area
- Cripple Creek Mining Overlay District
- Soil Profile Location

Soil Map Units

- 17-C = Catamount-Guffey complex, 15 to 40 percent slopes (Catamount series)
- 17-G = Catamount-Guffey complex, 15 to 40 percent slopes (Guffey series)
- 76 = Disturbed land, mine areas, overburden storage areas, mine complex
- 79 = Platdon loam, frequently flooded, 0 to 3 percent slopes
- 82-B = Quander-Bushpark very gravelly loams, 5 to 40 percent slopes (Bushpark series)
- 82-Q = Quander-Bushpark very gravelly loams, 5 to 40 percent slopes (Quander series)
- 97 = Seitz very gravelly loam, 20 to 50 percent slopes
- 88 = Rofork very gravelly sandy loam, 5 to 55 percent slopes



M-1980-0244 AMENDMENT NO. 11 PROJECT
CRIPPLE CREEK MINING DISTRICT
TELLER COUNTY, COLORADO

SOIL MAP

ARCADIS

FIGURE
2

CITY:(DEN-TECH) DIV/GROUP:(ENV/GIS) DB: WEBB LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Cresson\MXD\Figure2_soils_2015.mxd

Survey Area 1

Survey Area 2

AD
DG
AD
MC
NG/D
NG
D
AD
AD
NG
AD
D
AD

WM
D
DC
D
NG
DC
D

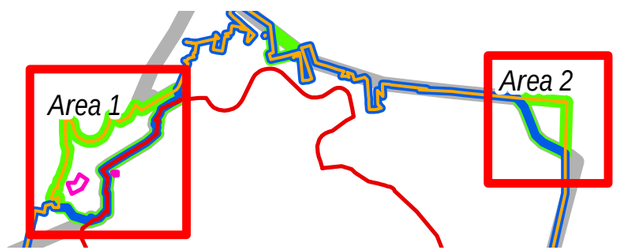
0 325 650
SCALE IN FEET

0 250 500
SCALE IN FEET

Legend

- Proposed Affected Land Boundary
- Chicago Tunnel Permit Boundary
- Current Affected Land Boundary
- Amendment 10 Boundary
- Cripple Creek Mining Overlay District
- Amendment No. 11 Project Area
- Plant Community

Plant Community Type
AD = Aspen Dominated
DC = Dense Conifer Dominated
D = Disturbed Areas
NG = Natural Grasslands
MC = Mixed Conifer - Aspen
WM = Wet Meadow
DG = Disturbed Grassland



M-1980-0244 AMENDMENT NO. 11 PROJECT
CRIPPLE CREEK MINING DISTRICT
TELLER COUNTY, COLORADO

PLANT COMMUNITY MAP

ARCADIS

FIGURE
3

CITY:(DEN-TECH) DIV/GROUP:(ENV/GIS) DB: WEBB LD: PIC: PM: TM:
PROJECT: PATH: Z:\GIS\PROJECTS_ENV\Cresson\MXD\Figure3_plantcommunity.mxd

