5.3.10 Special Status Vegetation Species and Noxious Weeds

5.3.10.1Affected Environment

5.3.10.1.1 Special Status Vegetation Species Overview.

This section presents information on the 58 special status plant species that potentially occur in the survey area, based on habitat requirements. The list of species was derived from an overall list of 101 species, including plants listed by the USFWS list as threatened, endangered, proposed, candidate, and conservation agreement species potentially occurring in Mohave and Coconino counties, Arizona, and Washington and Kane counties, Utah; Glen Canyon GCNRA Special Status Plant Species list; and the BLM Sensitive Plant Species List for the Arizona Strip, and for Kane and Washington counties, Utah (Table 5-88).

Table 5-88
Special Status Plant Species with Potential to Occur within the Area of Potential Effect

Species Name and Family	Status[1]	Found in Area of Potential Effect (Yes/No)
Acer glabrum (Rocky Mountain maple) Aceraceae	GCNRA G5	No
Acer grandidentatum (Bigtooth maple) Aceraceae	GCNRA G5	No
`Aralia racemosa (American spikenard) Araliaceae	GCNRA G5	No
Arctomecon humilis (Dwarf bear-poppy) Papaveraceae	ESA LE	No
Asclepias welshii (Welsh's milkweed) Asclepidaceae	ESA LT, CH	No
Astragalus ampullarioides (Shivwits milkvetch) Fabaceae	ESA LE, CH	No
Astragalus ampullarius (Gumbo milkvetch) Fabaceae	BLM UT	No
Astragalus holmgreniorum (Paradox [Holmgren] milkvetch) Fabaceae	ESA LE, CH	No
Astragalus striatiflorus (Escarpment milkvetch) Fabaceae	BLM UT	No
Camissonia bairdii (Baird camissonia) Onagraceae	BLM UT	No
Camissonia exilis (Slender evening primrose) Onagraceae	BLM-GSENM UT	Yes
Camissonia gouldii (Diamond Valley suncup) Onagraceae	BLM Utah	No
Ceanothus greggii var. *vestitus* (Mohave ceanothus) Rhamnaceae	GCNRA G5	No

Table 5-88
Special Status Plant Species with Potential to Occur within the Area of Potential Effect

Species Name and Family	Status[1]	Found in Area of Potential Effect (Yes/No)
Cornus sericea (Red-osier dogwood) Cornaceae	GCNRA G5	No
Cryptantha semiglabra (Smooth catseye) Boraginaceae	BLM UT	Yes
Cycladenia humilis var. *jonesii* (Jones cycladenia) Apocynaceae	ESA LT	No
Cystopteris utahensis Syn. *C. fragilis* (Utah brittle-fern) Polypodiaceae	GCNRA G3	No
Echinocactus polycephalus var. *xeranthemoides* (Kanab barrel cactus) Cactaceae	GCNRA G5	Yes
Enceliopsis argophylla (Silverleaf sunray) Asteraceae	BLM AZ	No
Epilobium nevadense (Nevada willowherb) Onogarceae	BLM UT	No
Eriogonum corymbosum var. *nilesii* (Las Vegas buckwheat) Polygonaceae	ESA C	Yes
Eriogonum mortonianum (Morton Wild-Buckwheat) Polygonaceae	N/A	Yes
Eriogonum thompsoniae var. *atwoodii* (Atwood Wild-Buckwheat) Polygonaceae	N/A	Yes
Euphorbia nephradenia (Utah spurge) Euphorbiaceae	BLM UT	No
Gilia latifolia var. *imperialis* Syn. *G. imperialis* (Cataract gilia) Polemoniaceae	BLM UT, GCNRA G5	No
Habenaria zothecina Syn. *Platanthera zothecina* (Alcove bog orchid) Orchidaceae	GCNRA G2	No
Imperata brevifolia (Satintail grass) Poaceae	GCNRA G5	No
Iris pariensis (Paria iris) Iridaceae	BLM UT	No
Jamesia americana var. *zionis* (Zion jamesia) Saxifragaceae	BLM UT	No
Cladium californicum (California sawgrass) Cyperaceae	GCNRA G4	No

Table 5-88
Special Status Plant Species with Potential to Occur within the Area of Potential Effect

Species Name and Family	Status[1]	Found in Area of Potential Effect (Yes/No)
Lepidium montanum var. *claronense* (Claron pepperplant) Brassicaceae	BLM UT	No
Lupinus caudatus var. *cutleri* (Cutler's spurred lupine) Fabaceae	BLM UT	Yes
Mentzelia memorabalis (September 11 stickleaf) Loasaceae	BLM UT BLM AZ	No
Oenothera murdockii (Chinle evening primrose) Onograceae	BLM UT	No
Ostrya knowltonii (Western hophornbeam) Betulaceae	GCNRA G3	No
Pediocactus peeblesianus var. *fickeiseniae* (Fickeisen plains cactus) Cactaceae	ESA LE	No
Pediocactus sileri (Siler pincushion cactus) Cactaceae	ESA LT	Yes
Pediomelum aromaticum var. *barnebyi* (Indian breadroot) Fabaceae	BLM UT	No
Pediomelum castoreum (Beaver Dam breadroot) Fabaceae	N/A	No
Pediomelum epipsilum (Kane breadroot) Fabaceae	BLM UT	Yes
Penstemon ammophilus (Sandloving penstemon) Scrophulariaceae	BLM UT	No
Penstemon laevis (Smooth penstemon) Scrophulariaceae	N/A	Yes
Petalonyx parryi (Parry petalonyx) Loasaceae	BLM UT	No
Phacelia howelliana (Howell's phacelia) Hydrophyllaceae	GCNRA G3	No
Phacelia mammalariensis (Nipple phacelia) Hydrophyllaceae	GCNRA G2	Yes
Phacelia pulchella var. *atwoodii* (Atwood's pretty phacelia) Hydrophyllaceae	BLM UT	Yes
Pinus ponderosa (Ponderosa pine) Pinaceae	GCNRA G5	No
Pseudotsuga menziesii (Douglas fir) Pinaceae	GCNRA G5	No

Table 5-88
Special Status Plant Species with Potential to Occur within the Area of Potential Effect

Species Name and Family	Status[1]	Found in Area of Potential Effect (Yes/No)
Psorothamnus thompsoniae var. *whitingii* (Whitting's indigo-bush) Fabaceae	GCNRA G5	No
Ptelea trifoliate ssp. *pallid* (Hoptree) Rutaceae	GCNRA G5	No
Rosa stellata var. *abyssa* (Grand Canyon rose) Rosaceae	BLM AZ	No
Salvia columbariae var. *argillacea* (Chinle chia) Laminaceae	BLM UT	No
Sclerocactus sileri (Paria Plateau fishhook cactus) Cactaceae	BLM AZ	No
Sisyrinchium demissum (Blue-eyed grass) Iridaceae	GCNRA G5	No
Sphaeralcea gierischii (Gierisch globemallow) Malvaceae	ESA LE	No
Spiranthes diluvialis Syn. *S. romanzoffiana* var. *diluvialis* (Ute ladies'-tresses orchid) Orchidaceae	ESA LT	No
Thelypodiopsis ambigua var. *erecta* (Kanab thelypody) Polypodiaceae	BLM UT	No
Viguiera soliceps Syn. *Heliomeris soliceps* (Tropic goldeneye) Asteraceae	BLM UT, GCNRA G3	No

Notes. [1]Status Definitions: ESA=Endangered Species Act, LE=Listed Endangered, LT=Listed Threatened, C=Candidate, CA=Conservation Agreement, CH=Designated Critical Habitat; BLM AZ=Bureau of Land Management Arizona Sensitive Species; BLM UT=Bureau of Land Management Utah Sensitive Species; GCNRA=Glen Canyon National Recreation Area, G1=Critically imperiled globally, G2=Imperiled globally, G3=Either vary rare and local throughout its range or found locally in a restricted range, G4=Apparently secure globally, and G5=Demonstrably secure globally.

5.3.10.1.2 Results of Special Status Plants Survey.

The following section provides species accounts organized alphabetically by botanical (Latin) name for the special status plant species occurring within the area of potential effect. Nomenclature follows the United States Department of Agriculture (USDA) Plants Database, except where noted. Physical descriptions, habitat abstracts, and distribution information are from Arizona or Utah sources, as cited.

The species accounts include natural history, survey results, and discussion. Of the 58 species for which surveys were conducted, 12 were observed within the area of potential effect; detailed information on those species is provided. The general locations at which the plants were observed are described, ordered

from east to west, and listed by reach name. The general location of each occurrence is provided, as well as the land ownership and the quantity of plants observed.

The distribution of special status species is analyzed according to the vegetation communities in which they occur. The two ecological regions represented within the survey area are Colorado Plateau and Mojave Desert. The ecological regions are further differentiated into ecological systems, which represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. The next level of vegetation classification within ecological system is alliance. An alliance is a group of plant associations sharing the same growth form and one or more dominant or diagnostic species which, as a rule, are found in the uppermost strata of the vegetation. Plant species that are dominant (cover the greatest area) and diagnostic (found consistently in some vegetation types but not others) are the foundation of both alliance and association names. At least one species from the dominant and/or uppermost stratum is included in each name. Alliance names include the growth form class (e.g., "Forest", "Woodland", "Herbaceous") in which they are classified, followed by the word "alliance" to distinguish them from associations. The lowest possible number of species is used for an alliance name, up to a maximum of four. The association is the finest level of the vegetation community classification hierarchy, and is the basic unit for vegetation classification in North America. It is a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy. Additional information on vegetation communities can be found in the Lake Powell Pipeline Vegetation Community Report (LSD 2010).

Further information on the habitats in which special status species occur is provided by an analysis of plant distribution by geologic formation and soil type. Geologic formation and soil names were determined in ArcMap from digitized data or georeferenced maps obtained from the USDA Geospatial Data Gateway, the Utah Geological Survey, and the U.S. Geological Survey.

The discussions for each taxon summarize the results focusing on the effectiveness of the sampling methodology for discovering special status species, land use as it coincides to plant occurrences, potential effects of nonnative plant species introduction in the survey area, effects from pipeline or transmission line construction to the species within the survey area, and recommendations to minimize potential effects to the species. For any taxa which may still have potential for presence in the survey area, recommendations are provided on optimal sampling dates. Where practical, the discussion also includes conflicts with past occurrence data and an estimate of the probability (high, medium, or low) that the plant might be found in a follow-up survey.

5.3.10.1.2.1 Camissonia exilis (Slender evening primrose).

Natural History

Camissonia exilis is an annual in the Onagraceae (the Evening Primrose Family). Its single slender, branched leafy stems are purplish-brown in color, contain minute glands, and arise from a tap root (Welsh et al. 1993), growing up to 4 inches in height. The plant is covered with soft, downy hairs that can appear white and shaggy or long. Leaves are 1.4 inches (3.5 centimeters) long, simple, and oval-shaped, with toothed margins and prominent veins below the leaf. Flowers are tiny, less than 0.06 inches (1 to 1.5 millimeters) long (Welsh et al. 1993), with yellow petals fading to purple (Figure 5-134). Flowers are self-pollinating and bloom from May to June in Arizona (ARPC 2001) and from late April to May in Utah (UNPS 2003 – 2008). *Camissonia exilis* is distinguished from other *Camissonia* species by having 4 stamens, rather than the 8 that are characteristic of the genus (ARPC 2001). *C. exilis* is also unique in that it lacks the ring of stamens that is attached to the petals of other *Camissonia* species (Welsh et al. 1993).

Figure 5-134
Close-up View of *Camissonia exilis* in Bloom

Camissonia exilis is a Colorado Plateau endemic. The known range of the species is limited to western Kane County, Utah, and Mohave and Coconino counties, Arizona. In Utah, *C. exilis* inhabits sagebrush, galleta, and pinyon-juniper communities between 5,000 feet (1,524 meters) and 6,900 feet (2,103 meters) in elevation (UNPS 2003 – 2008; Welsh et al. 2008). In Coconino County *C. exilis* is known from two sites in Coyote Valley at the Utah – Arizona state line. In Mohave County, *C. exilis* is known to grow near Fredonia (AGFD 2005). The species is found in warm desert scrub communities from 3,500 feet to 5,000 feet in elevation, on small islands of saline soils (AGFD 2005) derived from clay badlands of the Moenkopi Formation, as well as travertine-sandy gypsum outcrops (ARPC 2001). *C. exilis* has strict habitat requirements. Germination and plant growth are dependent upon adequate winter rainfall; during dry years, the species is absent from the landscape (ARPC 2001).

Survey Results

Camissonia exilis was encountered in six reaches, including: the Water Conveyance System, the Buckskin to Paria transmission line, the Hydro System High Point, the Hydro System Proposed Action, and 8-Mile Gap Road reaches. Surveys located a total of 6,046 individual plants, most of which (3,890) were encountered in the Hydro System and Hydro System Proposed Action reaches on BLM lands southwest of Telegraph Wash extending to Petrified Hollow Wash. A second location of 1,645 individuals, also on BLM lands, was also encountered in the Hydro System reach between Petrified Hollow Wash and Shinarump Cliffs. The smallest numbers were encountered on private land in the vicinity of Kimball Valley (25 individuals), and in an area southwest of White Sage Wash on BLM land where only eight individuals were identified (Table 5-89). From Seaman Wash to White Sage Wash to Eightmile Gap Road, *C. exilis* was found to share a microhabitat with *Phacelia pulchella* var. *atwoodii*.

Table 5-89
Summary of *Camissonia exilis* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Water Conveyance System and Buckskin to Paria Transmission Line	Five Mile Valley	Private	25
Water Conveyance System	Kimball Valley to Five Mile Mountain Road at US 89	BLM	174
Hydro System	3.0 miles southwest of Telegraph Wash to Petrified Hollow Wash	BLM	1,645
Hydro System and Proposed Action Hydro System	0.62 mile southwest of Petrified Hollow Wash to 0.45 mile northeast of Shinarump Cliffs	BLM	3,890
Proposed Action Hydro System	0.7 mile north and 3.0 miles southwest of Utah-Arizona state line	BLM	193
Proposed Action Hydro System	0.3 mile to 0.65 mile southwest of White Sage Wash	BLM	8
8-Mile Gap Road	1.35 miles to 2.65 miles north of Johnson Wash	BLM	111
		Total	**6,046**

Camissonia exilis was found within the Colorado Plateau Ecological Region, where it occurred in a total of five ecological systems and one area of ruderal vegetation. The species was identified in a total of 10 alliances and 21 associations (see Vegetation Communities Report). *C. exilis* was observed within the Mixed Desert Scrub, Shrub- Steppe, and Pinyon-Juniper ecological systems, and in Ruderal Vegetation (along Highway 89), but was most commonly encountered in the Big Sagebrush Shrubland and Gypsum Badlands ecological systems. The majority of *C. exilis* (2,119 individuals) were found in the Colorado Plateau Gypsum Badlands Ecological System in the *Artemisia tridentata* ssp. *vaseyana* Gypsum Badland Sparse Shrubland Alliance. Another area with large numbers of individuals (1,686 individuals) was located in the Colorado Plateau Big Sagebrush Shrubland Ecological System in the *Artemisia tridentata* ssp. *vaseyana* Sparse Understory Shrubland Association. Another large group of plants (764 individuals in total) was also located in an association co-dominated by *Juniperus osteosperma*.

Although most *C. exili* were encountered in associations dominated by native species, it was also found in ruderal vegetation. Additionally, three of the areas with the fewest plants documented occurred in associations co-dominated by invasive weeds, including *Bromus rubens*, *B. tectorum*, *Erodium cicutarium*, and *Salsola tragus*. *C. exilis* was frequently located with other special status species, including *Phacelia pulchella* var. *atwoodii* and *Pediomelum epipsulum*. Individuals of *C. exilis* were found at elevations ranging from 1,500 feet (457 meters) to 5,620 feet (1,713 meters).

Camissonia exilis was found on six geologic formations within the survey area. It was primarily identified on the Middle Red Member of the Moenkopi Formation and the Shnabkaib Member of the Moenkopi Formation within the Colorado Plateau Ecological Region. These are 250-256 million year old formations on which gypsum badlands can typically be found. The Undivided Moenkopi Formation is a light-red and dark-red, slope-forming siltstone and sandstone with minor gray gypsum. This Formation is often

exposed as isolated outcrops and is similar to the lower red and middle red members. The Shnabkaib Member alternates between beds of white to light-gray fine grained dolomite and light-gray, calcareous siltstone and silty gypsum (Billingsley et al. 2008).

Camissonia exilis was found on multiple soil types within the survey area. The majority of plants (2,069 individuals) were found on Kenzo-Retsabal-Progresso, cool complex soils and a combination of Kenzo-Retsabal-Progresso, cool complex and Ruinpoint-Barx complex soils (1,382 individuals). Often, the species was identified in soils with well-established cryptobiotic crusts.

Most often, *Camissonia exilis* was found in gypsum badlands; however, from Seaman Wash to White Sage Wash to Eight Mile Gap Road, *C. exilis* was encountered on grazed or disturbed lands of red clay soils, growing with *Artemisia tridentata* or *Gutierrezia sarothrae* and *Salsola tragus*. Along SR 389 between Seaman and Kimball Valley, *C. exilis* was primarily found within disturbed right-of-way lands on cracked gray or red clay soils in association with *Phacelia pulchella* var. *atwoodii* and *Artemisia tridentata*.

Camissonia exilis was observed in bloom as late as August 5, 2009, much later than what has been previously reported.

