

**VEGETATION ASSESSMENT
FOR THE PROPOSED SKUNK CAMP
TAILINGS STORAGE FACILITY IN
GILA AND PINAL COUNTIES, ARIZONA**
Resolution Copper

Prepared for:



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I. INTRODUCTION AND BACKGROUND

WestLand Resources, Inc. (WestLand), was retained by Resolution Copper (Resolution) to conduct a vegetation assessment within the Skunk Camp Tailings Storage Facility (TSF) Preferred Alternative footprint, in support of the U.S. Forest Service (USFS) evaluation of Resolution's planned mine development. The objective of this assessment is to fulfill the requirements of Draft Environmental Impact Statement (DEIS) Appendix J, Mitigation and Monitoring Plan, Forest Service mitigation measure FS-225 (FS-225), which states: *'in order to support detailed final reclamation plans and a final mining plan of operations, vegetation surveys need to be conducted within the disturbance footprint of the Preferred Alternative tailings storage facility. These surveys would identify general vegetation present, density, abundance of native/ non-native species, and any special status plant species for which site characteristics are appropriate for occurrence. The appropriate level of detail for these surveys would be determined in conjunction with the Tonto National Forest. The Forest Service is requiring that these surveys be conducted between the DEIS and FEIS.'*

To satisfy the FS-225 criteria, WestLand conducted vegetation surveys in the Skunk Camp TSF Preferred Alternative footprint (the Assessment Area) in October and November 2019. The Assessment Area is located within Gila and Pinal counties, Arizona, on approximately 4,002 acres of private lands and State Trust Land administered by the Arizona State Land Department (**Figure 1**). The Assessment Area is situated in the Dripping Springs Mountains and roughly centered on Dripping Springs Wash. Elevation in the Assessment Area ranges from approximately 3,074 to 3,730 feet above mean sea level (amsl). The Assessment Area contains three biotic communities, as broadly mapped by Brown and Lowe (The Nature Conservancy 2012): Semi-desert Grassland, Interior Chaparral, and Arizona Upland Subdivision of Sonoran Desertscrub.

The surveys were conducted by teams of WestLand biologists and Tribal Monitors participating in the Tonto National Forest Tribal Monitor Training Program (the Program). The Program was initially designed to incorporate Native American tribal perspectives into environmental review and decision-making processes, to identify places of cultural significance using Traditional Ecological Knowledge, and to provide representatives of several Native American tribal communities with training in modern cultural resources survey methods. The Program has since been expanded to include Tribal Monitor participation in biological resources surveys as well.

In order to meet the requirements of FS-225, three specific objectives were developed for the assessment:

1. Identify general vegetation present.
2. Estimate the density and abundance of native/non-native species.
3. Determine if any special status plant species or potential habitat occur.

The following sections provide the vegetation data collection and analysis methods (**Section 2**), the vegetation assessment results (**Section 3**), and the references cited within the text (**Section 4**). A total list of plant species identified within the Assessment Area is provided in **Appendix A**. Representative photographs of the vegetative habitat within Assessment Area are provided in **Appendix B**.

2. METHODS

In order to identify general vegetation present in the Assessment Area (**Objective 1**) a spatial derivation of a digital map of Brown and Lowe's *Biotic Communities of the Southwest* (The Nature Conservancy 2012) was used to identify discrete vegetation alliances. This classification was refined through photointerpretation of aerial imagery and on-site field visits that evaluated species composition and structure. Vegetation alliances were marked on aerial photographs during field surveys then digitized to create a vegetation map of the Assessment Area (**Figure 2**). The resultant alliances were inspected in true color display and in false color infrared displays to identify areas of interest and inform survey efforts.

The vegetation assessment surveys and mapping efforts incorporate core methods of the Bureau of Land Management (BLM) Assessment, Inventory, and Monitoring (AIM) Strategy (Herrick et al. 2017) and the Spring Stewardship Institute (SSI) Springs Ecosystem Inventory Protocols (Stevens et al. 2016). Nomenclature assigned to the identified vegetation alliances within the Assessment Area aligns with U.S. Department of Agriculture (USDA) vegetation classification methodology (USDA 1997). Four vegetation alliances were identified; Juniper Woodland Alliance, Shrubland Alliance Sparsely Vegetated Area, Mesquite-Catclaw Acacia Alliance, and Pondweed Dominated Earthen Tank (**Figure 2**). These four alliances were used as a sampling framework for ground survey.

In order to estimate the relative density and abundance of plant species within the Assessment Area, biologists designed a three-tiered (basal, shrub and canopy cover by species) plant cover sampling methodology (**Objective 2**). The high density of individual plant stems within each sample polygon precluded directly counting individual plants to estimate density (Damgaard 2014). Therefore, the combination of basal, shrub and canopy absolute cover was used to estimate the relative density and abundance of species (**Objective 2**). Relative density was calculated by dividing the absolute mean cover within each stratum (basal, shrub and canopy cover) by the total percent vegetation cover and multiplying the quotient by 100—(Individual species cover/total vegetation cover) x 100—(**Exhibits 1, 2 and 3**). Plant species abundance was expressed as the absolute percent cover of each species within each stratum (**Tables 1, 2 and 3**).

Structured cluster sampling was used within these four biotic communities in order to estimate the density and abundance of native/non-native species (**Objective 2**) and determine if any special-status plant species or potential habitat occur within the Assessment Area (**Objective 3**). The total coverage of these four alliances was used to drive sampling intensity. In total, 95 sample points were established

throughout the Assessment Area (**Figure 2**). The smallest vegetation alliance, Pondweed Dominated Earthen Tank (<0.001% of the Assessment Area) had one cluster sample with three sample points. Mesquite-Catclaw Acacia Alliance (3% of Assessment Area) had six cluster samples each with two to six sample points within each cluster for a total of 23 sample points. The Shrubland Alliance and Sparsely Vegetated Area alliance (30% of the Assessment Area) had seven sample clusters totaling 26 sample points. The largest alliance, Juniper Woodland Alliance (66% of Assessment Area) had nine sample clusters for a total of 43 sample points (**Figure 2**).

Sample plots were established along pedestrian survey transects throughout the Assessment Area. Plots were spaced approximately 165 to 330 feet apart and selected to represent the typical vegetative composition of the area. Plots were circular, each measuring an 8.2-foot radius (measured from a georeferenced waypoint). Within each circular plot, surveyors conducted floristic inventories to identify all plant species present and percent cover within the three sampling stratum. Taxonomic circumscription and common names follow the Southwestern Environmental Information Network (SEINet Portal Network 2019). Identification was performed to species level where practicable, though some plants could only be identified to genus level due to lack of reproductive structures or other necessary diagnostic features at the time of the survey. Surveyors conducted ocular estimations of percent cover (VE%C) for each species by cover strata within each plot, following the methods described in the SSI Springs Ecosystems Inventory Protocols (Stevens et al. 2016). The cover categories include: Aquatic, algae and emergent plants; Non-vascular, mosses, liverworts, and lichens; basal cover, live or dead stems > 3.9 inches in length emerging from the ground; shrub cover, perennial vegetation 0 to 13.1 feet tall; and canopy cover, perennial woody vegetation > 13.1 feet tall. A single small individual or species with a few small individuals within a plot was given a trace score of 0.1%. The sample plot data was grouped according to the vegetation alliance that each plot occurred in and calculated the mean VE%C for each species in each stratum to estimate relative density and abundance within each vegetation alliance.

3. RESULTS

Objective 1. Identify General Vegetation Present

In total, 175 vascular plant terminal taxa were identified within the Assessment Area (**Appendix A**). The majority of plant species detected (138) were Eudicots representing 46 discrete families. Thirty-two species of Monocots in six families were detected, along with two conifers (and relatives) within two families, and three species of ferns (and relatives) within two families. A high total diversity was detected within the Assessment Area, and species composition and percent cover varied considerably within the four alliances. The majority of species accounted for a small portion of total cover. Many species occurred in a small number of plots or contributed trace VE%C cover scores, resulting in mean cover values below 0.001% when calculated across the species' respective vegetation alliance(s). Species with mean cover values below 0.001% are reported in the total species list in **Appendix A**. All other species

mean basal, shrub and canopy cover are reported in **Tables 1, 2 and 3** in alphabetical order by species 4-letter code, categorized by the Juniper Woodland, Shrubland and Sparsely Vegetated Area, and Mesquite-Catclaw Acacia alliances, and presented graphically in **Exhibits 1, 2 and 3**, respectively. Due to the small proportion of the Pondweed Dominated Earthen Tank alliance within the Assessment Area (<0.001%) and the small sample size (3 plots), mean basal, shrub, and canopy cover of this alliance were not analyzed.