Appendix A

Vegetation Data

Table A-1 Plant Species Observed in Amendment 11 Project Area

Common Name	Scientific Name
TREES	
Subalpine fir	*Abies bifolia*
Rocky Mountain maple	*Acer glabrum*
Alder	*Alnus incana* ssp. *tenuifolia*
Englemann spruce	*Picea engelmannii*
Colorado blue spruce	*Picea pungens*
Bristlecone pine	*Pinus aristata*
Pinyon pine	*Pinus edulis*
Limber pine	*Pinus flexilis*
Ponderosa pine	*Pinus ponderosa*
Quaking aspen	*Populus tremuloides*
Douglas fir	*Pseudotsuga menziesii*
Gambel's oak	*Quercus gambelii*
Rocky Mountain juniper	*Sabina scopulorum*
SHRUBS	
Serviceberry	*Amelanchier alnifolia*
Bearberry	*Arctostaphylos uva-ursi*
Curl-leaf mountain mahogany	*Cercocarpus ledifolius*
Mountain mahogany	*Cercocarpus montanus*
Green rabbitbrush	*Chrysothamnus viscidiflorus*
Hazelnut	*Corylus cornuta*
Oceanspray	*Holodiscus discolor*
Common juniper	*Juniperus communis*
Prickly pear cactus	*Opuntia polyacantha*
Boulder raspberry	*Oreobatus deliciosus*
Shrubby cinquefoil	*Pentaphylloides floribunda*
Gooseberry current	*Ribes cereum*
Wild current	*Ribes inerme*
Wild gooseberry	*Ribes montigenum*
Wood rose	*Rosa woodsii*
Thimbleberry	*Rubacer parviflorum*
Red raspberry	*Rubus idaeus* ssp. *melanolasius*
Red elderberry	*Sambucus microbotrys*
Dwarf bilberry	*Vaccinium cespitosum*
Spanish bayonet	*Yucca glauca*
FORBS	
Yarrow	*Achillea millefolium*
Blue flax	*Linum lewisii*
False dandelion	*Agoseris glauca*
Wild onion	*Allium cernuum*
Pussytoes	*Antennaria rosea*
Arnica	*Arnica* sp.
Fringed sage	*Artemisia frigida*
Mugwort	*Artemisia ludoviciana*
Leafy aster	*Aster foliaceus*
Milk vetch	*Astragalus* sp.
Blue clematis	*Atragene columbiana*
Kochia	*Bassia sieversiana*
Bistort	*Bistorta bistortoides*

Table A-1 Plant Species Observed in Amendment 11 Project Area

Common Name	Scientific Name
False arabis	*Boechera* sp.
Canada thistle	*Breea arvensis*
Gunnison star-tulip	*Calochortus gunnisonii*
Common harebell	*Campanula rotundifolia*
Whitetop	*Cardaria chalepensis*
Musk thistle	*Carduus nutans*
Indian paintbrush	*Castilleja miniata*
Indian paintbrush	*Castilleja rhexifolia*
Fireweed	*Chamerion danielsii*
Canada thistle	*Cirsium arvense*
Colorado thistle	*Cirsium scariosum*
Bull thistle	*Cirsium vulgare*
Rocky Mountain beeplant	*Cleome serrrulata*
Brittle fern	*Cystopteris fragilis*
Fleabane	*Erigeron* sp.
Wild buckwheat	*Eriogonum umbellatum*
Wild strawberry	*Fragaria virginiana*
Monument plant	*Frasera speciosa*
Bedstraw	*Galium septentrionale*
Wild geranium	*Geranium caespitosum*
Gumweed	*Grindelia squarrosa*
Golden aster	*Heterotheca villosa*
Alum-root	*Huechera parvifolia*
Wild iris	*Iris missouriensis*
Ox-eye daisy	*Leucanthemum vulgare*
Nodding ragwort	*Ligularia bigelovii*
Dalmation toadflax	*Linaria genistifolia* ssp. *dalmatica*
Yellow toadflax	*Linaria vulgaris*
Tansy aster	*Machaeranthera canescens*
Moss	mosses
Mushroom	mushrooms
Evening primrose	*Oenothera elata*
Cat's-eye	*Oreocarya thyrsiflora*
Owl clover	*Orthocarpus luteus*
Canada lousewort	*Pedicularis canadensis*
Fern lousewort	*Pedicularis procera*
Red beardtongue	*Penstemon barbatus*
Beardtongue	*Penstemon virgatus*
Bottle gentian	*Pneumonanthe parryi*
Cinquefoil	*Potentilla ovina*
Cinquefoil	*Potentilla pulcherrima*
Tuber starwort	*Pseudostellaria jamesiana*
Black-eyed susan	*Rudbeckia ampla*
Dock	*Rumex* sp.
Figwort	*Scrophularia lanceolata*
Jim Hill mustard	*Sisymbrium altissimum*
Blue-eyed grass	*Sisyrinchium montanum*
Cut-leaf Tansy	*Tanacetum vulgare*
Dandelion	*Taraxacum officinale*