Discussion

The survey identified a total of 6,046 individuals of *Camissonia exilis* within the survey area, being found within five reaches: the Water Conveyance System, the Buckskin to Paria transmission line, the Hydro System High Point, the Hydro System Proposed Action, and 8-Mile Gap Road reaches. *C. exilis* was documented entirely on BLM lands, with the exception of a small group of plants found on private land. The majority of individuals were found in Colorado Plateau Big Sagebrush Shrubland and Colorado Plateau Gypsum Badlands Ecological Systems, in associations dominated by *Artemisia tridentata*, *Gutierrezia sarothrae*, or *Juniperus osteosperma. C. exilis* was generally observed on the Middle Red Member and Shnabkaib Member of the Moenkopi Formation. *C. exilis* was mostly encountered in the Kenzo-Retsabal- Progresso soil complex, and in a microhabitat characterized by soils with well-established cryptobiotic crusts. While many of these areas were disturbed, localized disturbance to the microhabitats supporting *C. exilis* appeared to be minimal. The species was also found in grazed lands and/or in disturbed ROWs.

The affinity of the species for sagebrush and juniper dominated (or co-dominated) vegetation communities is consistent with published data, as were other observations made relative to habitat. Although the species was encountered in 2008, 2009, and in 2010, the same sites were not sampled over multiple years, and therefore, a conclusion regarding variation in densities due to climactic conditions cannot be made. However, the extended blooming period observed in 2009 as a result of mid-summer precipitation is consistent with the known sensitivity of the species relative to climactic conditions.

Camissonia exilis was mostly found in vegetation communities dominated or co-dominated by native species; however, it was occasionally encountered in communities co-dominated by invasive weeds. At the same time, these sites had the fewest number of *C. exilis* of those encountered. In microhabitats with well-established cryptobiotic crusts that supported the greatest numbers of *C. exilis*, invasive weeds were noted to be absent or minimally present. Field observation suggests that invasive weeds do not appear to be well-adapted to gypsum badlands. However, disturbances within these microhabitats could result in the introduction of invasive weeds, which may affect the robustness of *C. exilis* within and adjacent to the survey area. Invasive weed species commonly encountered within the survey area, particularly *Bromus rubens*, *B. tectorum*, and *Erodium cicutarium*, would likely compete with *C. exilis* for resources such as moisture and soil nutrients.

The relationship between *Camissonia exilis* and disturbance is not entirely clear. While the species was commonly found in microhabitats that were minimally disturbed, encounters with the species in grazed lands and/or in disturbed ROWs indicate that the species is able to colonize disturbed soils. The species also seems to be tolerant of natural disturbance; in addition to the gypsum soils preferred by the species, it was encountered on alluvial lands, where clay and silty-clay deposits have formed through sheet-flow. Likely, this process has carried seeds across the landscape, moving the species into new habitats and extending the boundaries of the location. While the survey illustrates the ability of *C. exilis* to colonize in disturbed soils, the frequency and density of the resulting *C. exilis* was observed to be less than that observed in gypsum badland habitat.

As *Camissonia exilis* reproduces from seed, the number of individuals identified during the survey may represent relative distribution of the plant at various locations where *C. exilis* is present within the seed bank. Additionally, it is likely that seed is present within adjacent habitats containing saline soils or clay soils derived from the Moenkopi Formation, where localized climactic conditions may not have been conducive to germination prior to, or during the survey periods. Project construction activities could therefore include salvage and replanting of topsoil from habitats with the potential to contain viable *C. exilis* seed.

5.3.10.1.2.2 Cryptantha semiglabra (Smooth catseye).

Natural History

Cryptantha semiglabra is an herbaceous perennial in the *Boraginaceae* (the Borage Family) that grows 8 to 12 inches (2 to 3 decimeters) in height. Its woody root system produces single to multiple herbaceous stems covered in stiff, sharp hairs which are characteristically bent downward. Short, soft hairs cover the lower surface of the leaf, although an important identifying feature is the lack of hairs on the upper leaf surface. The margins of the lanceolate leaves may be fringed with hairs. The foliage is shiny green in color. The inflorescence of *C. semiglabra* is a scorpioid raceme up to 5 inches (12 centimeters) in length, and contains few individual white flowers with yellow appendages located in the throat (Figure 5-135). The tube of each flower is 0.35 to .50 inches (9 to 12 millimeters) long, and surpasses the calyx considerably in length. Seeds are contained within smooth and shiny nutlets, which are dispersed closely to the parent plant. Nutlets are broadly ovate in shape. The plants flower and set seed from May to June (UNPS 2003-08, AGFD 2004).

Figure 5-135
Close-up View of *Cryptantha semiglabra*

Cryptantha semiglabra may be confused with *C. flava* or *C. capitata.* While all three species produce white flowers with yellow appendages, *C. semiglabra* is easily distinguished by nutlet shape, the amount of hair present on the leaves, and the inflorescence. In contrast to *C. semiglabra*, both the top and bottom of the leaves of *C. flava* and *C. capitata* are hairy. *C. capitata* produces capitate inflorescences, rather than the racemes found on *C. semiglabra*. While *C. semiglabra* produces broadly ovate nutlets, those of *C. flava* are lanceolate to narrowly ovate (AGFD 2004).

Cryptantha semiglabra is endemic to Utah and Arizona. Its entire range is restricted to southeast Washington County, Utah, and Coconino and Mohave counties, Arizona. In Utah, it is identified as inhabiting clay soils in Great Basin Desert scrub and Great Basin Conifer Woodland (pinyon-juniper) communities, from 4,900 feet (1,494 meters) to 5,675 feet (1,730 meters) in elevation (Welsh et al. 2008). In Arizona, the species is associated with *Artemisia bigelovii*, *Atriplex confertifolia*, *Ephedra torreyana, Gutierrezia sarothrae, Oryzopsis hymenoides, Pediocactus sileri,* and *Yucca angustissima* within the Great Basin Desert scrub community, where it inhabits red clay soils of the Moenkopi Formation, at elevations ranging from 4,600 feet (1,402 meters) to 4,900 feet (1,494 meters) (AGFD 2004).

Survey Results

Within the survey area, *Cryptantha semiglabra* was only recorded in Mohave County, Arizona, within the Hydro System Existing Highway Alternative Reach. A total of 3,314 individuals were encountered, which were scattered along Highway 389, west of Fredonia and extending to Pipe Springs National Monument. Some occurrences were located on private and State Trust Lands, although the majority (2,243 individuals) were found on the Kaibab-Paiute Indian Reservation between Cottonwood Wash and Twomile Wash. A second substantial group (968 individuals) was encountered southwest of Kanab Creek along Highway 389. The fewest number of individuals were encountered adjacent to Twomile Wash, where 103 individuals were identified (Table 5-90).

Table 5-90
Summary of *Cryptantha semiglabra* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Hydro System Existing Highway Alternative	0.75 mile southwest of Kanab Creek along Highway 389	Private and State Trust	968
Hydro System Existing Highway Alternative	Cottonwood Wash to Twomile Wash	Kaibab-Paiute Indian Reservation	2,243
Hydro System Existing Highway Alternative	3 miles east and 0.4 mile west of Twomile Wash	Kaibab-Paiute Indian Reservation	103
		Total	**3,314**

All 3,314 *Cryptantha semiglabra* individuals were found growing between 4,550 feet (1,387 meters) and 4,718 feet (1,438 meters) in elevation within the Colorado Plateau Ecological Region. Individuals were observed in three ecological systems, seven alliances, and 10 associations. *C. semiglabra* was found primarily within the Colorado Plateau Gypsum Badlands Ecological System within the *Eriogonum (corymbosum, mortonianum, thompsoniae)* Gypsum Badlands Sparse Shrubland and *Artemesia biglovii – Ephedra torreyana /* cryptobiotic Gypsum Badlands Sparse Shrubland associations. *Cryptantha semiglabra* was mostly found in areas that were sparsely vegetated; however, those species most commonly present included *Artemisia bigelovii*, *Ephedra torreyana*, *Eriogonum corymbosum*, *Pleuraphis jamesii*, and *Atriplex confertifolia*, the occurrence of *C. semiglabra* often coincided with other rare plants with an affinity for red, gypsum soils, including *Eriogonum corymbosum nilesii, E. thompsoniae atwoodii, E. mortonianum,* and *Pediocactus sileri*.

The relative abundances of *Cryptantha semiglabra* individuals varied across microhabitats with Gypsum Badlands. Its abundance was documented as locally common on mud washes, as locally abundant at the base of red hills, and on toe slopes below gypsum outcrops. It occurred on gypsum outcrops occasionally, and within arroyos occurrences were rare. The absence of the species was noted from non-cryptobiotic soils on crests and benches, from cryptobiotic soils atop benches and knolls, and from bajadas. *C. semiglabra* appears to benefit from the process of mud wash creation through enhanced seed dispersal.

Cryptantha semiglabra was documented growing on red, clay or gypsum soils, and red mud flats believed to have derived from the erosion of gypsum outcrops. The majority of plants were found on Gypsiorthids-Gypsiorthids, shallow complex soils.

Discussion

The survey identified a total of 3,314 individuals of *Cryptantha semiglabra* within the survey area, occurring entirely within Mohave County, Arizona, within the Hydro System Existing Highway Alternative Reach. (Figure 5-136)*C. semiglabra* was observed most often on Gypsiorthids-Gypsiorthids soils of the Undivided Moenkopi Formation. Nearly all individuals were located on the Kaibab Indian Reservation, although some were found on private and State Trust Lands to the east of the Reservation. Note that *C. semiglabra* is a Utah BLM sensitive species found outside BLM jurisdiction and is not a special status species in Arizona.

Figure 5-136
Cryptantha semiglabra in Habitat within Area of Potential Effect

Cryptantha semiglabra was encountered in habitats mostly consistent with published data; it was observed within the Colorado Plateau Gypsum Badland, Colorado Plateau Grassland, and the Colorado Plateau Mixed Desert Scrub ecological systems. The lowest elevation where the species was encountered during the survey was slightly lower than that documented in Arizona by AGFD (4,550 feet [1,387 meters] versus 4,600 feet [1,402 meters] in The AGFD reports that *Cryptantha semiglabra* seems to be tolerant of disturbance; however, important management factors include habitat disturbance due to off-road vehicle recreation, trampling, and garbage dumping. Although speculative, survey findings suggest that the presence of *C. semiglabra* is associated with erosional processes, particularly mud flows. Also, *C. semiglabra* was found primarily on un-grazed or lightly grazed lands in areas otherwise minimally disturbed by human activities. These findings suggest that while *C. semiglabra* may be tolerant of some types of natural disturbance, the effects of human-caused disturbances are unclear. Field observations suggest that the species occurs with sparse vegetation cover and so the spread of invasive weeds could occupy *C. semiglabra* habitat due to ground disturbance. The dense monotypical growth habit of many invasive weeds may pose a potential threat to *C. semiglabra* through competition for resources and shading effects due to crowding.

As *Cryptantha semiglabra* reproduces from seed, the number of individuals identified during the survey may represent relative distribution of the plant at various locations where *C. semiglabra* is present within the seed bank. Additionally, it is likely that seed is present within adjacent habitats containing saline soils or clay soils derived from the Moenkopi Formation, where localized climactic conditions may not have been conducive to germination prior to, or during the survey periods. Project construction activities could therefore include salvage and replanting of topsoil from habitats with the potential to contain viable *C. semiglabra* seed.

5.3.10.1.2.3 Echinocactus polycephalus var. xeranthemoides (Kanab barrel cactus).

Natural History

Echinocactus polycephalus var. *xeranthemoides* is a perennial stem succulent shrub of the Cactaceae (Cactus Family), branching from the base to form compact mounds of 2 to 50 heads. Stems of this barrel are gray-green to yellow-green, spherical to short cylindrical in shape with 11 to 25 vertical ribs. The spines are straight to curved, but never hooked, red to straw in color, smooth or sparsely hairy, and in clusters of 10 to 19 spines per areole (Figure 5-137). Flowers are yellow and set within the spines, restricting the flower from fully opening. *E. p.* var. *xeranthemoides* is slow-growing and probably long-lived. Flowers bloom from June to August, and are pollinated by bees. Spiny, armored seeds are eaten and dispersed by birds and packrats. Bighorn sheep and javelina eat the whole plant, and may be responsible for long-distance seed dispersal (AGFD 2006). This species is not a BLM sensitive species.

Figure 5-137
Close-up View of *Echinocactus polycephalus* var. *xeranthemoides* within the Area of Potential Effect

Echinocactus polycephalus var. *xeranthemoides* is found near Kanab in Kane County, Utah, Coconino and Mohave counties in Arizona (Welsh et al. 2008) and has been reported from and Clark County in Nevada (AGFD 2006). This species is found in pinyon-juniper and desert shrub communities on rocky hills, slopes, and ledges (AGFD 2006). *E. p.* var. *xeranthemoides* is most often found on south-facing ledges and cliffs and southeast and west-facing slopes on igneous and calcareous soils, including limestone ledges and boulders and sandstone. Range wide this species is known to occur from 1,803 feet (550 meters) to 6,479 feet (1,975 meters) (AGFD 2006).

Echinocactus polycephalus var. *xeranthemoides* can be identified from *E. p.* var. *polycephalus* by having spines are either smooth or with scattered hairs and smooth, shiny seeds while *E. p.* var. *polycephalus* spines are felty and the seeds have soft glands (Welsh et al. 2008).

Survey Results

Echinocactus polycephalus var. *xeranthemoides* was encountered only in the Hydro System Proposed Action reach (Table 5-91), where it occurred on BLM lands south of the Kaibab-Paiute Indian Reservation on the cliffs above Kanab Creek. Surveys produced nine individual plants between 4,324 feet (1,318 meters) and 4,735 feet (1,443 meters) in elevation.

Table 5-91
Summary of *Echinocactus polycephalus* var. *xeranthemoides* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Hydro System Proposed Action	0.12 mile north, east, and south of Kanab Creek Canyon	BLM	9
		Total	**9**

Echinocactus polycephalus var. *xeranthemoides* was found within the Colorado Plateau Ecoregion in three Ecological Systems, three Alliances, and three Associations. *E. p.* var. *xeranthemoides* was observed within the Colorado Plateau Mixed Bedrock Canyon and Tableland, Colorado Plateau Shrub Steppe, and the Colorado Plateau Mixed Desert Scrub ecological Systems. The Colorado Plateau Shrub-Steppe Ecological System supported the largest quantity of individuals (6 of 9), all of which occurred within the *Eriogonum corymbosum – Gutierrezia sarothrae/Pleuraphis jamesii* Sparse Shrubland Association.

Based on GIS data, *Echinocactus polycephalus* var. *xeranthemoides* was found on one geologic formation within the survey area, the Undivided Moenkopi Formation. However, the geology data is only available in poor resolution, and field observations of the area where *E. p.* var. *xeranthemoides* was found discount the GIS data in this instance. In the field, *E. p.* var. *xeranthemoides* was found on exposed Kaibab limestone at Kanab Creek.

Echinocactus polycephalus var. *xeranthemoides* were found on multiple soil types within the survey area, with the majority of plants found on Torriorthents – Rock outcrop complex soils on 30 to 70 percent slopes.

Echinocactus polycephalus var. *xeranthemoides* individuals were generally found growing on cliffs with southern and western exposures. Often, the species was found in small openings on the cliff face, growing in small pockets of soil exposed amongst the bedrock.

Discussion

Echinocactus polycephalus var. *xeranthemoides* was only identified in the Hydro System Proposed Action reach, where it was found on the cliffs above Kanab Creek. Each cactus was observed on gravelly, rock outcrops, with southern or western exposures (Figure 5-138). Accompanying vegetation was sparse, but included *Eriogonum corymbosum, Artemisia tridentata, Gutierrezia sarothrae, Pleuraphis jamesii, Ephedra nevadensis*, and *Artemisia filifolia*. Note, *E. p.* var. *xeranthemoides* is a GCNRA species of concern; however no plants were located within GCNRA and the species is not a BLM sensitive species.

Echinocactus polycephalus var. *xeranthemoides* is subject to horticultural collecting, like most cacti (AGFD 2006). Public access and knowledge of *E. p.* var. *xeranthemoides* may increase as access roads

are created for the construction of the penstock or associated facilities. The species was found in a highly localized area within the survey area. Individuals growing within or immediately adjacent to the survey area may be at-risk from habitat loss, disturbance, or damage by mechanized equipment. Individuals to be avoided should be flagged and protected in place. Individuals that cannot be avoided could be salvaged and relocated outside of the affected area, but within similar habitat. Plants should be transplanted to sites with the same exposure, and replanted at the same depth as found prior to salvage. Invasive weeds are not considered a current threat to the species, as they were not found in high densities in association with *E. p.* var. *xeranthemoides*. Additionally, invasion of non-native plants as a result of project construction is unlikely to pose a significant threat to the species, as the sheer cliff habitat in which the species is found is not conducive to invasion by invasive weeds.

Figure 5-138
View of *Echinocactus polycephalus* var. *xeranthemoides*
within the Area of Potential Effect

Eriogonum corymbosum var. nilesii (Las Vegas buckwheat).

Natural History

Eriogonum corymbosum var. *nilesii* is a woody perennial shrub of the Polyonaceae (Buckwheat Family) reaching 4 feet (1.2 meters) tall. Leaves are oval shaped and approximately twice as long as they are wide. Flowering branches and one or both leaf surfaces are densely covered in wooly hairs, a distinguishing characteristic for this variety. The flower clusters reach 4 inches (10.16 centimeters) long, with small, yellow to pale yellow (Figure 5-139), or rarely white flowers, arranged in an umbrella-shape inflorescence (NNHP 2004). *E. corymbosum.* var. *nilesii* begins flowering in late August and blooms through early November (Mrowka 2008, Reveal 2010).