Objective 2. Estimate the Density, Abundance of Native/Non-native Species

Juniper Woodland Alliance

Approximately 66% of the Assessment Area (2680.4 acres) was mapped as Juniper Woodland Alliance (**Figure 2**). These juniper woodlands are most conspicuous along north facing slopes but also occur in variety of topographies (**Appendix B; Photos 1 through 9**). Across the sample plots in this alliance, total mean canopy cover was 6.9% (**Table 1**). One-seed juniper (*Juniperus monosperma*; JUMO) was the most abundant (5.2%). Other species contributing to the canopy stratum include netleaf hackberry (*Celtis reticulata*; CERE), blue palo verde (*Parkinsonia florida*; PAFL), velvet mesquite (*Prosopis velutina*; PRVE), scrub oak (*Quercus turbinella*; QUTU), and sugar sumac (*Rhus ovata*; RHOV), though combined these species accounted for 1.7% cover. Mean shrub cover was 31.7%, and one-seed juniper was the most abundant (10.5%). An additional 36 species contribute to the shrub layer, the most dominant of which included catclaw acacia (*Acacia greggii*; ACGR, 3.1%), scrub oak (2.6%), and turpentine bush (*Ericameria laricifolia*; ERLA, 2.4%), velvet mesquite (2.3%), and whitethorn acacia (*Acacia constricta*; ACCO, 2.1%). Total mean basal cover was approximately 5.7%. Thirty-four species contributed to this stratum, though all species contributed less than 1% basal cover individually. One-seed juniper was once again the most abundant species in the basal stratum, contributing 0.8% cover (**Table 1**).

Relative density varied across the three-sample stratum (**Exhibit 1**). Within the basal stratum, four plant species accounted for 50% of the relative density: turpentine bush (ERLA, 14.6%); one-seed juniper (JUMO, 14.4%); catclaw acacia (ACGR, 10.5%); and whitethorn acacia (ACCO, 10.5%). The remaining 35 plant species accounted for the remaining 50% relative density. Within the shrub stratum, one-seed juniper (JUMO) was 33% of the relative density and the remaining 38 plant species made up 77% of relative density. One-seed juniper (JUMO) also made up 76% of the relative density of the canopy stratum (**Exhibit 1**).

Table 1. Juniper Woodland Alliance Vegetation Species Abundance (Mean Cover) Values by Cover Stratum

Species Common Name (Scientific Name)	Species 4-Letter Code	% Mean Cover		
		Basal Stratum ¹	Shrub Stratum ²	Canopy Stratum ³
whitethorn acacia (<i>Acacia constricta</i>)	ACCO	0.598	2.095	0
catclaw acacia (<i>Acacia greggii</i>)	ACGR	0.600	3.147	0
Palmer's agave (<i>Agave cf. palmeri</i>)	AGPA	0.116	0.233	0
bee brush (<i>Aloysia wrightii</i>)	ALWR	0	0.002	0
singlewhorl burrobush (<i>Ambrosia monogyra</i>)	AMMO	0.002	0	0
white sagebrush (<i>Artemisia ludoviciana</i>)	ARLU	0.126	0	0
desert broom (<i>Baccharis sarothroides</i>)	BASA	0.002	0.116	0
desert baccharis (<i>Baccharis sergiloides</i>)	BASE	0.002	0.116	0
barberry (<i>Berberis haematocarpa</i>)	BEHA	0.126	0.709	0
fairyduster (<i>Calliandra eriophylla</i>)	CAER	0.470	0.116	0
crucifixion thorn (<i>Canotia holacantha</i>)	CAHO	0.002	0.002	0
mountain mahogany (<i>Cercocarpus montanus</i>)	CEMO	0.233	0.698	0
desert hackberry (<i>Celtis pallida</i>)	CEPA	0.002	0.116	0
netleaf hackberry (<i>Celtis reticulata</i>)	CERE	0.121	0.933	0.233
desert willow (<i>Chilopsis linearis</i>)	CHLI	0	0.002	0
cholla (<i>Cylindropuntia</i> spp.)	CYLI	0.012	0.240	0
sotol (<i>Dasylirion wheeleri</i>)	DAWH	0.002	0.119	0
Mormon tea (<i>Ephedra</i> sp.)	EPHE	0.002	0.002	0
turpentine bush (<i>Ericameria laricifolia</i>)	ERLA	0.833	2.444	0
Wright's buckwheat (<i>Eriogonum wrightii</i>)	ERWR	0.128	0.116	0
barrel cactus (<i>Ferocactus wislizeni</i>)	FEWI	0.002	0.002	0
snakeweed (<i>Gutierrezia sarothrae</i>)	GUSA	0.028	0.356	0
jimmyweed (<i>Isocoma tenuisecta</i>)	ISTE	0.121	0.349	0
one-seed juniper (<i>Juniperus monosperma</i> s.l.)	JUMO	0.819	10.465	5.235
range ratany (<i>Krameria erecta</i>)	KRER	0	0.002	0
wait-a-minute bush (<i>Mimosa aculeaticarpa</i>)	MIAC	0.119	0.235	0
prickly pear cactus (<i>Opuntia</i> spp.)	OPUN	0.249	0.698	0
blue palo verde (<i>Parkinsonia florida</i>)	PAFL	0	0.119	0.349
ground cherry (<i>Physalis</i> sp.)	PHOR	0	0.116	0
velvet mesquite (<i>Prosopis velutina</i>)	PRVE	0.126	2.326	0.349
scrub oak (<i>Quercus turbinella</i>)	QUTU	0.353	2.560	0.233
fragrant sumac (<i>Rhus aromatica</i>)	RHAR	0.002	0.116	0
hollyleaf buckthorn (<i>Rhamnus ilicifolia</i>)	RHIL	0.005	0.470	0
sugar sumac (<i>Rhus ovata</i>)	RHOV	0.002	0.698	0.465

Table 1. Juniper Woodland Alliance Vegetation Species Abundance (Mean Cover) Values by Cover Stratum

Species Common Name (Scientific Name)	Species 4-Letter Code	% Mean Cover		
		Basal Stratum ¹	Shrub Stratum ²	Canopy Stratum ³
jojoba (<i>Simmondsia chinensis</i>)	SICH	0.126	0.581	0
Rusby's globemallow (<i>Sphaeralcea rusbyi</i>)	SPRU	0.009	0.002	0
tamarisk (<i>Tamarix</i> cf. <i>chinensis</i>)	TACH	0.116	0.233	0
banana yucca (<i>Yucca baccata</i>)	YUBA	0.235	0.930	0
graythorn (<i>Ziziphus obtusifolia</i>)	ZIOB	0.002	0.233	0
TOTAL Mean Percent Cover		5.691	31.697	6.864

¹ Basal cover – live or dead stems > 3.9 inches in length emerging from the ground