Table A-1 Plant Species Observed in Amendment 11 Project Area

Common Name	Scientific Name
Meadowrue	*Thalictrum fendleri*
Golden banner	*Thermopsis Montana*
Pennycress	*Thlaspi arvense*
Salsify	*Tragopogon dubius*
Salsify	*Tragopogon pratensis*
Clover	*Trifolium* sp.
Stinging nettle	*Urtica gracilis*
Mullein	*Verbascum thapsus*
GRAMINOIDS	
Indian ricegrass	*Achnatherum hymenoides*
Letterman's needlegrass	*Achnatherum lettermanii*
Bentgrass	*Agrostis scabra*
Redtop	*Agrostis stolonifera*
Cheatgrass	*Bromus tectorum*
Pine dropseed	*Blepharoneuron tricholepis*
Mountain brome	*Bromopsis canadensis*
Smooth brome	*Bromus inermis*
Sedge	*Carex athrostachya*
Sedge	*Carex filifolia*
Elk sedge	*Carex geyeri*
Nebraska sedge	*Carex nebrascensis*
Sedge	*Carex simulata*
Sedge	*Carex utriculata*
Sedge	*Carex vesicaria*
Blue grama	*Chondrosum gracile*
Foxtail barley	*Critesion brachyantherum*
Parry's oatgrass	*Danthonia parryi*
Tifted hairgrass	*Deschampsia caespitosa*
Squirrel tail	*Elymus elymoides*
Blue wild-rye	*Elymus glaucus*
Thickspike wheatgrass	*Elymus lanceolatus*
Bearded wheatgrass	*Elymus trachycaulus* ssp. *subsecundus*
Slender wheatgrass	*Elymus trachycaulus* ssp. *trachycaulus*
Arizona fescue	*Festuca arizonica*
Idaho fescue	*Festuca idahoensis*
Baltic rush	*Juncus balticus*
Junegrass	*Koelaria macrantha*
Mountain muhly	*Muhlenbergia montana*
Green needlegrass	*Nassella viridula*
Western wheatgrass	*Pascopyrum smithii*
Kentucky bluegrass	*Poa pratensis*
Bluegrass	*Poa secunda*
Bluebunch wheatgrass	*Pseudoroegnaria spicata*
Intermediate wheatgrass	*Thinopyrum intermedium*
Spike trisetum	*Trisetum spicatum*

Taxonomic names conform to Weber and Wittman (1996)

Table A-2 Plant Species by Vegetation Types in the Amendment 11 Project Area

Typical Plant Species	Abundant	Common	Occasional
Aspen-dominated Woodland			
Trees	*Populus tremuloides*	*Picea engelmannii*	*Abies lasiocarpa*
		Pinus flexilis	*Picea pungens*
			Pinus contorta
			Pinus ponderosa
			Pseudotsuga menziesii
Shrubs	Not observed		
Forbs	*Thermopsis montana*	*Achillea lanulosa*	*Aquilegea coerulea*
		Astragalus sp.	*Campanula rotundifolia*
		Chamerion danielsii	*Maianthemum racemosum*
		Thalictrum fendleri	*Senecio sp.*
		Potentilla ovina	
		Trifolium sp.	
Graminoids		*Bromus ciliatus*	
		Elymus glaucus	
		Elymus trachycaulus	
		Festuca arizonica	
Dense, Conifer-dominated Woodland			
Trees	*Pinus contorta*	*Picea engelmannii*	*Picea pungens*
	Populus tremuloides	*Pinus flexilis*	
Shrubs	*Juniperus communis*	*Arctostaphylos uva-ursi*	
		Vaccinium spp	
Forbs	*Thermopsis montana*	*Erigeron* sp.	*Dasiphora [Pentaphyloides] floribunda*
			Astragalus sp.
			Achillea millefolium
			Aquilegea sp.
			Geranium caespitosum
			Campanula rotundifolia
Graminoids	Not observed		
Mixed Conifer/Aspen-Dominated Forest			
Trees	*Populus tremuloides*	*Pinus flexilis*	
	Picea engelmannii		
Shrubs		*Vaccinium sp.*	*Dasiphora floribunda*
Forbs	*Thermopsis montana*	*Fragaria virginiana*	*Astragalus sp.*
		Muhlenbergia montana	*Erigeron sp.*
Graminoids		*Bromus ciliatus*	