Figure 5-139
View of *Eriogonum corymbosum* var. *nilesii* within the Area of Potential Effect

E. corymbosum var. *nilesii* is presently known from Clark and Lincoln counties, Nevada, Mohave and Coconino counties, Arizona, and Washington and Kane counties, Utah. Mrowka (2008) lists it near Flagstaff in Coconino County, but no specimen has been confirmed (Reveal 2010). The species was previously considered a gypsophile in Nevada, but Drohan and Merkler (2009) determined that because it occurs on soils with little gypsum and does not accumulate sulphur, the species cannot be a gypsophile. Mrowka (2008) reports it growing in gypsum soils with *Arctomecon californica, Petalonyx parryi*, *Phacelia palmeri*, *Mentzelia pterosperma*, and *Camissonia multijuga. E. c.* var. *nilesii* may also be found in habitats dominated by *Ambrosia dumosa, Atriplex canescens, Ephedra torreyana, Larrea tridentata,* and *Psorothamnus fremontii* (NNHP 2004) and is found on exposed, cryptobiotic soils in sparsely vegetated washes and drainages. NNHP (2004) reports the recorded elevation range in Nevada for *E. c.* var. *nilesii* between 1,900 feet (579 meters) and 3,839 feet (1,170 meters). No specific elevation ranges for Utah or Arizona were noted.

Eriogonum corymbosum occurs as multiple varieties which can be difficult to distinguish. Varieties may hybridize, and resulting individuals can display a range of morphological characteristics. Key features used to differentiate them include the new leaves, pubescence, inflorescence, and flower color. *E. c.* var. *nilesii* has a rounded inflorescence, yellow flowers, and hairy leaves.

Survey Results

Eriogonum corymbosum var. *nilesii* was encountered in three project reaches: Glen Canyon Substation, the Water Conveyance System, and the Hydro System. A total of 1,815 individuals were documented at the very eastern and western edges of the Colorado Plateau Region within the survey area.

The majority of individuals (1,729) occurred in Glen Canyon Substation Reach, within GCNRA. One small group of 12 individuals was found in the vicinity of Upper Blue Pool Wash, also within GCNRA;

and eight plants were encountered on private lands near the Honeymoon Trail. In addition to the 1,749 plants identified within the survey area, 174 plants were noted outside of the survey area. Table 5-92 shows the reaches, locations, land ownership and number of *Eriogonum corymbosum* var. *nilesii* plants.

Table 5-92
Summary of *Eriogonum corymbosum* var. *nilesii* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Glen Canyon Substation	Within 1 mile of the Colorado River at Glen Canyon	Glen Canyon National Recreation Area	1,729
Water Conveyance System	0.1 mile north of Upper Blue Pool Wash	Glen Canyon National Recreation Area	12
Hydro System	0.75 miles southeast of the Honeymoon Trail	Private	8
		Total	**1,749**

Eriogonum corymbosum var. *nilesii* was documented in the Colorado Plateau Ecological Region where it occurred in six ecological systems and along a developed road. The species was found in 11 alliances and 14 associations, in two of which *E. c.* var. *nilesii* occurred as a co-dominant member of the vegetation community. *E. c.* var. *nilesii* occurred most often in the Colorado Plateau Mixed Bedrock Canyon and Tableland Ecological System (949 individuals in total), within the majority of those individuals (774) identified in the *Eriogonum corymbosum – Ephedra nevadensis – Coleogyne ramosissima* Sandstone Slickrock Sparse Vegetation Association. Thirty individuals were found growing within the right-of-way of an unnamed developed road on GCNRA. The species was encountered in elevations ranging from 3,589 feet (1,094 meters) to 4,833 feet (1,473 meters).

Eriogonum corymbosum var. *nilesii* was found on seven different geologic formations, occurring most commonly on Navajo Sandstones which are characterized as white, light-red, and yellowish-gray in color; or on a combination of Navajo Sandstones and stream-channel deposits, gray and tan cliff-forming fresh water limestone.

Individual *Eriogonum corymbosum* var. *nilesii* were primarily documented on soils classified as Rock outcrop – Needle complex 4 to 50 percent slopes (824 individuals), and the Sheppard loamy fine sand, 5 to 15 percent slopes (905 individuals).

Discussion

A total of 1,815 individuals of *Eriogonum corymbosum* var. *nilesii* were encountered during the survey. Plants were identified in Glen Canyon Substation, the Water Conveyance System, and the Hydro System but were predominantly found on the east side of the survey area within GCNRA, as part of Glen Canyon Substation for the Water Conveyance System Reach. All other individuals were encountered on BLM or private lands. *E. corymbosum* var. *nilesii* was found in a diverse collection of plant assemblages (Figure 5-140). The species was commonly documented on Navajo Sandstone, and in stream channel deposits that include Navajo Sandstone.

Figure 5-140
View of *Eriogonum corymbosum* var. *nilesii* within the Area of Potential Effect

Much of what is known about the range and habitat preferences of *Eriogonum corymbosum* var. *nilesii* outside of Nevada has been determined from surveys done on the LPP Project. Surveys located individual plants between 3,589 feet (1,094 meters) and 4,833 feet (1,473 meters) in elevation, a range extending above the previously recorded elevation range of 1,900 feet (579 meters) to 3,839 feet (1,170 meters). *E. corymbosum* var. *nilesii* was found growing in a wide variety of habitats, including gypsum badlands, sand, slickrock sandstone, roadsides, cinder talus, and in limestone outcrops. The late season phenology of this shrub precluded it from being surveyed at the same time as other special status plants. When encountered during the survey, individuals displaying appropriate vegetative characteristics (specifically, inflorescence branches that were wooly-hairy, and upper leaves with silvery hair) were noted, a voucher specimen was collected, and the site was later revisited (in September 2009 and in September and October 2010) while plants were in bloom. However, few of the re-visited locations displayed the necessary combination of a rounded inflorescence, yellow flower color, and hairy leaves needed to confirm the variety as *nilesii*. Two locations were encountered with intermediate characteristics, displaying mixed white (or pale yellow) and yellow flowers, both of which were positively identified as *E. corymbosum* var. *nilesii*. One location (in Long Canyon, outside the survey area) displayed a continuum of flower colors, occurring as white at lower elevations, yellow at higher elevations, and in a mixture of the two in between. The other location was a group of 3 individuals south of the Divide, and consisted of a single individual with pale yellow flowers and two individuals with yellow flowers. Voucher specimens representing the range of potential *E. c.* var. *nilesii* were presented to Dr. James Reveal in 2009. Dr. Reveal's examination of voucher specimens collected during the transect sampling verified *E. c.* var. *nilesii* presence within the area of potential effect.

There is a potential that the survey did not capture all existing individuals of *Eriogonum corymbosum* var. *nilesii* within the survey area because of challenges in identification (late blooming period), and the hybridization of the species . Based on field observations and analysis of collected data, the species could occur in washes anywhere south of the Hurricane Cliffs (near Little Creek Mountain), where the Middle Red Member of the Moenkopi Formation is exposed, on the east side of Cedar Mountain where sand

dunes meet the bedrock exposures of the mountain, or on gypsum soils between LaVerkin Creek and Sheep Bridge Road.

Few noxious weeds were observed in association with *Eriogonum corymbosum* var. *nilesii.* In one occurrence, on non-gypsum badland, on an overgrazed range *E. c.* var. *nilesii* grew with *Salsola tragus* as the dominant herbaceous plant**.** Lower available moisture from *S. tragus* competition is perhaps less important than having only one seed producing shrubs to colonize or recolonized the site. This is especially true when the herbaceous inflorescence on seed bearing shrubs is removed by grazing animals. Where *E. c.* var. *nilesii* occurs on roadsides in Washington County, the habitat is actively bladed to maintain drainage and the stunted shrubs appear to have re-sprouted from blading. Weeds are absent from these areas. In Coconino County, the shrubs grew along long abandoned roadbeds where native plants have out competed weeds which might have been present when the highway was active.

Eriogonum corymbosum var. *nilesii* has been successfully transplanted and propagated from seed, as evidenced by the successes of the Desert Demonstration Gardens at the Springs Preserve in Las Vegas. Any individuals which may not be avoided by project construction could be salvaged and transplanted into similar habitat as that in which it was found. Seed could also be collected from at-risk individuals and re-distributed following completion of construction. Consideration could also be given to growing individuals from collected seed, in order to supplement revegetation efforts of affected areas.

5.3.10.1.2.4 Eriogonum mortonianum (Morton wild buckwheat).

Natural History

Eriogonum mortonianum is a perennial in the Polyonaceae (Buckwheat Family). This woody shrub reaches 2.6 feet (80 centimeters) tall, and has yellowish-green stems and branches. The stems and underside of the leaves are hairless, a characteristic that sets it apart from similar *Eriogonum* species. The leaves are elliptic, 0.6 to 1.6 inches (1.5 to 4 centimeters) long and 0.2 to 0.4 inches (0.6 to 1 centimeter) wide. The flower stalk is highly branched and 5.6 to 10 inches (15 to 25 centimeters) long. The pale yellow to white, minute flowers are reported to bloom and fruit from July to September (ARPC 2001, AGFD 2001).

Eriogonum mortonianum is known only from west of Fredonia along Highway 389 in northwest Arizona. It is found on red gypsious sandy-clay soils derived from Moenkopi Formation outcrops in Great Basin Desert Scrub habitats at 4,650 feet (1,400 meters). *E. mortonianum* is reported as occurring "along small drainages on sandstone and shale uplands with *Atriplex* spp., *Artemisia* spp., *Ephedra* spp." (ARPC 2001, AGFD 2001). *Eriogonum mortonianum* is known to occur and hybridize with *E. thomsoniae* var. *atwoodii* (AGFD 2001), making identification difficult. Hybrid specimens can be woody like *E. mortonianum* but with long, linear leaves with hair on the bottom like *E. t.* var. *atwoodii*, as observed by Dr. James Reveal (2010). Hybridized intermediates from these species are as common as the parent species (ARPC 2001).

Survey Results

A total of 85 individuals of *Eriogonum mortonianum* were found in the Hydro System Existing Highway Alternative Reach, in the vicinity of Cottonwood Wash on the Kaibab Indian Reservation. *E. mortonianum* locations are shown in Table 5-93.

Table 5-93
Summary of *Eriogonum mortonianum* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Hydro System Existing Highway Alternative	1.5 miles southeast of Cottonwood Wash along Arizona Route 389	Kaibab-Paiute Indian Reservation	85
Hydro System Existing Highway Alternative	East of Riggs Flat	Kaibab-Paiute Indian Reservation	58,000*
		Total	**58,085**

Note: *Extrapolated count based 50-meter transect densities and acreages

Eriogonum mortonianum was only encountered in the Colorado Plateau Ecological Region, and all individuals were found growing within the Gypsum Badland Ecological System where they occurred in two alliances and two associations. The majority of plants were found within the *Eriogonum (corymbosum, mortonianum, thompsoniae)* Shrubland Alliance, in the *Eriogonum (corymbosum, mortonianum, thompsoniae)* Gypsum Badlands Sparse Shrubland Association. A small group was also encountered in shrubland dominated by *Artemisia bigelovii* and *Ephedra torreyana*, in habitat with cryptobiotic crusts as a dominant feature in the landscape. The species was located from between 4,680 feet (1,426 meters) and 4,720 feet (1,438 meters) in elevation.

Eriogonum mortonianum was found exclusively on the Undivided Moenkopi Formation within the survey area. This formation produces light-red and dark-red slope-forming siltstone and sandstone and minor gray gypsum (Billingsley et al. 2008). The geologic formations for the extrapolated plants were not documented.

Eriogonum mortonianum was primarily found on Gypsiorthids-Gypsiorthids, shallow complex soils within the survey area.

Eriogonum mortonianum was observed in a variety of microhabitats within the badlands landscape complex, and its relative abundance varied within this complex. On wash outflows from badland formations, the species was rare to locally occasional, in arroyos it was locally occasional, and on gypsum outcrops, it was a common feature in the landscape. The highest densities of the species occurred on mud flows downslope from ridges with exposed bedrock. *E. mortonianum* was encountered occasionally at the base of these ridges. The species was noted to be absent from knolls with cryptobiotic crusts, and from benches without cryptobiotic crusts.

Discussion

The survey identified a total of 85 individuals of *Eriogonum mortonianum* within the survey area, all of which occurred in the Hydro System Existing Highway Alternative Reach, and entirely within the Kaibab-Paiute Indian Reservation. All individuals were found in the Colorado Plateau Gypsum Badlands Ecological System. The species was often a predominant member of the vegetation community, occurring as a co-dominant along with other species of *Eriogonum*, including *E. mortonianum* and *E. thompsonii. E.*

mortonianum was generally observed on the Undivided Moenkopi Formation, in Gypsiorthids-Gypsiorthids soils. Voucher specimens collected across *E. mortonianum's* range within the survey area were presented to Dr. James Reveal in 2009. Dr. Reveal's examination of voucher specimens collected during the 50-meter transect sampling verified *E. mortonianum's* presence within the area of potential effect.

Research on *Eriogonum mortonianum* appears to be limited, and it is not likely to have been collected outside of the narrow highway right-of-way along the south side of the survey area. The survey located the species from 4,680 feet (1,426 meters) to 4,720 feet (1,438 meters) in elevation, which is slightly higher than elevations previously recorded for the species. Additionally, although the species is reported to bloom and fruit from July to September (ARPC 2001, AGFD 2001), plants were not found in bloom (Figure 5-141) until September. *E. mortonianum* was encountered in a variety of microhabitats, including arroyos, on gypsum outcrops, mud flows downslope from ridges with exposed bedrock, and on wash outflows from badland formations. This supplements published data reporting that the species is found on sandstone and shale uplands, and along small drainages (ARPC 2001, AGFD 2001).

The area east of Riggs Flat is presently the only known location for this plant. However, because contiguous habitat extends northwest from the survey area, it is highly likely that the range of *E. mortonianum* extends beyond that which is known. The species appears to be an important feature in the landscape, often occurring as a dominant or co-dominant species (along with other shrubby species of *Eriogonum*). Fifty-meter belt transects placed in these high-density areas resulted in an average of 0.3 individuals per square meter.

Extrapolations of this quantity over the same vegetation community within the survey area yield an estimated 58,000 individuals within the survey area. However, given the presence of likely *E. mortonianum* and *E. thompsonae* var. *atwoodii* hybrids (as determined by Dr. James Reveal's examination of voucher specimens collected during the transect sampling) within this area, at least some proportion of these individuals are expected to be hybrids.

Eriogonum mortonianum was exclusively found on rangelands available for cattle grazing. The area was historically used for cattle and sheep range, and for a time feral horses. *E. mortonianum* has evolved in, and is narrowly endemic to, a habitat characterized by sheet erosion and silt deposition within the gypsum badlands. Thus, it appears to be dependent upon natural disturbance regimes. Invasive weeds were minimally observed in association with *E. mortonianum*, and are believed to be poorly adapted to the gypsum habitat which supports *E. mortonianum*.

Eriogonum mortonianum habitat coincided with other rare plant habitats, including *Cryptantha semiglabra, Pediocactus sileri,* and *E. thompsoniae* var. *atwoodii*, as these species share an affinity for red, gypsum soils.

Figure 5-141
View of *Eriogonum mortonianum* within the Area of Potential Effect

5.3.10.1.2.5 Eriogonum thompsoniae var. atwoodii (Atwood wild buckwheat).

Natural History

Eriogonum thompsoniae var. *atwoodii* is an herbaceous perennial of the Polyonaceae (Buckwheat Family) that grows up to 2 feet (60 centimeters) wide and tall. The presence of a woody underground base gives it the appearance of a sub-shrub. The leaves are narrowly linear and 1.2 to 3.2 inches (3 to 8 centimeters) long with thickened or in-rolled margins. The flower cluster is open and branched in an umbrella shape. White, minute flowers are reported to bloom and set seed from July to October (AGFD 2001) (Figure 5-142).

Eriogonum thompsoniae var. *atwoodii* is a narrow endemic known only from near Fredonia and Lost Spring Mountain in Mohave County, Arizona (AGFD reported *E. t.* var. *atwoodii* from Utah in 2001, but this specimen was later identified as *E. thompsoniae* var. *albiflorum* by James Reveal). *E. t.* var. *atwoodii* is restricted to small drainages of red clay or red gypsum soils from Moenkopi Formation sandstone and shale outcrops. It is found in Great Basin Desertscrub habitats from 4,400 feet (1,341 meters) to 4,700 feet (1,433 meters) elevation. In Fredonia, it is found with *Artemisia bigelovii*, *Atriplex confertifolia*, and *Hilaria jamesii*. Near Antelope Springs (south of the Divide) in Mohave County, Arizona, it is found with *Atriplex*, *Salvia*, *Ephedra*, *Hilaria*, and *Chrysothamnus* (ARPC 2001, AGFD 2001).