² Shrub cover – perennial vegetation 0 to 13.1 feet tall

³ Canopy cover – perennial woody vegetation > 13.1 feet tall

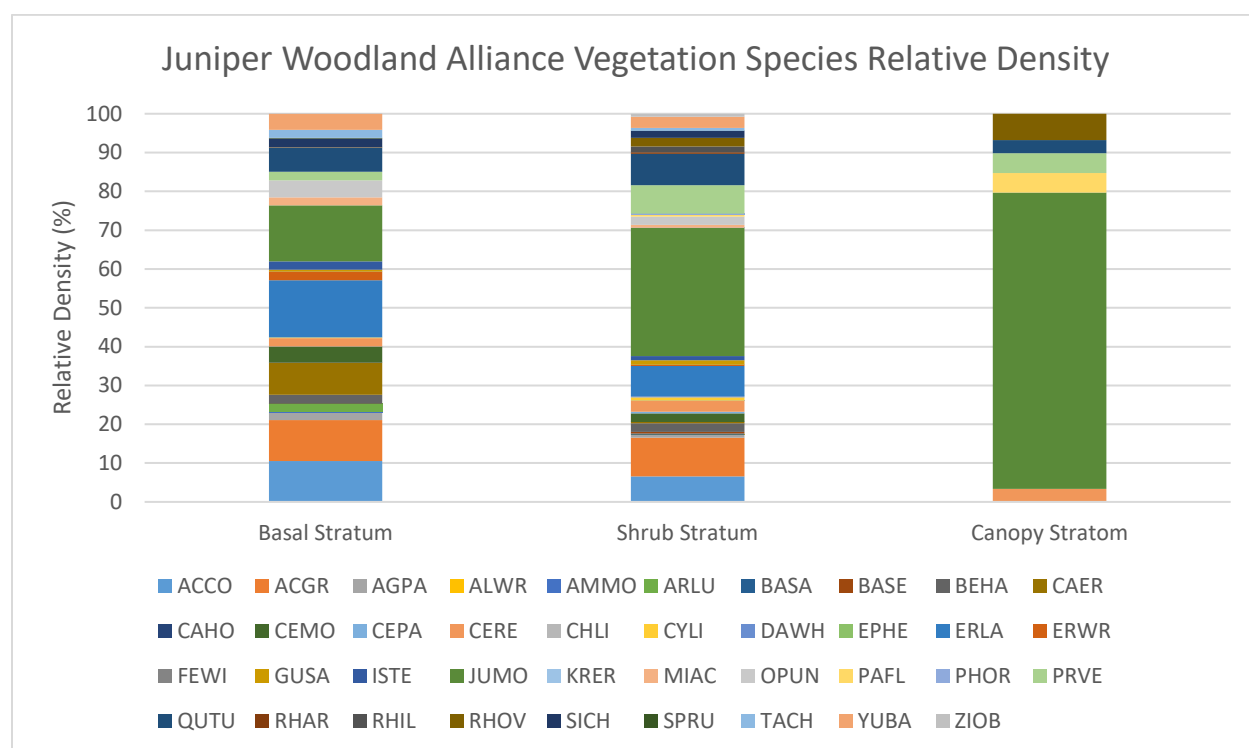


Exhibit 1. Juniper Woodland Alliance Vegetation Species Relative Density by Stratum

Shrubland Alliance and Sparsely Vegetated Area

Approximately 30% of the Assessment Area (1183.1 acres) was mapped as Shrubland Alliance and Sparsely Vegetated Area (**Figure 2**). These areas typically align with upland topography receiving full sun and are dominated by shrubs and grasses (**Appendix B, Photos 10 through 20**). Across the sample plots in this alliance, total mean canopy cover is low (approximately 0.8%), and only one-seed juniper contributed to the canopy stratum. Sixteen species contributed to the shrub stratum, and total mean shrub cover is approximately 24.3%. Prickly pear cactus (*Opuntia spp.*; OPUN) and turpentine bush were the most abundant species in the shrub stratum (5.0% and 4.8%, respectively), followed by one-seed juniper (2.5%), cholla (*Cylindropuntia spp.*; CYLI, 2.3%), whitethorn acacia (2.3%), fairy duster (*Calliandra eriophylla*; CAER, 1.4%), jimmyweed (*Isocoma tenuisecta*; ISTE, 1.3%), velvet mesquite (1.2%), and catclaw acacia (1.1%), with all other species contributing less than 1% mean shrub cover. Total mean basal cover was 11.2%. the most abundant species in the basal stratum include turpentine bush (2.9%), prickly pear cactus (1.6%), cholla (1.4%), snakeweed (*Gutierrezia sarothrae*; GUSA, 1.2%) (**Table 2**).

The relative density of species varied across the three-sampling stratum (**Exhibit 2**). The relative density within the basal and shrub stratum were similar. Within the basal stratum, turpentine bush accounted for 25.9 of relative density followed by prickly pear cactus (OPUN, 14.1%) and cholla (CYLI, 12.1%). The remaining 47.9% of relative density was spread across 19 species (**Exhibit 2**). The relative density in the shrub stratum was dominated by the same four species: prickly pear cactus (20.6%) turpentine bush (19.8%) and cholla (9.5%), and one-seed juniper (10.3%). The remaining 39.8% of relative density was spread across 18 species. Only one-seed juniper was detected within the canopy and thus this species accounts for 100% of relative density.

Table 2. Shrubland Alliance and Sparsely Vegetated Area Vegetation Species Abundance (Mean Cover) by Stratum

Species Common Name (Scientific Name)	Species 4-Letter Code	% Mean Cover		
		Basal Stratum ¹	Shrub Stratum ²	Canopy Stratum ³
whitethorn acacia (<i>Acacia constricta</i>)	ACCO	0.796	2.312	0
catclaw acacia (<i>Acacia greggii</i>)	ACGR	0.200	1.162	0
desert broom (<i>Baccharis sarothroides</i>)	BASA	0.004	0	0
fairyduster (<i>Calliandra eriophylla</i>)	CAER	0.981	1.350	0
cholla (<i>Cylindropuntia</i> spp.)	CYLI	1.358	2.315	0
sotol (<i>Dasylirion wheeleri</i>)	DAWH	0.385	0.769	0
brittlebush (<i>Encelia farinosa</i>)	ENFA	0.004	0	0
Mormon tea (<i>Ephedra</i> sp.)	EPHE	0.004	0	0
turpentine bush (<i>Ericameria laricifolia</i>)	ERLA	2.900	4.812	0
Wright's buckwheat (<i>Eriogonum wrightii</i>)	ERWR	0.196	0	0
snakeweed (<i>Gutierrezia sarothrae</i>)	GUSA	1.204	0.781	0
jimmyweed (<i>Isocoma tenuisecta</i>)	ISTE	0.769	1.346	0
one-seed juniper (<i>Juniperus monosperma</i> s.l.)	JUMO	0.392	2.500	0.769
range ratany (<i>Krameria erecta</i>)	KRER	0.004	0.192	0
twinberry (<i>Menodora scabra</i>)	MESC	0.012	0	0
tree tobacco (<i>Nicotiana glauca</i>)	NIGL	0.004	0.192	0
prickly pear cactus (<i>Opuntia</i> spp.)	OPUN	1.585	5.008	0
blue palo verde (<i>Parkinsonia florida</i>)	PAFL	0.008	0.196	0
velvet mesquite (<i>Prosopis velutina</i>)	PRVE	0.392	1.154	0
paper flower (<i>Psilostrophe</i> sp.)	PSIL	0.008	0	0
jojoba (<i>Simmondsia chinensis</i>)	SICH	0	0.004	0
tamarisk (<i>Tamarix</i> cf. <i>chinensis</i>)	TACH	0.008	0.192	0
TOTAL Mean Percent Cover		11.214	24.285	0.769

¹ Basal cover – live or dead stems > 3.9 inches (10 cm) in length emerging from the ground