Table A-2 Plant Species by Vegetation Types in the Amendment 11 Project Area

Typical Plant Species	Abundant	Common	Occasional
Disturbed Areas			
Trees		*Populus tremuloides*	*Pinus ponderosa*
Shrubs			*Dasiphora floribunda*
Forbs	Not observed		
Graminoids		*Danthonia parryii*	*Bromus tectorum*
		Muhlenburgia montana	
Natural Grassland			
Trees			*Populus tremuloides*
Shrubs	Not observed		
Forbs	*Antennaria sp.*		*Artemisia frigida*
			Achillea millefolium
			Cirsium scopularum
Graminoids	*Danthonia parryi*	*Carex oreocharis*	
	Koelaria macrantha	*Bromopsis ciliata*	
	Poa pratensis		
	Muhlenbergia montana		
	Elymus elymoides		
	Pascopyron smithii		
	Elymus trachycaulus ssp. *Subsecundus*		
	Festuca arizonica		
Disturbed Grassland			
Trees	Not observed		
Shrubs	Not observed		
Forbs		*Cirsium arvense*	
		Cirsium vulgare	
		Linaria dalmatica	
Graminoids	*Poa pratensis*	*Elymus elymoides*	
	Pascopyrum smithii	*Agrostis stolonifera*	
		Koelaria macrantha	
		Nassella viridula	
		Festuca arizonica	
		Bromus inermus	
Riparian Woodland – Not observed in Project area, but if it did occur, plants may include:			
Trees	*Picea pungens*	*Sabina scopulorum*	
	Populus tremuloides	*Acer glabrum*	

Table A-2 Plant Species by Vegetation Types in the Amendment 11 Project Area

Typical Plant Species	Abundant	Common	Occasional
	Pinus ponderosa	*Pinus aristata*	
	Alnus incana		
	Pseudotsuga menziesii		
	Picea engelmannii		
Shrubs		*Holodiscus dumosus*	
		Ribes inerme	
		Ribes montigenum	
		Ribes cereum	
		Rubacer parviflorum	
Forbs	*Linaria vulgaris*	*Achillea lanulosa*	
		Cystopteris fragilis	
		Bassia sieversiana	
		Thalictrum fendleri	
		Carduus nutans	
		Artemisia frigida	
		Penstemon virgatus	
		Cleome serrulata	
		Tanacetum vulgare	
Graminoids	*Elymus lanceolatus*	*Achnatherum lettermanii*	
	Poa pratensis	*Agrostis stolonifera*	
	Muhlenbergia montana	*Bromus canadensis*	
	Nasella viridula	*Elymus trachycaulus* ssp. *subsecundus*	
		Chondrosum gracile	
		Elymus trachycaulus ssp. *subsecundus*	
Wet Meadow			
Trees	Not observed		
Shrubs	Not observed		
Forbs		*Caltha leptosepala*	
		Iris missouriensis	
		Ranunculus spp.	
Graminoids		*Carex spp.*	
		Deschampsia caespitosa	
		Potentilla ovina	
		Eleocharis spp.	

Table A-2 Plant Species by Vegetation Types in the Amendment 11 Project Area

Typical Plant Species	Abundant	Common	Occasional
		Juncus balticus	

Taxonomic names conform to Weber and Wittman (1996)