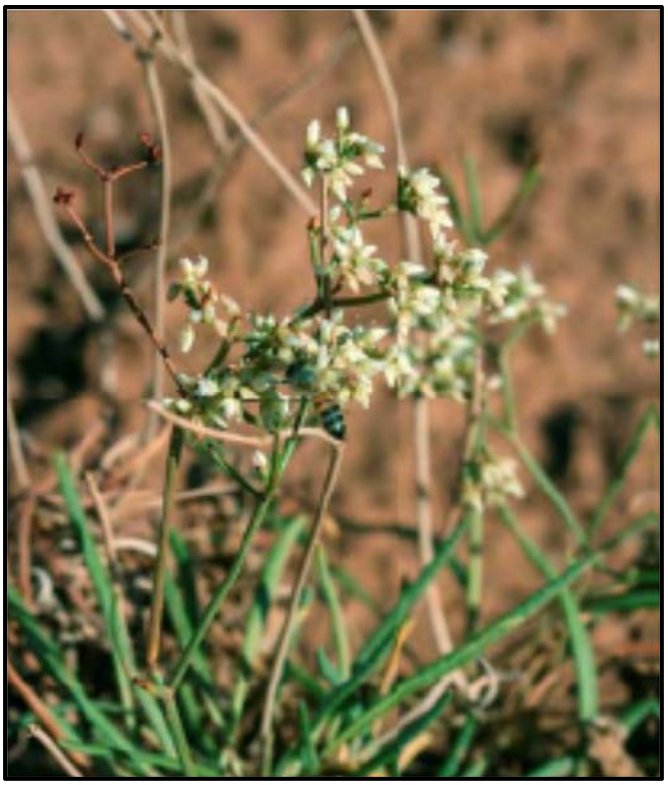

Figure 5-142
Close-up of *Eriogonum thompsoniae* var. *atwoodii* within the Area of Potential Effect

Survey Results
Eriogonum thompsoniae var. *atwoodii* were located within the Hydro System Existing Highway reach during the survey season. *E. t.* var. *atwoodii* was encountered mostly within the Kaibab-Paiute Indian Reservation in the vicinity of Cottonwood Wash. Two individuals were also found near the Divide, on BLM lands. *E. t.* var. *atwoodii* locations are shown in Table 5-94.

Eriogonum thomsoniae var. *atwoodii* was found exclusively in the Colorado Plateau Ecological Region and the Colorado Plateau Gypsum Badland Ecological System. It was found within four Alliances and six Associations. The majority of *E. t.* var. *atwoodii* occurred in the *Artemisia bigelovii* Shrubland Alliance, in the *Artemesia bigelovii – Ephedra torreyana /* Crytobiotic Gypsum Badlands Sparse Shrubland Association. *Eriogonum t.* var. *atwoodii* was also encountered as a co-dominant vegetation member in some vegetation communities, along with other shrubby species of *Eriogonum* (*corymbosum, mortonianum*). Surveys identified the species from between 4,640 feet (1,414 meters) and 4,760 feet (1,451 meters) elevation.

Table 5-94
Summary of *Eriogonum thompsoniae* var. *atwoodii* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Hydro System Existing Highway Alternative	1.4 miles southwest of Cottonwood Wash to 5.7 miles southwest of Cottonwood Wash	Kaibab-Paiute Indian Reservation	694
Hydro System Existing Highway Alternative	3 miles northeast of Twomile Wash	Kaibab-Paiute Indian Reservation	38
Hydro System Existing Highway Alternative	1.4 miles southwest of Cottonwood Wash to 3 miles northeast of Twomile Wash	Kaibab-Paiute Indian Reservation	85,000*
Transmission Line System	0.25 mile north of The Divide	BLM	2
		Total	**85,734**

Note: *Extrapolated count based 50-meter transect densities and acreages

Eriogonum t. var. *atwoodii* was found on two geologic formations within the survey area. It was primarily found on Undivided Moenkopi Formation and the Middle Red Member of the Moenkopi Formation. The Undivided Moenkopi Formation is a light-red and dark-red, slope-forming siltstone and sandstone with minor gray gypsum. It is often exposed as isolated outcrops and is similar to the Lower Red and Middle Red Members. Often the Middle Red Member exhibits mud cracks and ripple marks (Billingsley et al. 2008).

Eriogonum thompsoniae var. *atwoodii* were found on three soil types within the survey area. The majority of plants were found on Gypsiorthids-Gypsiorthids, shallow complex soils.

Eriogonum t. var. *atwoodii* was found on red, clay soils and red mud flats derived from diverse badlands topography, ranging from gypsum outcrops to thin soils with microbiotic crusts. This species was found growing on mud flats and also on red, sheet eroded hillsides. Its habitat coincided with other special status species, including *Cryptantha semiglabra, Pediocactus sileri,* and *E. mortonianum*, all of which share an affinity for red, gypsum soils. *E. t.* var. *atwoodii* was observed in sparse shrubland and sparsely vegetated habitats. The associated species which were most often present included *Artemisia bigelovii*, *Ephedra torreyana*, *E. corymbosum*, and *Pleuraphis jamesii.* Individuals were found on rangelands subjected to cattle grazing and to natural disturbances, particularly sheet erosion.

Discussion

The survey identified a total of 85,734 individuals of *Eriogonum thompsoniae* var. *atwoodii* within the survey area, mostly within the Kaibab-Paiute Indian Reservation. *E. t.* var. *atwoodii* were located within the Hydro System Existing Highway Alternative reach. *E. t.* var. *atwoodii* was generally observed on Undivided Moenkopi Formation and in Gypsiorthids-Gypsiorthids soils. Voucher specimens collected across *E. t.* var. *atwoodii's* range within the survey area were presented to Dr. James Reveal in 2009. Dr. Reveal's examination of voucher specimens collected during the 50-meter transect sampling verified *E. t.* var. *atwoodii's* presence within the area of potential effect.

Surveys identified *Eriogonum thompsoniae* var. *atwoodii* from between 4,640 feet (1,414 meters) and 4,760 feet (1,451 meters) elevation, which is slightly higher than the documented elevation range of the species. While the species is reported to bloom and set seed from July to October, individuals were

observed to bloom until September within the survey area. *E. t.* var. *atwoodii* was often observed to be a co-dominant member of the vegetation community, and in some areas high densities inhibited the ability of the survey crew to count individuals. The 50-meter belt transect technique was applied in these areas, and resulted in an average of one plant per square meter. Extrapolations of this quantity over the vegetation community yield an estimated 84,000 live plants within the survey area. However, due to the likely presence of hybrids, at least some proportion of these individuals cannot be confirmed as *E. t.* var. *atwoodii*. Nevertheless, this extrapolated quantity provides insight into the importance of the identified habitats to the species. Surveys for *E. t.* var. *atwoodii* were adequate to identify all potential habitats within the survey area. However, the known extent of *E. t.* var. *atwoodii* on the Kaibab-Paiute Indian Reservation is limited by the survey area artificially; thus, while the survey has plant occurrences on the Reservation, they do not include the entire contiguous locations, as those groups extended outside the survey area. Suitable habitat extends further north of the survey area for *E. t.* var. *atwoodii*.

The known range of *Eriogonum thompsoniae* var. *atwoodii* is believed to be due, in part, to human activity within the area in the 1800s. Its range extends east to west along and in proximity to Indian routes used by Spaniards for livestock drives on the Old Spanish National Historic Trail, much of which became the Honeymoon Trail. By 1870, livestock driven along the route numbered over 10,000 head per drive. These levels of activity could have contributed to the dispersal of *E. t.* var. *atwoodii* to either its Antelope Spring (south of the Divide) habitat near Hurricane Cliffs, or the Shinarump Cliffs habitat on the Kaibab-Paiute Indian Reservation.

Eriogonum thompsoniae var. *atwoodii* was exclusively found on rangelands subjected to cattle grazing. Historically these areas were used as cattle and sheep range. It also had grazing pressure from a portion of a reported 5,000 feral horses which roamed the range between Kanab and the Hurricane Cliffs in 1902 (Mead and Teal 1903). However, present stocking rates are much lower than those reported in the period 1870 to 1913, before the establishment of the Kaibab-Paiute Indian Reservation and when the land was ranched under LDS church and corporate ownerships (Austin et al. 2005). Plants which are within the right-of-way of Highway 389 are scarce and subjected to disturbance by graders. However, plants are growing in graded roadsides at the south of the Divide, and therefore the plant seems to be adapted to either colonizing bare ground, or recovering from top removal. There are no data or observations to determine if *E. t.* var. *atwoodii* is an increaser herb under cattle or sheep grazing, although other varieties of this species do appear to increase under grazing. *E. t.* var. *atwoodii* has evolved in and is narrowly endemic to a habitat characterized by sheet erosion and silt deposition. Thus, it appears to be dependent on the natural disturbance regime of gypsum badlands where they exist on the Kaibab-Paiute Indian Reservation and south of The Divide. Invasive weeds were not commonly observed in association with *E. thompsoniae* var. *atwoodii*, and are believed to be poorly adapted to the gypsum habitat which supports the species.

5.3.10.1.2.6 Lupinus caudatus var. cutleri (Cutler lupine).

Natural History

Lupinus caudatus var. *cutleri* is a perennial herb reaching 0.7 feet (21 centimeters) to 2.6 feet (80 centimeters) tall, originating from a woody caudex. Leaflets are broadly oblanceolate, a key characteristic when identifying *L. caudatus* var. *cutleri* from the two similar varieties, var. *argophyllus* and var. *utahensis* (Figure 5-143). Flowers are blue purple and reach 0.3 inches (8 millimeters) to 0.5 inches (12.5 millimeters) long. The banner of the flower is reflexed at the midpoint versus reflexed beyond the midpoint, as in var. *argophyllus* and var. *utahensis*. Flowers appear in mid-April through May (Welsh et al. 2008, UNPS 2003-08).

Figure 5-143
Close-up of *Lupinus caudatus* var. *cutleri* within the Area of Potential Effect

Lupinus caudatus var. *cutleri* is known from Defiance in Apache County, Arizona (Welsh et al. 1993). It is also known from the Cockscomb in Kane County; and east Garfield, Grand, and San Juan counties, Utah. Cutler lupine is found in pinyon-juniper woodlands and at 5,150 feet (203 meters) in Utah. It has been synonymized under *Lupinus caudatus* Kellogg in Welsh et al (2008).

Survey Results

A total of 54 *Lupinus caudatus* var. *cutleri* plants were found, one of which was encountered near Fivemile Valley in the Buckskin to Paria transmission line Reach, 20 individuals were found near the Paria Townsite Road Junction in the Water Conveyance System Reach, and 33 plants were identified near Long Valley Road within Glen Canyon to Buckskin transmission line North Reach. All individuals encountered were tentatively identified, as none of the *L. c.* var. *cutleri* encountered were flowering or producing fruits, making a positive identification impossible. Potential *L. c.* var. *cutleri* locations are provided in Table 5-95.

All *Lupinus caudatus* var. *cutleri* individuals were encountered on the Colorado Plateau, where it occurred in the Mixed Bedrock Canyon and Tableland, and Colorado Plateau Wash ecological systems. The species was identified in a total of three alliances and three associations in vegetation communities dominated by *Artemisia* spp., *Juniperus osteosperma*, and/or *Purshia glandulosa*. The majority of individuals occurred in the *Juniperus osteosperma* Woodland alliance, in the *Juniperus osteosperma / Artemisia filifolia* Sparse Woodland association. Plants were encountered between 4,760 feet (1,451 meters) and 5,000 feet (1,524 meters) in elevation.

Table 5-95
Summary of *Lupinus caudatus* var. *cutleri* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Buckskin to Paria Transmission Line	0.15 mile north of Fivemile Valley	Private	1
Water Conveyance System	1 mile southwest of the Paria Townsite Road Junction	BLM	20
Glen Canyon to Buckskin Transmission Line North	0.85 mile east of Long Valley Road	BLM	33
		Total	**54**

Lupinus caudatus var. *cutleri* was encountered on four geologic formations. The majority of individuals (33) were found on the Carmel Formation composed of medium to dark-red-brown to brown, slope forming silty sandstone or siltstone on the upper parts and mostly dark-red-brown siltstone or silty sandstone below (Doelling and Willis 2006); while the second largest group was identified on the Timpoweap Member of the Moenkopi Formation, a formation consisting of an upper part characterized by gray to yellow-gray sandy limestone, and a lower part characterized as gray, dark-gray, white and reddish-brown chert conglomerate in a gray gravel sandstone matrix (Biek at al. 2008).

The majority of individuals were found on Mido-Kenzo-Rock outcrop soils, with 2 to 30 percent slopes, while the second largest group occurred in Mellenthin, moist-Rock outcrop soils with 25 to 60 percent slopes

Discussion

A total of 54 plants were found in the Buckskin to Paria transmission line, the Water Conveyance System, and Glen Canyon to Buckskin transmission line North reaches. All *Lupinus caudatus* var. *cutleri* individuals were encountered on the Colorado Plateau, where it occurred in the Mixed Bedrock Canyon and Tableland and Colorado Plateau Wash ecological systems. The species was identified in vegetation communities dominated by *Artemisia* spp., *Juniperus osteosperma*, and/or *Purshia glandulosa*. *L. c.* var. *cutleri* was encountered on 4 geologic formations, the majority of which occurred in the Carmel Formation. Most individuals were found on Mido-Kenzo-Rock outcrop soils and in Mellenthin, moist-Rock outcrop soils.

Because positive confirmation of the variety is dependent upon key floral features, and none of the individuals encountered during the survey were in flower or fruit, a positive identification was not possible. However, the individuals identified by the survey as *Lupinus caudatus* var. *cutleri* displayed vegetative morphological characteristics that are consistent with the variety, and individuals were encountered in habitat consistent with published literature; therefore, identification of the species as *L. c.* var. *cutleri* was warranted.

Threats to the identified potential *Lupinus caudatus* var. *cutleri* individuals resulting from the project could possibly include introduction of invasive weeds. Although the woody caudex of the species would likely enable it to reach soil moisture depths greater than many invasive weeds encountered within the survey area, the dense monotypical growth habit of many invasive weed species may result in a shading effect if introduced into habitat supporting *L. c.* var. *cutleri*.

5.3.10.1.2.7 Pediocactus sileri (Siler's pincushion cactus).

Natural History

Pediocactus sileri is a perennial succulent in the Cactaceae (Cactus family). It is globose in shape and occasionally with clustered heads, reaching 4 inches (10 centimeters) tall and 3 inches (7.6 centimeters) to 4 inches (10 centimeters) in diameter. As the cactus matures, it tends to elongate. Tubercles are 0.35 inches (9 millimeters) to 0.59 inches (15 millimeters) long and 0.24 inches (6 millimeters) to 0.43 inches (11 millimeters) wide. Circular areoles contain three to seven brownish-black central spines reaching 1 inch (2.5 centimeters) in length. Central spines are straight and turn pale gray or white with age (Figure 5-144). Areoles also contain 11 to 16 whitish radial spines, slightly smaller than the central spines. Flowers are yellowish in color with purple veins, 0.7 inches (18 millimeters) to 0.9 inches (22 millimeters) long, and 0.8 inches (20 millimeters) to 1.2 inches (30 millimeters) wide. Fruit is dry, greenish-yellow in color, 0.5 inches (1.2 centimeters) to 0.6 inches (1.5 centimeters) long, and contain gray to black seeds. The flowers of *P. sileri* open from April to mid-May in Arizona and from March through April in Utah (AGFD 2004).

Figure 5-144
Close-up of *Pediocactus sileri* within the Area of Potential Effect

Pediocactus sileri is restricted to gypsum and salt-rich soils found in southwestern Utah and northwestern Arizona. It is known from the Fredonia area in northwestern Coconino County, Arizona, west into north-central Mohave County, Arizona (USFWS 1986). The range extends into Washington and Kane counties in Utah (Welsh et al. 2008). *P. sileri* is habitat specific and found only on low red or gray gypsiferous soils derived from the Moenkopi Formation, and sometimes similar Chinle and Kaibab Formations. It is known mostly from the Great Basin Desertshrub biotic community, but also from the Great Basin Conifer Woodland and Plains, Great Basin Grassland, and Mohave Desertscrub biotic communities (USFWS 1986). The USFWS reports the elevation across this species range from 2,800 feet (853 meters) to 5,400 feet (1,646 meters) (1986). In Utah, the range is reported from 2,950 feet (899 meters) to 5,220 feet (1,591 meters) in elevation (Welsh et al. 2008). The cactus is often found in rolling hills that have a "badlands" appearance with sparse vegetation. It is found in association with *Atriplex canenses*, *Artemisia*

tridentata, Artemisia bigelovii, *Chrysothamnus* spp., *Salvia dorrii*, *Eriogonum corymbosum, Eriogonum mortonianum, Eriogonum thompsoniae* var. *atwoodii*, and *Gutierrezia sarothrae* (USFWS 1986).

Pediocactus sileri appears similar to *Coryphantha vivipara* var. *rosea*, but the taxa can be distinguished by their flowers and spines. The yellow flowers with maroon veins are characteristic of mature *P. sileri* cacti, and differ from the pink flowers found on *C. v.* var. *rosea.* While *P. sileri* bares black central spines and curved spines mixed with straight spines, *C. v.* var. *rosea* bares spines that are white and always straight (eFloras 2010).

Pediocactus sileri was listed as endangered under the ESA in 1979 and delisted to threatened in 1993 (USFWS 1993).

Survey Results

Pediocactus sileri was encountered within the Hydro System, the Hydro System Proposed Action, and the Hydro System Existing Highway Alternative reaches (Table 5-96). The species was encountered predominantly southwest of Fredonia (13 individuals) and within the Kaibab-Paiute Indian Reservation (2,925 individuals); with two additional sites from White Sage Wash to Seaman Wash (one individual) and from west of Short Creek at Canaan Gap (seven individuals). Surveys located a total of 952 live and 2,000 dead cacti. The majority of individuals were found on the Kaibab-Paiute Indian Reservation, scattered along Highway 389 from west of Fredonia to the intersection of Highway 389 and the road to Pipe Springs National Monument. *P. sileri* locations are shown in Table 5-96.