² Shrub cover – perennial vegetation 0 to 13.1 feet (4 m) tall

³ Canopy cover – perennial woody vegetation > 13.1 feet (4 m) tall

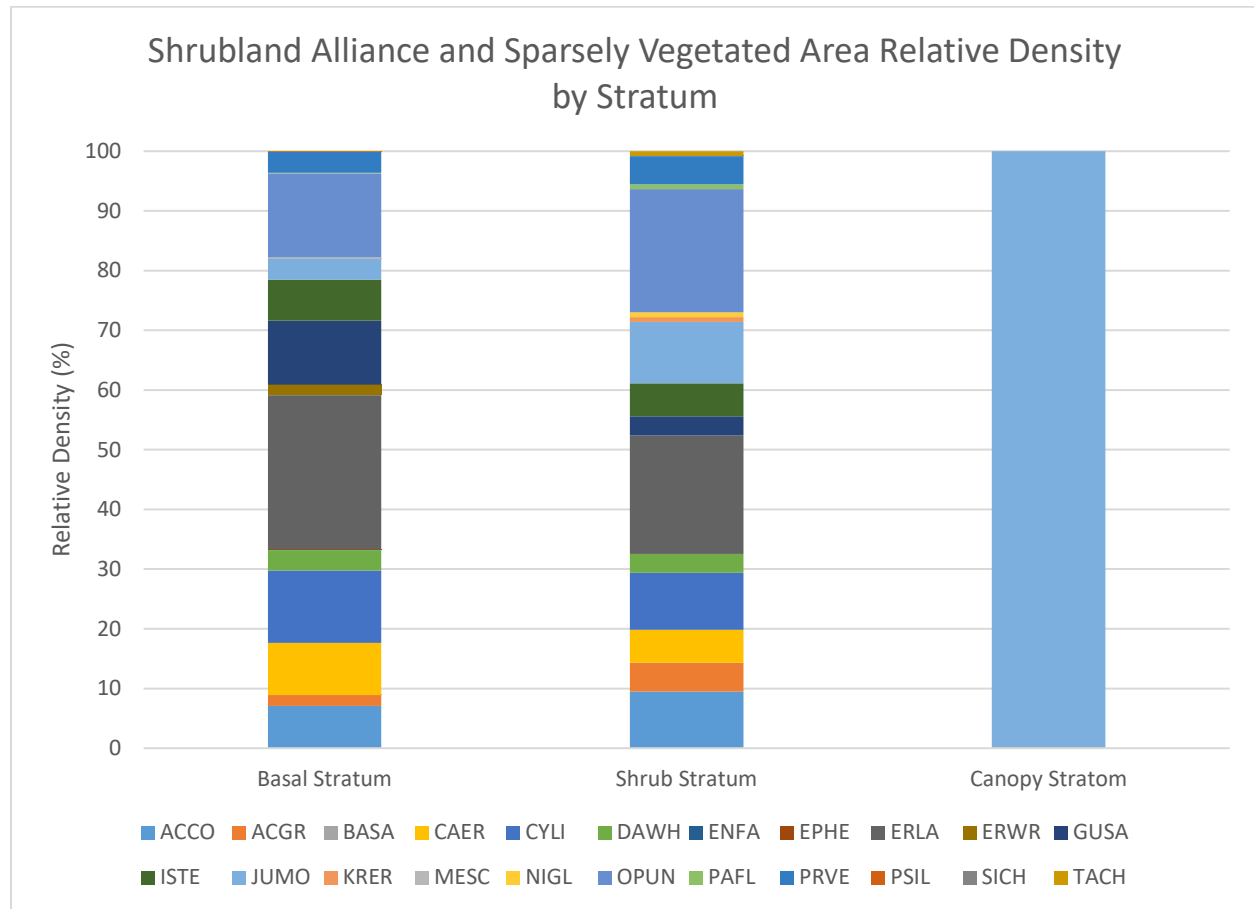


Exhibit 2. Shrubland Alliance and Sparsely Vegetated Area Vegetation Species Relative Density by Stratum

Mesquite-Catclaw Acacia Alliance

Approximately 3% of the Assessment Area (137.4 acres) was mapped as Mesquite-Catclaw Acacia Alliance (**Figure 2**). These areas are characterized by relatively flat lowland floodplains and washes (**Appendix B, Photos 21 through 28**). Across the sample plots in this alliance, total mean canopy cover was 6.1%, four species had the highest abundance; velvet mesquite (2.8% mean cover), one-seed juniper (1.3%), netleaf hackberry (1.3%), and whitethorn acacia (0.7%). Total mean shrub cover was approximately 34%, the most abundant species were velvet mesquite and catclaw acacia combined contributing over half of the cover in the stratum (17.6%). Other abundant species in the shrub stratum included whitethorn acacia (3.3%), one-seed juniper (2.4%) and singlewhorl burrobush (*Ambrosia monogyra*; AMMO, 2.0%). Total mean basal cover was 7.1%, with 16 species contributing to the basal stratum. Catclaw acacia and singlewhorl burrobush were the most abundant species in the basal stratum (1.5% and 1.3% mean cover, respectively), with the remaining 14 species contributing less than 1% mean cover (**Table 3**).

Relative density varied across sample stratum (**Exhibit 3**). Within the basal stratum, catclaw acacia had the highest relative density (21.6%) followed by singlewhorl burrobush (AMMO, 18.4%), and jimmyweed (ISTE, 12.4%) the remaining 15 species accounted for 47.6% of relative density. Velvet mesquite (PRVE) had the highest relative density in the shrub stratum (33.9%) followed by catclaw acacia (18.0%) and whitethorn acacia (9.6%) the remaining 15 species accounted for the remaining 38.5% of relative density. Within the canopy stratum, four species accounted for 100% of the relative density: velvet mesquite (46.4%), one-seed juniper (21.4%), netleaf hackberry (21.4%), and whitethorn acacia (10.7%).

Table 3. Mesquite-Catclaw Acacia Alliance Vegetation Species Abundance (Mean Cover) Values by Stratum

Species Common Name (Scientific Name)	Species 4-Letter Code	% Mean Cover		
		Basal Stratum ¹	Shrub Stratum ²	Canopy Stratum ³
whitethorn acacia (<i>Acacia constricta</i>)	ACCO	0.461	3.265	0.652
catclaw acacia (<i>Acacia greggii</i>)	ACGR	1.539	6.096	0
singlewhorl burrobush (<i>Ambrosia monogyra</i>)	AMMO	1.309	1.957	0
barberry (<i>Berberis haematocarpa</i>)	BEHA	0.239	1.087	0
brickellbush (<i>Brickellia californica</i>)	BRCA	0.004	0.217	0
netleaf hackberry (<i>Celtis reticulata</i>)	CERE	0.435	0.652	1.304
desert willow (<i>Chilopsis linearis</i>)	CHLI	0	0.652	0
turpentine bush (<i>Ericameria laricifolia</i>)	ERLA	0.217	0.435	0
snakeweed (<i>Gutierrezia sarothrae</i>)	GUSA	0.030	0.009	0
jimmyweed (<i>Isocoma tenuisecta</i>)	ISTE	0.883	1.748	0
one-seed juniper (<i>Juniperus monosperma</i> s.l.)	JUMO	0.435	2.391	1.304
wait-a-minute bush (<i>Mimosa aculeaticarpa</i>)	MIAC	0.435	1.304	0
prickly pear cactus (<i>Opuntia</i> spp.)	OPUN	0.009	0.222	0
velvet mesquite (<i>Prosopis velutina</i>)	PRVE	0.448	11.522	2.826
scrub oak (<i>Quercus turbinella</i>)	QUTU	0	0.435	0
fragrant sumac (<i>Rhus aromatica</i>)	RHAR	0.009	0.004	0
banana yucca (<i>Yucca baccata</i>)	YUBA	0.652	1.304	0
graythorn (<i>Ziziphus obtusifolia</i>)	ZIOB	0.004	0.652	0
TOTAL Mean Percent Cover		7.109	33.952	6.086

¹ Basal cover – live or dead stems > 3.9 inches in length emerging from the ground