Table 5-96
Summary of *Pediocactus sileri* Survey Results by Location

Reach	Location*	Land Ownership	# of Plants
Hydro System Proposed Action		BLM	1
Hydro System Existing Highway Alternative		State Trust	13
Hydro System Existing Highway Alternative		Kaibab-Paiute Indian Reservation	773
Hydro System Existing Highway Alternative		Kaibab-Paiute Indian Reservation	1,589
Hydro System Existing Highway Alternative		Kaibab-Paiute Indian Reservation	563
Hydro System		Private	7
		Total	**2,946**
***Location information removed at the request of USFWS**			

Pediocactus sileri individuals occurred predominantly on Gypsiorthids-Gypsiorthids soils in association with the Middle Red Member of the Moenkopi Formation and were found growing entirely within the Colorado Plateau ecological region, where individuals were encountered primarily in the Gypsum Badland Ecological System. The Moenkopi Formation appears reddish-brown and is found on slope-forming gypsiferous siltstone and sandstone and includes abundant thin veinlets and stringers of gypsum deposited in fractures and cracks throughout, mud cracks and ripple marks are common. There were two exceptions to the occurrence of *P. sileri* being found entirely within the Colorado Plateau ecological region, the Colorado Plateau Shrub-Steppe Ecological System and the Colorado Plateau Grassland

Ecological System. Within the Colorado Plateau Gypsum Badlands Ecological System, cacti were found occurring in 11 alliances and 17 associations, the majority of which (1,324 individuals) were found within the *Chrysothamnus viscidiflorus* Shrubland Alliance and the *Chrysothamnus viscidiflorus* Gypsum Badlands Sparse Dwarf-shrubland Association. Individuals were found in three alliances and the corresponding three associations within the Colorado Plateau Shrub-Steppe Ecological System, and just one alliance and association within the Colorado Plateau Grassland Ecological System. All plants were found from between 4,462 feet (1,360 meters) and 5,020 feet (1,530 meters) in elevation.

The vast majority of *Pediocactus sileri* individuals were found on Gypsiorthids-Gypsiorthids, shallow complex soils. Plants were often encountered in association with well-established cryptobiotic crusts, often occurring in, or adjacent to this microhabitat.

The abundance of *Pediocactus sileri* varied notably across the variety of microhabitats within the gypsum badlands landscape. In thinly bedded gypsum exposures the species occurred commonly, while at the base of slopes adjacent to these gypsum exposures individuals were encountered occasionally. In mud washes below these slopes the abundance was locally occasional; and on thin, red clay soils with microbiotic crusts the species was rare. The absence of *P. sileri* on non-cryptobiotic soils of crests and ridges was also noted. This diverse badlands topography supports other rare, endemic plants, including: *Cryptantha semiglabra, Eriogonum mortonianum,* and *Eriogonum thompsoniae* var. *atwoodii* all of which share an affinity for soils with alternating layers of red mudstone and gypsum.

Much of the area occupied by *Pediocactus sileri* has been used for cattle grazing; however, on the Reservation, minimal grazing was observed in the localized areas around encountered individuals. Most of the individuals encountered were observed growing in the open, with full sun exposure, but were also found on occasion growing adjacent to shade-providing shrubs. The majority of plants (2,000 individuals) were found dead.

Discussion

The survey identified an estimated 2,946 individuals of *Pediocactus sileri* within the survey area. All cacti were located within the Hydro System, the Hydro System Proposed Action, and the Hydro System Existing Highway Alternative reaches, with the majority of individuals occurring within the Hydro System Existing Highway Alternative reach. The vast majority (2,925 of 2,946) of plants were found on the Kaibab-Paiute Indian Reservation. The remaining 21 individuals were encountered on BLM land, State Trust land and private land. *P. sileri* was documented entirely in the Colorado Plateau Ecological Region, primarily within the Gypsum Badland Ecological System, and most often within *Chrysothamnus viscidiflorus* Shrubland, Mixed Desert Shrub Shrubland, *Artemesia biglovii* Shrubland, and *Eriogonum (corymbosum, mortonianum, thompsoniae)* Shrubland associations. *P. sileri* occurred predominantly on Gypsiorthids-Gypsiorthids soils in association with the Middle Red Member of the Moenkopi Formation, and individuals were often encountered in conjunction with gypsum outcrops (Figure 5-145), often growing in full sun. Many of the lands supporting *P. sileri* were disturbed, although localized disturbance around individuals was generally minimal, particularly on the Reservation.

Pediocactus sileri observations were consistent with published data regarding habitat preferences, and the observed variation in relative abundance across the landscape points to an affinity of the species for highly specific microhabitats. Surveys between Riggs Flat and Cottonwood Wash provided data on habitat for the species. *P. sileri* was more common on gypsum outcrops and toe slopes below the outcrops than on cryptobiotic soils of ridges and knolls. On toe slopes it was heavily subjected to mud caking. On cryptobiotic soils of ridges and knolls, *P. sileri* only occupied areas with minimal disturbances, including grazing and disturbance from animal burrows. The survey also observed a high proportion of mortality amongst the majority of encountered individuals, 2,000 out of the total 2,946 that were found. At least

some of this mortality is thought to be due to sediment deposition over the surface of these low-growing plants. Many of the dead individuals were covered in soil at the time of the survey, thought to be the result of runoff associated with intense rainfall events. Monitoring by BLM since 1987 involves a plot near the proposed LPP Project, made up of two subplots – one of these two subplots is open to grazing, while the other subplot is fenced off from livestock grazing. The data shows that these two populations of *P. sileri* are almost identical. The overwhelming majority of mortality in these subplots is due to rodents eating the roots and killing the plants. This is consistent with monitoring data from all BLM *P. sileri* plots on the Arizona Strip. Extended periods of time without subsequent precipitation to wash off this sediment could result in retardation of photosynthesis, and ultimately mortality (Figure 5-146).

Figure 5-145
Red Clay and Gypsum Soils Representing *Pediocactus sileri* within the Area of Potential Effect

Figure 5-146
***Pediocactus sileri* Caked in Mud**

Pediocactus sileri was only encountered in vegetation communities dominated by native species. Invasive weeds do not appear to be a current threat to the species, as many non-native plants encountered in *P. sileri* habitat were observed at low densities (field observations suggest that invasive weeds are not well adapted to the preferred gypsum badland habitat of the species). Potential existing threats to the species appear to be sediment deposition resulting from intense rainfall events, and anthropogenic disturbance, primarily grazing. Monitoring by BLM since 1987 involves a plot near the proposed LPP Project, made up of two subplots – one of these two subplots is open to grazing, while the other subplot is fenced off from livestock grazing. The data shows that these two populations of *P. sileri* are almost identical. The overwhelming majority of mortality in these subplots is due to rodents eating the roots and killing the plants. This is consistent with monitoring data from all BLM *P. sileri* plots on the Arizona Strip. This type of disturbance directly affects the species by trampling the cryptobiotic microhabitat on which the species is dependent, and indirectly by increasing erosion and causing the mudflows that may be responsible for sediment deposition over the plants.

Additional conservation measures for P. sileri would be developed in consultation with the USFWS.

5.3.10.1.2.8 Pediomelum epipsilum (Kane breadroot).

Natural History

Pediomelum epipsilum is a perennial herb from the Fabaceae (Pea Family) that grows from an underground woody base from deep tuberous roots. This plant grows in clumps reaching 1.4 inches (3.5 centimeters) to 6.1 inches (15.5 centimeters) tall, and produces leaves with five bi-colored leaflets, each yellow green and typically hairless above, and grayish with stiff hairs below. Flower clusters are 0.8 inches (2 centimeters) to 2.4 inches (6 centimeters) long, baring pale violet flowers 0.4 (1.1 centimeters) to 0.6 inches (1.6 centimeters) long (Figure 5-147). The leaf-like structure under the flower is strongly swollen on one side, and the lower tooth extends from 0.3 inches (0.8 centimeters) to 0.4 inches (1.0 centimeters) long (Welsh et al. 1993, UNPS 2003-08).

Pediomelum epipsilum is endemic to Kane County, Utah, and adjacent Mohave County, Arizona (Welsh et al. 2008). *P. epipsilum* is found in pinyon-juniper woodland on fine-textured soils derived from the Triassic Chinle or Upper Red, Middle Red, and Shnabkaib Members of the Moenkopi Formations (Welsh et al. 2008). At its type locality, it is found on brown, gypsious (soils with a high gypsum content) outcrops in a semi-barren habitat with few other plants, and can be found growing up through the bed of an old highway (UNPS 2003-2008, Welsh et al. 2008). It is known from 4,000 feet (1,219 meters) to 5,500 feet (1,676 meters) in elevation (UNPS 2003-08). The bicolored leaflets (yellow green above and grayish below) distinguish this species from all other species of *Pediomelum* (UNPS 2003-08).

Figure 5-147
Close-up of *Pediomelum epipsilum* within the Area of Potential Effect

Survey Results

Pediomelum epipsilum was encountered on the Colorado Plateau from Buckskin Gulch west to Johnson Wash, within the Kaibab-Paiute Indian Reservation west of Cottonwood Wash, and south of the Kaibab-Paiute Indian Reservation just west of Mount Trumbull Road. Surveys located a total of 23,041 individual plants. The majority (22,999 of 23,041) of *P. epipsilum* occurrences were scattered between Telegraph Flat and Seaman Wash. These occurrences were all on BLM lands, within the Water Conveyance System, the Hydro System, the Hydro System Existing Highway Alternative, and the Hydro System Proposed Action reaches. The remaining 42 *P. epipsilum* were found on BLM lands (one individual), the Kaibab-Paiute Indian Reservation (30 individuals), and Arizona State Trust lands (11 individuals) within the Hydro System Proposed Action and the Hydro System Existing Highway Alternative (Table 5-97).

Pediomelum epipsilum was encountered in seven ecological systems across the Colorado Plateau Region, with over half (14,181 individuals) occurring within the Colorado Plateau Gypsum Badlands Ecological System. Within these seven ecological systems, *P. epipsilum* was documented in 16 alliances and 20 associations. The plant was most abundant in the *Juniperus osteosperma* Woodland Alliance of the Colorado Plateau Gypsum Badlands Ecological System (6,434 individuals) and the *Juniperus osteosperma* Woodland of the Colorado Plateau Pinyon- Juniper Woodland Ecological System (5,706 individuals). Plants were identified from between 4,497 feet (1,371 meters) and 5,680 feet (1,731 meters) in elevation.

Pediomelum epipsilum was documented on a number of different geologic formations across the project area. It was most abundant on the Shnabkaib Member of the Moenkopi Formation and the alluvial deposits from floods associated with the Middle Red Member of the Moenkopi Formation. The Shnabkaib Member is recognized by its white to light gray siltstone and silty gypsum and includes some light-red mudstone, siltstone and sandstone (Billingsley et al. 2008).

Table 5-97
Summary of *Pediomelum epipsilum* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Water Conveyance System	0.5 miles northeast of Telegraph Wash	BLM GESNM	1,263
Water Conveyance System, Hydro System	1 mile southwest of Telegraph Wash to 1.2 miles southwest of Petrified Hollow Wash	BLM GSENM	2,464
Hydro System Proposed Action, Hydro System Existing Highway Alternative	1 mile to 2.7 miles southwest of Petrified Hollow Wash and to Shinarump Cliffs	BLM GSENM	1,575
Hydro System Proposed Action	2.2 miles southwest of Shinarump Cliffs	BLM AZ	25
Hydro System Proposed Action	0.65 mile southwest of White Sage Wash	BLM AZ	1
Hydro System Existing Highway Alternative	2.65 miles southwest of Cottonwood Wash	Kaibab-Paiute Indian Reservation	30
Hydro System Proposed Action	2.8 miles west of Bitter Seeps Wash	BLM AZ	11
		Total	**5,369**

Pediomelum epipsilum occurred on 21 different soil types within the survey area; it was most abundant on Kenzo- Retsabal-Progresso, Ruinpoint-Barx, and Yarts-Palma-Neville family-Barx-Atchee soils.

Pediomelum epipsilum tended to occur in areas of previous disturbance; individuals were often found along the remnants of old two-track roads, adjacent to old cattle holding areas, and in areas that have been grazed by cattle. During surveys, *Pediomelum epipsilum* was frequently encountered in vegetation openings, particularly where breaks in the groundcover (generally *Artemisia* spp.) occurred, and there was a short distance to nearby *Juniperus osteosperma* individuals. The species was often found in the open, growing in localized bare areas, further suggesting an affinity for sparse vegetation cover.

Discussion

Pediomelum epipsilum was documented within the central portion of the Colorado Plateau Region of the survey area; it was most abundant from Telegraph Wash to Seaman Wash within the Water Conveyance System and the Hydro System Existing Highway Alternative reaches. *P. epipsilum* was often found in close proximity to *Juniperus osteosperma* communities. The species was most common on the Shnabkaib Member of the Moenkopi Formation and alluvial deposits from floods associated with the Middle Red Member of the Moenkopi Formation. *Pediomelum epipsilum* was encountered in habitat consistent with published literature, although some individuals were found to occur at elevations lower than the published range of the species. Also, all of the plants encountered had bi-colored, white and violet, flowers, which contrasts with the description of the species as originally published (Grimes 1986), which states that the flowers are a monochromatic pale violet.

Pediomelum epipsilum was often observed in disturbed areas, including old road beds and areas that experience natural flooding (Figure 5-148).

Figure 5-148
View of *Pediomelum epipsilum* and its Habitat within the Area of Potential Effect

Much of the area where *P. epipsilum* was documented has been grazed by cattle; the species is likely able to tolerate grazing because its tuberous root enables it to store carbohydrates. Despite the disturbance commonly found in association with the species, invasive weeds were not abundant in these habitats. Individual *P. epipsulum* were primarily found in the open, surrounded by bare ground. Whether invasive weeds were absent because they are poorly adapted to these habitats, or because these localized areas are too shaded by nearby trees (*Juniperus osteosperma*) and shrubs, invasive weeds do not appear to be a significant threat to *P. epipsulum*.

5.3.10.1.2.9 Penstemon laevis (Smooth penstemon).

Natural History

Penstemon laevis is a perennial herb in the Scrophulariaceae (Figwort Family) reaching 1foot (3 decimeters) to 3.3 feet (10 decimeters) tall. Erect, hairless stems arise from a stout crown, or base. Leaves are thick and entirely or slightly wavy. The plant is hairless with three to eight flowered stems, a 0.2 (0.4 centimeters) to 0.3 inches (0.7 centimeters) flower complex with blue lobed petals (Welsh et al. 1993) (Figure 5-149).

Figure 5-149
***Penstemon laevis* Observed within the Area of Potential Effect**

Penstemon laevis is known from a small geographic range in Utah and Arizona. In Utah, it is known to occur from east Washington County in Zion National Park, western Kane County from Orderville to Kanab, and in Garfield County. It is known from the Kaibab Plateau in Coconino County, Arizona (NatureServe 2009). *P. laevis* inhabits sandy places in pinyon-juniper, ponderosa-manzanita, and mountain brush communities from 4,920 feet (1,500 meters) to 6,560 feet (1,999 meters) in elevation across its range (NatureServe 2009, Welsh et al. 2008).

Survey Results

Penstemon laevis was found scattered across the survey area. From east to west, it was encountered between Calf Springs and Long Valley Road, just north of Five Mile Valley, west of Pipe Springs National Monument, east of Cedar Ridge, and west of Short Creek at Canaan Gap. Three of these locations were on BLM lands, one was on private land, and the remaining was on the Kaibab Indian Reservation. A total of 107 *P. laevis* individuals were observed within the survey area, and occurred in Glen Canyon to the Buckskin transmission line North reach, the Buckskin to the Paria transmission line reach, the Hydro System Existing Highway Alternative reach, and the Hydro System reach. The distribution of *P. laevis* across the survey area is shown in Table 5-98

Penstemon laevis was identified in multiple geologic formations within the survey area. The species was primarily encountered on young mixed alluvium and eolian deposits within the Colorado Plateau Pinyon-Juniper Woodland Ecological System. This geologic formation is composed of gray, light-red, and white silt and fine- to coarse-grained eolian and fluvial sand lenses (Billingsley et al. 2008).

Penstemon laevis was found in seven soil types within the survey area, the majority of which were identified growing in Begay fine sandy loam soils.

Penstemon laevis was observed during surveys in areas that have been grazed by cattle and perhaps by rabbits. Many plants exhibited signs of herbivory, as foliage was partially to mostly grazed, and often missing the inflorescence, making a positive identification of *P. laevis* difficult at times.

Table 5-98
Summary of *Penstemon laevis* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Glen Canyon to Buckskin Transmission Line North	Between Calf Springs and Long Valley Road	BLM	12
Buckskin to Paria Transmission Line	North of Five Mile Valley	BLM	3
Hydro System Existing Highway Alternative	1.14 miles west of Pipe Springs National Monument	Kaibab-Paiute Indian Reservation	70
Hydro System Existing Highway Alternative	0.25 miles east of Cedar Ridge	Private	20
Hydro System	Reach 133 feet south of the Utah/Arizona state line	BLM	2
		Total	**107**

Discussion

A total of 107 *Penstemon laevis* individuals were found in the survey area, and occurred in Glen Canyon to Buckskin Transmission Line North, the Buckskin to Paria transmission line, the Hydro System Existing Highway Alternative, and the Hydro System reaches. The majority of individuals were documented on the Kaibab-Paiute Indian Reservation within the Hydro System Existing Highway Alternative reach. Individuals were primarily found in *Juniperus osteosprema* woodlands on sandy or silty soils. The species was mostly encountered in young mixed alluvium and eolian deposits, in Begay fine sandy loam soils. Note that *P. laevis* is a BLM sensitive species found on BLM, private, and Kaibab Indian Reservation lands.