² Shrub cover – perennial vegetation 0 to 13.1 feet tall

³ Canopy cover – perennial woody vegetation > 13.1 feet tall

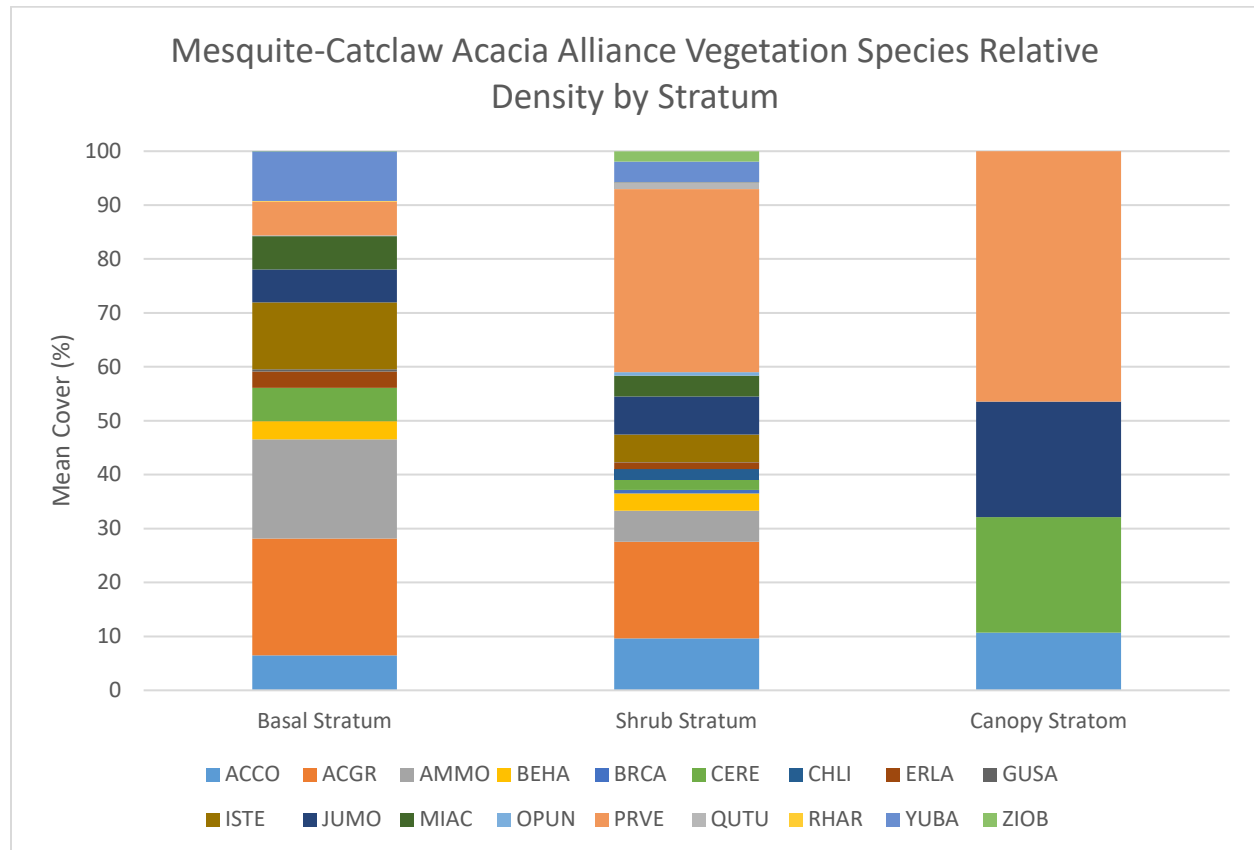


Exhibit 3. Mesquite-Catclaw Acacia Alliance Vegetation Species relative density by Stratum

Pondweed Dominated Earthen Tank

Approximately 0.0003% of the Assessment Area (1.2 acres) was mapped as Pondweed Dominated Earthen Tank (**Figure 2**). Although the Assessment Area contains numerous earthen tanks and relic tanks, only two have been observed by WestLand to hold surface water (WestLand 2020, In Prep) (**Appendix B, Photos 29 through 32**). At the time of survey, the wetted areas in this alliance were dominated by pondweed (*Potamogeton* sp.), a submerged aquatic plant, and the perimeters of both tanks comprising this alliance were sparsely vegetated, likely due to cattle, which are known to graze throughout the Assessment Area. Concrete and metal cattle drinkers and other smaller hydrological features within the Assessment Area hosted similar vegetation (**Appendix B, Photos 33 and 34**), though these features were not mapped as part of this alliance due to their small size.

Non-Native Species

Cluster sampling and opportunistic documentation resulted in the detection of 13 non-native taxa within the Assessment Area (**Appendix A**; non-native species indicated with an asterisk). Widespread non-native species include red brome (*Bromus rubens*), stork's-bill (*Erodium cicutarium*), and London rocket (*Sisymbrium irio*). Non-native species with more limited occurrence include Bermuda grass (*Cynodon dactylon*), common mallow (*Malva neglecta*), desert mustard (*Brassica tournefortii*), golden-top grass

(*Lamarckia aurea*), oats (*Avena* sp.), Russian thistle (*Salsola tragus*), shepherd's purse (*Capsella bursa-pastoris*), stinkgrass (*Eragrostis cilianensis*), tamarisk (*Tamarix* cf. *chinensis*), and tree tobacco (*Nicotiana glauca*).

Objective 3. Determine If Any Special-status Plant Species or Potential Habitat Occurs

Prior to conducting the field survey, WestLand reviewed special status species lists generated for the Assessment Area, including a list from a U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation Report (IPaC) online query¹ and a list from an Arizona Game and Fish Department (AGFD) Heritage Database Management System (HDMS) online environmental review tool query² (WestLand 2018). The plant species identified in these lists include Arizona hedgehog cactus (AHC; *Echinocereus triglochidiatus* var. *arizonicus*), which is listed as endangered without critical habitat by the USFWS under the Endangered Species Act (USFWS 2000) and as Highly Safeguarded under Arizona Native Plant Law (Arizona Department of Agriculture 2016), and San Carlos wild-buckwheat (*Eriogonum capillare*), which is listed as Salvage Restricted under Arizona Native Plant Law (Arizona Department of Agriculture 2016). No AHC were located during the survey and furthermore, the Assessment Area lacks the appropriate geologic substrate for AHC (WestLand 2018) and is located outside of AHC predicted habitat (Baker 2013). San Carlos wild-buckwheat is present within the Assessment Area (**Appendix A**), and approximately 10 individuals were observed along a road cut in the northeastern portion of the Assessment Area within the Juniper Woodland Alliance community.

¹ The IPaC list identifies special status species and designated and proposed critical habitat that *may* occur within one or more delineated United States Geological Survey 7.5-minute quadrangles that the Assessment Area intersects.

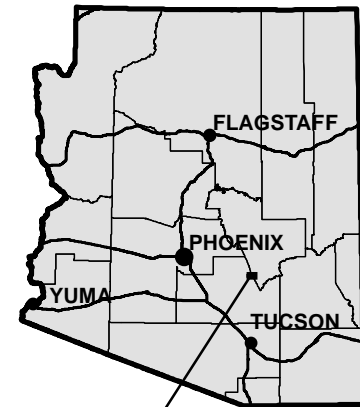
² The AGFD HDMS online environmental review tool query was used to identify records of special status species within 5 miles of the Assessment Area.

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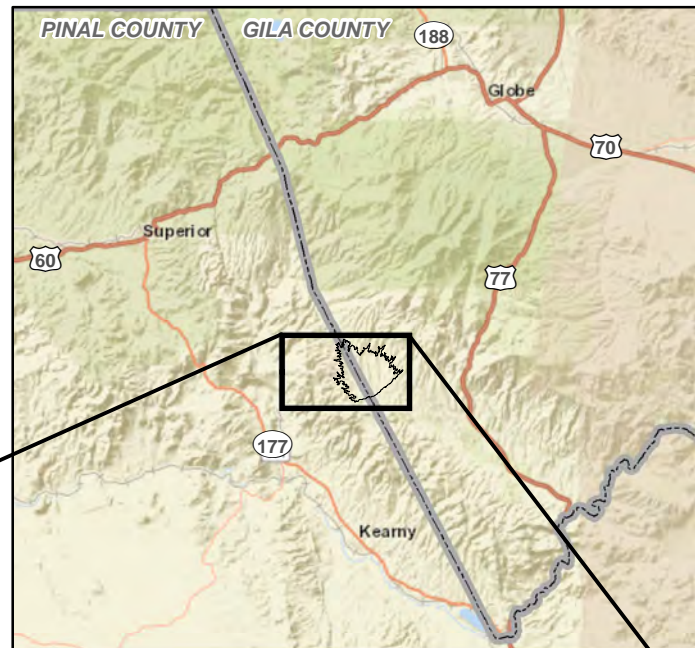
FIGURES