However, while current data describes the species as occurring from 4,920 feet (1,500 meters) to 6,560 feet (2,000 meters) in elevation, all encountered individuals were found at lower elevations, ranging from approximately 4,760 to 5,000 feet (1,451 to 1,524 meters). Thus, the range of the species appears to be broader than that currently documented.

Penstemon laevis was often found in areas where cattle grazing occurs; cattle appear to graze directly on the plant. Signs of herbivory were often present, with foliage and inflorescences partially to moderately grazed. Although *P. laevis* may be subject to grazing by other herbivores, habitat use observed by the survey suggests that much of this is the result of cattle grazing.

Although invasive weeds were commonly found in habitats supporting *P. laevis*, invasive weeds do not appear to greatly threaten the species.

5.3.10.1.2.10 Phacelia mammalariensis (Nipple phacelia).

Natural History

Phacelia mammalariensis is an annual herb in the Hydrophyllaceae (Waterleaf Family), between 3.5 inches (0.9 decimeters) to 19.7 inches (5 decimeters) tall. Stems are simple or branched and erect. Leaves are simple, oblong to lance-shaped and irregularly toothed or rounded. The flower is tubular-funnel form with pale blue to white lobes and lavender anthers (Figure 5-150). The plant has four brown seeds that are pitted down the back (Welsh et al. 2008).

Phacelia mammalariensis is endemic to eastern Kane and Garfield counties, Utah and occurs in salt and mixed desert shrub communities from 4,000 feet (1,219 meters) to 6,000 feet (1,829 meters) in elevation (Welsh et al. 2008).

Phacelia mammalariensis appears very similar to *P. crenulata*, but the taxa can be distinguished by flower color and their seed. In contrast to the blue violet or purple flowers found on *P. crenulata,* the flowers of *P. mammalariensis* are pale blue to white in color with lavender anthers, a distinguishing characteristic for this plant. The seeds of both species are brown with pitted surfaces, but those of *P. mammalariensis* contain a longitudinal groove (Welsh et al. 2008).

Figure 5-150
Close-up of *Phacelia mammalariensis* within the Area of Potential Effect

Survey Results

Phacelia mammalariensis was encountered in the survey area during field surveys. Surveys located a total of 1,688 individual *Phacelia mammalariensis* plants. All but one *Phacelia mammalariensis* was documented on GCNRA lands at Glen Canyon Substation and along the BPS-2 transmission line Reach. The other lone *P. mammalariensis* was found on BLM lands just west of Calf Springs along Glen Canyon to Buckskin transmission line North Reach. The distribution of *P. mammalariensis* across the survey area is shown in Table 5-99

Table 5-99
Summary of *Phacelia mammalariensis* Survey Results by Location

Reach	Location	Land Ownership	# of Plants
Glen Canyon Substation and BPS-2 Transmission Line Alternative	2 miles south and 1.5 miles north of Colorado River at Glen Canyon Dam	Glen Canyon National Recreation Area	1,687
Glen Canyon to Buckskin Transmission Line North	1.5 miles west of Calf Springs	BLM	1
		Total	**1,688**

Phacelia mammalariensis was found growing most often within the Colorado Plateau Active and Stabilized Dune Ecological System, but also within sandy pockets in the Colorado Plateau Mixed Bedrock Canyon and Tableland Ecological System, and sandsheets of the Colorado Plateau Blackbrush-Mormon-tea Shrubland Ecological System. The vast majority of plants were found in the *Artemisia filifolia – Ephedra (nevadensis, torreyana, viridis)* Sparse Shrubland Association of the *Artemisia filifolia* Shrubland Alliance within the Colorado Plateau Active and Stabilized Dune Ecological System. In total, *P. mammalariensis* was documented in three ecological systems, four alliances and five associations. The species was encountered at elevations ranging from 3,792 feet (1,156 meters) and 4,810 feet (1,466 meters).

Phacelia mammalariensis was found most frequently on stream channel deposits; these deposits are commonly composed of white to light-red silt, sand, gravel, and pebbles. It was also regularly documented on Navajo Sandstone; these soils are white, light-red and yellowish-gray, fine- to course-grained windblown sandstone (Billingsley et al. 2008).

Phacelia mammalariensis was found on multiple soils within the survey area. It was most commonly found on Needle-Sheppard complex soils.

Much of the areas where *Phacelia mammalariensis* was encountered exhibited signs of disturbance, particularly due to grazing. Localized areas that were less conducive to grazing, such as pockets occurring within slick rock, appeared to support higher densities of the species. Individuals were also encountered that displayed morphological characteristics intermediate between *P. mammalariensis* and *P. crenulata,* and thus, were not positively identified as *P. mammalariensis* and are not included in the presented tallies.

Discussion

A total of 1,688 *Phacelia mammalariensis* individuals were encountered within the survey area. The species occurred predominantly at the far eastern end of the survey area at Glen Canyon Substation, along the BPS-2 transmission line Alternative Reach, and within Glen Canyon to Buckskin transmission line North Reach. The vast majority of plants were found in associations dominated by *Artemisia filifolia*, *Ephedra* spp., and *Eriogonum corymbosum*. The species was encountered most frequently on stream channel deposits and Navajo Sandstone, and commonly on soils of the Needle-Sheppard complex. Although, *P. mammalariensis* is a GCNRA species of concern; however no plants were located within GCNRA.

Phacelia mammalariensis individuals were encountered at elevations ranging from 3,792 feet (1,156 meters) and 4,810 feet (1,466 meters), the lower range falling slightly below the recorded range. The species was encountered infrequently, and in few habitat types. Positive identification of individuals was

challenging, as *P. mammalariensis* and *P. crenulata* are very similar in appearance, and appear to hybridize easily resulting in plants displaying intermediary characteristics. The highest density of individuals occurred in the vicinity of the Colorado River at Glen Canyon Dam, and decreased in abundance moving westward, as did the presence of definitive morphological characteristics. Near Flat Top and Upper Paria River, individuals were encountered with characteristics intermediate between *P. mammalariensis* and *P. crenulata*, and therefore a positive identification was not justified. One individual plant was found in the vicinity of Calf Springs and was the furthest west that the species was confirmed to occur. Suitable habitat for this species occurs in much of the eastern survey area.

The survey observed that some of the encountered groups occurred in areas not as susceptible to grazing, particularly in sand pockets amongst slick rock. This suggests that pressures occurring in the area both historically and currently likely have resulted in diminishment of the species. Further disturbance resulting from project activities would be expected to add continued stress to existing groups. Invasive weeds were encountered in abundance in some of the most disturbed portions of this area, and although field observations and collected data do not provide much insight into the ability of the species to compete with invasive weeds, the introduction of invasive weeds resulting from the project would also likely result in additional pressure on the species.

Due to taxonomic confusion of the species and the occurrence of individuals displaying a range of intermediary characteristics, it is possible that the survey did not capture all existing groups of *P. mammalariensis* occurring within the survey area. As *Phacelia mammalariensis* reproduces from seed, the number of individuals identified during the survey may represent relative distribution of the plant at various locations where *P. mammalariensis* is present within the seed bank. Additionally, it is likely that seed is present within adjacent habitats containing soils derived from the stream channel deposits, where localized climactic conditions may not have been conducive to germination prior to, or during the survey periods. Project construction activities could therefore include salvage and replanting of topsoil from habitats with the potential to contain viable *P. mammalariensis* seed. The presence of individuals identified within Glen Canyon Substation, the BPS-2 transmission line reach, and Glen Canyon to Buckskin transmission line North reach, however, suggests that *P. mammalariensis* is present within the seed bank in localized areas immediately surrounding documented individuals and across suitable habitat within these reaches. Additionally, it is likely that seed is present within suitable habitats occurring from the areas of Colorado River at Glen Canyon Dam to Calf Springs and Upper Paria River.

5.3.10.1.2.11 Phacelia pulchella var. atwoodii (Atwood's pretty phacelia).

Natural History

Phacelia pulchella var. *atwoodii* is an annual herb in the Hydrophyllaceae (Waterleaf Family), growing to between 2 inches (0.5 decimeters) and 8 inches (2 decimeters) tall. Succulent, leafy stems branch at the base, and are spreading to erect and finely glandular. Leaves are lobed to rounded, oval to obovate or ovate and simple. Flowers reach up to 0.4 inches (0.7 to 0.9 centimeters) long, bell-shaped, with violet to purple corollas and yellow tubes (Figure 5-151). Flowering occurs from April to May (UNPS 2003-08). Plants produce 28 to 50 oblong to elliptic seeds, each no more than 0.04 inches (0.5 to 1 millimeters) long, brown, and pitted (Welsh et al. 2008).

Phacelia pulchella var. *atwoodii* is endemic to Kane County, Utah and is known from west of the Cockscomb to Petrified Hollow (Welsh et al. 2008). *P. phacelia* var. *atwoodii* occurs on thin gypsum soils within the Moenkopi Formation, or on alluvium contaminated by gypsum (Welsh et al. 2008). It is found in duff under junipers in pinyon-juniper, oak, sagebrush, single-leaf ash, and serviceberry communities from 5,085 feet (1,550 meters) to 5,510 feet (1,679 meters) elevation (UNPS 2008, Welsh et al. 2008).

Phacelia pulchella var. *atwoodii* appears very similar to other varieties of *P. pulchella*, including var. *pulchella* and var. *gooddingii*. The varieties can be distinguished by leaf characteristics and geographic location. Welsh et al (2008) defines both var. *pulchella* and var. *atwoodii* as taxa with smooth or nearly smooth leaves, while the leaves of variety *gooddingii* are coarsely toothed. Also, while the leaves of variety *pulchella* are mostly less than 0.7 inches (1.8 centimeters) long, those of variety *atwoodii* are 0.7 (1.8 centimeters) to 1 inch (2.5 centimeters) long, and the leaves of var. *gooddingii* grow to between 1 inches (2.5 centimeters) and 1.4 inches (3.5 centimeters) long. The varieties are also geographically segregated, with only variety *atwoodii* occurring in Kane County, Utah.

Figure 5-151
Close-up of *Phacelia pulchella* var. *atwoodii* within the Area of Potential Effect

Survey Results

Phacelia pulchella var. *atwoodii* was encountered in four reaches, including: the Water Conveyance System, the Hydro System, the Hydro System Proposed Action, and Eightmile Gap Road reaches. An estimated total of 13,581,025 individuals were encountered during the surveys, the majority of which occurred within the Hydro System and Hydro System Proposed Action reaches. The greatest density of individuals was identified from the vicinity of Telegraph Wash to Petrified Hollow Wash, and large numbers of individuals were identified from the vicinity of Petrified Hollow Wash to the area around Shinarump Cliffs. All individuals were encountered on BLM lands, with the exception of a very small group of plants (five individuals) which was identified in both BLM and private lands. In the vicinity of Eightmile Gap Road, *P. pulchella* var. *atwoodii* was observed cohabitating a microhabitat with *Camissonia exilis.* The distribution of *P. pulchella* var. *atwoodii* across the survey area is shown in Table 5-100.

During 2009, counts of *Phacelia pulchella* var. *atwoodii* were likely underestimated due to an overlap in morphological variability with other varieties. In some localities, the leaf margins of individuals were found to have a continuum of expressions, ranging from smooth and wavy to lobed or toothed, with the latter stated in UNPS (2003-08) to be characteristic of var. *pulchella*. While those individuals which exhibited toothed margins (approximately one-third of *Phacelia pulchella* individuals encountered in

some communities) were identified as var. *atwoodii*, at least some of the remaining individuals exhibiting intermediary characteristics were likely falsely identified as var. *pulchella*.

Table 5-100
Summary of *Phacelia pulchella* var. *atwoodii* Survey Results by Location

Reach	Location	Land Ownership	Estimated # of Plants Based on Density Calculations
Water Conveyance System	1.05 miles to 2.6 miles southwest of Telegraph Wash	BLM	161,075*
Hydro System	3.1 miles southwest of Telegraph Wash to Petrified Hollow Wash	BLM	8,439,674*
Hydro System and Hydro System Proposed Action	0.62 mile southwest of Petrified Hollow Wash to 1.45 miles southwest of Shinarump Cliffs	BLM	4,978,925*
Hydro System Proposed Action	2.3 miles southwest of Shinarump Cliffs to 2.3 miles northeast of White Sage Wash	BLM	1,346*
Eightmile Gap Road	2.3 miles northeast of Johnson Wash	BLM and Private	5
		Total	**13,581,025***
Note: * Counts are estimates based on 50-meter transect densities			

Phacelia pulchella var. *atwoodii* was found within the Colorado Plateau Ecological Region, and occurred in a total of five ecological systems, six alliances, and 11 associations. *P. pulchella* var. *atwoodii* was found most often growing within the Colorado Plateau Big Sagebrush Shrubland and Colorado Plateau Gypsum Badlands ecological systems. The largest quantity of individuals was found in the *Artemisia tridentata* ssp. *Vaseyana* Shrubland alliance, although the *Eriogonum corymbosum* Shrubland alliance also supported a high density of individuals. The two largest groups were found in the *Artemisia tridentata* ssp. *vaseyana* / Sparse Understory Shrubland (an estimated 7,894,227 individuals), and in the *Eriogonum corymbosum – Artemesia tridentata* ssp. *vaseyana* Gypsum Badlands Sparse Shrubland (an estimated 4,320,450 individuals) associations. All encounters were in associations dominated by native species, most often *Artemisia tridentata* ssp. *vaseyana*, *Eriogonum corymbosum*, *Gutierrezia sarothrae*, and/or *Juniperus osteosperma*. Individuals were found at elevations ranging from 4,980 feet (1,518 meters) to 5,620 feet (1,713 meters).

Phacelia pulchella var. *atwoodii* was found on five geologic formations within the survey area. The species was primarily encountered on the Middle Red Member of the Moenkopi Formation, which are 250-256 million year old formations that typically support gypsum badlands, and on alluvial deposits dating from 1200 to 1880 AD (Billingsley et al. 2008).

Phacelia pulchella var. *atwoodii* were found on multiple soil types within the survey area. The majority of individuals occurred in Kenzo-Retsabal-Progresso, cool complex soils, Ruinpoint-Barx complex soils, or in combinations of Kenzo-Retsabal-Progresso, cool complex soils, Ruinpoint-Barx complex soils, and Yarts-Palma-Nelville family-Barx-Atchee soils. The species was often identified in association with well-developed cryptobiotic crusts. As with *Camissonia exilis*, *P. pulchella* var. *atwoodii* often occurred on

mounds with cryptobiotic crusts; however, *P. p.* var. *atwoodii* was encountered at higher densities within the mineral soil found at the periphery of these mounds.

Discussion

The survey identified an estimated 13,581,025 individuals of *Phacelia pulchella* var. *atwoodii* within the survey area. The species occurred in a total of four reaches: the Water Conveyance System, the Hydro System, the Hydro System Proposed Action, and Eightmile Gap Road. *P. p.* var. *atwoodii* was documented in five ecological systems, six alliances, and 11 associations. Most commonly, the species was encountered in Colorado Plateau Big Sagebrush and Gypsum Badlands Ecological Systems (Figure 5-152) in vegetation communities dominated or co-dominated by *Artemisia tridentata* ssp. *vaseyana*, *Eriogonum corymbosum*, *Gutierrezia sarothrae*, or *Juniperus osteosperma*. All encounters occurred on BLM lands, with the exception of one small group that occurred on a combination of BLM and private lands. The species was primarily found on the Middle Red Member of the Moenkopi Formation and on alluvial deposits, and in Kenzo- Retsabal-Progresso, cool complex soils, Ruinpoint-Barx complex soils. *P. pulchella* var. *atwoodii* was often observed to occupy the same microhabitat as *Camissonia exilis*, particularly in association with well-developed cryptobiotic crusts, and occasionally underneath shade-providing nurse shrubs. While many of these areas were disturbed, localized disturbance to the preferred microhabitats supporting *P. pulchella* var. *atwoodii* appeared to be minimal.

Figure 5-152
View of *Phacelia pulchella* var. *atwoodii* and *Camissonia exilis* within the Area of Potential Effect

Phacelia pulchella var. *atwoodii* was found in extremely high densities in portions of the survey area, particularly from the vicinity of Telegraph Wash to Petrified Hollow Wash, and from Petrified Hollow Wash to Shinarump Cliffs. When the survey crew encountered these high-density localities, rather than counting individuals, the species was noted as present and assigned a relative abundance within each vegetation community. After the initial survey, 50-meter transects were conducted in representative vegetation where *P. p.* var. *atwoodii* was observed. During data analysis, counts for *P. p.* var. *atwoodii* were extrapolated using the 50-meter transect densities and the acreages for each vegetation community

where *P. p.* var. *atwoodii* was observed. Field knowledge of the expected densities of the species relative to each vegetation community was utilized to weight the extrapolated quantities across vegetation communities by relative abundance.