ARIZONA

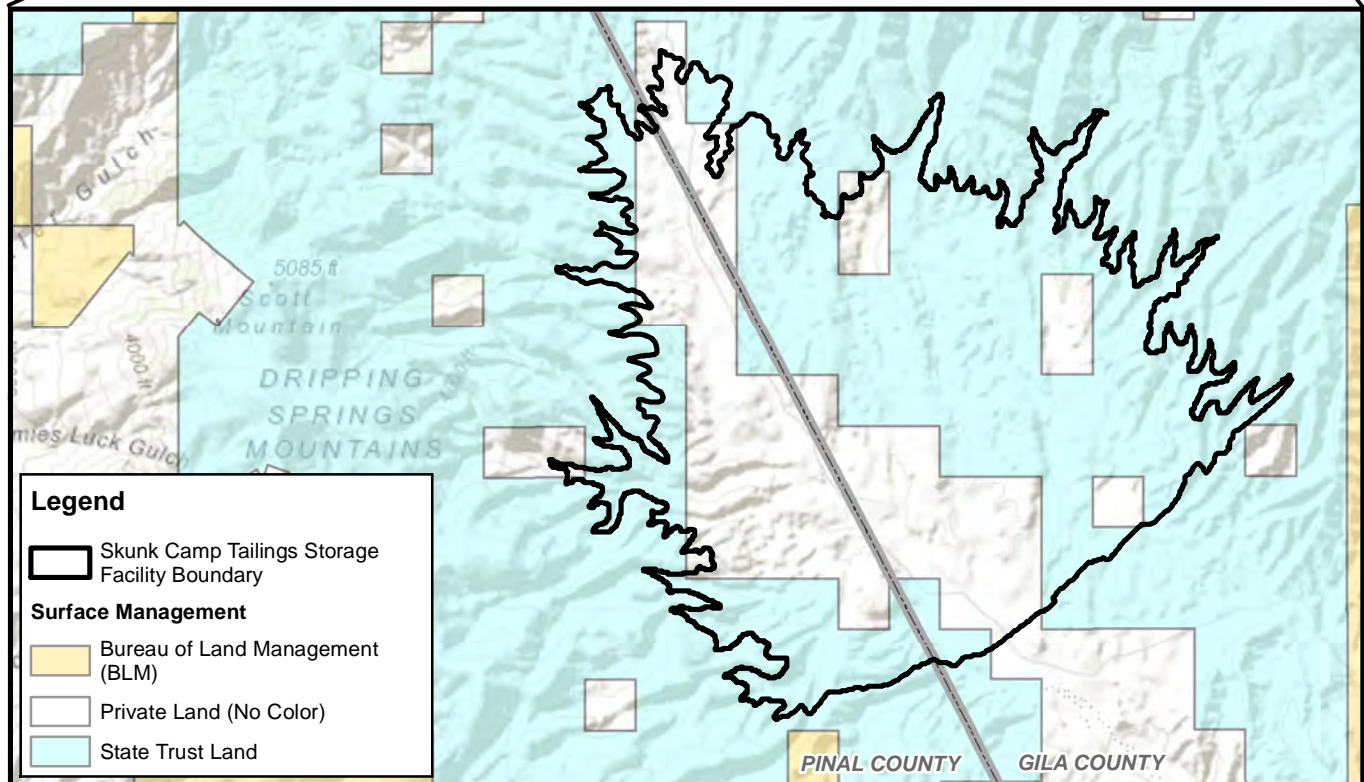


PROJECT LOCATION

PROJECT VICINITY



Approximate Scale 1 Inch = 10 Miles



T2S, R14E, Portions of Sections 33-35,
 T3S, R14E, Portions of Sections 1-4, 9-12 and 14-16,
 Pinal and Gila Counties, Arizona,
 Data Source: SWCA (DEIS)
 Surface Management: BLM 2019, WRI modified 2019
 Image Source: ArcGIS Online, World Street Map and
 World Topographic Map

RESOLUTION COPPER
 Vegetation Assessment for the
 Proposed Skunk Camp Tailings Storage Facility
 in Gila and Pinal Counties, Arizona

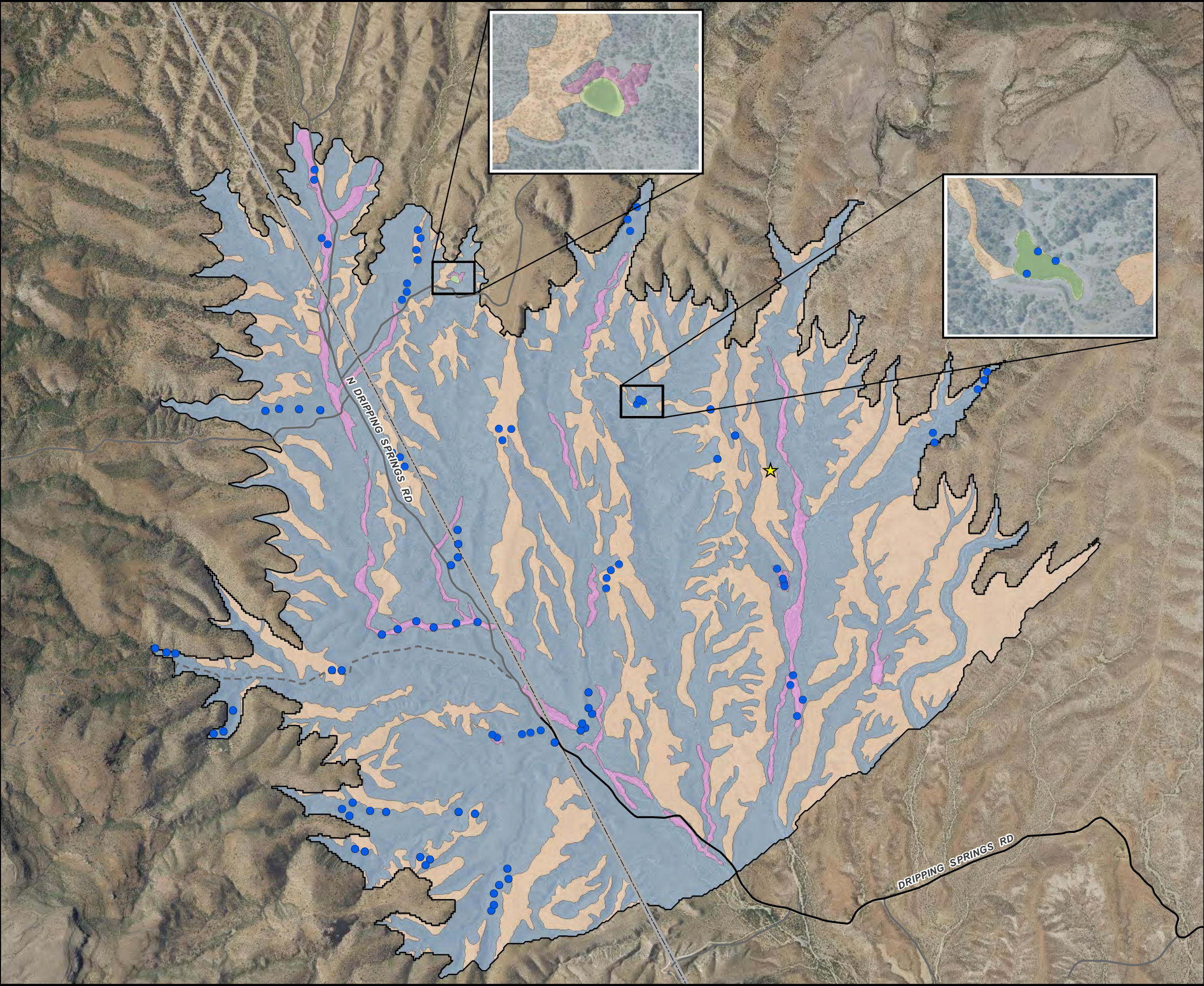
VICINITY MAP

Figure 1



0 2,500 5,000 Feet

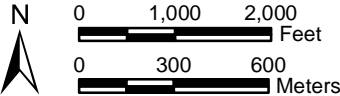
0 800 1,600 Meters



T2S, R14E, Portions of Sections 33-35,
T3S, R14E, Portions of Sections 1-4, 9-12 and 14-16,
Pinal and Gila Counties, Arizona,
Data Source: SWCA (DEIS)
Image Source: ArcGIS Online, 2017 USA NAIP Natural Color

Legend

- Sample Plot Location
- ★ San Carlos wild-buckwheat (approx. 10 individuals observed)
- Juniper Woodland Alliance (2680.4 acres)
- Shrubland Alliance and Sparsely Vegetated Area (1183.1 acres)
- Mesquite-Catclaw Acacia Alliance (137.4 acres)
- Pondweed Dominated Earthen Tank (1.2 acres)
- Skunk Camp Tailings Storage Facility Boundary



Detail Areas 1" = 400' (1:4800)



WestLand Resources

RESOLUTION COPPER
Vegetation Assessment for the
Proposed Skunk Camp Tailings Storage Facility
in Gila and Pinal Counties, Arizona