This method presents some discrepancies. For instance, *Phacelia pulchella* var. *atwoodii* was often observed on specific microhabitats of cryptobiotic soils in gypsum badlands. Often these microhabitats existed within a larger vegetation community, and survey crews were unable to capture the boundaries or acreages of the microhabitats within the vegetation community. This could lead to *P. p.* var. *atwoodii* densities being applied to the greater acreages of the vegetation community instead of the more specific acreage of the plant's actual boundary within the microhabitat. Another discrepancy is not all abundances (or densities) and vegetation communities were sampled using 50-meter transects. For example, 50-meter transects were established in *Artemisia tridentata* ssp. *vaseyana* Sparse Understory Shrubland where the abundance of *P. p.* var. *atwoodii* was occasional, but a 50-meter transect was not established in the same community where *P. p.* var. *atwoodii* was noted as rare. It should be noted that although the exact number of *P. p.* var. *atwoodii* cannot be determined this way, the counts are still good indicators of the importance of the habitats, geological formations and soil types supporting *P. p.* var. *atwoodii* within the survey area. This method still provides the relative distribution of the plant within the survey area where *P. p.* var. *atwoodii* is present within the seed bank.

While collected data and field observations are consistent with published data regarding habitat preferences, the survey identified *Phacelia pulchella* var. *atwoodii* as far west as Johnson Canyon, which is outside of the known range of the species (currently documented by Welsh et al. [2008] as occurring from west of the Cockscomb to Petrified Hollow). With regard to climate, field observations suggest that the species is highly influenced by climactic factors. The survey area in the vicinity of Hurricane was surveyed for vegetation in 2009 and for desert tortoise in 2010. While surveying the area in 2009, the survey crew encountered very limited quantities of *P. p.* var. *atwoodii*, contrasting sharply with the extremely high densities observed while conducting tortoise surveys in 2010. Additionally, despite the occurrence of suitable habitat between Telegraph Flat and Seaman Wash, the species was not encountered in this segment during the 2009 survey, further suggesting depressed groups during the 2009 growing season. While appropriate data were not collected that would allow for an empirical conclusion regarding variation in densities due to climactic conditions, anecdotal evidence would suggest that germination of *P. p.* var. *atwoodii* is highly responsive to precipitation.

Phacelia pulchella var. *atwoodii* was only encountered in vegetation communities dominated or co-dominated by native species. Although invasive weeds were also found in these communities, field observations suggest that invasive weed species are not well adapted to gypsum badlands, as any invasive weeds encountered in gypsum badland habitat were observed at low densities. However, disturbance to this habitat would be expected to foster the destruction of cryptobiotic soils and the introduction of invasive weeds. Invasive weed species commonly encountered within the survey area, and expected to be further dispersed as a result of project activities, particularly *Bromus rubens*, *B. tectorum*, and *Erodium cicutarium*, would, once introduced, likely compete with *P. p.* var. *atwoodii* for resources. In addition to its preferred gypsum soils, the species was also encountered on alluvial lands, where clay and silty-clay deposits have occurred through sheet-flow. This process likely distributes its seeds across the landscape, depositing the species into new habitats and extending the boundaries of the group, and suggests that the species is tolerant of disturbance. While this may illustrate the ability of *P. p.* var. *atwoodii* to colonize in disturbed soils, the frequency and density of the resulting groups was observed to be less than those observed in gypsum badland habitat. The species was also found on occasion in association with shade-providing nurse plants; thus, the elimination of nurse-shrubs as a result of project activities should also result in an effect on the species.

As *Phacelia pulchella* var. *atwoodii* reproduces from seed, the number of individuals identified during the survey may represent relative distribution of the plant at various locations where *P. p.* var. *atwoodii* is present within the seed bank. Additionally, it is likely that seed is present within adjacent habitats containing soils derived from the Middle Red Member of the Moenkopi Formation, where localized climactic conditions may not have been conducive to germination prior to, or during the survey periods. The presence of individuals identified along the Water Conveyance System, the Hydro System, the Hydro System Proposed Action, and Eightmile Gap Road reaches, however, suggests that *P. p.* var. *atwoodii* is present within the seed bank in localized areas immediately surrounding documented individuals and across suitable habitat within these reaches. Additionally, it is likely that seed is present within gypsum badlands and in habitats with mineral soils occurring throughout these reaches, where localized climactic conditions may not have been conducive to germination prior to, or during the survey periods.

5.3.10.1.3 Noxious Weeds and Invasive Species.

The survey for noxious weeds confirmed the presence of 16 taxa within the LPP survey area (Table 5-101). The most broadly-distributed taxa were *Bromus rubens*, *Bromus tectorum*, *Erodium cicutarium*, and *Salsola tragus*. *Tamarix* species was relatively widespread. Exhibiting moderate abundance throughout the survey area were *Asclepias subverticillata*, *Convolvulus arvensis*, *Elaeagnus angustifolia*, *Halogeton glomeratus*, *Onopordum acanthium*, *Portulaca oleracea*, and *Tribulus terrestris*. Limited occurrences were noted for *Aegilops cylindricus*, *Brassica tournefortii*, *Sorghum halepense*, and *Ulmus pumila*.

5.3.10.1.3.1 Weed Occurrence by Ecological System and Anthropogenic Lands.

The vegetation community survey conducted in conjunction with the noxious and special status species surveys provided a base of information upon which to analyze the findings of noxious and invasive weed occurrences. The vegetation classification process determined that the LPP Project spans two Ecological Regions: Colorado Plateau and Mohave Desert.

5.3.10.1.3.2 Ecological Systems.

Progressing from the broad scale of Ecological Region to a finer scale, ecological systems are the next level with which to categorize vegetation. Ecological systems represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. They are intended to provide a classification system that is readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field (Comer, et al 2003). Within the LPP survey area, 38 ecological systems were identified by the survey team, 15 within the Colorado Plateau, 11 within the Great Basin, and 12 within the Mojave Desert.

5.3.10.1.3.3 Anthropogenic Lands.

In addition to classification of plant communities, the survey team classified some areas within the LPP survey area as anthropogenic (affected by human activity) lands. These areas contain neither natural nor semi-natural plant communities; rather, they include Agricultural Lands, Developed Roads, Developed Lands, areas of Invasive Upland Vegetation (where the original plant community is no longer extant), quarries, reservoirs, and Ruderal Vegetation (occurring where the natural vegetation cover has been disturbed). Anthropogenic lands compose 3,831 acres of the LPP survey area. The largest number of noxious and invasive weed species was found in Invasive Upland vegetation (14), Agricultural Land (13), and Ruderal Vegetation (13). Significant numbers of weed species were also found on Developed Roads and Developed Lands (nine species each).

The concentration of noxious and invasive weeds throughout the LPP survey area is clearly along highways and roads which provide not only the means of transport for weed propagules, but also the disturbed soils upon which they thrive. The greatest concentrations of weeds are also found in relatively close association with human population centers.

Table 5-101
Noxious and Invasive Weed Species Encountered During Surveys in the Area of Potential Effect

Species		USFWS[1]	State of AZ[2]	State of UT[3]	WA Co., UT	BLM AZ Strip FO[4]	BLM St. George FO	BLM Kanab FO	BLM GSENM	GCNRA
Scientific Name	**Common Name**									
Aegilops cylindrica	Jointed goatgrass		PNW RNW							
Asclepias subverticillata	Poison milkweed						N		N	
Brassica tournefortii	African mustard, Sahara mustard	I								I
Bromus rubens	Red brome	I				I				
Bromus tectorum	Cheatgrass	I				I		I		
Convolvulus arvensis	Field bindweed		PNW RGNW	NC			NN		N	
Elaeagnus angustifolia	Russian olive					I				I
Erodium cicutarium	Red stem filaree, Stork's bill	I								
Halogeton glomeratus	Halogeton		PNW RNW			N				
Onopordum acanthium	Scotch thistle		PNW RNW	NB		NNN			N	
Portulaca oleracea	Common purslane		PNW RGNW							
Salsola tragus[5]	Russian thistle									
Sorghum halepense	Johnsongrass			NA					N	
Tamarix spp.	Tamarisk					N				
Tribulus terrestris	Puncturevine		PNW RGNW			N				
Ulmus pumila	Siberian elm									I

Notes:
[1] I = Invasive Species
[2]PNW = Prohibited Noxious Weed, RGNW = Regulated Noxious Weed, RNW = Restricted Noxious Weed (State of Arizona Department of Agriculture Noxious Weed List)
[3]NA = Noxious Class A (Early Detection Rapid Response), NB = Noxious Class B (Control), NC = Noxious Class C (Containment) (State of Utah Noxious Weed List)
[4] N= Noxious Weed Designation
[5]Not listed as noxious or invasive by any agencies, but of considerable concern to land managers

5.3.10.1.3.4 Weed Species Occurrences.

Five hundred transects measuring 50 meters by 1 meter were established throughout the LPP survey area. All plants within these transects, including noxious and invasive weeds, were counted or otherwise classified according to relative abundance for noxious and invasive weeds. Weeds were observed in 309 of the 500 transects. The most occurrences of noxious weeds within the transects were recorded for *Salsola tragus* (199). Other weed species that occurred in numerous transects were: *Bromus tectorum* (108), *Bromus rubens* (84), and *Erodium cicutarium* (84). Occurring in a limited number of transects were *Aegilops cylindrical* (2), *Asclepias subverticillata* (1), *Convolvulus arvensis* (2), *Elaeagnus angustifolia* (1), *Halogeton glomeratus* (3), *Sorghum halepense* (3), *Tamarix* spp. (9), and *Tribulus terrestris* (2). Four of the 16 noxious weed species recorded as occurring in the LPP survey area were not found in the 50-meter transects. Those species included *Brassica tournefortii*, *Onopordum acanthium*, *Portulaca oleracea*, and *Ulmus pumila*.

5.3.10.1.3.5 Weeds in Association with Special Status Plant Species.

The broad distribution of noxious weed species across the LPP survey area inevitably resulted in their association with special status plant species. Noxious weeds compete with native species for resources, and of particular concern is their invasion of areas inhabited by special status plant species. *Bromus rubens, B. tectorum, Erodium cicutarium,* and *Salsola tragus* all occurred as co-dominant species in two associations supporting *Camissonia exilis*. Despite the broad distribution of *Tamarix* spp., this species was not observed in sufficient abundance to be considered a dominant element in any alliance in which special status species occurred. The occurrences of all other encountered noxious weeds, including *Asclepias subverticillata, Brassica tournefortii, Convolvulus arvensis, Eleagnus angustifolia, Halogeton glomeratus, Onopordum acanthium, Portulaca oleracea, Sorghum halapense, Tribulus terrestris,* and *Ulmus pulmila*, were more localized and/or sporadic within the survey area; none of these species occurred in sufficient abundance to be considered a dominant member of any vegetation communities supporting special status species.

5.3.10.2 Environmental Effects

5.3.10.2.1 Proposed Action.

The Proposed Action would have short-term direct effects on nine special status plant species and their habitats. Eight of the affected species consist of sensitive plants on federal or state plant lists. One of the affected plants is federally listed as endangered. The Proposed Action would not pass through any designated critical habitat for listed plant species. The Proposed Action construction should affect high numbers of three special status plant species: *Phacelia pulchella* var. *atwoodii* (~161,000); *Pediomelum epipsilum* (~23,850); and *Camissonia exilis* (~6,046). The Proposed Action construction would affect moderate numbers of two special status plant species: *Eriogonum coryumbosum* var. *nilesii* (1,749) and *Phacelia mammalariensis* (1,688). The Proposed Action construction would affect small numbers of four special status plant species: *Lupinus caudatus* var. *cutleri* (54), *Penstemon laevis* (17), *Echinocactus polycephalus* var. *xeranthemoides* (9), and *Pediocactus sileri* (8), the latter listed as threatened. The Proposed Action construction could be aligned to avoid direct effects on the eight *Pediocactus sileri*, which occur along the edge of the Hydro System alignment in two places. The cryptobiotic soil crusts where *Pediocactus sileri, Camissonia exilis* and *Phacelia pulchella* var. *atwoodii* occur are fragile and once disturbed can take decades or longer to redevelop; therefore, adverse effects on the cryptobiotic soil crusts and the three associated plant species could be long-term.

The Proposed Action would be constructed within areas where invasive and noxious weed species were found, particularly around highways and human communities. Proposed Action systems and features

would be constructed in areas containing 12 of the 16 identified invasive and noxious weed species. Four weed species have high prevalence: *Salsola tragus, Bromus tectorum, Bromus rubens,* and *Erodium cicutarium.* The remaining 8 weed species growing along the Proposed Action alignment have low to very low prevalence. The primary effects of the Proposed Action construction would be increasing the potential for invasive and noxious weed growth in the disturbed areas. These potential effects would be short-term and minimal following construction; however, the Proposed Action could have long-term effects from weed infestations if control measures and revegetation efforts are not successful.

5.3.10.2.2 Existing Highway Alternative.

The Existing Highway Alternative would have short-term direct effects on 11 special status plant species and their habitats. Ten of the affected species consist of sensitive plants on federal or state plant lists. One of the affected plants is federally listed threatened species. The Existing Highway Alternative construction would affect high numbers of four special status plant species: *Phacelia pulchella* var. *atwoodii* (~161,000); *Eriogonum thompsoniae* var. *atwoodii* (~86,000), *Eriogonum mortanianum* (~58,000), and *Pediomelum epipsilum* (~23,000). The Existing Highway Alternative construction would affect moderate numbers of five special status plant species: *Camissonia exilis* (~6,046), *Cryptantha semiglabra* (~3,300), *Pediocactus sileri* (2,945), *Eriogonum coryumbosum* var. *nilesii* (1,741) and *Phacelia mammalariensis* (1,688). The Proposed Action construction would affect small numbers of two special status plant species: *Penstemon laevis* (107) and *Lupinus caudatus* var. *cutleri* (54). The Existing Highway Alternative construction could not be aligned to avoid direct effects on the 2,945 threatened *Pediocactus sileri* plants. This long-term adverse effect would be significant. The cryptobiotic soil crusts where *Pediocactus sileri, Camissonia exilis, Eriogonum thompsoniae* var. *atwoodii, Eriogonum mortanianum,* and *Phacelia pulchella* var*. atwoodii* occur are fragile and once disturbed can take decades or longer to redevelop; therefore, adverse effects on the cryptobiotic soil crusts and the five associated plant species would be long-term. Most of the cryptobiotic soil crusts and associated special status plant species that would be affected by the Existing Highway Alternative construction and operation are located on the Kaibab-Paiute Indian Reservation.

The Existing Highway Alternative would be constructed within areas where invasive and noxious weed species were found, particularly around highways and communities. The Existing Highway Alternative would not pass through any designated critical habitat for listed plant species. Existing Highway Alternative systems and features would be constructed in areas containing 14 of the 16 identified invasive and noxious weed species. Four weed species have high prevalence: *Salsola tragus, Bromus tectorum, Bromus rubens,* and *Erodium cicutarium.* The remaining ten weed species growing along the Existing Highway Alternative alignment have low to very low prevalence. The primary effects of the Existing Highway Alternative construction would be increasing the potential for invasive and noxious weed growth in the disturbed areas. These potential effects should be short-term and minimal following construction; however, the Existing Highway Alternative could have long-term effects from weed infestations if control measures and revegetation efforts are not successful.

5.3.10.2.3 Southeast Corner Alternative.

The Southeast Corner Alternative would have the same effects on special status plant species and their habitats as described for the Proposed Action in Section 5.3.10.2.1. The Southeast Corner Alternative would be susceptible to invasive and noxious weed infestation and subject to the same effects as described for the Proposed Action in Section 5.3.10.2.1. The Southeast Corner Alternative would not pass through any designated critical habitat for listed plant species.

5.3.10.2.4 No Lake Powell Water Alternative.

The No Lake Powell Water Alternative would have no direct effects on special status plant species. Known special status species and their habitats in the St. George metropolitan area would remain undeveloped and protected from direct effects of construction, recreation, and other land disturbing activities. The No Lake Powell Water Alternative could have long-term indirect effects on invasive and noxious weed infestations in the St. George metropolitan area resulting from elimination of outdoor landscape watering with potable water. The transition from irrigated landscape to desert landscape in the disturbed soils could result in more pervasive infestations of invasive and noxious weeds. St. George metropolitan areas receiving continued secondary water for outdoor irrigation would be less susceptible to long-term invasive and noxious weed infestations.

5.3.10.2.5 No Action Alternative.

The No Action Alternative would have no direct effects on special status plant species.

5.3.10.3 Protection, Mitigation and Enhancement Measures

The protection, mitigation and enhancement measures for special status plant species would begin with the foundation of BMPs, which constitute the most effective and practical methods to avoid, minimize or reduce construction effects on naturally occurring landscapes. The implementation of BMPs during project design and construction, in combination with the education of project personnel and monitoring and enforcement of strategies, would serve to minimize project-related effects. The development of specific conservation strategies and protective measures, which strive to reduce effects on focal species, may be developed when a construction footprint is identified. BMPs would help minimize Lake Powell Pipeline project construction disturbances on the natural landscape, reduce effects on known rare plants and sensitive habitats and aid in the prevention of noxious weed dispersal. Because of the complexity of the project area (number of species, sensitive habitats, potential for spread of invasive species) and the variety of construction activities (pipelines, penstocks, transmission lines, pump stations, hydro stations, forebay and afterbay reservoirs), conflicts would occur in attempting to implement all BMPs for every location potentially affected by a particular project-related activity. General BMPs are recommended for overall construction activities, the restoration/rehabilitation of disturbed areas, riparian, wetland and aquatic habitats, and invasive species control.

5.3.10.3.1 General BMPs.

BMPs and mitigation would address protected species or species afforded special protections and their habitat as practicable. The following are general BMPs that would be considered for implementation to avoid and/or minimize overall project related effects:

BMP-G1: Employ a Resource Advisor to design (or develop) and recommend implementation of specific conservation strategies and protective measures (endorsed by the land management agencies and USFWS). A designated resource advisor would also coordinate natural resource conflicts and concerns.

BMP-G2: On-site project personnel would be educated about protected species and the importance of minimizing effects on individuals and habitats. All project personnel would be informed of the BMPs, protective measures, and conservation strategies.

BMP-G3: All applicable BMPs, protective measures, and conservation strategies would be applied to all un-surveyed designated habitats for federal and state listed and sensitive species and habitats until surveys have been conducted to clear the project areas or prescribe appropriate and specific BMPs, protective measures, and conservation strategies.

BMP-G4: Equipment staging areas and fueling areas would be located outside of sensitive habitats, preferably in previously disturbed areas outside of areas with known noxious and invasive species occurrences.

BMP-G5: Appropriate BMPs would be implemented on temporary site access routes.

BMP-G6: When temporary access routes are required, construct on ridge tops, stable upper slopes, or wide valley terraces, if feasible. Stabilize soils on-site. Avoid slopes steeper than 70 percent. All temporary access routes would be rehabilitated to pre-disturbance conditions when use is no longer needed.

BMP-G7: Avoid soil-disturbing actions during periods of heavy rain or wet soils. Apply travel restrictions to protect soil and water. Install cross drains to disperse runoff into filter strips and minimize connected disturbed areas. Make cuts, fills, and road surfaces strongly resistant to erosion between each stream crossing and at least the nearest cross drain.

BMP-G8: Apply protective measures to all areas of disturbed, erosion-prone ground that is not to be further disturbed. These areas could be especially protected during snow melt or summer monsoon season to minimize erosion and sedimentation. This may include covering exposed ground with mulching, jute mats or containing exposed soil areas with soil erosion control fencing.

BMP-G9: Construct roads and other disturbed sites to minimize sediment discharge into streams, riparian areas, and wetlands.

BMP-G10: Stream sediment loads would be managed by not washing equipment or vehicles in streams, riparian areas or wetlands. Equipment or vehicles would be inspected and cleaned as necessary to remove weed seeds before entering federal and state listed and sensitive species designated habitats. Equipment and vehicles would only be washed in designated locations where material would be captured/contained and removed off-site to an approved disposal area so that invasive plant material would not be spread.

BMP-G11: Require that no servicing or refueling of equipment occurs within 1/8-mile of streams, reservoirs, or associated wetlands.

BMP-G12: Pipeline and penstock construction would not block, dam, or change the natural course of any drainage. If excavation occurs in a streambed, the streambed may be protected with suitable stabilizing materials. Mineral and silt accumulated due to construction activities would be deposited into approved locations. If disturbance occurs, a streambed would be restored to its original configuration, including natural grade, condition, and alignment.

BMP-G13: Vegetation slash not containing noxious and invasive or special status plants would be disposed of by removal to an agreed upon location. In upland areas, vegetation could be disposed of by: piling and burning, windrowing at the base of fill slopes, and chipping and scattering.

BMP-G14: Enclosed containment should be provided for all trash. All construction waste, including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials would be contained and properly disposed of.

5.3.10.3.2 Restoration and Rehabilitation Measures.

Restoration and rehabilitation treatments are an integral part of control and management of future invasions of invasive species, and to prevent further harm to sensitive plants from disrupted local ecosystem function. Executive Order 13112 Section 2(a)2: charges federal agencies to “provide for restoration of native species and habitat conditions in ecosystems that have been invaded.” Native

vegetative communities can suffer cumulative effects from the direct and indirect effects of invasive species (2008-2012 National Invasive Species Management Plan National Invasive Species Council [NISC] August 2008) and environmental stressors from ground disturbing construction activities. Complex ecological relationships can be jeopardized by invasive species as well as human related processes, such as pipeline and penstock construction, that can potentially disrupt ecological processes. Disturbed site soil stabilization incorporated with site restoration serves as an ecological transition to recovery of native habitat components and ecosystem processes interrupted by project related effects. The general restoration BMPs presented are intended to provide a framework for meeting the intent of Executive Order 13112 and enhance probability of local ecosystem recovery from disturbance.

BMP-R/R1: The soil surface of a disturbed area would be re-vegetated with a mix of species that is best suited to meet the erosion control objective, with consideration for range, wildlife, or fuels management objectives.

BMP-R/R2: When rehabilitating designated sensitive habitats affected by project related activities, seeds from regionally native or approved non-native species of grasses and herbaceous vegetation would be used in areas where reseeding is necessary to stabilize soils, prevent erosion, or provide temporary wildlife forage and/or cover. Additional plant species would be considered and approved by the appropriate land management agency where conditions are not realistic for the success of native seed revegetation.

BMP-R/R3: Vehicles used during reseeding activities should follow BMP-G6.

BMP-R/R4: Sediment traps or other erosion control measures should be implemented in restoration areas to prevent soil or seed loss and to protect the restoration area from invasive species seed sources.

BMP-R/R5: Restoration areas would be monitored for germination, establishment of desired species and cover prescription, and presence of invasive species. Results of monitoring should be reported to the FWS, federal land management agencies, and state wildlife management agencies.

BMP-R/R6: Topsoil removed during construction would be salvaged and reapplied during reclamation and plant debris could be left on-site to serve as mulch. Disturbed soils would be reclaimed as quickly as possible or protective covers could be applied. Topsoil material would be segregated and not mixed or covered with subsurface material.

5.3.10.3.3 Special Status Plants.

The implementation of the following BMPs would avoid or reduce the effects of construction activities on special status species within the LPP Project corridor.

BMP-SS1: Protection by avoidance of known individuals and locations of habitats known to be occupied by federally listed species and other special status plant species.

BMP-SS2: Special status plant species present in the area of disturbance may be salvaged and transplanted into restoration areas.

BMP-SS3: Collect perennial special status plant seeds and seed plants on-site. Seeds may be collected from genetically identical populations as those plants lost to construction.

BMP-SS4: Avoid where possible routing pipeline and transmission line access roads through gypsum badlands with known special status plant populations and highly developed cryptobiotic soils.

5.3.10.3.4 Noxious and Invasive Plants.

Noxious weeds and invasive plants readily colonize disturbed areas and habitat edges, such as transportation and river corridors. Once established in these areas, noxious and invasive plants often continue to spread to adjacent habitats. All invasive plant species are aggressive competitors with the ability to significantly reduce diversity of native plant species. Eliminating or reducing the spread and establishment of noxious and invasive plants requires a proactive approach, in which there are two key elements. First, new introductions or expansion of existing infested habitats could be prevented to the maximum extent possible. Second, detection and eradication of undesirable species within the project area could reduce the potential for further expansion. The BMPs discussed in the following sections are applicable to all noxious and invasive weeds within the project area. When followed, these BMPs could reduce the likelihood of introducing noxious and invasive plants into new areas via construction and subsequent maintenance of the pipeline corridor. BMPs are most effective when they address site-specific weed issues; however, at this stage of the LPP Project, detailed plans are not available on which recommendations can be made.

5.3.10.3.4.1 Invasive Species - Prevention and Monitoring.

BMP-IS1: Minimize soil disturbance whenever possible. Invasive plants readily colonize areas of disturbed soil. Monitor recent work sites for the emergence of invasive plants for a minimum of two years after project completion.

BMP-IS2: Stabilize disturbed soils as soon as possible by seeding and/or using mulch, hay, rip-rap, or gravel that is free of invasive plant material. Seeds of native species should be used whenever possible. Efforts would be made to not plant species on any associated agency's invasive plant list.

BMP-IS3: Newly constructed access routes could be monitored for noxious and invasive weed infestations and treated during construction.

BMP-IS4: Post-construction and post-decommissioning monitoring may be performed for invasive plant species.

5.3.10.3.4.2 Invasive Species - Excavated Material.

BMP-IS5: Excavated material taken from sites that contain invasive plants would not be used away from the site of infestation until all viable plant material is destroyed. Excavated material from areas containing invasive plants may be reused within the exact limits of the infestation.

BMP-IS6: Any excavated material that contains viable plant material and is not reused within the limits of the infestation could be stockpiled on an impervious surface until viable plant material is destroyed or the material could be disposed of by burying a minimum of three feet below grade.

BMP-IS7: Whenever possible, excavation should be avoided in areas containing invasive species.

BMP-IS8: Soil and other materials containing invasive plants should be covered during transport.

5.3.10.3.4.3 Invasive Species - Movement and Maintenance of Equipment.

BMP-IS9: If work in areas containing noxious and invasive plants cannot be avoided, then the movement of maintenance and construction equipment would be from areas not infested to areas infested by noxious and invasive plants whenever possible. This is especially important during ditch cleaning and shoulder scraping activities. All equipment/vehicles would be cleaned (in a containment area) to prevent the spread of noxious weeds and invasive species.

BMP-IS10: To the extent possible, materials such as fill, loam, mulch, and hay would not be brought into project areas from sites where invasive plants are known to occur. If the absence of noxious and invasive plant parts in these materials cannot be guaranteed, recent work sites would be monitored for the emergence of invasive plants. Products would only be purchased from suppliers who can demonstrate that the products are certified weed-free.

BMP-IS11: Locate and use staging areas that are free of noxious and invasive plants to avoid spreading seeds and other viable plant parts. If staging areas are located in an area with noxious and invasive plants, treat areas with an herbicide prior to initial use.

BMP-IS12: If equipment is used in areas where noxious or invasive plants occur, all equipment, machinery, and hand tools would be cleaned of all visible soil and plant material before leaving the project site. Equipment would be cleaned at the site of infestation. Conversely, if equipment is brought from areas where noxious or invasive weeds may occur, into areas where they do not occur, all equipment, machinery, and hand tools would be cleaned of all visible soil and plant material before entering the project site. Acceptable methods of cleaning include, but are not limited to, portable wash stations that contain runoff from washing equipment (containment would be in conformance with wastewater discharge regulations), high pressure air, brush, broom, or other hand tools (used without water).

5.3.10.3.4.4 Invasive Species - Disposal of Plant Materials.

BMP-IS13: When noxious or invasive plants are cut or removed for roadside maintenance, construction, or control of plants, the spread of viable plant material could be avoided by rendering plant material nonviable. The following methods can be used to destroy plant material:

- Drying/Liquefying: For large amounts of plant material or for plants with rigid stems, place the material on asphalt, tarps, or heavy plastic and cover with tarps or heavy plastic to prevent the material from blowing away. For smaller amounts of plant material or for plants with pliable stems, bag the material in heavy-duty (3-mil or thicker) garbage bags. Keep plant material covered or bagged for at least one month. Material is nonviable when it is partially decomposed, very slimy, or brittle. Once material is nonviable, it can be disposed of in a landfill or brush pile.

- Brush Piles: Plant material from most invasive plants would be piled on site to dry out. Brush piles are recommended for woody shrubs, trees, and vines.

- Herbicide: Herbicide applications would be carried out by a licensed applicator with a permit from the appropriate land management and state agencies and following the label instructions will be mandatory.

BMP-IS14: When an herbicide is used to control vegetation, the climate, soil type, slope, vegetation type, and toxicity to special status plants could be considered in determining the risk of herbicide contamination.

BMP-IS15: Herbicide use would be limited to nonpersistent, immobile herbicides and would be applied only by licensed applicators in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

BMP-IS16: Only herbicides with low toxicity to wildlife and wild horses and burros would be used. Applicators would have to follow the label regardless of the toxicity level. The label would say if livestock needs to be removed for a particular amount of time after spraying.

BMP-IS17: Herbicides would not be applied during rain.

BMP-IS18: Appropriate herbicide-free buffer zones would be used for herbicides not labeled for aquatic use, based on BLM/Forest Service risk assessment guidance, which has minimum widths of 100 feet for aerial applications, 25 feet for applications dispersed by vehicle, and 10 feet for hand-spray applications. If an herbicide needs to be used near an aquatic area, an aquatic approved herbicide would be used.

5.3.10.4 Cumulative Effects

5.3.10.4.1 Proposed Action.

The Proposed Action could have indirect cumulative effects on special status plants and habitats when combined with the effects of the Southern Corridor Highway, which would cross the Proposed Action penstock alignment near Sand Hollow Reservoir. The vegetation clearing for the Southern Corridor Highway construction would permanently remove special status plants and habitats extending for miles north and south of the Proposed Action penstock crossing, with the intensity of the cumulative effects decreasing with distance from the intersection of the two projects. The indirect cumulative effects on special status plants and habitats would be minor. The Proposed Action could have short-term cumulative effects on special status plants and habitat with the Southern Corridor Highway if invasive and noxious weeds infest disturbed soils by both projects. These cumulative effects could become long-term cumulative effects if invasive and noxious weeds become established and pervasive in the areas disturbed during construction.

The Proposed Action could have indirect cumulative effects on special status plants and habitats when combined with the effects of the proposed Kern River-Hurricane Natural Gas Pipeline, which would parallel the Southern Corridor Highway. The vegetation clearing for the Kern River-Hurricane Natural Gas Pipeline construction would permanently remove special status plants and habitats extending for miles north and south of the Proposed Action penstock crossing, with the intensity of the cumulative effects decreasing with distance from the intersection of the two projects. The Proposed Action could have short-term cumulative effects on special status plants and habitat with the Kern River-Hurricane Natural Gas Pipeline if invasive and noxious weeds infest disturbed soils by both projects. These cumulative effects could become long-term cumulative effects if invasive and noxious weeds become established and pervasive in the areas disturbed during construction.

The indirect cumulative effects of the Proposed Action, Southern Corridor Highway and Kern River-Hurricane Natural Gas Pipeline on special status plants and habitats would be minor and short-term, with the Southern Corridor Highway effects permanent and the Proposed Action and Kern River-Hurricane Natural Gas Pipeline cumulative effects occurring only during construction. The indirect cumulative effects of the Proposed Action, Southern Corridor Highway and Kern River-Hurricane Natural Gas Pipeline on special status plant species and habitats could become long-term cumulative effects if invasive and noxious weeds infest disturbed soils by all three projects.

5.3.10.4.2 Existing Highway Alternative.

The Existing Highway Alternative would have the same cumulative effects on special status plants and habitats as described for the Proposed Action in Section 5.3.10.4.1, plus the following additional cumulative effects.

The Existing Highway Alternative could have minimal short-term indirect cumulative effects on special status plants and habitats when combined with the permanent effects of vegetation clearing for the Jackson Flat Reservoir located in close proximity to the Existing Highway Alternative alignment.

The Existing Highway Alternative could have minimal short-term direct cumulative effects on special status plants and habitats when combined with the permanent effects of the proposed Fredonia Flood Retarding Structure. The Existing Highway Alternative would be constructed under a portion of the Flood Retarding Structure embankment near Lost Spring Wash. The special status plants and habitats disturbed by constructing the Existing Highway Alternative would be revegetated with the same species if affected following construction completion.

5.3.10.4.3 Southeast Corner Alternative.

The Southeast Corner Alternative would have the same cumulative effects on special status plants and habitats as described for the Proposed Action in Section 5.3.10.4.1.

5.3.10.4.4 No Lake Powell Water Alternative.

The No Lake Powell Water Alternative is not expected to have cumulative effects on special status plant species and habitats in the St. George metropolitan area.

5.3.10.4.5 No Action Alternative.

The No Action Alternative is not expected to have cumulative effects on special status plant species and habitats.

5.3.10.5 Unavoidable Adverse Effects

5.3.10.5.1 Proposed Action.

The Proposed Action would have short-term unavoidable adverse effects on special status plant species and habitats during construction. The portions of the ROW used for access roads along the Proposed Action alignment could have long-term unavoidable adverse effects on special status plant species and habitats because the road surfaces would not be revegetated. The Proposed Action features (pump stations, regulating tank, hydro stations, forebay reservoir, afterbay reservoir, substations and switchyards) could have long-term unavoidable adverse effects on special status plant species and habitats because the footprint of these features (1,619 acres) would not be revegetated following construction. The Proposed Action would have long-term unavoidable adverse effects on short segments of cryptobiotic crust soils that are habitat for five special status plant species. The federally listed (threatened) species *Pediocactus sileri* would be avoided by the Proposed Action construction.

5.3.10.5.2 Existing Highway Alternative.

The Existing Highway Alternative would have the same unavoidable adverse effects on special status plant species and habitats as described for the Proposed Action in Section 5.3.10.5.1, except the long-term unavoidable adverse effects on special status plant species and habitats from the footprint of project features would be 1,469 acres not revegetated following construction. The Existing Highway Alternative would have significant unavoidable adverse effects on the five species of special status plants that grow in cryptobiotic crust soils. Long segments of cryptobiotic crust soils would be disturbed by penstock construction along the alignment through Fredonia, west of Fredonia and across the Kaibab-Paiute Indian Reservation parallel to Arizona Route 389. The federally-listed (threatened) species *Pediocactus sileri* would not be avoided by the Existing Highway Alternative construction and at least 2,945 listed threatened plants and their habitat would be adversely affected. This effect would be a significant long-term effect on *Pediocactus sileri* and its habitat.

5.3.10.5.3 Southeast Corner Alternative.

The Southeast Corner Alternative would have the same unavoidable adverse effects on special status plant species and habitats as described for the Proposed Action in Section 5.3.10.5.1, except the long-term unavoidable adverse effects on special status plant species and habitats from the footprint of project features would be 1,611 acres not revegetated following construction.

5.3.10.5.4 No Lake Powell Water Alternative.

The No Lake Powell Water Alternative is not expected to have unavoidable adverse effects on special status plant species and habitats in the St. George metropolitan area.

5.3.10.5.5 No Action Alternative.

The No Action Alternative would have no effects on special status plant species or noxious weeds.

5.3.10.6 References

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