VEGETATION MAP
Figure 2

APPENDIX A

**Plants Identified
within the
Skunk Camp
TSF Vegetation
Assessment
Area**

APPENDIX A. PLANTS IDENTIFIED WITHIN THE SKUNK CAMP TAILINGS STORAGE FACILITY VEGETATION ASSESSMENT AREA

Scientific Names	English Common Names
FERNS AND RELATIVES (3 species)	
Pteridaceae	Maidenhair Fern Family
<i>Astrolepis cochisensis</i>	Cochise scaly cloakfern
<i>Pellaea</i> sp.	cliffbrake
Selaginellaceae	Clubmoss Family
<i>Selaginella arizonica</i>	Arizona spike-moss
CONIFERS AND RELATIVES (2 species)	
Cupressaceae	Cypress Family
<i>Juniperus monosperma</i> s.l.	one-seed juniper
Ephedraceae	Mormon Tea Family
<i>Ephedra</i> sp.	Mormon tea
EUDICOTS (138 species)	
Acanthaceae	Acanthus Family
<i>Anisacanthus thurberi</i>	Thurber's desert honeysuckle
Amaranthaceae	Amaranth Family
<i>Amaranthus palmeri</i>	careless weed
<i>Chenopodium</i> sp.	goosefoot
<i>Salsola tragus</i> *	Russian thistle*
<i>Tidestromia lanuginosa</i>	woolly tidestromia
Anacardiaceae	Sumac Family
<i>Rhus aromatica</i>	fragrant sumac
<i>Rhus ovata</i>	sugar sumac
Apiaceae	Carrot Family
<i>Daucus pusillus</i>	American wild carrot
Apocynaceae	Dogbane Family
<i>Sarcostemma</i> sp.	twinevine
Asteraceae	Sunflower Family
<i>Acourtia thurberi</i>	Thurber's desert peony
<i>Ambrosia ambrosioides</i>	canyon ragweed
<i>Ambrosia confertiflora</i>	weakleaf bur ragweed
<i>Ambrosia monogyra</i>	singlewhorl burrobrush
<i>Artemisia ludoviciana</i>	white sagebrush
<i>Baccharis salicifolia</i>	seepwillow
<i>Baccharis sarothroides</i>	desert broom
<i>Baccharis sergiloides</i>	desert baccharis
<i>Baileya multiradiata</i>	desert marigold
<i>Brickellia atractylodes</i>	hollyleaf brickellbush
<i>Brickellia californica</i>	brickellbush
<i>Cirsium</i> sp.	thistle
<i>Encelia farinosa</i>	brittlebush
<i>Ericameria laricifolia</i>	turpentine bush
<i>Erigeron</i> sp.	fleabane
<i>Gutierrezia sarothrae</i>	snakeweed
<i>Heterotheca villosa</i>	hairy false goldenaster
<i>Isocoma tenuisecta</i>	jimmyweed
<i>Logfia filaginoides</i>	California cottonrose

Scientific Names	English Common Names
<i>Machaeranthera tanacetifolia</i>	Takhoka daisy
<i>Psilostrophe</i> sp.	paper flower
<i>Stephanomeria</i> sp.	wire-lettuce
<i>Trixis californica</i>	American Threefold
<i>Uropappus lindleyi</i>	silverpuffs
<i>Xanthisma gracile</i>	grass-leaf sleepy daisy
Berberidaceae	Barberry Family
<i>Berberis haematocarpa</i>	barberry
Bignoniaceae	Trumpet Creeper Family
<i>Chilopsis linearis</i>	desertwillow
Boraginaceae	Forget-me-not Family
<i>Amsinckia</i> sp.	fiddlenecks
<i>Cryptantha nevadensis</i>	cat's eye
<i>Pectocarya recurvata</i>	curve-nut combseed
<i>Phacelia</i> sp.	scorpion-weed
Brassicaceae	Mustard Family
<i>Boechera perennans</i>	rock cress
<i>Brassica tournefortii</i> *	desert mustard*
<i>Capsella bursa-pastoris</i> *	shepherd's purse*
<i>Lepidium</i> sp.	pepperweed
<i>Physaria</i> sp.	bladderpod
<i>Sisymbrium irio</i> *	London rocket
<i>Thelypodium wrightii</i>	Wright's thelypody
Cactaceae	Cactus Family
<i>Carnegiea gigantea</i>	giant saguaro
<i>Coryphantha vivipara</i>	Arizona spiny star
<i>Cylindropuntia acanthocarpa</i>	buck-horn cholla
<i>Cylindropuntia leptocaulis</i>	Christmas cholla
<i>Cylindropuntia spinosior</i>	Cane cholla
<i>Echinocereus engelmannii</i>	Engelmann's hedgehog cactus
<i>Echinocereus fasciculatus</i>	bundle hedgehog cactus
<i>Ferocactus wislizeni</i>	barrel cactus
<i>Opuntia engelmannii</i>	Engelmann pricklypear
<i>Opuntia phaeacantha</i>	dark-spined pricklypear
Cannabaceae	Hemp family
<i>Celtis pallida</i>	desert hackberry
<i>Celtis reticulata</i>	netleaf hackberry
Caprifoliaceae	Honeysuckle Family
<i>Lonicera</i> cf. <i>interrupta</i>	honeysuckle
Caryophyllaceae	Pink Family
<i>Herniaria hirsuta</i>	hairy rupturewort
<i>Silene antirrhina</i>	sleepy catchfly
Celastraceae	Staff-tree Family
<i>Canotia holacantha</i>	crucifixion thorn
Cleomaceae	Beeplant Family
<i>Polanisia dodecandra</i>	red-whisker clammyweed

Scientific Names	English Common Names
Convolvulaceae	Morning Glory Family
<i>Cuscuta</i> sp.	dodder
<i>Evolvulus arizonicus</i>	Arizona blue-eyes
<i>Ipomoea</i> sp.	morning glory
Euphorbiaceae	Spurge Family
<i>Ditaxis serrata</i>	Yuma silverbush
<i>Euphorbia albomarginata</i>	white-margin sandmat
<i>Euphorbia maculata</i>	spotted sandmat
<i>Tragia ramosa</i>	noseburn
Fabaceae	Bean Family
<i>Acacia constricta</i>	whitethorn acacia
<i>Acacia greggii</i>	catclaw acacia
<i>Calliandra eriophylla</i>	fairyduster
<i>Dalea formosa</i>	featherplume
<i>Lupinus</i> sp.	lupine
<i>Marina parryi</i>	Parry's false prairie-clover
<i>Mimosa aculeaticarpa</i>	wait-a-minute bush
<i>Parkinsonia florida</i>	blue palo verde
<i>Prosopis velutina</i>	velvet mesquite
<i>Rhynchosia senna</i>	Texas snoutbean
<i>Senna covesii</i>	desert senna
<i>Trifolium</i> sp.	clover
Fagaceae	Oak Family
<i>Quercus turbinella</i>	scrub oak
Fouquieriaceae	Ocotillo Family
<i>Fouquieria splendens</i>	ocotillo
Geraniaceae	Geranium Family
<i>Erodium cicutarium</i> *	Stork's-bill
Krameriaceae	Ratany Family
<i>Krameria erecta</i>	range ratany
Lamiaceae	Mint Family
<i>Hedeoma</i> sp.	false pennyroyal
<i>Salvia columbariae</i>	California sage
<i>Scutellaria</i> sp.	scullcap
Loasaceae	Loasa Family
<i>Mentzelia pumila</i>	blazing star
Malvaceae	Mallow Family
<i>Abutilon parvulum</i>	dwarf Indian mallow
<i>Ayenia filiformis</i>	Trans-Pecos ayenia
<i>Malva neglecta</i> *	common mallow
<i>Sphaeralcea rusbyi</i>	Rusby's globemallow
Martyniaceae	Devil's Claw Family
<i>Proboscidea</i> sp.	devil's claw
Moraceae	Mulberry Family
<i>Morus microphylla</i>	Texas mulberry
Nyctaginaceae	Four O'clock Family
<i>Allionia incarnata</i>	trailing windmills
<i>Boerhavia</i> sp.	spiderling

Scientific Names	English Common Names
Oleaceae	Olive Family
<i>Fraxinus anomala</i>	singleleaf ash
<i>Menodora scabra</i>	twinberry
Phrymaceae	Lopseed Family
<i>Erythranthe</i> sp.	monkeyflower
Plantaginaceae	Plantain Family
<i>Keckiella antirrhinoides</i>	bushy beardtongue
<i>Maurandya antirrhiniflora</i>	roving sailor
<i>Penstemon</i> cf. <i>rostriflorus</i>	beaked beardtongue
<i>Penstemon pseudospectabilis</i>	desert beardtongue
<i>Plantago</i> cf. <i>patagonica</i>	wooly plantain
Polemoniaceae	Phlox Family
<i>Eriastrum diffusum</i>	miniature woolstar
<i>Phlox tenuifolia</i>	Santa Catalina phlox
Polygonaceae	Buckwheat Family
<i>Eriogonum capillare</i>	San Carlos wild-buckwheat
<i>Eriogonum inflatum</i>	desert trumpet
<i>Eriogonum trichopes</i>	little desert trumpet
<i>Eriogonum wrightii</i>	Wright's buckwheat
Ranunculaceae	Buttercup Family
<i>Clematis drummondii</i>	clematis
Rhamnaceae	Buckthorn Family
<i>Ceanothus greggii</i>	desert ceanothus
<i>Rhamnus ilicifolia</i>	hollyleaf buckthorn
<i>Sageretia wrightii</i>	mock buckthorn
<i>Ziziphus obtusifolia</i>	graythorn
Rosaceae	Rose Family
<i>Cercocarpus montanus</i>	mountain mahogany
Rubiaceae	Bedstraw Family
<i>Galium aparine</i>	bedstraw
<i>Galium wrightii</i>	Wright's bedstraw
Rutaceae	Citrus Family
<i>Ptelea trifoliata</i>	common hoptree
Sapindaceae	Maple Family
<i>Dodonaea viscosa</i>	hopbush
Santalaceae	Sandlewood Family
<i>Phoradendron californicum</i>	mesquite mistletoe
<i>Phoradendron serotinum</i>	mistletoe
<i>Phoradendron</i> sp.	mistletoe
Simmondsiaceae	Jojoba Family
<i>Simmondsia chinensis</i>	jojoba
Solanaceae	Nightshade Family
<i>Datura wrightii</i>	sacred thorn-apple
<i>Nicotiana glauca</i> *	tree tobacco*
<i>Nicotiana obtusifolia</i>	wild tobacco
<i>Physalis</i> sp.	ground cherry
Tamaricaceae	Tamarisk Family
<i>Tamarix</i> cf. <i>chinensis</i> *	tamarisk

Scientific Names	English Common Names
Verbenaceae	Vervain Family
<i>Aloysia wrightii</i>	bee brush
<i>Verbena bracteata</i>	bigbract
Zygophyllaceae	Creosote Family
<i>Larrea tridentata</i>	creosote
MONOCOTS (32 species)	
Asparagaceae	Asparagus Family
<i>Agave cf. palmeri</i>	Palmer's agave
<i>Dasyllirion wheeleri</i>	Sotol
<i>Dichelostemma capitatum</i>	blue dicks
<i>Nolina microcarpa</i>	Bear grass
<i>Yucca baccata</i>	banana yucca
<i>Yucca elata</i>	soaptree yucca
Cyperaceae	Sedge Family
<i>Cyperus oderatus</i>	fragrant flagstaff
Liliaceae	Lily Family
<i>Calochortus sp.</i>	Mariposa lily
Poaceae	Grass Family
<i>Aristida adscensionis</i>	six-weeks three-awn
<i>Aristida purpurea</i>	purple three-awn
<i>Aristida ternipes</i>	spider grass
<i>Avena sp.*</i>	oats*
<i>Bouteloua aristidoides</i>	needle grama
<i>Bouteloua gracilis</i>	blue grama
<i>Bouteloua curtipendula</i>	side-oats grama
<i>Bouteloua hirsuta</i>	hairy grama
<i>Bouteloua repens</i>	slender grama
<i>Bromus rubens*</i>	red brome*
<i>Cynodon dactylon*</i>	Bermuda grass*
<i>Dasychloa pulchella</i>	low woollygrass
<i>Dinebra panicea</i>	needle viper grass
<i>Elymus elymoides</i>	squirreltail
<i>Elymus glaucus</i>	blue wild rye
<i>Eragrostis cilianensis*</i>	stinkgrass*
<i>Hilaria belangeri</i>	curley-mesquite
<i>Hordeum sp.</i>	barley
<i>Lamarckia aurea*</i>	golden-top grass*
<i>Poa bigelovii</i>	Bigelow's blue grass
<i>Tridens muticus</i>	slim tridens
Potamogetonaceae	Pondweed Family
<i>Potamogeton cf. pusillus</i>	pondweed
Typhaceae	Cattail Family
<i>Typha sp.</i>	cattail

* Non-native species

APPENDIX B

Representative Photographs



Photo 1. Juniper Woodland Alliance. Vegetation in the foreground includes sotol, red brome, and juniper.



Photo 2. Juniper Woodland Alliance. A north-facing slope vegetated with juniper, dark-spined prickly pear, red brome, and snakeweed.



Photo 3. Juniper Woodland Alliance. A slope with scrub oak, sotol, juniper, red brome, and mesquite pictured in the foreground.



Photo 4. Juniper Woodland Alliance. A small rocky drainage lined with scrub oak and sugar sumac.



Photo 5. Juniper Woodland Alliance. A north-facing slope vegetated with banana yucca, skunkbush, barberry, and juniper.



Photo 6. Juniper Woodland Alliance. A small rocky drainage vegetated with mesquite, juniper, red brome, and other grasses.



Photo 7. Juniper Woodland Alliance. A small drainage vegetated with scrub oak, juniper, and netleaf hackberry.



Photo 8. Juniper Woodland alliance. A north-facing slope vegetated with juniper and grasses. Red brome is prevalent.



Photo 9. Juniper Woodland Alliance. A slope vegetated with catclaw acacia, red brome, juniper, sotol, and skunkbush.



Photo 10. Shrubland Alliance. A grassy slope vegetated with dark-spined pricklypear, red brome, and sleepy catchfly.



Photo 11. Shrubland Alliance. A rocky slope with Engelmann prickly pear, jojoba, and Mormon tea pictured in the foreground.



Photo 12. Shrubland Alliance. A hilltop vegetated with turpentine bush, Engelmann prickly pear, catclaw acacia, and whitethorn acacia.



Photo 13. Shrubland Alliance. A slope vegetated with fluffgrass, red brome, whitethorn acacia, and juniper.



Photo 14. Shrubland Alliance. A rocky, south-facing slope vegetated with jojoba, turpentine bush, and whitethorn acacia.



Photo 15. Shrubland alliance. A rocky slope with Engelmann pricklypear, Mormon tea, and sotol.



Photo 16. Shrubland Alliance. A south-facing slope (pictured at right) with whitethorn acacia, jojoba, and red brome pictured in the foreground.



Photo 17. Shrubland Alliance. A heavily grazed upland terrace dominated by dark-spined prickly pear.



Photo 18. Shrubland Alliance. An upland terrace vegetated with cholla, turpentine bush, snakeweed, dark-spined prickly pear, and whitethorn.



Photo 19. Shrubland Alliance transitioning into Juniper Woodland Alliance. Vegetation in the foreground includes sotol, scrub oak, and grasses.



Photo 20. Shrubland Alliance transitioning into Juniper Woodland Alliance. A hilltop vegetated with beargrass, red brome, and juniper



Photo 21. Mesquite-Catclaw Acacia Alliance. A wash vegetated with mesquite, catclaw acacia, and barberry.



Photo 22. Mesquite-Catclaw Acacia Alliance. A floodplain terrace. Jimmyweed is pictured.



Photo 23. Mesquite-catclaw acacia alliance. A wash by catclaw acacia, mesquite, and occasional juniper.



Photo 24. Mesquite-Catclaw Acacia Alliance. A floodplain vegetated with mesquite, jimmyweed, juniper, whitethorn acacia, and catclaw acacia.



Photo 25. Mesquite-Catclaw Acacia Alliance. View of a dry earthen tank. The tank perimeter is dominated by mesquite, catclaw acacia, and juniper.



Photo 26. Mesquite-Catclaw Acacia Alliance. A floodplain terrace with turpentine bush and Engelmann prickly pear pictured in the foreground.



Photo 27. Mesquite-catclaw acacia alliance. Banana yucca stand (scale held by surveyor = 2 m) situated within small drainage.



Photo 28. Mesquite-Catclaw Acacia Alliance. Desert willow occurs sparsely in the Assessment Area and is typically confined to its larger washes.



Photo 29. Earthen Tank, October 28, 2019. The dry perimeter of the tank is dominated by jimmyweed and bigbract verbena.



Photo 30. Earthen Tank, October 22, 2019. The wetted area is dominated by pondweed.



Photo 31. Earthen Tank, October 28, 2019. View of bigbract verbena dominance in drawdown area.



Photo 32. Earthen Tank October 22, 2019. The outer perimeter of the tank is dominated by mesquite.



Photo 33. An open-top metal tank with emergent cattails.



Photo 34. A concrete cattle drinker associated with the metal tank pictured in Photo 33. Submerged pondweed, algae, and stoneworts are dominant.